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PAULI EXCLUSION PRINCIPLE AND NONLINEAR DIRAC EQUATION

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The nonlinear Dirac equation is a magical equation that hides many mysteries of nature, so it is worth systematic study. In this paper, we give a detailed analysis for the effects of various covariant potential terms on the energy eigenstates and the representation space as well as the solvability of the spinor equation, and we obtain the specific potential energy terms that lead to the standing wave solutions. By simplifying the spinor equation, we find that the nonlinear pseudo scalar potential causes the oscillation and divergence of the radial wave function, so the nonlinear weak interaction between spinors may be the dynamical reason of Pauli exclusion principle. The nonlinear potentials of a spinor has some wonderful properties, such as the confinement of negative energy state, the generation of negative pressure and celestial magnetic field, etc. We also present a calculating method for solving the Dirac equation with complicated potentials, which may be a useful tool for further uncovering the mysteries of elementary particles.

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