

# Distinguishing between general relativity and modified theories of gravity using Quasi-normal modes

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## Abstract

Quasi-Normal Modes (QNM) from the ringdown phase of gravitational waves provide critical information about the structure of compact objects like Black Holes. Thus, QNMs can be a tool to test General Relativity (GR) and possible deviations from it. In the case of GR, it is known for a long time that a relation between two types of Black Hole perturbations: even parity (Zerilli) and odd parity (Regge-Wheeler), leads to an equality of reflection coefficients. With the direct detection of Gravitational waves, it is now natural to ask: whether the same relation (between scalar and vector perturbations) holds for modified gravity theories? If not, whether one can use this as a way to probe deviations from General Relativity. As a first step, we show explicitly that the above relation between Regge-Wheeler and Zerilli wavefunctions break down for modifications to gravity, and hence the two perturbations do not share equality of reflection coefficients. We discuss the implication of this imbalance on observations.