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Gravitational Wave Parameter Estimation as a Test of General Relativity

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Abstract:

In anticipation of the new era of gravitational wave detectors, it is especially important to develop methods for gaining information about astrophysical systems from gravitational wave signals. We have been working on developing a method for testing the cosmic censorship conjecture and the no-hair theorem of General Relativity using the inspiral portion of the compact binary coalescence gravitational waveform. The method we are developing will allow us to say whether detected systems are consistent with the cosmic censorship conjecture and the no-hair theorem, within the context of the Kerr geometry. We use parameter estimation techniques to calculate the measurability of spin, mass and tidal parameters appearing in the gravitational waveform. The Kerr limit on allowed spin for a given mass allows us to say whether a detected system is consistent with a Kerr black hole obeying cosmic censorship within our calculated measurement error. Using a physical prior on the symmetric mass ratio improves the measurability of spin significantly. Using the same prior to improve the measurability of the tidal parameter, we can say whether or not a detected black hole obeys the no-hair theorem.

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