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Quantum Levels Spectroscopy of Magnetic Molecules Using Tunnel-diode Resonator STEVEN YENINAS, CATALIN MARTIN, MARSHALL LUBAN, RUSLAN PROZOROV, Iowa State University/Ames Laboratory, LARRY ENGELHARDT, Francis Marion University, MICHAEL BAKER, GRIGORE TIMCO, FLORIANA TUNA, RICHARD WINPENNY, University of Manchester — Many magnetic molecules form crystals in which intermolecular interactions can be ignored and at suitably low temperatures the description of these finite – spin systems can be reduced to the analysis of a discrete spectrum of quantum energy levels within an individual molecule. By applying external magnetic field one can access information about low-lying energy levels that cross due to Zeeman splitting. Conventional experimental techniques are only sensitive to the ground state level crossings. Tunnel-diode resonator is a radio-frequency technique to measure the differential magnetic susceptibility in the millikelvin range and in high static external field. Having 1 ppb sensitivity, it can probe the magnetic energy spectrum in both the ground state and low-lying excited states. As a successful example, the TDR technique has recently been used to investigate the magnetic molecules $Cr_{12}Cu_2$ and $Cr_{10}Cu_2$. When compared with theoretical quantum Monte Carlo (QMC) simulations, we find the TDR results to be in extraordinary agreement with the predicted energy spectrum. This shows that the TDR technique is a unique and powerful spectroscopic tool for studies of magnetic molecules.

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