# Deformed compact objects in general relativity and beyond

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Einstein's theory of general relativity predicts that the only stationary configuration of an isolated black hole (BH) is the Kerr spacetime, which has a unique multipolar structure and a spherical shape when non-spinning. This simplicity of BHs is in striking contrast with other models of compact objects which can have a non-trivial multipolar structure such as neutron stars (NSs) and objects inspired by semiclassical and quantum gravity . In this talk, I will present an extension to the Hartle-Thorne formalism that relaxes the assumption of equatorial symmetry and includes deformations induced by multipole moments higher than the spin, thus providing a more general parametrization for deformed compact objects. Within this framework, I will show that these multipole moments must approach the corresponding Kerr values as the compactness increases. I will discuss NSs with intrinsic quadrupole moments, which provide a more accurate description for stellar remnants. These new intrinsic deformations are significant for gravitational-wave parameter estimation, for the electromagnetic signal from accreting NSs, and for tests of the nature of compact objects.

[1] G. Raposo, P. Pani, and R. Emparan, "Exotic compact objects with soft hair", arXiv:1812.07615, under review in PRD (2018);
[2] G. Raposo and P. Pani, "Novel solutions for deformed neutron stars in general relativity", in preparation.

*This abstract may also be applicable to the B3: "Approximations, perturbation theory, and their applications" session.*