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A generalized precession parameter to interpret gravitational-wave data MATTHEW MOULD, DAVIDE GEROSA, DARIA GANGARDT, PATRICIA SCHMIDT, GERAINT PRATTEN, LUCY THOMAS, University of Birmingham — Current gravitational-wave data analysis of merging binary black holes accounts for two precessing spins, allowing inference of the six spin degrees of freedom. Nonetheless, it is convenient to use effective parameters to interpret detections; the effective aligned spin $\chi_{\rm eff}$ and precessing spin $\chi_{\rm p}$ measure spins parallel and perpendicular to the orbital angular momentum, with measurements away from zero indicating large spins and significant precession, respectively. While $\chi_{\rm eff}$ is conserved during an inspiral, $\chi_{\rm p}$ is not; furthermore, it employs a single-spin approximation that retains some, but not all, precession-timescale variations. To rectify this inconsistency we propose two-spin definitions that either fully consider or fully average those variations. In addition to the previous domain $\chi_{\rm p} \in [0, 1]$, our generalized parameter presents an exclusive region $1 \leq \chi_{\rm p} \leq 2$ accessible only to binaries with two precessing spins. For current LIGO/Virgo events, our generalized parameter indicates that, while (i) previous measurement errors on $\chi_{\rm p}$ may be underestimated, (ii) the evidence for spin precession may be stronger than suggested previously.

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