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Supersymmetric Gravitational Solutions in N=2 Supergravity Theories

by

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Not only are black holes important objects in the field of gravitational physics, but also in studying other branches of physics such as quantum field theory [1], condensed matter physics and material science [2]. Within supergravity theories, black holes are considered as solutions of the low energy supergravity theories originating via compactification of the M-theory, and they can, in principle, be lifted to solutions in higher dimensions. In recent years, there has been a lot of research activities in physics and mathematics on the subject of finding and classifying black hole solutions and gravitational instantons admitting various fractions of supersymmetry (see for example [3], [4] and [5]). Supersymmetric solutions are those admitting Killing spinors, i.e., covariantly constant spinors with respect to the supercovariant connection. My thesis is based on learning spinorial geometry [6], a powerful method used in classifying and finding supersymmetric solutions in supergravity theories. We, specifically, discuss the ordinary and the fake *N=2, D=4* supergravity theories coupled to vector multiplets.In the fake theory, the gauge fields have kinetic terms with a sign opposite to that present in the ordinary case. We solve the Killing spinor equations for the standard and the fake theories in a linked manner by introducing a parameter *kappa*. The solutions found are fully determined in terms of algebraic conditions, the stabilisation equations, in which the symplectic sections are related to a set of functions. These functions are harmonic in the case of the ordinary supergravity theory and satisfy the wave-equation in flat (2+1)-space-time in the fake theory.

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