Slow Dynamics in Ordered Fe-Oxalates Kagome Antiferromagnets

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When induced by the topology of the lattice, magnetic frustration is expected to produce new ground states, characterized for instance by a 120° spin arrangements on each triangle of a classical kagome lattice with antiferromagnetic interactions. These ground states are associated to remarkable excitations, such as deconfined magnetic monopoles in dipolar spin-ices yielding slow dynamics. We have studied a new quaternary oxalate family $Na_2Ba_3[Fe_3^{II}(C_2O_4)_6]X$ with $X=[A^{IV}(C_2O_4)_3]$ where $A^{IV} = Sn^{IV}$, Zr^{IV} or $X = [Fe^{III}(C_2O_4)_2(H_2O)_2]_{0.5}$ in which the Fe^{II} ions, which are the only in-plane magnetic moment carriers, form a lattice with the kagome connectivity. Neutron diffraction measurements provide evidence for the onset of a 120° type of magnetic ordering below 3 K. The magnetic behavior, in particular a field-induced magnetization plateau, is well described by a strong multiaxial single-ion anisotropy, larger than the nearest-neighbor exchange interactions, and by weaker dipolar interactions. This new hierarchy of interactions on a kagome lattice produces in the ordered phase a remarkable slow dynamics as observed by AC susceptibility measurements. It is associated with strings of spins along the magnetic domain walls, with a first regime of single spin-flips enabled by the low lattice connectivity, evolving towards a cooperative behavior at lower temperature proposed to be due to the onset of dipolar interactions.