
# Spin Wave Technology

INITIAL RELEASE

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George J. Bugh

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*This book is dedicated to my old man.*
*¡Mi maestro es el más grande!*

# Note from the Publisher

This is a book based on the initial release CD-ROM of the HTML and graphic files that make up the research papers of Electronics Engineer, George J. Bugh. These documents used to be found at the URL http://www.egroups.com/files/MagnonLasers/. The data is no longer located there.

The information contained in this book originated from files located on Mr. Bugh's personal computer when the Vasant Corporation obtained copyrights to his work. (See the Chapter 40, "Permissions" for the copyright permission given to George Bugh by his day job employer.) Mr. Bugh has given the Vasant Corporation sole right to sell his research files.

George J. Bugh is a senior staff electronics design engineer at a major aerospace company. He has 20 years of experience working with electronic and electromagnetic devices and systems. The information published in this book is unrelated to his day job. Over the last 7 years Mr. Bugh has made a personal and in depth study of unusual claims by various inventors involving energy producing devices. In addition, he has done much research of his own.

The files from which this book originated are the result of his 7 years of research. No invented terminology is needed to explain these devices. Using conventional science it is possible to explain electromagnetic processes that have not previously been described or understood. Some of these inventors have stumbled onto certain phenomena that are significant, opening the door for possible technological advances.

The information contained in this book includes a number of URL references and links. Although we have done our best to ensure that all links are active at the time of publishing, the Internet is a constantly changing environment and links do go dead from time to time. If you find that some of the links mentioned in this book are no longer active, you can often find the information by going to the internet archive at: http://www.archive.org/ , and entering the URL there.

Please visit the Vasant Corporation[1] Website from time to time for further updates and more learning materials on Spin Waves Technology.

[1] http://www.vasantcorporation.com/

# Introduction from the Author

These are HTML text files and diagrams created over a 7-year time period while I was trying to understand the various topics that these files cover. The files and diagrams are not guaranteed to be without error although, for the most part, I believe them to explain things correctly.

In addition to trying to better understand physics in general, I began a study of unusual electrical power producing devices by various inventors that I came across on the Web.

Over the years I have done a lot of studying of spin wave processes and magnetic materials. In the newsgroups archives accessible at: http://groups.google.com/, one can see some naïve questions and wrong statements on my part (and hopefully a few good questions and statements as well) in my quest to understand these various processes. I have had misconceptions in the beginning on how these processes work and now I believe I have cleared up my own misconceptions, while still coming to a few conclusions that are not exactly in line with those of the average quantum physicist.

I should tell you that all my years of study are from an electronics engineer's point of view. However, I am studying phenomena that quantum physicists contend can only be described correctly with quantum theory. I have come to the conclusion that quantum behavior of atomic particles can be explained with classical electrodynamics and that there are spin wave processes and particle interactions taking place between all matter that are not being described in the most correct way by quantum theory.

In quantum theory, spin waves (magnons)[2] are defined as the propagation of magnetic field changes from particles flip spin states, and the effect of this on surrounding spins will propagate out from the spin that flipped states. In my research files I describe spin waves as occurring even among spins that don't flip spin states. It is a more classical electrodynamic way of explaining things. Quantum theory uses the term spin waves for this too but only in as much as the accumulated precessional motions of many precessing spins are together able to absorb or emit a whole quanta (photon) of electromagnetic radiation.

It is my contention that electromagnetic interactions occur at energy levels less than that of individual photons. It is due to non-quantized classical electrodynamic interactions of various types that particle states and particle interactions become quantized. This is explained better in this book.

Regarding the possibility of electro-gravity: in Einstein's Theory of General Relativity, gravity is explained as being an effect of a warp in space-time rather than being a force. Objects that fall to Earth are actually just staying in the same place in a warped space-time. In these papers, gravity is explained as being caused by the very slight attraction that develops between all matter as a consequence of the natural tendency of all matter everywhere to move towards a state of harmonious precessional motion.

This tendency is caused by the continuous exchange of a kind of electromagnetic radiation between all precessing particles that applies forces to all of them so as to move all similar type atomic particles towards a state of precessing in harmony. This in turn gives rise to a sea of standing waves among all matter. This sea can have fluctuations to the standing waves from a type of spin temperature and spin waves among all matter, which, I believe quantum theory explains as fluctuations of the zero point energy.

Gravity is an effect of a warp in space-time but this warp is caused by this unique electromagnetic interaction among all matter that is not readily apparent. So also, all fundamental forces are actually effects of various forms of warps in space-time. This is discussed in this book.

By looking at particle interactions and describing them all in a more correct manner using easy to understand classical electrodynamics

[2] http://www.harcourt.com/dictionary/def/6/1/5/0/6150600.html

it will be possible to see that a new technology based on spin wave processes can be developed. This includes electrical power generation devices without moving parts that can provide all the power anyone could want. They can consume radiant heat energy and output electrical power. Electro-gravity effects arise from the same particle spin interaction processes that allow these devices to generate electrical power.

This is all theory right now. I have made no devices. However, I have studied many devices by hobbyists and have concluded that some have accidentally succeeded in making spin wave lasing devices that output electrical power even while the inventors themselves don't truly understand how their devices are working. There are many similar homemade devices like this that have been discounted by the scientific community. I have decided to take the stance of "What if at least some are for real, and if so then how could they work?" These devices have similar electromagnetic design characteristics and they have similar electrical power, electro-gravity and temperature change characteristics.

These research papers have an increasing level of correctness, as in the beginning I did not understand atomic particle interactions as well as I do now. I'm sure there are many quantum physicists who will say that I still don't understand particle interactions. These papers come from my study of unusual devices and of physics in general.

I would like to thank all of those who have helped and encouraged me in this pursuit. I especially want to thank Lauren Stevens, editor for this book, and her husband, Stephan Schmidt, designer of the Vasant Corporation website. Their help and moral support have been invaluable.

I hope these research papers will be beneficial to everyone.

George J. Bugh

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**Preview of papers from work in progress on future publications:**



**Diagrams:**

# 1

# Electrostatics

The following chapter contains very elementary information about electrostatics. There are also many things that are mentioned but are not explained in more detail. Nevertheless, it is important to include this chapter because it lays the foundation for understanding "electric charge" and the history behind the development of the concept of "charge" when associated with atomic and subatomic particles with electric fields.

This first chapter was a paper intended to be only an outline of information and reminder notes used in a first lecture of a course on introductory electronics for high school students.

Most of electronics has to do with either stationary or moving atomic particles that have electric charge. So I want to start out by describing the characteristics of electric charge and electrically charged particles. I will try to give the generally accepted explanations for things but also I will try to point out where these explanations don't always work. I will give some alternative points of view but I can't say what is the final and correct point of view. I would rather give you enough information to allow you to think about the various ways of looking at the same things and develop your own opinions. This lecture will cover:

- Units of measure
- What is charge?

- The Leyden jar[3], condenser and capacitor[4]
- Electric charge of charged particles
- The electric force and using the electric force to do work.
- Structure of an electron.
- Mass and energy of charged particles
- Insulators, conductors and semiconductors
- Triboelectric effect[5]

## *Units of measure:*

Around the world, in different times and different places there have developed different units of measure to represent the same things. For example, in the USA we have used the "yard" to measure distance while in other places the "meter" is used. In a similar manner there are several different measurement systems for describing units of force, electric charge as well as other things. In this discussion we will use the International System of Units (SI) for representing various units of measure.[6]

There is also a difference between "units" and "variables". Explained in the lecture at: http://physics.nist.gov/Pubs/SP811/sec04.html

## *What is Charge?*

The word "charge" is both a noun and a verb. If you fill something up with the thing it is designed to hold then that is called charging it and the quantity of a thing or stuff you charge it with is called "a charge".

An air conditioning system can be described as being "charged" up with a substance called Freon and the quantity of Freon that it holds is called its "charge".

A methane or propane or butane gas tank can be said to hold a charge of gas in a similar manner.

A deep-sea diver can have an air tank that is charged up with pressurized air.

A car battery can be charged up with electricity and when it is being charged up it is said to be "taking a charge".

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[3] http://www.alaska.net/~natnkell/leyden.htm
[4] http://www.howstuffworks.com/capacitor.htm
[5] http://henry.ee.rochester.edu:8080/~jones/demos/charging.html
[6] http://physics.nist.gov/Pubs/SP811/sec04.html

The online Merriam-Webster's Collegiate Dictionary[7], describes "charge" as follows:

*Noun:*

*a) the quantity that an apparatus is intended to receive and fitted to hold*
*b) a store or accumulation of impelling force*
*c) a definite quantity of electricity; especially: an excess or deficiency of electrons in a body*

*Verb:*

*a) archaic : to lay or put a load on or in to LOAD,*
*b) (1): to place a charge (as of powder) in*
*(2): to load or fill to capacity*
*c) (1): to restore the active materials in (a storage battery) by the passage of a direct current through in the opposite direction to that of discharge*
*(2): to give an electric charge to*

A charge can be an excess of something or a deficiency of something. An air tank usually has compressed air in it but an air tank could also have a vacuum in it. The pressure in the tank could be higher or lower than the surrounding air outside the tank.

Whenever a container is charged up with a quantity of something, there is a difference in pressure and there will be a force associated with the charge because of the difference in pressure. An air tank with compressed air in it will have its air forced out of the valve on the tank when the valve is opened, or an air tank with a vacuum in it will have air forced into it if its valve is opened.

It is important to remember that there is a force associated with this charge. When talking about a container of gas, this force is caused by the difference in gas pressure between inside a container and outside a container or perhaps between 2 containers that are connected but that have different amounts of gas pressure in them.

For a car battery, the force is due to a difference in electric pressure from one terminal of the battery to the other terminal of the battery. A battery holds an electric charge because of the chemical processes that take place inside the battery.

[7] http://www.m-w.com/

## *Electric Charge:*

The matter of our universe is made up of atomic particles. Some of the particles have a positive (+) electric charge and some have a negative (-) electric charge.

The characteristic of polarity applies to these electrically charged particles.

> *Polarity*[8]
>
> *1: the quality or condition inherent in a body that exhibits opposite properties or powers in opposite parts or directions or that exhibits contrasted properties or powers in contrasted parts or directions: the condition of having poles*
>
> *2: attraction toward a particular object or in a specific direction*
>
> *3: the particular state either positive or negative with reference to the two poles or to electrification*
>
> *4 a: diametrical opposition b: an instance of such opposition*

There are also particles with a neutral charge. The most common particle with a positive charge is the proton. The most common particle with a negative charge is the electron. The most common neutral particle is the neutron. The various solid, liquid and gaseous substances in our universe are made of atoms. The nucleus of an atom is made up of protons and neutrons while electrons move around the nucleus of an atom. Electrically charged particles have the characteristic of an electrostatic force that will interact with the electrostatic force of other electrically charged particles so as to push or pull on them.

If two charged particles are both positive they will repel each other because of the opposing electrostatic forces from their same polarity charges. Likewise, if two charged particles are both negative they will repel each other. If a particle has a positive charge and another has a negative charge then there will be an attractive electric force between them. I will talk more about electrically charged particles in general but first I want to talk about how we measure the amount of electrical charge that something has.

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[8] http://www.britannica.com/dictionary?book=Dictionary&va=polarity

*Units of Electric Charge*[9]

The electric charge that a particle or a collection of particles has is represented with the math variable "q" or "Q". The amount of electric charge that a particle or collection of particles will have is represented with the SI units of "Coulomb" and in math equations this is represented with the letter "C". The electric charge "q" of 1 C is the amount of electric charge that is transferred from one location to another by 1 ampere of electric current flow over a time period of 1 second. The Ampere is the unit of measure for the rate that electric charge moves from one location to another. This allows charge to be represented mathematically as:

q = 1 Coulomb = 1 ampere-seconds or q = 1 C = 1 A-s

Similarly, 1 ampere of current flow of electric charge can be written as:

1 A = 1 C/s

This means that 1 Ampere of electric current occurs from 1 Coulomb of electric charge moving to a new location during a time period of 1 second.

*Coulomb*[10]

Attractive or repelling electric force between electric charges causes charges to move from one location to another. This electrostatic force is often called Coulomb force and it is a force that moves electric charges directly towards or directly away from the center of the source of electric charge.

*Coulomb's Law*[11]

*Coulomb force*[12]

Between 2 individual electrically charged particles such as 2 electrons or an electron and a proton, the Coulomb force between them in a vacuum can be represented with the math formula:

F =(k * q1 * q2) / ( r * r)

9 http://www.britannica.com/search?query=electric%20charge&ct=eb
10 http://www.britannica.com/search?query=coulomb&ct=eb
11 http://www.britannica.com/search?query=coulomb%27s%20law&ct=eb
12 http://www.britannica.com/search?query=coulomb%20force&ct

Where r = the distance between them in meters, q1 and q2 are the amounts of each electric charge in Coulombs and k is the constant: $8.98 * 10^9$ Newton (N) square meter ($m^2$) per square Coulombs ($C^2$). The k constant is needed to make all the various type of units come out to the correct values in the SI units of measurement system.

$k = 8.98 * 10^9 \ N * m^2 / C^2$

## *The Leyden jar[13], condenser and capacitor[14]:*

There is an electrical device simpler than a battery which can also hold an electric charge. It is called a capacitor but in the past it has also been called a condenser. Capacitors are used in automobiles and some companies that make automobile parts still call them condensers.

Even earlier forms of capacitors were called Leyden jars.[15] [16]

When Leyden jars were developed people did not know that the electric charge of a Leyden jar was made up of an excess or a deficiency of individual electrically charged particles called electrons.

A man named Joseph John (JJ) Thomson discovered that there were smaller particles than the atom itself. This was in fact the discovery of the electron.

References:

- http://www.aip.org/history/electron/jjhome.htm
- http://virtual.park.uga.edu/nhilton/hc/electron.html
- http://www.pbs.org/transistor/science/events/electron.html

JJ Thompson and some co-workers also worked on measuring just how much electric charge an individual electron had. Then a man named Robert A. Millikan made the definitive measurement of the charge of an electron and won the Nobel Prize for his work.[17]

Where and how is the electric charge located in an electron?

1. Charge as a substance or charge as the consequence of the processes in a charged particle.
2. The electron as a sphere with charge on surface

[13] http://www.alaska.net/~natnkell/leyden.htm
[14] http://www.howstuffworks.com/capacitor.htm
[15] http://www.bartleby.com/65/le/Leydenja.html
[16] http://www.britannica.com/search?query=leyden%20jar&ct=eb
[17] http://dbhs.wvusd.k12.ca.us/AtomicStructure/Determine-electron-charge.html

3. The electron as a sphere with charge uniformly distributed inside

4. The electron with a point of charge with zero dimensions requiring renormalization of the equation for the electric field strength near the electron's point of charge. (Renormalization[18] is a process by which equations that are not completely correct can have their results changed to match measured values).

5. Solid model (and what contains the charge) and alternative vortex models that solve the problem of charge self-repulsion that would otherwise cause an electron's charge to disperse.

6. Electron annihilation and where charge goes.

Mass and energy of charged particles

$E = m * c^2$

Related links to understanding electrostatics and processes of charged particle interactions:

- http://www.sciencemadesimple.com/static.html
- http://www.ex.ac.uk/cimt/dictunit/notes3.htm
- http://www.techlib.com/science/electrostatics.html
- http://www.borg.com/~eosesd/cebasics.html
- http://www.eskimo.com/~billb/emotor/stmiscon.html
- http://www.ce-mag.com/archive/2000/janfeb/mrstatic.html
- http://henry.ee.rochester.edu:8080/~jones/demos/triboseries.html
- http://www.cpo.com/CPOCatalog/RP/rp_b2.htm
- http://www.phys.virginia.edu/classes/109N/lectures/momentum.html
- http://www.westga.edu/~chem/courses/ntsc7685/lectures/7685Ch_4/sld031.htm
- http://www.glenbrook.k12.il.us/gbssci/phys/Class/energy/u5l1a.html

[18] http://www.britannica.com/search?query=renormalization&ct=eb

# 2

# Charge of an Electron

In diagram 2-1 the electron is shown as a blue ball (CD Version). This is a symbolic diagram of an electron. It is not this author's contention that the electron is a ball or that it is blue in color.

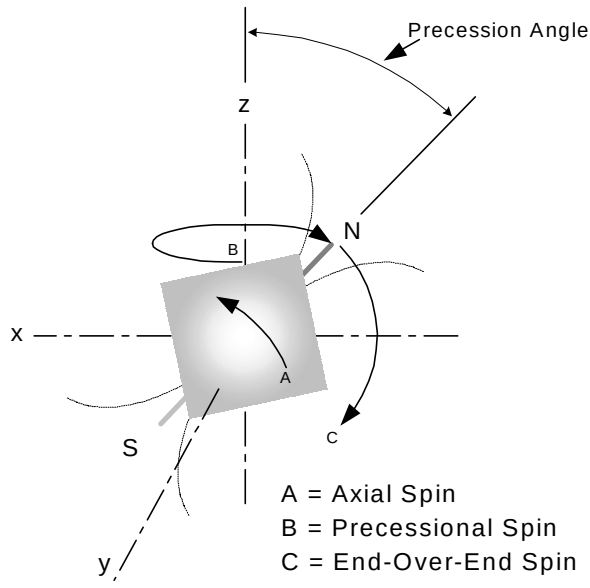



DIAGRAM 2-1
Electron Spin, Types of

The color blue is often associated with an electron because lightning and electric sparks ionize the air creating a blue light. The electron itself has no color. However, if it moves back and forth at a high enough frequency then it will radiate light (electromagnetic waves) of the color determined by the frequency of its motion. I believe the electron can be explained as a vortex of energy flow. Although Feynman[19] was unable to show how the electron can be explained as a vortex flow of energy (Poynting vector)[20], it is this author's contention that that is what it is. It's simply a matter of coming up with the correct way of explaining the vortex.

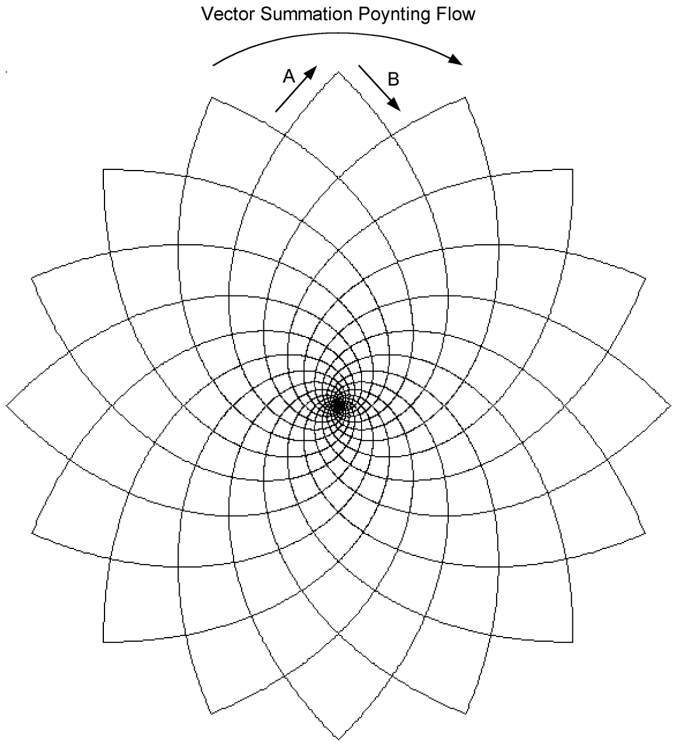



DIAGRAM 2-2
Electron Poynting Vector

[19] Feynman Lectures on Physics", Volume 2, Richard P. Feynman, Addison-Wesley Publishing Company, Reading, Massachusetts, (June 1970) p 28-1, section title: "Electromagnetic Mass", ISBN: 0201021153

[20] http://www.britannica.com/eb/article?eu=62702&tocid=0&query=poynting%20vector

Diagram 2-2 is one possible explanation but not necessarily the best one. It is a top down view looking into the spin axis of the electron with magnetic North coming out of the page.

The Poynting vector of an electron could possibly be explained as the vector summation of the Poynting vector "A" of energy flowing out of the center and the Poynting vector "B" of energy flowing into the center of an electron.

Both energy flows are at the velocity of light at all locations. The summation of the 2 vectors is also a flow of energy at the velocity of light. It is the flow of energy through space that causes the flow of energy through time. Both are traversed at the ratio of space traversed/ time traversed = c relative to all other matter or energy.

The energy density increases towards the center. There may or may not be an "eye" to this vortex. It may be possible that the flow outward is passing right through the flow inward.

The spiral arms are representative of an infinite or continuous number of arms that represent the flow of energy in and out from all directions around the center of the vortex of energy flow. Although in this diagram the spiral arms end to form a lotus shape, they are meant to be representative of inward and outward energy flow that continues out into space.

Poynting vector "spin" is clockwise with magnetic North coming out of the page. The total Poynting vector is circular and at any particular cross section area at some distance out from the center is less energy flowing in a circle than the circular Poynting vector through a same size cross section area closer to the center. This circular Poynting vector is perpendicular to both the electric and magnetic field vectors.

The Vasant Corporation logo designed by Stephan D. Schmidt is a stylized graphic of this energy flow.

It is this author's contention that the electron's charge does not exist at a single point at its center. In a low-pressure weather system there is a gradient of decreasing air pressure towards the center and airflow around it. This constitutes a vortex and it is the dynamics of the vortex that determine the gradient in decreasing air pressure. There is not a singularity or point at the center responsible for this. Similarly, there is not a point of "charge" responsible for the electric field gradient of the electron. There is not an actual "thing" of chewy charge at the tootsie pop center of an electron. The electric field gradient that we consider as caused by "charge" is all there is to the charge. In other words, the "charge" may be considered as everywhere there is any

amount of electric field from an electron. The electric field gradient is the natural consequence of the vortex of energy flow just as a barometric pressure gradient is the natural consequence of the vortex of airflow in a circulating weather system.

The concept of "charge" as being some actual "thing" at the center of an electron came from the whole initial idea of "charge". Capacitors were "charged" up with electricity before individual electrons were known of or understood. When individual electrons were discovered, this same concept of "charge" was applied to each electron such that each electron has been thought of as having this "thing" of "charge" that is responsible for its electric field and the accompanying electric field force. This is not correct. Anytime an equation uses a variable for charge of an individual electron it is really just a way of referring to that which causes the sum total of electric field energy and electric field force of that electron. It is appropriate to hang onto the concept of "charge" only as a representation of the amount of electric field and field force but these are determined by the vortex dynamics and not by a "thing" or "things" of charge.

For individual electrons, an electric field force is not something that radiates out from points of charge. Changes in electric field strength still spread out at the speed of light but the changes do not radiate from points of charge. The charge simply IS where the field strength gradient IS and the field force is not radiating from a substance of charge. One way to look at it would be to say that in any given area of space, the portion of the total charge of a particle in that area of space will be proportional to the portion of the total electric field energy that is in that same area of space. However, again, the electric field force is not radiating from "charge". The electric field force is due to the gradient in electrostatic pressure as determined by the vortex dynamics and not from a "charge" at the center of the vortex or "charge" anywhere else.

When an electron and a positron interact they completely disappear in exchange for electromagnetic waves (photons if you like). Neither the electron nor the positron is made of smaller particles. They are each made of electric fields in rotation. If you look into some of the older physics books before the popularity of quantum physics you will find that charged particles were already shown to have a mass equal to the energy of the sum total of their electric fields rotating in space. Some of these books refer to just the charge in rotation but the charge is actually just a way of referring to the sum total of the electric field of a particle.

According to J B Rajam[20] in the book "Atomic Physics", the only reason this way of explaining particle mass has been ignored is that it tended to add credibility to the existence of aether when supposedly aether had been shown to not exist. Rajam is a pretty smart guy. His book is endorsed by DeBroglie who writes an introduction for Rajam's book.

Any volume of space that contains an electric field will contain a certain amount of energy in the amount of electric field in that space. The mass of a single charged particle is equivalent to the sum total of all the electric field in rotation of that particle. For a proton, there is an additional mass equivalent of the electromagnetic waves continually exchanged between the extreme amount of precessional motions of the quarks that make up the proton. There is likely much more energy continually exchanged by precessional motions than there is in simple rotation of the electric field of each quark.

When an electron and a positron interact, there are no little bits or pieces to either of them, just energy of electric fields in motion. The rotational motions of respective electric fields, along with each particle's magnetic dipole, will interact so as to translate their rotational motion of electromagnetic energy into linear motion as electromagnetic waves (photons if you like).

All energy is in the form of waves or whirlpools (particles).

> *"Hermann von Helmholtz showed that a vortex in a frictionless fluid, such as the ether was assumed to be, was astonishingly stable and would continue to exist through eternity."*[21]

The same characteristics of permeability and permittivity that allow the linear motion of electromagnetic energy also allow the rotational motion of electromagnetic energy as a vortex. This is what a particle is. It is not even necessary to speak of an aether. If a person has a problem accepting that an aether could exists and yet be undetectable then a person need only substitute "aether" with "space endowed with the qualities of permittivity, permeability and compressibility". Space can be thought of as compressible or warpable because the ratio of time to space can be changed in such a way as to cause the effect we know of as gravity. A charged particle can be explained as a whirlpool of electromagnetic energy where both time and space are being

[20] Atomic Physics, Rajam, J B, 1966, page 52-53.
[21] "The Origins of Field Theory", CEN 530.1 W Williams, L. Pearce, Random House, 1966 p. 129

compressed or warped in equal proportion compared to some other location in space-time. Please study chapter 28, "The Nature of Time", to better understand this way of explaining the relationship between space and time.

As long as there is only chaotic motion of electromagnetic energy then there are no particles and so there is no physical matter to the universe. It is only when electromagnetic energy begins to move in vortices that matter is formed. The ancient Greeks say the following about the creation of the physical matter of the universe:

> *"Then intelligence starts a "vortex," a whirling motion in chaos which begins the process of ordered separation, eventually resulting in the universe we know ...".* [22]

[22] "An Introduction to Ancient Philosophy" page 17 CEN 180 Armstrong A. H. Armstrong, The Newman Press, 1949

# 3

# Dialog on Structure of the Electron

The following dialog is excerpts of discussions on electron structure from the news group sci.physics.electromag. The thread "How much energy is in electron's field?" splits up in several places so please forgive me if I fail to transfer the text in a manner that is easy to follow.

The complete thread is in the news group archives accessible through http://groups.google.com/advanced_group_search. Just type the text, "How much energy is in electron's field?" into the search box at that website. Words tend to be misspelled in the following excerpts just they were misspelled in the original posts to the news group. People tend to post to the groups in order to express ideas without worrying much about double types or misspelling, as the main idea is to express, with minimum time and effort given to perfect sentence correctness.

**Bugh**:

> What is the total energy of an electron's total electric field? It's identical to the energy equivalent of its mass isn't it?

**Gordon D. Pusch**:

> If the electron were a true "point" particle, it would have an =INFINITE= electromagnetic mass-energy.

If it had a finite size (e.g., if it were a uniformly charged sphere), then working out the stored electromagnetic energy and setting it equal to the electron's observed mass-energy equivalent, one gets a radius on the order of the so-called "classical electron radius," R_e = e^2/(m_e c^2) [cgs gaussian] ~= 2.8 x 10^(-15) m.

The problem with this "classical" estimate is, that as far as experiment has been able to determine, the electron *is* a "pointlike" particle, with =NO= measurable internal structure yet seen, even though we have probed it all the way down to less than 10^(-18) meters! If one were to naively insert this bound into the "classical" energy formula, one finds that the amount of energy that would have been classically stored in the field *EXCEEDS* the total mass-energy of the electron by *AT LEAST* a factor of 1000 — which makes little sense; it would seem to imply that the electron must have a huge and =NEGATIVE= "non-electromagnetic" or "bare" mass-energy that **almost** (but not quite!) cancels its huge positive E/M energy. Most researchers consider this to be an absurd conclusion, and therefore have rejected the notion that the electron's mass can be understood as merely its stored electromagnetic energy.

Within the framework of QED, It's not clear this question has *any* well-defined meaning; about the best on can say is that part of the so-called "renormalization" process involves assigning the electron's =TOTAL= mass energy (that is, the sum of its electromagnetic plus "bare" mass-energy) to the experimentally observed value "by fiat." However, this is basically just an admission that we are totally ignorant of the details (if any) of the electron's internal structure, and have therefore "adjusted by hand" the parameters of the renormalized theory to reproduce the experimentally-observed values. In this sense, QED cannot be considered a "complete theory," but is rather what we sometimes call an "effective theory."

**Bugh**:

At what distance out from an electron's center will half of the total electric field energy be near the electron and half of the total electric field energy be further out from the electron?

**Pusch**:

The field-energy stored outside a sphere twice the "classical" radius equals half an electron mass-energy equivalent, assuming the electron's radius is smaller than this value. However, one cannot answer the question of just how much energy is *inside* this sphere without first specifying the details of its internal charge distribution — which gets us back into the total-energy vs. size paradox discussed earlier.

**Bugh**:

Why does a classical concept of the electron need any object at the center at all. There is no object at the center of a circulating low pressure weather system yet still it is capable of having a gradient in barometric pressure from the center out. There is no "charge" of the air to create this low pressure. It is the natural result of the circulation of the air.

So why does there have to be a solid sphere or a point charge at the center of an electron? If the sum total of the energy of the electric field is equal to the energy of its mass then there can't be anything additional of some object at the center. All there is to the electron is a circulation of the electric field energy. Yes?

**Bugh**:

When I said there is no "charge to the air in a circulating low pressure weather system, that's not right. There is charge in as much as there is lower pressure but this is maintained by the dynamics of the circulation. Otherwise, outside air would simply rush to the center and that would be the end of the low pressure as the pressure would all equalize.

Similarly, with an electron the "charge" or in other words, the electric field gradient is maintained by the circulation. There is no object or substance of "charge" at a point at the center.

**Michael Spanner**:

The problem is that the energy stored in the coulomb field surrounding the electron is infinite if one integrates the energy right down to the center of the field (note there is a singularity at the center of the coulomb field which is prop. to 1/r.)

Assuming some size to the electron truncates the integration before getting to the singularity. Unfortunately, as was mentioned in a previous post, this still doesn't really help the matter...

**Bugh**:

Instead of assuming some size of some object truncates the increasing coulomb field, assume an "eye" to the vortex truncates the increasing coulomb field. In every way that I can see, the electron behaves as a vortex with no other objects or points of charge involved.

**Michael Spanner**:

> *Quote from previous post in thread: [The electron has] "=NO= measurable internal structure yet seen, even probed it all the way down to less than 10^(-18) meters! If one were to naively insert this bound into the classical" energy formula, one finds that the amount of energy that would have been classically stored in the field EXCEEDS the total mass-energy of the electron by AT LEAST a factor of 1000 "*

Don't you see what this means George? It has been experimentally shown that the *minimum* possible energy stored in the electric field surrounding the electron is much larger than the rest mass energy of the electron. You can assume a point particle at the center of the field or some "eye" or a small army of sub-atomic monkeys but the energy in the field is already too big to match the rest mass energy.

**Bugh**:

I see what you mean. If in fact the rate remains that same that the electric field strength increases towards the center then a simple vortex model won't work. The electric field increase would have to taper off to a set value like a barometric pressure does in a circulating low pressure weather system. Else there must be an "eye" that is larger than 10^-18 meters. Its possible to detect that there is no object to bounce particles off of at least down to 10^-18 meters but it may not be so easy to tell that an "eye" or a tapering in electric field potential has already

been encountered before 10^-18 meters radius. or is it possible to measure this?

**Michael Spanner**:

Electrons scatter experiments have shown that the coulomb potential is an accurate description of the electrons E-field down to about 10^18 meters.

**Bugh**:

Sorry but you can't have it both ways at once. You can't say that experiments show the field increases down to 10^18 meters when this would cause the electron's field energy to add up to much larger than the measured value. If it continues to increase down to 10^18 meters then it must not be increasing at the same rate.

In any case, don't scattering experiments only show if there is a solid object down to that size to scatter off of. It seems that the scattering experiments prove my point that there is no object, just a vortex of electric field energy in rotation that stops at a radius such that the sum total of electric field energy outside that radius equals the energy of the electron mass.

**Steven B. Harris**:

No, I don't think this is the coulomb potential, but rather the coulomb potential corrected for vacuum polarization. Which means it doesn't increase as fast as coulomb, and doesn't have as much energy.

**Bugh**:

Is coulomb potential the same as electrostatic field potential? And what does it mean to say a coulomb potential is corrected for vacuum polarization? I am not familiar with this.

**Bugh**:

> *Is coulomb potential the same as electrostatic field potential?*

These are different names for the same thing aren't they?

*And what does it mean to say a coulomb potential is corrected for vacuum polarization? I am not familiar with this.*

Is vacuum polarization the creation of a virtual pair of electron and positron? That's not really relevant here is it?

**mc**:

Please tell me how do you calculate the total energy in the electrostatic field of an electron assuming it has a finite radius? Thank you.

**Martin (David) Green**:

This question deserves an answer....however, it's not clear if "mc" is asking for an explanation of the concept of distributed field energy, or whether he is merely asking for help with the actual 3-dimensional integration. Can I begin by asking him if he knows that the energy density of an electric field is proportional to the square of the field strength?

**mc**:

David Green, thank you for replying. An explanation of the concept of distributed field energy would be welcome. No, I didn't know that the energy density of an electric field is proportional to the square of the field strength, but, anyway, how is the field strength determined?

I would like to know how to calculate the total energy in the electric field of an electron assuming it has a radius of 1 x 10^-15 m.

**Bugh**:

Thank you from George too. Sorry I'm not good enough at the math to answer.

**Green**:

OK, let's back it up one more step. What do you know about the "parallel-plate capacitor"? Do you know what it looks like, where the charge goes, and how the voltage is related to the charge?

**mc**:

That I know.

**Green**:

How do you calculate the energy of a charged capacitor?

**mc**:

The energy of a charged parallel-plate capacitor W is W = ½ Q Vab, where Q is the charge, and Vab is the potential difference between the plates.

**Green**:

OK, that's good. The next question is: where is the energy located? Most people want to say that the energy is "located" in the charges on the plates. There are some problems with this point of view. The alternative is to say that the energy is in the space between the plates, in the electric field. Are you familiar with this idea? Do you know how to calculate the electric field based on the size of the plates, the separation, and the total charge?

**mc**:

I think the energy is located in the space between the plates. But what I would like to know is the field energy of a single electron located far away from any matter. I don't know how to calculate this.

**Green**:

So the first step to understanding the calculation is to do the corresponding calculation for the parallel-plate capacitor. It is good if you "think" the energy is located in the space between the plates; but to go any farther, you probably need to know how to do the actual calculation.

Do you want to work through the parallel-plate capacitor case?

**mc**:

Yes, I do. I looked in one of my textbooks and it says that the energy u in the electric field is u = ½ epsilon E^2, where epsilon is the permittivity constant and E is the electric field. But this

doesn't make much sense to me, because it says that although this equation is derived for the special case of a parallel-plate capacitor, it is true in general. But what if the field fills a great volume? Where is that taken into account? And, of course, the field would not be uniform, it must diminish as a function of the distance from the charge.

**Pusch**:

This is not the formula for the energy — it is the formula for the LOCAL ENERGY *DENSITY* in a vacuum, i.e., the energy per unit volume at each point.

To get the total energy in the external vacuum-region, you have to integrated 'u' over the external vacuum-region. (In a material medium, it must be replaced by u = (1/2) E.D, where 'D' is the so-called "electric displacement vector;" in vacuum, D = \epsilon_0 E.)

> *But this doesn't make much sense to me, because it says that although this equation is derived for the special case of a parallel-plate capacitor, it is true in general.*

It is the true formula for the local energy-density in a vacuum-region; in a material medium, it must be replaced by u = (1/2) E.D as stated above.

> *But what if the field fills a great volume? Where is that taken into account? And, of course, the field would not be uniform, it must diminish as a function of the distance from the charge.*

Since the formula gives the *local* energy-density at each point, and depends only on the field, and not on the field-gradient, one merely needs to integrate it over all space to get the total energy.

**Martin Green**:

Gordon Pusch has responded to some of your questions. He correctly observes that the formula you quote is for energy density, not energy. To get the total energy, you have to multiply by the volume of the capacitor...namely, the area of the plates times the separation between the plates.

It is a good exercise to show that this gives you the same value as the formula you quoted earlier in the discussion, u=1/2QV.

Hint: use the relation: epsilon*E = D, where D is defined in terms of charge density, and recall also that E is defined in terms of volts per meter.

**mc**:

Thank you Gordon D. Pusch and Martin Green for your replies. I still cannot determine the total field energy of one electron in the vacuum. I would like to have a numerical result I can compare with the rest mass-energy of the electron.

***[New thread branch]***

**John C. Polasek**:

*What is the total energy of an electron's total electric field? It's identical to the energy equivalent of its mass isn't it?*

*At what distance out from an electron's center will half of the total electric field energy be near the electron and half of the total electric field energy be further out from the electron?*

George, this is easy work.

Just take ½ the expression for D(r) times the expression for E(r), multiply by dV = 4pi r² dr and integrate from r to infinity. The result should be W = -(e²/2)/(8*pi *ep * r)

**Bugh**:

I think I follow what you are saying. Thanks. 18 years ago when I was just out of college I could understand all this math stuff but I'm so rusty now.

**John C. Polasek**:

George: D(r) = q/4pi r² and E(r) = q/4pi r² eps0. Multiply it all out and get a 1/r² expression to be integrated. (18! how about 35?)

**Bugh**:

Is 4pi*r^2 the surface area of a sphere of radius r? Is D(r) the electric field strength at distance r? Is eps0 the permittivity of

space representing how much electric field energy can be stored in space?

**John C. Polasek**:

Yes dV is Adr = 4pir² dr, surface of sphere D(r) is volts per meter at range r. Eps0 is permittivity of space telling the surface charge density from so many volts per meter.

Be sure to use SI or mks units if you don't want to get mixed up. The answer will be in joules.

***[Old thread branch***]

**Jet Thomas**:

*The energy of a charged parallel-plate capacitor W is W = ½ Q Vab, where Q is the charge, and Vab is the potential difference between the plates.*

*OK, that's good. The next question is: where is the energy located?*

I don't understand the question. When both plates are charged there is an attraction between them. They have a potential energy, and if no other forces were involved they would move toward each other. This is like asking, "Given a gravitational attraction between the sun and Jupiter, where is the energy located?".

