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Towards a wave extraction method for Numerical Relativity: Estimating the gravitational wave content of spatial hypersurfaces LIOR M. BURKO, University of Alabama in Huntsville — We extract the Weyl scalars in the quasi-Kinnersley (qK) tetrad by finding first the (gauge–, tetrad–, and background–independent) transverse qK frame. This extraction still leaves two undetermined degrees of freedom: the ratio $|\Psi_0|/|\Psi_4|$, and one of the phases. The residual symmetry can be removed by gauge fixing of spin coefficients in two steps: First, we break the boost symmetry by requiring that ρ (or alternatively μ) corresponds to a global constant mass parameter that equals the ADM mass. Second, we break the spin symmetry by requiring that π/τ gives the expected polarization state for the gravitational waves. While the total emitted energy is independent of this second step of gauge fixing, its distribution between the $h_+, h_\times$ polarization states is not. We argue that a physical assumption on the polarization of the waves needs to be made. Our method of gauge fixing, specifically its second step, is appropriate for cases for which the Weyl curvature is purely electric. When the magnetic part does not vanish, π and τ may have non-coinciding zeros, thus hindering the use of their ratio. Applying this method to Misner and Brill–Lindquist data, we explicitly find the Weyl scalars ψ_0 and ψ_4 in the qK tetrad. We also reaffirm that Misner data have more radiation present on the initial time slice. We find the Weyl scalars purely from spatial data, without evolving the field equations.

Lior M. Burko
University of Alabama in Huntsville

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