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Distinguishing neutron stars from black holes and probing the mass gap with Advanced LIGO/Virgo observations TYSON LITTENBERG, Northwestern Univ, BENJAMIN FARR, University of Chicago, SCOTT COUGHLIN, Cardiff University, VICKY KALOGERA, CIERA/Northwestern University —
As the LIGO and Virgo detectors reach their advanced design sensitivities gravitational wave observations will become an indispensable tool for learning about the universe. The mergers of binary systems comprised of compact stellar remnants (black holes and neutron stars) are expected to be the most abundant sources detectable by ground-based interferometric detectors.Advancing our understanding of binary astrophysics has long been recognized as a primary science objective for LIGO and Virgo.The potential for using GW observations as laboratories to study the nature of binary systems, and the underlying population of compact binaries, has been explored for several decades building the signal processing framework needed for the coming rush of data. We assess LIGO/Virgo's capabilities by taking advantage of modern data analysis methods and waveform models which include spin-precession effects to study a large ensemble of plausible GW sources. From this large-scale parameter estimation investigation we make quantitative predictions for how well LIGO and Virgo will be able to distinguish between black holes and neutron stars; we appraise the prospect of using LIGO/Virgo observations to definitively confirm, or reject, the existence of a "mass gap" between high-mass neutron stars and low-mass black holes; and we demonstrate the importance of including spin precession effects in our model for the gravitational wave signal.

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