OUR PHYSICS WORLD AND ITS PROBLEMS

This paper was offered for publication to the Editor of *Physics World*, the member's journal of the U.K. Institute of Physics. This was shortly after reading the September 2005 issue of that journal. However, the response received was that the suggestion in the paper that the sun might not be powered by a nuclear reaction was deemed too risky for publication to be accepted and so he well understood, as I had indicated with my submission, that I would be publishing the paper on my website.

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Here an Engineer cum European Patent Attorney who became a member of the Institute of Physics in 1983 at the age of 55 comments on our physics world and, with hindsight and a lifelong interest in physical science, draws attention to our problems.

I decided to write these words after reading through the September 2005 issue of *Physics World.* In the *News and Analysis* section on page 13 there is the title '**Hydrogen results cause controversy**' telling us that Mills and coworkers in USA 'have observed a range of phenomena that cannot be explained by standard atomic and plasma physics'. It would appear that a new unconventional source of energy is on the horizon, with findings confirmed by independent researchers in Netherlands, but with its discoverer claiming that the hydrogen atom can exist in a state involving what are said to be hitherto unheard of 'hydrinos'.

As a mere reader interested in both physics and new energy technology this reminded me of a book written by Keith Tutt, a graduate of Bristol University, who in 1993 won a prestigious Science Journalism of the Year Award for his documentary *'Killing us Softly'* about Sizewell 'B' nuclear power station. That book *'The Search for Free Energy'*, published in 2001, devoted a whole 19 page chapter to the subject of the saga of what Randell Mills claims to have discovered.

So here is a news item that tells us of a discovery of some years standing that might impact our energy future but, as is so often the case, the inventor has a theory as to how it works, one that physicists justifiably question, but yet there are still questions to be answered in the light of experimental findings. The problem is not whether the hydrino theory is right, but rather whether the supporting experimental evidence will be heeded, assuming the theory is incorrect.

Page 12 of *Physics World* opposite to this item, there is '**A physicist's view of energy supply**', which tells us that nuclear power should be expanded, though the author, a British physicist, ends by saying "Whether fusion could solve the world's energy needs in the long term remains to be seen, but it's certainly imaginable." That is indeed a problem, given 50 years of past effort and an outlook that contemplates success only in a matter of decades from now.

Given that the folklore of physics assures us that the sun, which comprises hydrogen, is powered by heat generated by nuclear fusion, one can hardly look ahead to the future feeling confident that what we might 'imagine' will solve our future energy problems, especially as doubts are being raised as to the very structure and composition of the hydrogen atom. I use the word 'folklore' because I have never seen an answer to the puzzle of how it is that some of the sun's hydrogen atoms can be ionized without their protons, then free and having a mass 1836 times that of the electron and so being subject to a very much stronger mutual gravitational interaction than applies between electrons, not thereby causing the sun to have a positively charged core. That surely should mean setting up repulsive electrostatic forces which preclude compression and mean that the sun has a uniform pressure and so a uniform mass density of 1.41 times that of water throughout its entire body, hardly a recipe for inducing a fusion reaction in its central core.

Such are the problems with which we contend. The primary focus for research interest is driven by the need for funding on a large scale to pursue research interests in space probes, high energy particle colliders, nuclear fusion and the like and the, albeit doubtful, claims of discovery of anomalous energy effects by outsiders are treated as mere noise in a background of primary effort governed by that funding need.

By page 15, the Editor invites readers to wonder if we are '**Living in a dodecahedral universe**' as we address the mysteries of "dark" energy in a flat universe which a French astrophysicist discusses on pages 22-28 under the title '**A cosmic hall of mirrors**'. Research on that subject is aimed at choosing between alternative cosmological models and depends on the outcome of space probes in the years ahead but one can hardly think that that will lead us to the energy source that can sustain our needs.

Then we come to pages 29-31 where a U.S. scientist now tells us about **'Strange events in the proton**', where we are looking into the composition of the hydrogen atomic nucleus, the proton. We are told that there is a 'spin'crisis owing to strange quarks inside the proton. One reads: 'Once the contribution of the strange quark is known with better precision, theorists should be able to build a consistent mathematical picture of the structure of the proton by including strange quarks in computer simulations of quantum chromodynamics (QCD), the theory of the strong force.'

Now, at risk here of seeming cynical, there was a time in the history of physics when, in 1920, Rutherford here in Britain coined the name **proton** for the hydrogen nucleus and when it was then believed that the nuclei of heavier atoms were composed of a combination of protons and electrons, but a problem arose from what was referred to as 'nuclear spin'. Physicists could not understand what determined the magnetic moment of the proton. They had a proton 'spin' crisis then but that was before the 'quark' era. Rutherford, also by 1920, had coined the name **neutron** to describe the electrically neutral combination of a proton and an electron as a single particle. It was only later in 1932 that Chadwick, a longtime associate of Rutherford, discovered the neutron we speak of today. Thereafter, our picture of the atomic nuclei of atoms other than hydrogen ceased to be a mere combination of protons and electrons and instead became a combination of neutrons and protons, the electron having been banished from the nucleus owing to the problem posed by combination of spin magnetic moment moments.

