Exploring Strong-Field Deviations from General Relativity via Gravitational Waves

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Abstract

With the advent of an observational window into strong-field gravity from mergers of compact objects, it has become important to understand the extent to which we can make robust empirical conclusions about the nature of these objects. Some authors have taken the information paradox to imply a modification to the description of classical black holes at scales as large as the horizon radius. We study the extent to which quantum-gravitational modifications to black holes may be distinguished from classical black holes by means of a toy model wherein these 'compact quantum objects' (CQOs) are modeled as exotic perfect fluid stars in general relativity. In this toy model, an analysis of the inspiral part of a merger cannot distinguish between these CQOs and classical black holes with the current sensibility of gravitational wave detectors. This exhibits the importance of numerical simulations for moving past inspiral and obtaining better understanding of the behavior of CQOs during plunge, where their deviations from classical black holes are expected to be larger.