ENERGY SCIENCE ESSAY NO. 13

THE CRYSTALLINE VACUUM

Introduction

In the January 30, 1998 issue of *SCIENCE*, vol. 279, pp 675-676 and pp. 686-689, there are two articles concerning the discovery that ions can form into a crystal-like cubic array in a cold plasma. The experimental technique by which the crystal structure is detected is quite interesting as is the fact that it has an intrinsic tendency to rotate.

Now, this is particularly interesting to me because I have, over the years, been advocating the belief that the vacuum itself is a very cold ionized medium having a crystalline structure and that it is the rotation or rather spin of a small 3x3x3 cubic element of such a structure that really constitutes what we know as the 'photon'.

Furthermore, I have, in my writings, drawn attention to the fact that it is the rotation of large spherically bound forms of such a vacuum structure that accounts for the rotation of stars and, indeed, planets, as well as explaining their magnetic properties. I have regarded the event of the cooling of that ionized world of 'free space' as forming the crystal structure, which by analogy with the onset of ferromagnetism as iron cools below its Curie temperature is the event which initiates the related action we refer to as 'gravitation'. Indeed, the onset of gravitation is the event which, in lieu of the so-called 'Big Bang', nucleates the protons dispersed throughout space and forms the stars. The initial concentration of positive charge in that way sets up the radial electric fields which act upon the cold and structured space plasma to promote the rotation which is imparted to stars at birth.

All that is mere theory, but theory from which I have developed a truly wonderful unifying account of the fundamental features of the aetherial world which we inhabit.

In recent times I have seen developments on the 'New Energy' front which have further encouraged my efforts and provided what I regard as confirmation of my theoretical efforts. So it was that I developed a particular interest in claims concerning the anomalous generation of electrical power as if by tapping the energy of the environment by techniques using plasma discharges of a special kind. One such technique reveals ionized plasma spheres, charge clusters, which seemingly defy what can be expected using standard physical principles.

In my own experiments in which I had a magnetic rotor spinning I sensed an anomalous inertial effect which I could attribute in quantitative and qualitative terms to the induction of a radial electric field which in turn induced 'aether spin' or what one could call 'vacuum spin'.

That said, it came as a pleasant surprise when I received a letter dated April 10, 1998 from Dr. Gerald Lindley of Manchester, Connecticut, USA, drawing my attention to those two articles in the January 30, 1998 issue of *SCIENCE*. He claimed that what is disclosed in those articles is "enough to falsify and disprove the charge cluster hypothesis of Jin and Fox plus

Shoulders, King and Aspden."

I use the word 'pleasant' because it is pleasing to be informed that the model of the simple cubic structure that I developed for the old but yet energy-active vacuum has been found to have an analogous counterpart in the ionized matter form. It is pleasing to see that rotation develops naturally in such a medium. Also, in some respects, it is pleasing to receive criticism, rather that being ignored, because that then excites a greater interest in one's onward efforts to unravel whatever it is that hides us from the truth.

This, therefore, is my introduction to this Essay No. 13. I feel that I can now present my comments concerning aether, photons and 'vacuum spin' energy with more chance of being given a hearing than hitherto and I appreciate Dr. Lindley's consideration for drawing those *SCIENCE* articles to my attention, notwithstanding a certain lack of grace in his assertion that "The charge cluster hypothesis of ... and Aspden is totally absurd" and that "The entire charge cluster hypothesis is falsified, disproved, demolished, torn to shreds, blown to pieces, smashed, annihilated and obliterated."

The Crystal Structure of the Vacuum Medium

The 'vacuum medium', otherwise known as the 'aether', is a cold neutral ionized plasma that has such a perfect crystalline form that it cannot be 'seen' or 'felt' as a medium resisting force. In fact it responds so easily in its reaction to invasion by matter that it dissolves its structure and reforms that structure in the wake of matter that does move through it. These are mere words, but they will be converted into a formal physical description once we explore the structural form of the aether and connect that to observable phenomena.

I will build my case by reference to the second of those articles in SCIENCE, namely that by Itano et al at p. 686 of Vol. 279, 30 January 1998.

That article begins by saying:
"Plasmas, the ionized states of matter, are usually hot and gaseous. However, a sufficiently cold or dense plasma can be liquid or solid. A one-component plasma (OCP) consists of a single charged species embedded in a uniform, neutralizing background charge. Aside from its intrinsic interest as a simple model of matter, the OCP may be a good model for some dense astrophysical plasmas, such as the crusts of neutron stars or the interiors of white dwarfs, where nuclei are embedded in a degenerate electron gas."
Well, that is a good introduction to an interesting topic in physics in this year 1998. However, something very similar was seen by me, back in the early years of the 1950s, when I was trying to devise a model which I could apply to a ferromagnetic crystal in a way which could account for the magnetic polarization of the magnetic domains inside the body-centred crystal structure of iron. That model had a version that regarded one solitary electron in each atom as moving in synchrony with corresponding electrons in adjacent atoms, each contributing to the ferromagnetic saturation in the host domain.

