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Black Hole Imaging: Tackling the SgrA* orbital motion riddle

The GRAVITY instrument made a remarkable observation during the Near-Infrared flares of 2018, detecting a fast-moving hot spot in what seemed to be a circular orbit around SgrA, the supermassive black hole in our Galactic Center. The Gravity Collaboration attempted to fit the observed flaring behavior with a circular Keplerian orbit, a few gravitational radii from the supermassive black hole. However, the short orbital period and broad angular extent of the observed trajectory raised concerns about the suitability of this model. Motivated by these results, we developed a Python code for General-Relativistic Radiative Transfer calculations within the framework of Kerr spacetime. In our most recent work, we employ our radiative transfer algorithm to reproduce the observed flaring behavior in the vicinity of SgrA, and seek out the optimal orbital parameters for modeling similar phenomena. Specifically, we investigate the kinematics of the July 22 flare and calculate the impact of the hot spot angular velocity, the observer inclination, and the black hole spin in the resulting trajectory. Most importantly, this parametric study encompasses physically motivated ejected hot spot configurations, such as conical and parabolic models, that represent the most suitable candidates for replicating the observed flares, in accordance with the latest state-of-the-art GRMHD simulations.

Authors: NATHANAIL, Antonios (Academy of Athens); ANTONOPOULOU, Eleni (National & Kapodistrian University of Athens/ Academy of Athens)

Presenter: ANTONOPOULOU, Eleni (National & Kapodistrian University of Athens/ Academy of Athens)

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