So the proton has been on our minds for 85 or so years and we are still trying to figure out what it is. This is in spite of the fact that its mass in terms of the mass of the electron has been measured to a precision well below one part in ten million and its magnetic moment to well within one part in a million. Such numbers are coded messages that need to be deciphered, but one needs to visualize the right structural basis that can account for those numbers in physical terms. What I find difficult to understand is why it is that we now say there are no electrons in the atomic nuclei, relying on it being impossible because electrons have a property not exhibited by such nuclei, namely too high a spin magnetic moment, whereas we say atomic nuclei contain neutrons without heeding the very important fact that neutrons have the property of a lifetime measured in minutes, whereas most atomic nuclei are stable particles. Where is the theory that accounts for the lifetime of the neutron, telling us why it decays in its free state and does not decay if part of the atomic nucleus?

In my opinion, until we have accepted a viable theory that can explain the proton-electron mass ratio, the magnetic moment of the proton, along with the magnetic moment of the neutron as well as proton and neutron structure plus neutron lifetime, we cannot be sure of anything on this subject. That is the real problem facing the world of physics, whether we are interested in the creation of the universe or the energy source which created it and which might come to our aid if we fathom its mysteries.

As to that effort to probe proton structure in terms of QCD theory, I recall reading in 1985 the following item in *SCIENCE NEWS*, **v. 128**, p. 88:

> "So far, IBM has been conspicuously absent from the supercomputer market, now dominated by Cray Research, Inc., and Control Data Corp., both based in Minneapolis. However, news of at least one IBM research effort in high-speed computing surfaced in last month's National Computer Conference in Chicago. A team of physicists will soon take over a specially built computer designed to solve a single physics problem. According to an IBM official, this computer is supposed to take less than a year to solve a problem that would take a Cray-1 supercomputer more than 300 years to do. The IBM machine consists of an array of 576 processors, each one capable of 20 million 'floating point' operations per second. The machine will be used to calculate the mass of a proton from 'first principles', applying quantum chromodynamics theory. This year-long exercise should give physicists some clues as to the validity of their concepts about quarks and gluons."

That was in 1985 and yet, twenty years on, in 2005 we are now told by an article in *Physics World* that 'Once the contribution of the strange quark is known with better precision, theorists should be able to build a consistent mathematical picture of the structure of the proton by including strange quarks in computer simulations of quantum chromodynamics (QCD), the theory of the strong force.'

Computer technology may have improved in that time but I, for one, am not excited by the prospect of success in this venture, given that I never did hear the outcome of that colossal IBM attempt to test the QCD theory as applied to proton structure some twenty years ago.

On pages 33-38 of that September 2005 issue of *Physics World* one reads what Matthew Stanley of the Department of History at Iowa State University has to say about our Cambridge Professor Arthur Eddington, famous for his solar eclipse expedition which confirmed a feature of Einstein's General Theory of Relativity. Stanley tells us how Eddington explained the energy source that causes stars to shine basing his argument on compliance with the gas laws. In reading that I found it enlightening but remain puzzled as to the answer to my problem above concerning that question of ionization and the alternative belief that nuclear fusion is involved. My interest in Eddington arises more from his attempts to decipher the numerical significance of the basic dimensionless constants of physics, notably the proton-electron mass ratio, solution of which problem, as stated above, would give us insight into the structure and form of the proton itself.

Thereafter on pages 40-44, preceding two book reviews, there is an article on silicon microelectronics by Japanese and Hong Kong authors, a subject that was of considerable interest to me in earlier times when I was IBM's Director of European Patent Operations, but having retired in 1983 to indulge in my interest, our energy future and more fundamental physics topics, one on which I will not comment.

As to book reviews, the first was entitled '**The future of nuclear power**', indeed a subject warranting concern, and the second '**The life of the brightest star**', a subject in which I was also interested. The first review concerned a book by William J Nuttall and entitled: '**Nuclear Renaissance: Technologies and Policies for the Future of Nuclear Power**' and the second referred to two books: '**Fred Hoyle: A Life of Science**' by Simon Mitton and '**Fred Hoyle's Universe**' by Jane Gregory.

