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Puncture Initial Data for Highly Spinning Black-Hole Binaries
IAN RUCHLIN, JAMES HEALY, CARLOS LOUSTO, YOSEF ZLOCHOWER, Rochester Institute of Technology — Accretion arguments suggest that some astrophysical black-holes will possess nearly extremal spins. It is expected that gravitational wave signals from orbiting and merging black-hole binaries will be detected by Advanced LIGO in the next few years. Accurate waveform models are needed to interpret detector data. We solve the Hamiltonian and momentum constraints of General Relativity representing two black-holes with nearly extremal spins and ultra-relativistic boosts in the puncture formalism using spectral methods in the Cactus/Einstein Toolkit framework. We use a non-conformally-flat ansatz with an attenuated superposition of two conformally rescaled Lorentz-boosted-Kerr 3-metrics and their corresponding conformal extrinsic curvatures. The initial data are evolved in time using moving punctures in the BSSN and Z4 formalisms. We compare with the standard Bowen-York conformally-flat ansatz, finding an order of magnitude smaller burst of spurious radiation.

Ian Ruchlin
Rochester Institute of Technology

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