Understanding Magnets with EFD and the Superparamagnetic Lens

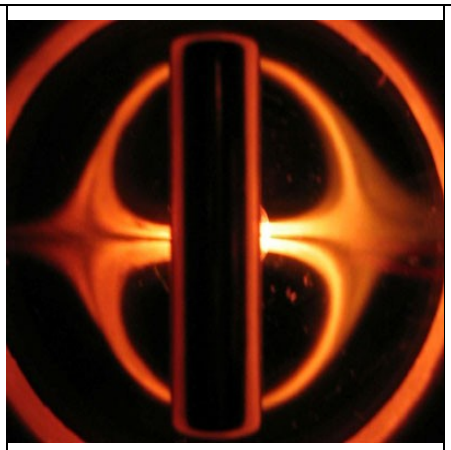
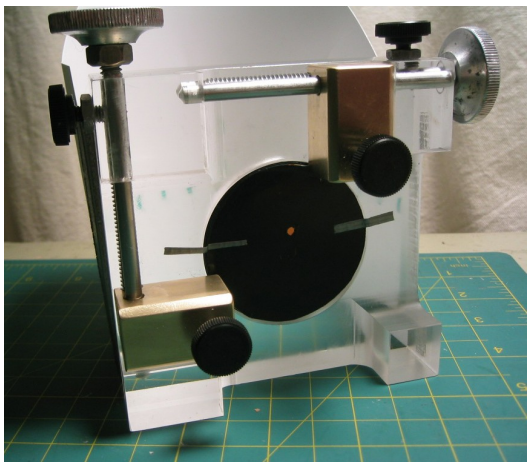
Introduction

What you are reading is a presentation about “how magnets work” - using key concepts from a technique called EFD plus images formed by the Superparamagnetic Lens, as shown on Timm's www.magnetostatics.com.

What's EFD - what's a Superparamagnetic Lens - come to that - what's a magnet, how does it work?

This is going to take some time. But first, the Superparamagnetic or SPM Lens. These show vibrant, glowing fields, quite different in style and position to “Lines of Force” shown by iron filings.

In general the arcs run at right-angles to lines of force. What are these glowing arcs? And what exactly are lines of force? Magnetics is full of oddness - we have to sort these out to get some sense.

SPM Images. The rods are magnets and the lens is lit from below.			
The SPM lens. An individual lens in a collar; a lens in a jig for an experimental test run			

To explain I will use a modelling method called “EFD”. Devised to teach how magnets work, EFD is completely graphical and already implied such images so could suggest what the lens shows.

What is an SPM Lens?

A Superparamagnetic Lens consists of a sealed pair of glass sheets filled with an oil suspension of autonomous (non-clumping) metallic nano-particles.

What does an SPM Lens Show?

The lens shows a holographic style image controlled by the magnetic field plus line of sight. The glowing arcs seen are views of same-potential magnetic regions.

When seen square-on, the arcs suggest magnetic "lowest Potential Energy" scalar A regions.

So, what does all that mean?

That's where EFD comes in. EFD was devised as a pictorial way to teach magnetism (part of physics called electrodynamics) to school kids. Best of all, EFD diagrams need little or no math.

The "Electrostatic Frame Drag" model is a mix of old and new; a version of the "ether vortex" model used by James Clerk Maxwell, the guy who built the math for the subject around 1860.

About the ether. An old idea, ether (traditionally written "aether") is supposedly an invisible, all-pervading sea filling space - rather, space *is* the ether. The Universe is ether, as is all in it.

The ether to us is "like water is to fish" – invisible, intangible, not really solid. Always there with invisible properties like wind and tides - or, as we non-fish people called them - forces of gravity and electro-magnetism. Ether particles (whatever they may be) are so small as to pass through us.

Note that the ether is a concept used to help understanding; it is not thought real - sometimes space just behaves very like a sea.

Most of electro-magnetics "was understood" by most in the late 1800s, as they used simple ideas to show what was happening. Space was a sea and various things happened in that sea. This was dropped in favour of Einsteinian approaches and is now disregarded. But it still makes sense.

Maxwell wrote his math thinking about literal vortexes, real "mini tornadoes" of space. EFD is just a different way of presenting Maxwell's work, again imagining vortexes in space.

After Maxwell the ether concept slowly faded - finally dropped as it was not needed, not because it could not be made work. *At this time, ether is on an upswing in other forms e.g. Higgs field.*

Notes

1. Like every model, EFD is a **simplified representation of reality**. It illustrates.

2. In EFD "spin" means "mechanically rotates".

3. *Warning! The ether is not the accepted ("Standard Model") way of thinking about physics; it is a historic approach. Not for use at school - unless you write of history.*

Magnetism (part of electrodynamics) is one force known to physics. In ether terms, forces form when space is distorted away from a regular "flat" form - causing "pressure of space" imbalances.

Examples:

* charge is the density of space i.e. local aggregations (clumps) of space, either an excess (positive) or lack (negative). Positive clumps “drive up” spacial pressure, negatives reduce.

* electricity is a flow of space between charge (usually as electrons) to “even out pressure”

* magnetism is the swirl (curl, spin or torque) of space, and

* gravity is a weak combination: flow plus compression as space falls into mass.
Note: gravity is derived elsewhere and shows that we are held to the Earth like leaves to a water intake, held down by space flowing through us into the planet.

