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Effects of dynamical dark-matter distributions on intermediate mass-ratio inspirals (IMRIs) DAVID NICHOLS, Univ of Virginia, BRADLEY KAVANAGH, IFCA Santander, GIANFRANCO BERTONE, University of Amsterdam, DANIELE GAGGERO, IFT Madrid — Dense distributions of cold dark matter can form around massive black holes, and the dark matter can change the rate of inspiral of a small compact object into the massive black hole. The dark matter induces an additional drag on the compact object through dynamical friction, and this accelerates the inspiral of the small compact object. Previous studies of these systems assumed the dark matter distribution was static as the compact object inspirals, and they found dynamical friction can have a significant effect. We show for many IMRI systems that energy balance requires that dark matter redistributes in response to the inspiral of the compact object. We develop a formalism for jointly evolving the dynamics of the dark matter and the inspiraling compact object. We find that dynamical friction can still play a substantial role in the evolution of these IMRIs with dynamical dark-matter distributions, but it produces a significantly smaller effect than it does in IMRIs with static dark-matter distributions. Determining the properties of the dark-matter distribution from the emitted gravitational waves, therefore, requires higher initial dark-matter densities in the dynamic case than in the static case.

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