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The gravitational-wave signature of binary black holes in spin-orbit resonances MICHAEL KESDEN, The University of Texas at Dallas, DAVIDE GEROSA, University of Cambridge, EMANUELE BERTI, University of Mississippi, RICHARD O'SHAUGHNESSY, University of Wisconsin - Milwaukee, ULRICH SPERHAKE, University of Cambridge — Mass transfer and tidal alignment during the evolution of their stellar progenitors can induce an asymmetry in the misalignment of binary black-hole spins with the orbital angular momentum. If binaries preferentially form with the the spins of the more massive black hole more (less) aligned with the orbital angular momentum than that of the less massive black hole, the components of the spin in the orbital plane will preferentially align (anti-align) during the gravitational-wave induced inspiral. Once trapped in these spin-orbit resonances, the orbital angular momentum and both spins jointly precess in a common plane during the remainder of the inspiral. We examine the gravitational waves emitted by binary black holes in these resonant configurations, and find that binaries with aligned spin components in the orbital plane can be distinguished by the greater precession of the orbital plane. This precession leaves a distinctive signature in the gravitational waveform which can be identified by ground-based gravitational-wave detectors in sources with sufiecient signal-to-noise ratios.

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