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Observation of Skyrmions in a Multiferroic Material

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Magnetic skyrmion is a topologically stable particle-like object, which appears as nanometer-scale vortex-like spin texture in a chiral-lattice magnet [1]. In metallic materials (MnSi, FeGe, $Fe_{1-x}Co_xSi$ etc), electrons moving through skyrmion spin texture gain a nontrivial quantum Berry phase, which provides topological force to the underlying spin texture and enables the current-induced manipulation of magnetic skyrmion [2]. Such electric controllability, in addition to the particle-like nature, is a promising advantage for potential spintronic device applications. Recently, we newly discovered that skyrmions appear also in an insulating chiral-lattice magnet Cu_2OSeO_3 [3,4]. We find that the skyrmions in insulator can magnetically induce electric polarization through the relativistic spin-orbit interaction, which implies possible manipulation of the skyrmion by external electric field without loss of joule heating [5]. The present finding of multiferroic skyrmion may pave a new route toward the engineering of novel magnetoelectric devices with high energy efficiency. In this talk, the latest experimental and theoretical results on the dynamical aspect of magnetoelectric skyrmions will also be discussed.

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[5] S. Seki et al., Phys. Rev. B **86**, 060403(R) (2012).