*Most people want to say that the energy is "located" in the charges on the plates. There are some problems with this point of view. The alternative is to say that the energy is in the space between the plates, in the electric field. Are you familiar with this idea? Do you know how to calculate the electric field based on the size of the plates, the separation, and the total charge?*

It's one thing to talk about the potential energy of the plates. When you go to the electric field you're at another level of abstraction. Now it's turned into the potential energy that a hypothetical charge would have, if it was at any specific place between or near the plates. Not the actual potential energy, but a potential energy, an interaction that could be predicted for charges that could be put there.

There's an Arabic story about a man who visited some people who lived by the road, he brought them a duck he'd killed and they cooked it for him and everybody had a nice dinner. Some time later some people came by who said they were friends of the man who'd brought the duck, and they were fed too.

Later some people came by who said they were friends of the friends of the man who brought the duck. They were served mostly water. When they complained, they were told "This is the soup of the soup of the duck the man brought.".

It's hard to say just where the potential energy is between a known charge and a charge that isn't there.

**Pusch**:

> *I don't understand the question. When both plates are charged there is an attraction between them. They have a potential energy, and if no other forces were involved they would move toward each other. This is like asking, "Given a gravitational attraction between the sun and Jupiter, where is the energy located?".*

Actually, that's not AT ALL a silly question — it's one of the longest-standing unsolved questions in General Relativity theory!

In GR, energy, momentum, and stresses form the source of the gravitational field — not just mass as in Newtonian theory. If the gravitational field itself can store energy (which it appears to be able to do!), then one might expect it to be a source for **itself** — which indeed it is:

GR is a *NON-LINEAR* theory. The contribution of gravitational energy to the gravitational field produced by an object has even been measured experimentally — see [http://publish.aps.org/abstract/PRL/v83/p3585].

Nevertheless, despite 79 *YEARS* of work by some EXTREMELY competent physicists and mathematicians starting with Einstein himself, it has so far proved IMPOSSIBLE to define exactly where gravitational energy is localized in any meaningful sense (or even HOW MUCH gravitational energy is there!), except in the highly restrictive

case that space is "asymptotically flat" — i.e., that the Universe is a finite "island" in an infinite space, which appear to be rather strongly contradicted by observation. Hence, this problem has come to deeply disturb most of the physicists who have thought about it carefully — e.g., C. Moller, who once wrote:

"...It is inconceivable that such an important concept as the quantity of energy contained within a room should be rendered meaningless simply because it is situated near a massive body..."

Likewise, "where is the energy stored in a capacitor?" is an important question in GR because it influences the gravitational field produced by that energy, and is (in principle!) measurable via the changed gravitational multipole moments of a charged versus a neutral capacitor. In this case,

GR theory *DOES* provide an answer: The energy must be stored in the *ELECTRIC FIELD*, not in the charges on the plates.

**Jet Thomas**:

Thank you for responding. Before breakfast I felt like writing confidently, as if I could tell the difference between a meaningful question and a meaningless one. Now I feel more philosophical, I remember that it might not always be possible in physics to tell the difference. It may not always be possible to tell whether it's possible.

I didn't follow that, no doubt due to my inadequate background. If the only way to detect gravitation is from its effect on a known uncharged mass, what would you know by localizing the energy that you wouldn't know otherwise?

**Pusch**:

Well, consider this question: If one cannot say *where* the energy is localized in a coordinate-invariant way — or even HOW MUCH ENERGY is there (except under circumstances that do not appear to obtain in this Universe), then how can one say that energy *is* conserved, in any meaningful sense ???

In GR, there does not appear to be any equivalent of =GLOBAL= energy conservation any more — only a purely local "covariant conservation law" [http://math.ucr.edu/home/

baez/physics/energy_gr.html] that does =NOT= reduce to the normal laws except in flat spacetime (which we don't appear to live in). In particular, in a curved spacetime, it is =IMPOSSIBLE= to meaningfully "add up" the energy in a volume to find the total energy contained within it — so what does this do to the First and Second Laws of Thermodynamics ??? How do we interpret the macroscopic thermodynamic average quantities like energy density and entropy density that appear in the theory, when the integrals appearing in these averages are UNDEFINED ???

Can we still meaningfully argue that "There Is No Free Lunch" in such a Universe ??? (It was precisely these sorts of questions that so deeply disturbed C. Moller, as discussed in the section of the paper I quoted in my previous post.)

So, if someone could manage to find a meaningful way of defining where energy is localized in GR, we could (among other things) put relativistic thermodynamics back on a solid footing — whereas as things now stand, while most (sane) physicists still feel deep down in their guts that one can't get energy "out of nothing," we can no longer *prove* it to our own satisfaction, unless we assume boundary-conditions that don't appear to apply to the Universe we live in. Like C. Moller, I personally find this quite deeply disturbing, and would like to see the problem solved — preferably in a fashion that closes back off the thermodynamic paradoxes the General Relativity unwittingly re-opened. (Note that this has become much more critical now that the so-called "Cosmological Constant" appears to be non-zero, since as noted General-Relativist Matt Visser has noted, it violates the energy-conditions assumed by all the most important theorems in GR, and in principle (if not in practice) would allow the construction of traversable wormholes, time-machines, and FTL drives, and implying all manner of causality paradoxes:

[http://www.arXiv.org/abs/gr-qc/9705070],

[http://www.arXiv.org/abs/gr-qc/9710010],

[http://www.arXiv.org/abs/gr-qc/0001099].

While fans of SF probably cheer these prospects, most (sane) physicists find the idea that we might =NOT= live in a Universe in which causality is globally defined and in which energy could be extracted "from nothing" rather disturbing — and even despite being an SF Fan, I'm one of them... :-/

Martin Green wrote: (referring to a parallel plate capacitor:)

> *OK, that's good. The next question is: where is the energy located?*

Jet Thomas replied:

> *I don't understand the question. When both plates are charged there is an attraction between them. They have a potential energy, and if no other forces were involved they would move toward each other. This is like asking, "Given a gravitational attraction between the sun and Jupiter, where is the energy located?"*.

It's really just a matter of book-keeping. The original discussion was about how you calculate the electromagnetic energy of an electron. There is a way of calculating this quantity based on the field density everywhere in space. To illustrate this calculation, the simplest example is the parallel plate capacitor. I'm not trying to get into any long philosophical discussions...but if anyone is interested, I am willing to walk them through the calculation one step at a time.

**Bugh**:

> *OK, that's good. The next question is: where is the energy located?*
>
> *I don't understand the question. When both plates are charged there is an attraction between them. They have a potential energy, and if no other forces were involved they would move toward each other. This is like asking, "Given a gravitational attraction between the sun and Jupiter, where is the energy located?"*.

Yes! It is like asking where gravitational energy is located. So stop and think about it. Scientists say that gravity is not really a force but rather an effect caused by a warp in space-time.

What makes Jupiter attracted to the sun is Jupiter's tendency to try and stay in the same place in a warped space-time.

The amount of energy is proportional to the amount of warp. The amount of warp is apparent by the change in the speed of light in warped space-time. c = distance/time

Only the disproportional change in space traversed compared to time traversed by light will be apparent as gravity.

Now extend the same idea to the electric force. But consider the possibility that near a charge both space and time are warped in equal proportion compared to some other location in space where there is not a charge. The speed of light stays the same since space warps and time warps in equal proportion such that c is still equal to distance/time which is the same as some other point in flat space-time away from a charge.

It is the vortex of electric field energy in rotation that IS the electron and that is the cause of the proportional warp in both space and time.

In a hurricane there is a decrease in barometric air pressure. If there were an accumulation of hurricanes in a large region of air then the overall barometric pressure around that region will be less than some other region of air.

In a region of space, if there is a collection of electrons then the overall electric field gradient is comparable to the overall air pressure gradient around a region of vortices in the air.

**Mathew**:

Can electro-magnetism produce zero gravity ?

**Jérôme Juillard**:

I thought electro-magnetism produced no gravity... so I guess the answer is yes...

**Pusch**:

*Can electro-magnetism produce zero gravity?*

If by this you mean, "can electromagnetism produce a gravitational field that cancels the Earth's field," the answer is

"no," since as far as physics currently knows, these two forces are completely and totally unrelated to each other.

If by this question you mean, "is it possible to apply a magnetic force to an object that will exactly =BALANCE= the force of gravity on it," then the answer is "yes — it's called 'magnetic levitation'," see: [http://www-hfml.sci.kun.nl/hfml/levitate.html]. However, please do note that this does =NOT= represent true "zero gravity" — it is merely the balancing of one force by an equal and opposite force of a different type.

**Bugh**:

*Can electro-magnetism produce zero gravity?*

Maybe. Kind of.

It depends on what really causes gravity, i.e. it depends on what really causes the disproportional warp in space-time. If the energy of the electric fields in rotation of electrons and of quarks of the protons and neutrons and the EM energy exchanged between them by their motions is the energy of their mass then it may be something about their mutual interactions that causes gravity.

See the messages and files at: http://www.egroups.com/messages/MagnonLasers

In particular, study the files regarding magnetic waves and the pictures about interaction between rotating magnetic fields of electrons and nuclear particles.

Its just an idea.

***[The dialog continues but is not all recorded here.]***

Hyperlinks to pictures mentioned above which are no longer accessible at the above mentioned website:

- Diagram of Signals from Rotating Magnet (*DIAGRAM 26-1*)
- Diagram of Signals from Rotating and Counter-rotating Magnets (*DIAGRAM 26-2*)

These pictures are explained in Magnetic Waves (*Chapter 26*)

# 4

# Classical Particle Spin versus Quantum Particle Spin

Suggested preliminary reading:

- http://hyperphysics.phy-astr.gsu.edu/hbase/spin.html
- http://www.benbest.com/science/quantum.html
- http://www.chembio.uoguelph.ca/educmat/CHM386/RUDIMENT/TOURQUAN/broglie.htm
- http://modelingnts.la.asu.edu/html/GAinQM.html
- http://zopyros.ccqc.uga.edu/~kellogg/docs/rltvt/node6.html
- http://www.physics.uc.edu/suranyi/Modern_physics/Lecture_Notes/modern_physics8.html
- http://230nsc1.phy-astr.gsu.edu/hbase/spin.html#c4

(Note: At the above URLs, sometimes EPR will mean “Einstein, Podolski and Rosen” rather than “Electron Paramagnetic Resonance”)

In classical physics, a particle has a spin axis and spin occurs around the spin axis. For an electron or any particle with an electric field, its spin around the axis creates a magnetic dipole with a North-South magnetic field through the spin axis. For the electron, the magnetic field strength that is measured does not match the value expected using classical physics equations for determining the expected magnetic field strength. This anomaly is very small but enough to be

measured. The measured value would require that the electron spin at a rate that is slightly faster than the speed of light, which can't happen in flat space-time. One would expect that the warp in space-time due to its gravity would cause the spin to be slower rather than faster than the speed of light.

In quantum physics, the word "spin" refers to something different than in classical physics. Refer to the diagram, Electron Spin (*DIAGRAM 2-1*). In quantum physics, a particle like the electron has spin but also its spin axis can rotate end over end as well as precess around as it is flipping end over end. It can flip so it is spin "up" or spin "down". In quantum physics it is the end-over-end rotation that is referred to when a particle is said to flip spin states. A particle flipping end-over-end will have its precession angle increase until it is passing through the plane of 90 degrees precession angle and continue its end-over-end spin flip motion until it is in a spin down direction.

Electrons or any particle with a magnetic moment will precess in an external magnetic field. Two free electrons, in the absence of any other disrupting signals, will tend to precess in phase.[23]

When 1 of the 2 electrons is made to flip end-over-end once (180 degrees) then its precession phase relative to the other electron will be shifted 90 degrees relative to the first electron due to the effect of the forces that cause a flip in spin states. If 1 of the 2 electrons is made to flip end-over-end twice (360 degrees) then its precession phase relative to the other electron will be shifted 180 degrees making it out of phase with the first electron. This is because its precession frequency shifted slightly while it was acted upon by an external magnetic field to flip it in the end-over-end direction. By flipping it end-over-end twice, once again its precession phase is shifted another 180 degrees making it in phase again with the first electron. In quantum physics this is why an electron is said to not be in the same quantum state again until in has experienced 2 complete rotations. It is end-over-end rotation that quantum theory is referring to and not rotation around the basic spin axis and not rotation around the axis of precession.

By performing a "2 slit" experiment it can be determined that the quantum state is not the same until 720 degrees (end-over-end) rotation because the interference pattern has a different set of constructive and destructive interference. When doing a 360 degree (end-over- end)

[23] "Encyclopedia of Physics", 2nd Ed., CEN 530.03 dc20, Rita Lerner/George Trigg, VCN Publishers Inc., NY, NY, 1991, p313-314 "Electron Spin Resonance"

rotation and then interfering with electrons that have not been rotated, destructive interference is seen where constructive interference was before and vice-versa. At the macroscopic level, after 360 degrees of rotation, the direction and strength of the electric and magnetic fields of the electron are the same. However, the precessional phase of the electron with respect to its surroundings has shifted by 180 degrees from what it was previously. It is the interaction of the electromagnetic fields of all the precessing electrons and all the precessing particles of the atoms of a "2 slit" experiment apparatus that affect the path of the electrons to cause either the constructive or destructive interference pattern to develop from the overall distribution of electrons that pass through 1 slit or the other.

Also in quantum physics, the amount of angular momentum for an electron is what would be expected if it were somehow stuck at a constant precession angle of ½ way to the straight up or straight down direction relative to an external magnetic field. At least this is what has been assumed to explain the out come of the Stern-Gerlach experiment. Along with this assumption a gyromagnetic factor of "2" was also selected in order to make the equation still come out with the correct value for the magnetic moment of the electron. Then Dirac did a relativistic correction to come out with a final value of "2.00232", which would account for the magnetic anomaly.

The up or down precession angle may not actually be stuck at a single + or - quantum value. The results of the Stern-Gerlach experiment make it only appear that way. It seems that only electrons bound in atoms should be stuck at quantum amounts of angular momentum. The electrons precess at only the up or down precession angle which causes the EM waves radiated from their precessing to be re-enforced and continuously exchanged with similar EM radiation from particle precession and motion in the nucleus of atoms as well as the other electrons in the atoms. If an electron within an atom is acted upon by external EM waves or magnetic fields that would move the electron to some other precession angle then it will cause the electron's continuous EM emissions (due to precessing) to be out of phase with emissions from the nucleus and other electrons of its atom. The EM forces (due to this disharmony with the precession and motion of particles in the nucleus) will act upon the electron to immediately bring it back to a quantized angle of precession of spin up or spin down. Harmony is re-established. Still, each electron could have, even if just temporarily, a change in its total angular momentum while experiencing a torque on

its spin axis by an external magnetic field to align it with the external magnetic field.

Free electrons should have no such forces acting on them from particles in the nucleus. It is therefore not appropriate to say that they have a gyromagnetic factor of 2 and a quantized angular momentum of only + or - ½. If there is any evidence that even free electrons have quantized angular momentum with a quantized angle of precession then there must be a process or mechanism or interaction with other particles to make this happen.

# 5

# Acoustic Spin in Barium Ferrite

The following is a description of an acoustic vibration of electron spin motion and a description of a very low frequency magnon laser design based on spin waves of this acoustic mode of spin. The idea came from careful analysis of Floyd Sweet's electromagnetic device[24] and 5 years of study of many other similar devices. Some of the descriptions here are based on preliminary topics already discussed in this book. It is suggested that all previous chapters be studied to fully grasp the following ideas.

Three forms of electron spin are shown in the diagram Electron Spin (*DIAGRAM 2-1)*

These 3 forms of spin are:

1. Basic spin about axis responsible for the magnetic dipole
2. Precessional spin of the magnetic dipole spin axis about a precession axis
3. End-over-end spin of the particle's spin axis due to a changing angle of precession

The precessional spin frequency for an unpaired electron in a ferromagnetic material is around 10GHz in an external magnetic field in the range of 3000-10000 gauss. (Thanks to Vladimir Korostelev for this information.) This is just a rough estimate as this frequency is

[24] http://www.altenergy.org/3/new_energy/zero_point_and_other/floyd_sweet/floyd_sweet.html

greatly affected by the particular materials and the chemical bonds between atoms of the material.

There is another mode of precessional spin that can occur at a much lower frequency. In a ceramic magnet there is a certain amount of elasticity between the chemical bonds of the material's atomic lattice. Random acoustic vibrations in the material's atomic lattice are called phonons and these are often incoherent. This acoustic vibration is present to some degree when there is some amount of heat in the material that is above absolute zero. There can be many different modes of acoustic vibration within the atomic lattice of the material and it is possible to stimulate more coherent waves of resonant acoustic vibration. The following will help visualize just some of these modes of acoustic vibration.

Visualize a sheet of ferromagnetic material in a horizontal x-y plane. The material is just an atomic lattice that is a few atoms thick in the vertical direction. Within the sheet there will be the unpaired electrons shared between atoms. These are responsible for the material's magnetism. Actually, in a ferrite, it is more accurate to say that uncompensated spins cause the magnetism and these spins can be other than just 1 unpaired electron shared between each set of adjacent atoms as would occur in a sample of pure iron. But for simplicity, the processes involved are described as coming from just the unpaired electrons. Keep in mind however that the acoustical vibrations described actually are affecting directions of magnetization of the uncompensated spins.

Just one of several modes of acoustic vibration will be waves of linear motion that will propagate through the material that will move the unpaired electrons back and forth in the x-y plane. The amount of elasticity between the chemical bonds of the material's atomic lattice will determine the propagation velocity of this vibration.

There can also be a mode of thermal vibration that propagates through the lattice which causes a tilt back and forth to the unpaired electrons' precession axes. The spin axes of all these unpaired electrons do not point directly up or down to create the material's magnetic field. The electrons' spin axes are continually precessing about a precession axis. It is the precession axis of the electrons that points up or down. The EM waves radiated due to the electrons' precessional motion about the precession axis are normally canceled by similar EM waves due to nucleus particles' motion and precession. It is the direction of the electron's axis of precession that determines the direction of a ferromagnetic material's magnetic field.

It is possible for a mode of thermal vibration to develop and propagate through the atomic lattice in which the precession axis doesn't just move back and forth or tilt back and forth but rather rotates at some tilt angle. In other words, each electron's precession axis will rotate about another axis of acoustic spin. There will be a tilt angle from the axis of acoustic spin and a rotation frequency associated with acoustic spin about this axis. The frequency of this form of spin will be determined by the elasticity characteristics of the chemical bonds within the atomic lattice of the material. This will be a much lower frequency than an unpaired electron's typical paramagnetic or ferromagnetic precession frequency.

There will not only be acoustic spin of the individual unpaired electrons but also acoustic spin waves among the individual acoustic spins. This is similar to the more familiar spin waves that propagate through precessing unpaired electrons. The frequency of acoustic spin will be lower than the frequency of the more familiar precessional spin. Similarly the frequency of acoustic spin waves will be lower than the frequency of the individual acoustic spins.

Any amount of acoustic spin waves in a ferromagnet will normally be highly incoherent. The average macroscopic direction of magnetization of a ferromagnet will not change since at any instant in time just as many magnetic dipoles will be tilting one way as another. However, magnetic resonance (MR) techniques can be utilized to affect this acoustic form of low frequency spin such that all the acoustic spins can be made to tilt in the same direction. Some ferromagnetic materials will be more susceptible to this type of resonance than others. If resonance is established then the material's macroscopic magnetic field can be made to tilt and rotate at a resonant frequency.

Ferromagnetic materials can be made to develop greater amplitude acoustic spin waves. From experimentation, it appears that some types of barium ferrite magnets are more susceptible to this than other ferromagnets. In the following analogy of this process the individual electron magnetic dipoles are replaced with bar magnets.

Visualize 100 cylindrical bar magnets 3" long and .25" in diameter. Visualize a .5" thick stiff firm sheet of rubber in a horizontal plane. The rubber has a 10 x 10 array holes in it at 1.0" spacing. The magnets are centered in the holes in the rubber sheet with all North poles facing up. The whole sheet is then placed in a large opposing magnetic field. Now there is high metastability to the bar magnets' tilt orientation since the opposing field is trying to push them over while the rubber sheet

holds then up against the opposing field. The least amount of side pull on the magnets from any particular direction will make them tilt over in that direction to a greater degree than if there were no opposing magnetic field pushing down on the magnetic dipoles. If a rotating magnetic field is applied in the horizontal plane then the magnets will all precess together.

Within a ceramic magnet in an opposing field, the individual magnetic dipoles will act in a similar manner. As long as the opposing field is not strong enough to flip the axis of precessional spin of the unpaired electrons, the opposing field will simply apply a force against the dipoles and the dipoles will tilt as they stretch the elasticity of the chemical bonds between atoms. This makes them very susceptible to developing acoustic spin waves as opposed to other forms of thermal acoustic vibration. This also makes these acoustic spin waves susceptible to acoustic-magnetic resonance so as to make the ceramic magnet's macroscopic magnetic field rotate at a resonant frequency.

It is possible for there to be a type of Magnetocaloric Effect associated with this acoustic spin wave temperature as opposed to linear acoustic vibration temperature. Before an opposing magnetic field is applied there will be a certain amount of entropy in the ferromagnetic material. This entropy will be in the form incoherent acoustic vibration of a variety of modes. Here are some but maybe not all of the modes of thermal vibration:

1. Up and down and/or back and forth linear vibration that propagates through the material.

2. Up and down and/or back and forth tilt of spin axes that propagate through the material.

3. Acoustic spin waves that propagate through the material.

When an external magnetic field is applied in an opposing direction to the ferromagnet's field direction then the first two modes of acoustic vibration can decrease in exchange for more of the acoustic spin wave mode of vibration. If an acoustic-magnetic resonance excitation signal is applied, then when the first two modes of vibration give way to the acoustic spin wave mode, they will in fact change from modes of random motion to a mode of coherent motion as stimulated by the acoustic-magnetic resonance excitation signal. The magnetic material will have a rotating magnetic field under the influence of the acoustic-magnetic resonance excitation signal. When the thermal energy of the first two modes of vibration is transferred to the acoustic spin

wave mode of vibration then the rotating magnetic field's angle of tilt will have increased and so the magnitude of the radiated EM waves due to the magnets rotating magnetic field will increase as well. This EM radiation from the magnet can be received and reflected back to the magnet if the acoustic-magnetic resonance excitation source is in fact a type of resonant antenna reflector at the acoustic-magnetic resonance frequency.

At a very low frequency rate the external opposing magnetic field can be relaxed and then re-applied. Each time it is re-applied the thermal energy present in the first two modes of thermal acoustic vibration will be transferred to the stimulated coherent acoustic spin waves. From experimentation it appears that there may be processes that allow the opposing magnetic field to never be removed yet other modes of thermal vibration will continually transfer to the spin wave mode of thermal vibration.

A transmission line connected to the excitation antenna reflector can tap into some of the emissions from the ferromagnet and use this EM energy to power electrical appliances. The result will be that the ferromagnet will get colder by the amount of heat energy converted to resonant low frequency EM emissions and transferred to an electrical appliance

The same laws of thermodynamics that apply to a hurricane also apply to this device. In the development of a hurricane, heat in the air exists in the form of various modes of air molecule vibration. The various microscopic modes of vibration give way to a macroscopic rotating motion of the air. Similarly, in this device, various modes of microscopic thermal vibration give way to a macroscopic rotating motion of the magnetic field.

In a hurricane, a windmill can tap into the heat energy once the heat energy is converted to rotating wind energy. In this device an antenna and transmission line can tap into the heat energy once the heat energy has been converted to rotating magnetic field energy.

Experimenters like Floyd Sweet have reported that the device will "sing" or "ring" at the acoustic frequency of the rotating magnetic field when it is supplying power to electrical appliances. Thermal energy in the device is converted to electrical energy. Experimenters have reported that the ceramic magnet gets colder just as the air of a hurricane gets colder when heat energy in the air is converted to rotating wind energy.

It is important to make the distinction between coherent acoustic spin and coherent acoustic spin waves. The individual unpaired electrons will have their individual magnetic dipoles rotate at some frequency and at some tilt angle. If all the individual magnetic dipoles tilt the same direction and rotate together then there will be coherent acoustic spin at that frequency.

It is also possible for there to be coherent acoustic spin waves that propagate through the individual acoustic spins just as the more familiar spin waves that propagate through individual precessing unpaired electrons. These acoustic spin waves will be lower in frequency than the frequency of rotation of the individual acoustic spins. In devices made by experimenters like Floyd Sweet, I am unsure if they were tapped into emissions from a rotating magnetic field created by coherent spin or coherent acoustic spin, or if they were tapping into emissions from the rotating magnetic field of coherent spin waves or coherent acoustic spin waves or both.

Typical output frequencies were said to be 60 Hz or 400 Hz. I do not know what a typical acoustic spin frequency would be or what a typical acoustic spin wave frequency would be. For a device to work however, it is necessary that emissions be reflected back into the ferromagnet to keep the coherence established. These emissions must arrive at the ferromagnet at an EM wave phase that aids rather than opposes the acoustic spin motion. This requires that more than a ½ wavelength delay occur so a source of reflection will have to be more than ¼ wavelength from the ferromagnet so that EM waves radiated and reflected back will have a delay of more than ½ wavelength. This would mean that the acoustic spin frequency must be high such that the reflector is not a very large distance from the ferromagnet.

Those who have worked with Barium Ferrite magnets report that they must condition the magnet first. This is a process of partially demagnetizing the magnet. In the process of demagnetizing the magnet, approximately half of the individual magnetic domains across the surface of the magnet can flip such that the surface of the magnet converts to a microscopic array of many alternating poles. Acoustic spin waves are then induced in the magnet and these alternating poles will emit EM waves. These EM waves can then be reflected back with enough delay that the microscopic poles will have shifted position enough that they receive an aiding rather than opposing EMF from the reflected EM waves.

# 6

# Angular Momentum of an Electron

This chapter describes the various motions contributing to the angular momentum of an electron and describes how momentum can be exchanged between these types of motion to extract thermal energy from a barium ferrite magnet. Please refer to the diagram Electron Spin (*DIAGRAM 2-1*).

The electron can be described as having 3 forms of spin that contribute to its angular momentum. These are:

A = Axial Spin
B = Precessional Spin
C = End-Over-End Spin

In the previous chapter about Floyd Sweet's device[25] another form of spin was introduced and here it will be referred to as:

D = Thermal Acoustic Spin or just Acoustic Spin

Any and/or all of these 4 types of spin can contribute to an electron's total angular momentum.

For a free electron that is not precessing, all its angular momentum will be from axial spin.

For an electron bound in an atom, part of its total angular momentum will be from axial spin and part of its total angular momentum will be from precessional spin. The total angular momentum

[25] http://www.altenergy.org/3/new_energy/zero_point_and_other/floyd_sweet/floyd_sweet.html

will be that from "A + B" and this will equal the "A" axial spin angular momentum of a free electron. When a free electron becomes bound in an atom, part of it axial spin angular momentum will convert to angular momentum from its precessional spin.

When an electron experiences thermal acoustic spin then there will be an angular momentum associated with this as well. This acoustic angular momentum will add to the electron's total angular momentum. The thermal energy associated with the thermal acoustic spin angular momentum will add to the electron's total energy due to the electron's total angular momentum.

In the previous chapter it was stated that there may be a process by which an opposing magnetic field is always applied and thermal energy within the barium ferrite can be continuously converted. This thermal energy is continuously converted to EM radiation from the coherent acoustic spin motion of the unpaired electrons in a barium ferrite magnet. To understand how this process can work it is necessary to understand what happens when attempting to apply Lenz's Law at microwave frequencies. This is discussed in detail in future chapters of this book.

# 7

# Lenz's Law and a Generator

Review of Lenz's Law and making an extraordinary generator from an ordinary generator using magnetic resonance techniques:

This chapter is an analysis of Lenz's Law and an analysis of how it applies to a generator as the distance between a permanent magnet rotor and a stator approaches ½ wavelength of the frequency of rotation of the rotor. Some unusual characteristics will develop. Here is reference material for those who are a bit rusty on Lenz's Law:

- http://www-d0.fnal.gov/~raymond/rh_lenz.htm
- http://www.pa.msu.edu/courses/1997spring/PHY232/lectures/induction/lenz.html

Lenz's Law is often demonstrated using a strong magnet that is dropped down a thick walled copper pipe. The currents induced in the pipe will create a magnetic field that opposes the magnet's fall so that it falls slowly. The following analysis starts out in a similar manner.

However, the copper pipe is replaced with a hollow highly conductive sphere and an attempt is made to rotate the magnet inside the sphere. A similar result occurs. It is hard to rotate the magnet relative to the sphere due to the opposing magnetic field developed from induced currents in the sphere. This apparatus is analyzed as the distance from the sphere to magnet is increased.

First visualize a strong magnet that is a solid sphere 1 cm in diameter. The magnet is mounted to a strong non-conductive, non-magnetic shaft between the poles. This forms a rotor of a generator. The stator will not be a coil but just a hollow highly conductive sphere. In other words, it is like a 1-turn stator coil that is shorted out. Let's say the stator has an inner diameter of 1.1 cm. The stator has insignificant holes for the rotor shaft to protrude through and the shaft has nearly frictionless bearings of insignificant size. Let's also say that the stator is fastened to a massive structure so it cannot turn along with the magnet's motion.

If the magnet rotor is turned on its axis then current is induced in the stator that causes counter electromotive force (CEMF) opposing the turn.

When the magnet rotates, it will radiate an electromagnetic field and this propagates from the rotor to the stator at the speed of light, $c = 3*10^8$ meters/second. The induced stator currents produce an electromagnetic field that propagates back at c as well.

If the distance traveled by the magnetic field from the rotor to the sphere = s then for counter electromotive force (CEMF) to get back to the rotor the total distance traveled = 2s.

The time delay (td) before the rotor will feel this opposing force = td = (2s)/c

Let's say the frequency of rotor rotation = f. The time (tr) for 1 rotation = tr = 1/f

The CEMF produced by the stator current can be thought of as coming from reflected electromagnetic (EM) waves. For the typical generator, the time it takes for these EM waves to get back to the rotor is very small. The amount of rotor rotation that has occurred will be very small before the reflected EM waves get back and apply CEMF to the rotor.

In other words, as long as td is much less than tr then Lenz's Law clearly applies.

Now lets make the stator sphere (*DIAGRAM 7-1*) much bigger. The rotor is still at the center. If the rotor is turned, then it radiates out EM waves from its spin motion. These waves spread out so they are weaker by the time they reach the sphere. The sphere radiates back reflected EM waves. These waves converge and focus at the center where the rotor is so that by the time they reach the rotor their amplitude adds up to the same value as if the stator sphere was close to the rotor.

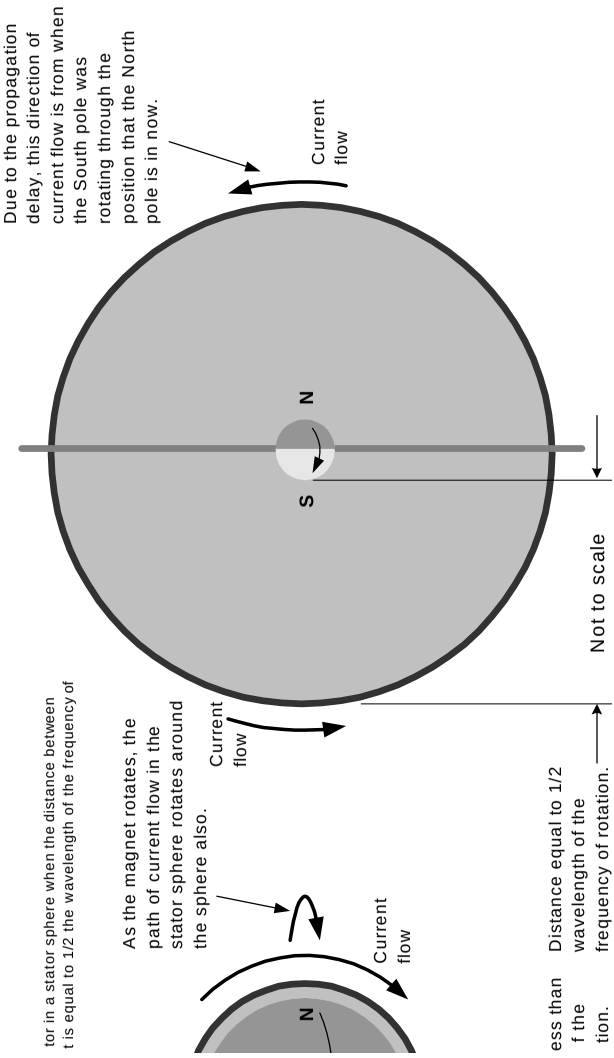



DIAGRAM 7-1
Stator Sphere

The electromagnetic field strength is essentially the same. The thing that has changed is the time delay for the EM waves to radiate to the stator sphere and back. Actually, much of the rotor's magnetic field will stay in close proximity to the rotor until it rotates extremely fast. In this case more electromagnetic wave energy is radiated away from the rotor.

So now lets start spinning the rotor faster and faster. At first it will still be difficult to spin it faster because the applied accelerating torque fights against the opposing force applied by the CEMF from the reflected EM waves. Still, as the rotor spins faster and faster it will rotate through a greater and greater amount of rotation relative to the delay of the waves coming back from the stator. The reflected waves will not be able to apply as much force due to the ever-increasing change in the position of the rotor's magnetic field when the reflected waves arrive. As the rotor keeps increasing its spin rate, a point will be reached where the reflected EM waves from the stator will be applying an EMF that aids rather than opposes the spin of the rotor.

At this point the rotor's own EM emissions once reflected back to it will apply an accelerating force on the rotor. Assuming minimum friction losses, the rotor will continue to increase in speed on its own until it is moving through enough degrees of rotation that the delay of the reflected EM waves from the stator would be such that they again apply an opposing force on the rotor. With no friction losses, the rotor would continue to spin at this speed because spinning slower would cause the phase of the reflected EM waves to apply an accelerating force on the rotor and spinning faster would cause the phase of the reflected waves to apply a decelerating force on the rotor. The rotor spin and the reflected waves would be in harmony at this constant spin velocity.

An even simpler design is possible as well. The EM waves radiated from a rotor can be replaced with EM waves radiated from precessing electrons. Precessing electrons are capable of precessing and radiating EM waves at the frequencies required so that a stator sphere can be of a practical size. The reflected EM waves from the stator would essentially act as an electron magnetic resonance stimulus. Also, there is no problem of friction in a shaft when precessing electrons are used. A ferromagnetic material with precessing electrons will act as kind of a solid state rotor.

There is an interesting thing to take note of here. Once the rotor reached a point where its own reflected emissions applied an

accelerating force on its own spin, it is in fact energy from the rotor that accelerates the rotor. There are two sources of energy in the rotor that could have been radiated out as EM waves to accelerate itself. There is thermal energy in the rotor and then there is the energy of the angular momentum of the particles of the atoms of the rotor. In particular, there is the angular momentum of the unpaired electrons responsible for the rotor's magnetic field. The electrons' axial spin angular momentum is decreased in exchange for greater precessional angular momentum such that each unpaired electron's total angular momentum will tend to remain the same. This is stimulated to occur by the reflected EM waves from the stator.

If the stator sphere is not perfectly conductive then it will get warm from current flow in it and radiate heat out to the environment. The rotor will get cool by the same amount that the stator gets warm.

If the stator dissipates as heat some of the EM wave emissions that it absorbs then not all of the EM energy is reflected back to the rotor. The unpaired electrons will lose angular momentum and they no longer orbit and precess in harmony with the other electrons and particles of the nuclei of the atoms of a ferromagnetic material. This disharmony causes EM forces to develop between the particles' precessional motions. The unpaired electrons will have forces applied to them to try an get them to spin back up to the amount of angular momentum that re-establishes harmony with the "hotter" particles. The "hotter" particles will radiate away energy as EM waves that are absorbed by the precessional motion of the "cooler" unpaired electrons so as to try and get them back up to speed. This will cause the unpaired electrons to stay "warm" to a certain degree but also it will tend to "cool" other particles of the atoms as EM wave energy is radiated away by their precessional motion and absorbed by the unpaired electrons. In this explanation the terms "hot" and "cold" are used as a way of indicating the relative amount of angular momentum particles have relative to the angular momentum all other particles that are still in synchronous precessional motion with each other.

# 8

# The Stator Sphere Generator Design

I did the following more detailed analysis of the generator to see if a mechanical rotor could spin fast enough and be a workable size and give an output that is high enough in frequency to allow a "stator" resonant cavity that is not excessively large. I looked into some flywheel battery web sites to see what sizes and rpm values are possible.

Reference:

- http://sites.netscape.net/dickfradellausa/basics.htm

Based on what appears possible from the above reference I'll try the following values for a flywheel disk with alternating polarity permanent magnet poles around its outer circumference:

> Spin rate: 10,000 rpm = 166.67 rps = approx. 167 rps
> Disk diameter: 1 meter
> Disk Circumference: 3.14 meters
>
> I'll have magnets 1 cm wide and 1-cm gap between magnets so there will be 2 cm for center to center of adjacent magnets. Total magnets around the rim will be 314/2 cm = 157 magnets.

> As the rim rotates past a point on the stator, 2 poles must pass for each complete cycle of magnetic field reversal. Therefore, for 1 revolution of the disk there will be 157/2 = 78.5 magnetic reversal cycles. In other words, if the disk spins at 1 revolution per second (rps) then it will radiate 78.5 Hz electromagnetic waves.
>
> At 167 rps, the EM waves will have a frequency of 13109.6 Hz.
>
> The wavelength will be: $3*10^8$ / 13109.6 = 22884 meters.
>
> A ¼ wavelength distance is needed from the rotor rim to the stator wall so that the reflected EMF will be ½ delayed so that it will be aiding rather than opposing the rotor motion.

This is 22884/4 = 5720 meters. This is totally impractical. If reports of a generator like this were for real and if it did experience the reported unusual phenomena then it must have been radiating some EM waves that were much higher in frequency for these reflected emissions to return at a phase that aided rather than opposed the rotor's rotation.

