

You are cordially invited to our:  
**Department Seminar**

- Topic:** Reversible spin texture in ferroelectric oxides
- Speaker:** Prof. Evgeny Y. Tsymbal
- Date:** Wednesday, 20 February 2019
- Time:** 10am to 12nn
- Venue:** T-Lab Building Level 5 Seminar Rooms, 5A Engineering Drive 1  
(map of NUS can be found at <http://map.nus.edu.sg/>)
- Host:** A/Prof. Jingsheng Chen

### 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,  $\text{HfO}_2$ , which is known to be ferroelectric in a non-centrosymmetric orthorhombic phase. We show that  $\text{HfO}_2$  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  $\text{BiInO}_3$ . Our results broaden the range of materials, which may be employed in spintronics.

### About the Speaker



Evgeny Tsymbal is a George Holmes University Distinguished Professor at Department of Physics and Astronomy of the University of Nebraska-Lincoln (UNL) and Director of the NSF-funded Materials Research Science and Engineering Center (MRSEC). He joined UNL in 2002 as an Associate Professor, was promoted to a Full Professor with Tenure in 2005 and was named Charles Bessey Professor in 2009 and George Holmes University Distinguished Professor in 2013.

Prior to his appointment at UNL he was a senior research scientist at University of Oxford, UK, a research fellow of the Alexander von Humboldt Foundation at the Research Center-Jülich, Germany, and a research scientist at the Russian Research Center “Kurchatov Institute” in Moscow. Evgeny Tsymbal is a fellow of the American Physical Society and a fellow of the Institute of Physics, UK.

**Admission is free. All are welcome to attend.**