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The IMRPhenom program: accurate and computationally efficient waveform models for compact binary gravitational wave signals

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The phenomenological waveform modelling program is one of the main approaches to accurately model gravitational wave signals from compact binary coalescences during all the emission stages, incorporating information from several analytical and numerical frameworks (Post-Newtonian theory, Numerical Relativity, Black-hole perturbation theory) in compact close-form computationally efficient expressions for the waveforms. This talk is dedicated to the most recent generation of IMRPhenom models: the frequency-domain IMRPhenomX family, a major improvement in accuracy over the previous IMRPhenomD-based generation of models, including sub-dominant harmonics calibrated to Numerical Relativity, enhanced computational efficiency through an implementation of the multi-banding technique, and the inclusion of generic spin treatment for precessing systems through the incorporation of the multiscale analysis approach for describing the Euler angles in an improved "twisted-up" formulation. A novel IMRPhenom waveform family constructed natively in the time domain is also presented, IMRPhenomT, highlighting the main improvements it carries over the traditional Fourier domain modelling, mainly the avoidance of the stationary phase approximation for modelling the precessing transfer functions, more robust treatment of the precessing merger-ringdown through the inclusion of analytical approximations, and a new computationally efficient numerical evolution of the spin degrees of freedom for modelling the precessing inspiral.

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