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Simulating black hole dynamics and gravitational wave emission in galactic-scale simulations

Tuesday 12 November 2019 14:30 (30 minutes)

We will briefly review how supermassive black holes (SMBH) are modelled in galactic-scale simulations. Recently, large-scale cosmological simulations have been used to predict the gravitational wave background. These simulations typically rely on semi-analytic models to describe the small-scale black hole binary dynamics and gravitational wave emission, as these processes cannot be directly resolved in simulations employing gravitational softening. An alternative is to use a hybrid approach, such as the KETJU code, recently developed in our group. The KETJU code includes algorithmically regularized regions around every SMBH. This allows for simultaneously following global galactic-scale dynamical and astrophysical processes, while solving accurately the dynamics of SMBHs at sub-parsec scales. The KETJU code includes also post-Newtonian terms in the equations of motions of the SMBHs, which allows us to directly calculate the expected gravitational wave signal from the motion of the resolved SMBH binary in mergers of massive gas-poor galaxies.

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