

## Remo Ruffini and Charged Black Holes

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Reissner-Nordstrom and Kerr-Newman black holes in the Einstein-Maxwell theory have electric and/or magnetic charges. Thibout Damour and Remo Ruffini studied quantum electrodynamical (QED) effect in Kerr-Newman geometries that is the Sauter-Schwinger mechanism of pair creation from charged black holes [T. Damour and R. Ruffini, Phys. Rev. Lett. 35, 463 (1975)], and proposed the mechanism for extraction of huge energy such as gamma-ray bursts (GRBs) from rotating charged black holes. For details of Schwinger mechanism and astrophysical applications, see R. Ruffini, G. Vereshchagin and S-S Xue, Phys. Rept. 487, 1 (2010).

Considering an enormous disparity between the electrostatic and gravitational forces in the standard model, it remains an open question how astrophysical objects accumulate net charges during direct formation processes [D N Page, Astrophys. J. 653, 1400 (2006)]. The mass difference between electrons and protons can yield a net accretion of charges 100 C per solar mass [M. Zajacek et al, MNRAS 480, 4408 (2018)]. Magnetic fields around rotating black holes can boost charge accretion [R. Wald, Phys. Rev. D 10, 1680 (1974); G. W. Gibbons, A. H. Mujtaba and C. N. Pope, Class. Quant. Grav. 30, 125008 (2013)]. Dark QED with extremely weak interaction predicts black holes with maximal charges. Perspective of charged black holes in astrophysics will be discussed.

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