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A new taxonomy of black-hole binary spin precession in the post-Newtonian regime[1] DARIA GANGARDT, University of Birmingham, NATHAN STEINLE, MICHAEL KESDEN, University of Texas, DAVIDE GEROSA, University of Birmingham — For black holes in binaries, the misalignment of their individual spins and the binary's orbital angular momentum, $\mathbf{L}$, causes the orbital plane to precess. The change of direction of $\mathbf{L}$ induces modulations in the gravitational waveform emitted by the binary. By working in the post-Newtonian regime, where the precession timescale is well-separated from the radiation reaction timescale, we define five new parameters that encapsulate the motion of the orbital angular momentum, $\mathbf{L}$, about the total angular momentum of the system, $\mathbf{J}$. Notably, our parameters separate the motion of $\mathbf{L}$ into its precession and its nutation. We explore the behaviour of our five parameters for isotropic distributions of black hole binaries and review the taxonomy of spin precession using our new framework. One of our results is that the amplitude of nutation is small: the maximum angle between $\mathbf{L}$ and $\mathbf{J}$ across our study is 1.4°. We also find that this angle is largest for binaries with moderate mass ratios ($m_2/m_1 \approx 0.6$, where m_1 (m_2) is the mass of the heavier (lighter) black hole) and maximally spinning black holes.

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