Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Enhancement of spin relaxation times by dilution and by an avoided crossing in the molecular nanomagnet Cr_7Mn[1] C.A. COLLETT, Department of Physics and Astronomy, Amherst College, Amherst, MA, USA, G.A. TIMCO, R.E.P. WINPENNY, School of Chemistry, The University of Manchester, Manchester, UK, J.R. FRIEDMAN, Department of Physics and Astronomy, Amherst College, Amherst, MA, USA — We report an increase in the spin relaxation times of dilute samples of the spin $S = 1$ molecular nanomagnet $[(CH_3)_2NH_2][Cr_7MnF_8((CH_3)_3CCOO)_{16}]$ ("Cr_7Mn") in the vicinity of an avoided crossing. We study both 100% and dilute samples, with the dilution achieved by co-crystallizing Cr_7Mn with Ga_7Zn, a diamagnetic isostructural analogue. We perform parallel-mode electron-spin resonance (ESR) spectroscopy using a loop-gap resonator (LGR), allowing us to probe the zero-field avoided crossing. With the resonant frequency of the LGR tuned to the tunnel splitting of Cr_7Mn, ~ 4 GHz, we observe an ESR peak centered at zero field. We measure the saturation of that peak with pulsed ESR experiments in a pump-probe configuration, and find that T_1 increases from ~ 450 ns for a non-dilute sample to ~ 15 μs for a 10% dilute sample. The dramatic effect that dilution has on the measured T_1 value indicates that there is substantial spin diffusion taking place. We can estimate T_2^* from the saturation data and T_1 values and find it to be ~ 20 ns and largely independent of dilution. The results of spin-echo experiments to measure T_2, currently in progress, will also be discussed.

[1]NSF Grant DMR-1310135

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Date submitted: 11 Nov 2016 Electronic form version 1.4