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A Hybrid Approximation Technique for Head-on Black-Hole-Binary Mergers DAVID NICHOLS, YANBEI CHEN, DREW KEPPEL, California Institute of Technology, GEOFFREY LOVELACE, Cornell University, ULRICH SPERHAKE, California Institute of Technology — Black-hole-binary coalescence is often divided into three stages, inspiral, merger and ringdown; the post-Newtonian (PN) approximation treats the inspiral phase, black-hole perturbation (BHP) theory describes the ringdown, and the strongly nonlinear dynamics of spacetime characterize the merger. In this paper, we introduce a hybrid method that incorporates elements of PN and BHP theories, and we apply it to the head-on collision of black holes with transverse, anti-parallel spins. We compare our approximation technique with a full numerical-relativity simulation by G. Lovelace et al, and we find surprisingly good agreement between the gravitational waveforms and the radiated energy and momentum. We also apply this model to understand the flow of gravitational field momentum in the simulation, quantified by the Landau-Lifshitz pseudotensor. Our results indicate that while PN and BHP theories do not capture all the strongly nonlinear physics of the merger, they do suffice to explain the outgoing gravitational radiation for head-on mergers.

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