Letters to the Editor

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Notes on the Wheeler-Feynman Theory

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March 13, 1947

THE present writer has suggested[1] that there is a qualitative relation between Mach's principle of the relativity of inertia as employed in Einstein's general theory, and the Wheeler-Feynman principle that the radiative damping reaction is dependent upon absorbers *via* advanced potentials.[2] Professor Wheeler[3] believes this suggestion may be significant. In relativity, there would be no inertial reaction of mass particles if there were no gravitational bodies in the universe; and the retarded gravitational fields of the material universe provide these inertial reactions.[4] In the Wheeler-Feynman theory, there would be no radiative reaction of electrical particles if there were no absorbing bodies in the universe; and the half-advanced electromagnetic fields of the absorbers provide the radiative reaction of the charged particle. It may be advisable to "symmetrize" the gravitational potentials by introducing both the half-advanced and half-retarded fields. Taking the interior gravitational law for macroscopic matter under certain specified coordinate conditions and for weak fields:[5]

$$2R_\mu{}^\nu - g_\mu{}^\nu R = -\frac{16\pi G}{c^4}\cdot T_\mu{}^\nu,$$

we obtain

$$\nabla^2 f_\mu{}^\nu - \partial^2 f_\mu{}^\nu/c^2\partial t^2 = -4\pi\left(-\frac{4\pi G}{c^4}\cdot T_\mu{}^\nu\right),$$

which could be solved symmetrically over the volume v:

$$f_\mu{}^\nu = \frac{1}{2}\cdot\frac{1}{4\pi}\int\frac{\left[-\frac{16\pi G}{c^4}\cdot T_\mu{}^\nu\right]}{r}dv + \frac{1}{2}\cdot\frac{1}{4\pi}\int\frac{\left\{-\frac{16\pi G}{c^4}T_\mu{}^\nu\right\}}{r}dv,$$

where the square brackets refer to retarded time $t-r/c$, and the curly brackets refer to advanced time $t+r/c$; and where

$$f_\mu{}^\nu = h_\mu{}^\nu - \tfrac{1}{2}\delta_\mu{}^\nu h, \text{ and } h_\mu{}^\lambda = \delta^{\lambda\alpha}h_{\mu\alpha},\ h = h_\alpha{}^\alpha \text{ and } g_{\mu\nu} = \delta_{\mu\nu} + h_{\mu\nu},$$

where $\delta_{\mu\nu}$ are the Galilean values and $h_{\mu\nu}$ are the higher order deviations of the gravitational field from these values.

It also seems of considerable importance to direct attention to the fact that Wheeler and Feynman employ Frenkel's solution for a *point* charge which gives a *finite* self-energy or self-mass. In this way we can define a *point* mass for the subatomic "particles." Some years ago, L. Silberstein[6] obtained an axially symmetric line element for a gravitational field:

$$ds^2 = e^\nu dt^2 - e^{\lambda-\nu}\cdot(dx^2+dy^2) - x^2e^{-\nu}dz^2.$$

He pointed out that λ and ν cannot be functions of the time t if this line element is to remain in agreement with the gravitational law:

$$R_{\mu\nu} = 0.$$

His solution would therefore represent two resting gravitational bodies that would have to remain at fixed distances with respect to each other. For macroscopic gravitational bodies, this would be absurd. This absurdity arises from the fact that Silberstein treated these finite bodies as *point* singularities of the field, the problem thereby having axial symmetry. But if we are willing to take over the theory of Frenkel into the domain of *all* subatomic "particles," then Silberstein's solution may be most significant. Thus the proton-neutron combination could be represented by Silberstein's solution, and could give rise to fixed energy levels between these particles, i.e., with point masses in the subatomic equations, general relativity, for the first time, opens up the possibility of deriving quantization.

There are two further facts that are relevant: the laws of motion are obtainable[7] for two bodies from $R_{\mu\nu}=0$, hence quantized motion may also emerge in this case. Finally, it may be possible to obtain the nuclear forces from gravitation.[8]

1 C. W. Berenda, Phil. Sci. 14, No. 1, p. 19.
2 J. Wheeler and R. Feynman, Rev. Mod. Phys. 17, 157 (1945).
3 Private communication.
4 H. Thirring, Physik. Zeits. 19, 33, 156 (1918); 22, 29 (1921).
5 R. Tolman, *Relativity, Thermodynamics, and Cosmology* (Oxford Press, New York, 1934), pp. 236–238.
6 L. Silberstein, Phil. Mag. 24, 814 (1937).
7 Einstein, Hoffmann, Infeld, and Robertson, Annals Math. 39, 65, 101 (1938); 41, 455 (1940).
8 M. Wang, K. Wang, and H. Tsao, Phys. Rev. 66, 103, 155 (1944); 68, 163 (1945).

Probability of Nuclear Meson-Absorption

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March 20, 1947

THE experimental studies of the decay of negative mesons stopped in various materials[1] leads to the conclusion[2] that the probability for a K-orbit meson to be absorbed by the nucleus is of the order of magnitude of 10^6 sec.$^{-1}$, i.e., about 10^{12} times smaller than would be expected on the basis of conventional meson field theory.[3] It is significant that a discrepancy of the same factor of 10^{12} was encountered in the early attempts to explain nuclear forces (and magnetic momenta) on the basis of electron-neutrino exchange theory.[4] In connection with this earlier discrepancy it was suggested by Gamow and Teller[5] that the probabilities of the three possible processes, (1) electron-pair emission, (2) electron-neutrino emission, and (3) neutrino-pair emission, may represent a geometrical progression with a ratio equal to 10^{12}, the first being the most probable and the last the least probable. Under such an assumption, nuclear forces must be due exclusively to