

Workshop on Kinetic Models of Relativistic Plasmas



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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 this talk, I will present recent progress in capturing the key signatures of these black-hole flares. I will present first-principles kinetic simulations of a flaring black-hole, displaying a reconnecting equatorial current sheet. I will show polarized images of the nonthermal radiation emitted during the flare, in order to predict features of future polarized EHT observations. I will also talk about a novel strategy designed to alleviate the numerical challenges inherent to global kinetic 3D simulations of black-holes magnetospheres.

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