So, how difficult is this to use? Imagine a moving electron - and its wake. The wake curls space either side, making a magnetic field! Stop the electron, the wake disappears - no magnetism. Easy!

We do not have time to “do everything” (I am always just about to start a book on modern ether ideas) but be assured that every major area is covered. Anyhow - to magnetism and swirls of space.

Here is EFD. We start with the electron (which acts like a tiny rod magnet) and look at:

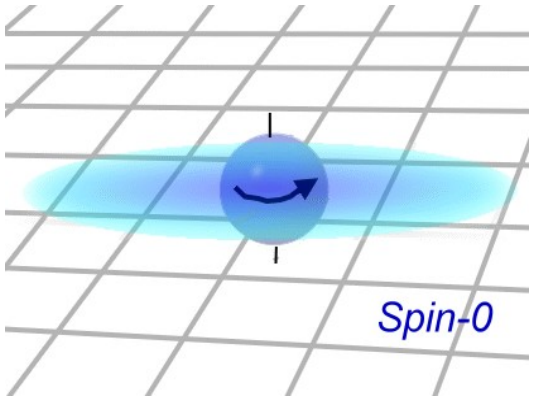
a) the spin field about the electron,
b) the drag field about the electron,
c) the forces / potentials present about the electron, and
d) how attraction and repulsion work.

We go on to apply these to a real magnet, then explain what the Superparamagnetic Lens shows.

A) The spin field about the electron

Each electron is a region of negative charge (electricity) spinning on an axis, and may be thought of as a sphere (that's a really big simplification but will have to do for now). The electron embodies no known parts (perhaps they hold a void) yet continually spin with fixed speed.

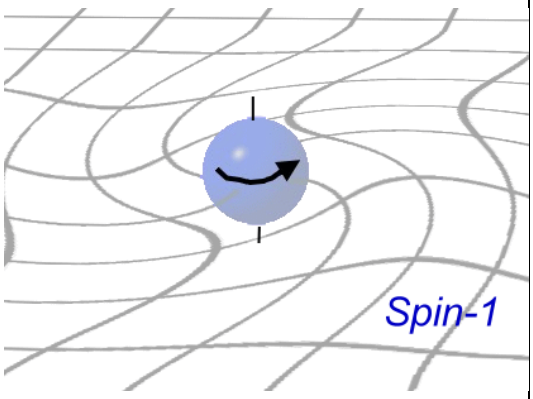
But what spins? Today's science says “the properties of space”. Some say “an ether”. Here is a graphic of a spinning electron; I'll call this picture “Spin-0”. This is a ***traditional view***.

Spin-0 An electron simplified to a spinning ball of negative charge (blue) on a grid. Outer edges move slowly; central, darker regions move fast. The grey lines show space as a grid, just 1 of many flat planes. This one is through the equator of the electron. 3D cubes should really be drawn (but that would make the diagram confusing)		

B) The drag field about the electron

We now use an ether view of what happens to space (M-Theory might call this a "charge brane experiencing drag") - all caused by the electron's spin. This is Spin-1, showing the way the electron drags space. The important thing here is that we drop the idea of "spinning electric charge" floating in space – and instead say that ***space itself*** is dragged in the direction of rotation.

* The "frame drag" effect is long known in other situations.

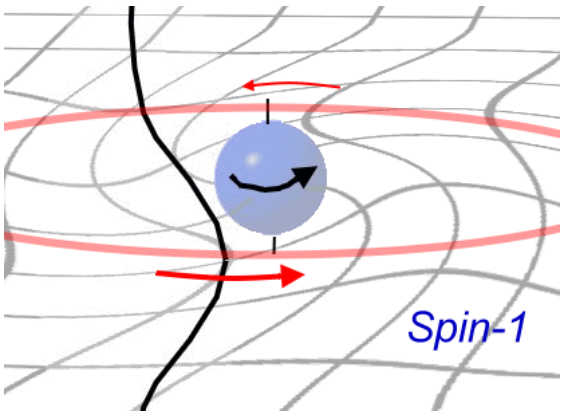
Spin-1 Showing an electron "twisting space". Regions far from the electron are twisted less; regions close to the electron are twisted more. The twist spreads out "forever" getting weaker and weaker – eventually becoming lost in the background noise of other spins, distortions, wakes of moving particles, photons etc.		

This distortion of space needs continuous work (energy burn). This was initially loaded (torqued) into space when the electron "spun up" and is now "bound" there by the spin. It is similar to a "hill" or an "offset", giving rotated displacements from where that part of space would have been - if the electron didn't spin. *Note - if the spin stops, so does the drag. Frame drag is a dynamic effect.*

Electrons (and most particles) spin forever, as far as we know. Seemingly this makes spinning "impossible" for they exhibit perpetual motion (just like planets and gravity). But there is a power source - the pressure difference between the particle interior and exterior space.

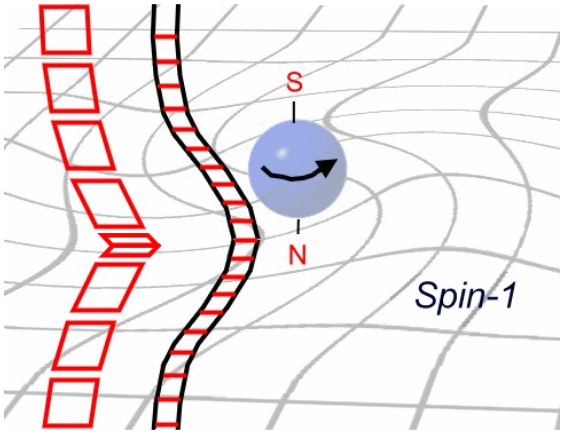
Electrons are usually bound to protons in some arrangement. The spin of each is exactly equal and normally cancel each other out. If somehow not everything is cancelled, you get ... magnets!

