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Quantum Effects in Molecule-Based Nanomagnets

STEPHEN HILL, University of Florida

Research into molecule-based-magnets has made immense strides in recent years, with the discoveries of all organic molecular magnets, room temperature 3D ordered permanent magnets, and single-molecule magnets (SMMs), the latter exhibiting a host of spectacular quantum phenomena; for a review, see ref. [1]. SMMs represent a molecular approach to nanoscale and sub-nanoscale magnetic particles. They offer all of the advantages of molecular chemistry as well as displaying the superparamagnetic properties of mesoscale magnetic particles of much larger dimensions. They also straddle the interface between classical and quantum behavior; for example, they exhibit quantum tunneling of their magnetization. I will give a general introduction to this area of research, followed by an overview of recent results obtained using high-frequency (40-800 GHz) electron paramagnetic resonance techniques developed at the University of Florida. These results include: an elucidation of the role of molecular symmetry in the magnetic quantum tunneling phenomenon [2]; and the observation of quantum entanglement between pairs of nanomagnets within a supramolecular dimer [3].

1. D. Gatteschi and R. Sessoli, Angew. Chem. **42**, 268 (2003).
2. E. del Barco et al., J. Low Temp. Phys. **140**, 119-174 (2005).
3. S. Hill et al., *Science* **302**, 1015 (2003).