My model was an 'OCP', a one-component plasma, that being initially the easiest case to treat mathematically. I did, however, abandon the 'OCP' model when I saw that two electrons per atom had to cooperate in the co-ordinated motion. I was not worried about the fact that the 3d electrons in the atom are the ones responsible for the ferromagnetic state, but only have an orbital motion able to contribute two Bohr magnetons per atom. My reason was that I knew (a) that the measured value was 2.221 Bohr magnetons and (b) that there was something

wrong with the existing theory and that in fact that magnetic moment was really double the value normally assumed. So, I had my sights on a contribution per atom of 8 Bohr magnetons which my intuition, based on the need to keep magnetostrictive strain within the bounds of sensible theory, said was flipping between the three axial directions in the body-centred structure. That meant that, on average, there would be 2.667 Bohr magnetons developing the primary polarization in one crystal axis direction, with the lateral transient polarizing effects compensating to zero. It further meant that, since I had established by my theoretical probing that the prevailing primary polarization effect would set up a half-cancelling reaction confronting the instantaneous 8 Bohr magneton field, then half of 2.667, divided by 3, would be the true mean offset. That said that the 2.667 Bohr magnetons per atom of the iron crystal would be offset by 0.444 Bohr magnetons to give, overall, a net effect of 2.222 Bohr magnetons.

The experimental value was 2.221 Bohr magnetons and so, as you can imagine, I was rather pleased with this discovery, especially when I got similar results for nickel and cobalt which have a different crystal structure. That work was eventually published, but it was frowned upon by the referee physicists who saw themselves as experts in magnetism. After all, I was suggesting that there is a universal reaction to any primary magnetic field and that it acts to half-cancel that field.

To me, given that a unit measure is unity, it is not that outrageous to suggest that unity is 2 minus 1, especially when that unity reaction can be the action which feeds inductance energy back to a solenoid when power is switched off. However, those experts had somehow convinced themselves that ferromagnetism in iron comes from something called 'electron spin' and here I was suggesting it all came from the orbital motion of electrons! Add to that the fact that a discerning referee could well have sensed that I was talking about a real field reaction seated in a real aether and it is no wonder that I was left to wander in the scientific wilderness.

I did wander and I also wondered about that 'OCP' model of mine, eventually seeing this, not as the kind of structure to expect in a neutron star, whatever that is, but rather the very structure that must exist in the aether itself!

That is how my all-embracing unified 'field' theory was born, because that 'OCP' model of the vacuum medium, with its structural features, yielded a valid theoretical account of the fine-structure constant.

A point vital to this onward discourse, however, is that I discovered that the structure of the vacuum is not body-centred-cubic, as it is in the ionized plasma of the experiments reported in that article in SCIENCE. No, the vacuum has a simple cubic structure, not body-centred (bcc) and not face-centred (fcc)! If you wonder why, then ask yourself what determines the (bcc) structure in the real crystals we see around us.

The answer is that atoms in a solid bond together owing to some overlap in the electron entourage and so, in effect, all crystals are, in some respects, ionized plasma forms, though one does not use that terminology. In the cold plasma experiments of that article in SCIENCE, one can assert quite authoritatively that the crystal structure that develops is governed by 'least energy' considerations.

Now the problem with applying such theory to real matter is that we can build material

systems in which the internal electric potential has a negative value. Take a cube of positive charge which is distributed uniformly throughout that cube and put a particle having a compensating negative charge at the very centre of that cube and you have a model of a material cell in that 'OCP' plasma form. Work out the electric potential energy attributable to the interaction between the positive and negative charges and the self-interaction as between the distributed elements of that positive charge. This net energy potential governs the position adopted by that negative charge within that cubic cell. It has a minimum when the charge is at the centre of the cell, but that minimum value is a negative quantity!

One needs to do work to displace the negative charge from the centre of that cube, but you will find that the overall potential becomes positive before the negative charge reaches a cube face. However, if the potential can be negative then that negative charge will come to rest at the cube centre.

