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When can gravitational-wave observations distinguish between black holes and neutron stars? DUNCAN BROWN, Syracuse University, MARK HANNAM, STEPHEN FAIRHURST, Cardiff University, CHRIS FRYER, LANL, IAN HARRY, Syracuse University — Gravitational-wave observations of compact binaries have the potential to uncover the distribution of masses and angular momenta of black holes and neutron stars in the universe. The binary's physical parameters can be inferred from their effect on the phasing of the gravitational-wave signal, but a partial degeneracy between the components' mass ratio and their angular momenta limits our ability to measure the individual component masses. At signal to noise ratios likely to be seen by advanced gravitational-wave detectors, we show that it will in many cases be difficult to distinguish whether the components are neutron stars or black holes. We identify when the masses of the binary components could be unambiguously measured outside the range of current observations. However, additional information would be needed to distinguish between a binary containing two 1.35 $M_\odot$ neutron stars and an exotic neutron-star–black-hole binary. We also identify those configurations that could be unambiguously identified as black-hole binaries, and show how the observation of an electromagnetic counterpart to a neutron-star–black-hole binary could be used to constrain the black-hole spin.

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