

Workshop on Kinetic Models of Relativistic Plasmas



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Collisionless Black Hole Accretion

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The accretion flows around the black holes in Sgr A, M87, and other systems are strongly magnetized and collisionless. This, in fact, makes the usually employed general relativistic (GR) magnetohydrodynamic (MHD) method formally inapplicable. Thus, addressing the BH accretion problem, in principle, requires a fully kinetic approach. In this talk, I will show a study of axisymmetric accretion of collisionless plasma around the black holes from first principles using GR particle-in-cell simulations (GRPIC). By doing so, I carry out a side-by-side comparison of global dynamics in GRMHD simulations and GRPIC for the same black hole accretion problem. Magnetic reconnection, which is believed to be responsible for particle acceleration and subsequent flares, is accurately captured in the kinetic approach. I directly examine the production of non-thermal particles due to magnetic reconnection. I will also discuss the implications of our results for modeling event-horizon scale observations of Sgr A and M87 by GRAVITY and the Event Horizon Telescope.

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