BULL. AUSTRAL. MATH. SOC. 83E99, 83F05
VOL. 16 (1977), 151-152.

A geometry with spinor connection as a model for space, time and matter

J.T. Lynch

The aim of the thesis is to construct a geometry in which the fundamental operation of parallel displacement is defined in terms of spinors instead of tangent vectors. The underlying motivation for this construction is to find a geometric model for space, time, matter, and electric charge.

The space-time manifold is supposed to carry a 4×4 spinor field, or a tetrad of Dirac 4×1 spinors. Algebraically, the tetrad is represented in the Clifford algebra generated by the Dirac Γ symbols as a decomposition into four minimal left ideals. The structure group for the connection of this spinor tetrad is a direct product $G = L \times R$ where L acts from the left and R from the right. The left connection group L is taken as the smallest group which could have physical interest: the simply connected spin representation of the homogeneous Lorentz group. The right group R is taken as a one-parameter group of phase transformations (isomorphic to the circle group) whose effect on each member of the spinor tetrad is to multiply it by a factor $e^{i\eta\lambda}$ where η is $+1$ for half of the quartet and -1 for the other half. The two curvature fields, together with the metric and spinor fields, are constrained by variation of a suitable Lagrange density function which is interpreted as a world action function in the sense of Mie. In the weak field approximation the field equations reduce to the Maxwell-Einstein equations and hence give the correct Lorentz equations of motion for a charged particle immersed in an external electromagnetic field, provided that the electromagnetic field is

Received 11 October 1976. Thesis submitted to the University of New South Wales, April 1976. Degree approved, October 1976. Supervisor: Professor G. Szekeres.

represented by the curvature tensor of the R-connection.

The spinor field satisfies a Dirac type equation with a universal mass term; nevertheless particles with different masses and even zero restmass can be obtained. Similarly by suitable combinations of members of the spinor tetrad it is possible to obtain solutions with positive or negative charge or no charge at all, from a single world Lagrangian.

Much of the thesis is devoted to the study of specific solutions of the field equations, such as neutral and charged spherically symmetric (boson) particles, zero restmass fields, and cosmological solutions.