

Title: The study of non-expanding Plebański–Demiański solutions

Abstract: The Plebański–Demiański class of solutions describes spacetimes of algebraic type D with an aligned non-null electromagnetic field and a cosmological constant. When the repeated principal null directions have non-zero expansion, it describes generalized black holes with rotation, acceleration, charges, NUT parameter and possibly non-zero cosmological constant. We study the complementary non-expanding case of Plebański–Demiański metric, which has not received as much attention as its expanding counterpart. Minkowski, de Sitter and anti-de Sitter spacetimes in Plebański–Demiański coordinates are studied as a background for a more general subcase of metric, so-called B-metrics by the classification of Ehlers and Kundt. A possible physical interpretation of the B-metrics is that they describe gravitational field of a tachyon; in a sense, they are counterparts of the Schwarzschild black hole solution. When the cosmological constant is non-zero, we obtain a tachyon in (anti-)de Sitter spacetime. The B-metrics can be further generalized to include the so-called “anti-NUT” parameter and electric and magnetic charges.