This is still a possibility. The typical CEMF from stator windings with a load connected to the generator could have applied forces to the permanent magnets in the rotor that stimulated spin waves or acoustic spin waves in the magnets. The emissions from these could have been high enough in frequency that their reflected EMF would aid rather than oppose the rotation of the rotor.

A generator can be designed in which there is no macroscopic motion of the rotor. The rotor would radiate its output solely from spin waves or acoustic spin waves in the ferromagnetic material of the rotor.

# 9

# The Cigar Shaped Resonant Cavity

This chapter describes how an ellipsoid cavity can be used instead of the spherical stator previously described. A description is given of changing the frequency of the magnetic wave emissions of atoms of the cavity and its contents to reduce its attraction to similar emissions from the atoms of the Earth.

The stator of the previously discussed design is essentially a resonant cavity and will be referred to as such in this chapter. When the distance from rotor to the cavity wall is ½ wavelength of the frequency of electromagnetic (EM) waves radiated from the motion of the rotor, the rotor will spin on its own with no external energy input required. The energy to drive the rotor will come from the angular momentum of the unpaired or uncompensated electron spins of the rotor magnet. These are the electrons that are responsible for the magnet's magnetism. The angular momentum of the spins of all the particles of the atoms of the rotor magnet will be decreased through the interaction of the unpaired or uncompensated electron spins with the other particles of the atoms of the magnets. Quantum physics is unable to recognize that this is possible, however, it is actually similar to extreme cooling of the magnet's atoms with the energy removed being used to maintain the macroscopic rotation of the rotor.

With a rotor at the center of a resonant cavity sphere, the stator sphere ( *DIAGRAM 7-1*) inner diameter would be 1 whole wavelength.

The following is a list of what the necessary diameter would be for various frequencies of EM waves radiated from the rotor:

| **Spherical cavity diameter.:** | **EM wave frequency:** |
|---|---|
| 3 cm | 10 GHz |
| 30 cm | 1GHz |
| 3 meters | 100MHz |
| 30 meters | 10MHz |
| 300 meters | 1MHz |

It is not practical to build a mechanical rotor that can rotate fast enough so that it radiates at the upper frequencies of this list. At the lower frequencies, the sphere size is too large to be practical. Instead of using a single rotor at a focal point at the center of a sphere, it would be more practical to use an ellipsoid shape with a focal point at each end. An ellipsoid resonant cavity can be shaped such that the distances from 1 focal point to the other will be the same for reflected EM waves regardless of the path that any individual reflected wave might take. The following is an example of how to construct this shape.

Orient an 8.5”x11” sheet of paper in the “landscape” position, draw a horizontal centerline on the page. Place 2 pins or needles in the centerline with a spacing of 20 cm or approximately 8 inches between them. Tie a fine thread or string between the pins such that the length of the string is 21 cm or approximately 8.25 inches. Press a pencil against the top of the string and push the string down and move the pencil left to right tracing from the centerline at the left to the centerline at the right. Press the pencil against the bottom of the string and push up and trace another line from left to right.

This forms an ellipse. Visualize rotating the ellipse about the centerline and this encloses an ellipsoid. An ellipsoid of reflective material forms a resonant cavity such that all reflected EM waves from one focal point will be equal distance from the other focal point. For this particular apparatus, this equal distance between focal points will be ½ the wavelength of the EM waves radiated from a rotating magnet at one of the focal points. The EM waves will radiate to the other end of the cavity, pass through the second focal point and reflect back to the rotating magnet after a total of 1 wavelength delay.

Visualize that a magnet is spinning at a rate such that the reflected waves are delayed 1 wavelength. If an attempt is then made to spin the magnet faster, the reflected EM waves will apply counter electromotive force (CEMF) that opposes this increase in rotation velocity. Now,

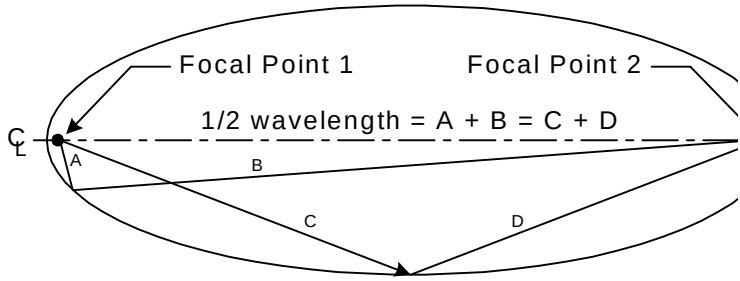



DIAGRAM 9-1
Ellipsoid Resonant Cavity

visualize that the rotor is allowed to spin on its own with no type of motor turning the rotor. Frictional losses from the rotor's axle of rotation and from the rotor moving through air will tend to make the rotation rate decrease. As this happens the rotor magnet will develop EMF between the magnet and the reflected EM waves. This EMF will apply force to the rotor to keep it spinning at a rate that maintains a 1-wavelength delay in its reflected EM waves.

The energy required to keep the rotor rotating at the same rate will come from the rotor's own radiated EM waves from its own magnetic field in rotation. This energy will actually come from the angular momentum to the particles of the atoms of the magnet itself. Only the slightest decrease in the magnet's particles' angular momentum will translate to a large amount of energy radiated as EM waves that apply EMFs that maintains the magnet's spin rate. This decrease in angular momentum of all the particles of the magnet will cause the particles that make up the atoms of the magnet to precess at a slower rate relative to atoms outside of the magnet.

The atoms of the magnet will already be radiating waves of alternating magnetic field that tends to be in harmony with similar waves from all the atoms of the Earth. Before the rotor begins rotating, the atoms of the magnet will feel the pull from the waves of alternating magnetic field from the Earth, as would also all the atoms of the contents of the resonant cavity. When the magnet's particles lose angular momentum, the atoms of the magnet will radiate lower frequencies of alternating magnetic field waves. Similarly all the atoms within the cavity will be radiated with these lower frequency waves and tend to move into harmony with these lower frequencies. All the atoms within the cavity will move to a set of frequencies of radiated waves of

alternating magnetic fields that are no longer in harmony with similar waves from the atoms of the Earth.

The cavity and its contents will no longer be pulled to the Earth by the magnetic waves from the Earth. The cavity would be able to fly, at least at some minimal velocity once it has risen into the air. The amount of negation of the Earth's pull will be determined by how much the magnetic wave frequencies have been shifted from the atoms of the cavity and its contents. The amount of frequency shift will depend on the amount of energy removed from the magnets to compensate for loses in the reflected EM waves in the cavity and frictional losses in the mechanical processes involved. Energy can be purposefully dissipated as heat to develop lower frequencies of magnetic wave emission from all the atoms of the cavity and its contents.

To improve symmetry, a second rotor can be used at the second ellipsoid focal point. Its rotation would be phased to match the delayed EM waves of the 1st rotor.

This flying cigar shaped resonant cavity would have to be large such that the frequencies involved would be feasible. If the distance covered from a reflected EM wave from one focal point to the other were 300 meters then this would be the ½ wavelength of the frequency of magnet rotation. One wavelength would be 600 meters. This would require a magnet rotation frequency of 500,000 revolutions per second. If the rotor has multiple alternating magnetic poles around its circumference then this allows it to radiate at higher frequencies for the same rotation rate. For example, if the rotor has 499,999 alternating poles around its circumference then it can rotate at approximately 1 revolution per second or in other words, 60 RPM.

A more feasible design would not use a mechanical rotor. A solid-state rotor can be used such that spin waves in a magnetic material would radiate EM waves at the desired frequency. Those who have worked with barium ferrite magnets as solid-state rotors report that they must condition the magnet first. This is a process of partially demagnetizing the magnet. In the process of demagnetizing the magnet, approximately half of the individual magnetic domains across the surface of the magnet can flip such that the surface of the magnet converts to a microscopic array of many alternating poles. Acoustic spin waves are then induced in the magnet and these alternating poles will emit EM waves. These EM waves can then be reflected back with enough delay that the microscopic poles will have shifted position

enough that they receive an aiding rather than opposing EMF from the reflected EM waves.

There have been reports of people stating they have seen cigar shaped UFOs. These UFOs are reported to be very large and this is consistent with what would be necessary for this design to work. On an episode of the television show Unsolved Mysteries, a sheriff in a rural area in the Southwestern United States gave a detailed description of a craft he saw that matches exactly the craft described here. He observed a large ellipsoid craft with a reflective metal skin. He saw men in space suits outside. They went back in the craft. It engaged conventional rocket engines that he reported as very loud until it was at an altitude that cleared the local ground terrain variations. Then it moved horizontally without a sound until it was out of sight.

Update: Here is some more information from Steve Gerrard of the Southampton UFO Group, sufog.freeserve.co.uk, regarding the incident that was in the Unsolved Mysteries episode, "The incident you refer to sounds like the case of Lonnie Zamora who encountered the object in the Socorro, New Mexico on the 24 April 1964. The object roar[ed] and descended in a blue and orange flame. The police officer described the object as egg-shaped, shiny-white, sitting in a shallow gully. He thought at first it was a crashed car up on end. Two beings in white coveralls seen. The object stood on 2 legs and [had] a strange red insignia. Suddenly, there was a load roaring noise. At about a height of 10 feet, the object moved slowly SW. Then it rose higher and 'took off', disappeared in the distance. Burn marks found at the location with 4 depressions in the ground."

Steve Gerrard says further that there is a book about it, "…the book 'Socorro Saucer' by Ray Stanford. This 190 page paper back book covers the whole incident in great detail.[26]

Here's more information:

- http://www.cufon.org/contributors/chrisl/socorro.htm

Other design shapes could work as well. For example, the resonant cavity could be flatter and round with a solid state rotor located at a circular foci. In other words, it could look like a flying saucer. A horizontal view cross section of it would look like the ellipsoid diagram above.

[26] Socorro Saucer, in a Pentagon Pantry", Ray Stanford, Blueapple Books, 1st edition, 1976, ISBN 0917092007)

# 10

# Dialog on Solid State Rotor Design

From the usenet newsgroup sci.physics.electromag in post titled “Rotor design”.

***[The diagrams in this discussion were meant to be round.]***

**Bugh**:

> If I have a permanent magnet rotor that spins at say 5000 RPM will I get approximately the same output from a stator coil around the rotor regardless of whether:
>
> . . .
> . . . . . .
> . . . . . .
> . . . . . .
> . . . . . .
> . . . . . .
> . . . . . .
> . . .
>
> a. the rotor consists of 52 magnets all rotating together about 1 central axis or,
>
> b. the rotor consists of 52 magnets each rotating each on its own axis such that the North poles of all the magnets point the

same way all the time, i.e. they rotate in phase, assuming the spacing between magnets and between magnets and stator are approximately the same in both cases?

**Green**:

You left out a few important assumptions, which I am sure you mean to include: the total magnetization of the magnets is the same in each case, and so is w, the angular rotation rate, I presume.

I am reminded of a simple fact in geometry which somehow escaped me all these years: the intrinsic rate of rotation of each submagnet is the same if it is glued into a disk at some location, the disk rotating at w, as if the submagnet were independently spinning at w. Which sounds like it should be the motivation for a trick answer, "the same". Maybe this is even right. The magnetic field shows the same variation external to the magnets in either case.

**Bugh**:

Yes, those were my assumptions that I was taking as a given. I thought the output should be the same with either set up but I wasn't sure. So then I'm also wondering, the same setup could be used as a motor as well right? I mean I can put a signal in on the stator coil and get either:

a. all the magnets to rotate together about a central axis if they are mechanically setup this way or

b. each magnet to independently rotate about its own axis.

In the case of "b" I should be able to apply a higher frequency signal to the stator and get the magnets to spin faster because the ends of each smaller magnets do not have to rotate through as much area of space with as much centrifugal force trying to tear the magnets apart. Or is that centripetal force? I'm always getting those two mixed up.

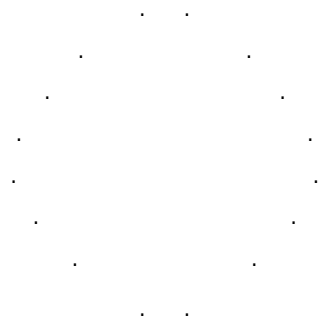
If I had an array of nano size rotors, for a motor or a generator, they could spin very fast.

Also if I used just the individual electrons' magnetic dipoles and rotating them all together as my rotor then my rotor could

spin at electron paramagnetic resonant frequencies. In that case there would be some lag from spin position at one side of the overall magnet to the other side of the overall magnet and spin waves of spin phase lag that propagate through the magnet. But a stator coil could be designed to deal with the shifting phase from one part to another part of the ferromagnetic material.

**Ted Russ**:

or would various magnetic poles interfere as they rotated past one another? (ie cancel and reinforce as the various poles are brought into juxtaposition?) maybe you don't need rotor magnets in the centre, just around the outside of the "rotor" disc:



**Bugh**:

If individual electron precessions are used as the rotors then this may certainly be the preferred configuration. The frequency of rotation would be so high that the amount of induced current in the stator coil or coils could be very high even though there is not much ferromagnetic rotor material. In fact just a loop of magnetic recording tape may be sufficient.

**Pusch**:

They will more-or-less cancel in the interior (just as do the microscopic dipoles in a bulk magnetic material), but they will add in the exterior region (again, just as in a bulk magnet). Such arrays of small permanent magnets are used in many applications where it would be impractical to make a single chunk of permanent magnet-material of the required size, shape,

or magnetization pattern; the most sophisticated designs of this type are called "Halbach magnet-arrays," after Klaus Halbach, who developed a number of elegant design-principles for such arrays.

> *maybe you don't need rotor magnets in the centre, just around the outside ofthe "rotor" disc:*

Yes, this will work — and if the dipoles are oriented properly, it will form a Halbach magnet-array, which concentrates most of its flux in the exterior w/out wasting flux in the interior [http://www.skytran.net/press/sciam02.htm].

(Halbach arrays do this by arranging that the fringe-fields of the dipoles mostly cancel in the interior and add in the exterior, or vice-versa, depending on what type of field is desired.)

**Paul Victor Birke**:

This is kind of a key idea!

Humble EE

Paul

BTW keep your ideas coming!

The concept of a motionless motor is wonderful. An engineer's question:==> what make up of the spin wave function maximizes rotational momentum. BTW I have some papers on spin waves. I liked the idea and kept them aside. Strange! All the best, Paul

**Bugh**:

Thank you. I have lots of ideas. Sometimes they are wrong ideas though because I don't understand things well enough. Other times I just don't know how to get my ideas converted to words much less math formulas.

I don't know how to give a spin wave function formula for maximum rotational momentum. Just thinking about it, with a mechanical permanent magnet rotor, it is the amount of force applied to a particular amount of mass of the rotor and the amount of time that force is applied that determine the velocity and thus momentum that the rotor develops.

With a solid state rotor utilizing rotating spin waves, the velocity of the waves has more to do with the charateristics of the material. With most any kind of waves, it is more the characteristics of the material that the waves propagate through that determine the velocity. In a ring of ferromagnetic material, the velocity of the spin waves are determined by things like how strongly or weakly the magnetic dipole spins couple to each other and things like the elasticity or rigidity of the spin interactions as well as the elasticity or rigidity of the material as a whole.

The material would need to have the easy axis of the magnetic dipoles oriented in such a way that the spin waves have a preferred plane of propagation rather than being prone to having the spin waves dispersing into many different directions and orientations.

If the velocity of the spin waves is mostly set by the characteristics of the ferromagnetic material then the momentum will be mainly determined by how large of amplitude of spin waves can be developed. In an AC motor-generator used as a flywheel battery, the AC input signal increases rotor velocity and this increases its momentum and thus the energy it stores. With a solid state rotor, the AC input signal increases the amplitude of the spin waves by continuously re-enforcing them like pushing on the waves at the right phase to add energy to them. I think it will be the phase of electromagnetic input-output signal relative to the phase of the spin waves that determine if energy is being put into the waves or removed from the waves and it will be the amplitude of the input-output signal that determines how much energy is put into the waves or taken out from the waves.

**Edward Green**:

No matter... that is a pedantic distinction anyway, since the force necessary to accelerate an object and the force the accelerated object exerts on its accelerator are the same magnitude, by the third law of some Newton guy. I guess “centrifugal” refers to the latter, since it is the force tending to make the object “fly (from) the center”, and “centripetal” is the one that’s left.

To answer your other question, I don't know. I was lucky to get the first part right. You would think, by symmetry, that if all the little spinning magnets could induce the same current as one big spinning magnet, that you could run the thing backwards as a motor to spin all the little magnets. It just seems less clear this way; would the outer magnets somehow shield the inner magnets from the applied field? Would all the little magnets stumble over each other because of effects of their poles passing each other? We reasoned all the little magnets produce the same external field as one rotating magnetic disk, but we did not inquire about the torque necessary to do this.

Every time adjacent magnets line up N/S they go through a stable configuration, and the torque necessary to drive them, just internally, forget about the load, goes through two cycles each rotation. Operating as a generator, we just decree that we have means to drive them all at constant w by fiat, but how will this affect their performance in a motor? I do not know.

> *If I had an array of nano size rotors, for a motor or a generator, they could spin very fast.*
>
> *Also if I used just the individual electrons' magnetic dipoles and rotating them all together as my rotor then my rotor could spin at electron paramagnetic resonant frequencies. In that case there would be some lag from spin position at one side of the overall magnet to the other side of the overall magnet and spin waves of spin phase lag that propagate through the magnet. But a stator coil could be designed to deal with the shifting phase from one part to another part of the ferromagnetic material.*

I have no idea at all if that makes any sense or not. But I ask you, how do you propose to harness the power from this motor? Isn't a motor a device to convert electrical work to motive force? If nothing is moving...

(George Bugh: I hope you the reader after studying all these science files carefully will understand how to harness the power of this motor.)

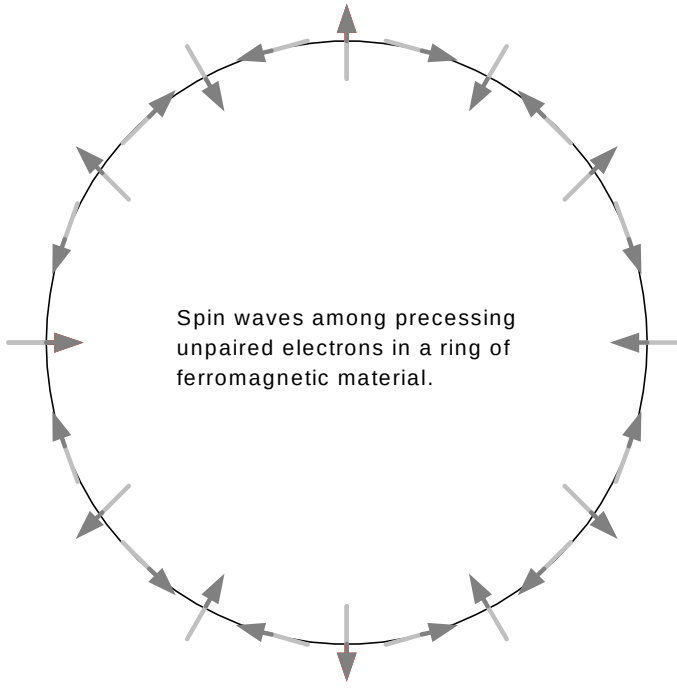



DIAGRAM 10-1
Solid State Rotor

# 11

# Introduction to Magnetic Ferrites

Read first:

- http://www.britannica.com/search?query=ferromagnet&ct=eb
- http://www.britannica.com/search?query=magnet&ct=eb

Read this if you want more, near the end it covers magnetism:

- http://www.britannica.com/search?query=magnetism&ct=eb

## *Ferrites:*

I'm not an expert at this but the following is what I think is true. First off, I often see people refer to a ferrimagnetic material as ferromagnetic and so I may sometimes do the same. I think this is not technically correct but it is referred to this way because ferrimagnetism can sort of be considered as a subcategory of ferromagnetism.

Soft ferrites are easily re-magnetized in a new direction. Hard ferrites are hard to re-magnetize in a new direction. Hard ferrites are permanent magnets, although a permanent magnet does not necessarily have to be made with ferrite. A permanent magnet can be constructed of non-ferrite materials. However, the focus of this chapter is magnetic ferrites.

A ferrite is a ferrous material, usually iron, that is combined with oxygen to become an oxide and this is formed into a ceramic crystal or crystals. Pure iron is ferromagnetic and a ferrite of iron and oxygen

can be a ferrimagnetic material. However, not all combinations of iron and oxygen are ferrimagnetic.

Uncle Al says: “Fe(2)O(3) rust is not ferromagnetic. Perovskites and spinels like magnetite Fe(3)O(4) and commercial magnetic ferrites are intervalence charge transfer complexes with engineered crystallographic unit cells, diddled intergranular whatever for forming, and complex physics.”.

Rust, Fe(2)O(3), is not ferromagnetic while Fe(3)O(4) is ferromagnetic. A material’s magnetism depends on whether there are “uncompensated spins” created by a particular configuration of combined elements and this will be discussed further in the following paragraphs.

Now I’m confused because Uncle Al says Fe(2)O(3) is just plain rust and is not magnetic while the reference below says that Fe(2)O(3) is the mineral maghemite and that it is highly ferromagnetic. It may be that there are 2 iron atoms and 3 oxygen atoms in both cases but the pattern in which they are connected determines if the mineral is just nonmagnetic rust or ferromagnetic maghemite.

- http://www.treasure-troves.com/chem/Maghemite.html
- http://www.treasure-troves.com/chem/Magnetite.html
- http://www.galleries.com/minerals/oxides/magnetit/magnetit.htm

Various chemicals are mixed and then heated to chemically change them and bond them together. Then this is ground to a fine powder. Then the many small crystals of ferrite are pressed together and heated up in a kiln to make a larger piece of ferrite. This process does not completely melt the individual crystals together. Usually they are just melted together partially to make a single hard piece. It is like making a brick of ceramic magnetic material. Commercial ferrites usually have elements added like barium or strontium for example. These other elements increase a hard ferrite’s magnetic strength. Here is a tour of the process:

- http://www.grouparnold.com/products/ferrite/ferrite_manufacturing_tour.htm

Various elements may also be added to soft ferrites as well to improve their soft properties. Here is more information on ferrites.

- http://www.bytemark.com/amidon/material.htm
- http://www.temex-components.com/temex/technote/fer_basi.html

The preceding reference says ferrites are cubical crystals. Many ferrites are cubical but there are also hexagonal ferrites that are referred to as hexaferrites.

The following references show nanometer size hexagonal platelets of hexaferrites. *Find these at http:/www.archives.org*

- http://www.apt-powders.com/BarFerite.htm
- http://www.apt-powders.com/StronFerrite.html

The graph at the following URL shows a hysteresis curve, (sometimes called a hysteresis loop) of the material. Please also see diagram 11-1, Hysteresis Loop. This tells an engineer how strong of an

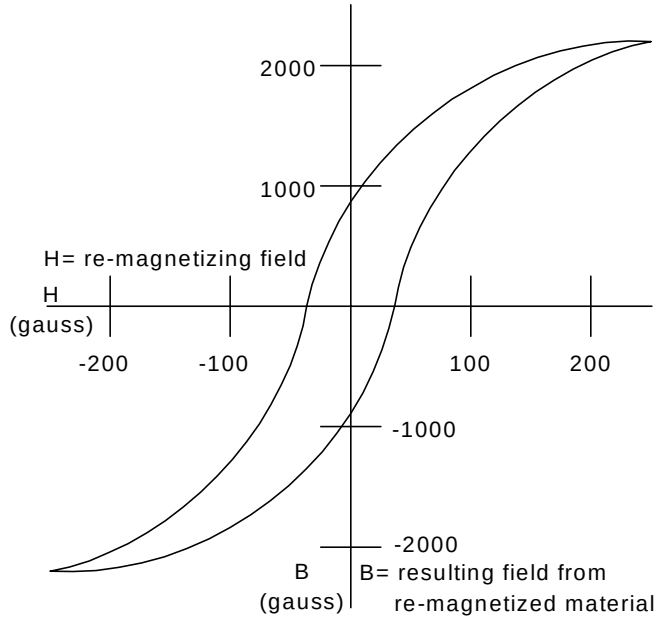



DIAGRAM 11-1
Hysteresis Loop

external magnetic field must be applied in the opposite direction to the existing magnetized direction of the material before uncompensated electron spins will flip over and the material will swap its direction of magnetization and become magnetized in the new direction. Often the chemical structure of the material will cause it to be re-magnetized in two primary directions, either up or down along what is called the "easy axis". It is more difficult to magnetize the material at some direction other than along its easy axis.

It is the unpaired electrons of the bonds between atoms of a ferromagnetic material that flip up or down to cause a change in the material's direction of magnetization. This is the case for pure iron but it is an oversimplification to describe a ferrite this way.

Joseph D.Warner, referring to the bonds between ferrite molecules, says:

"…these bonds are more ionic in nature and the iron valence state can be +2 or +3. With spin-orbit coupling the 3d and 4s states can be mixed and the relative energy levels of the hybrid orbitals are dependent on the crystal symmetry."

In describing electrons as paired or unpaired with other electrons, this is related to whether electron spins are "compensated" or "uncompensated". An electron can have orbital spin and spin about its own precession axis or an addition of both or a subtraction of one from the other that still leaves some amount of total spin that will create a magnetic field. All forms of motion of an electric field will create a magnetic field. If an electron has a total spin that is canceled by equal but opposite total spin of another electron then it is described as "compensated". The more "uncompensated" electron spins there are in a material the greater magnetic field it can produce from all these uncompensated spins pointing a similar direction.

Quantum physics does not recognize the precessional spin that I mention here. Quantum physics calls the axis of precession the spin axis. Also quantum physics does not recognize the exchange of EM waves between precessing particles as is mentioned here. To understand the difference between electron axial spin and electron precessional spin find Electron Spin (*DIAGRAM 2-1*) and the related text files about the electron's spin motions that are in Classical Particle Spin vs Quantum Particle Spin (*Chapter 4*)

Usually when speaking of the direction that an electron's spin axis is oriented, it is actually the electron's axis of precession that is pointing in that direction and that causes a ferromagnetic or

ferrimagnetic material's magnetic field. The electron is always precessing around this precession axis at a precession tilt angle such that a vector portion of its magnetic field is in the magnetized direction while another vector portion of its magnetic field is rotating around an axis of precession. The rotating portion of its magnetic field direction will radiate electromagnetic (EM) waves that are exchanged between the other particles of the atoms as other charged particles of the atoms are all precessing as well. The other electrons and quarks that make up the protons and neutrons will all precess. Each plane, in which lie the 3 quarks of a proton or neutron, will precess as well.

As long as these EM waves are exchanged only between each other, these EM waves are not apparent outside of the material except during a particle's flip in spin axis direction. The flipping of a particle's spin axis will interrupt its exchange of EM waves with the other particles of the atoms. It is the magnetic field interaction among uncompensated spins that keeps them aligned in a particular direction. The uncompensated electron spin directions are forced to remain in the direction that maintains the highest degree of harmony between the EM waves continuously exchanged by the precessional motions of these electrons and the precessional motions of the other orbital electrons of the atoms in the material as well as the precessional motions of the particles of the nuclei.

External forces that tend to push an uncompensated electron's spin in some other direction will cause a phase shift in the electron's precession and so also a phase shift in its EM waves relative to the EM waves of all the other particles that it was in harmony with. This causes EMF to develop and so tension to develop due to the disharmony with the emissions of all the other particles, and this tension and EMF applies a counter force on the unpaired electrons preventing them from changing their spin axis direction. The vector of the uncompensated electrons' magnetic fields that does not precess will also apply forces among each other to keep them oriented the same direction.

For any particular ferrite material, it is the strength of these forces that determine the coercivity of the material. A material's internal coercive force or coercivity is a measure of the amount of internal forces keeping the material magnetized in a particular direction. The more coercivity a magnet has the more permanent it is. A hard ferrite has high coercivity and a soft ferrite has low coercivity.

Soft ferrites are easy to re-magnetize in the opposite direction of magnetization whereas hard ferrites are hard to re-magnetize in the

opposite direction. The hysteresis of a magnetic material like a ferrite is what indicates how hard it is to change its direction of magnetization. Usually the energy required to make this change is lost as heat in the material. This is called hysteresis loss.

If a ferrite is going to be used in an inductor for high frequency signals then it is desirable to use a soft ferrite so that there will be low hysteresis losses. In high power applications, you can feel an inductor's ferrite core while it is being used and feel the heat from energy lost as hysteresis losses from re-magnetizing the material back and forth in changing directions at high frequency.

A ferrite powder does not have to be sintered into a single piece. The powder can be mixed with melted plastic or an epoxy and then hardened while in an external magnetic field. This keeps the easy axis of all the powder grains pointing the desired direction while the material solidifies. Flexible refrigerator magnets are made this way. Once the easy axis direction is set, the material can be re-magnetized in the opposite direction but this is not usually done with permanent magnets. However, it is done all the time with magnetic recording media like floppy or hard drives or recording tape.

Magnetic powder is deposited on plastic film to make recording tapes.[27]

Referring to the Diagram 11-2, a graph of a soft ferrite's hysteresis loop has a gradually rising change in magnetization direction and not much separation between the 2 sides of the loop. A hard ferrite has a wide-open hysteresis loop and flatter more parallel sides. This indicates that the change occurs later but more abruptly as an external magnetic field is applied with increasing strength to change the material's magnetized direction.

This chapter on ferrites is meant to focus mainly on magnetic materials with grain sizes as small or smaller than a typical single magnetic domain. For the applications of interest here, it is desired that the material be designed such that changing domain walls and grain shape changes are at a minimum. In anisotropic single domain magnetic ferrite crystals, rather than experiencing a change in shape or a macroscopic change in direction of orientation of the whole crystal, the individual uncompensated spins within the material will flip to cause a reversal of the direction of magnetization of the material along its easy axis.

[27] http://www.ee.washington.edu/conselec/CE/kuhn/magtape/95x1.htm

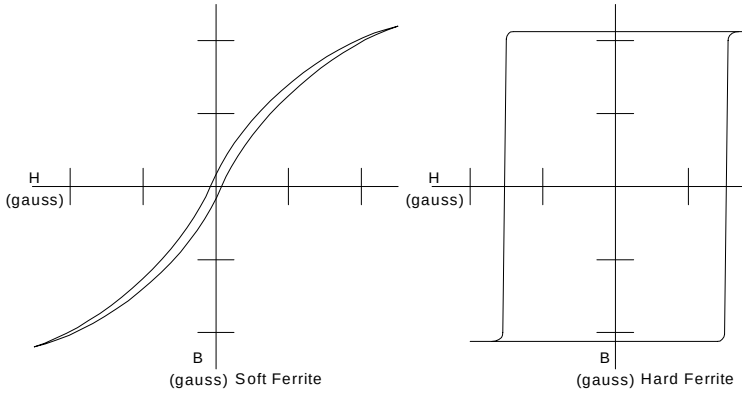



DIAGRAM 11-2
Hysteresis Loop: Soft vs. Hard

# 12

# Hysteresis in the Lasing Material

- http://www.lassp.cornell.edu/sethna/hysteresis/hysteresis.html
- http://treasure-troves.com/physics/HysteresisEffect.html
- http://phy-server.phy.queensu.ca/wwwhome/atherton/linepipe.html

In selecting the lasing medium for a magnon laser there are at least two possible approaches; using a soft ferrite or using a hard ferrite.

In whatever material is used, it is necessary that when the individual unpaired electrons flip spin states to align with the external field, they should emit a photon in phase with a stimulating photon from the reflector antenna.

## *Soft ferrite*

As the external magnetic field increases in strength, a statistically greater and greater number of precessing electrons will flip spin states at a more linear rate than in a hard ferrite. Their precession frequency will continuously increase as the external magnetic field increases. To stimulate the precessing electrons to emit photons, it is necessary that the antenna reflector emit the correct frequency of photons to match the precession rate for any given external magnetic field strength.

There are at least two ways to do this.

1. The capacitance of the antenna reflector can be adjusted with something like tuning diodes driven with a

signal proportional to the current through the field coil that creates the external magnetic field. As the external magnetic field increases in strength, the antenna capacitance is decreased causing an increase in its resonant frequency.

2. It is also possible to use a series of antenna reflectors to create a series of resonant frequencies that beat together at the desired phases to create a low frequency "difference" signal. As the external magnetic field strength increases, each antenna's resonant frequency is reached in succession and the antennas' reflections stimulate the precessing electrons to flip spin states and emit more photons in phase and at the same frequency as the antenna's resonant frequency.

### *Hard ferrite,*

As the external magnetic field increases in strength, the precessing electrons will not flip spin states until a given field strength when most of the precessing electrons all flip spin states. Their precession frequency will continuously increase as the external magnetic field increases however few electrons will flip. To stimulate the precessing electrons to emit photons, it is necessary that the antenna reflector emit the correct frequency of photons to match the precession rate for the given external magnetic field strength at the point when all the electrons will flip spin states. At this point the stimulating photons from the antenna reflector will cause all the electrons to flip in succession creating a coherent spin wave. This is a controlled avalanche to the new spin state.

When using a hard ferrite it is necessary that there be hysteresis when applying the external magnetic field but no hysteresis when decreasing the external magnetic field. This can be accomplished using the Magnetocaloric Effect. When the material reaches the avalanche point and the electrons all flip spin states and emit photons, the material should get warm enough that now it is above its Curie temperature. At that temperature, when the external magnetic field is decreased, thermal energy in the ferrite's atomic lattice will drive the unpaired electron's spin axis to random directions.

The material, if it is lasing, will get continuously colder and no longer go above its Curie temperature. It will begin to operate out of the range where the Magnetocaloric Effect will be experienced. This

will cause a decrease in the intensity of the coherent EM wave output until a point of equilibrium is reached where the amount of heat energy being pumped into the whole system will equal the amount of coherent EM wave energy being removed from the system.

# 13

# Magnetic References


- http://www.scitoys.com/scitoys/scitoys/magnets/magnets.html
- http://www.magnetec.de/nanoperm_emv_e.htm
- http://metglas.com/index.htm
- http://www.aps.org/meet/CENT99/BAPS/abs/S4345.html
- http://www.magnetsales.com/Design/DesignG_2.htm
- http://www.magnetweb.com/magamer.htm
- http://www.magnetweb.com/equip.htm
- http://www.pels.org/Comm/Publications/Newsletter/9610/SCHOLARS.HTML
- http://bytemark.com/amidon/material.htm
- http://www.onr.navy.mil/onrasia/poly/talukdr22.html
- http://www.stanfordmaterials.com/magnet.html
- http://www.mag-inc.com/FAQ.html
- http://www.ceramicjournal.org/issues/v83n5/abs/0186.html
- http://www.mrs.org/publications/jmr/jmra/1999/aug/038.html

# 14

# Magnetic Recording Tape

It may be possible to use magnetic recording tape as a lasing medium. The following links are provided to give the reader information on magnetic tape. In a magnon laser, the easy axis of the magnetic domains of the ferromagnetic material need to be parallel with the magnetic field of a field coil and perpendicular to the standing waves that stimulate coherent precession of unpaired electrons or uncompensated electron spins. It is possible that anisotropic and/or acicular magnetic particles will work best for this. But it is very important that all the individual magnetic domains are arranged with their easy axes parallel as opposed to randomly distributed orientations as is common on many recording media.

Links:

- http://www.strl.nhk.or.jp/open98/4-2/detail-e.htm
- http://www.el.utwente.nl/tdm/istg/research/metalev/
- http://www.el.utwente.nl/tdm/istg/research/metalev/metalev.htm
- http://www.el.utwente.nl/tdm/istg/research/patterned/patterned.htm
- http://hyperphysics.phy-astr.gsu.edu/hbase/audio/tapecon.html#c1
- http://www.dwelle.de/rtc/infotheque/magn_recording/magrec.html

- http://www.dwelle.de/rtc/infotheque/magn_recording/magrec_03.html
- http://rabi.phys.virginia.edu/106/1999/PS5a.html
- http://www.ee.washington.edu/conselec/CE/kuhn/magtape/95x1.htm
- http://www.wsrcc.com/alison/magrec.html

# 15

# EM Waves - Spin Waves Interaction

Classical Interaction of Electromagnetic Waves and Spin Waves (Photons and Magnons) in a Ferromagnetic Material:

Quantum physics contends that electromagnetic (EM) waves come in discrete units called photons and photons are treated as particles. This is the smallest unit of EM energy that is absorbed or emitted by electrons changing orbitals around an atom. An electron can absorb a photon while rising to a higher energy level orbital. An electron can also emit a photon when falling to a lower energy level orbital around an atom.

In classical electrodynamics it is possible that EM waves can exist at amplitudes smaller than that of a photon. These EM waves are not readily detectable since they are too small to interact with orbital electrons of an atom and an EM wave detection device is made of atoms. A whole photon of EM energy is required to move electrons between orbitals.

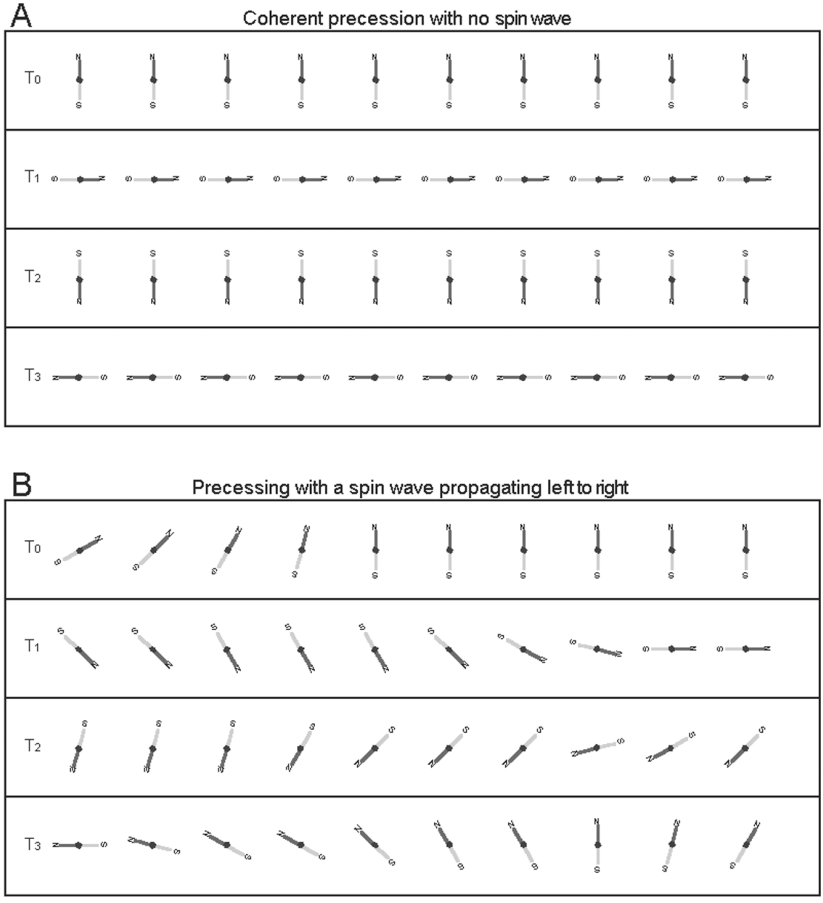
In quantum physics, a magnon is the quasi-particle name for a unit of elementary excitation in which the direction of magnetization in a ferromagnetic material, or that of a sublattice moment in an antiferromagnetic material, is spatially nonuniform and propagates as a wave. This is a spin wave.