(This is a slight simplification - magnets employ "spin of orbit" caused by the electron's movement about the nucleus - but the principle of operation is the same.)

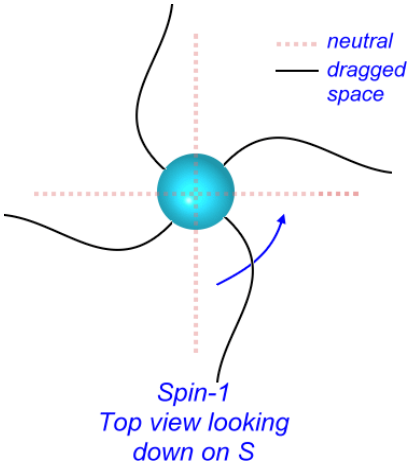
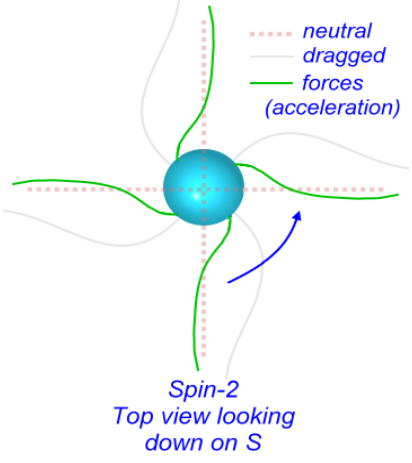
Spin-1-B Showing the equatorial drag on space plus the drag in a vertical direction. Drag peaks at the equator, dropping away to zero above and below (line in black).		

Both above and below the electron space gains a sideways torque (shown in red in the next diagram) – and we begin to see a difference between "North" and "South". Cubes of vertical space show torque slanting different ways, coming to a peak of twist at the equator.

In EFD spins are usually shown turning like Earth so go anti-clockwise for a magnetic S at the top. *Note - Earth has magnetic S at the geographic North, that's why compass "N" points that way.*

Spin-1-C Notional cubes / squares showing the way space is dragged above and below the electron. The distortions in red have peak sideways drag at the equator, all around the electron. The near-edge position of a flat equatorial disk is shown. The distortion follows about the disc. Inside the central double-red arrow, the N – S drag sense flips. North and South drag space "in opposite directions".		

C) The forces present about the electron

Top-A Looking down on Spin-1 // drag surrounds the electron - only 4 drag lines shown.			Top-B Drawing in acceleration (= slope of Spin-1 arms)

The top-down views below show Spin-2 in green, fields of potential acceleration. "Potential" means they "do nothing" - until something enters the field. This is very like a planet's gravity field.

Top-A shows the Spin-1 view and Top-B the differential (the slope) of Spin-1 looking down on S. To simplify, only 4 "drag arms" are drawn. NB: dragged space fully surrounds the electron.

Top-B shows in green the potential accelerations; there is a positive region near the electron, a zero-crossing then a long negative region. Again, these "do nothing" unless something enters them.

Spin-1 and Spin-2 together represent regions of "Potential Energy" (PE) latent in space about the electron. Displacement (Spin-1) and potential acceleration (Spin-2) together represent an energy well or hill, plus directionality (the sign of acceleration).

The fact that the sign reverses (the green arms of Top-B go from positive to negative) means that the acceleration zones "push" in opposing directions. The zero-crossing point marks where "curves like S" become "curves like N", going further out from the electron. The frame or view of the electron is - immediately outside space spins like itself, then a wall of zero, then space of other-ways-spin.

At the zero-crossing point *acceleration is zero* - this thin region has no forces. When iron filings are scattered about a magnet Spin-2 accelerations generate forces which pull filings to inner and outer zones – yet the zero region is often clear, an "empty part". Anything in here is going to want to fall either side, in or out – it's difficult to stay put.

http://son.nasa.gov/tass/content/electricity.htm (see the blue picture mid-page) --(pic 1)
http://demoroom.physics.ncsu.edu/orders/demos/128.html --(pic 2)

Apparently it is possible to place thin mild steel in the zero slope zone, to block the outer negative slope Spin-2 field (see "Wesley Gary" on the web; his "neutral line" = zero slope zone). Space at the zero crossing / zero slope zone (the peak of a Spin-1 arm) is not "cubic", rather is slightly convex – cubes here are slightly pushed-in in the middle.

Modern electrodynamics expresses all this in math; the Spin-1 arrangement is called the Scaler A field and the Spin-2 the B field. Many engineers have bemoaned the inability to extract anything from the A field, where absolute field intensity is very high. But the B field holds the forces!

Also, the shape of the arms in Spin-1 has not been explained. These shapes arise by deliberately limiting differences in distortion between adjoining "ether cubes" to some low number - and adding some simple geometry rules (junctions cross at right-angles). The result is a drawing style called "curvilinear" (a technique dating from the early 1800s).

If we did not do that - and just used arbitrary straight lines - we imply that space can be nipped or sharply distorted – with no leakage of distortion into adjoining space. This does not happen; ether space always works to "even things out". Pressure waves (typically photons) radiate out from differences, smoothing out the situation. These are transitory.

