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Distinguishing black-hole spin-orbit resonances via gravitational waves II: Full parameter estimation DANIELE TRIFIRÒ, Università di Pisa, RICHARD O'SHAUGHNESSY, Rochester Institute of Technology, DAVIDE GEROSA, University of Cambridge, EMANUELE BERTI, University of Mississippi, MICHAEL KESDEN, Rochester Institute of Technology, TYSON LITTENBERG, Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA), ULRICH SPERHAKE, University of Cambridge — Gravitational waves can constrain the magnitude and orientation of binary black holes' spins, providing a powerful diagnostic of compact binary formation mechanisms. Post-Newtonian spin evolution has three solutions: librating around two fixed point families ("resonances") or circulating; as binaries inspiral, they become preferentially trapped near the two resonant families. In this work, we infer the properties of a two-parameter family of exactly resonant binaries from their gravitational wave signal by performing full parameter estimation. We show that these measurements reproducibly and correctly identify the neighborhood associated to each resonance, except for highly symmetric configurations, and that resonances can be distinguished for a wide range of binaries. Our results confirm and significantly extend previous results which had assumed almost all source parameters were known, corroborating the hypothesis by Gerosa et al (2013, 2014) that morphologies can be identified from the gravitational wave signal. Finally, motivated by new insight into double spin evolution (Kesden et al, 2014), we present results in coordinates that respect the separation of timescales of the problem.

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