In a ferromagnetic material, spin waves propagate through precessing unpaired electrons. A magnon is the smallest quantum unit

of measure of spin waves just as a photon is the smallest quantum unit of measure of electromagnetic waves.

It is possible however that spin waves can exists at amplitudes smaller than one magnon. One magnon is simply the size of spin wave necessary to emit or absorb one photon.

A spin wave consists of many precessing electrons each at a slightly shifted precession phase relative to the precessing electrons around it. Refer to the Spin Waves diagram (*DIAGRAM 15-1)*. This is a diagram that shows a single row of precessing electrons as seen looking




10 unpaired electrons along 1 dimension of a ferromagnetic crystal lattice as viewed looking into the axis of precession.

DIAGRAM 15-1
Spin Waves Propagation

down into the precession axis. First the electrons are shown all precessing in phase. Then the electrons are shown with a spin wave propagating through them. A spin wave has momentum.

According to classical electrodynamics, each single precessing unpaired electron in a ferromagnetic material should continuously emit EM waves and so it is the author's contention that they actually do. It is possible that a precessing electron will always be emitting and absorbing a very small amount of EM waves even when it is not experiencing a change in its precession angle. On average, it will absorb just as many EM waves as it emits until there is a certain degree of equilibrium reached among all the precessing electrons in a ferromagnetic material. In fact it is possible for sub-photon amplitudes of EM waves to be continuously exchanged between all precessing charged particles everywhere.

The precessing electrons will emit or absorb EM waves the most when the precessing electrons flip end-over-end or in other words they experience a change in their precession angle. When a precessing electron is in an external magnetic field it can emit a greater amount of EM waves when there is a change in its precession angle due to its spin axis moving to align with the external magnetic field. This is a change to a lower energy state.

A spin wave contains a large number of precessing electrons each at a slightly shifted phase. When the individual precessing electrons change in their precession angle they each emit larger amplitude EM waves. The more the precession angle approaches 90 degrees the more the electron's magnetic dipole sweeps through a greater circle so it sends out larger EM waves. The EM waves of each precessing electron are emitted each at a consecutively shifted phase due to the consecutively shifted precession phases between the unpaired precessing electrons. The amplitudes of all these EM waves will add to create an EM wave of amplitude large enough to be a photon's worth of EM wave energy. A magnon is the size of spin wave whose individual precessing electrons radiate a total of a single photon worth of EM energy from their individual EM waves summed together.

In a similar manner, when a spin wave absorbs a photon of EM energy, this energy is absorbed and distributed among all the precessing electrons that make up a magnon worth of spin wave. This spin wave has momentum and carries with it the energy that was the energy of the photon.

The frequency of a magnon or spin wave will be lower than the frequency of precessional rotation of the individual precessing electrons through which a spin wave propagates. Also the propagation velocity of a spin wave will be much slower than the speed of light.

Classically, a precessing electron should experience a decrease or increase in its total angular momentum when it emits or absorbs EM waves while experiencing a shift in its spin axis to align with or against an external magnetic field. It is possible that, temporarily, the precessing electron actually does experience a change in its angular momentum. However, due to the EM interaction due to its precession phase relative to the precession phases of all other precessing electrons around it, it will absorb EM waves radiated from all the other precessing electrons until it regains or loses angular momentum and thus reaches equilibrium with them. There will never be perfect equilibrium and this is due to spin entropy. There will be a degree of randomness to the precession angles, precession rates and precession phases of all the interacting precessing electrons. This spin entropy is manifest among all the precessing electrons as random spin waves in a variety of amplitudes and frequencies.

There is a wrist exercise toy, the Dynabee®[28] [29], that provides a useful analogy and is helpful in visualizing how precessional interaction can cause a precessing electron to quickly gain or lose angular momentum until it is in equilibrium with all the other atomic particles in its surroundings. It consists of a small plastic ball that fits in the palm of the hand. Inside is a heavy metal ball that moves freely on a set spin axis. It has a pull cord to get the ball spinning. Then a person can increase the ball's total angular momentum by giving precessional motion to the ball with leading force relative to its already established precessional motion. When a precessing electron is in precessional equilibrium or harmony with the other particles in its surroundings then it will be emitting and absorbing a minimum amount of either leading or lagging phase of EM waves relative to the EM waves of all other precessing electrons around it.

The following is a classical electrodynamics explanation of an atom. In the end, the thing that determines what the standard amount of angular momentum for a precessing electron is, will be that amount of angular momentum that makes an electron precess in harmony with all the other electrons and particles of the nucleus within an atom. Electrons

[28] http://www.dynabee.com
[29] Dynabee is a trademark of Variety Plastic Products

will precess as they move in their orbitals. They precess under the influence of the magnetic fields from external magnetic field sources, all the other electrons in the atom and the particles of the nucleus. The quarks of the protons and neutron also precess. There is a continuous exchange of EM wave energy between all the particles of an atom. This is due to all of the complex precessional and orbital motions of them all, such that they re-enforce each other only when the electrons are in distinct orbitals. The atom as a whole does not continuously lose or gain much energy as these EM waves are exchanged mostly between the precessing and moving particles of the atom. It is this exchange of EM energy that keeps the electrons moving in orbitals rather than falling into the nucleus.

There may be a sub-photon amount of EM wave energy radiated from precessional motion of particles in all atoms. This is radiated and absorbed between all atoms and between atoms and free particles. They will all reach a certain degree of angular momentum equilibrium and this causes them to all reach a certain degree of harmony among the precessional motions of all of them. For the most part, this EM wave activity is at a sub-photon energy level and so is not readily apparent.

# 16

# The Magnetocaloric Effect

The Magnetocaloric Effect[30] is not unique to a magnon laser. In fact it is normally utilized in magnetic cooling for refrigeration units.

References:

- http://www.aps.org/BAPSMAR98/abs/S3220004.html/
- http://www.aps.org/BAPSMAR98/abs/S3220.html
- http://www.sciam.com/1998/0598issue/0598techbus5.html

The following terms are defined as they are used in this chapter:

- http://www.harcourt.com/dictionary/

A photon is the quantum unit of radiated electromagnetic energy.

A phonon is a quantum of vibration excited by the acoustic mode of a crystal lattice; the vibration is usually thermally excited. Thermal motion in a ferromagnetic[31] material's lattice can be described as incoherent phonons.

A magnon is a quantum unit of elementary excitation in which the direction of magnetization in a ferromagnetic material, or that of a sublattice moment in an antiferromagnetic[32] material, is spatially

[30] http://www.harcourt.com/dictionary/def/6/1/4/1/6141900.html
[31] http://www.harcourt.com/dictionary/def/3/8/8/6/3886600.html
[32] http://www.harcourt.com/dictionary/def/6/4/0/0/640000.html

nonuniform and propagates as a wave. This is called a spin wave. It propagates through precessing unpaired electrons in a ferromagnetic material. A magnon is the smallest unit of measure of spin waves just as a photon is the smallest unit of measure of electromagnetic waves.

In the descriptions that follow, the Magnetocaloric Effect[33] is described as it applies to a ferromagnetic material with the magnetism attributed to the unpaired valence electrons shared between atoms in the crystal lattice. These same descriptions can also be extended to ferrimagnetic[34] and antiferromagnetic[35] materials however it is not the unpaired valence electrons that contribute to the materials magnetism but rather the uncompensated spins within the material. There will be precessional motion of these uncompensated spins. These uncompensated spins are the sum or difference of combined orbital and axial spin of electrons whose total spin is not compensated for by equal and opposite spins of other electrons within each molecule of ferrimagnetic or antiferromagnetic material.

Lattice entropy means the amount of random agitation, jiggling or jostling of atoms within an atomic lattice. In a ferromagnetic material, lattice entropy can be described as a measure of the number of incoherent phonons propagating through the lattice. An increase in lattice entropy can be felt as an increase in temperature while a decrease in lattice entropy can be felt as a decrease in temperature.

Spin entropy means the amount of changing orientations of the spin axis of atomic particles. When discussing the Magnetocaloric Effect[36], we are only concerned with the spin entropy of the unpaired orbital electrons of a ferromagnetic material. These are the electrons that are responsible for the magnetic field of a ferromagnetic material. In a ferromagnetic material, spin entropy can be described as a measure of the number of incoherent magnons[37] propagating through all the randomly precessing unpaired electrons.

Before an external magnetic field is applied, there is a certain degree of randomness (spin entropy) in the spin axis orientations of all the unpaired electrons in the ferromagnetic material. This spin entropy takes the form of magnons of spin waves that randomly propagate throughout all the randomly precessing unpaired electrons. An external

[33] http://www.harcourt.com/dictionary/def/6/1/4/1/6141900.html
[34] http://www.harcourt.com/dictionary/def/3/8/8/0/3880200.html
[35] http://www.harcourt.com/dictionary/def/6/4/0/0/640000.html
[36] http://www.harcourt.com/dictionary/def/6/1/4/1/6141900.html
[37] http://www.harcourt.com/dictionary/def/6/1/5/0/6150600.html

magnetic field causes the random orientations to move more into alignment with the external field. This constitutes a decrease in randomness (spin entropy) in the orientations. When this happens the ferromagnetic material gets warmer. When the spin entropy decreases the lattice entropy tends to increase so that entropy is conserved. An increase in lattice entropy causes an increase in temperature.

Any time that entropy is increased or decreased in anything it is due to the transfer of energy. In this case, it is photons or electromagnetic energy that transfers the entropy. Photons don't have to be in the visible light frequency range. Photons can also be emitted or absorbed at microwave or infrared frequencies. Any frequency of photon, even down to 60Hz for example, can be considered as the carrier of radiant heat energy when it causes heat (increased entropy) in the material that absorbs it.

When a precessing unpaired electron moves into alignment with an external magnetic field it is not normally described as emitting a photon. It is said to give up energy through spin-orbit coupling. In other words, as it changes its spin axis orientation, it has electromagnetic coupling to the nearest orbital electrons in the atomic lattice of the material. It transfers energy directly to these orbital electrons causing more random motion in these electrons and since there is coupling between these electrons and surrounding electrons and nuclei, the thermal energy readily propagates through all of them as phonons. Since any interaction between changing spin axis orientations and lattice vibrations are due to electromagnetic interactions these interactions can be described as mediated by photons. For the purposes of explaining how the Magnetocaloric Effect can be utilized it is easier to describe all spin-lattice or spin-orbit energy transfer interactions in terms of photon or electromagnetic wave interactions.

So here is what happens to cause the Magnetocaloric Effect.[38] An external magnetic field is applied to a ferromagnetic[39] material. This stimulates the magnetic dipoles of the unpaired electrons in the material to turn more into alignment with the external magnetic field. The precessing unpaired electrons emit energy as they change their spin axis orientation so that they are aligned the same direction as the external magnetic field. This is a lower energy state for each unpaired electron.

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[38] http://www.harcourt.com/dictionary/def/6/1/4/1/6141900.html
[39] http://www.harcourt.com/dictionary/def/3/8/8/6/3886600.html

When an unpaired electron with spin within a ferromagnetic material is immersed in an external magnetic field, its magnetic dipole does not swing directly up into alignment with the external magnetic field. It works like a gyroscope in a gravitational field. If you balance a gyroscope spinning vertically in a gravitational field and you pull the end of its shaft out from vertical then the shaft torque's around at 90 degrees to the direction of pull. The gyroscope starts precessing about its original spin axis at some precession angle and precession rate.

In a similar manner, the unpaired electrons in a ferromagnetic material have precessional motion and they emit and absorb photons at their precessional frequency (Larmor frequency[40]). The Larmor frequency is affected by the strength of the external magnetic field. The stronger the magnetic field, the higher the Larmor frequency will be. Depending on the material used, the precessional motion dampens out at some rate as the electrons re-orient more into alignment with the external magnetic field. Larmor frequency originally referred to the precessional tilt and rotation of the plane of an electron's orbit around a nucleus for an electron with a circular orbit. Here the term is being used to refer to the precession of an electron's spin axis about an axis of precession through the electron. Refer to the diagram Electron Spin (*DIAGRAM 2-1*).

In a ferromagnetic material within an external magnetic field, the unpaired electrons emit photons when they change their spin axis alignment. The photons are emitted at their precessional frequency. Normally the precessional frequency and phase angle will vary among all the electrons' spin axes that are changing orientation. This is due to the interaction of the magnetic fields of all the electrons and due to variations in the external magnetic field as it passes through various areas of the ferromagnetic material. There are magnons[41] (spin waves of interaction) that propagate through the material in an incoherent manner. Therefore photons are emitted at incoherent phases due to the incoherent magnons.

At the same time that individual unpaired electrons emit EM waves and move into alignment with an external magnetic field, the magnons or spin waves among all the precessing electrons will dissipate. The energy that was in the form of magnons is transferred to phonons in the atomic lattice. There are now more phonons in the atomic lattice. Therefore the ferromagnetic material gets warmer.

[40] http://www.harcourt.com/dictionary/def/5/6/9/5/5695800.html
[31] http://www.harcourt.com/dictionary/def/6/1/5/0/6150600.html

A magnon is an elementary or quantum unit of a spin wave just as a photon is an elementary or quantum unit of an electromagnetic wave. Magnons propagate through the precessing electrons. When these electrons move into alignment with the external magnetic field, they can be stimulated to all emit EM waves in succession. A magnon or spin wave among many precessing electrons will dissipate in exchange for a succession of individual EM waves radiated out from each precessing electron that an individual magnon is propagating through. Each EM wave is radiated at a slightly shifted phase from each precessing electron that is at a shifted precessional rotation position. The summation of all the EM wave phases is an EM wave large enough in amplitude to be a whole photon of EM energy. Since magnons are normally highly incoherent it is not apparent that they dissipate in this manner and the energy is normally described as being transferred to phonons through spin-orbit interaction. If electron paramagnetic resonance is stimulated and spin wave resonance is stimulated with an outside signal source then the spin waves can be made coherent and they can be described as emitting coherent photons to the atomic lattice in this manner to become phonons. It is also possible for these coherent photons to radiate outside of the ferromagnetic material.

In this paper the total magnetic field of a ferromagnetic material is attributed simply to the sum of the individual magnetic moments of all the individual unpaired electrons. This is a simplified explanation. In careful measurements of actual magnetic fields compared to theoretically expected values using quantum mechanics, it is found that they do not match. Other processes and mechanisms take place within a ferromagnetic material and these have been explained with various theories but to my knowledge no one has proof of the validity of any particular theory. I believe Professor Charles Kittel's explanations are most widely accepted, see Introduction to Solid State Physics, by Charles Kittel[42]

[42] http://jws-edcv.wiley.com/college/tlp/0,9842,SCIC-PHC-PHX3C-PH37C_0471111813_BKS,00.html

# 17

# Thermodynamics of a Magnetic Hurricane

This is a chapter comparing thermodynamic processes in a hurricane with similar processes in the forms of magnon lasing covered at this website:

- http://www.egroups.com/group/MagnonLasers

It is possible to extract thermal energy from ferromagnetic materials and turn this thermal energy back into useful electromagnetic energy. The processes involved are similar to those of a hurricane. In a hurricane, incoherent motion of air molecules (heat) at the microscopic level is converted to coherent rotating motion of air molecules at a macroscopic level. This in itself may appear to be a violation of the laws of thermodynamics but it is not.

There are other related processes that take place that make this possible. Specifically, as a hurricane develops, water in gaseous form converts to water in liquid form. This is a self-accelerating and then self-sustaining process while there is water in gaseous form to be converted. This is a temperature-related process that also involves the heat capacity of the air. As water vapor turns to rain, the air cools and this accelerates the transition of more water vapor to rain. This process is inter-related to and promotes the conversion of incoherent air motion to coherent air motion, which becomes the hurricane.

The initial input of energy into the system is heat energy from the sun. The output of energy from the system is a macroscopic rotation of the air. As long as there is energy input into a system like this and as long as there are continuous phase transitions the system can convert heat energy into energy in the form of rotating air.

The various devices that I have written about all use ferromagnetic materials that undergo processes similar to a hurricane. The ferromagnetic material does not change from a gas to a liquid or from a liquid to a solid however there still can be phase changes or transitions in a ferromagnetic material's characteristics that are temperature related and that involve the material's heat capacity. In a ferromagnetic material this is called the Magnetocaloric Effect.

Similar to a hurricane, microscopic incoherent motions of magnetic fields can be converted to macroscopic rotation of the magnetic fields. The laws of thermodynamics are not violated. Heat is the input energy source into the system and a rotating magnetic field is the output of the system. As long as there is energy input into a system like this and as long as there are continuous phase transitions, the system can convert heat energy into energy in the form of rotating magnetic fields.

Regardless of what processes you want to say occur in a hurricane or what characteristics there are inside a hurricane, the end result stays the same.

Namely, there is heat going in and coherent air rotation coming out. Similar behavior can occur in a ferromagnetic material with heat going in and a rotating magnetic field coming out. The processes are not completely identical to a hurricane. They are similar however in that heat is turned back into a useful form of energy by utilizing the phase transitions of magnetic material.

Before and after a hurricane the condition of the water is the same.

There is no net change in that regard.

The thermodynamic system starts off with cool water.

The sun heats it. The water gets warm and some converts to gas.

After the cycle is complete, after it has rained, the water is back in the ocean and the water is cool again. Where did the heat energy go?

It converted to coherent rotation of air molecules.

The heat energy is input into the system from the sun.

When it is raining, when the air gets cool again and when the water gets cool again, where did the heat go?

The heat is absorbed by the transition of water from one state to another but after the cycle is complete the water ends up right back in its original cool state. There is no net change there.

Some of the heat is pumped out to the troposphere above the hurricane such that this area gets warm while the water and air in the hurricane get cool.

However, heat is also converted to coherent rotation of the air.

Update: After further thought, I see that when trying to make a common correlation between the characteristics of a hurricane and the characteristics of electric and magnetic fields, in a magnetic material a rotating hurricane with a gradient in barometric air pressure may more closely relate to a rotating electric field. A rotating magnetic field may relate to a precession of a vortex of air but hurricanes don't precess.

Further Update: This subject is best put on the back burner. Instead, it's better to start over and start comparing a collection of molecular electric dipoles to magnetic dipoles. There should be an effect akin to the Magnetocaloric Effect, an Electrocaloric Effect perhaps, that can be utilized to extract heat energy.

# 18
# Comparing Electric and Magnetic Dipoles

Recommended reading:

- http://164.125.104.76/lectures/ferro/ferroelectric.htm

Near the Curie temperature of a ferroelectric material, it may experience something similar to the Magnetocaloric Effect; an Electrocaloric Effect. Before an external electric field is applied there will be entropy in the material in the form of random linear motion and jostling of the molecules. There will also be entropy in the form of random rotational orientations of the molecular dipoles. When an external electric field is applied the electric dipoles will rotate to align with the external electric field. As the electric dipoles all move to a more ordered orientation of alignment with the external electric field, this constitutes a decrease in dipole rotational entropy. Entropy of linear motion jostling must increase so that the total entropy is conserved.

Unlike the Magnetocaloric Effect, the overall temperature of the material may not increase. This is because both the temperature of rotational motion and the temperature of linear motion of a ferroelectric material will already radiate heat. However, in a ferromagnetic material, for some reason, spin temperature does not radiate heat like lattice temperature does. Spin temperature must first convert to lattice temperature before it radiates heat.

So then the question is:

In a ferromagnetic material with a Magnetocaloric Effect, why does lattice temperature radiate heat but spin temperature does not? When an external magnetic field is applied causing spin entropy to decrease in exchange for more lattice entropy then suddenly it can radiate heat. But why couldn't the spin temperature already be radiating heat such that the total heat radiated would remain the same regardless of how much is radiated by spin temperature and how much is radiated by lattice temperature?

It may be that the energy dissipated as heat in a ferromagnetic material with a Magnetocaloric Effect comes from the source of the applied external magnetic field. However, this does not correlate with explanations that the rise in temperature is from spin temperature energy transformed into lattice temperature energy.

# 19

# Introducing the Magnon Laser

***A magnon laser consists of***:

1. A lasing medium made of ferromagnetic material
2. A reflector antenna for generating/reflecting photons at EPR (electron paramagnetic resonance) frequencies.
3. A very low frequency antenna coil for generating relatively static but toggling magnetic field.

***Theory of Operation:***

To understand the operation of a magnon laser it is necessary to first review what happens in a ferromagnetic material without the use of something to stimulate electron paramagnetic resonance (EPR).

1. Before a ferromagnetic material is placed in an external magnetic field it will have a certain amount of spin entropy and a certain amount of lattice entropy. The spin entropy is in the form of incoherent magnons or spin waves among all the interacting magnetic dipoles of the randomly precessing unpaired electrons. There is a certain amount of energy stored in the form of spin temperature just as there is also a certain amount of thermal energy stored in the form of lattice temperature.

2. When the ferromagnetic material is placed in an external magnetic field, each unpaired electron will emit

EM waves at its Larmor frequency and will move its spin axis more into alignment with the external magnetic field. This is a lower energy state.

3. As the spin axes of the unpaired electrons move into alignment they become more ordered thus there is less spin entropy. The magnons or spin waves are normally incoherent and give up their energy by through direct spin-lattice coupling or emission of incoherent photons. The atomic lattice absorbs most of these photons and this creates

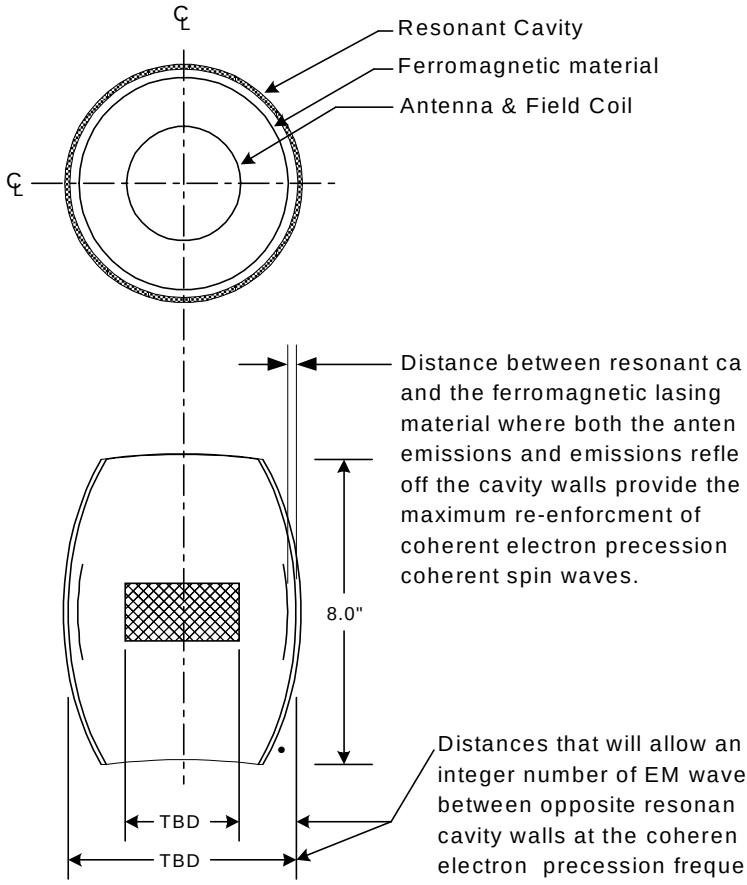


DIAGRAM 19-1
Magnon Laser

more phonons. Therefore, lattice entropy increases. The number of magnons decrease and the number of phonons increase.

4. At this point, this heat energy in the atomic lattice can be absorbed by direct contact with a colder substance, like cold water or cold air. Also, this heat energy in the form of phonons in the atomic lattice can dissipate as photons of radiant heat.

5. When the ferromagnetic material is removed from the external magnetic field, magnons are formed again from photon energy absorbed from the phonons.

In a magnon laser, precessing unpaired electrons emit coherent photons in phase with stimulating photons emitted from a reflector antenna. The phase of these photons continuously change in a rotating manner at a rate that matches the standing spin wave resonant frequency of standing spin waves in a ferromagnetic material used as the lasing medium. In order to create and maintain standing spin waves and EPR in the ferromagnetic material, electron paramagnetic resonance (EPR) is stimulated by use of the antenna reflector coil and an up/down magnetic field coil.

Here is the same sequence of events when an EPR antenna reflector coil is added:

1. Before a ferromagnetic material is placed in an external magnetic field it will have a certain amount of spin entropy and a certain amount of lattice entropy. The spin entropy is in the form of incoherent magnons or spin waves among all the interacting magnetic dipoles of the randomly precessing unpaired electrons. There is a certain amount of energy stored in the form of spin entropy just as there is also a certain amount of thermal energy stored in the form of lattice entropy.

2. When the ferromagnetic material is placed in an external magnetic field, each unpaired electron will emit EM waves at its EPR frequency and will move its spin axis more into alignment with the external magnetic field.

Now however, standing waves at the EPR frequency are created between the precessing unpaired electrons and the EPR antenna reflector coil. The phase of these reflections continuously change in a rotary manner and stimulate a rotating coherent spin wave around the equator of the cylinder of ferromagnetic (*DIAGRAM 19-1)* lasing material.

3. As the spin axes of the unpaired electrons move into alignment they become more ordered thus there is less spin entropy. This forces the magnons or spin waves to give up energy by emitting photons at the EPR frequency. Normally these magnons are somewhat incoherent and emit incoherent photons. The atomic lattice absorbs most of these photons and this creates more phonons. However, now that the spin waves are coherent, when the magnons emit a rotating phase of EPR frequency photons, they do not all become absorbed in the lasing material but are radiated out to the antenna reflector.

4. At this point, this heat energy is partly absorbed by the atomic lattice and partly absorbed by any resistance in the antenna coil. Any energy not dissipated by the antenna reflector will be reflected back into the lasing material and still become absorbed by the lasing material. Now there will be less phonons in the lasing material since it did not absorb all the photons radiated by the coherent magnons. The antenna and devices connected to it have absorbed some of the photon energy.

5. When the external magnetic field is removed, magnons are formed again from photon energy absorbed from the phonons. Since there are less phonons than were originally there in step 1, the lasing material gets colder than in step 1.

6. The external magnetic field is now applied in the opposite direction and the process is repeated. With each cycle the lasing material gets colder by the amount of heat transferred to the reflector antenna. As the temperature

> difference builds between the lasing material and the external environment, the lasing material will absorb any amount of radiant heat from all sources of heat in the area.

The magnon laser's reflector is not a simple mirror as is used with a traditional laser. The frequencies involved are in the RF spectrum so the reflector involved is a type of reflector antenna. The reflector antenna is designed to create partially standing/partially traveling waves along its length at the resonant frequency. The frequency of the standing waves is the resonant frequency of the precessing electrons in the ferromagnetic material. These standing waves travel around the circular antenna at the propagation rate of the spin waves in the ferromagnetic material. The reflector antenna is built either around the outside of the lasing material so that it reflects back into the material or it is built on the inside of a hollow lasing medium so that it reflects back out to the lasing medium. In either case the partially standing/partially traveling waves travel in a circular manner around the lasing medium. When the reflected emissions from the antenna propagate back to the lasing medium they are in the correct phase to re-enforce coherent magnons (spin waves) and coherent EPR within the lasing medium.

To maintain a lasing process it is necessary to have coherent spin waves. It is also necessary to have continuous flipping of spin states so that the precession of the electrons never completely dampens out. A very low frequency, relatively static, external magnetic field toggles in up-down orientation for the purpose of maintaining a stimulus for the precessing electrons to continue flipping back and forth from up and down spin states. This magnetic field is created by a field coil connected to a capacitor to form a tuned LC tank circuit as the desired toggle frequency.

Once the precessing electrons have flipped spin states to the lower energy state of being aligned with the external field then the external field is reduced in strength. At this point phonons emit photons that are absorbed by the precessing electrons causing them to have more energy in the form magnons and there is increased spin entropy. Next the external magnetic field is toggled to an opposite direction of North-South orientation and increased in strength again. Now the unpaired precessing electrons can be considered as being in a metastable state. They must lose energy to again align with the external magnetic field. They lose energy by emitting photons.

The key to a magnon laser's operation is the reflector antenna which stimulates the coherent emission of photons from the precessing electrons at their magnetic resonant frequency while the electrons are toggling between spin states. Otherwise the electrons will toggle spin states and emit photons in an incoherent manner and the majority of photons emitted by the electrons will be re-absorbed only by the atomic lattice rather than transmitted to the reflector antenna. This would be the typical hysteresis loss. In a magnon laser, only a portion of the energy is reflected back into the lasing medium to stimulate more photons to be emitted. The remainder of the energy received by the antenna can be sent to communications equipment via a transmission line (as an example) or rectified and used as a power source.

Radiant heat is used as an energy source. The atomic lattice of the lasing material absorbs this energy, which is in turn absorbed by the magnons. The magnons re-emit this energy as photons in phase with the stimulating photons reflecting back from the reflector antenna. This is analogous to a traditional laser that is pumped with radiant light.

The operation of a magnon laser involves the transfer of entropy. It may appear as if entropy is being reversed in a manner that violates the laws of thermodynamics however it does not. Its operation is analogous to the operation of a hurricane in that a hurricane is fed with heat energy and outputs rotating wind energy. A magnon laser is fed with heat energy and outputs rotating electromagnetic radiation.

# 20

# Preliminary to Beating Frequencies

Visualize a thin cylindrical wall of ferromagnetic material with reflector antennae inside the cylinder. The object is to create spin waves that rotate coherently around the cylinder while the unpaired electrons are flipping spin states to align with the external magnetic field.

If you have watched very many football games then you probably have seen "The Wave" performed by all the people in the stadium. In a magnon laser, the magnons do "The Wave" until the unpaired electrons have flipped spin states and their precessing begins to dampen out. Next the external magnetic field is reduced and so the magnons then absorb photons from the phonons and spin entropy increases again while the lattice entropy decreases. In other words more magnons are created and these magnons are incoherent.

Then the external magnetic field is applied again in the opposite direction. The precession of the unpaired electrons never completely dampens out and the standing waves in the reflector antenna never completely dampen out so the precession of the unpaired electrons just picks up again. Still there are more magnons now and they become more coherent under the influence of the photons emitted by the reflector antenna. In the more coherent state, the magnons no longer emit photons to phonons but rather they emit photons outside the ferromagnetic material to the reflector antenna. Many of these photons are reflected back into the lasing material to continue the lasing process, however,

some of the energy can now be routed through a transmission line to whatever equipment will process this RF (radio frequency) output.

Meanwhile, since the phonons of the ferromagnetic cylinder did not absorb all the photons that were emitted by the magnons, the entropy was not all transferred back to the ferromagnetic material. Entropy is conserved still but it is conserved in the larger system that now includes whatever equipment is connected to the transmission line. The ferromagnetic material still maintains a certain level of entropy or heat since it will absorb radiant heat photons from whatever sources of heat are in the area and are radiating photons to the ferromagnetic material.

# 21

# Creating Beat Frequencies

It may be desirable to create an RF output that is much lower in frequency than the EPR frequencies generated by the magnon laser, because a lower frequency is much easier to rectify and use to power electrical appliances or other switching power supplies.

When the external magnetic field passes through the material used as the lasing medium for a magnon laser, it tends to not be the same field strength through out all areas that is passes through. This causes the unpaired electrons to precess at a variety of Larmor frequencies. This effect can be purposely enhanced to create EPR at a variety of desired frequencies. The thin wall of material can be built up in layers of magnetic materials of different characteristics to purposely create a series of EPR frequencies. Several EPR antennae can then be used to re-enforce EPR and spin wave resonance in a series of different frequencies.

The purpose for this is to inter-modulate all the various frequencies so as to create sum and difference outputs. To give a simple example, if a 10GHz output is created and a 10.000,000,060 GHz output is created then the 2 signals will create higher and lower frequencies that will include a 60Hz output. A loop antenna tuned for 60Hz can then tap off this output and use the signal to power electrical equipment.

In order to get more power at specific low frequency; a whole series of EPR frequencies can be created rather than just 2 frequencies. These can be phased such that at a low frequency rate, they all cancel

out then all tend to be positive then all tend to cancel out then all tend to be negative such that a difference signal at low frequency is created.

Of course there will be summation signals created as well. If the summation signals are in the visible light range then a small amount of this light can be seen by the human eye as various colors of light that rotate around the outer surface of the lasing material. UFOs have been observed to have resonant patches of peak brightness and null brightness of various colors of light that can be explained as caused by the upper beat frequencies of magnon lasing processes.

# 22

# Dialog on Magnon Lasers

The following are excerpts of discussions in the newsgroups that are included in this book as a way of clarifying the ideas about how a Magnon laser could work. The following starts with the thread: “FMR laser (was Re: Gravity)” in the newsgroup: “sci.physics.electromag”.

**Bugh**:

> Your quote of my text was a description of a ferromagnetic material with a Magnetocaloric effect. The overall purpose of that text is to describe how lasing can be stimulated with the material used as the lasing medium. When the material is removed from an external magnetic field it does get cooler. The heat energy in the form of phonons does get transformed to become magnons (spin waves). The energy can be transferred back out of the magnons as well by reapplying the external magnetic field. Usually this energy transfer is described as occurring through spin-orbital coupling but it can also be described as a photon mediated transfer and it is possible to stimulate photons to be emitted coherently with stimulus from a reflecting antenna when transferring the energy out of the magnons.

(The following diagram was not part of the dialog but is included to help in understanding the dialog: magnon laser (*DIAGRAM 19-1)*

**Uncle Al**:

That's silly. Where are you going to get a transparent amorphous or single crystal single domain ferromagnet? The physics doesn't fly, either. Thermal and magnetic hysteresis don't operate on the time scale of optical and electronic transitions.

**Bugh**:

I'm not talking about operating in the range of optical or electronic transitions. I'm talking about operating in the range of ferromagnetic resonance. I'm taking about stimulated emission at FMR frequencies. Assume that a thin film material is already magnetized in one direction and I apply an external magnetic field to overcome its hysteresis and magnetize it in the other direction. Just at a point of reversal of magnetization direction of the material, the material can be considered as having the many magnetic dipoles in a metastable state. There will be a (more or less) common precession frequency at the specific field strength just at the point before reversal will occur. By applying an external FMR frequency at that specific precession rate it should be possible to stimulate the emission of coherent photons that are in phase with the stimulating signal. It would be like stimulating an avalanche in magnetization reversal. The coherent photon emission will occur right when the material reverses its magnetization direction.

Now at some low frequency rate I can keep reversing the external magnetic field and repeating the process.

Magnons come into the picture when instead of performing this process with just any magnetic material, I perform this process with an enhanced Magnetocaloric effect material. In that case the energy that is in the form of magnons will be converted to photons that are in phase with the FMR frequency stimulating photons from an antenna. The antenna can be designed to develop large standing waves at the FMR frequency. The emissions from the antenna will keep stimulating coherent emission from the thin film each time its magnetization direction is reversed back and forth. In a Magnetocaloric thin

film, magnon energy will continually be converted to photon energy.

In a light frequency Laser, one mirror is less than 100% reflective and the coherent light is output from the laser through that mirror. In this type of laser, the output it tapped off the reflector antenna with a transmission line.

This is what I discuss at the website: http://www.egroups.com/messages/MagnonLasers/ (The information is not available there anymore.)

**Bugh**:

Normally the energy emitted (when the magnetization direction is reversed) will be absorbed by the atomic lattice of the material and make it warm. This is the typical hysteresis loss. However, by stimulating the energy to be emitted as coherent photons, this energy can radiate out of the material instead and to the antenna.

**Bilge**:

These are lattice phonons, not photons. The phonons are a lattice excitation, in this case it's a synchronized precession of the magnetic moment. It's not a laser.

**Bugh**:

The energy can be transferred to the lattice to become phonons but I'm talking about something else. I'm talking about a different process that can be stimulated by an antenna reflector that emits a signal to stimulate coherent emission of photons at FMR frequencies.

If the all the individual magnetic dipoles flip spin states incoherently then yes, you are right, the energy is transferred to phonons in the lattice of the ferromagnetic material.

**Bilge**:

Coherence is also known as resonance. Resonance is necessary, but not sufficient to build a laser. The laser part is the amplification. The resonance is Lasing implies amplification. Resonance is a step to getting there. For your purposes, you

need to show you can achieve an energy separation of the two states which is large compared to the width of the two states. This implies that the fluctuations in the populations of the two states due to kT is small compared to the number of transitions you can induce. That way random fluctuations don't dominate the population of the levels. If the energy levels look like (dw = width, w = radiation):

| dw

——— - - - _

——— | - - - |

dw | | w instead of w

| dw |

——— - | - _

——— - -

dw

you'll be out of luck. You haven't addressed this, but this shouldn't be an issue apart from determining what your equilibrium population of the upper and lower states must be so that you can define a population inversion. A partition function will determine this for a given magnetic moment, applied B field and temperature.

