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Revisiting the Quasi-Kinnersley Tetrad in Numerical Relativity[1]
NICOLE ROSATO, JAMES HEALY, CARLOS LOUSTO, Rochester Institute of Technology — We present a method of constructing rotation parameters a and b for performing Type I and Type II transformations of Weyl scalars Ψ_a into the quasi-Kinnersley frame. This frame is transverse ($\Psi_1 = \Psi_3 = 0$) and should have $\Psi_2 \to -\sqrt{\mathcal{I}/\exists}$ asymptotically, where $\mathcal{I}$ is a spacetime invariant. This frame better represents physical properties of the spacetime, such as outgoing gravitational radiation. Using the quasi-Kinnersley frame, we study an index $\mathcal{D}$ that, in conjuction with the $\mathcal{S}$ invariant, measures the deviations from Petrov Type D of a BBH system in the strong-field region. $\mathcal{D}$ is invariant under Type II and III rotations, but not under Type I. Studying this index will tell us more accurately how far a BBH spacetime deviates from Type D. This index is used in numerical simulations of BBH systems to investigate the Petrov Type in the Strong Field region during the final inspiral and merger phases. This talk will also discuss how the gravitational wave scalar Ψ_4 in the quasi-Kinnersley frame can be used to extract gravitational radiation. Since the QK Ψ_4 is an accurate representation of outgoing radiation, waveforms can be extracted close to the BBH system, reducing computational expense.

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