These diagrams originate from analysis of spinning / dragged charge-branes, which essentially duplicate the vortex ideas of Maxwell c. 1857 in a modern manner.

D) How Attraction and Repulsion work

Attraction and repulsion are about "pressure of space" - a form of Potential Energy.

In EFD, neutral "relaxed" or cubic (lowest Potential Energy) space has NO distortion.

Least-distorted space has lowest pressure.

Distorting geometry raises "internally bound pressure". This makes a force-vector pointing towards less-distorted (lower pressure) space.

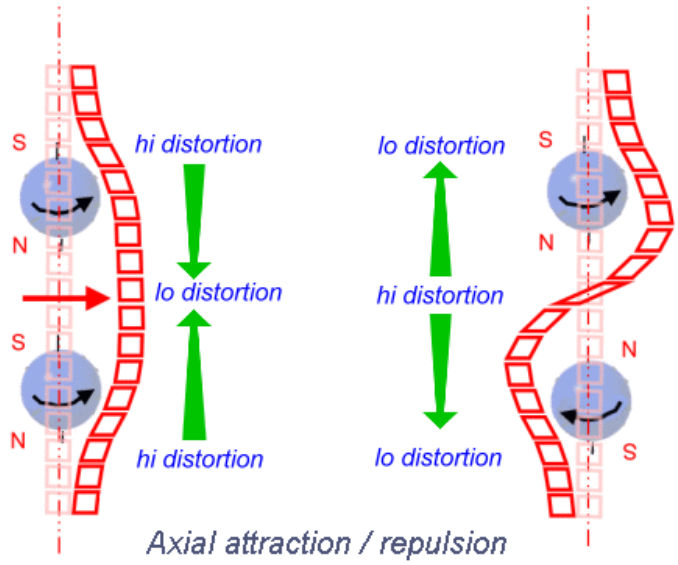
Result- adding distortion lifts spacial pressure, which tries to push into lo distortion space.

If we vertically stack co-spinning electrons, the region between the electrons "spins together",

sharing the same twist. In this region there is less torque (just rotational displacement) – hence less stress per cube of space and lower Potential Energy. Result - less pressure in the middle.

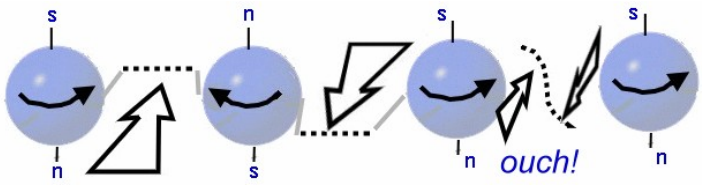
With lower central pressure, space above and below the electrons (still having high pressure) - push the two together. This is attraction. Almost perfect cubic space (sideways offset in the spin direction) will form between the magnets, holding them in place.

Now flip the lower electron so it rotates against the top. When brought close the middle space now gets extra-twisted. "Go to lowest PE" will want the electrons to move apart. Pushing the two electrons back together takes work. This work is bound into space by making it distort even more; this forms a central over-pressure and will push back - this is repulsion.

Attract-Repel-A (axial) Very faint red – "neutral" un-curved ether. Green - pressure More distorted: higher PE bound in space; attempts to push other squares away (=repulsion) ***Left*** Co-rotating (S-N S-N) electrons attract by forming zero PE central space ***Right*** Contra-rotating (S-N N-S) electrons repel as high sheer torques (=max distortion) form in central space		

NB introducing other magnetic material instantly modifies the situation.

This analysis works for side to side electrons too; this time (S-N N-S) side-spins attract.

Attract-Repel-B (side to side) S-N to N-S: drags agree => attract N-S to S-N: drags agree => attract S-N to S-N: DISagree => repel		

In summary, drags of space which go the same way "attract" by forming low PE ("more cubic") space. Drags which increase twist or distortion of cubic space repel. It is thought that space is incredibly stiff; the distortions shown here are likely very exaggerated.

Next up - What is a "magnetic pole"? How come there are always two, always married?

It has been long known that if you take a magnet and split it - anywhere - each end gets a pole. How can this be?

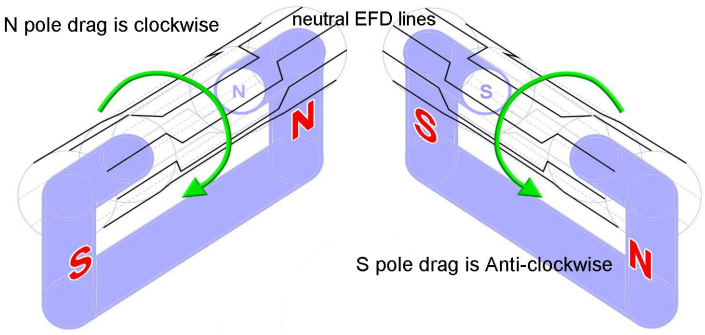
The simplest way is to draw this out:

<table>
<tr>
<td>The Mystery of Poles

N space seemingly goes clockwise, S anti-clockwise.

By changing observation position, the direction of rotation seems to swap. The “other” pole comes into view.

*All the time space goes one way.

This has caused much confusion!</td>
<td> 

<u>EFD drag viewed about poles of C magnet</u></td>
<td></td>
</tr>
</table>

Axial Threads (Lines of Force)

The poles have threads of fast-spun space reaching out to the nearest same-ways spinning pole. Perhaps another spinning body, or it might go around the electron to attach the other pole.