Now let \Delta\omega = width_upper + width_lower. Let \omega = radiation freq and \mu the magnetic moment and B = the B field from an applied rf (not the B field above). The probability of a transition per unit time is:

P = {(\mu B\over\hbar)}^2 (1\over\Delta \omega)

The total output is proportional to the number of transitions per unit time from the upper to lower level X the radiated energy of each transition. That implies (1) there are more upper states than lower states in comparison to the equilibrium, (2) you supply the rf to provide B above. OK, you've supplied B by virtue of however you plan to accomplish what you stated. You haven't addressed the problem of a population inversion.

Without the population inversion, no lasing occurs. The output from the above is:

Radiation Intensity = P x (\Delta N)\hbar\omega

\Delta N = [N_upper - N_lower]

If lower is > upper, it's an absorber and any radiation is dominated by states that randomly return to equilibrium. You need to show how this part occurs. With just two levels, it's not clear how you'll manage to do this.

**Bugh**:

Yes, I agree that amplification is needed and not just resonance. Yes, there needs to be an energy separation between 2 states. A ferromagnetic material is used as the lasing medium. Instead of having electrons in orbitals of higher and lower energy states there will be unpaired electrons in higher and lower spin states. The 2 energy states are:

The lower energy state of alignment with the external magnetic field

and

the higher energy state of alignment against the external magnetic field.

Below the Curie temperature the hysteresis of the material or in other words the coercive force within the material is what prevents random fluctuations between energy states.

In your equations and comments regarding equilibrium between upper and lower energy states it appears you are using an analogy of a traditional continuous output laser whereas a FMR laser operates a little more like a pulsed laser. This is because hysteresis in the ferromagnetic lasing medium prevents a continuously transition of spin states from higher to lower energy states. No transition can occur until there is a strong enough external magnetic field to re-magnetize the material in the opposite direction.

Assume the material is already magnetized in one direction. As soon as I apply any amount of external magnetic field in

the opposite direction then relative to that external magnetic field there will be a complete population inversion of the spin states because they will be in a higher energy spin state relative to the external magnetic field. As the external magnetic field is increased in strength, the potential energy of the "aligned against" spin state will continue to increase.

In a traditional laser the energy level of an orbital electron in a metastable state is fixed and the electron is stimulated to drop to another fixed but lower energy level. However, in a FMR laser, both the potential energy between energy states and the metastability continue to increase as the external magnetic field is increased in an opposing direction. The metastability is at a maximum just at the point where either small or large avalanches begin to occur in the direction of magnetization of the ferromagnetic material. This is when the material's individual unpaired electrons can most easily be stimulated to all transition together to the lower energy state of alignment with the external magnetic field. At this point all the precessing unpaired electrons will emit microwaves at their precessional frequency and in phase with stimulating microwaves of that same frequency as they flip spin states.

To be more precise, according to classical electrodynamics, the precessing unpaired electrons should be emitting microwaves all the time that they are precessing and not just during a flip in spin states. It is my contention that there are emissions all the time and these are absorbed and re-emitted by motion and precession of particles in the nuclei of the atomic lattice. There is a continuous exchange of EM emissions between precessing electrons and the moving/precessing particles of the nuclei so the emissions are not ever apparent macroscopically. Only during a spin flip do the emissions radiate external of the atoms.

If an external magnetic field of 500 gauss is enough to put the material at the point of avalanche and if after the avalanche the unpaired electrons' magnetic moments add another 5000 gauss to the overall magnetic field then an amplification of 10 has occurred. However, this may not be the same as the amplification of the microwaves of the precession frequency. I

would expect it to be similar but I'm not sure how to calculate it.

Normally when a ferromagnetic material is re-magnetized in the opposite direction, the atomic lattice of the material absorbs most of the energy. When no FMR stimulation is provided then the spins flip incoherently. The atomic lattice would absorb the energy that is emitted and this would be the typical hysteresis loss. However if an antenna reflector provides stimulation then much of the stimulated coherent microwave emissions should radiate out to the antenna reflector. If a watt of energy is transferred to the atomic lattice in one incoherent avalanche transition then in a coherent avalanche transition perhaps .95 watts could be transferred to the antenna reflector. Only .05 watts would be transferred to the ferromagnetic material to become phonons of thermal energy.

Then the external magnetic field would be reversed and increased in strength and the process repeated. This would be a continuous process with bursts of microwaves emitted with each coherent avalanche transition.

If the antenna reflector maintains standing waves at the precession frequency and

if these standing waves stimulate microwave bursts from the lasing material and

if the standing waves are re-enforced with these bursts of microwaves and

if the bursts occur at a rate faster than the rate that the antenna's standing waves dampen out then

the process should be self sustaining. Lasing will occur.

The source of energy input for a plain old ferromagnetic material with a degree of hysteresis will be the energy put into building up the external magnetic field in opposing directions to the current direction of magnetization of the lasing material.

In a ferromagnetic material with an enhanced Magnetocaloric effect there will be additional energy source in the form of magnons. This energy will be converted to microwaves also. It should be possible to design a magnon laser in which the larger

source of input energy is radiant heat photons from external sources.

These radiant heat photons are absorbed by the lasing material's atomic lattice to become phonons.

Phonons convert to magnons when the external magnetic field is relaxed between each magnetic field reversal.

Magnons convert to coherent photons in phase with stimulus from the antenna reflector.

# 23

# Dialog on Magnon Lasers continued

**Mikal 606**:

> There is a “built in” loss as well. Hi (internal static magnetic field) may be coupled to the RF field, and components of the RF induction can be generated in several directions. w=yHi where the magnetic dipoles precess at a frequency that is proportional to the magnitude of the internal magnetic field-ui=initial permeability, b = uih, ui = ui’ - jui” Dramar Ankalle

**Bugh**:

> The problem of components of the RF from the lasing medium going in different directions is something I have been considering. There will be spin waves associated with this. It should be possible to not only stimulate coherent precession but also controlled spin waves. The standing waves on the antenna reflector can be made to also travel around the antenna at a velocity that causes the antenna’s emissions to radiate in a continually rotating manner and stimulate a controlled re-directing of the RF emissions from the lasing material. The continuous change in the direction of RF emission can occur in a controlled manner rather than a chaotic manner. This would match the propagation velocity of the spin waves and the spin waves would be stimulated to propagate around the surface of

a cylindrical lasing material with the antenna reflector on the inside. I have diagrams of possible antenna designs (*DIAGRAM 41-1)* and lasing medium shape at that MagnonLaser URL but I don't know if that particular design of antenna will work best.

Also the lasing material may not need to be made of such tightly coupled magnetic moments. Possibly a thin film would allow external RF from the antenna to dominate more over internal spin-spin coupling. But it would still have to have enough gain to sustain lasing. Another possibility is to use a larger bulk of material that is molded into the desired shape but not made of a solid piece of ferromagnetic material. A powder can be used and evenly dispersed in some proportion to an epoxy to reduce internal coupling to allow RF from the antenna to dominate more the influence of the precessing of the unpaired electrons. Something like at: http://www.apt-powders.com/BarFerrite.html

**Mikal 606**:

I've never worked with it. But I do know there are a lot of steps to getting ferromagnetic material, and I wonder just what you could do with this molding idea, or if to get your desired saturation and gain and whatnot you would have to have it presintered formed pressed q tested, green density, line width, loss, etcetera and end up with a material that meets your needs but is inflexible. Perhaps it is a sort of finished technical powder that can be "dialed" in and added to an epoxy?

Why not?

**Bugh**:

You're making it way too complicated. The lasing medium might work with something as simple as layers of video recording tape that are wound into the desired shape and that have the 2 desired directions of magnetization oriented along the lines of magnetic flux from a field coil that creates the external magnetic field. I suggest barium ferrite because of reports from various experimenters who used it and seemed to have accidentally already succeeded at creating this lasing process. From all the various reports I've read over the past 5

years I don't think any of these experimenters have understood that this was the process that is taking place.

I hope you don't mind too much if I delete "alt.religion.kibology" from my reply newsgroup list but I prefer to keep this discussion as scientific as I can. I admit that I'm an engineer and not a physicist so I myself am not an expert at all this but I am trying to learn more. I would rather not have the discussion be diluted by others that have even much less understanding at all of the engineering and science involved. My goal is to see if this is really feasible and not have this turn into unscientific speculations. I hope my own speculations are not too unscientific.

**Bugh**:

I'm guessing barium ferrite worked because its precession frequency for a given external magnetic field strength just happened to be within a range that matched the resonant frequency of various antenna reflector designs that experimenters stumbled across. Here also I think only certain types of barium ferrites have worked. There are lots of possible ratios of barium to iron and other elements. Each different combination is going to have a different Larmor frequency for the unpaired electrons.

**Mikal 606**:

Its cool, d00d :-) I am interested in the responses myself. Andrea

**Bilge**:

What I wrote was not specific to lasing. It was the expression for the transition probability per unit time for a transition.

Period. What one does with that is up to the individual. I just gave the conditions required, not a means to obtain them, since I don't see how you'll be able to obtain the population inversion. You'll note that the transition probability works both ways.

Before getting carried away with a slogan, you should figure out whether you can create the conditions you need. In fact, you need to list the conditions with realistic numbers that give you at least a ballpark idea of whether or not you've asked for

something contradictory. It's not necessary to get an exact result, but there's a huge gap between exact and what you have.

Look, I know exactly what you are trying to do. What I'm telling you is that a lot of things sound good until you figure reality in. Don't explain it to me; I'm not going to sit down and do the arithmetic for you. Go grab a copy of Kittel, or Ashcroft and Mermin, or whatever solid state physics text floats your boat, and grind through the bloch equations (assuming the terminology carries over from other magnetic resonance). You have an interaction that, for the n_th

lattice site, looks like:

U_{n} = \muS_{n}\cdot[B(w)+B] + \muS_{n+1}[B(w)+B] + S_{n}\cdotS_{n+1}

You need to impose boundary condition so that you get a periodic wave function. Now, take the advice my very first qm instructor told us at final exam time in case of difficulty: Just remember H\Psi = E\Psi and go from there. So, you need to solve:

[p^2/2m + U]\Psi = E\Psi, except you need the _n subscripts.

See the above. You should be able to create a diagram, something like a Rabi diagram that shows the energies of the states in your fields.

+— Use a real text editor.

To be precise, you'll need to do some arithmetic. Right now you are being speculative.

Don't contend. Calculate with pen and paper. It will be a good exercise regardless.

A good old-fashioned calculation will erase the "if" in that sentence and make it a "will" or "wont".

Find a library or bookstore with physics books and head toward "solid state". Choose one that you find comprehensible. Kittel is pretty easy, Ashcroft and Mermin is a little more complete and at a somewhat higher level or difficulty, however I just saw a used copy in a bookstore for $82.00, so you'd have to

like it a lot. There are others I'm sure, but since I wasn't all that excited about solid state, I am not familiar with many and a number of ones that I am familiar with don't cover spin waves, apart from those two.

It's ridiculous to speculate on "what ifs" with this degree of specificity until you have an idea of how to connect it to reality. Wild speculation is no substitute for a real calculation that produces real numbers that aren't just pretend results.

You're babbling. Get a pen and some paper and spend a few days getting something to replace the slogans. And use a text editor that doesn't think usenet is 8 bit word processing storage. I give 50-50 odds there's a Microsoft compatible text editor that isn't too broken to deal with 7-bit characters. Like vi.

**Bugh**:

Thank you for a lot of good advice. It will take me some time. I already have library books stacked all around in a circle where I sit on my sofa at home. I have about $700 worth of books on order. I just have to do like you say and figure it all out in better mathematical detail. Else, just wing it and see if trial and error will give me a working device but I doubt that will be easier than if I do some number crunching first.

# 24

# Electron Precessional Harmony

In an external magnetic field, two precessing free electrons at a distance from each other, in the absence of disrupting signals, will tend to precess in phase. [43]

This is because each electron is radiating EM waves due to its precessional motion. The EM waves of each will affect the other to provide EM forces on each other that will bring them into phase with each other. However, the distance between them will also affect the precessional phase between the 2 electrons. For example, the distance between the 2 electrons could be at some whole increment of the precession frequency's wavelength plus an additional ½ wavelength increment. If so, then by the time each electron's EM waves reach the other, the phase of the EM waves of each will provide forces that align them with each other at a 180-degree phase difference between them. There will be some distance increments where the EM forces between them will not be in harmony as it is not at a ½ wavelength or whole wavelength increment.

In an atom, an electron's precessional motion can only occur in-phase or 180 degrees out of phase with all the other particles' precessions within the atom. Any other phase in precession would cause forces between particles to either bring an out of phase particle in to phase or to cause forces that would end up ejecting a particle or particles

[43] "Encyclopedia of Physics", 2nd Ed., CEN 530.03 dc20, Rita Lerner/George Trigg, VCN Publishers Inc., NY, NY, 1991, p313-314 "Electron Spin Resonance"

from the atom. For example, if precessional harmony changed due to an absorption of a photon then an electron may rise to a higher orbital so as to re-establish harmony among all the particles of the atom.

For all the particles of an atom to be in harmony, the electrons sharing orbitals will pair up with half being up spin and half being down spin. In other words, if 1 electron in a pair is precessing clockwise then the other will be precessing counter-clockwise. Actually it may not be as simple as “clockwise” and “counter-clockwise” depending on the positions of the electrons within each orbital. Both electrons will still be emitting a small amount of EM waves due to their precessional motion. These EM waves will mostly cancel each other out. However, as the electrons precess and counter-precess, their magnetic North poles will point more the same way as they rotate past each other. Then their magnetic South poles will both point that same way. As this is going on continuously, it will radiate out waves of toggling magnetic fields. The EM waves of each electron will tend to cancel out, except for the waves of toggling magnetic field direction. The complex interaction of all the electrons of the atom and the interaction with the weak magnetic fields of the protons and neutrons will set the precession rate of the pairs of electrons.

There may be a set of fundamental precession frequencies shared by paired electrons in common orbitals of all atoms. Electrons may move through their orbitals such that they re-enforce each other’s precessional motion by maintaining whole precessional wavelength increments in distance around their orbitals.

In any case, all paired electrons of all atoms will radiate a weak toggling magnetic field as described above. This signal will then serve as a stimulus to all other paired electrons in the same orbitals of other atoms at distant locations. This stimulus will cause the electron pairs to precess and counter-precess in phase with the stimulus. Due to this stimulus, the precession of paired electrons of all atoms will tend to stay aligned to some degree. This will then develop an attractive force between the toggling magnetic fields of the electron pairs that will tend to pull on each other.

It is important to note that since electron pairs will precess and counter-precess, the EM waves of the pair will mostly cancel except for the toggling magnetic fields as described above. This type of radiated signal may not be easily detected with typical EM wave detecting equipment.

# 25

# Repulsive and Attractive Forces between Bodies

Visualize two large bodies in space at some temperature above absolute zero. As long as the atoms of each body have any energy at all there will be some temperature to the atoms that is above absolute zero. There will be electromagnetic (EM) waves exchanged between them due to thermal radiation from the temperature of their atoms. When the EM waves hit each body they will push on each body. The EM waves carry momentum. Regardless of whether the EM waves are absorbed or reflected, they will still produce a counter EMF in the body and push against each body.

The result will be that the 2 bodies will experience a certain amount of force that tends to push them away from each other. Similarly, all objects with a temperature above absolute zero will have a certain amount of force between them that tends to push them apart due to the EM radiation exchanged between them.

The particles of atoms of all objects will also have a spin temperature. In atoms or groups of atoms with unpaired electrons it is easy to see that these unpaired electrons spin and precess and interact with other precessing charged particles. There will be a certain degree of randomness to these spin interactions and so these particles can be said to have a spin temperature.

However, even the paired electrons will have precessional motion. Classically, all precessional motion of charged particles should emit and absorb EM waves regardless of the amplitude of the waves. It is this author's contention that they do. The EM waves of paired electrons will cancel except for an oscillating magnetic field direction with no accompanying electric field oscillations. This is because while one precesses clockwise the other will precess counter-clockwise.

The EM waves emitted and absorbed between any and all precessing particles will have a tendency to apply forces to the particles to move their precessional motions into phase with the EM waves. Wher as linear motion of charged particles in response to an EM wave will create a counter EMF and push against an EM wave, a precessional motion of a charged particle will create an EMF that is more in phase and attracted to the EM wave.

While thermal radiation absorbed or reflected by linear motion of charged particles tends to push objects apart, precessional radiation absorbed or reflected by precessing charged particles tends to pull objects together if there is a degree of alignment between the magnetic dipoles of precessing particles.

Gravity can be explained as the tendency of all precessing particles of all atoms to pull on all other precessing particles of all other atoms. It may not be necessary that all precessing particles everywhere precess in phase or even at the same precession frequency. It is only necessary that they all experience a tendency to be more aligned than not aligned. On average precessing particles will then react to EM waves with a pull on them rather than push on them. This same tendency will also tend to make similar precessing particles everywhere move towards a common quantity of angular momentum for same type particles.

Particles with greater mass have a greater gravitational force associated with them. For example, both a proton and a neutron have much greater mass than an electron. These particles are made up of quarks. The 3 quarks of a proton or a neutron will spin and precess at a much higher frequency than electrons. The 3 quarks will also experience precession of the plane that all 3 lay in. There is a continuous exchange of EM waves between quarks due these combined complex motions. The near field EM forces between precessing quarks is another way of explaining the strong nuclear force. In the far field a toggling magnetic field will exists similar to paired electrons that precess and counter-precess. However, the toggling magnetic field (gravity) from 3 quarks interacting with each other will be much more intense and at a much

higher frequency than for paired precessing/counter-precessing electrons. A proton or neutron may precess very little and at a relatively low frequency range while its quarks precess at an extremely high frequency.

The precessional attraction theory of gravity is a testable theory. If gravity is the attraction caused by toggling magnetic fields and if all similar particles among atoms experience similar precessional motions and attraction due to toggling magnetic fields then a test of this can be performed. Paired electrons in a group of atoms can have their precession/counter-precession frequency changed. By shifting the phase or frequency of their precession it should be possible to create a push or a de-sensitivity rather than an attractive force on the accumulated toggling magnetic fields from paired electrons of the atoms of the Earth.

In Podkletnov's experiments[44] experiments with superconductors, weight loss has been reported of objects above the superconductor test apparatus. It may be that the test apparatus has stimulated a shift in the precessional phase or frequency of electrons of atoms of the objects above the apparatus.

There have also been several experimental devices made that have created coherent spin waves and coherent precession of unpaired electrons in ferromagnetic materials. Weight loss has been reported in some of these devices but to date these findings have not been accepted due to lack of an explanation for how that could happen. It is possible that once coherent spin waves and coherent precession is created then the precessional frequency is getting shifted of paired electrons within the material as well until they no longer interact with the toggling magnetic fields from atoms of the Earth.

If this theory is correct then it should be possible to make a flying vehicle based on these principles. The vehicle's outer hull could be designed to function as a resonant cavity. Inside the vehicle, EM waves can be generated that stimulate the paired electrons of the atoms of the vehicle and all its contents. They can be stimulated to precess at a shifted phase relative to the waves of toggling magnetic field direction emanating from the paired electrons of the atoms of the Earth.

If this theory is correct there should be waves of toggling magnetic field direction at a frequency or a set of frequencies that is common to all atoms. There may be a frequency associated with the precessional

[44]http://popularmechanics.com/science/research/1997/12/antigravity_machine/print.phtml

frequency of paired electrons in each of the possible orbitals. There should also be a much higher frequency or set of frequencies common to precessing quarks in protons and neutrons of all atoms.

# 26

# Magnetic Waves from Precessing and Counter-Precessing Particles

While reading this, please refer to:

- Diagram of Signals from Rotating Magnet (*DIAGRAM 26-1*)
- Diagram of Signals from Rotating and Counter-rotating Magnets (*DIAGRAM 26-2*)

If a magnetic dipole spins with its North and South poles rotating about a central axis then this will send out electromagnetic (EM) waves at the frequency of rotation. An apparatus can be constructed from 2 magnetic dipoles where one is placed above the other such that they share a common spin axis. If one magnetic dipole spins clockwise while the other spins counter-clockwise then it has an interesting effect on charged particles like the electron with a magnetic dipole through its spin axis.

First consider what will happen with just 1 magnet spinning in a horizontal x-y plane with the spin axis in the z plane. Visualize an electron at some distance to the side of the magnet. As the South magnetic field sweeps past the electron, it will apply a force on the electron in the vertical plane. As the magnet continues to spin its North magnetic field will sweep past the electron and apply a force in the vertical plane in the opposite direction. The electron will move up and

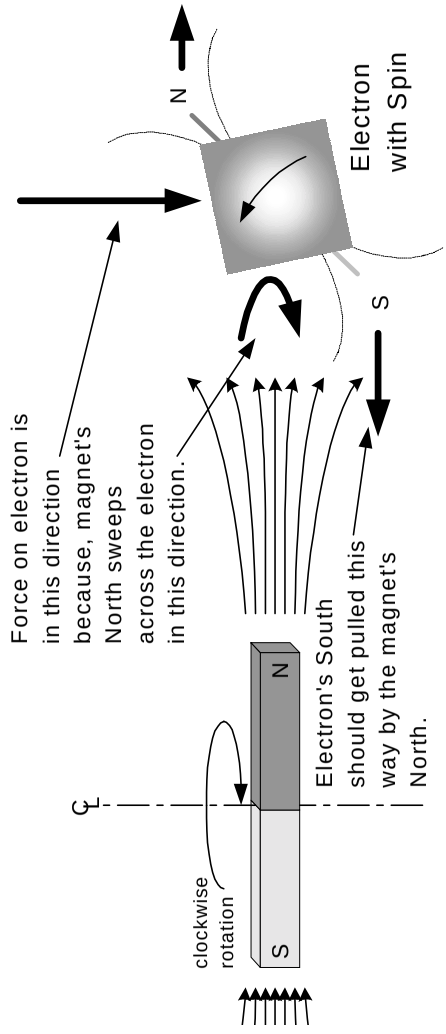


DIAGRAM 26-1
Signal from a Rotating Magnet

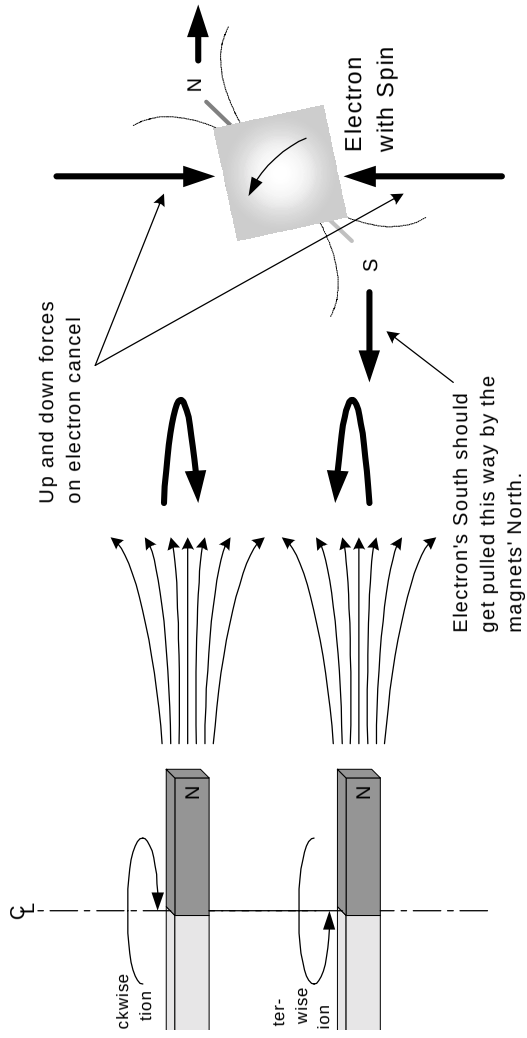


DIAGRAM 26-2
Signals from Counter-Rotating Magnets

down in response to the EM waves radiated by the spin of the magnet in the horizontal plane.

The electron has spin and an associated magnetic dipole through its spin axis. There will be a magnetic force on this dipole each time that a North or South magnetic field sweeps past the electron. The electron's magnetic dipole orientation will be acted upon to move into alignment with the North magnetic field as it sweeps past and then the electron's magnetic dipole orientation will be acted upon to move into alignment with the South magnetic field as it sweeps past. In both cases, as alignment develops, there will be a pull on the electron's magnetic dipole in the direction of the spinning magnet.

The electron will not only be acted upon to move up and down, it will also be acted upon to move towards the spinning magnet to the extent that the electron's magnetic dipole has rotated into some amount of alignment with the magnetic fields from the spinning magnet.

Now consider again the apparatus consisting of 2 magnets, with one magnet spinning clockwise and the other magnet spinning counter-clockwise. Consider again the forces acting upon the electron at a distance from the magnets. Consider that the electron is in a direction in the horizontal plane that is in the direction the magnets are facing as their same poles cross. As both North poles sweep past each other, one going clockwise and the other going counter-clockwise, then while one magnetic North pole is sweeping past and is forcing the electron up in the vertical direction, the other magnetic North pole is sweeping past the electron and is forcing the electron down with equal and opposite force. There will be no up or down movement of the electron since the opposing force directions will cancel each other.

Still the electron experiences the North magnetic fields from both magnets and the electron's South pole will rotate to align towards these North magnetic fields. To the extent that it has moved into alignment, it will feel an attraction to the North magnetic fields and the electron will move towards the spinning magnets. As the magnets continue to spin, their South poles rotate past each other in the direction of the electron. Just as before, the up and down forces on the electron will cancel. As before, the electron will feel the combined South poles and the electron's North pole will turn to align towards them. To the extent that the electron has moved its magnetic dipole into alignment with the South poles of the spinning magnets, the electron will feel a pull from the South poles of the spinning magnets and the electron will again move towards the spinning magnets.

As the magnets continue to spin and counter-spin they will apply attractive forces on the electron as the electron's magnetic dipole rotates to align with the waves of changing magnetic field direction from the spinning magnets. Whichever direction the electron first rotates to move into alignment it will tend to keep rotating in that direction for the electron's other pole to also move into alignment when the alternate poles of the magnets come around to the direction of the electron. This will cause the electron to develop a precessional spin of its magnetic dipole that is in harmony with the motion of the spinning magnets. This will cause the most possible amount of continuous alignment between the electron's magnetic dipole and the waves of alternating magnetic fields from the magnets. This will cause a greater pull on the electron towards the spinning magnets than if the electron was not in harmonious precessional spin motion with the spin of the magnets.

Now consider pairs of electrons that all share an orbital around an atom. Each pair will have one electron that is "spin up" and the other that is "spin down". Each electron will be precessing, one clockwise and one counter-clockwise. Actually, it's not that simple depending on where each of the paired electrons are in their same orbitals but transverse forces will tend to cancel leaving alternating magnetic fields. Their respective precessional motions will have electric forces at a distance that cancel. They will radiate only waves of alternating magnetic fields. These magnetic waves will cause similar electrons in similar orbitals and free electrons to have rotating magnetic dipoles that always tend to rotate in harmony with the waves of alternating magnetic fields. This will cause an attractive force between them. Gravity!

If there is other intelligent life around and if they have developed magnetic wave technology then it is more likely that they communicate with something like spread spectrum alternating magnetic field waves rather than with transverse electromagnetic waves. The SETI (Search for Extra Terrestrial Intelligence) project would do much better if they were to start looking for transmissions of this type of magnetic wave rather than the transverse electromagnetic waves that are more familiar to us right now.

# 27

# More on Magnetic Waves as Cause of Gravity

The following is further discussion of the subject that follows in "Magnetic Waves from Precessing and Counter-Precessing Particles" in the newsgroup: sci.physics.electromag.

**Mark Bloore**:

> wow! so I can use mu metal as a gravitational shield. I'll meet you on the moon!

**Bugh**:

> Well, off the top of my head, I'd have to say that either my idea is all wrong or the characteristics of mu metal are different at the frequencies of precession of the electrons in orbitals around the atoms of the mu metal. If these electrons are already precessing in harmony with electrons of similar orbitals in all other elements and chemicals then it would essentially make the mu metal gravitationally attracted and also transparent to waves of magnetic interaction at these frequencies among all the precessing/counter-precessing electron pairs. There would also be magnetic waves at much higher frequency and greater amplitude from the precessional motion of quarks in protons and neutrons of all atoms. They would likely share common

frequencies and be in harmony with the emissions of all other protons and neutrons of all atoms. The "near field" EMFs of these precessional motions of the quarks would be exactly as strong and attractive as the strong nuclear force. In other words it would be the strong nuclear force. At far field distances all the is left of these very attracting but canceling EMFs from quark precession would be (relative to the electrons') very strong and higher frequency magnetic waves as already described. In other words, there well be more gravitational pull from the greater magnitude precessional EMF interactions of particles with greater energy.

**Richard Herring**:

Why higher frequency? Why greater amplitude? Spin magnetic moment varies inversely with mass.

**Bugh**:

Higher frequency and higher amplitude allow exchange of more energy that would account for strong EMFs of EM waves exchanged between precessing quarks in protons and neutrons.

When talking about the precession of a greater mass like a proton you are talking about the precession of the plane in which its 3 quarks will lay. I'm talking about the frequency of precession of each quark as they all precess and thus emit EM waves that they exchange with each other that thus cause the very strong attractive EMFs between them thus forming a whole proton or neutron. These EM waves and EMFs will negate each other in the far field except for the type of magnetic waves I tried to explain about earlier. However, in this case there are 3 particles exchanging EM waves that all cancel at a distance rather than just 2 particles as happens with electron pairs. With 3 particles exchanging EM waves the overall precessional and orbital motions of the quarks about each other will still leave a weak magnetic field remaining after the greater EM waves among them have canceled and attracted each other.

**Richard Herring**:

A magnetic field exerts a torque, not a "pull", on an object with a magnetic moment. The only "pull" comes from the

gradient of an inhomogeneous field acting on a body of non-zero size, which an electron is not.

**Bugh**:

Yes! That's right it is the inhomogeneous fields of the electron's magnetic dipole and of the magnets that would cause the pull. I disagree that the electron is not of non zero size. I think the electron is as large as its electric field. There is no solid object or chewy charge at its tootsie pop center. The energy of the field in rotation is the electron.

**Richard Herring**:

Nor, since its spin is quantized, does it make much sense to talk about the electron's dipole moment "rotating" in this sense. The torque produces a precession of the dipole moment. See the chapter on paramagnetism in any good EM textbook.

**Bugh**:

Yes, I agree that there will be precession. Actually spin is only quantized due to the precessional interaction of electrons bound in atoms. The electron cannot spin and precess except at a specific precession angle up or down without there being disharmony between its precessional motion and the precessional motions of all the other particles of atoms. That is the process that creates the quantizing effect. No other spin precession value is possible else there will not be harmonious exchange of EM waves between the particles of atoms.

**Richard Herring**:

So Faraday's law is suspended?

**Bugh**:

You must have fallen asleep when I was explained using, Faraday's Law, why only waves of alternating magnetic field was left.

**Richard Herring**:

Why should particles "rotating in harmony" experience a different force from merely static ones, and why would it necessarily be attractive?

**Bugh**:

> When an electron precesses in harmony its inhomogeneous magnetic field spends a greater percentage of time aligned with an inhomogeneous field from the magnets. If the electron did not precess in harmony with the magnets' motion then there would be a greater percentage of time when the fields were not aligned and so less percentage of time that the inhomogeneous magnetic fields would be pulling on each other with the greater force that comes with greater alignment.

**Richard Herring**:

> Electrons aren't attracted (or repelled) by inhomogeneous magnetic fields. End of story.

**Bugh**:

> The pull is there but maybe not readily apparent as there is pull on any particular free electron from all alternating magnetic fields generated all places that there is the electrodynamic interactions between particles everywhere that I described.

**Richard Herring**:

> No. Unlike energy, which is indeed only quantized in bound states, the spin is always quantized.

**Bugh**:

> I'm trying to tell you the process that makes this true but you are not trying to understand. It is not quantum magic that makes things quantized.

**Richard Herring**:

> No again. Individual spin components are quantized regardless of their neighbors.

**Bugh**:

> No, it is the EM interactions between all particles that creates the quantization. Particles spins will be only in the states where there is harmony with surrounding particle spin and precessional motion.

**Richard Herring**:

Yes, I seem to have missed the part where you explained how curl E = - dB/dt, with time-varying B, is consistent with E = 0.

**Bugh**:

Yes, you did. Please study it more carefully.

**Richard Herring**:

This “pull” is nonexistent.

**Bugh**:

Gravity is real. The pull is existent.

**Greg Neill**:

George is coming perilously close to earning a place of honor in my list of bozotic nonsense providers.

**Bugh**:

I’m sorry I’m not better at the formulas but if you will read carefully my previous description of the process I initially described then you should see why there is a pull on the electron but not a force on it perpendicular to the plane of rotation of the rotating and counter-rotating magnets.

If you skim through it in a hurry without trying to see what I was saying then yes, everything else will sound like bozotic nonsense. All processes I describe are based on the idea that the laws of classical electrodynamics apply even at the quantum level and if it appears that processes no longer abide by the laws of classical electrodynamics it is because the electrodynamic processes have not been fully described.

It is not correct to say that at a certain level the quantum states take over without giving a classical electrodynamic process that causes those states to occur.

**Bugh**:

If the laws of electrodynamics say that the inhomogeneous magnetic field of an electron’s magnetic dipole should be attracted to the inhomogeneous magnetic field spreading out

from a magnet but it is observed that that does not happen, then there is a classical electrodynamic process to explain this.

The first obvious reason is that a free electron is precessing so that its magnetic North is facing the magnet just as much as its magnetic South is facing the magnet such that the average push and pull is zero. Then the question is, Why would a free electron always be precessing and precessing such that its spin up or spin down is always at some specific value relative to all the other particles with magnetic fields in its environment? It must be electromagnetic interaction with other particles that causes this.

My description of alternating magnetic fields radiated from precessing and counter-precessing electron pairs in orbitals around atoms is a description of the cause for even free electrons to precess. I know, still sounds like bozotic nonsense. I could show you what I mean if we were both in front of a blackboard or whiteboard.

***Further discussion***:

**Gordon D. Pusch**:

I'm sorry, Richard, but I must emphatically disagree with you about this. Electrons most definitely =DO= experience forces in inhomogeneous magnetic fields — it is what causes them to be deflected up or down according to their S_z quantum-number in a Stern-Gerlach apparatus.

However, I agree that George Bugh is completely wrong in thinking that this force has anything whatsoever to do with gravity...

**Richard Herring**:

Yes, you're quite right. Sloppy wording on my part, to say the least. What I meant was that they will not all experience a force in the **same** direction, as George B is suggesting. Half will go up, half down, depending on their spins.

**Bugh**:

Yes, in a Stern-Gerlach apparatus half will be up spin and half will be down spin and both groups will be precessing. It is the

axis of precession that is up or down. All will precess either in phase or 180 degrees out of phase. Also, those with spin up will precess one direction while those with spin down will precess the other direction. Besides the up or down attraction there will be a slight sideways attraction due to the EM waves exchanged between them and this slight attraction is what I'm talking about.

You can't readily measure the EM waves exchanged between them. The EM waves from the half that precess with up spin will cancel out the EM waves of those that precess with down spin except for the waves of alternating magnetic field not in the up or down but in the sideways direction for that particular setup with the Stern-Gerlach apparatus.

**Bugh**:

The EM waves exchanged between them, that cause the slight attraction in the sideways direction, are the EM waves radiated by the precession of their magnetic dipoles.

**Bugh**:

The precessing electrons do not lose energy due to the EM waves radiated by their precession because they are receiving just as much energy as they lose. They receive this energy from the EM waves of all the other precessing electrons such that all the electrons are precessing in harmony and maintaining the same energy level among them all. This energy level maintained by a particle like the electron is the angular momentum of the electric field in rotation of each electron.

Classically, the electron's precession should radiate that energy away as EM waves from the electron's precession. However, each electron receives as much energy as it radiates and the emission and absorption of these EM waves among them all will maintain harmony among all their precessional motions, it will tend to keep them all maintained at the same level of angular momentum and it will cause an attraction among them all from the exchange of these EM waves among them all.

A similar process is taking place with all charged particles everywhere. It is not just free electrons or unpaired electrons in single atoms of silver but paired electrons too. Paired

electrons still precess and counter precess and exchange energy with precessional motion of particles in the nucleus of their atoms. In all atoms there is a constant exchange of energy due to the precessional motions of all the particles that make up atoms.

All free particles feel the waves of magnetic fields alternating and this tends to bring even free particles into harmonious precessional motion with these waves. Of course this will be affected by things like the strength of static magnetic fields in the location of free particles but on average all particles everywhere will tend to move towards common harmonious precessional motion and there will be an attractive force between them due to this.

**Gordon D. Pusch**:

In phase or out of phase with *what* ?!? Why do you expect them to become synchronized with something ???

**Bugh**:

Electrons can have their axis of precession oriented the same way (or the opposite way) and also have the same angle of precession and frequency of precession in a similar strength magnetic field. Then each will also have a relative phase of magnetic dipole rotation about its precession axis relative to other electrons as each electron precesses through 360 degrees over and over again. The electrons' precessional spin causes them to send out weak EM waves that will apply EMFs on each other's magnetic dipoles. These EMFs exchanged between them will apply forces to the magnetic dipoles that will move the phases of precessional rotation about the precession axes so that they are in phase or 180 out of phase with the precession position of other electron's magnetic dipole orientations. The phase positions of "in phase" or "180 degrees out of phase" will be where the EMFs among them will be a minimum. A change to some other phase, due to other forces acting on them, will cause EMFs to develop between them due to this change in phase alignment and these EMFs will tend to move them back to a phase position of in phase or 180 out of phase. They naturally seek harmonious phase positions due to the EMFs of the weak EM waves exchanged between them.

Thermal interactions can tend to apply enough EMFs to overwhelm this tendency towards harmony to some extent but the tendency will still be there. Thermal energy can manifest in many ways and one way will be as kind of spin waves of harmonious interaction between the precessional phases of unpaired electrons' and even between free electrons. The overall tendency will be towards a state of harmonious precessional motions. To the extent that there is harmonious precession, there will be attractive EMFs between all the precessing electrons.

Even as an external magnetic field changes in strength and causes a shift in precession frequency from one area of space to another, still there will be spin waves of EM interaction between electrons of changing spin rates. These waves will still cause EMFs among them all that try to move them all more toward harmonious precession and so still there will be an attractive force between their EMFs.

