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Comparing Post-Newtonian and Numerical-Relativity Precession Dynamics LAWRENCE KIDDER, Cornell University, SERGEI OSSOKINE, Canadian Institute for Theoretical Astrophysics, MICHAEL BOYLE, Cornell University, HARALD PFEIFFER, Canadian Institute for Theoretical Astrophysics, MARK SCHEEL, BELA SZILAGYI, California Institute of Technology — Binary black-hole systems are expected to be important sources of gravitational waves for upcoming gravitational-wave detectors. If the spins are not colinear with each other or with the orbital angular momentum, these systems exhibit complicated precession dynamics that are imprinted on the gravitational waveform. We develop a new procedure to match the precession dynamics computed by post-Newtonian (PN) theory to those of numerical binary black-hole simulations in full general relativity. For numerical relativity (NR) simulations lasting approximately two precession cycles, we find that the PN and NR predictions for the directions of the orbital angular momentum and the spins agree to better than $\sim 1^\circ$ with NR during the inspiral, increasing to 5° near merger. Nutation of the orbital plane on the orbital time-scale agrees well between NR and PN, whereas nutation of the spin direction shows qualitatively different behavior in PN and NR. We also examine how the PN equations for precession and orbital-phase evolution converge with PN order, and we quantify the impact of various choices for handling partially known PN terms.

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None

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