Special Guest Lectures

Parallel Adaptive Mesh Studies of Black Hole Spin-Spin Interactions

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Abstract:

We have implemented a parallel multigrid solver with adaptive mesh refinement, to solve the initial data problem for 3 + 1 General Relativity. This involves solution of elliptic equations derived from the Hamiltonian and the momentum constraints. We use the conformal transverse-traceless method of York and collaborators which consists of a conformal decomposition with a scalar that adjusts the metric, and a vector potential that adjusts the longitudinal components of the extrinsic curvature. The constraint equations are then solved for these quantities such that the complete solution fully satisfies the constraints. We apply this technique to compare with theoretical expectations for the spin-orientation- and separation-dependence in the case of spinning interacting (but not orbiting) black holes. We write out a formula for the effect of the spin-spin interaction which includes a result of Wald as well as additional effect due to the rotation of the mass quadrupole moment of a spinning black hole.

Speaker's Bio:

Scott Hawley, Ph.D., is Assistant Professor of Physics at Belmont University in Nashville, TN. He got his Ph.D. in 2000 under Matthew Choptuik, while at the Center for Relativity of the University of Texas at Austin, performing numerical simulations of collapsing boson stars. He has served as a postdoc at the Albert Einstein Institute under Ed Seidel (hence the connection to CCT), and again at the Center for Relativity, working on evolutions of binary black holes, mesh refinement techniques, and initial data in particular. His publications have appeared in Science, Astrophysical Journal, Physical Review, and Classical & Quantum Gravity. In 2006 he accepted a teaching position at Belmont University, one of the top commercial music schools in the country (Hawley is also a musician), where he enjoys teaching Acoustics and Electronics to Audio Engineering students.

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