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High-energy neutrino generation at jets from supermassive black holes

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The famous Blandford-Znajek mechanism or process (Blandford R.D., Znajek R.L. Mon. Not. R. Astr. Soc. 179 433 (1977)) explains the formation of relativistic jets from the fast-rotating accreting black hole due to the electric current trough black hole event horizon. The working efficiency of the Blandford-Znajek mechanism is justified recently by numerous numerical simulations of the General Relativistic Magnetohydrodynamics (GRMHD) accretion onto rotating Kerr black hole at the most powerful supercomputers in the world. In this process the acceleration of protons and other nuclei is impossible due the energetic losses in the powerful radiation field from the accretion disk.
From physical point of view the favorable place for acceleration of protons and other nuclei are the outflowing jets from accreting supermassive black holes, hitting the dense plasma clouds along the jets. It must be happened far enough from the black hole e vent horizon, radiation field from the accretion disk becomes a rather weak (at the distance ~1 pc or more). Therein is the generation of high-energy neutrino as secondary particles.
The maximum energy of these neutrinos estimated by the method (or criterium) by Hillas (Hillas A.M. Annu. Rev. Astron. Astrophys. 22 425 (1984)), may reach 1015 eV. These high-energy neutrinos are accessible for observations by the largest neutrino telescopes, such as IceCube at the South Pole and Baikal Neutrino Telescope (Baikal Gigaton Volume Detector, Baikal-GVD).

Section

Neutrino physics and nuclear astrophysics

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