APPENDIX II

Inertia and $E = Mc^2$

The physical basis of inertia and the well-known formula $E = Mc^2$ resides in the Principle of Conservation of Energy and, contrary to what many physicists believe, the unwillingness of an electron to radiate and so shed the only attribute that accounts for its existence, its electric charge and the energy intrinsic to that charge.

Electron acceleration in company with other electrons accelerated by the same electric field will engender a collective action by which energy can be said to be dispersed by setting up electromagnetic wave propagation. If N electrons are involved then the rate of energy radiation is, by Larmor theory, said to be proportional to N^2. Physicists who see this as applying to radio transmission from antenna in which numerous electrons are caused to oscillate in synchronism with one another must, however, ask themselves whether the radiation might be proportional, not to N^2 but to $(N^2 - N)$, whereby we exclude radiation of the very energy that keeps the electrons alive.

Why, I ask, should physicists just declare that an electron is accelerated without, as they do, factoring into their analysis the external electric field that causes that acceleration?

Now I could write many, many pages in support of my concern, but see no reason for replicating and developing what I have already published elsewhere. My book: *'Physics Unified'* includes a discussion in chapter 4 where I refer to 17 authors who seem to be troubled by this problem. These authors include Dirac and Einstein.

If you think Einstein's theory is rigorous, ask yourself how we measure relativistic mass increase of a fast-moving electron unless it is rapidly accelerated. Then note Einstein's words in a famous paper of his entitled: *'On the Electrodynamics of Moving Bodies'*:

> "As the electron is to be slowly accelerated, and consequently may not give off any energy in the form of radiation, the energy withdrawn from the electrostatic field must be put down as equal to the energy of motion of the electron."

The reference is Annalen der Physik, **17**, 891 (1905).

If you respect the work of Nobel Laureate Paul Dirac, just look up the paper in which, in discussing the classical theory of energy radiation by accelerated charge to accommodate relativistic principles, he stated:

> "It would appear that we have a contradiction with elementary ideas of causality"

Here the reference is Proc. Roy. Soc., **A167**, 148 (1938).

So my case is simple. Just go back to see how the formula for electron energy radiation was derived in the first place. I will not repeat the analysis here but will present the mathematical integral on which it is based:

$$2\int_0^{\pi}[\,(1/8\pi)(ef\sin\Theta/c^2t)^2 2\pi(ct)^2\sin\Theta\; cdt]\; d\Theta \;=\; 2e^2f^2/3c^3$$

This is derived at p. 81 in my book: *'Physics Unified'*. There are two important points to notice about this formulation. Firstly, it contains no symbol which represents the intensity of the electric field which must be present in order to set up the acceleration f. Secondly, that factor of 2 before the integral sign is put there because it is assumed that the electric field disturbance that is propagated must, by virtue of our understanding of Maxwell's theory of wave propagation, be matched by the propagation of an equal magnetic field disturbance.

Now I can declare quite categorically that once the accelerating electric field of strength V is included that integral above becomes zero, provided we have:

$$Ve/f = e^2/2c^2(ct)$$

and since $e^2/2(ct)$ is a measure of the electric field energy outside the radius ct, t being time, that remains to be accelerated as the disturbance progresses at speed c, it is evident that here we have a formula that tells us that an electron will accelerate in just such a way as to avoid shedding its electric energy, the condition being that the inertial mass is the electric field energy involved divided by c^2. So we have $E = Mc^2$ derived by classical electron theory and a physical insight into the nature of inertia.

The reason I am delving into this subject here is my concern about the theory of the Hubble constant in relation to the classical formula for the Thomson scattering cross-section of the electron. The theory for this depends upon the above formula for the rate of energy radiation by the electron deemed to be accelerated by the passage of an electromagnetic wave intercepted by the electron. If there can be no radiation of electric field energy by the isolated electron accelerated by such a wave then, in that respect, the scattering cross-section of the electron must be zero. However, I can see the case for the magnetic disturbance, or rather the kinetic energy disturbance implied, to still ripple through as part of the resulting wave propagation. To that extent, and bearing in mind that there is a measure of qualitative evidence supporting the Thomson scattering attributed to electrons, I tend to the opinion that an electromagnetic wave encountering isolated electrons in space does confront an obstructing cross-section that is half that indicated by the classical Thomson formula.

In this case there is logic in looking to the transient creation of electrons by the aether's failed attempts to create protons as a reason accounting for the attenuation of intensity and frequency of waves coming from distant stars. It is just that the theoretical determination (chapter 8) of the magnitude of the Hubble constant is affected, but surely we do have here a profound insight into some fascinating aspects of the physics that underpin our universe and I just hope that physicists will see enough reason to revise their opinions in the light of these comments.