报告三 题目：Probing Spin-Induced Quadrupole Moments in Precessing Compact Binaries

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报 告 摘 要：

Spin-induced quadrupole moments provide an important characterization of compact objects, such as black holes, neutron stars and black hole mimickers inspired by additional fields and/or modified theories of gravity. Black holes in general relativity have a specific spin-induced quadrupole moment, with other objects potentially having differing values. Different values of this quadrupole moment lead to modifications of the spin precession dynamics, and consequently modifications to the inspiral waveform. Based on the spin-dynamics and the associated precessing waveform developed in our previous work, we assess the prospects of measuring spin-induced moments in various black hole, neutron star, and black-hole mimicker binaries. We focus on binaries in which at least one of the objects is in the mass-gap (similar to the 2.6 solar mass object found in GW190814). We find that for generic precessing binaries, the effect of the spin-induced quadrupole moments on the precession is sensitive to the nature of the mass-gap object, i.e., whether it is a light black hole or a massive neutron star. So that this is a good probe of the nature of these objects. For precessing black-hole mimicker binaries, this waveform also provides significantly tighter constraints on their spin-induced quadrupole moments than the previous results obtained without incorporating the precession effects of spin-induced quadrupole moments. We apply the waveform to sample events in GWTC catalogs to obtain better constraints on the spin-induced quadrupole moments, and discuss the measurement prospects for events in the O4 run of LIGO.