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Calculation of the Proton Mass in a Lattice Model for the Aether.

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Summary. — A lattice model for the aether is shown to give indications of a fundamental charged particle of mass M such that $M/m_e = \frac{3}{4}(108)^3\pi^2(1843)^{-\frac{4}{3}}[(\frac{3}{2})^{\frac{1}{2}} - 1]^{-1} = 1836.15232$, a value very close to the observed proton-electron mass ratio of 1836.15152(70).

A model for the aether involving a simple cubic lattice structure of negatively charged particles embedded in a continuum of positive charge has been shown by ASPDEN [1] to be capable of giving alternative explanations of many of the experimental supports for relativity theory (*), and to permit calculations of some of the fundamental constants of physics which are treated as empirical parameters in more conventional approaches. Recently a slight development of part of Aspden's original work was shown to permit an exact formula to be obtained for the calculation of the fine-structure constant [2] α. It was found that

$$\alpha^{-1} = 108\pi(8/1843)^{\frac{1}{3}} = 137.035\,915\,. \tag{1}$$

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(1) H. ASPDEN: *Physics without Einstein* (Southampton, 1969).

(*) Relativity has good support experimentally from the increased lifetimes of fast-moving mesons which give direct evidence of time dilation. A nonrelativistic explanation based upon the aether concept has yet to be developed but may perhaps be found in the contraction of electric charge in storing energy due to increase in speed.

(2) H. ASPDEN and D. M. EAGLES: *Phys. Lett.*, **41** A, 423 (1972).

This value lies within 0.9 p.p.m. of the latest estimate from experimental results ([3]). In the present paper we give arguments to indicate how a particle of mass equal to that of the proton can appear in the lattice aether theory, and we find a precise expression for the ratio of the mass of this particle to that of the electron.

The aether lattice shares the motion and rotation of the Earth locally, and also moves in such a way that each lattice point rotates in a small circle of radius $r = \hbar/2m_e c = 1.93 \cdot 10^{-11}$ cm about its position of equilibrium at an angular speed $\Omega = c/2r = 7.76 \cdot 10^{20}\ s^{-1}$. The ratio of r to the lattice constant d satisfies ([1,2])

$$r/d = \tfrac{3}{2}(a/2b)^{\frac{1}{2}} = 0.302\,916\,, \tag{2}$$

where

$$a/b = (1843)^{-\frac{1}{3}} \tag{3}$$

is the ratio of the radii a and b of the electron and lattice particle respectively, with ([1,4])

$$a = \tfrac{2}{3}\, e^2/m_e c^2 \approx 1.88 \cdot 10^{-13}\ \text{cm}\,. \tag{4}$$

The ratio of the lattice constant to the electron radius is given by ([1])

$$d/a = 108\pi\,. \tag{5}$$

A fruitful postulate in ref. ([1]) was that creation of matter is likely to be concerned with changes in lattice cells near boundaries between normal regions of the lattice aether and regions in which the signs of the charges of lattice particles and the continuum are reversed. Such a reversal was assumed to occur in the interiors of stars. The creation is envisaged as proceeding from the lighter to the heavier particles. If we suppose that as a first stage a number of lattice particles and a corresponding number of cells of the continuum mutually annihilate, and that the equivalent volume is replaced by an appropriate number of positively or negatively charged particles of the same type as those forming the lattice, then an energy quantum Q_0 associated with the number of these particles per lattice cell will be given by (*)

$$Q_0 = \tfrac{2}{3}(e^2/b)(3d^3)(4\pi b^3)^{-1}\,. \tag{6}$$

([3]) E. R. COHEN and B. N. TAYLOR: *J. Phys. Chem. Reference Data*, **2**, 663 (1973).

([4]) M. BORN: *Einstein's Theory of Relativity* (New York, N. Y., 1965), p. 211.

