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Electric field control of magnetic chiralities in ferroaxial multiferroic $RbFe(MoO_4)_2$[1] ALEXANDER J. HEARMON, FEDERICA FABRIZI, Clarendon Laboratory, Department of Physics, Oxford University, UK, LAURENT C. CHAPON, Institut Laue Langevin, Grenoble, France, ROGER JOHNSON, Clarendon Laboratory, Department of Physics, Oxford University, UK, P. JANE BROWN, Institut Laue Langevin, Grenoble, France, PAOLO G. RADAELLI, Clarendon Laboratory, Department of Physics, Oxford University — The onset of ferroelectric polarisation in high symmetry, proper-screw type multiferroic materials cannot be explained in terms of conventional microscopic mechanisms or symmetry analysis since the direction of the magnetic propagation vector is orthogonal to the plane of the spins. $RbFe(MoO_4)_2$undergoes a structural distortion at $T_c = 190$ K in which the oxygen tetrahedra rotate, imposing an "axiality" to the crystal structure. We show that a simple symmetric-exchange driven coupling of this axiality with the magnetic chiralities below $T_N = 4$ K explains the appearance of a ferroelectric polarisation parallel to both the axial vector and direction of magnetic propagation. We present spherical neutron polarimetry data that are sensitive to both helical and triangular chiral domains of the magnetic structure. We are able to distinguish the magnetic order in the two axial domains that are present in equal proportions, and to demonstrate direct control of the magnetic structure by an applied electric field. The above formalism may be readily generalised to other 'ferroaxial' systems in which the magnetic ordering breaks the inversion symmetry in a point group supporting an axial vector.

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