

701st ASRC Seminar

Date: Monday, January 15, 13:30 ~ 15:00

Location: Room 302, ASRC bldg.

Speaker: Professor Evgeny Y. Tsymbal
(University of Nebraska-Lincoln, USA)

Title: Reversible spin texture in ferroelectric oxides

Abstract: Spin-orbit coupling is known to be responsible for non-trivial spin configurations and a number of emergent physical phenomena. Ferroelectric materials are especially interesting in this regard due to their reversible spontaneous polarization, which allows for a non-volatile electrical control of the spin degrees of freedom. Here, using density-functional theory calculations, we explore two classes of ferroelectric oxide materials, which belong to non-symmorphic space-group symmetry. First, we consider a technologically relevant oxide material, HfO_2 , which is known to be ferroelectric in a non-centrosymmetric orthorhombic phase. We show that HfO_2 exhibits chiral spin textures driven by spin-orbit coupling, and argue that this material can be used as a tunnel barrier to produce tunnelling anomalous and spin Hall effects that are reversible by ferroelectric polarization. Another example involves a class of materials capable to maintain a persistent spin texture. This property has been predicted to support an extraordinarily long spin lifetime of carriers promising for spintronics applications. We show that the persistent spin texture can be enforced by non-symmorphic space-group symmetry of the crystal and illustrate this behaviour using wide band gap semiconductor BiInO_3 . Our results broaden the range of materials, which may be employed in spintronics.

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