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Models of helically symmetric binary systems JOCELYN READ, SHIN'ICHIROU YOSHIDA, Department of Physics, University of Wisconsin-Milwaukee, BENJAMIN BROMLEY, Department of Physics, University of Utah, KOJI URYU, JOHN FRIEDMAN, Department of Physics, University of Wisconsin-Milwaukee — We report results from helically symmetric scalar field models and first results from a convergent helically symmetric binary neutron star code; these are models stationary in the rotating frame of a source with constant angular velocity Ω. In the scalar field models and the neutron star code, helical symmetry leads to a system of mixed elliptic-hyperbolic character. The scalar field models involve nonlinear terms of the form ψ^3, $(\nabla\psi)^2$, and $\psi\Box\psi$ that mimic nonlinear terms of the Einstein equation. Convergence is strikingly different for different signs of each nonlinear term; it is typically insensitive to the iterative method used; and it improves with an outer boundary in the near zone. In the neutron star code, convergence has been achieved only for an outer boundary less than ~ 1 wavelength from the source or for a code that imposes helical symmetry only inside a near zone of that size. The inaccuracy of helically symmetric solutions with appropriate boundary conditions should be comparable to the inaccuracy of a waveless approximation that neglects gravitational waves; and the (near zone) solutions we obtain for waveless and helically symmetric BNScodes with the same boundary conditions nearly coincide.

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