Unpaired electrons and free electrons will not radiate the type of alternating magnetic fields I spoke of before. It will be electron pairs in atoms that do this. These magnetic waves will still tend to move not only paired electrons but also unpaired and free electrons towards harmonious precession. To the extent that they do, there will be a weak attractive force among them.

**Gordon D. Pusch**:

> *George Bugh said: "Also, those with spin up will precess one direction while those with spin down will precess the other direction."*

That's utterly false. The precession is in the same direction at the same frequency, regardless of whether the electrons are spin up, spin down — or even if they are treated classically and the spin is allowed to take ANY angle wrt the magnetic field. This is all very basic physics — you =REALLY= should try looking some of this stuff up, occasionally...

**Bugh**:

Sorry, I was thinking about paired electrons in atoms when I said that they would precess in opposite directions. You are right, unpaired electrons in silver atoms moving through the

Stern-Gerlach apparatus would precess the same direction. Still they would exchange EM waves between them due to their precession and this would apply EMFs on them all and this would tend to move them into synchronization in a similar strength external magnetic field.

**Gordon D. Pusch**:

These waves are absolutely, utterly negligible. Work out the precession-frequency, plug it in to the dipole radiation formula, and you will find that for any reasonable field-strength, the power is so low that the radiative lifetime is on the order of hundreds of thousands of years.

**Bugh**:

Yes, I agree that it is a weak interaction between them. Gravity is a very weak force. It takes many particles within many atoms to get much attractive force from the tendency of them to precess in harmonious motion.

**Gordon D. Pusch**:

> *George Bugh said: "You can't readily measure the EM waves exchanged between them. The EM waves from the half that precess with up spin will cancel out the EM waves of those that precess with down spin except for the waves of alternating magnetic field not in the up or down but in the sideways direction for that particular setup with the Stern-Gerlach apparatus."*

The above is based on the false assumption that the precession-directions are opposite for spin up and spin down. They aren't — they are in the same direction, with the same frequency. However, the amount of energy they radiate is negligible."

**Bugh**:

Although unpaired or free electrons precess in the same direction, most electrons in atoms are paired and the force of their magnetic dipoles' magnetic fields on each other would create a natural predisposition to precess in opposite directions.

**Gordon D. Pusch**:

> And before you jump to the false conclusion this means they all radiate in phase, they don't: One can easily observe in any NMR apparatus that the phases of the individual spins rapidly diffuse away from macroscopic alignment with a short timescale (fractions of a second to at most a few minutes), until only random thermal fluctuations in the sample's dipole moment are observed."

**Bugh**:

> Yes, I agree. There will be kind of a form of spin wave among particles at a distance. One of the ways that thermal energy will swamp the perfect phase alignment will be in the form of spin waves that still maintain a degree of harmony. Rather than being all exactly in harmony, there will be a tendency towards harmony.
>
> Also, it would be the interaction of particles within atoms that are not susceptible to NMR or ESR that would radiate waves of alternating magnetic field that I spoke of before. These waves would give free particles and particles bound in other atoms a tendency to precess in harmony with these waves. It is not a strong link but a weak link interaction between these waves and the motions of all particles that creates a very weak attraction among them. It is the overall tendency towards harmony that creates the overall weak attraction of gravity.
>
> Also, it is the magnetic waves radiated from the precessing quarks within protons and neutrons of atoms that will provide a much greater amount of attraction among precessing quarks in other atoms that will tend to precess in harmony. This will contribute a greater amount of gravity than the precession and counter-precession of paired electrons in atoms.
>
> Still, like you say, it is a weak force. Gravity is a weak force.

**Gordon D. Pusch**:

> In summary, your entire mechanism is based on a large number of false assumptions — and even if they were true (which they aren't), the numbers show the effect would have been absolutely negligible. But don't take my word for it — find yourself a

good physics book, work out the numbers, and you'll find out just how wrong you are about the magnitude and significance of your proposed effect...

**Bugh**:

Only some of the things I have said, I mis-stated. Still my basic theory can work and explain the weak force of gravity. You are right in that it is negligible compared to the other forces.

**Bugh**:

I made another mistake. When I said:

> *These EMFs exchanged between them will apply forces to the magnetic dipoles that will move the phases of precessional rotation about the precession axes so that they are in phase or 180 out of phase with the precession position of other electron's magnetic dipole orientations.*

I was borrowing from something else I was trying to figure out that doesn't apply exactly here. Precessing electrons will align "in phase" or "180 out of phase" depending on how many ½ wavelengths distance increments there are between them with the wavelength being of the frequency of precessional rotation.

In this case, when it comes to any distances between electrons, the precession phase depends on the distance the EM waves have to travel. In any case, when the EM waves arrive they will apply EMF on precessing electrons to move them more in alignment with the EMF. There will be an attractive pull on the magnetic dipole of an electron when ever there is more than + or - 90 degrees alignment.

**Bugh**:

In my original attempt to explain the source of waves of alternating magnetic fields from atoms, I talked about precessing and counter-precessing electrons. That is an over simplification of what happens. The magnetic waves will be generated from the total spin motions of compensated electron spins. This includes precessional motion of an electron spin axis about an axis of precession. It also includes orbital precession. It also includes all other forms of spin. When all these forms of precession and spin are compensated for by all

similar but opposite precessions and spins of another electron it will leave weak waves of alternating magnetic field direction.

The analogy of the 2 magnets spinning in opposite directions is a simplified explanation of this. The total compensated spins of electrons will leave weak alternating magnetic field waves similar to my original analogy to spinning and counter-spinning magnets.

**Bugh**:

It will be primarily the compensated axial and orbital precessional motions rather than just axial and orbital spin that cause the weak alternating magnetic field waves.

# 28

# The Nature of Time

Contents:



## *Introduction*

The purpose of this chapter is to describe the nature of "cosmological" time, as Professor Stephan Hawking refers to it in his book "A Brief History of Time", in chapter 9, "The Arrow of Time" and to distinguish this from our mental concept of time or "psychological" time that we all use for organizing the events of life into the past, present and future. Our mental concept of time is based on the perception that we are continuously moving forward in time. However, this may be an illusion.

Professor Stephen Hawking explained in his book and explained further once in a television show about our universe, that if the matter of the universe expands outward that it is possible it also moves forward

through time. Further that if the universe contracts, it is possible that the matter of the universe could move backwards in time. This is one way of explaining "cosmological" time and Hawking's explanation is important in that it suggests a relationship between matter's motion in space and matter's motion in time and this is the subject of this chapter.

Hawking explains further that our psychological perception of a "forward" direction in time is determined by thermodynamic processes in which the overall entropy of a system increases in accordance with the 2nd law of thermodynamics. But it is this author's belief that there can also be spin temperature processes at work throughout nature that are not as easily recognized that can decrease the entropy of a system.

This chapter will introduce the reader to the concept of 3D time and show mathematical and physical evidence that time is 3 dimensional. It is our mind that creates the concept of forward movement in 1 dimensional time to organize experiences that we go through while spinning in 3D time.

We spin in time at the microscopic level because of the atomic and subatomic particles we are made of that are spinning in space on their axes at the speed of light. It is this spin motion in 3D space that causes motion in 3D time. Of course all motion including orbital motion and thermal agitation contribute to matter's motion in time relative to other matter.

According to quantum physics the classical concept of spin cannot be applied to atomic and subatomic particles. It is the author's contention that the classical concept of spin can be used; however, the spin characteristics of particles must be described not only in 3D space but also in 3D time.

The direction of motion considered forward in time is completely relative just as the direction of motion in space considered forward is relative to the chosen coordinate system orientation. To understand what is meant by this we need to see how time can be represented using the same 3 dimensions that space uses.

## *3 Dimensional Vectors in Time*

The purpose of this section is to demonstrate that time can be represented with 3 dimensional vectors. In diagram 28-1, there is an object at the center of an x, y, and z coordinate system representing 3 dimensional space. The object emits a pulse of light that propagates out spherically.

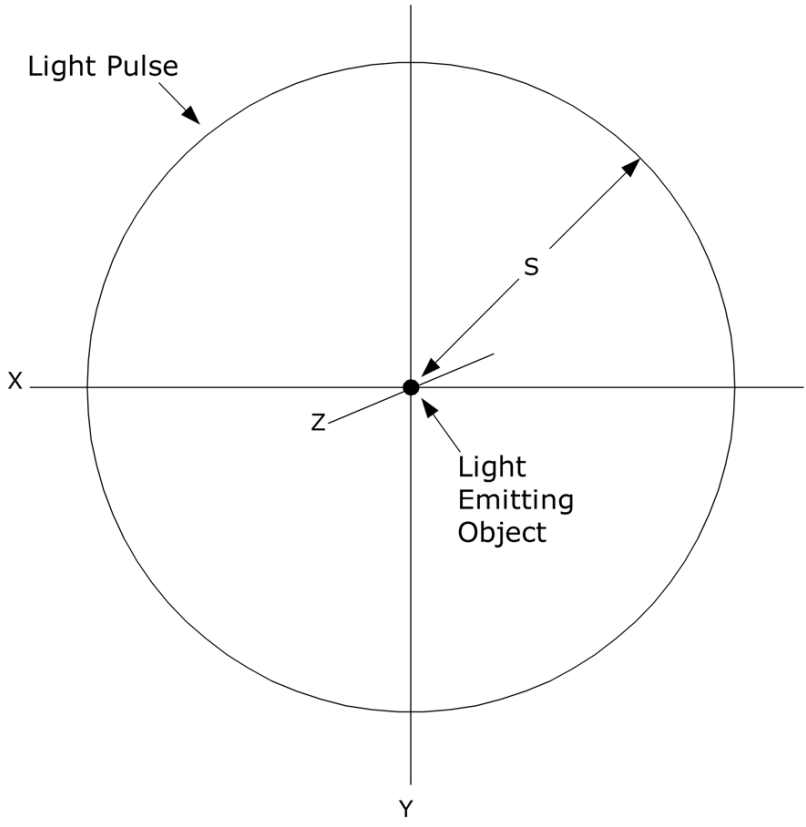


DIAGRAM 28-1
Spherical Propagation of a Light Pulse

The distance that the pulse has traveled out in any direction is represented by the variable "s". The distance "s" to reach any particular point in space will be the vector summation of the x, y and z coordinates for that point such that:

$s^2 = x^2 + y^2 + z^2$.

We know that the light pulse propagates out in any particular direction at the velocity "c" or $3*10^8$ meters/second so:

$c = s/t$ therefore $ct = s$.

Substituting above:

$c^2t^2 = x^2 + y^2 + z^2$

$t^2 = (x^2 + y^2 + z^2)/ c^2$

$t^2 = (x^2/c^2) + (y^2/c^2) + (z^2/c^2)$

The term: $(x^2/c^2)$

is really: $(x^2 \text{ meters}^2)/(c^2 \text{ meters}^2/\text{seconds}^2)$.

This reduces to: $(x^2/c^2 \text{ seconds}^2)$.

This represents the square of how far the light pulse travels through time in the x direction. In the same manner, the light pulse also travels through time in the y and z directions. If we use $t_x$, $t_y$ and $t_z$ to represent these intervals of time then:

$(x^2/c^2) = t_x^2$

$(y^2/c^2) = t_y^2$

$(z^2/c^2) = t_z^2$

therefore

$t^2 = t_x^2 + t_y^2 + t_z^2$.

We can see from this equation that the interval of time required for light to propagate to any particular point in space can be expressed in terms of the amount of time required to travel in the x direction, y direction and z direction. This does not prove that time is 3 dimensional, however it makes it clear that the time "t" can be broken down into 3 dimensional components.

## *The Velocity of Light vs. the Speed of Light*

For the purpose of understanding the nature of time it will be necessary to discuss the velocity of light rather than the speed of light. The purpose of this section is to clarify the difference between the speed of light and the velocity of light. While discussing the speed of light, the constant "c" is normally used for the speed of light in a vacuum. This is often rounded up to $c = 3*10^8$ meters/second. There is no directional information included since "speed" represents only the magnitude portion of a velocity vector.

Einstein introduces his special theory of relativity in his paper "On the Electrodynamics of Moving Bodies"[45]. In this paper Einstein

[45] Principle of Relativity", Albert Einstein, Dover Pubns; (June 1924), section title: "On the Electrodynamics of Moving Bodies",or online at: http://www.fourmilab.ch/etexts/einstein/specrel/www

says that the velocity of light is the same for all inertial frames of reference. Since then, most people including Einstein himself, have more often referred to the speed of light being constant. However, to be more accurate, it may indeed be correct to say the velocity of light is the same for all inertial frames of reference. The following is an example of the implications of using "c" to represent the velocity of light.

If we let: $c = x/t_x$

then if we set $x = 3*10^8$ meters

it follows that $t_x = 1$ second.

Now if we set $x = -3*10^8$ meters

it follows that $t_x = -1$ second.

The implication is that if light propagates in a negative "x" direction in space then it also must propagate in a negative "$t_x$" direction in time. Similarly, if light propagates in a negative "y" or "z" direction it also propagates in a negative "$t_y$" or "$t_z$" direction. Normally when discussing the velocity of light or the velocity of most anything, we assume the direction of motion in time is positive and set it this way in our math. This is because it is our perception that we are always moving forward in time.

It is the author's contention that it is an illusion that we are always moving forward in time. If we ignore this illusion and study the mathematics that follows, we will see that the mathematics can accurately describe the physics of the physical universe. Therefore, the following discussions are based on the assumption that the velocity of light is constant for all inertial frames of reference. Accordingly, we can say:

There is no preferred direction of motion in time.

We know that time(t) can be expressed as:

$$t^2 = t_x^2 + t_y^2 + t_z^2.$$

Also, a distance in space (s) can be expressed as:

$$s^2 = x^2 + y^2 + z^2$$

Therefore, we can express the propagation of light in any direction in both time and space as:

$$c^2 = s^2/t^2 = (x^2 + y^2 + z^2) / (t_x^2 + t_y^2 + t_z^2)$$

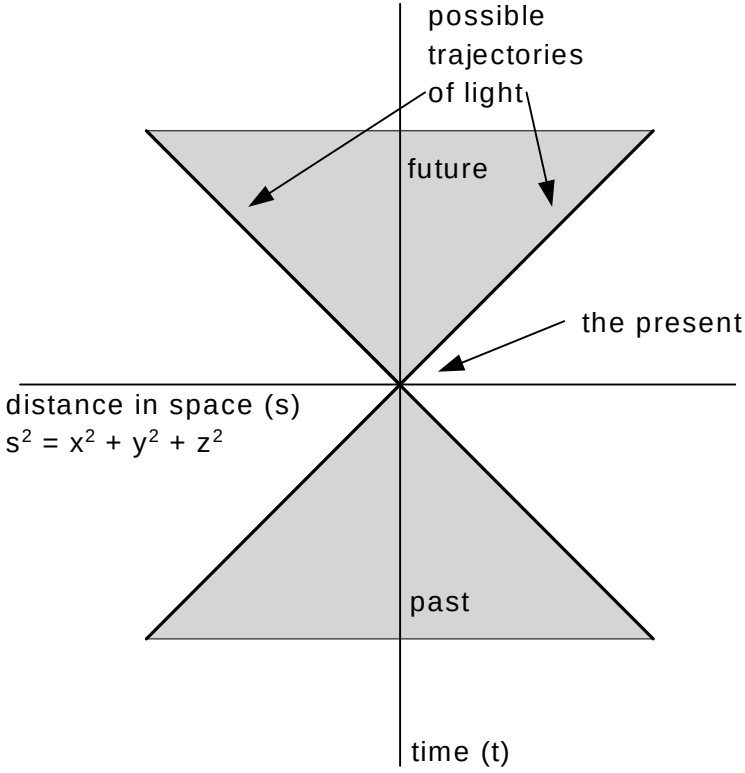


DIAGRAM 28-2
Light Cone

## *Minkowski Space-time versus 3D Space - 3D Time*

In Minkowski space-time, time is considered to be a 4th dimension that is mathematically thought of as being at rights angles to the 3 dimensions of space. In order to describe light moving through space and time, time is scaled by a factor of "c" and light moves at a 45 degree angle between the ct direction and the s direction where,

$$s = (x^2 + y^2 + z^2)^{1/2}.$$

The light cone is used to show the area in which objects can move without exceeding the speed of light. The motion of objects is assumed to be from the past into the future for matter and from the future into the past for antimatter. For more information on the current thinking about time and light cones please go to: http://www.uwinnipeg.ca/~vincent/Cosmology/time.htm

When describing the speed of light using Minkowski space-time mathematics, we make the unwritten assumption that when we write, $c = s/t$

we really mean, $c = |s|/|t|$.

This is because division of a vector by another vector is not defined unless both vectors are in the same direction and if time is a 4th dimension, a magnitude of motion in time's direction must be a vector just as is motion in the x, y or z direction of space. We must therefore use only the magnitudes of the vectors.

In 3D Space-3D Time, time is 3 dimensional. Therefore, when light moves in the s direction in space it also moves through time in the same direction. There is no need to make the unwritten assumption used with Minkowski space-time that only the magnitudes are to be used. This means that $c = s/t$ is a correct statement and;

$$c = s/t = ((x^2 + y^2 + z^2)/(t_x^2 + t_y^2 + t_z^2))^{1/2} .$$

When a particle spins in space it also spins in time. When light travels through 3D space it is also travels through 3D time. When light reflects back to the same place in space it also reflects back to the same place in time. No time has passed for the light yet the object that is the light source has been spinning in time all the while. The passage of time is experienced for the light source since the particles that it is made of are all spinning in time and space. It is while spinning in time that all things experience continuous change and experience the passage of time. Rather than time being a 4th dimension considered at right angles to the other 3 dimensions, it is 3 dimensional just as space is.

## *Relative Motion between Objects in 3D Space - 3D Time*

In diagram 28-3, two objects are used to demonstrate the relative motion in both time and space between them. The mathematics that follows is based on the 2 postulates of Einstein's theory of special relativity:

1. The laws of physics are the same for all inertial frames of reference.

2. The velocity of light is the same for all inertial frames of reference.

Object 2 passes object 1 at velocity "v" from object 1's point of view. When they are at the same x position both objects emit a pulse of light and they propagate out with spherical wave fronts. The equations

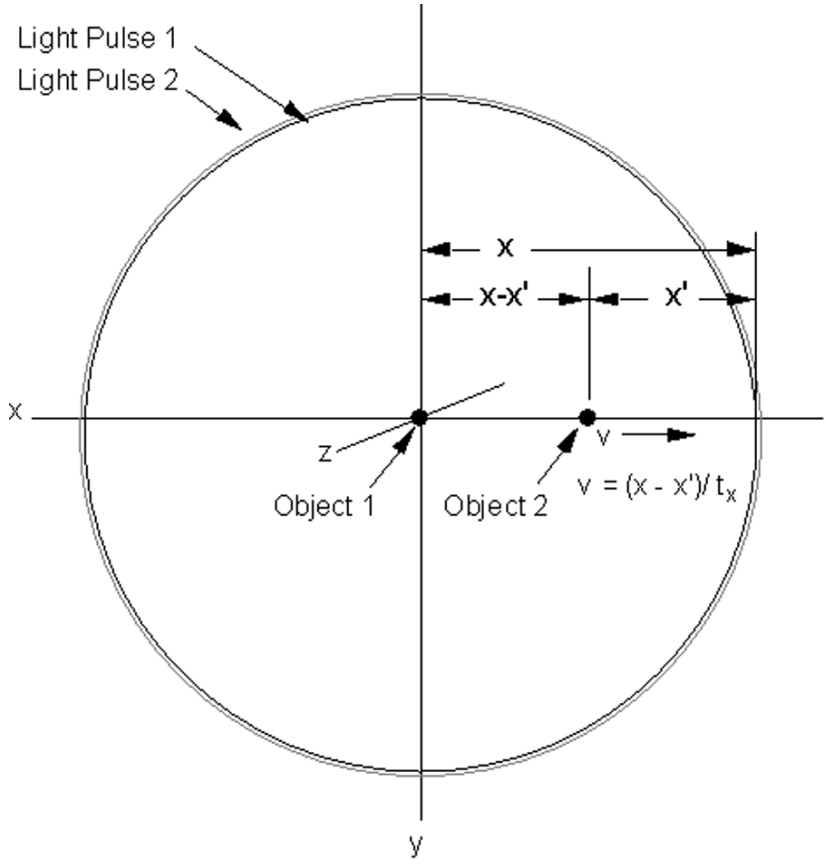


DIAGRAM 28-3
Spherical Prpagation of Light Pulses

that follow show the passage of time necessary for each object to perceive the velocity of light to be "c". Notice that the velocity of light will be used as opposed to the speed of light.

In diagram 28-3,

$x = ct_x$

$x' = ct_x'$

so then

$(x-x') = ct_x - ct_x'$

$(x-x') = c(t_x-t_x')$

so $(x-x')/(t_x-t_x') = c$

or $c = (x-x')/(t_x-t_x')$

If object 2 were to come to a stop, then it would be separated in space from object 1 by the amount (x-x'). It would be separated in time (in the x direction) from object 1 by the amount $(t_x-t_x')$.

If object 2 were to now move in the -x direction, to the left, then for c to remain a positive number, object 2 must move in the $-t_x$ direction relative to object 1. It is important to note that travel through time in the negative direction is allowed and the direction considered negative is relative to the chosen coordinate system orientation.

If there were a clock on object 2 it would always indicate forward movement in time even when object 2 moves in the -x direction. The clock is actually measuring the spin motion in time of the atomic and subatomic particles that make up object 2. Even while at a macroscopic level object 2 moves in the -x direction in time and space, at the microscopic level its particles are spinning continuously +x and then -x. They could also be moving + or - in the y and z directions depending on any particular particle's spin axis orientation. Our minds interpret this + and - motion in time as continuous forward motion in time.

So far we have only considered time as observed along the x-axis as represented by $t_x$. Likewise, an observer in the y direction observing any movement in the +y or -y direction will see a change in object 2's position in the $t_y$ position according to the equation:

$c = (y-y')/(t_y-t_y')$

Next consider an observer that is in the +z direction, i.e. coming out of the page, and perpendicular to both objects when they emit their light and still almost perpendicular to both when object 2 has moved the distance (x-x'). If object 2 were to be moving in the +z or -z direction by any amount at the same time that it moves in the +x or -x direction then it would move to a new $t_z$ position according to the equation:

$c = (z-z')/(t_z-t_z')$

If we use (s - s') to represent object 2's change in position in space in any direction then:

$(s-s')^2 = (x-x')^2 + (y-y')^2 + (z-z')^2$ .

Since

$(x-x')/(t_x-t_x') = c$ and

$(y-y')/(t_y-t_y') = c$ and

$(z-z')/(t_z-t_z') = c$

then

$(x-x') = c*(t_x-t_x')$

$(y-y') = c*(t_y-t_y')$

$(z-z') = c*(t_z-t_z')$ .

Substituting we get

$$(s-s')^2 = (c(t_x-t_x'))^2 + (c(t_y-t_y'))^2 + (c(t_z-t_z'))^2$$

so

$$(s-s')^2 = c^2((t_x-t_x')^2 + (t_y-t_y')^2 + (t_z-t_z')^2)$$

so

$$c^2((t_x-t_x')^2+(t_y-t_y')^2+(t_z-t_z')^2) = (x-x')^2 + (y-y')^2 + (z-z')^2$$

so then

$$c^2 = ((x-x')^2+(y-y')^2+(z-z')^2)/((t_x-t_x')^2+(t_y-t_y')^2+(t_z-t_z')^2).$$

If an observer is not directly in line with the movement of an object then the vector of the object's movement that is directly toward or away from the observer will determine how much the object is changing its position in time relative to the observer. This is another way of describing the Doppler shift that causes the familiar red shift of light from moving objects.

## *Spin Motion in 3D Time*

Notice in the equation:

$$c^2 = ((x-x')^2+(y-y')^2+(z-z')^2)/((t_x-t_x')^2+(t_y-t_y')^2+(t_z-t_z')^2),$$

once the time terms are squared the negative direction in time is not apparent since the results only represent a magnitude. A positive direction in time has always been assumed in the past since that is the way our minds interpret reality. It is the spin of particles that give us the sensation of continuous forward movement through time when in fact we spin in circles in 3 dimensional time and space.

The linear movement of an object through space causes linear movement through time as well. It is the spin motion of a particle in space that changes its position in space relative to all other things in space and likewise, it is the spin motion of a particle in time that changes its position in time relative to all other things in time. This is how spin motion in time causes the sensation of continuous movement through time.

The "clock" of an object moving linearly at almost the speed of light will be almost stopped yet time passes for particles spinning at the speed of light. This is because it is this spin that is responsible for the passage of time to begin with. When all of a particle's spin motion in time is transferred to linear motion in time it is only its spin motion in time that stops while it is still moving linearly to a new position in 3D space and 3D time.

If we consider ourselves as an observer and examine any particular part of any particle of matter that is spinning with its axis perpendicular to us, we find that part of the particle is moving toward and then away from us in its spin motion. To the same extent it is moving toward and away from us in time as well. A graph of that particular part of a particle would be a sinewave for both its motion in space relative so us and likewise for its motion in time relative to us. The two sinewaves would be in phase with one another.

## *Matter, Antimatter and Dark Matter*

The spin of a particle of antimatter can also be described using the concept of both 3 dimensional space and 3 dimensional time. Feynman is noted for saying that antimatter is the same as matter except that it is moving backwards in time. The formula:

$$c^2 = \underline{(x-x')^2} + \underline{(y-y')^2} + \underline{(z-z')^2}$$

$$(t_x-t_x')^2 + (t_y-t_y')^2 + (t_z-t_z')^2$$

represents how matter moves in time and space relative to other objects with both its vectors in time and in space in the same direction. To represent a vector in time for antimatter its vector in time should be 180 degrees in the opposite direction from the vector in time for normal matter. So the equation for the motion of antimatter is:

$$c^2 = \underline{(x-x')^2} + \underline{(y-y')^2} + \underline{(z-z')^2}$$

$(-(t_x-t_x'))^2 + (-(t_y-t_y'))^2 + (-(t_z-t_z'))^2$.

Note the minus sign for the time vectors that is not present for matter. When solving equations for time dilation, we normally square the time terms. This causes us to lose any evidence that the time term was negative. But if we consider a particular part of a particle of antimatter moving only in the x direction and only observed along the x-axis then the equation reduces to:

$c^2 = (x-x')^2 / (-(t_x-t_x'))^2$

so $c = (x-x') / -(t_x-t_x')$

or $-c = (x-x') / (t_x-t_x')$

Matter's motion in both space and time can be explained as having its directional vector in space and directional vector in time both pointing the same direction. Antimatter's motion in space can be explain as having a directional vector that is 180 degrees in the opposite direction from its directional vector in time as just explained.

However, there are many more possible directional vector combinations between time and space. Matter does not have to necessarily exist only as normal matter or antimatter. Dark matter may consist of matter with a direction vector of motion in time that is neither in phase or 180 degrees out phase with its motion in space. Using the equation:

$$c^2 = \frac{(x-x')^2 + (y-y')^2 + (z-z')^2}{(t_x-t_x')^2 + (t_y-t_y')^2 + (t_z-t_z')^2},$$

c is a real number for matter and a real number for antimatter, however if matter's motion in time is neither in phase or 180 degrees out of phase with its motion in space then the result "c" is an imaginary number. The effect may be that this matter (dark matter) will not be visible to normal matter. In other words, photons emitted from normal matter may pass right through dark matter and vice-versa.

It may be possible to shift the phase of matter's motion in time relative to its motion in space. It is possible to use rotating electromagnetic fields to perform this phase shift. If there is any truth to the Philadelphia Experiment, the reported invisibility may have been performed in this manner. Furthermore, if the phase of motion of matter in space compared to its motion in time is shifted far enough then matter's motion in time can start going more in a negative phase direction compared to its motion in space. In other words, the matter

would start becoming more like antimatter in its characteristics. This phase shifted matter could then be combined with matter to release photon energy.

## *Density Changes in 3D Space and 3D Time*

In flat space-time: c = 3D space density / 3D time density.

To explain gravity, the ratio of the density of space compared to the density of time no longer equals "c". A gravitational field is caused when the density of time is greater compared to the density of space. This causes "c" to change value toward the center of the density difference. Light passing through a gravitational field slows down on the side towards the density difference and thus curves toward the center of this density gradient.

When the density of both space and time change in equal proportion then the value of "c" will stay the same. However, both time and space could be either denser or less dense compared to some other region of space. This could be the source of positive or negative charge. Since the change in density is proportional, light is not bent while passing through these density gradients.

## *Conclusion*

The time(t) needed to describe the physical universe is 3 dimensional. The concepts of past and future do not apply to this 3 dimensional time. The motion of an object to a new place in 3D space causes motion to a new place in 3D time and vice versa. We experience change because of atomic and subatomic particles spinning in both time and space. The past and future exist only as concepts in our minds that we use to make sense of the experiences we go through while spinning in time. Change occurs in the present due to the spin, thermal agitation, linear motion, etc. of matter. Our brains change in the present to record our experiences while also always in the present.

Even if time travel were possible, there is no past or future to go to as often depicted in science fiction stories. They exist only as concepts in our mind. The atomic and subatomic particles that make up the matter of the universe can be thought of as going into the past and back into the future with each revolution that they make on their axis while spinning at the speed of light.

There is no preferred direction of motion in time just as there is no preferred direction of motion in space.

# 29

# Connecting Concepts

In this book, Lenz's Law is discussed when applied to a permanent magnet rotor in a conductive sphere used as a shorted stator. It is shown that the energy of the precessional spin angular momentum of the uncompensated electron spins of a magnet rotor can be radiated as electromagnetic waves if reflected EMF from the stator sphere (*DIAGRAM 7-1)* reaches a magnet rotor after sufficient delay. Once particles lose energy in this manner, these particles naturally absorb heat energy from other particles due to electromagnetic interaction with other particles that are not as cold.

In this book, methods of creating magnon lasers are discussed. These magnon lasers ARE in fact various forms of a permanent magnet rotor in a stator sphere. A mechanically rotating rotor has been replaced with a solid-state rotor. Spin waves radiate electromagnetic waves, as would a mechanical rotor spinning at very high frequency. A mechanically rotating magnet cannot turn fast enough so a solid-state rotor is used. Also a very high frequency of rotation is desired as this couples much more electromagnetic wave energy out into space and to the resonant cavity (stator sphere).

At the speeds that a mechanical rotor turns, most of its magnetic field energy stays in the near field and little radiates out to a distance where the resonant cavity wall (stator sphere) is. The higher the frequency of rotation of a magnetic field, the more its energy will couple

to the permittivity[46] and permeability[47] of space and be radiated out from the source.

In chapter 28, “The Nature of Time”, there is a discussion of the difference in how matter and antimatter move through time. Antimatter is essentially matter that is moving in the opposite direction in time from normal matter. When particles that are moving in two different directions in time, interact with each other, energy is released. When two particles are moving in exactly opposite directions in time then all the energy of the electric fields in rotation that make up each particle is converted to energy that is radiated as electromagnetic waves.

In chapter 28, “The Nature of Time”, the theory is introduced that particles can move in other directions in time other than in just the same direction or exactly opposite directions. When two particles are moving in some other direction in time relative to each other besides these first two options then it can be possible for only some amount of energy to be released by their interaction rather than the total energy of both particles.

In magnon lasers, the electromagnetic interactions ARE interactions involving matter moving in different relative directions in time. The energy released IS the energy radiated from interaction of particles moving in different relative directions in time. When matter and antimatter interact, all the energy is radiated since the particles are moving in exactly opposite directions in time. In a magnon laser particles have only a slight shift in their relative direction of motion in time and so only a slight amount of energy is released. This energy loss is made up by heat energy absorbed from any other particles in the area that radiate electromagnetic energy due to their precessional motions.

[46] http://www.britannica.com/search?query=permittivity&ct=
[47] http://www.britannica.com/search?query=permeability&ct=

# 30

# Sea of Standing Waves

Classically, electrons in orbitals around atoms should be continuously both absorbing and radiating on average equal amounts of energy as they spin, precess and move around in their orbitals. This energy is exchanged with other particles within the atom as this energy is absorbed and re-radiated by other particles' own set of motions.

Energy can also be absorbed or radiated outside of the atom when an electron moves between orbitals of different energy levels or between spin axis orientations of different energy levels. This later quantity of electromagnetic energy radiated or absorbed is readily measurable as occurring in quantum energy level increments but it is classical electrodynamics at work that causes this.

If you consider the possibility that electrons in orbitals are precessing all the time, even paired electrons, then classically they must be radiating energy by the sweeping magnetic fields of the continuous change in direction of the magnetic dipole through each of their spin axes. Yet they don't radiate away all their energy because they are absorbing just as much energy from the sea of radiated emissions of precessional motion of all other electrons everywhere.

This continuous exchange of energy from precessional motion will apply forces to electrons as they precess so as to bring them all towards a state of precessing at similar frequencies thus creating a sea of standing waves among all electrons everywhere. The forces acting on them from absorbing emissions of other electrons will tend to push

them into positions and precessional phases relative to other electrons that become quantized, i.e. in phase or 180 degree out of phase relative precession motions. Even paired electrons in same orbitals around atoms, one with up spin and the other with down spin, will tend to move to positions and precessional phases of either in phase or 180 degrees out of phase. Classical electrodynamics is at work creating quantum characteristics of atomic particles.

This sea of standing waves has been observed experimentally. It is similar to what quantum physics refers to when showing how an accumulation of waves can be summed together to explain a localized electron. Quantum physics resorts to probability waves when in fact there are real classical electromagnetic waves involved, not just abstract waves of probability. DeBroglie's matter waves are not just some abstract wave of probability. All experiments that show the wave like behavior of particles are experiments that show this. It is difficult to show that it is simply electromagnetic standing waves involved when the phenomena exists even for all the particles making up any test apparatus along with particles being tested. The exchange of energy is between particles being tested and the particles that make up the test equipment as well.

Another way of saying the same thing:

Classically, any time an electron accelerates or decelerates to a new location in space, whether it does so as part of a circular orbit or some other kind of orbital motion or even when not associated with an atom as with a free electron, when it moves to a new location in space not all of its electric field energy, extended out in space from its old location, moves to its new position. The fluctuation or transient in electric field strength continues to radiate out into space and causes changes in how much it pushes or pulls on any other charged particle at whatever distances away compared to the amount of pushing and pulling it did with its electric field force from its old location. Not all its electric field energy stays with the electron but some radiates out and away when it moves. Classically, it can be visualized like a stick in the water moving around in circles and sending out ripples. As it does so and those ripples cause motion in the things they encounter as they radiate out from the motion. So to the extent that the electric field chances are radiating out and causing motion of other charges they are in fact performing work on other charges charged particles and so transferring energy to them by the amount of motion they cause in them. The amount of energy transferred should now be that much energy

the orbiting electron has less of. The electron should be continuously losing energy.

But if all charged particles everywhere are in fact classically radiating out energy in this manner then they will all continuously be absorbing each others' radiated energy, i.e. energy they each radiate away to other charged particles from each of their individual motions. But it is not just position changes that can classically radiate or absorb electromagnetic energy. A change in the spin axis orientation of a charged particle from precessional motion can also radiate and absorb electromagnetic energy.

So classically, these motions should be radiating and absorbing electromagnetic energy all the time from orbital motion, precessional motion or any kind of motion. If we assume that perhaps they really are then next we must consider what the result would be. The energy radiated will push and pull on the position or spin orientation of other charged particles. After awhile the forces between all charged particles, due the electromagnetic energy exchanged by their motions, will apply forces that tend to move their motions into sync. As they are all moving in sync a grand sea of standing waves develop among them from the electromagnetic energy they are all exchanging all of the time. If we consider the possibility that classical electrodynamics remains valid down to the atomic and subatomic level then this must be the state of affairs.

It explains why all electrons everywhere have the same amount of angular momentum. If any one electron were to lose more angular momentum than others, then its precessional motions would be out of sync. It would feel the forces on it of all the standing waves of all other similar particles and these forces would push it back into precessing in sync. It is similar to holding a Dynabee® wrist exerciser in your hand and applying precessional motion to it to get its spin rate back up again. In the case of the electron, it is not a hand's motion that is applying forces but the motions of all other particles that are radiating electromagnetic waves that apply forces to get all particles up to a common level of angular momentum.

Along these same lines, if you try to move a particle, or large group of particles making up a large group of atoms, to some new location in space then as soon as their positions move the slightest, the electromagnetic waves radiated from the precessional motions of all

the particles will no longer be in phase with the sea of standing waves. You've got to push against this difference in phase because the difference in phase causes electromagnetic resistance forces to develop. Inertia can be explained as caused by having to push against these forces caused by this difference in phase. As forces are applied to move the group of particles, their precessional phases, orbital motions, etc. will move back into sync with the sea of standing waves for what ever new velocity the particles have changed to in whatever direction they are now moving.

If by a man made mechanism within a vehicle, a large group of particles making up the vehicle and its contents could be made to shift in phase of all their precessional motions of all their particles relative to the sea of standing waves then the forces that develop from the phase shift will cause a very quick motion of the vehicle and its contents to new locations in space. This is how a flying saucer works.

# 31

# What are Spin Waves?

In solid state physics, a magnon is the term for an elementary excitation in which the direction of magnetization in a ferromagnetic material, or that of a sublattice moment in an antiferromagnetic material, is spatially nonuniform and propagates as a wave (spin wave).

Reference:

- http://www.harcourt.com/dictionary/def/6/1/5/0/6150600.html

Just as a photon is a quantum of energy in the form of an electromagnetic wave so also a magnon is a quantum of energy in the form of a spin wave. It is still an electromagnetic interaction but in this case the spin waves are propagating through the rotating electromagnetic fields of precessing spins.

In a sample of pure iron, it is the unpaired electrons within the atomic lattice that are responsible for the material's magnetic properties. These electrons have spin and an associated magnetic moment creating individual magnetic dipoles through each electron's spin axis. Each electron's spin axis can also precess like a gyroscope and spin waves propagate through these precessing magnetic dipoles of the electrons as their individual magnetic fields interact with each other. In other magnetic materials a combination of both axial and orbital electron spin can create magnetism if the combination is not compensated for by equal and opposite combined spins of other electrons. Spin waves

can propagate through the precession of these resulting uncompensated spins. Spin waves can also propagate through uncompensated nuclear spins but the magnetic moments and coupling between spins is weaker than with electron spins.