If negative potential is permitted and there are numerous negative charges all seated in a corresponding cube of positive charge, then they will pool their energy potential and not just take up positions each at the centre of a simple cubic structure. Instead, the (bcc) structure is adopted by the plasma, such as we see in our material systems, typically iron. However, underlying the real world there is that backcloth or sub-structure of the quantum world of the aether. If the aether is intolerant of the negative energy potential state there can be no way in which it can tolerate the presence of matter in (bcc) or (fcc) of other structural form. Yet, as we well know, it does tolerate those (bcc) and (fcc) crystal forms and the aether itself cannot have regions of negative potential.

So here was my breakthrough, made in the mid-1950s, the realization that the aether is a cold plasma, essentially of that 'OCP', one component plasma, form and it has the one structure which corresponds to least electric energy potential, provided that potential is a little greater than zero everywhere. It has to be sufficiently greater than zero for it to outweigh the negative energy potential densities that accompany the (bcc) and related crystal structures in matter present locally. This tells us that the lattice spacing as between the charges constituting the aether itself is very much smaller than those we see in crystalline matter. Indeed, there are of the order of tens of millions of aether lattice cells within every lattice cell of an iron crystal, for example.

The resulting structure of the aether is simple-cubic and every one of the charges which are that 'one-component' constituent must be displaced from the centre of the compensating charge cell in which it is located. Yet its energy must remain minimal and positive. That can only be if all those charges orbit their cell centres in unison so as to preserve their relative structural arrangement. This in turn introduces the features we associate with quantum theory, the Bohr magneton quantization in particular.

Such then was my introduction to the mysterious realm we call the 'aether' and it will take a great deal more than criticisms of the kind raised by Dr. Gerald Lindley to knock me off course, bearing in mind that I am now more that 40 years on from these initial discoveries and onward research during those years has reinforced my position.

The Lindley Criticisms

This particular Web page is not the place in which I wish to spend time explaining details concerning my theory. I will therefore concentrate on the specific attack mounted against my

work by Dr. Lindley.

The case he puts is that the experiments reported in the SCIENCE articles prove that an ion plasma in its lowest energy state has a maximum ion density experimentally measured as being of the order of $2.15x10^8$ to $4.53x10^8$ per cc. He concludes from this that "the charge cluster hypothesis of Jin and Fox plus Ken Shoulders, Moray B. King and Harold Aspden requires a charge cluster density that is fifteen orders of magnitude greater than the physically possible maximum density."

Now, that, without him having elaborated further, is his total case. He declares that whatever I and these other worthy individuals have said in our quite independent utterances on this charge cluster topic has to be in error by an enormous factor, solely because something measured in very cold plasma involves an ion concentration that does not square with our independent assertions.

Now, firstly, so far as I am aware Ken Shoulders has not claimed that the charge clusters appearing in his experiments have any crystal structure. Furthermore, I have assumed that those experiments were performed in a laboratory using vacuum tubes that would no doubt get rather warm in their operation. I note that the SCIENCE article experiments were performed on plasma that is cooled, not just to a very low temperature near absolute zero Kelvin, but down to 10 mK, that is one hundredth of a degree absolute!

There is no comparison between the energy states in that cold plasma experimental work and the energy levels involved in the research aimed at generating excess energy from spinning plasma. However, I have just used the word 'spinning' and here we do have something that warrants comment.

First, I make the simple point that if, by cooling an ionized plasma down to 10 mK, it is possible to slow the ions down to the level at which they can each stay within an orbit confined to a single cell volume of that plasma, then that is the basis on which the cubic structure can form. As I have read the SCIENCE articles the plasma is a very rarified state set up in a vacuum environment as otherwise there would be more ions present than some $4.53x10^8$ per cc. This measure of the uniformly dense plasma was what was dictated by the criteria needed to permit formation of that cubic structure.

Surely, if one ionizes a gas that is at a normal or moderate pressure, as in a lightning discharge, there will be a higher concentration of ions per cc than that $4.53x10^8$ figure relied upon by Dr. Lindley in his criticism. No one is suggesting that there will be structure, cubic or otherwise, in the plasma formed in that way.

I can only assume, therefore, that Dr. Lindley has misdirected his comments by including names other than mine in his attack.

I will, however, concede that I have suggested in my writings that it is the structural crystal-like form of the vacuum state that gives scope for its exploitation as a source of energy in those plasma cluster experiments that do concern Dr. Lindley. I need therefore to clarify why Dr. Lindley's remarks are utterly absurd in that connection.