(*) An alternative way of viewing the quantum Q_0 is to regard it as equal to the energy contained within two lattice cells (one of each polarity) associated with the pressure of magnitude $P = e^2/4\pi b^4$ required to keep lattice particles from disintegrating. Reasons are given in ref. ([1]) for thinking that such a pressure pervades all space.

From eqs. (3) to (6) we find that $Q_0/m_e c^2 = 412.665\,816$. This quantum does not appear to have been observed in experiments performed to date, but it may be of significance that $\frac{1}{2}[Q_0/m_e c^2 + 1] = 206.8$ is close to the muon-electron mass ratio.

In order to progress from this quantum to the mass of the proton we need to make the postulate that for calculations of the ground-state energy of elementary particles and of some composites it is not appropriate to use quantum theory, and that a classical consideration of spheres with charges $\pm e$ in contact is a valid approach. The relation between the masses and radii of the particles concerned is assumed to be similar to that given by eq. (4) for the electron. Then, if positive- and negative-charged particles associated with energy quanta P and Q are allowed to come into contact with each other, it is easy to show that the energy E of the composite system satisfies

$$E = P + Q - \tfrac{3}{2} PQ/(P + Q)\,. \tag{7}$$

Minimizing this energy with respect to Q we find that

$$Q/P = (\tfrac{3}{2})^{\frac{1}{3}} - 1\,. \tag{8}$$

Thus it appears plausible that, if heavy particles of mass P/c^2 form one of the main types of building block for matter, then the environment will be such as to involve energy quanta Q given by eq. (8); but we have already indicated how quanta of energy Q_0 given by eqs. (3) to (6) are associated with matter creation in the lattice aether theory. Hence, identifying Q and Q_0, we calculate that

$$P/m_e c^2 = \tfrac{3}{4}(108)^3 \pi^2 (1843)^{-\frac{4}{3}}[(\tfrac{3}{2})^{\frac{1}{3}} - 1]^{-1} = 1836.152\,32\,. \tag{9}$$

A recent reassessment of experimental data [3] gives the proton-electron mass ratio as 1836.151 52(70). Thus, although there is no *a priori* reason for the identification of Q rather than, *e.g.*, P with Q_0, the numerical result which follows from such an identification is persuasive.

The present note and ref. [2] have demonstrated that lattice aether theory can be used to find expressions that give close agreement with experiment for two very accurately determined fundamental constants of physics. The agreement with the most probable experimental value is to within 0.91 p.p.m. for the fine-structure constant and within 0.44 p.p.m. for the proton-electron mass ratio. Thus the calculated values lie only just outside the estimated standard deviation errors of 0.82 p.p.m. and 0.38 p.p.m. given for the two experimental figures [3]. An extension of the ideas presented in ref. [1,2] and the present note can be used to give an exact expression for the gravitational

constant G in terms of the charge-mass ratio of the electron. Agreement with a recent experimental value ([5]) is obtained. The constant G is only known to an uncertainty of about 90 p.p.m., so this agreement does not provide a very strict test of the significance of the model on its own. However, in combination with the two accurate results for the fine-structure constant and for m_p/m_e, it provides additional support for thinking that the lattice aether model merits thorough study and further development. Details about the calculation of G have been published recently ([6]).

([5]) C. PONTIKIS: *Compt. Rend.*, **274**, B 437 (1972).
([6]) H. ASPDEN: *Gravitation* (Southampton, 1975).

● RIASSUNTO (*)

Si mostra che un modello reticolare dell'etere dà indicazioni di una particella fondamentale carica di massa M tale che $M/m_e = \frac{3}{4}(108)^2\pi^2(1843)^{-\frac{3}{4}}[(\frac{3}{2})^{\frac{1}{2}} - 1]^{-1} = 1836.15232$, un valore molto prossimo al rapporto osservato fra la massa del protone e quella dell'elettrone che è 1836.15152(70).

(*) *Traduzione a cura della Redazione.*

Резюме не получено.

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