Black hole binaries in ultralight dark matter environments

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Abstract

Ultralight dark matter is an exciting alternative to the standard cold dark matter paradigm, reproducing its large scale predictions, while solving most of its potential tension with small scale observations (like the "cusp-core" and "missing satellites" problems). If dark matter is made of some new ultralight bosonic particle, relatively dense and large structures are expected to form at the center of galaxies, like solitonic cores or superradiant clouds around spinning massive black holes. These non-trivial environments are expected to affect the evolution of black hole or neutron star binaries, opening the possibility for using future space-borne gravitational-wave observatories to probe the nature of dark matter. In this talk, I will discuss some recent efforts on the modelling of black hole coalescences in ultralight dark matter environments: from numerical relativity simulations of mergers of equal-mass binaries, to general-relativistic perturbative approaches to the evolution of extreme mass-ratio inspirals.

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