Vacuum Spin

When I realized that the vacuum medium, the aether, had a cubic structure owing to there being within it a crystal-like array of electric charges uniformly distributed in a background continuum of opposite charge, precisely that (OCP), one-component plasma, system mentioned in the article in SCIENCE, I was interested in how spherical sectors of that medium could spin, as with body Earth. How would the rotation affect its cubic structure? Keep in mind that, besides there being that cubic distribution of charge, each such element of charge describes a small orbit to ensure that it stays displaced from the position of minimal, but negative, energy potential and holds itself at a positive level of potential.

That orbital motion or quantum jitter, as I have called it, ensures that those charges keep in synchronism in their jitter motion. Now, to do that, it works out that they must suffer a slight radial displacement with respect to the spin axis. This is because, if the rotation is in the same sense as that orbital jitter motion, the charges are travelling faster at their outermost positions than they are at their innermost positions and, relative to the centre of charge about which they orbit, they must therefore be displaced inwardly in order that they can stay in synchronous motion throughout their orbital jitter motion.

In short, this meant that if, for some reason, there was a radial electric field set up by a concentration of electric charge, then the enveloping aether would develop a spin motion about that charge concentration. That was what my theory predicted and it caused me to understand how astronomical bodies develop their rotation. I presented the theory in mathematical terms in a small 48 page printed booklet, the preface of which bears the date 22 November 1959. That is nearly 40 years ago. My aether theory not only gave the theoretical value of the fine-structure constant, meaning the dimensionless constant combining Planck's constant, the electron charge and the speed of light, all parameters of the vacuum itself, but it gave, both qualitatively and quantitatively the value we observe as the Earth's magnetic moment.

That convinced me that the vacuum medium was as I suggested, namely a simple cubic array of charges set in a uniform background continuum of opposite charge.

It has led me in recent times to suggest that the setting up of a radial electric field about an axis will develop aether rotation about that axis, something I have called vacuum spin. More than this, however, it meant that, in constraining those orbital jitter motions to keep in step, the external enveloping system of charge which is all part of the same dynamic system, must supply energy as necessary to assure that the charges do not get out of step. This is a one-way process in that energy converges on the focal point or rather the system at the focus or centre of this activity. Here then is a mechanism by which excess energy can be expected to creep into plasma discharges or other physical systems which develop electric fields directed radially with respect to a spin axis.

Naturally, although my theory concerning this dates from the 1950s, I could not, merely on the strength of this theory, contemplate such a breach of the kind of physics I had been taught in my early academic years. However, when I did hear of claims concerning experiments that implied generation of excess energy, I then started to wonder and began to see a connection with the theory I had been developing since the mid 1950s.

So now in early 1998 when Dr. Gerald Lindley draws my attention to an experimental discovery reported in SCIENCE, one which he says disproves my theory but yet which on my reading indicates otherwise, I am more than just interested.

I have said above that my case as published in my copyrighted work back in 1959 was that a radial electric field acting on a cubic charge array would cause it to spin owing to a phase-lock acting throughout that structure. So I say that my prediction is confirmed when I read in the Itano et al SCIENCE article:
"In our experiment the ions were confined in a cylindrical Penning trap, consisting of an electrostatic quadrupolar potential and a uniform magnetic field. The radial electric field leads to a rotation..."

Yes, the plasma not only developed its cubic structure, but it then began to rotate about a spin axis owing to the setting up of a radial electric field inside that plasma. The test data indicated that the spin speed was determined by the strength of that radial electric field.

Now, how can it be that an ionized plasma will spin bodily about a central axis merely because there is an electric field radial from that axis? Surely it will only do that if it is a least energy state for that spin to develop. The magnetic field will no doubt help to keep the charge orbits in mutually parallel planes, but that will not account for that plasma spin. In fact the magnetic field acting alone would merely develop a reacting motion of charge in tiny helical paths. The data concerning the strength of the magnetic field then tells us that such helical motion would be at frequencies far in excess of those observed for the plasma spin.

In summary, therefore, the SCIENCE articles support the proposition that the combination of a cubic charge structure in an ionized plasma plus the presence of a radial electric field will assure that plasma spin develops.

That said, I am now left to contest Dr Lindley's assertion that the charge densities observed in those plasma experiments are far less than those deemed necessary to assure excess energy gain in charge clusters formed by experiments such as that of Ken Shoulders or, one presumes, those of the PAGD (Pulsed Abnormal Glow Discharge) experiments performed by Paulo and Alexandra Correa in Canada.

Well, first of all, I am looking at cubic charge structure in the vacuum medium, whereas Dr. Lindley is looking at a cubic charge structure generated in an extremely-rarified ionized plasma, which by some very freak conditions of extreme cooling to incredibly low temperature happen to permit such structure to develop.

