



# High Energy Radiation from Black Holes: Gamma Rays, Cosmic Rays, and Neutrinos (Princeton Series in Astrophysics)

*Charles D. Dermer, Govind Menon*

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Bright gamma-ray flares observed from sources far beyond our Milky Way Galaxy are best explained if enormous amounts of energy are liberated by black holes. The highest-energy particles in nature--the ultra-high-energy cosmic rays--cannot be confined by the Milky Way's magnetic field, and must originate from sources outside our Galaxy. Understanding these energetic radiations requires an extensive theoretical framework involving the radiation physics and strong-field gravity of black holes. *In High Energy Radiation from Black Holes*, Charles Dermer and Govind Menon present a systematic exposition of black-hole astrophysics and general relativity in order to understand how gamma rays, cosmic rays, and neutrinos are produced by black holes.

Beginning with Einstein's special and general theories of relativity, the authors give a detailed mathematical description of fundamental astrophysical radiation processes, including Compton scattering of electrons and photons, synchrotron radiation of particles in magnetic fields, photohadronic interactions of cosmic rays with photons, gamma-ray attenuation, Fermi acceleration, and the Blandford-Znajek mechanism for energy extraction from rotating black holes. The book provides a basis for graduate students and researchers in the field to interpret the latest results from high-energy observatories, and helps resolve whether energy released by rotating black holes powers the highest-energy radiations in nature. The wide range of detail will make *High Energy Radiation from Black Holes* a standard reference for black-hole research.

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