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Abstract

Monopole Solutions in SU(2) Yang–Mills and Nonlinear Spinor Field Theory †

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Abstract: Monopole solutions in SU(2) Yang–Mills theory, which interact with massive nonlinear spinor fields, described by the nonlinear Dirac equation, are obtained. These solutions describe a magnetic monopole created by a spherical lump of nonlinear spinor fields. It is shown that the monopole solutions obtained differ in principle from the 't Hooft–Polyakov monopole so that (a) it is topologically trivial; (b) the radial magnetic field decreases as r^{-3}; (c) the Higgs field is not necessary for its existence. It is demonstrated that the energy spectrum of such a system possesses a global minimum, the appearance of which is due exclusively to the nonlinearity of the Dirac spinor fields. This global minimum can be considered a mass gap, i.e., the energy difference between a vacuum and the next lowest energy state. A similar minimum was found for the energy spectrum of regular solutions to the nonlinear Dirac equation and this minimum is called "the lightest stable particle".

Keywords: non-Abelian SU (2) Yang–Mills theory; nonlinear Dirac equation; scalar Higgs field; monopole; energy spectrum; mass gap

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