

Abstract Submitted  
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**Distinguishing between merging black hole binaries, with orientation-dependent emission**<sup>1</sup> RICHARD O'SHAUGHNESSY, University of Wisconsin, Milwaukee, JAMES HEALY, ZACHARY MEEKS, LIONEL LONDON, DEIRDRE SHOEMAKER, Georgia Tech — Merging black hole binaries emit observationally distinguishable signals in each direction, particularly when symmetry breaking (precession and unequal masses) allow the merger to excite many harmonics. Generally, more (linear) basis functions than angular degrees of freedom are needed to describe each binary's signal, to the accuracy gravitational wave detector noise will permit us to distinguish. This challenge persists even in the simplest possible scenario: low-amplitude, short signals from high-mass binaries ( $M > 100M_{\odot}$ ). Despite their brevity and thus minimal opportunity to precess in band, we show that merging binaries' detectable signals are *not* universal, with distinctive features not seen in the the emission of nonprecessing binaries. We describe two examples: (a) the precession of a preferred emission orientation through and after merger and (b) the pairwise overlap of signals sent along different directions. We discuss the implications of significant orientation-dependent emission on gravitational wave astrophysics, including source parameter estimation; models of survey selection bias; and construction of hybrids for generic precessing waveforms.

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