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Eccentric Inspiral-Merger-Ringdown Models for Binary Black Holes with Gauge-invariant Eccentricity

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Residual eccentricity in gravitational waveforms can be a unique tool to identify binary systems formed in dynamical environments. In general relativity, eccentricity is not defined uniquely. Different waveform models rely on gauge-dependent definitions of eccentricity, which leads to incompatibility between them. We remove this ambiguity by employing a gauge-invariant eccentricity definition in our modelling approaches. We present an eccentric Inspiral-Merger-Ringdown (IMR) model for binary black holes, calibrated against a set of target IMR waveforms. The model is also validated against an independent waveform family resulting overlaps better than $\sim 96.5\%$ within the calibrated range of binary parameters.

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