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Superexchange-driven Magnetoelectricity in Magnetic Vortices

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We demonstrate that spins in topologically frustrated antiferromagnetic systems can form periodic arrays of magnetic vortices with symmetry allowing for a linear magnetoelectric response. Realization of this magnetic structure can be provided by transition-metal oxides with a layered Kagomé lattice. In such systems, an appropriately structured lattice leads to a microscopic coupling between spins and polar lattice distortions via Anderson superexchange, which has the potential to provide a large magnetoelectric response. In order to quantitatively probe the strength of the magnetoelectric coupling, we have performed density functional theory calculations in the presence of an applied electric field (using linear response) for hexagonal manganites. We demonstrate that the coupling is large and summarize the challenges for achieving such a response in real materials.