Contribution ID: **47** Type: **not specified**

Gravitomagnetic interaction of a Kerr black hole with a magnetic field as the source of the high-energy radiation of gamma-ray bursts

Thursday, 4 November 2021 11:00 (30 minutes)

It is shown how the gravitomagnetic interaction of a Kerr black hole (BH) with a surrounding magnetic field induces an electric field able to accelerate surrounding charged particles to ultra-relativistic energies. Along the BH rotation axis, electrons/protons can reach even thousands of PeV leading to ultrahigh-energy cosmic rays (UHECRs) from stellar-mass BHs in long gamma-ray bursts (GRBs) and from supermassive BHs in active galactic nuclei (AGN). At off-axis latitudes around the BH vicinity, particles are accelerated to hundreds of GeV, and by synchrotron radiation emit high-energy GeV photons. Such a process occurs at all latitudes within 60 degrees of the polar axis. The theoretical framework describing these acceleration and radiation processes, how they extract the rotational energy of the Kerr BH, as well as the consequences for the astrophysics of GRBs are outlined.

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