

NEW CLASS OF ROTATING CHARGED BLACK HOLES IN AN EXTERNAL UNIFORM (ELECTRO-)MAGNETIC FIELD.

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Abstract

We present a novel class of spacetimes, describing exact solutions to the Einstein-Maxwell equations that represent rotating and charged black holes in the external uniform electromagnetic field of the Bertotti-Robinson type. This new class has a sequence of important algebraic properties (such as being of algebraic type D), but this class differs from the known Plebanski-Demianski (PD) solution in the structure of the electromagnetic field, whose eigenvectors are not aligned with the principal null directions of the Weyl tensor (while for the PD solution they are aligned). Basic parameters describing this solution are the mass m , the Kerr rotation parameter a , the charge of the black hole e , the strength of the magnetic field B , the Taub-NUT parameter l , the acceleration of the black hole α , and the duality rotation parameters β and γ . We elaborate on finding various forms of the solution and analyzing its particular cases. One of the particular cases gives the so-called Kerr-Bertotti-Robinson black hole (Phys. Rev. Lett. **135**, 181401 (2025)) that we discuss in more detail, as it presents a useful model for the analysis of various astrophysical processes near magnetized black holes.