Contribution ID: **167** Type: **invited talk**

Electric field control of skyrmions in the chiral-cubic insulator Cu2OSeO3

Wednesday 18 September 2013 17:00 (30 minutes)

Skyrmions are topologically protected magnetic spin vortices that form a hexagonal 2D lattice arrangement in non-centrosymmetric magnets. Until last year, skyrmions had been observed only in metallic and semi-conducting chiral-cubic B20 compounds where, in MnSi in particular, it was shown that skyrmions can also be manipulated by conduction electrons. The recent discovery of a skyrmion lattice (SkL) phase in the chiral-cubic insulator Cu2OSeO3
has generated excitement since it evidences skyrmion formation as a more general phenomenon to be expected in non-centrosymmetric systems. Since Cu2OSeO3 furthermore displays a magnetoelectric coupling, an important open question was to learn how and if the skyrmion lattice can be manipulated by applied electric fields. We report small-angle neutron scattering experiments that demonstrate the successful manipulation of skyrmions by applied electric fields in insulating Cu2OseO3. In an experimental geometry with µ0H||[1-10] and E||[111], we discover that the effect of applying an electric field is to controllably rotate the SkL around the magnetic field axis in a manner dependent on both the size and sign of the electric field. Our results provide the first evidence for a new manifestation of the electric field control of magnetism in insulators, and also show the electric field to be a new experimental parameter for studying the basic physics of skyrmions in chiral-cubic lattices.

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Session Classification: Plenary session