The generic term for such threads is “torsion string”. In magnetics these equate to “Lines of Force”.

** All spinning phenomena have such threads; twisters in air, rotations in water and rotating bodies in space have these too - and are bigger (lengthwise) then the spinning body:

http://www.lbl.gov/Science-Articles/Archive/sabl/2005/August/05-GRB-supernovae.html --(pic 3)

(note the second blue image - very similar to our electron)

** The threads have a much higher force per unit volume of space (i.e. force density) hence magnets seem much stronger at the poles.

EFD sees a Line of Force as a chain of space rotated along its length, gaining a spiral twist similar to spun cotton. EFD calls these “axial threads”; they are very mobile and hunt to find their lowest PE situation. They are extremely subject to attraction / repulsion. These likely rotate as fast as space allows (think about that and the effects likely to occur in the surrounding region).

Note that the thread from each pole inherits the pole's direction of spin and is “most torqued” at the pole. This applies to all spinning bodies - electrons, protons, neutrons, planets and stars.

Real Magnets

Real magnets contain vast numbers of “domains”, each a crystal of metal with atomic groups co-spinning axially, SN-SN attached. A strong magnet has many domains all spinning space the same way i.e. all point in the same direction.

Domains tend to repel “sideways” - this is not the way metals usually arrange themselves; normally most materials try to attain minimum PE, which gives no overall field. This sideways repulsion is seen when iron filings form “lines of force”. Filings stick tip to tip as axial threads transit them (SN-SN same spin axial attraction) but avoid each other sideways, leaving small gaps.

In general, magnets can be approximated as a “big electron” but with many axial threads at each pole end. These do slightly complicate matters, making “loops” around each pole.

In Summary

* a magnetic field is dragged / curled / spun space, the drag fading to zero “at infinity”

* magnetic forces are caused by distorted space (cubes dragged by slants and twists)
* attraction / repulsion are: reducing or increasing Potential Energy bound in distorted space
* there are no forces in perfect-cubic regions (zero slope zone and equatorial disc)

* side spin and torque “peaks” at the equator in a disc of “rotationally displaced” cubic space
* spinning axial threads of twisting space attach at S and N poles.

* N is “seen clockwise spinning space”, S anti-clockwise (see experiment to prove later)
* N and S cannot be separated, they are top / bottom views of a torqued region of space

* what is N and what is S is determined by the observers position - by moving, the observer sees space spun “the other way round” - however space has not changed, it still rolls the same way.

* EFD says monopoles are impossible, as N/S are two sides of a single disk. A monopole would have to “spin the same way” however the observer looked at it - a 2D disk cannot do this.

Why Should We Think that EFD is a Good Model?

Predictions match Observation. For example,

1. EFD predicts monopoles cannot exist in 3-space - and no-one has found a monopole (if they did, EFD would be in trouble).

2. The reason why an S pole is stronger in the Northern Hemisphere is explained by EFD:

a) Consider the magnetic field of the Earth. Space is dragged sideways (skewed) more strongly towards the equator, so in the North the skew (see the Spin-1-C diagram) slants more strongly at the bottom edge - and in the South of the Earth the top edge is more skewed.

Each is a trapezium, but they slope “other ways” to each other.

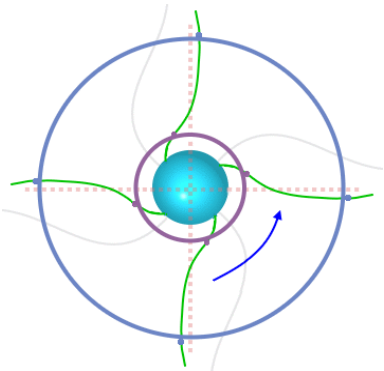
b) Consider a magnet. It is a mini-version of the Earth.

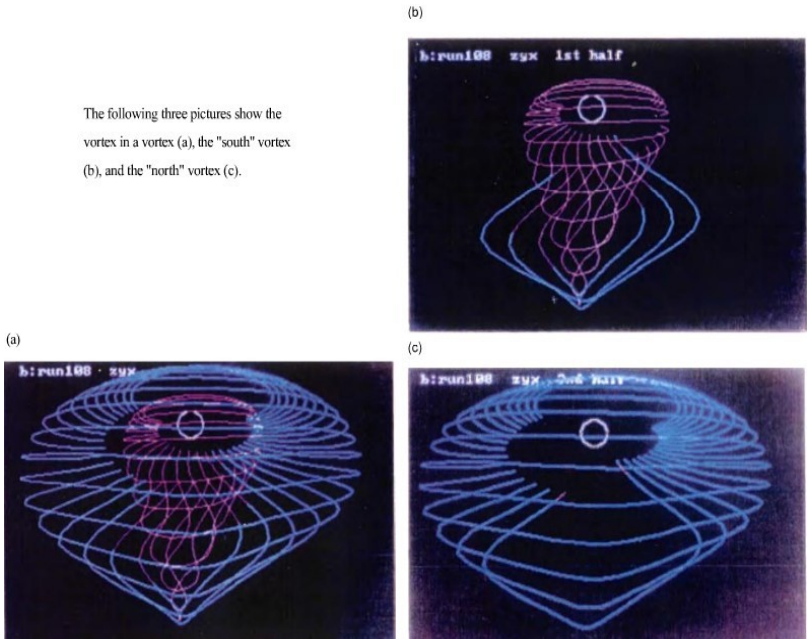
c) In the Northern Hemisphere, however you hold the magnet, the S pole will be helped by the Earth's Northern Hemisphere skew of space - and the magnet N pole hindered. Because the slope trapeziums are symmetrical, you can turn the magnet any way and this will hold true.

d) look at any photo of a magnet taken in the Northern Hemisphere (say pic 1 or similar). By checking closely, note that the effects about the S pole are bigger then the N pole has.

