# Black Hole Imaging: Tackling the SgrA* orbital motion riddle

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**Abstract**

The GRAVITY instrument made a remarkable observation during the Near-Infrared flares of 2018, detecting a fast-moving hotspot in what seemed to be a circular orbit around SgrA*, the supermassive black hole at the center of our galaxy. The Gravity Collaboration attempted to fit the trajectory of the July 22 hotspot with a circular Keplerian orbit, a few gravitational radii away from the 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 the Kerr spacetime. Our first priority was to conduct rigorous tests to evaluate the accuracy of our code's results. We then employed our algorithm to interpret the recently observed flaring events in the vicinity of our galactic center and seek out the optimal orbital parameters for modeling similar phenomena. More specifically, we investigate the kinematics of the July 22 flare and study the effect of parameters such as the hotspot's angular velocity, the observer's inclination, and the orbital plane's rotation in the resulting trajectory. Last but not least, we expand our research to include physically motivated ejected hotspot models, which present the most suitable candidates for explaining the recently observed flares.

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