I fully agree with the concept advocated by Hoyle that we live in a steady-state universe in which matter in continuously being created. However, to justify my belief, two important points need clarification. Firstly, one must explain why the Hubble time constant is not a measure of a Doppler effect indicating an expanding universe. Secondly, one needs to emphasize that protons and electrons appear to have an infinite lifetime, solely because, if they decay, they are the favoured particle form which Mother Nature immediately recreates with the energy so released. Since we cannot tell one proton from another or one electron from another, they appear as stable particles in a steady-state universe that, as Hoyle believed, is one in which matter is continuously created. It is just that it can only feed on energy being shed either by radiation or particle decay.

So, as a reader of *Physics World* interested in the fundamentals of physical science, the September 2005 issue warranted my full attention. I add that, my university education and Ph.D. research years being in the Electrical Engineering field, hence my interest in the energy theme, I cannot help, as an engineer by training, posing another puzzle, that of why physicists accept Maxwell's equations for electromagnetic wave propagation without concern for dynamic balance. A wave has something physical in motion lateral to its direction of propagation and lateral motion can only occur if there are two components, one in dynamic balance with the other with their energy ratio being a function of wave frequency. So, if physicists need to understand how light from distant stars can propagate without frequency dispersion but with loss of frequency, as needed to avoid the Doppler interpretation of stellar red shift, and if matter is being created throughout space, then one needs to see one such wave component shedding energy in greater measure than the other. Keep in mind that waves traversing one another in opposite directions somehow know their frequency. Here lies the alternative answer that explains the Hubble time constant, but I have yet to see the story of this mentioned in *Physics World*. Here is another problem for the physics world, a belief in the Big Bang theory and an expanding universe, that is based on wave theory that defies engineering common sense.

To be sure physics is a subject that challenges our creative faculties on a worldwide scale and the authors of what we read in *Physics World* will, as for this issue, include many of overseas location. However, given a personal interest in the proton, the most basic particle form that accounts for our universe, I do wonder what is currently emerging in Britain on the subject of the proton.

Can it be that the readers of *Physics World* would be interested in a British initiative on this proton question that dates back to1975, one which was recognized ten years later, by the foremost experts on measuring its value (R. S. Van Dyck, Jr., F. L. Moore, D. L. Farnham and P. B. Schwinberg, *Int. J. Mass Spectroscopy and Ion Processes,* **66**, 327; 1985)? They had measured its value to within a precision of 41 parts in a billion and included the following comment in their paper:

> "The value that they [Aspden and Eagles] calculate is remarkably close to our experimentally measured value (i.e. within two standard deviations). This is even more curious when one notes that they published this result several years before direct precision measurements of this ratio had begun."

Yes, that surely is a remarkable result, a severe test for any theory.

It was later, in 1988, that this same theory of the proton developed sufficiently to afford a theoretical evaluation of the proton magnetic moment as being 2.792847367 in nuclear magnetons, which, as can be seen, compared quite well with the CODATA measurement value of 2.792847386(63). I reported this in *Hadronic Journal*, **11**, 169-176, (1988) and it certainly did not involve anything remotely resembling QCD theory, being founded on a simple physical concept that the spin properties of a particle are those exhibited by its charge and mass-energy as confined within a radius defined by an enveloping wave-defined boundary. That paper is entitled '**The Theory of the Proton Constants**' and it is appropriate here to mention my earlier paper of equal importance entitled '**The Theoretical Nature of the Neutron and the Deuteron**' that appeared in *Hadronic Journal,* **9**, 129-136 (1986). Should this be of interest, both of these papers are fully recorded on the website www.aspden.org.

I add one final comment aroused by reading through the September 2005 issue of *Physics World*, which concerns the page 64 commentary under **Lateral Thoughts** by Simon Singh who refers to the 'unutterable beauty' of the equation $E = Mc^2$ and, of course, refers to this as 'Einstein's equation'. Physicists in Britain in the early years of the 20th century would, I am sure, have agreed as to the importance of this equation, but have seen it more in the context of their knowledge even back in the late 19th century of the formulation of the mass of the electron as being equal to $2e^2/3a$, where e is the charge of the electron in electromagnetic units and a is the assumed radius of that electron charge. A 1904 textbook on Physical Science authored by a Fellow of Trinity College, Cambridge, told us about J. J. Thomson's use of that relationship in showing how its variation with electron speed ranging up to 95% of the speed of light could explain the threefold mass increase observed. Every physics student surely knows that, if electron charge e is expressed in electrostatic units, that formulation would represent energy, so the ratio of electrostatic units to electromagnetic units, being c, that student can surely see that the energy of the electron is equal to c^2 times its mass.

So, to my way of 'lateral thinking', our student community should not be expected to believe that the great British physicists of the pre-Einstein era, needed Einstein to tell them that energy is equivalent to mass times c^2. Is this a problem? Yes it is, because of that 'folklore' theme I mentioned above. Who, I wonder, will challenge my comment that the sun is not powered by hot nuclear fusion?

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