The following website includes a good symbolic diagram of spin waves[48] moving through the precessing of uncompensated electron spins in a 2 dimensional crystal lattice layer of a magnetic material. In real life, spin waves can propagate in all directions in a magnetic material and not just across a 2 dimensional surface as the diagram shows. But materials can be engineered to promote the development of coherent spin waves in preferred directions.

Compensated spins can also precess under the influence of electromagnetic interaction with other particles but due to the compensation, electromagnetic radiation to/from these compensated spins at the frequency of precession is not detectable as a typical form of electromagnetic radiation.

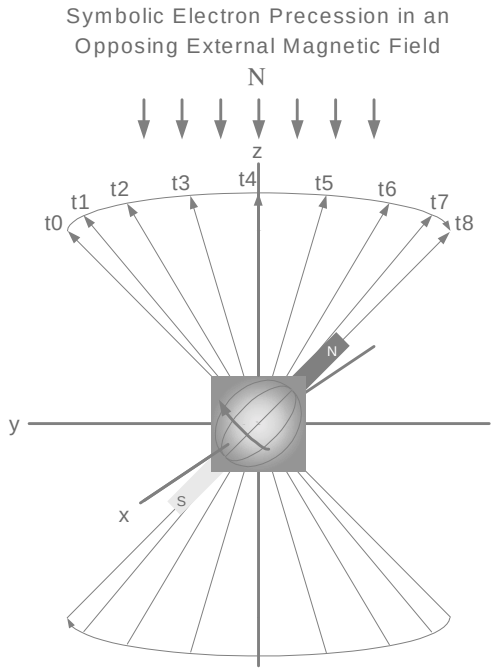


DIAGRAM 31-1
Electron Precession

48 http://www.phys.soton.ac.uk/ugbook/teach1.htm

# 32

# What is a Spin Wave Laser?

It may be easiest to explain this with a comparison between a simple traditional laser and a simple spin wave laser.

In a traditional laser, photons (discrete amounts of energy in the form of electromagnetic waves) are emitted when electrically charged particles move in step transitions from a location of higher potential energy to a location of lower potential energy. The amount of energy emitted as photons equals the difference in energy states. These events are stimulated to occur by other photons such that the emitted photons are in phase with the stimulating photons. These in turn stimulate more and more photons to be released from more charged particles that are in higher energy states as they fall to lower energy states.

Often electrons in orbitals around atoms are used. It is first necessary to have a population of electrons that are in higher energy states awaiting a stimulus to fall to a lower energy state. There are various ways to get the electrons to move to orbitals that are of a higher energy state. One way is the pump in energy in the form of incoherent light, which are just electromagnetic waves of a variety of phases, frequencies and polarizations. Many electrons absorb this energy and move to higher energy state orbitals.

In the particular lasing materials used, these electrons have a natural tendency to fall to an orbital that is a lower energy state for the electrons but not their original lowest energy state. This intermediate state is called a metastable state and while in this state an external

stimulus can cause the electrons to fall back to their original energy state. Now photons can stimulate the electrons to fall and at the same time emit photons themselves. These in turn stimulate more and more photons to be emitted. The photons are emitted in phase with the stimulating photons such that their amplitudes add together.

Here is what may be a better description:

- http://www.fas.org/man/dod-101/navy/docs/laser/fundamentals.htm

In a traditional laser, electrons will radiate photons (energy in the form of electromagnetic waves) from changing position in space from higher energy orbitals to lower energy orbitals. A spin wave laser is based on the emission of energy in the form of electromagnetic waves from electrons with axial and orbital spin that transition from higher energy spin states to lower energy spin states. In a magnetic material, if each spin orientation and associated magnetic dipole is not aligned with an external magnetic field then there is potential energy stored in that difference in orientation. When each individual magnetic dipole orientation moves to align with the external magnetic field this is a lower energy state. The energy lost is often described as propagating away through direct spin-lattice coupling but the energy lost can be made to radiate away as electromagnetic waves. This energy is lost as heat in a magnetic material where lasing is not occurring.

Similar to a tradition laser, it is first necessary to create a population inversion in which a large number of spins are in a metastable spin state. In this case, the metastable state is a higher energy state in which there is a natural tendency of the individual spins to reorient to a direction that is a lower energy state but they must first receive some stimulus to initiate the event. This is all related to the hysteresis characteristics of the particular magnetic material used as the lasing medium. Normally when a magnetic material is re-magnetized in a new direction the process occurs as disorganized avalanches of more and more magnetic domains until the whole sample is re-magnetized in a new orientation. In a spin wave laser this process involves a very ordered avalanche of spins transitioning to lower spin states.

In a spin wave laser with a population inversion of spin states, the individual spins will precess like little gyroscopes or tops. The stimulus to drop to a lower energy spin state comes in the form of electromagnetic waves that match the frequency of precession, the

Larmor frequency. The spins are stimulated to emit electromagnetic waves that are in phase with the stimulating electromagnetic waves.

Unlike a traditional laser, the phase of the simulating electromagnetic waves is more of an issue when the electromagnetic waves encounter all the spins of all the individual magnetic domains with spins that are in metastable states. In a traditional laser, the wavelength is very small relative to the distances between electrons in metastable states. In a spin wave laser the frequencies are lower and there is also more electromagnetic coupling between metastable spins.

Therefore a spin wave laser is designed such that the phase is continuously shifting along the lasing medium. Coherent spin waves are made to propagate through the medium as spins are transitioning from higher to lower spin states. The magnetic lasing material is designed to enhance the development of coherent spin waves in preferred directions. The emission of electromagnetic radiation is in a rotating manner around a loop of magnetic material that is inside a circular reflector whereas in a traditional laser the electromagnetic radiation bounces back and forth between mirrors.

A traditional laser can be pumped with radiant light energy. A spin wave laser can be pumped with radiant heat energy. Radiant heat is just electromagnetic waves that are lower in frequency than visible light. This type of spin wave laser uses a magnetic lasing material with a Magnetocaloric Effect. It is operated near its Curie temperature. An external alternating magnetic field is used to sequence the lasing medium through various magnetic field strengths and orientations.

# 33

# Spin Waves and Power Generation

The following are excerpts from the newsgroup: sci.physics.electromag:

**Peter Hanely**:

> I'm exploring magnetic energy storage, and one point I haven't been able to find is a formula for the inductance of a current loop.
>
> What I'm after is a relation between the energy stored and the stress on the loop. From that, and reasonable figures on material strengths, I hope to figure energy/mass for such a system.

**George J Bugh**:

> You could also consider energy storage in a loop of magnetic material using spin waves that propagate around the loop rather than energy storage using current flowing around a loop of wire.

**Peter Hanely**:

> How would that work?

**George J Bugh**:

Spin waves have momentum. You give a little push to them over and over creating a series of coherent spin waves that get larger and larger in amplitude.

First you make a ring of magnetic material. Visualizing the ring in a horizontal plane, you make the magnetic material of anisotropic magnetic particles such that they have a well defined easy axis in a particular direction. Acicular particles like are used in credit card or recording tape may work but the particles can't be randomly oriented on the ring. They must be oriented such that the easy axis of all the acicular particles are up and down such that the only 2 possible directions of magnetization are either up or down.

Then magnetize the particles, let's say so North is up to begin with. Then apply a homogeneous static magnetic field in the opposing direction but one that is not strong enough to re-magnetize it in the opposite direction. Now the aligned spins that create the materials North magnetic field will be susceptible to precession at the frequency established by the static magnetic field.

Now excite precession of the spins with a signal source tuned to the precession frequency and excite with a signal with EM waves that shift in phase around the ring so as to enhance the desired spin wave frequency. This reinforcing signal will stimulate larger and larger spin waves to develop.

But the key to getting a useful amount of energy back out of the system lies in understanding some other related stuff. It has to due with what happens when trying to apply Lenz's law at microwave frequencies when the reflected load does not reach back to the generator rotor (in this case, replaced with rotating magnetic fields of precessing electrons) until it is no longer opposing the motion of the source but rather aiding it.

To understand what all will happen it may be simpler to start with a simple computer simulation using a single acicular magnetic particle in the center of a circular resonant cavity. Set the static magnetic field strength such that the precession frequency of the spins of the single magnetic particle are at the

correct frequency such that the phase delay of radiated EM waves from the precessions are ¼ wave to the cavity wall and another ¼ wave back to the particle. Some interesting things will happen. Actually it may be better if in the computer simulation you first try adjusting this delay by adjusting the precession frequency such that it starts out at much less than 1 time period of precession before the back EMF reaches the center and then start making more and more of a delay until the back EMF starts to aid the rotation of the magnetic field.

The computer simulation assumes that the precessing spins within a single particle can be made to precess all more or less in phase with each other. This doesn't always happen in all magnetic materials. A ceramic nano-crystal doped with just a small amount of magnetic material can make it easier. It's a trade off between how easy it is to excite coherent precessions and how much overall coercivity is desired for the magnetic particle. Very weak doping makes the material re-magnetize too easily to align with the external static field that is setting the precession frequency. Too strong of magnetic doping causes too strong of coupling between precessing spins to be able to create coherent precession via excitation from an external source.

(This is just the part of the posts to the thread "inductance of current loop" that covers using spin waves in power generation devices. Go to http://groups.google.com/ and search for the thread "inductance of current loop" to see all posts to this thread.)

# 34

# Particle Spin and Propulsion

If a particle has spin angular momentum of 1hbar then if the particle's spin axis flips from up spin to down spin and then to up spin again then it will be in the same quantum state--meaning that how it interacts with all the other particles around it will be the same as before it flipped twice or a total of 360 degrees of spin axis flip.

If a particle has spin angular momentum of 1hbar/2 like the electron then if the particle's spin axis flips from up spin to down spin and then back to up spin again then it is only ½ way back to being back in the same quantum state even though its spin axis and associated North-South magnetic dipole field is pointed back in the same direction again. The way it interacts with its environment has changed. This is evident in a "2 slit" experiment because destructive interference occurs where constructive interference had occurred and vice versa when creating an interference pattern between electrons that haven't been flipped by 360 degrees with those that have 360 degrees of flip. But after 720 degrees of flip, the electrons passing through a 2 slit apparatus show the original interference pattern again when interfering with electrons that haven't been flipped at all.

These characteristics of an electron can be explained in a classical way by analyzing how all particles precess all the time and by analyzing the precessional phases of all the particles involved and the EM (electromagnetic) waves exchanged between them all by their precessional motions. These precessional motions give rise to a sea of

EM standing waves among all matter that is not readily apparent. Similar EM standing waves develop from precessional motions of quarks within protons and neutrons. Not all EM radiation to/from paired electrons or sets of quarks is compensated. Some is just not apparent. The wave characteristics of particles are not from abstract probability waves but from these unique electromagnetic waves.

When describing the spin of the electron, quantum physics suggests that it is "as if" the electron has a precessional angle and has precessional motion. What modern science has not realized is that in fact it really does. EM energy radiated and absorbed due to this precessional motion is continuously exchanged with all other particles with similar precessional motions. This EM interaction between the electrons passing through a 2 slit apparatus and the particles of the atoms of the 2 slit apparatus is what causes a particular interference pattern to develop.

If 2 free electrons are precessing in phase and 1-electron experiences 360 degrees of spin axis flip then its precessional phase is also shifted relative to the other electron. Two free electrons precessing will tend to naturally move to a state of either precessing in phase or 180 degrees out of phase due to the EM waves exchanged between them by their precessional motions. At any other precessional phase the EM forces developed between them will tend to push them back to positions where they are either precessing in phase or 180 out of phase. These EM forces developed between them from EM energy exchanged between them, due to the precession of their magnetic dipoles, is what moves them into quantized states.

To visualize precessional phase, imagine looking down into the axis of precession of 2 particles and then see (in a 2D plane from that eye point) the precessing of them both frozen in a snap shot of time and see the spin axis of each pointing the same direction (zero phase difference) or opposite directions (180 degrees precessional phase difference). I think it is hard to visual what I'm trying to get across and I will try to show this with a video showing the actual positions, motions and exchange of EM energy when I can.

Quantum physics describes exchange coupling and exchange energy in a purely mathematical way without any real world processes and characteristics of particles or classical analog that accounts for the spin characteristics of particles. It is possible that there are real processes and spin characteristics of particles and particle interactions and that a valid classical description exists. In this case, compensating precessional

motions are involved of paired electrons with up and down spin or simply precessional motion of unpaired electrons. There is EM energy that is radiated to and from the precessional rotation of the magnetic dipoles of all these precessing charged particles, even from spins normally thought of as compensated, such that energy is continuously exchanged between them all and there is always an amount of EM coupling between all precessing particles. EM coupling and energy exchange from precessional motion occurs even among quarks of protons and neutrons but at much higher precessional frequencies than with electrons.

Once any particular particle has achieved synchronous precessional motion will all other particles then the energy stored in the difference in phase of the EM emissions between them will reduce towards zero. It would be hard to detect even any EM energy between them since as long as they are in sync there is very little energy stored in the difference in phase of EM emissions from them all.

However as soon as you attempt to make that particle move to a new position in space then it will not have its EM emissions from its precessional motion in phase with emissions of all other precessing particles around it near or far. The EM forces that develop due to this difference in phase between their precessional motions will cause a resistance to its motion to a new location and force must be applied against this resistance in order to successfully move any precessing particle to a new location. This is a way of explaining inertia.

All charged particles precess due to the EM emission exchange that has already been setup among them all. Also angular momentum is kept the same for all same type particles because if any particle emits too much energy from its precessional motion so as to start precessing slower then that energy is immediately replaced with energy absorbed from all EM emissions of all other precessing particles everywhere of similar type.

If by a man made device a large group of precessing particles making up all the atoms of a flying vehicle and its contents could be made to precess at a shifted phase relative to the phase of EM emissions of all other matter then a sudden and swift motion of the vehicle could be achieved by the forces that develop on all the particles of the vehicle due to the phase shift of the EM emissions of all the particles of the vehicle relative to all the EM emissions of all other matter in the area. This could be called antigravity propulsion or electrogravity propulsion.

# 35

# Recommended Reading

To better understand the topics in this book it is recommended the reader have studied the following subjects:

## *0. Basic Electronics*

At this link click on electromagnetism and study the various things there.

- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
- http://science-ebooks.com/electronics/table_of_contents.htm
- http://web.utk.edu/~kizzer/hrd557/

## *1. Lasers*

- http://www.adm.uwaterloo.ca/infohs/lasermanual/documents/section5.html
- http://www.laserhotline.com/laserfundamentals/lasersfund.html
- http://www.fas.org/man/dod-101/navy/docs/laser/fundamentals.htm

## *2. Electromagnetics*

- http://www.duboismarketing.com/electromagnetism.html
- http://www.physics.orst.edu/~ph213/lecture/
- http://micro.magnet.fsu.edu/electromag/java/index.html
- http://morgan.rutgers.edu/HTMLDocs/physicsBookmarks.html

- http://webug.physics.uiuc.edu/courses/phys112/fall97/outline.html
- http://www.ee.surrey.ac.uk/Personal/D.Jefferies/transmission.html
- http://emlib.jpl.nasa.gov/EMLIB/files.html

### *3. The Magnetic Field*

- http://www.phys.virginia.edu/classes/252/home.html
- http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Lorentz.html
- http://www-groups.dcs.st-and.ac.uk/~history/HistTopics/Special_relativity.html#12

### *4. Nuclear Magnetic Resonance and Electron Paramagnetic Resonance, sometimes called Electron Spin Resonance*

- http://www.pma.caltech.edu/~derose/labs/exp6.html
- http://www.encyclopedia.com/articles/07870.html
- http://www.t2star.com/basic_mr/Basic.html
- http://ierc.scs.uiuc.edu/epr.html

### *5. Entropy, in particular in systems involving heat transfer*

- http://acnet.pratt.edu/~arch543p/readings/thermodynamics.html
- http://therion.minpet.unibas.ch/minpet/groups/thermodict/notes/maxwelldemon.html
- http://www.maxwellian.demon.co.uk/name.html

### *6. Particle Spin and Precession*

- http://hyperphysics.phy-astr.gsu.edu/hbase/spin.html
- http://www.benbest.com/science/quantum.html
- http://www.chembio.uoguelph.ca/educmat/CHM386/RUDIMENT/TOURQUAN/broglie.htm
- http://www.columbia.edu/itc/chemistry/photochem/chapter15.html
- http://www.columbia.edu/itc/chemistry/photochem/spin/06.pdf
- http://www.physics.uc.edu/suranyi/Modern_physics/Lecture_Notes/modern_physics8.html
- http://230nsc1.phy-astr.gsu.edu/hbase/spin.html#c4

### *7. Spin Wave Resonance*

- http://users.rowan.edu/~lofland/RES/SWR1/

### *8. Hysteresis in the Lasing Material:*

- http://www.lassp.cornell.edu/sethna/hysteresis/hysteresis.html
- http://www.student.uni-kl.de/~mewes/magnet.e.html
- http://treasure-troves.com/physics/HysteresisEffect.html
- http://phy-server.phy.queensu.ca/wwwhome/atherton/linepipe.html

### *9. Magnetocaloric Effect*

- http://positron.aps.org/BAPSMAR98/abs/S3220004.html
- http://www.science.uva.nl/research/mmm/mtm/ch8.pdf

### *10. Magnetic Materials:*

- http://www.ee.washington.edu/conselec/CE/kuhn/magtape/95x1.htm
- http://maxwell.byu.edu/~spencerr/websumm122/node79.html

# 36

# Transmutation of Atomic Elements via Proton Manipulation

This is a theory developed after several years of studying the claims of people who say they have succeeded in transmuting elements. Their devices were studied to see how they could work. Devices were also studied that claim to get energy from unknown sources that also sometimes appeared to result in transmutation of some of the materials used in these devices. Based on these studies the following theory arouse that it is possible to pop protons out of a nucleus and gain what appears to be anomalous energy in the process. Further, that this appears to be possible at lower energy levels than what would be expected to be necessary to cause a proton to dislodge from a nucleus. The following explanations of this theory are based on the idea that particles of an atom move and precess in a harmonious motion with all the other particles of an atom. When the harmonious motion of a particular particle is made to be temporarily out of synchronization with the other particles of an atom then it becomes more susceptible to forces that can dislodge it from an atom. There are two ways to explain how this is possible. Both ways are actually describing the same thing.

## *1. Quantum Mechanical explanation:*

Protons are not perfectly round spheres. They are made up of 3 quarks and the electric force from, and nuclear strong force in the proton are not perfectly distributed at any instant in time. This distribution is

somewhat indeterminate at a particular instant in time. However, at any instant in time, the 3 quarks will always lie in a plane as opposed to forming a sphere. If a proton can be made to flip spin states, then during the flip, the proton is not bound in the nucleus as strongly as when in a stable up spin or down spin. Due to the changing orientations of the electric and strong forces, in the middle of flipping spin states, there is a higher probability that a very high external electric force can overcome the nuclear strong force and pop the flipping proton out of the nucleus. NMR (Nuclear Magnetic Resonance) can be used to cause a proton to flip spin states. It is said that there is no time that a proton is in transition, but rather that it is either up spin or down spin. This may not be correct. It is more accurate to say that we are incapable of measuring the transition but only of the state before and after. This is partly due to how we perceive a particle's motion not only in space but also in time.

One of many devices studied was a motor made by an experimenter who claimed to get an anomalous energy output. This was some version of a Joseph Newman motor. A large coil of copper wire was used. At certain periods of time, certain areas of the copper had a very high positive charge, which left some copper atoms in the wire without an electron, in other words there were + copper ions. This in turn allowed the unpaired protons in the copper atoms to be susceptible to NMR and thus also susceptible of flipping their spin states. Because of the configuration of the motor, high frequency oscillations occurred that matched the NMR frequency determined by a static B field setup by a permanent magnet within the motor. The coil of copper also developed extremely high voltage spikes at times that were capable of popping protons out of the nucleus during the time the protons were flipping spin states.

## *2. Vortex Explanation:*

Years ago there was an article in a science magazine about several physicists that created a NMR or EMR type rotating EM field around particles caught in some laser beams. The phasing of these beams also created a rotating EM field. The physicists claimed that using the right rotation frequency and orientations relative to the particles' spin axes, the size of the particles could be greatly increased. The description sounded somewhat similar to laser cooling. In an experimental apparatus like this a particle can be made to precess at a rate that is not in harmony with the precessional motions of all the other particles or atoms in the same vicinity.

Keeping that in mind, here is another way of explaining proton popping. It uses more of a Maxwell model of particles. Maxwell believed a charged particle could be described as vortex of energy. A proton can be described as 3 vortices (quarks) combined into one. If you saw the movie "Twister" then perhaps you recall the scene of 3 twisters forming one. It is similar to that except the vortex we call a proton can be oriented in any direction whereas a twister is always more or less vertical.

An atomic particle with spin can be thought of as a small vortex in space-time. This is not a bizarre new theory. Maxwell and Helmholtz had valid mathematical models that showed how this could be true.[49] Now visualize a tight little vortex proton in an atom that is acted upon by NMR to make it flip over. It is possible for it to expand out in size and slow down in spin and decrease in its precessional harmony with the other atomic particles as it flips over and then it will snap back to its tight spin again and regain its precessional harmony which again makes it stable with its surrounding particles. A vortex tends to expand in size when forced from vertical to horizontal orientation. It is kind of like an ice skater than spins with arms in and then puts arms out and then back in again.

It can't spin any slower than the speed of light just as before. It will temporarily slow down its spin not only through space but through time also. It still spins at the speed of light only because the proportion of space traversed divided by the proportion of time traversed is still the speed of light even though it spins slower through both. This idea is based on the concept that it is relative motion through space that causes relative motion through time to begin with. This concept is discussed in depth in a related paper titled "The Nature of Time". These + copper ion atoms would be transmuted to another element with one less proton.

I apologize for not keeping better records of exactly where I saw these motors discussed. There have been so many different devices that I have read about and studied over the years. If I knew that this theory was going to come to me years later I would have kept better records. These devices were on many different websites that dealt with creating anomalous energy outputs.

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[49] " The Origins of Field Theory", CEN 530.1 W Williams, L. Pearce, Random House, 1966 p. 129

# 37

# Transcript of Video Lecture on Spin Waves

My name is George Bugh, and this is a video to explain spin waves. This is going to be a simplified explanation and it is a classical explanation rather than a quantum electrodynamic explanation. The classical explanation should be sufficient for you to develop a pretty good understanding of what spin waves are, how they work and what kind of things you can do with them.

Spin waves propagate through precessing electrons within a magnetic material. First I am going to start by talking about the electron.

The electron, or actually any particle with an electric field and the attribute of spin will have a magnetic field associated with it due to the spin of the electric field. If you have a loop of wire and current flowing through the wire, you may already be aware that this develops a magnetic field due to the flow of current through the loop of wire. A similar type of thing happens with a single electron. If the electric field of the electron is moving (it is no longer the current flowing through a loop of wire, but rather the electric field itself that is rotating) it will still develop a magnetic field similar to that caused by a current flowing in a loop of wire.

(from George Bugh: When I talked about the cause of the magnetic field of an electron, I was talking about the spin of the electric

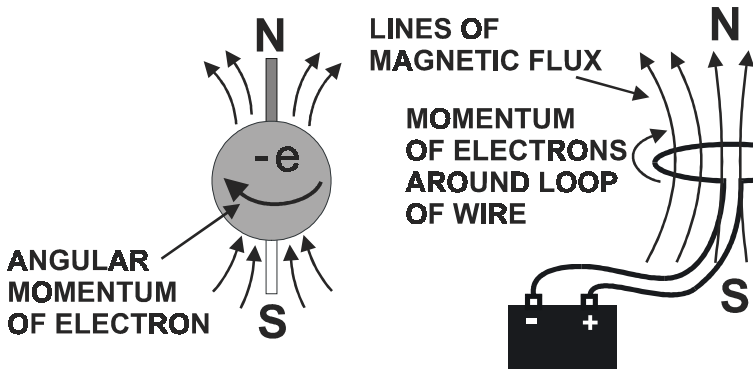


DIAGRAM 37-1
Electron Magnetic Field

field and that's not exactly correct. Just as the barometric pressure gradient in a hurricane does not actually spin so also the electric field of the electron is not actually the thing that spins. However, when giving a classical electrodynamic explanation, I still resist saying that it is a substance called "charge" that spins and this is explained further in the included chapters.)

For an electrically charged particle like the electron, there is a small magnetic dipole associated with it that runs through its spin axis with a North pole on one end and a South pole on the other and lines of magnetic flux between the two—just as if you had a small bar magnet.

Within a magnetic material like pure iron, when the spins of all of the electrons are pointed in a similar direction they develop a large macroscopic magnetic field from the microscopic magnetic fields of the individual electrons. Within a sample of iron it is not every electron that develops the magnetic field associated with a magnetic material like iron. Rather it is only the unpaired electrons shared between bonds, between the atoms in an atomic lattice of the material.

If you look at a single atom of iron, the electrons that are in the orbitals around the nucleus of that atom will be paired up so that there will be an even number of electrons in each orbital. For each electron with its spin axis pointing in one direction, there will be a second paired electron with its spin axis pointing in the opposite direction, such that outside of that atom the magnetic fields are neutralized by each other.

However, if there is a sample of a larger quantity of iron atoms bound together in an atomic lattice, between each set of molecular bonds there will be one electron shared between bonds so that it is no longer paired with a second electron.

Once there are unpaired electrons, then there are magnetic fields that are not cancelled out by the compensating electron spin of a paired electron. If all of those individual magnetic fields are pointed in a similar direction, then there can be a larger macroscopic magnetic field from that sample of iron. With any magnetic material if there is electron spin and/or orbital motion that is not compensated for by equal and opposite motion of other electrons then those magnetic fields, if all pointed in a similar direction, will make a larger magnetic filed for that whole sample.

It is also possible to develop spin waves among the electrons within a material like this. To explain spin waves, first let's look at how an electron reacts to changes in the direction of its spin axis orientation.

If there is a single electron that is shared between atoms in a material like iron and the electron spin axis is pointing up and down, then that electron with spin, if acted upon by some outside electromagnetic force or magnetic field so as to try to turn the magnetic field in a different orientation, will not turn directly into the direction that it is pulled or pushed. Rather, since it has spin, it will react by precessing.

For example: If you have a top or a gyroscope and you tilt it so that gravity is pulling on it, it doesn't move straight down due to the pull of gravity but rather the combined forces due to its spin and the pull on it, cause it to precess at some precession rate and precession angle due to the combined interactions of the spin and the forces acting on it to try to reorient its spin axis.

Electrons within an external magnetic field will do something similar—they will precess. Within a sample of magnetic material, if there is a large group of unpaired electrons all pointing in a similar direction, and there is an external magnetic field pulling on them trying to reorient them in a different direction, then they will precess under the influence of that external field. The frequency at which they will precess is dependent on how strong the force is that is pulling on them.

A typical precession frequency for electrons in a magnetic material in an external magnetic field of one Tesla will be anywhere from 3 to 10 Gigahertz (GHz) or possibly even a wider range than that.

(This was misstated and should be; In an external magnetic field strength of .3 to 1 Tesla, depending on the particular material, the precession frequency will be about 10GHz.)

To understand spin waves, we look at a very simplified explanation: We start off with just two electrons that are unpaired within material. Due to the influence of an external magnetic field those two electrons are precessing. If they precess in phase there is a minimal amount of energy stored in the form of the compression and expansion of the magnetic fields between those two. However if they are precessing and one momentarily precesses faster than the next, then there will be a compression of the magnetic field between them due to the difference in precessional phase angle.

When I talk about precessional phase, I am talking as if we are looking down into the axis of precession. If this is the axis of precession pointing directly towards the camera and there are two electrons precessing together, if they are in phase, then the instantaneous position of their axis will be the same.

Looking at it horizontally again with the spin axis or actually the precession axis up and down, if they are precessing like this and one has a slightly higher frequency of precession momentarily, then its magnetic field influences the magnetic fields of the other electrons around it. Momentarily there is a compression of the magnetic field lines between them and this has the effect of propagating along and pushing on this one, and this one temporarily speeds up and there is a compression wave or a wave of change in precession frequency that propagates along through the precessing electrons.

It's kind of like if you had a long coiled spring like a Slinky™ [50] and you have it expanded to some extent, if you were to compress a few coils and let them go, then that compression wave would move along the coil. The same thing happens with precessing electrons. The magnetic flux density compression, due to the momentary change in precession frequency, will propagate along through the precessing electrons.

The electrons will each have a magnetic field that rotates at microwave frequencies all of the time and these can be stimulated to precess at greater amplitude (more in phase with each other i.e. coherently) —they can be stimulated to all precess together. With electrons this is called electron spin resonance or sometimes electron

[50] "Slinky" is a trademark of James Industries, Inc.

paramagnetic resonance. Within a ferromagnetic material, this is called ferromagnetic resonance.

Ferromagnetic resonance can be stimulated to get a peak amount of absorption or radiation from a group of electrons precessing together if they are stimulated at their natural frequency of precession, which is dependent on the field strength of the external magnetic field.

If a group of electrons is stimulated to precess more or less together, then they are also susceptible to spin waves. At this point we already have many electrons precessing together in the microwave frequency range, and then amongst those we also have the ability to have spin waves propagating through them from changes in their precession rates.

These spin waves carry momentum. In other words, these spin waves can transfer energy from one location to another. Again we use the example of the Slinky™: If somewhere along the slinky you tape a little pencil that is sticking out and over here compress a bunch of the coils, when you let them go that compression wave propagates through the slinky and it is going to move the pencil. That pencil can then push objects back and forth—in other words it is doing work. A similar thing can happen with spin waves—spin waves carry momentum; they carry energy at some velocity and are capable of performing work.

So far I have given you an idealized picture of spin waves. However, within a single sample of magnetic material, spin waves can propagate in all directions. They can propagate along the surface in both directions of a thin film of magnetic material for example; they can also propagate into the depth of that same thin film of magnetic material. In making things that utilize spin waves, it is desirable to stimulate the development of coherent spin waves in certain directions and to minimize the propagation of spin waves in other directions.

This can be done by controlling what type of magnetic material is used, how the magnetic particles are applied to the surface that is being worked with, as well as other things, which I will go into later.

The next and also important detail to understand when developing things that utilize spin wave technology is how Lenz's Law applies to things that are rotating at microwave frequencies.

Lenz's Law is most often used in dealing with things like motor generators. Lets say that I have a permanent magnet rotor as part of a motor generator and I create a current flow in something using magnetic fields – for example: if I spin the rotor so that it induces current flow in

the stator windings, and those stator windings are connected to something like a resistor or light bulb, and the spin of that permanent magnet rotor induces current to flow in the stator windings and the current flows through the light bulb and the light bulb lights up, then I have transferred energy through the work of turning the rotor to the energy that is lighting up the light bulb.

Lenz's Law states (and this is just a rough explanation, not a dictionary definition of Lenz's Law) that the magnetic field that would develop around the stator coil winding due to the flow of induced current, will always be in opposition to the magnetic field that induced the current flow to begin with.

So if I turn a rotor, the current flows through the stator windings, it lights the light bulb, the amount of work being done and the amount of energy being expended by that light is reflected back into the field strength of the magnetic field of the stator windings which is in opposition to the magnetic field orientation of the rotor, and so it opposes my trying to turn that rotor such that the amount of work that I'm putting into lighting that light—the amount of energy that I'm transferring—is equal to the amount of energy that is actually getting to the light bulb or to any thing else within that circuit that is dissipating energy in the form of heat or whatever.

So now interesting things happen when we apply Lenz's Law to devices working at microwave frequencies.

Lenz's Law normally applies in situations where the wavelength of the radiated electromagnetic signal from a rotating rotor, and established by the rate of rotation, is much more than the distance it takes the electromagnetic field to radiate to the stator windings during the period of one rotation. For example: say that I am rotating a rotor at one cycle per second or the frequency of one Hertz. The distance from the stator coil to the permanent magnet rotor is going to be much less than the distance it takes the electromagnetic field to radiate during the time period of one second. So the reflected load, from the amount of current the light bulb is drawing back into the rotor to affect how hard it is to turn the rotor, is almost instantaneous.

The same thing can be done at microwave frequencies and something different will happen. If we take a single nano-crystal sized magnetic particle and cause all of its (unpaired or uncompensated) electrons to precess in phase at microwave frequencies, then it will be sending out an electromagnetic field that rotates just as if we had a very small permanent magnet rotor of a motor-generator. This rotating

magnetic field is capable of inducing current flow. In this case we wouldn't have a stator winding, but rather could use microwave reflector antennas that are also tied to a load.

To give an even more basic example: Instead of a single stator coil or loop, you can imagine that there are a whole number of loops around the rotor and that these loops are shorted together, i.e. one big loop with a short. The maximum of current flow will be possible through this coil – which is actually not a coil anymore, but now a spherical chamber in which a single rotating field is at the center. The maximum amount of current induced in this spherical chamber will reflect back magnetic fields that would normally oppose the motion of the rotor's rotating magnetic field at the center. If there is any amount of resistance to the spherical cavity because it is not a superconductive material or for any other reasons, then the energy dissipated in the form of heat through the resistance of the reflecting material should be reflected back and cause resistance to the motion of the magnetic field that induced the current flow such that work must be done in an amount equal to the energy dissipated in order to keep the rotor turning.

At microwave frequencies it takes a certain amount of time for the rotating magnetic field from the precessing electrons to reach the cavity wall and it also takes time for the induced current's own magnetic field (which would normally be in opposition) to reach back to the rotating magnetic field at the center. It is possible to obtain a size of cavity such that the time delay of the rotating magnetic field to the surface, and the time delay of the reflected opposing magnetic field back to it, is, by the time it returns, at a point where the rotating magnetic field has made at least 90 degrees or possibly closer to 180 degrees rotation in the orientation of its magnetic field. This means that the reflected signal that is coming back no longer opposes the motion but rather aids the motion.

Another way of looking at it: If you have a sample of ferromagnetic material, a very very small sample – just a single nano-sized crystal— of magnetic material, and you stimulate ferromagnetic resonance in that material, then it is radiating out a rotating magnetic field at its precession frequency. If I reflect it right back into it, then my reflected signal can now act as the stimulating source for ferromagnetic resonance, rather than continuing to use any external microwave antennas to stimulate that ferromagnetic resonance. I can use its own emissions to continue to stimulate it, to continue to have ferromagnetic resonance at that particular frequency, which is the natural resonant

frequency as established by the field strength of an external magnetic field.

This only works with an external magnetic field that is not strong enough to re-magnetize the material in the opposite direction. The external magnetic field is there and it is establishing what the precession frequency will be but it is not strong enough to flip the spins of the electrons that are causing the magnetic field. Otherwise the whole sample of material would be re-magnetized in the other direction. In this example we want to create a magnetic field that sets up what the precession frequency will be, but not a magnetic field that is strong enough to re-magnetize the material in the opposite direction.

In a situation where I have electromagnetic radiation from a simulated magnetic rotor (it is simulated by using a single nano-crystal of magnetic material, which is not moving macroscopically, only the individual electrons within it are moving at a common precession frequency) it is inducing current in the resonant cavity or reflective cavity such that it is dissipating a certain amount of energy absorbed in the form of heat lost in the resistance of that cavity walls.

Normally that energy loss reflected back would slow down or oppose the motion of what is causing this induced current to begin with. But now not only is heat being drawn from this and dissipated on the cavity surface, but the reflected load which would normally remove energy from the source and require more energy to continue the motion, is coming back and aiding the direction of precession. There is still energy being drawn from the system and the energy comes from the individual electrons themselves. To explain further how this can work, it is necessary to understand how all precessing electrically charged particles everywhere interact with each other.

According to classical electrodynamics, any time an electrically charged particle is precessing, it is going to have a rotating magnetic field associated with that precessional motion, and that rotating magnetic field is radiating electromagnetic waves. Energy should be dissipated from that precessing particle to the same degree that energy is radiating out into space in the form of electromagnetic waves.

Also according to classical electrodynamics, a precessing electron would very quickly radiate away its energy and there would be nothing left to the electron. I say this because the mass of the electron is equivalent to its energy. This is a very famous equation: $E=mc^2$. All of the energy of the electron within its electric field is equivalent to the

mass of the electron. If energy is being radiated away in the form of electromagnetic fields, that energy has to come from somewhere.

If there are precessing electrons and they are radiating electromagnetic energy, not only do they radiate electromagnetic energy, but they also absorb electromagnetic energy. In fact all electrically charged magnetic particles do this all of the time—they are constantly radiating and absorbing electromagnetic energy from their precessional motions. This radiated energy applies forces to all other precessing particles' similar precession and these electromagnetic waves exchanged among them tend to move them all to a common rate of precession.

If any individual particle radiates away more energy than the rest, such that it loses angular momentum (which quantum physics says never happens, but if it could happen, and according to classical electrodynamics it should be able to happen), then what will happen is that it will be precessing slower than the other similar particles. As soon as this happens its precessional motion will no longer be in phase with the precessional motion of all similar particles everywhere and the electromagnetic field forces that develop between it and other similar particles will apply forces to it to make it pick up speed again. (It will never lose much speed at all because it immediately absorbs whatever energy it requires to get back in harmonious precessional motion with all other particles that are constantly exchanging electromagnetic energy with each other).

There is no way to measure the electromagnetic energy exchanged between two particles that are precessing in phase, because there is a minimal force that is between them when they are precessing in phase. It is only when one slows down and the phase difference between them develops that there is energy stored between them due to that difference in phase, and that is what applies forces between them to move them back into synchronized precessional motion.

For unpaired electrons within a ferromagnetic material, the particular precession frequencies involved are established by the field strength of an external magnetic field. However, even paired electrons within all atoms precess, and the frequency of precession in that case is established by what orbital the electrons are in and how the electromagnetic fields of the electrons interact with each other and interact with the electromagnetic fields of the nuclei (the protons, the neutrons and the quarks that make up the protons and neutrons within the nucleus of atoms). When there are paired electrons there is

precessional and counter precessional motion such that external to it, the magnetic fields appear to cancel each other out. But still, there can be waves of magnetic fields radiating from their motion that affect similar particles of other atoms and they all share this interaction among each other everywhere.

