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Natural polynomials for Kerr quasi-normal modes

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Accurate estimation of quasinormal modes from black hole mergers is an important open problem for gravitational waves, and has applications for tests of general relativity. In the case of Kerr black holes, linear perturbation theory has allowed for solutions of some of these modes to be calculated, but a general, exhaustive calculation for high overtones has remained evasive. We consider the Teukolsky formalism of the linearized Einstein equations, and solve the radial component using a basis of canonical polynomials which we construct numerically. In particular, we find a spectral representation of the differential operator representing this radial equation. By combining these solutions with those of the angular equation, we calculate quasinormal modes for general spin black holes.

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