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Tidal deformability of black holes surrounded by thin accretion disks

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The tidal Love numbers of self-gravitating compact objects describe their response to external tidal perturbations, such as those from a companion in a binary system, offering valuable insights into their internal structure. For static tidal fields, asymptotically flat black holes in vacuum exhibit vanishing Love numbers in general relativity, even though this property is sensitive to the presence of an external environment. In this work we study the tidal deformability of black holes surrounded by thin accretion disks, showing that the Love numbers could be large enough to mask any effect of modified gravity and to intrinsically limit tidal tests of black-hole mimickers. Furthermore, we investigate the measurability of the tidal parameters with next-generation gravitational wave experiments, like LISA and Einstein Telescope. Our findings suggest that these parameters could be measured with high precision, providing a powerful tool to probe the environment around coalescing binary systems.

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