

Photon energy to controlled motion of a diamagnetic material

At the suggestion of Dr. Clark, I am posting a short essay theorizing two methods of using photon energy to manipulate the magnetic moment of diamagnetic material resulting in controlled movement of the material. Before proceeding please see the following You tube video.

- 405 & 980 nm photo heating control of diamagnetic pyrolytic graphite <https://www.youtube.com/watch?v=q91xAqAfzRA>

In the early 1860s, Maxwell named the anti magnetic phenomena diamagnetism. Due to it's weak force no one could find a use for it and so it was promptly forgotten and generally not taught in traditional magnetic theory. I have listed some everyday diamagnetic elements below, plus the value for iron.

MAGNETIC SUSCEPTIBILITY OF THE ELEMENTS

Name Formula $\chi_m/10^{-6} \text{ cm}^3 \text{ mol}^{-1}$

Water (l, 373 K) H₂O -13.09

Gold Au -28

Bismuth Bi -280.1 strongest naturally occurring diamagnetic element

pyrolytic graphite C -400 man made material

Iron(II) sulfate FeSO₄ +12400

On Thursday May 29th our Eco Sat Diamagnetic Satellite group from the University of Victoria <http://www.csd.c.uvic.ca/> won the Canadian Satellite Challenge and their Cube-sat will be launched into space. On board are several diamagnetic experiments. We will be testing real out of this world applications. No friction, micro gravity, a light source for power, the earth's magnetic field to work against, perfect for a weak force to be effective.

As seen in the video, high powered 300 & 200 mw lasers 405 & 980 nm were used to modify the magnetic moment (query point) of the pyrolytic graphite converting photo energy to motion, (pitch and roll). This is what the first experiment in the satellite will be doing. In the satellite, we are using up to 4 of 250 mw, 980 nm lasers. When we reach near the maximum magnetic field close to the poles, one laser will be fired for about 1 minute onto a small corner section of a 4 inch square sheet of thin pyrolytic graphite. The sheet is oriented at right angles to the earth's magnetic field for maximum coupling. Then we will wait to see what the results are. This is measured with a set of dual Inertial Measurement Units (IMU incorporates three sensors - an [ITG-3200](#) (MEMS triple-axis gyro), [ADXL345](#) (triple-axis accelerometer), and [HMC5883L](#) (triple-axis magnetometer)

. In the video, the laser heats the pyrolytic graphite in one spot. This seems to creates a hole in the diamagnetic field moment and the rest of the fields push, or fall toward the heat source, a loss of diamagnetism resulting in a controlled movement. Interesting facts of pyrolytic graphite, the diamagnetic reaction seems to be limited to the first 0.5 mm depth, similar to a super conductor,

but at room temperature. Almost no reaction along the thin edge, extremely good heat conductor and is made from methane gas.

Also interesting is the radiation shielding effect of the pyrolytic graphite. We accidentally discovered the very strong shielding affect against gamma rays and will be running tests on how effective it is. The very dense lattice structure of the pyrolytic graphite seems very effective. I had a suspicion that it might work based on the first Chicago graphite reactor. More details may be seen at <http://www.agofuelcells.com/diamagnetic-Experiment.html> and <http://www.csd.c.uvic.ca/>

Theory two, for the next version of the satellite, we will be trying to modify the magnetic moment for linear drive by using fluorescent segments in a sequential line simulating a moving diamagnetic moment with crystals like Blue John fluorite. (note, Blue John fluorite was formed in the presence of hydrocarbons which accounts for the fluorescence). This will be done with very low powered 1 to 5 mw 405 nm lasers. Initial tests of the Blue John indicated a polarized change in the magnetic field of about 3 to 6 nt. It has been hard to repeat the results due to our inadequate magnetometers and possible local EM noise. Later new crystals will have to be engineered and grown that would have a greater diamagnetic moment. There is still a lot of work to be done but interest is increasing with each successful step. It has been a long road since I found my first diamagnetic crystal in 1972 and figured out what it could mean. The greatest progress has resulted since 2012, when I became involved with the students, a great group to work with.

One other none related idea, that I had been theorizing about is the possible connection between water (a diamagnetic) and dowsing for water - that some people may be sensitive to the diamagnetic field of water. Kind of like sharks or birds to magnetic fields. This would give a real physical force to what seems to be an unexplainable phenomena.

I have audited the three Cousera terms on quantum physics. In each course, I gained a better understanding of different segments of what I have been theorizing for the last 34 years. It has all been a big help particularly when I have had to discuss the concepts with physicists and engineers. I can put the practical ideas into action, but writing the formulas is beyond my background especially when I see how easy it is for Dr. Clark, Dr. Appelbaum or Dr. Galitski. Thank you gentlemen for your efforts, it has been a big help.

Regards
Jim Harrington
Principal Experiment Investigator