Resonance conditions for entangled state switching and simulated EPR spectra in a three coupled spin particle model

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Coupled higher-spin centers, such as molecular magnet dimers, are predicted to have useful properties in the context of quantum information science[1]. We further investigate these predictions by modeling a spin ½ particle coupled to two spin *S* particles, and attempt to answer a vital question in conceptualization of a representative device: can an electron prepare, manipulate, and interrogate the entanglement state of two-spin particles? In our theoretical work, we describe entangled state switching resonance conditions for any spin *S* stemming from the interplay of exchange coupling between the spin particles of the system (J) and the magnetic anisotropy of the larger spin particles (D). We also report simulated EPR spectra to fingerprint such a system. We find that magnetic anisotropy in $S_{2,3} \neq 1/2$ models or anisotropy in the exchange coupling enables control of the orientation of a representative Bloch vector in several spin subspaces.

[1] E. D. Switzer, X.-G. Zhang, and T. S. Rahman, Physical Review A 104, 052434 (2021). DOI: 10.1103/PhysRevA.104.052434.