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Cosmic Engines: How Black Holes Power the Brightest Objects in the Universe

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Black-holes are like the genie of the lamp, as they can store vast amounts of energy within an extremely compact region. Under the right conditions, this energy can be harnessed to power some of the most luminous and energetic phenomena in the universe, like quasars and gamma-ray bursts. Current theoretical understanding suggests that the energy release is facilitated by the black-hole's rotation and its interaction with magnetic fields supplied by accreted matter. Yet, how the black-hole magnetosphere responds to the energy extraction and by what processes this energy is ultimately converted into the observable emission is still debated. In this talk, I will discuss the necessary conditions near the event horizon that can sustain a stable energy extraction. I will trace the path of the outflowing energy that gives rise to relativistic jets and examine the mechanisms responsible for converting the energy into the observed light. These processes may offer insights into recent observations of core emission from black hole-powered systems.

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