

Abstract

The Dirac and Maxwell Equations

Roland Roy Lloyd

A straightforward model of Dirac's and Maxwell's equations with field variables on a Clifford algebra is proposed. To this end, considerable details regarding the algebraic structures of Clifford algebras are investigated. These are,

- (a) Module Theory of Clifford algebras,
- (b) Matrix representation of the algebras, and
- (c) A Clifford conjugate, inner products and their isometric groups.

With this information, it is possible in this model to write Maxwell's and Dirac's equations of physics with the photon and electron fields with Clifford algebra values. When these equations are expressed in the components of the fields, they exhibit various Yang-Mills gauge symmetries of physics. In particular for the Pauli algebra the symmetry is the $SU(2) \times U(1)$ theory.

There are also algebras in which the theory reduces to a one-photon fermion theory (i.e. a $U(1)$ theory) and a two-photon fermion theory (i.e. a $U(1) \times U(1)$ theory).

Keywords: Dirac Equations; Maxwell Equations; Clifford Algebras; Yang-Mills gauge symmetries of physics.