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### **Spectroscopic Investigation of the Origin of Magnetic Bistability in Molecular Nanomagnets<sup>1</sup>**

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Molecular nanomagnets (MNM) are coordination complexes consisting of one or more transition metal and/or f-element ions bridged and surrounded by organic ligands. Some of these can be magnetized in a magnetic field, and remain magnetized after the field is switched off. Because of this, MNMs have been proposed for magnetic data storage applications, where up to 1000 times higher data densities than currently possible can be obtained. Other MNMs were shown to display quantum coherence, and, as a consequence, are suitable as quantum bits. Quantum bits are the building blocks of a quantum computer, which will be able to carry out calculations that will never be possible with a conventional computer. The magnetic bistability of MNMs originates from the magnetic anisotropy of the magnetic ions, which creates an energy barrier between up and down orientations of the magnetic moment. Currently, most work in the area focuses on complexes of either lanthanide ions or low-coordinate transition metal ions. Synthetic chemical efforts have led to a large number of novel materials, but the rate of improvement has been slow. Therefore a better understanding of the origin of the magnetic anisotropy is clearly necessary. To this end we have applied a wide range of advanced spectroscopic techniques, ranging from different electron spin resonance techniques at frequencies up to the terahertz domain to optical techniques, including luminescence and magnetic circular dichroism spectroscopy. We will discuss two examples, one from the area of lanthanide MNMs [1], one a transition metal MNM (unpublished). [1] . Rechkemmer, J.E. Fischer, R. Marx, M. Dörfel, P. Neugebauer, S. Horvath, M. Gysler, T. Brock-Nannestad, W. Frey, M.F. Reid, J. van Slageren\*, "Comprehensive Spectroscopic Determination of the Crystal Field Splitting in an Erbium Single-Ion Magnet", J. Am. Chem. Soc., 137, 13114–13120 (2015).

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