Flares from black-hole magnetospheres

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A variety of astrophysical phenomena can only be explained as being powered by black holes. In particular, accreting supermassive black holes are responsible for launching relativistic plasma jets and for accelerating ultra-energetic particles.

Recent years have seen several observational breakthroughs in the understanding of these objects. The Event Horizon Telescope (EHT) collaboration has been able to image the shadow of the supermassive black hole M87*, probing the magnetic structure almost down to the event horizon. Very high-energy gamma-ray flares from radio galaxies are detected at very short time scales, hinting at a magnetospheric origin. However, a first-principles understanding of these observations is still lacking. In particular, the time period of the flares, or the location of the multi-wavelength emission sites, are poorly constrained.

In this talk, I will present some recent kinetic simulations incorporating some aspects of black-hole accretion physics. I will show that magnetic reconnection in the equatorial plane drives the transition between a flaring state, with gamma-rays being emitted in a reconnecting current sheet, and a more quiescent accreting state. I will also discuss the prospects of observability of the flaring state by the EHT.