An Extensive Search for Overtones in Schwarzschild Black Holes

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In this paper we show that with standard numerical methods it is possible to obtain highly precise results for quasi normal modes (QNMs). In particular, secondary modes are obtained by numerical integration done in the well-known time-domain grid. We have compared such numerical results to the also well-known 6th-order WKB method and have found a striking degree of agreement, which could be as good as seven significant figures for the fundamental mode and three for the first overtone. We have chosen the Schwarzschild BH (black hole) to start with because it is the simplest and most well-known of all BHs, so it provides a very safe testing ground to the aforementioned numerical method.

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