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General relativistic null-cone evolutions with a high-order scheme

CHRISTIAN REISSWIG, Caltech — The accurate modeling of gravitational radiation is a key issue for gravitational wave astronomy. As simulation codes reach higher accuracy, systematic errors inherent in current numerical relativity wave-extraction methods become evident, and may lead to a wrong astrophysical interpretation of the data. Gravitational radiation is properly defined only at future null infinity, scri+. The method of Cauchy-characteristic extraction (CCE) has been successful at evolving metric data from a finite radius along null hypersurfaces to future null infinity, scri+. Current characteristic Einstein evolution codes, however, are only second-order accurate, thus requiring unnecessary high resolution to reach a given accuracy goal. Unfortunately, due to the nature of the Einstein equations in characteristic form, extending the algorithm to higher than second-order is non-trivial and requires a different approach than the so called "null-parallelogram" scheme. In this talk, I present a new fully non-linear 3D characteristic evolution algorithm based on spectral angular derivatives and fourth-order radial and time integration. Using linearized solutions (+noise), I show that the scheme is stable and efficient for solving the characteristic Einstein equations.

Christian Reisswig
Caltech

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