3. Direct mapping of magnetic fields, primarily by Howard Johnson's team in the 1970's.

The maps are of "same strength fields", as recorded in 3D by a Hall effect measuring device moved through a cubical grid of 3D space about a magnet. The sensor "flips" polarity for slope of field (e.g. says + for "sloping in to me" and - for "sloping away from me"). These are colourised and the plotting software joins up the same value regions, forming a helix when seen from the side.

Top-B / Spin 2 *diagram coloured to showing how 8 measured points may be plotted.* *Around the circles the same value is found; sign flips colour.* *(top-down view)*	 *Spin-2* *recolourised to match Johnson's spin plots*	

3D plot of the actual magnetic field about the (lower half?) of a magnet. *These show one pole only.* *Taken from:* *"The secret world of magnets"* *By* *Howard Johnson* *Cheniere Press*		
By permission of	Cheniere Press www.cheniere.org	
Mapping Team	Howard Johnson, Prof. Dr. Gerhard Beyer and Steve Davis of the Virginia Polytechnic Institute	

The result - two spirals, one of each colour. These can be complex - a simple plot has been chosen. We see the lower half of a bar magnet as 2-colour maps of measured field intensity (other values are measured, but not shown - lines drawn join one value only).

The joined values equate to the magnitude of the slope of the acceleration - caused by drag - caused by spin. Whew - these are maps of volumetric space, 2 differentials up from spin as measured in an orthogonal (X-Y-Z) system (that is significant for it forms the "spirals").

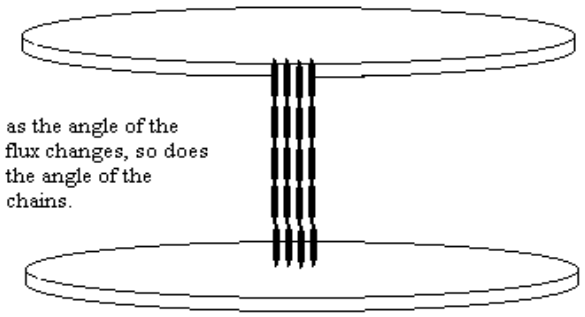
So – What might the Superparamagnetic Lens show?

The lens technology is new and there is no definitive conclusion at this time. There are several possibilities - and the issue is complicated by "what is happening in the lens?" plus "what is it that the glowing lines show?"

I will split this into "What is Happening" then "What it shows". These are my own interpretations, which do need to be verified in a lab.

1. What is Happening in the SPM Lens ?

* In the lens, fluid particles align tip-to-tip like iron filings (SN to SN) forming many thin lines

Between the lens sheets, nano-particles are held by flux lines / lines of force in chains - a diffraction grating of sorts. **1 The grid is 3D - it has depth* **2 in depth, chains are staggered* **3 the space about chains has spin.*	 exagerated view of particles with magnetic field perpendicular to glass	

* repulsive side-spin make the lines of particles separate sideways; lines of gaps form

* staggered layers / sheets of chains form, one per line of force - these "honeycomb" apart to maximise separation

* light passing through the formed gaps - react as if a diffraction grating is present, a grating of a shape created by the local magnetic field.

The spin-field about the particles will polarise / spin the light, but that is a different story and beyond the scope of this work.

2. What is it that the Glowing Arcs Show ?

(I've got to hedge this a bit - nothing is proven...)

When looked at "square on" the glows seemingly correspond to regions of space with the lowest PE - space about a magnet which are most cubic in Spin-1.

Usually this means regions of least acceleration or “slope flip-over” / zero crossing zones. Included in this is “saddle-backed space” (equatorial, non-trapezoidal) i.e. cubes which are near square or are slightly concave / convex, rather then diamond-rhomboid shaped.

These occur in three distinct areas:

1) at the equatorial region of the magnets spin field, as a disc about the waist / mid-section (a “tutu” about the equator, see the centre red “arrow flight” of Spin-1-C picture),

2) as a loop about the magnet, in the region where the sign of the acceleration flips (a loop formed by all the Top-B Spin-2 green zero-crossing points), and

3) at the poles of the magnet (less often seen)

Let's mark-up some lens photos and explain them. Do realise: the direction of the light plus where the lens is make a difference. The images are formed in space as light comes to you, controlled by material suspended within the lens – which sample a slice of space *away* from the magnet.

We see NOT the space about the magnet but the effects of fields as they cross through the lens. Sometimes this has little difference, sometimes a lot. Looking square-on minimises the differences.

As viewing angles are changed, the glows formed by the “diffraction grating” will appear offset. It is difficult to interpret these so a “square-on” view is suggested for now.

It is possible to form other interpretations. Lab testing may give another, presently unknown reason!

All that can be said for now is that glows mark lowest-bound PE space; to me this seems significant.

The images below are dynamic - they flow and change as you move the light, magnet and your eye.

