7th International Workshop on 2D Materials

Title of the Presentation: Generation and control of Berry curvature dipole in 2D honeycomb lattices

First Name: Jieun

Last Name: Lee

Affiliation: Department of Physics and Astronomy, Seoul National University, Seoul, Korea

Email: lee.jieun@snu.ac.kr

Short Biography:

Jieun Lee is an Assistant Professor of Physics at Seoul National University. She obtained B.S. and M.S. in Physics from Pohang University of Science and Technology (POSTECH) in 2007 and 2009, respectively, and Ph.D. in Physics from the University of Michigan in 2014. From 2014 to 2016, she worked as a Postdoctoral Associate at the Pennsylvania State University and then joined Ajou University in Korea as an Assistant Professor in 2016. From 2020, she started her position as an Assistant Professor of Physics at Seoul National University. Dr. Lee received the POSCO Science Fellowship awarded for Young Principle Investigators in 2019. Her research interests include spin/valley properties of 2D materials, quantum information science, and integrated nanophotonics.

Abstract:

Berry curvature is a physical quantity intrinsic in some periodic crystals which can give rise to many interesting physical phenomena in solid-state materials. Two-dimensional (2D) transition metal dichalcogenides such as MoS_2 have non-trivial Berry curvatures at the edges of the conduction band at K and K' valleys. This feature leads to many interesting valley-dependent phenomena such as the valley optical selection rule and the valley Hall effect [1]. In this talk, we show that by further applying strain to monolayer MoS_2 and breaking the 3-fold rotational symmetry of the crystal, the dipole moment of the Berry curvature emerges, which enlarges the scope of the Berry curvature effects. In particular, by applying an electric field in the direction parallel to the Berry curvature dipole, we found the generation of the valley orbital magnetization on the entire channel of the sample, which is detected by the scanning Kerr rotation microscopy [2]. By incorporating flexible monolayer MoS_2 transistor devices with tunable strain, we measured the valley orbital magnetization that depends on the magnitude and direction of strain, which is fully understood by the Berry curvature dipole effect [3]. We will also discuss the dependence of the valley magnetization on electric field, crystal orientation and doping densities.

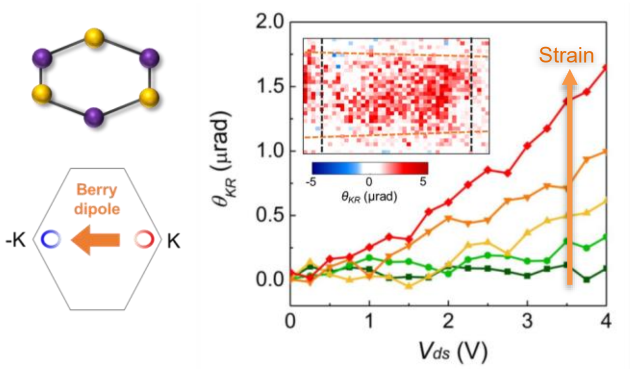

Fig. 1. Strain-induced Berry curvature dipole

[1]J. Lee et al., Nat. Nanotech. 11, 421 (2016).
[2]J. Lee et al., Nat. Mater. 16, 887 (2017).
[3]J. Son et al., Phys. Rev. Lett. 123, 036806 (2019).