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Magnetic Flux Rope and the Flares in Sgr A* from 3D Two-Temperature GRMHD Simulations

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Sgr A* exhibits flares at various wavelengths, but their origin remains unclear. Magnetic flux ropes emerging from the black hole are one of the possible candidates for explaining the observed flares. Based on 3D two-temperature GRMHD simulations of magnetized accretion flows with multi-loop magnetic loops, we calculate the non-thermal emissions from the magnetic flux ropes using a kappa non-thermal electron distribution function (eDF). In kappa eDF, we use a variable kappa sub-grid model based on turbulent and magnetic reconnection acceleration scenarios. In a variable kappa model based on the turbulent acceleration scenario, we can reproduce the observation of near-infrared flares and broadband spectral energy distribution (SED) from the non-thermal emission from the magnetic flux ropes. In the flux variability, we also found an ~30 minute time lag between the near-infrared and submillimeter flares which agrees with observation well.

Primary authors: Mr JIANG, Hongxuan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University); Prof. MIZUNO, Yosuke (TDLI / Shanghai Jiao Tong University)

Presenter: Mr JIANG, Hongxuan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

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