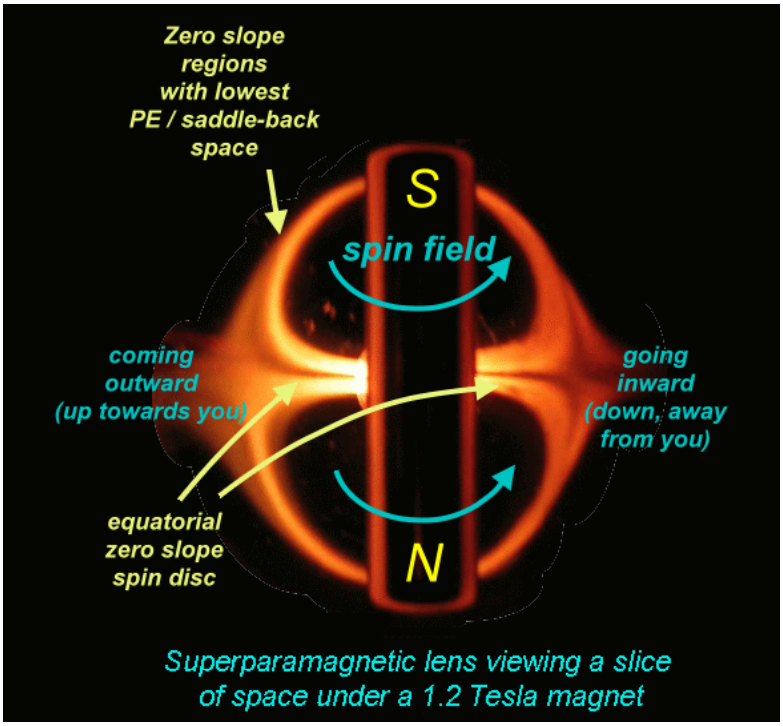
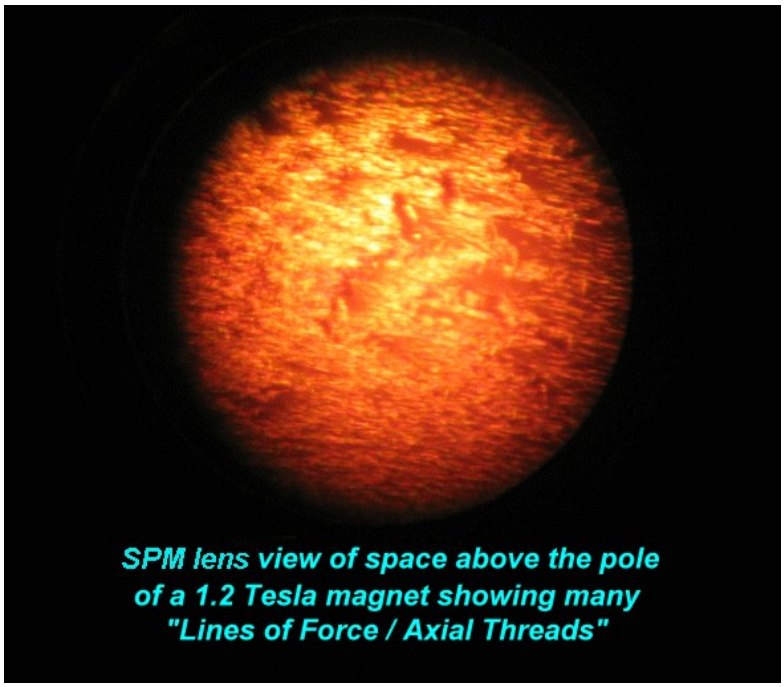
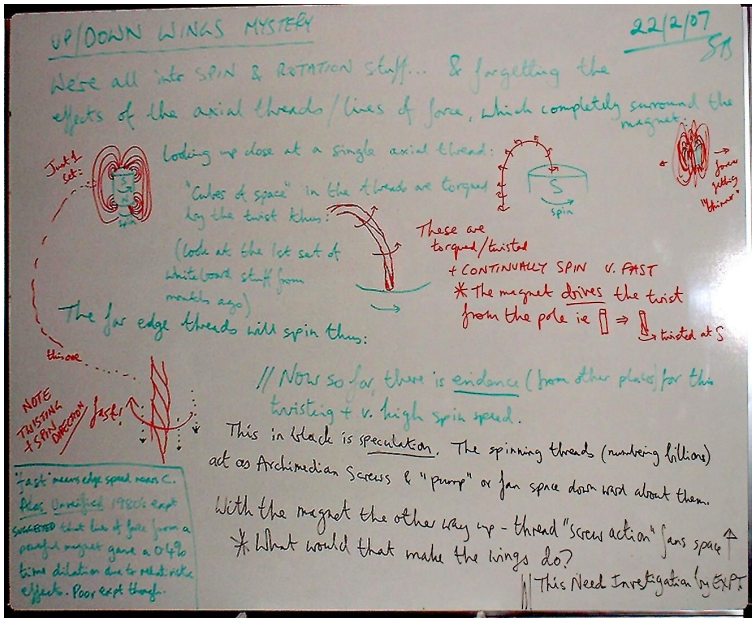
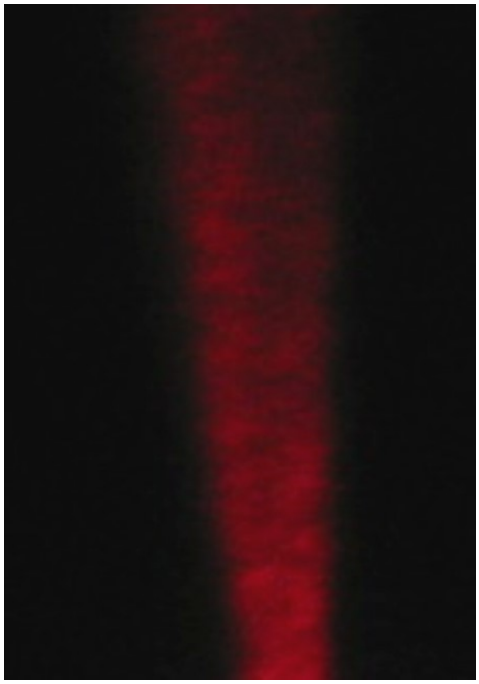
<u>Image-A</u> This is a marked-up photo of a magnet laid on a SPM lens, lit from below. Glowing lines suggest regions with the following properties: 1: Lowest PE 2: Space nipped between zones with differing “poleness slope” i.e. the equatorial glow is Spin-1-C's red arrow region, forming a disc (see also Image-B below)		

