Abstract Submitted
for the APR11 Meeting of
The American Physical Society

Intermediate-mass-ratio black hole binaries: numerical relativity meets perturbation theory[1] CARLOS LOUSTO, MANUELA CAMPANELLI, HIROYUKI NAKANO, YOSEF ZLOCHOWER, Rochester Institute of Technology — We perform a series of full numerical simulations of nonspinning black holes with mass ratios $q = 1/10$ and $q = 1/15$. We compare gravitational radiation waveforms as computed by full numerical and perturbative evolutions. In the source terms of the Regge-Wheller-Zerilli Schwarzschild perturbations equations we use the full numerical tracks transformed into the Schwarzschild gauge. We then extend this perturbative formalism to take into account small intrinsic spins of the large black hole (valid for spins $|a/M| < 0.3$). Including the final spins improves the overlap functions when comparing full numerical and perturbative waveforms, reaching 99.5% for the leading $(\ell, m) = (2, 2)$ and (3,3) modes, and 98.3% for the nonleading (2,1) mode in the $q = 1/10$ case, which includes 8 orbits before merger. For the $q = 1/15$ case, we obtain overlaps near 99.7% for all three modes. We discuss the modeling of the full inspiral and merger based on a combined matching of post-Newtonian, full numerical, and geodesic trajectories.

[1]Thanks NSF and NASA for support.

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Date submitted: 05 Jan 2011 Electronic form version 1.4