



Contribution ID: 21

Type: **not specified**

Temperature properties in two-temperature accretion flows onto a black hole

Tuesday 28 February 2023 11:00 (40 minutes)

In the accretion flows around low-luminosity active galactic nuclei such as M87, electrons and ions are not in thermal equilibrium. Therefore, the electron temperature, which is important for the thermal synchrotron radiation at EHT frequencies of 230 GHz, is not independently determined. Simplified assumptions about the electron thermodynamics are normally employed in GRMHD simulations of accretion flows onto a black hole. To counter this, we have developed a self-consistent approach to study two-temperature accretion flows around a black hole. We have compared radiative properties between the commonly used parametrized ion-to-electron temperature ratio prescription R-beta model and electron-heating prescriptions obtained from two-temperature GRMHD simulations and found a good match between them. We have also investigated magnetized and radiatively cooled two-temperature accretion flows around a Kerr black hole. The inclusion of the radiative cooling impacts the thermodynamical properties of both the ions and electrons which are important for radiative images.

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