

ABSTRACT

The Dirac Equation in the Kerr-de Sitter Metric

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We consider a Fermion in the presence of a rotating black hole immersed in a universe with positive cosmological constant. After deriving new formulae for the event, Cauchy and cosmological horizons we adopt the Carter tetrad to separate the aforementioned equation into a radial and angular equation. We show how the Chandrasekhar ansatz leads to the construction of a symmetry operator that can be interpreted as the square root of the squared total angular momentum operator. Furthermore, we prove that the spectrum of the angular operator is discrete and consists of simple eigenvalues and by means of the functional Bethe ansatz method we also derive a set of necessary and sufficient conditions for the angular operator to have polynomial solutions. We show that there exist no bound states for the Dirac equation in the non-extreme case [7]. Furthermore, we use the Dirac equation in a fixed black hole background and different independent techniques to demonstrate the absence of fermionic bound states around a Schwarzschild black hole. We show that no embedded eigenvalues exist for the case when the energy is less than the particle's mass. Finally, we conclude that no bound states exist regardless of the value of the mass [9].

Keywords: Kirk Richard Morgan; Black hole: Kerr-de Sitter metric; Event horizon and singularity.