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Generalizing the Dirac Equation with Clifford Algebra CARL BRANNEN — Our objective is to look for a unified field theory by generalizing the linear Dirac equation to a nonlinear, multi-particle wave equation using Clifford Algebra. Since the γ^μ matrices are familiar to all physicists, we will use this notation. We begin by generalizing the Dirac equation from one where matrix operators operate on vectors to one where the same matrix operators instead operate on matrices, thereby providing a multi-particle linear wave equation. Finding the nilpotent $\{\eta_n\}$ structure (spectral decomposition) of an algebra allows a nonlinear wave equation to be broken up into interacting linear waves. The resulting quantum numbers will suggest that the Weyl spinors, or massless chiral fermions (as used in weak interaction theory) are composite particles each made up of triplets of η_n. In order to break symmetry, we will modify γ^μ to $c_\alpha^{-1}\gamma^\mu c_\alpha$ where α is a parameterization of the values that preserve the Klein-Gordon equations. We will speculate that the binding potential is given by $|\beta_n\eta_n|^2$, where β_n is a phase, and show that with $c_\alpha = 1$, there are no bound states. Finally, we will examine the spectrum of bound states of η_n and indicate future efforts.

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