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Quantum Interference in the Longitudinal Oscillations of the Total Spin of a Dimeric Molecular Nanomagnet CHRISTOPHER RAMSEY, ENRIQUE DEL BARCO, University of Central Florida, STEPHEN HILL, University of Florida, SONALI SHAH, CHRISTOPHER BEEDLE, DAVID HENDRICKSON, University of California at San Diego — The synthetic flexibility of molecular magnets allows one to systematically produce samples with desirable properties such as those with entangled spin states for implementation in quantum logic gates. Here we report direct evidence of quantum oscillations of the *total spin length* of a dimeric molecular nanomagnet through the observation of quantum interference associated with tunneling trajectories between states having different spin quantum numbers. As we outline, this is a consequence of the unique characteristics of a molecular Mn_{12} wheel which behaves as a (weak) ferromagnetic exchange-coupled molecular dimer: each half of the molecule acts as a single-molecule magnet (SMM), while the weak coupling between the two halves gives rise to an additional internal spin degree of freedom within the molecule, namely that its total spin may fluctuate. This extra degree of freedom accounts for several magnetization tunneling resonances that cannot be explained within the usual giant spin approximation. More importantly, the observation of quantum interference provides unambiguous evidence for the quantum mechanical superposition involving entangled states of both halves of the wheel.

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