Emergent Spin-Related Phenomena in the $Fe_{5-x}GeTe_2$ across a Wide Temperature Range

Sanghoon Kim*

University of Ulsan, Korea

In this presentation, microscopic structures and magnetic properties of the $Fe_{5-x}GeTe_2$ single crystal, recently discovered as a promising van der Waals (vdW) ferromagnet, are introduced. This study demonstrates that the √3 × √3 superstructures have two different phases due to the symmetry of Fe(1) ordering. Intriguingly, the observed √3 × √3 ordering breaks the inversion symmetry of the crystal, resulting in substantial antisymmetric exchange interaction. The temperature dependence of its magnetization reveals a sharp magnetic anomaly suggesting helical magnetism of the $Fe_{5-x}GeTe_2$ due to its non-centrosymmetricity. Analytical study also supports that the observed ordering can give rise to helimagnetism.

I will also introduce a new way of the magnetization control of the vdW magnets via the electrical control of the interlayer coupling from ferromagnetic (FM)-to-antiferromagnetic (AFM). The current-induced phase transition results in drastically enhanced magnetoresistance from 5% to 170% with current in-plane geometry. This observation is fundamentally different from other conventional ways such as spin torque effects and gate voltage effects.

This study will provide essential information to understand the complex magnetic properties and the origin of the new vdW ferromagnet, $Fe_{5-x}GeTe_2$ for future topology-based spin devices.

*Corresponding author	Sanghoon Kim
Affiliation	University of Ulsan
E-mail address	sanghoon.kim@ulsan.ac.kr