Abstract Submitted
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Giant magnetic anisotropy and quantum tunneling of the magnetization in $Li_2(Li_{1-x}Fe_x)N$[1] ANTON JESCHE, R. WILLIAM MCCALLUM, SRINIVASA THIMMAIAH, JENEE L JACOBS, VALENTIN TAUFOUR, ANDREAS KREYSSIG, ROBERT S. HOUK, SERGEY L. BUD'KO, PAUL C. CANFIELD, The Ames Laboratory, Iowa State University, Ames, USA — The magnetic anisotropy of $3d$ transition metals is usually considered to be weak, mainly due to the widely known paradigm of orbital quenching. However, a rare interplay of crystal electric field effects and spin-orbit coupling causes a large orbital contribution to the magnetic moment of iron in $Li_2(Li_{1-x}Fe_x)N$. This leads, not only to large magnetic moments of $\sim 5\,\mu_B$ per iron atom but, also, to an enormous magnetic anisotropy field that extrapolates to more than 200 Tesla. Magnetic hysteresis emerges for $T \leq 50\,K$ and the coercivity fields of more than 11 Tesla exceed even the hardest $4f$ electron based ferromagnets. $Li_2(Li_{1-x}Fe_x)N$ not only has a clear and remarkable anisotropy, generally not associated with iron moments, but also shows time-dependence more consistent with molecular magnets. In particular for low iron concentrations $x \ll 1$ the spin-inversion is dominated by a macroscopic tunneling process rather than by thermal excitations. It is shown that the huge magnetic anisotropy makes $Li_2(Li_{1-x}Fe_x)N$ (i) an ideal model system to study macroscopic quantum effects at elevated temperatures and (ii) a basis for novel magnetic functional materials.

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