1 & 2DM Conference and Exhibition
January 29-30, 2019

**J.D. Lee***
Youngjae Kim
Department of Emerging Materials Science, DGIST, Daegu 42988, Korea

*jdlee@dgist.ac.kr

# Creation and manipulation of valley magnetic domain toward valleytronic current processing

First-principles density functional theory provides significant insights into an interplay between an applied strain and the Berry curvature reconstruction in the uniaxially strained monolayer $MoS_2$, which leads to the unbalanced Berry curvatures centered at **K** and **–K** points and eventually the homogeneous valley ferromagnetism, i.e., valley magnetic domain (VMD) under an external static electric field. This is the valley Edelstein effect (VEE) to explain a recent experimental observation of the strain-induced valley magnetoelectricity [1]. Here we demonstrate (i) the migration of VMD (i.e., domain wall moving) and (ii) the inversion of VMD (i.e., domain switching) in terms of controlling a strain streangth and an external electric field direction, respectively. We further extensively investigate the electric current responses depending on those various manipulations of VMD and suggest relevant potential applications. It is proposed that the VMD manipulation should be a key ingredient of valleytronic realization and application.

## References

[1] Lee, J.; Wang, Z.; Xie, H.; Mak, K. F.; Shan, J. Valley magnetoelectricity in single-layer $MoS_2$. *Nat. Mater.* **2017,** 16, 887–891.

## Figures

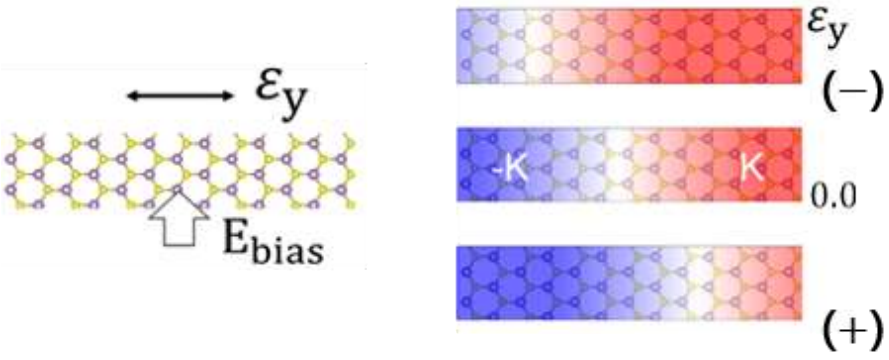


**Figure 1:** Strain-induced valley magnetic domain in monolayer $MoS_2$ under an external electric field ($E_{bias}$)