To explain what I mean by that it is best to read the papers that I've written that are available and I will be doing more videos to explain it further.

[End of transcript]

Added later:

I did not make it clear what the connection was between spin waves and a magnetic rotor created from coherent precessing electrons. Basically, it is difficult to have a macroscopic size rotor of this type that maintains zero phase shift among all the coherent precessing electrons so it is necessary to incorporate into the design coherent spin waves among the precessing electrons. It is going to take some time to make this all clear as to how it all works as this is so new.

# 38

# Understanding the Magnetic Force

The magnetic field force is explained as caused by the effects of relativistic length contraction. From one object's point of view, another object with moving charge appears to have more charge per unit of length due to length contraction.

References:

- http://www.phys.virginia.edu/classes/252/home.html
- http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Lorentz.html
- http://www-groups.dcs.st-and.ac.uk/~history/HistTopics/Special_relativity.html#12

The amount of electric force and direction of electric force are translated from one frame of reference to the other to become the magnetic field force. It is possible however to show that the magnetic force is actually caused by a change in the amount of charge for a given length of time due to time dilation rather than a change in the amount of charge per given length in space due to length contraction. It is important to make this distinction because it shows a relationship between charge, the electric force, the magnetic force and time that can be expanded upon.

The following is a thought experiment to make it clear that length contraction never actually occurs. Special relativity applies to frames

of reference moving at constant velocity with respect to each other. This thought experiment shows that it is impossible for length contraction to develop when accelerating to a constant velocity between two frames of reference and so it is likely that length contraction never happens once at a constant velocity.

Please study the thought experiment carefully before passing judgment on these assertions.

The experiment:

Refer to the diagram "Length Contraction" (*DIAGRAM 38-1)*

In an x-y plane in deep space between galaxies there is an observation post with three wise men on it. They have placed two spaceships and a pole in deep space many light years away from anything as shown in the diagram. The two ships are in a line facing left at a right angle to the observation post. Between the two ships is a long pole. One end is plugged into a hole in the back of ship B. The other end is plugged into a hole in the nose of ship A.

The two spaceships have powerful thrusters. The pole also has small but powerful thrusters along its length. The thrusters are pointed so that their thrust does not hit the other objects. All three objects are remote controlled from the observation post. Both spaceships and the pole receive a command at exactly the same time (from the observation post's point of view). The commands instruct the two spaceships and the pole to begin accelerating at a very high speed at exactly the same rate of acceleration.

Parallel to the spaceships and pole there is a line of equally spaced distance marker lights in space to help in determining how far each object has moved.

All three wise men live a very long time and they are very patient. Each has a very powerful telescope and a precision Rolex watch. The telescopes also superimpose very precise grid marks across their image to aid in determining the distance that each object has traveled. The spaceships and pole all have lights to light them up and the wise men have vision over a very wide range of frequencies. Once the light from the spaceships and the pole reach the observation post, the wise men carefully monitor their motion against the distance markers and against their timers. The objects are so very far away that even after accelerating a long time, the objects still are moving almost exactly at a right angle to the line from the observation post to the objects.

Wise man A watches the rear spaceship A. Wise man B watches the front spaceship B. The third wise man watches the one single spaceship that consists of all three objects in contact with each other. Over a period of 1,000,000,000 seconds they all observe the objects reach a velocity that is a significant fraction of the speed of light. The first wise man is happy to see that his spaceship is accelerating exactly at the commanded rate. His telemetry data from hisship reports that his ship is neither pushing nor pulling on the pole. In exactly1,000,000,000 seconds it has passed exactly 1,000,000,000,000,000,000,000,000,000,000 marker lights.

Wise man B reports exactly the same thing for the front spaceship B.

The third wise man reports that the pole has covered exactly the same distance in exactly the same amount of time as the two spaceships. All three objects have accelerated exactly as each was commanded. Each has traveled exactly the same distance in exactly the same amount of time.

It is observed that:

SPACESHIP A HAS NOT ACCELERATED FASTER TO SHORTEN THE DISTANCE TO SPACESHIP B.

SPACESHIP B HAS NOT ACCELERATED SLOWER TO SHORTEN THE DISTANCE TO SPACESHIP A.

THE POLE HAS NOT SHORTENED AND COME OUT OF THE MOUNTING HOLES IN THE 2 SPACESHIPS.

At this point, the three objects get a command to stop accelerating. They are all moving together and since the distance between them was never observed to decrease they are still the same distance apart. The pole is still in place in the mounting holes in spaceship A and spaceship B.

No length contraction occurs.

Per unit length of time, the amount of charge as manifest in the electric field force from moving charges, remains invariant. When an electron is accelerated, the increase in kinetic energy is not manifest as an increase in charge with a more intense electric field. The energy and force from moving charges are manifest as a magnetic field force. This magnetic field can be described as a translation of the electric field due to a difference in the rate that the electron's charge moves through time as seen from an observer in a different frame of reference.

In any equation describing length contraction, the terms representing length (l) in 1 frame of reference and length (l') in a 2nd frame of reference can be broken out and represented using time variables instead. The speed of light "c" is the same in both frames. If we let (t) equal the time it takes light to travel length (l) and (t') equal the time it takes light to travel length (l') then the following is true.

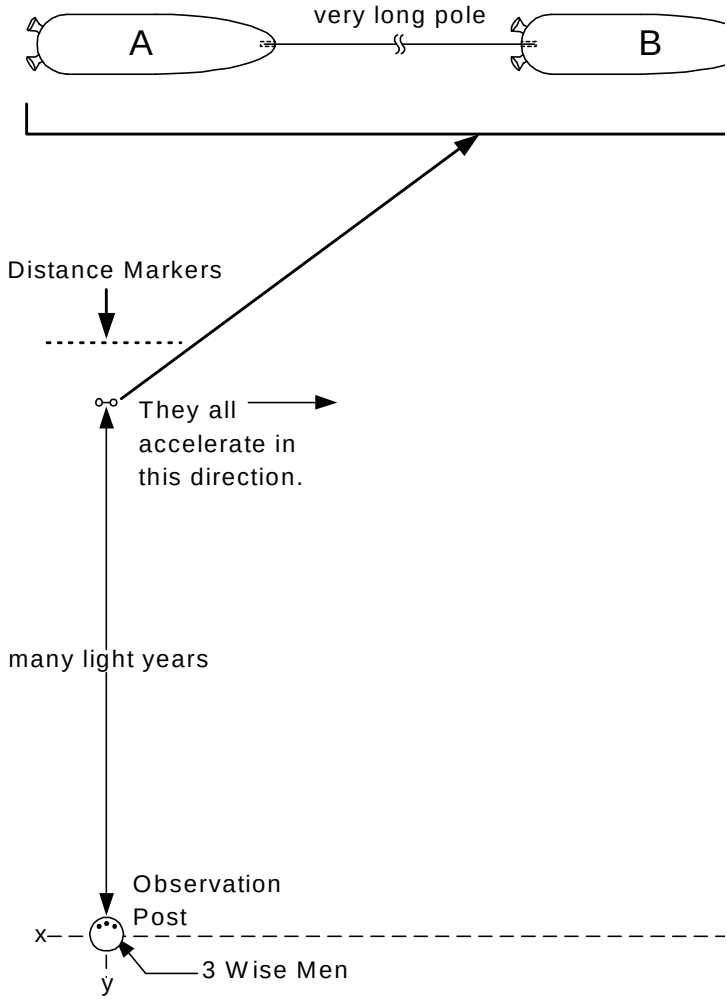


DIAGRAM 38-1
Length Contraction-Observation

$(c = l/t = l'/t')$

Therefore

$l = ct$ and

$l' = ct'$.

Now by substituting these into a length contraction equation it is possible to show that what was thought to be length contraction is actually only manifest in reality as time dilation.

# 39

# Caduceus Coil Antenna Design

This diagram shows only 7 loops however typically there will be many more so that the loops will be smaller. There must always be an odd number of loops. The more loops there are, the smaller the loops are and so it will operate at higher frequencies. However, the higher the frequency, the more difficult it is to control trim capacitance values that set the desired resonant frequency. The trim capacitors are placed in series at each loop and the antenna is tuned for series resonance.

The antenna's inductance and capacitance are tuned to create standing waves at the desired EPR frequency of the lasing medium for a given up/down magnetic field strength. Then it is tuned slightly off frequency to create traveling waves at the desired spin wave frequency. The desired EPR frequency depends on the distance from the antenna to the lasing medium such that antenna reflections return to the lasing medium at the correct phase to re-enforce EPR.

Dimension "B" is selected based on the number of loops and the desired distance from the antenna to the lasing medium. Dimension "A" is selected so that the loop width and height are equal. The loops do not have to be square but rather can be more sinusoidal in shape however cross points should cross at right angles.

At the cross points it is VERY IMPORTANT that one wire pass through another rather than going around one side of the other wire. If one wire were to go around one side of the other this would force the magnetic fields at the EPR frequency to rotate around in a particular

manner as the traveling waves move along the wires. This is not desirable since certain modes of magnetic field rotation here can radiate a particular EM pattern that can cause adverse affects in living organisms.

The diagram Magnon Laser Antenna Standing-Traveling Waves (*DIAGRAM 39-2)* is of partially standing - partially traveling waves on a caduceus coil antenna with an odd number of crossing points/ loops. The diagram indicates the changing magnetic field vectors.

In the preceding antenna description the antenna is described as using series trim capacitors to tune the resonant frequency. It may turn out that series trim capacitors are too difficult to tune for all exactly the same resonance. The antenna could also be designed with parallel trim capacitors but a larger series capacitance may be needed so that the antenna reflector does not act as a shorted secondary of the field coil.

Then again, a larger series capacitor in series with the antenna would allow the antenna reflector to act as a 2 turn field coil such that another field coil may not be necessary.

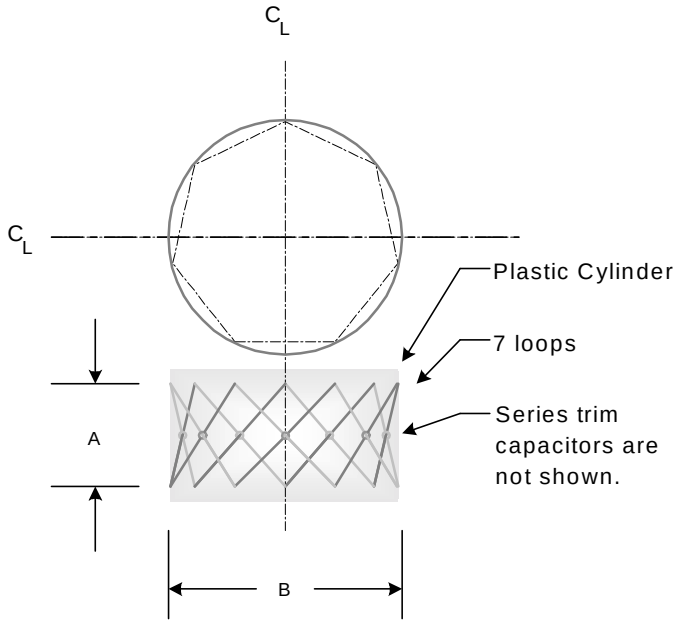


DIAGRAM 39-1
Magnon Laser EPR Antenna Reflector Coil

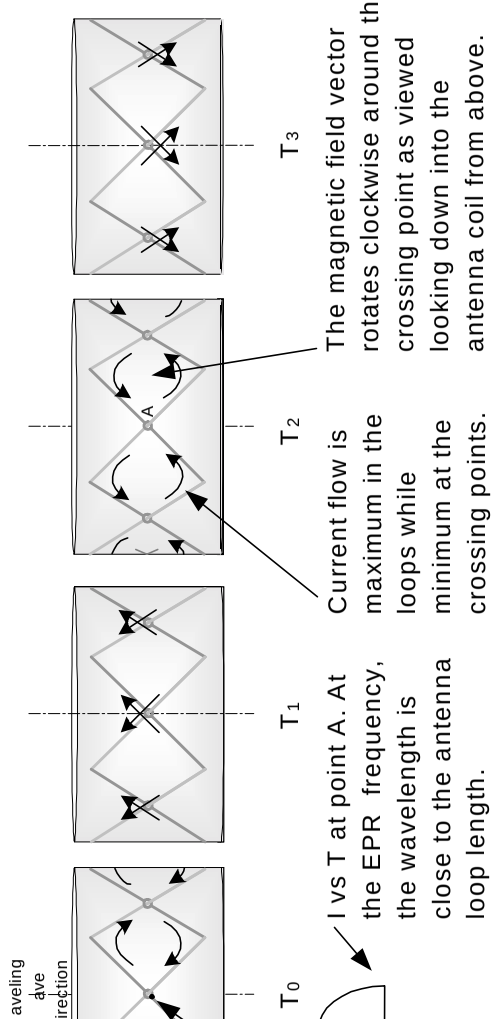


DIAGRAM 39-2
Magnon Laser Antenna Standing-Traveling Waves

# 40

# Permissions

From George Bugh,

Part of my agreement in selling my science ideas is that I don't use my employer's name in the publications. In keeping with this restriction the company name, other employee names and phone numbers have been blanked out in these copies of email communications. These copies of communications are provided as proof that I have my employer's permission to sell my science ideas. The first email below was sent to me after I sent in an "Outside Business Interest Disclosure" form via slow mail to the staffing department.

---

(This person's computer clock is set ahead of mine and so the email message appears to have been sent after the response from me that follows.)

---

From:Bxxxxxxx,Cxxxx
Sent: Tuesday, June 19, 2001 8:27 AM
To: Bugh, George J
Cc: Mxxxxxx, Jxxx F
Subject: Outside Business Interest Disclosure

George,

Our process for review and approval of outside business interests requires the General Counsel's office to review and sign-off of the disclosure forms. Your disclosure for Vasant Corporation was submitted to my office for review.

Your proposed outside business interest raises some concerns which should be taken into consideration. First, each employee is required to sign an Intellectual Property Agreement in connection with his/her employment with Company x. This agreement permits Company x to assert ownership over any concept or invention created by the employee during the term of his/her employment, regardless of whether such concept or invention is created on Company x property, or created during or after working hours, and, regardless of whether the concept or invention is related to any line of business in which the corporation is currently engaged.

Secondly, publication of concepts or ideas related to Company x business or technology requires approval from the General Counsel's office and Communications. Since Company x can assert a business interest over any concept or invention you create during your term of employment, it would be difficult to determine whether an item you have proposed for publication would in fact be of interest to Company x. Accordingly, any item you have prepared for publishing should be approved by Communications and Legal prior to being submitted for consideration by any commercial publication.

Please acknowledge your receipt of this message by responding via e-mail. If you have any questions, please contact me at ext. nnnnn.

Cxxxx Bxxxxxxxx
Associate General Counsel

---

From: Bugh, George J
Sent: Tuesday, June 19, 2001 8:17 AM
To: Bxxxxxxx, Cxxxx
Subject: RE: Outside Business Interest Disclosure

I have read and understand your email.
George Bugh

---

From: Bugh, George J
Sent: Tuesday, June 19, 2001 5:23 PM
To: Bxxxxxxx, Cxxxx
Subject: RE: Outside Business Interest Disclosure

I think maybe I will forget about selling my ideas. The few physicists at COMPANY X and outside COMPANY X that I've talked to seem to think my 3 dimensional time idea is pretty bogus anyway. If I pursue any more ideas like that maybe I'll leave COMPANY X and go back to college anyway.

George Bugh

---

From: Hxxxxxx, Jxxxx C
Sent: Thursday, June 28, 2001 2:49 PM
To: Bugh, George J
Subject: Outside Business Interest

Your notification of a potential outside business interest conflict has been reviewed. It has been determined that there is no conflict with this position at this time.

Thank you for bringing this matter to our attention. Please let us know if any changes occur in this outside interest.

/s/
Gxxxx Jxxxx
Sr. Manager, Staffing

Jxxxx C. Hxxxxxx
Company x, Staffing
Dept. xxx-x; Mail Zone nnnn
nnn-nnn-nnnn (phone) nnn-nnn-nnnn (fax)
jxxxx.c.hxxxxxx@companyx.com

---

From: Bugh, George J
Sent: Friday, June 29, 2001 8:10 AM
To: Bxxxxxxx, Cxxxx
Subject: RE: Outside Business Interest Disclosure

I was going to drop the whole idea but I see today that Staffing approved my outside business. Still, as I understand it, I need to give you a copy of the CD files that I want to publish. How long will it take to let me know if I can publish them or not? I need to know as soon as possible as it affects my advertising and it affects my planning with publishers.

thanks, George

---

From: Bxxxxxxx, Cxxxx
Sent: Friday, June 29, 2001 12:32 PM
To: Bugh, George J
Subject: RE: Outside Business Interest Disclosure

George,

As I understand the process, if there is something you want to publish you need to submit it to Communications and Legal. In Legal, the point of contact is Jxxx Mxxxxxx. I believe there is a specific form or document to use. You may want to contact Kxxxx Hxxxx in Communications and ask her if she has the form.

How long does it take? I really don't know, since I'm not in the process.

Cxxxx

---

(I talked to Jxx Sxxxx on the phone about this before getting the next email below:)

---

From: Sxxxx, Jxx W
Sent: Monday, July 02, 2001 8:34 AM

To: Bugh, George J
Subject: Science papers

George,

I see no problem with you selling your papers as long as they do not pertain to work performed at Company x, and as long as you don't use our company name for marketing purposes.

Jxx Sxxxx
Communications

---

From: Bugh, George J
Sent: Monday, July 02, 2001 8:49 AM
To: Mxxxxxx, Jxxx F
Subject: FW: Outside Business Interest

Jxxx,

I want to sell science papers I've written over the last 5 years on my own time.

These have to do with things like,
The Nature of Time
Magnetism and Special Relativity
Understanding Spin Wave Processes
The internal structure of the electron
Electromagnetic Particle interactions.
Gravity
Solid State Motor Generator Rotors
Spin wave lasers

This has nothing to do with my work. It is something I have done on my own time. I have permission from Staffing (see below) and Communications (see below) to try and sell my files like in ads in the classifieds section of Popular Science magazine and that type of thing.

As I understand it, I need to tell you because I am supposed to inform COMPANY X of concepts I come up with while I'm employed at COMPANY X in case COMPANY X wants to do something with them. Is it ok with your dept for me to proceed with selling my science ideas?

George Bugh

---

FROM COMPANY X COMMUNICATIONS:

George,

I see no problem with you selling your papers as long as they do not pertain to work performed at Company x, and as long as you don't use our company name for marketing purposes.

Jxx Sxxxx
Communications

---

FROM COMPANY X STAFFING

"From: Hxxxxxx, Jxxxx C
Sent: Thursday, June 28, 2001 2:49 PM
To: Bugh, George J
Subject: Outside Business Interest

Your notification of a potential outside business interest conflict has been reviewed. It has been determined that there is no conflict with this position at this time.

Thank you for bringing this matter to our attention. Please let us know if any changes occur in this outside interest.

/s/
Gxxxx Jxxxx
Sr. Manager, Staffing

Jxxxx C. Hxxxxxx
Company x, Staffing
Dept. Xxx-x; Mail Zone nnnn
nnn-nnn-nnnn (phone) nnn-nnn-nnnn (fax)
jxxxx.c.hxxxxxx@companyx.com"

---

From: Mxxxxxx, Jxxx F
Sent: Monday, July 02, 2001 9:11 AM

To: Bugh, George J
Subject: RE: Outside Business Interest

Please give me a call at your convenience to discuss.

nnnnnn

---

(After calling Jxxx Mxxxxxx and talking on the phone, I gave him a CD-ROM of my science files and my Spin Wave Technology Introduction Video file. Several weeks later after reviewing the files he wrote me the email that follows.)

---

From: Mxxxxxx, Jxxx F
Sent: Tuesday, July 31, 2001 12:42 PM
To: Bugh, George J
Subject: RE: Outside Business Interest

I see no conflict of interest or copyright issues involved in the publication of these papers. Good luck.

Jxxx F. Mxxxxxx
Associate General Counsel for Intellectual Property
Company X- Xxxx Xxxxx
nnn-nnn-nnnn

---

After getting all necessary permissions from my employer, I gave copies of these emails to special agent Sxxx Hxxx of Defense Security Services (part of the Department of Defense). Special agent Sxxx Hxxx stated that if my employer doesn't have any problem with me selling my science ideas then the Defense Department doesn't either. This subject was discussed with special agent Sxxx Hxxx and copies of these emails given to him in the course of routine security clearance updates required as part of my work for an aerospace company on tasks totally unrelated to my science papers.

**The following 4 chapters are provided as a preview of work in progress on future publications.**

# 41

# Basics Of Maglev Transporation

The purpose of this chapter is to describe the basics of MagLev (Magnetic Levitation) transportation systems and then to go on to describe how spin wave technology can be utilized to improve the design of the magnetic systems used for levitation and propulsion in these systems. The primary advantage of spin wave technology over conventional electromagnetic systems is that the Maglev rails or Maglev guide ways can be dispensed with and the transportation compartment can be made to push against spin waves present in any type of ground material. This claim sounds extraordinary but in this chapter it will be explained in simple terms how it is possible.

There are 2 main processes taking place in MagLev systems, levitation and propulsion. Electromagnetic systems are used for both functions. Usually, each electromagnetic system works independently of the other but some systems combine the electromagnetic designs into one system that both lifts and propels. Both the levitation and the propulsion functions are based on utilizing the push of opposing magnetic fields or the pull of attracting magnetic fields.

Here are some links to give you the basics of the EM (electromagnetic) theory involved.

Click on the little diagrams at this link:

- http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/magfie.html#c1
- http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/faracon.html#c1
- http://www.phys.uconn.edu/~wells/152/lec20.pdf

At the following link just skip down to Chapter 31 if you want:

- http://maxwell.byu.edu/~spencerr/websumm122/web.html

If your browser has Java enabled then try these links:

- http://www.micro.magnet.fsu.edu/electromag/java/magneticlines2/
- http://www.micro.magnet.fsu.edu/electromag/java/faraday2/
- http://www.micro.magnet.fsu.edu/electromag/java/lenzlaw/
- http://www.micro.magnet.fsu.edu/electromag/java/pulsedmagnet/

MagLev systems usually use either LIM (Linear Induction Motor) or (MSM (Linear Synchronous Motor) propulsion so here are some sites about these motors:

- http://unofficial.capital.edu/admin-staff/dalthoff/lim.html
- http://www.theproductfinder.com/motors/elemot.htm
- http://www.nctransportation.com/LinearMotor.html
- http://www.prod.sandia.gov/cgi-bin/techlib/access-control.pl/1995/951268.pdf
- http://www.baldor.com/pdf/brochures/br1800/Section6.pdf
- http://www.calinear.com/
- http://www.lem.ee.ethz.ch/RESEARCH/PDF/maglev2000.pdf
- http://www.xrefer.com/xrefs.jsp?xrefid=508565
- http://www.ecn.purdue.edu/ESAC/Example_Simulations/example.whtml

Here are some links to give you an overview of various MagLev systems:

- http://www.skytran.net/press/sciam01.htm
- http://www.maglev2000.com/works/W_fs_SCM.htm
- http://www.phy.uct.ac.za/courses/phy209s/projects/EDWDAV004/edwdav004.htm
- http://www.rtri.or.jp/rd/maglev/html/english/maglev_frame_E.html
- http://www.llnl.gov/str/Post.html
- http://www.pa.msu.edu/people/roberson/Inductrack/post.pdf_1.pdf
- http://www.pa.msu.edu/people/roberson/Inductrack/ieee1099.pdf
- http://www.pa.msu.edu/people/roberson/Inductrack/Inductrack_files/frame.htm

Now that you have an idea of what MagLev levitation and propulsion is all about, we will explain how spin wave technology can be utilized to design an improved MagLev system. Some basic design changes are made to utilize the characteristics of spin waves. Later MagLev design examples are given that will seem impractical using conventional magnetic levitation equipment but this is just to give preliminary insight into how it can be done using spin waves.

# 42

# Propagation Velocity in MagLev Systems

To describe how to use spin waves for a MagLev system, comparisons are made to a MagLev system using LSMs (Linear Synchronous Motors) or LIMs (Linear Induction Motors). The forward speed of the bogie (train compartment) of a MagLev system that uses LSMs is determined by the propagation velocity of the electromagnetic fields of the guide rail coils that push against the magnets of the bogie. The frequency and wavelength of the electromagnetic fields that do the pushing have to be considered.

The velocity of an electromagnetic wave in free space is referred to as “c”.

This velocity is constant and is approximately $c = 3*10^8$ meters/second. This velocity is established by the coefficient of inductive permeability and coefficient of capacitive permittivity of space itself.

*Diagram of an Electromagnetic Wave in Free Space*

The velocity of an electromagnetic wave moving along a single wire is about 95% of the velocity in free space. This is due to the inductance down the length of the wire and the capacitive coupling of the surface of the wire to free space. Keep in mind that even though electromagnetic signals move along the wire at almost the velocity of light, the current of electrons within the wire will have an average drift in one direction or the other at a much lower velocity in reaction to the

changing electromagnetic signals on the wire. This is called drift current.

*Diagram of an Electromagnetic Wave in a Wire*

The velocity of an electromagnetic wave in a coaxial cable is slower still than an electromagnetic wave along a single wire. It is typically around 65-75% the velocity in free space. This is due to the inductive and capacitive coupling to the coaxial shield. It takes more time as a signal moves along the wire to charge up the capacitance between the wire and the shield. There is also self inductance of the center conductor and finally a mutual inductance with the shield such that a changing magnetic field from the signal moving along the wire induces current in the opposite direction in the shield, which in turn generates its own magnetic field which induces a CEMF (counter electromotive force) opposing and thus slowing the propagation of the signal along the wire.

*Diagram of an Electromagnetic Wave in a Coax Cable*

The propagation velocity of an electromagnetic wave through a series of large coils and large capacitors is slower still. This is due to the much greater time it takes to charge up the capacitors and to overcome the greater self-inductance of the coils.

*Diagram of an Electromagnetic Wave in a Series of Coils and Capacitors*

For MagLev propulsion systems, the propagation of the signal energizing the succession of coils can be slowed down even more by simply switching on each coil in succession at the rate desired.

*Diagram of an Electromagnetic Wave of a Series Switched Coils*

In each of the above examples the propagation velocity gets slower and slower and the physical wavelength of the electromagnetic wave gets shorter and shorter compared to the wavelength of the same frequency electromagnetic wave in free space.

The system of electromagnetic coils and capacitors has the effect of compressing the wavelength and slowing the propagation of the signal. If the coil excitation frequency is 10 Hz (10 Hertz = 10 cycles per second) for example, this equates to an electromagnetic wavelength in free space of:

(1 divided by (10 cycles per second)) x ($3x10^8$ meters per second) = $3x10^7$ meters

This wave travels through space at a velocity of $3x10^8$ meters per second.

*Diagram Comparing Wavelength in Free Space to Wavelength in Series of Coils and Capacitors:*

If a MagLev system used a succession of coils and capacitors along the MagLev guide rails then it is the propagation velocity of the electromagnetic coil excitation signal determines the velocity of the bogie. In a MagLev system using LSMs the bogie will move exactly at the propagation velocity. In a MagLev system using LIMs the bogie will have a certain amount of slip and will travel at a somewhat slower rate than the propagation velocity of the electromagnetic coil excitation signal that pushes and pulls on the magnetic fields of the bogie.

It is necessary to be able to adjust the propagation velocity in order to control the bogie velocity and this can be done in various ways. Adjusting the capacitance between the coils can change the propagation velocity but this alone is not very practical. One way to solve this problem is to have a switched system in which the guide way coils can be switched on and off in a faster or slower succession.

Another solution is to have a succession of excitation coils driven by a succession of multiple phases of the same AC coil excitation signal. This then becomes the same as a multi-pole rotary motor coil that has been laid out flat. The multiple phases of a higher frequency coil excitation signal will drive the excitation coils at a faster succession rate. The propagation velocity of the coil excitation signal then becomes dependant of the frequency of the excitation signal. This allows the bogie to be easily accelerated by just increasing the frequency of the coil excitation signal. There will likely still be various values of capacitors switched in along the succession of coils to maintain an optimum power correction factor for various ranges of coil excitation frequencies. Also, only those excitation coils will be driven that are

where the bogie is at any particular time rather than all the excitation coils along the whole length of the guide rails.

Now let's get back to analyzing the whole thing in terms of how it can be implemented using spin waves to propel the bogie. For bogies driven by LSMs, the wavelength of the coil excitation signal will match the pitch (spacing between North-South-North-South poles) of the bogie magnets. The bogie magnets have static magnetic fields that push and pull against the magnetic fields of the drive coils along the guide rails.

*Diagram of magnetic fields of bogie and guide rail coils:*

The North-South-North-South fields of the drive coils can be thought of like teeth on a timing belt. It's the propagation velocity of the belt that matters and the pitch of the teeth will match the pitch of the bogie magnets. Since the magnetic fields of the bogie magnets are static they can be said to have a propagation velocity along the bogie of zero. A more generalized equation for the bogie velocity would be as follows:

v1 = Propagation Velocity of Guide Rail Drive Coils' Magnetic Fields

v2 = Propagation Velocity of Bogie Magnetic Fields

vb = Bogie Velocity

$vb = v2 - v1$

This means that if the bogie's magnetic fields propagation velocity is zero then:

$vb = v1$

Also, if there are magnetic fields on the bogie moving at the same rate and direction as the magnetic fields of the guide rail drive coils then:

$v1 = v2$

$vb = v1 - v2 = 0$ so the bogie will not move. This is like walking at the same speed but in the wrong direction on an escalator or an airport moving walkway.

*Animated diagram of bogie not moving but with moving magnetic fields and guide rail coils magnetic fields:*

If the propagation velocity of the bogie's magnetic fields is in the opposite direction then the bogie velocity will be:

$v2 = - v1$

$vb = v1 – (-v1) = 2 * v1$

*Animated diagram of bogie moving and with moving magnetic fields and guide rail coils magnetic fields:*

Now consider a system where there are standing waves on the drive coils such that the drive magnetic fields are toggling in North-South orientation but that have a propagation velocity of zero.

*Animated diagram of guide rail drive coils' signal and toggling drive coil magnetic fields:*

It is also possible for there to be standing waves on the bogie magnetic field coils making bogie magnetic fields that are toggling in North-South orientation but that have a propagation velocity of zero.

*Animated diagram of bogie magnetic field coils' signal and toggling bogie magnetic fields:*

If both the bogie and the guide rail coils have standing waves then there is a way to propel the bogie. The phase of the standing waves of the bogie relative to the standing waves of the guide way drive coils adjusted so that the 2 sets of magnetic fields push against each other in one direction or the other depending on the direction and amount of phase shift. However, once the phase shift causes the bogie to be pushed to a new position, the phases will be back in alignment. To maintain a phase shift, the bogie's standing waves must not be perfect standing waves but will need to have a small propagation velocity in addition to being standing waves. Then the bogie's velocity will equal the propagation velocity of its partially standing waves/partially traveling waves.

*Animated diagram of toggling bogie magnetic fields pushing against toggling guide rail coil magnetic fields*

# 43

# Levitating with Spin Waves

If you have studied the various web links about Faraday's Law, Lenz's Law and the web links about various MagLev systems then you should already understand the theory of MagLev levitation. So now modifications to these basic designs will be described to explain how it would be done with spin waves. Repelling and/or attracting forces of the guideway magnetic fields with the bogie magnetic fields will push or pull a bogie up causing it to levitate.

There will be alternating magnetic field orientations along the guideway and alternating magnetic field orientations of the bogie's magnetic fields. The phase of the bogie's alternating magnetic fields can be adjusted to control the amount of repulsive and attractive forces with the magnetic fields of the guideway. Previously, the amount of forward or reverse propulsion force on the bogie was described as caused by adjusting the phase of the alternating magnetic fields. This is still true. Now there will be another type of phase adjustment that can be made to control the degree of levitation. To understand the difference it is necessary to describe better how the magnetic fields of a guideway and of a bogie are created using spin waves.

The magnetic fields of spin waves are caused not by current flow of electrons but by the changing spin axis orientations of electrons. A magnetic field can be created by the flow of electrons through a coil of wire as has already been described.

*Diagram of coil of wire and its magnetic field:*

A magnetic field can also be created from many electron spin axis orientations all pointing in a similar direction. Each individual electron will already have its own little magnetic field associated with its own particle spin characteristics.

*Diagram of electron spin its magnetic field:*

When all the spin axis orientations point in a similar direction then it makes a large macroscopic magnetic field.

*Diagram of many electron spins and their magnetic field:*

The electron's spin axis also has a tendency to precess like a gyroscope.

*Animated diagram of an electron spin precessing and its magnetic field:*

Many electron spin axis all precessing together at microwave frequencies will send out microwave frequency electromagnetic waves.

*Animated diagram of many electron spins precessing and their magnetic field:*

For our application we want all the electrons to precess together but we don't want to make large microwave frequency electromagnetic waves. There is a way to prevent this. For every electron that precesses clockwise we will have an electron that precesses counter-clockwise. The combined electromagnetic waves from these motions will cancel each other except for waves of changing magnetic field orientation.

*Animated diagram of 2 electrons spins precessing opposite directions:*

Both North Poles point the same way and then both South Poles point that same way. Now we need many electron pairs doing the same thing. It is not important that their precession axis all be pointing similar directions but they do need to all lay in the same plane and precess in phase at the same rate such that all the North Poles point a particular direction and then all the South Poles point that same direction.

*Animated diagram of many electron pairs precessing opposite directions with various precession axis orientations but all in the same plane:*

Now we have a magnetic field that alternates North-South-North-South but it does not send out microwave frequency electromagnetic waves. These magnetic field waves can pull on similar magnetic waves from the guideway that are alternating in phase.

*Animated diagram in phase magnetic waves and attractive forces:*

Similarly, they can push against alternating magnetic fields from the guideway that are of opposite phase.

*Animated diagram of opposite phase magnetic waves and repulsive forces:*

The phase changes associated with the attractive or repulsive bogie levitating forces are demonstrated below using just a pair of electrons of the guideway and 1 pair of electrons of the bogie.

*Animated diagram of both pairs precessing in opposite directions and sending out magnetic waves that are in-phase.*

*Animated diagram of both pairs precessing in opposite directions and sending out magnetic waves that are 45 degrees out of phase.*

*Animated diagram of both pairs precessing in opposite directions and sending out magnetic waves that are 90 degrees out of phase.*

*Animated diagram of both pairs precessing in opposite directions and sending out magnetic waves that are 135 degrees out of phase.*

*Animated diagram of both pairs precessing in opposite directions and sending out magnetic waves that are 180 degrees out of phase.*

However, the magnetic forces between the 2 are only ever attractive or repulsive if the magnetic fields diverge as opposed to being completely homogeneous.

Before this line of explaining things continues it may be necessary to first explaining more about naturally occurring alternating magnetic waves within materials and to explain about diverging magnetic fields from large bodies of material that are experiencing this phenomena. Please read the next chapter, Diverging Alternating Magnetic Fields (*Chapter 44*).

# 44

# Diverging Alternating Magnetic Fields

If a small magnetized sample of material is in a large magnetic field and it has become oriented such that its magnetic field is oriented with the large magnetic field then it is not the strength of the large magnetic field alone that determines how strongly the small magnetic sample is attracted. Rather, it is the amount of divergence of the large magnetic field that determines how strongly the small sample is attracted towards the diverging magnetic fields.

*Diagram of sample in non-diverging magnetic field:*

*Diagram of sample in diverging magnetic field:*

This same phenomena is true when the strong magnetic field is an alternating magnetic field. So if a small sample of material is radiating magnetic waves that are in-phase with the magnetic waves of the diverging magnetic field then both the strength and the amount of divergence affect how strongly the sample is attracted.

It is the natural tendency of paired electrons in orbitals around all atoms to precess clockwise and counter-clockwise and to develop in-phase magnetic waves among all of them. With a large body of atoms like the Earth, all these in-phase magnetic waves add in strength.

However, this is not the only natural source of magnetic waves. There are also extremely high frequency precessional motions of quarks within protons and neutrons of all atoms. These motions generate their own frequency of magnetic waves. These also have a natural tendency to move to a state of all these magnetic fields alternating in phase. The typical transverse electric field components normally induced are cancelled due to the nature of the compensating precessional motions for sets of quarks and for pairs of electrons. The total attractive force of the alternating magnetic fields of various frequencies that remain from all particle precessional motions within the Earth is equal to an accelerating force of exactly 1G at sea level. In other words, gravitational force can be explained as caused by the attraction among all matter as a consequence of in-phase magnetic waves.

At any given distance out from the center of the Earth there will not be perfect phase alignment among the magnetic waves that are all at that exact distance from the center. Instead there will be spin waves and spin temperature fluctuations of the otherwise perfect phase alignment of these magnetic waves.

These magnetic waves are not the same as the following that you may find if surfing the internet for “magnetic waves”:

- http://www.space.com/news/solarwind.html
- http://helios.gsfc.nasa.gov/solarmag.html
- http://www-solar.mcs.st-andrews.ac.uk/~robert/statement.html
- http://science.nasa.gov/newhome/headlines/ast08jul99_2.htm
- http://www.gsfc.nasa.gov/gsfc/spacesci/swind/swind.htm
- http://www.planetary.org/news/articlearchive/headlines/1999/headln-071399.html
- http://history.nasa.gov/presrep99/pages/smithso.html
- http://science.nasa.gov/newhome/headlines/ast02sep99_1.htm

The difference is that the magnetic waves described in the NASA and other articles are waves of changing magnetic field intensity and orientation over periods of perhaps 300 seconds or more whereas the magnetic waves described in this paper are oriented along the same direction that the magnetic waves travel, completely toggle in direction of orientation and toggle at extremely high frequencies. The magnetic waves described in this paper are radiating outward in all directions

from gravitational centers as opposed to directions somewhat related to the orientation of magnetic Poles of a large body like the sun.

The magnetic waves described in this paper are present between all matter all the time. The waves have associated with them a slight natural attractive force towards any centers of divergence. As more mass accumulates at these centers this naturally causes the divergence to increase. These diverging alternating magnetic waves have the attributes we associate with gravity.

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