Image-B Photo of apparent spin about a rod magnet, 3/4 view end-on. Magnet is below the lens, with the light above and central.		
Image-C Spinning axial threads attached to the pole of a rod magnet appear DARK Notes 1: Each thread spins the same way so will REPEL side-to-side wise their fellows (see Attract-Repel-B showing co-side spinning bodies repel). 2: Each thread is far below sub-atomic in diameter. 3: Grouping is thought to be a function of the internal domains of the magnet.		

Next - some speculations and photo evidence of... something (NB This is NOT proof).

Topic: how Lines of Force might spin as they leave a magnet:

Image-D Whiteboard speculation of how axial threads may twist space and what that might "look like" if represented as a thread of space, torqued by rotation from a driving pole (in red).		
Image-E This is a photo was taken a few hours later, using laser light. A double helix can be seen (one light, one dark). The ray photographed was around 1mm in width. Real axial threads would be closer to foam size (approx 10^-35m) and quite invisible. This is not a picture of a Line of Force - but it does suggest that spin is put onto photons as they move though space. More lab work is needed!		

A Simple Experiment: To Show the "Pole" of Space Circling C*lockwise* is "N"

You will need: a compass, some insulated wire and a 1.5v battery.

Make a coil of wire and power the coil from the battery. Consider the spin put onto space by the electrons following the wire spiral. What does the compass show? (Remember, the N of the compass points to S poles). *Don't let your battery run down!*

Q1. Draw the space around the coil, showing the drag (the peak will be with the wire of the coil).

a) Where is the most intensely twisted region?
b) How many axial threads does the plain coil produce?
c) Draw in the acceleration line. Where is the zero-slope zone?

Q2. The overall field will make each electron in the wire align for minimum PE vs. the axial thread. Which is their best (lowest) arrangement for side-spin and axial-spin simultaneously? Draw this.

Add vectors (arrows) to the digram to show: the direction of flow of the electrons, the point of N-end orientation of the electron fields - and the side spin attraction they feel to the coil's axial thread.

Look up and confirm you have just derived Faradays Left Hand or motor rule (check you use a version for electron flow, not “conventional” which runs backwards!).

Q3. If mild steel was placed inside the coil, the alignment of the metal's magnetic domains are set by the coil - how do they move to find a lowest PE situation? How many axial threads form now?

Q4. Historically there has been much confusion over “which way” electricity flows - originally it was thought it went plus to minus, then the idea was reversed. Could the direction of spin of a magnet perhaps be subject to the “wrong-way round” problem? *How can this be tested?*

Final Words

Magnets have been causing confusion for a long time, mainly because the effects are higher differentials (slopes and curves) - situations with which we are not very familiar and struggle to understand. And to have this all happening in some invisible space does not help.

The simplest way to understand electrodynamics (electricity and magnets) is to look at the way space gets curved, what the energy implications are and to find what the impact will be.

In physics, *understanding the energy situation* is a rugged way to approach most problems. If you know what is happening to the energy - you know what is happening.

The Superparamagnetic Lens is a simple, immediate way to view the space around a magnetic system, clearly useful to those investigating magnetic devices. If you have a complex arrangement of magnets, then the lens can indicate the fields about the assembly.

* Interpreting the images needs practice * As a general rule, the glows cross Lines of Force at right angles. To reduce complications, the images are best viewed with the light square-on i.e. light - magnet - lens - viewer in a direct line.

EFD explains many magnetic devices and is far more developed then shown here. It is presently being extended into a full physics model called BAU (Bowman's Alternative Universe) - a full physics model using only diagrams of curved space, showing the pressure situations which arise.

However, even this description of EFD explains the front of Howard Johnson's “magnetic gate”, which is a tube of many same-end-on magnets - the hollow centre of which curiously attracts the same pole. That is, the mouth of a tube of magnets - all with N the same end - attracts another N.

Draw the end-on view and spin about each N. What happens in the middle? *(Spoiler! answer over..)*

Have fun!

SR Bowman
July 2007

efd . 2007 at yahoo . co . yk

What happens in the middle? Front attractor of Magnetic Gate made of only 4 magnets, all with N facing out and arranged with in a tube. The “empty” centre attracts N because... *See “The secret world of magnets”* *By Howard Johnson* *Cheniere Press* *(more on page 10)*