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From Compact Objects to Quasi-Normal Modes and Back

With the repeated detection of gravitational waves by LIGO, new frontiers in astrophysics and gravitational physics are waiting to be explored. The work we present is dedicated to the theoretical description of ultra compact objects, more recently also called exotic compact objects (ECOs). Using analytic and semi-analytic techniques we focus on gravitational perturbations, where the associated quasi-normal mode spectrum contains important information of the source and is therefore a promising object of further research.

In a first project [1] we have successfully shown how different versions of the Bohr-Sommerfeld rule, a WKB result, can be used to compute the so-called trapped axial modes of ECOs. For these objects it was also possible to develop and solve analytically a toy model, which allows a simple and quick estimation of their trapped modes.

In the subsequent project [2] we have worked on the inverse problem, where one reconstructs the potential of gravitational perturbations from the knowledge of the QNM spectrum. The inverse problem is of great interest because it allows to study a source mainly model independently. In general it is not possible to find a unique solution, but a quite generous additional assumption allows it for many objects.

References:

- [1] S. H. Völkel and K. D. Kokkotas, *Class. Quantum. Grav.*, 34, 12, 2017
- [2] S. H. Völkel and K. D. Kokkotas, accepted in *Class. Quantum. Grav.*, 2017

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