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# Dynamical tidal Love numbers of Kerr-like compact objects

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We develop a framework to compute the tidal response of a Kerr-like compact object in terms of its reflectivity, compactness, and spin, both in the static and the frequency-dependent case. Here we focus on the low-frequency regime, which can be solved fully analytically. We highlight some remarkable novel features, in particular: i) Even in the zero-frequency limit, the tidal Love numbers (TLNs) depend on the linear-in-frequency dependence of the object's reflectivity in a nontrivial way. ii) Intriguingly, the static limit of the frequency-dependent TLNs is discontinuous, therefore the static TLNs differ from the static limit of the (phenomenologically more interesting) frequency-dependent TLNs. This shows that earlier findings regarding the static TLNs of ultracompact objects correspond to a measure-zero region in the parameter space, though the logarithmic behavior of the TLNs in the black hole limit is retained. iii) In the non-rotating case, the TLNs generically vanish in the zero-frequency limit (just like for a black hole), except when the reflectivity is $R=1+O(M\omega)$, in which case they vanish with a model-dependent scaling, which is generically logarithmic, in the black-hole limit. The TLNs initially grow with frequency, for any nonzero reflectivity, and then display oscillations and resonances tied up with the quasi-normal modes of the object. iv) For rotating compact objects, the TLNs decrease when the reflectivity decreases or the rotation parameter increases. Our results lay the theoretical groundwork to develop model-independent tests of the nature of compact objects using tidal effects in gravitational-wave signals.

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