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Reduced Basis representations of multi-mode black hole ringdown gravitational waves SCOTT FIELD, University of Maryland, SARAH CAUDILL, Louisiana State University, CHAD GALLEY, JPL-Caltech, FRANK HERRMANN, MANUEL TIGLIO, University of Maryland — We construct compact and high accuracy Reduced Basis (RB) representations of single and multiple quasinormal modes. The RB method determines a hierarchical and relatively small set of the most relevant waveforms. We find that the exponential convergence of the method allows for a dramatic compression. Inclusion of a second mode is expected to help with detection, and might make it possible to infer details of the progenitor of the final black hole. We find, for example, that the number of RB waveforms needed to represent any two-mode ringdown waveform with an accuracy of $\sim 10^{-10}$ is *smaller* than the number of metric-based, one-mode templates with $MMm = 0.99$. For unconstrained two-modes, which would allow for consistency tests of General Relativity, our high accuracy RB has around 10^4 *fewer* waveforms than the number of metric-based templates for $MMm = 0.99$. The number of RB elements grows only linearly with the number of multipole modes versus exponentially with the standard approach, resulting in very compact representations even for many multiple modes. These results open the possibility of searches of multi-mode ringdown gravitational waves.

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