Spin coherence scale: operator-ordering sensitivity beyond Heisenberg-Weyl

Aaron Goldberg

We introduce the spin coherence scale as a measure of quantum coherence for spin systems, generalizing the quadrature coherence scale (QCS) previously defined for quadrature observables. This SU(2)-invariant measure of the noncommutativity of angular momentum operators serves as a witness of nonclassicality. We demonstrate that many hallmark properties of the QCS carry over to the spin setting, including its links to noise susceptibility of a state and implications for metrology. We then generalize the framework to SU(n) systems to outline a Lie-algebraic approach to coherence scale beyond harmonic oscillators.