S19 At the Galactic center:

X-ray Flaring at the Galactic Center: Insights from GRMHD and PIC simulations

Sgr A* exhibits flares in the near-infrared and X-ray bands, with the luminosity in these bands increasing by factors of 10–100 for \approx 60 min. One of the models proposed to explain these flares is synchrotron emission of non-thermal particles accelerated by magnetic reconnection events in the accretion flow. We investigate this scenario by combining general relativistic magnetohydrodynamic (GRMHD) simulations of a magnetically arrested disk (MAD) with particle-in-cell (PIC) simulations of magnetic reconnection. Our findings show that current sheets near the black hole provide favorable conditions for particle acceleration to Lorentz factors of γ_e up to 10⁶, producing simultaneous X-ray and NIR flares. Our model can simultaneously reproduce the quiescent and flaring X-ray luminosities as well as the X-ray spectral shape of Sgr A*. These results underscore the role of magnetic reconnection in driving high-energy variability in the Galactic center and other low-luminosity AGN such as M87*.