I know that the charge density of that (OCP) vacuum medium itself is very nearly $4x10^{30}$ per cc. If it were as low as Dr. Lindley suggests as the maximum value then the spacing between the charges in the cubic structure would be about $1.35x10^{-3}$ cm. That means that the aether, which contains charge needed to explain Maxwell displacement currents and the energy storage in the electric field, would have to get by on having its charge components, if of electron size, spaced so far apart that one could, for example, not set up electric fields in logical circuitry on the microscopic scale now prevalent in the computer industry.

So I simply cannot understand how Dr. Lindley can question the need for the very substantial ion densities that go with normal electrical activity in plasma generally and in the aether in particular. There are of the order of 10^{23} free ions per cc in copper at room temperature, but they do not form into any structure. However, if I set up a strong flow of current through a copper rod, I well know that those electrons will experience an electrodynamic pinch effect, meaning that they will set up a radial electric field with respect to the central axis of that rod.

I suspect that the effect of that radial field upon the structured aether 'plasma' inside that rod will promote rotation of that 'plasma', but it makes no sense at all to hear from Dr. Lindley that, because the ion density in a rarefied plasma in a Penning trap with no copper core present is quite low, notwithstanding the presence of that plasma rotation, so one cannot have plasma ion densities any greater in that copper rod or in a normal room temperature plasma glow discharge.

I submit that the SCIENCE articles to which Dr. Lindley has referred help my case in asserting that the setting up of a radial electric field in a conductive medium, be it of metal or plasma, will induce what I call 'vacuum spin'. That spin arises because of a phase-lock enforced by the constraints set up by the cubic ion structure and the need for synchrony in the motion of those ions to conserve that structure. Such constraints exerted as between charges constituting a real aether medium are then likely to be effective in drawing energy from the enveloping environment in order to keep the charge motion in a phase-locked state.

So long as physicists accept that an ionized plasma can contain more that 4.53×10^8 ions per cc, the case presented by Dr. Lindley has to be considered meaningless. Numerous chemical solutions that are subject to ionic dissociation have far more free ions per cc than Dr. Lindley suggests as being the possible maximum.

The thunderball could not exist if Dr. Lindley's assertion was true. In a book *Modern Aether Science*, that I wrote in 1972, I drew attention to the experiments, in 1963, of D J Ritchie of the Bendix Corporation. (*Journal of the Institution of Electrical Engineers*, p. 202 (1963). Ritchie was experimenting on the assumption that the thunderball is an ionized sphere of gas energized by the induction of short-wave electromagnetic oscillations produced in a thunderstorm. As the years went by it came to be recognized that the energy densities inside thunderballs based on measurement of their capacity to heat water when terminating their stable existence upon falling into a water barrel was between 2×10^9 J/m^3 and 5×10^9 J/m^3. This was reported by M D Altschuler et al in *Nature* in 1970 at p. 545 of v. 228. Later, in 1979, one could read in *Reviews of Modern Physics* at p. 417 of v. 51 that Nobel Laureate P L Kapitza had recognized that the energy densities of the thunderball are of the right order for application in fusion reactors and that he sought to create them artificially by radio frequency techniques.

Dr. Lindley would have us believe that such phenomena are not possible because he has read about an experiment in a Penning trap which shows that the maximum ionic density in a plasma that can create a spherical charge cluster having cubic structure is 4.53×10^8 ions per cc.

I will therefore adhere to the opinion which I expressed on p. 14 of my 1972 book *Modern Aether Science*:
If a spherical volume of the unseen aether medium rotates, it may result in an electric displacement effect radial from its axis of rotation. It is well known from Maxwell's work that a vacuum exhibits electric displacement properties so we are not making an unreasonable proposition. Rotation of a sphere of aether would then develop a magnetic field. It is easy then to say that if such a sphere housed an ionized plasma rotating with it, then both the radial electric field and the magnetic field would be cancelled. However, we know that the sun has a magnetic field and we also know that "lightning balls have been known highly to magnetize metallic objects such as gun-barrels" [Here there was a footnote reference to that above-

mentioned paper by Ritchie]. Therefore, the cancellation may only be partial and we can examine with justified curiosity the properties of the rotating aether medium.

In conclusion, do keep in mind that those experimental results reported in SCIENCE do show that ions in a cold plasma can form into cubic structure and that not only may have relevance to there being a kind of crystal structure in stars, but undoubtedly must have relevance to the prospect of there being such a charge structure in the vacuum medium itself, meaning the aether!

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To proceed to the next Essay, which is on a somewhat similar theme, press:
Energy Science Essay No. 14