University of Victoria
Centre for Advanced Materials & Related Technology

CAMTEC SEMINAR

TITLE: ***Optical control of valley pseduospin in 2D semiconductors***

SPEAKER: **Dr. Ziliang Ye**
University of British Columbia

DATE: February 19, 2020

TIME: 2:00 – 3:00 pm

LOCATION: EOW 430

Abstract: Valley polarization associated with the occupancy in energy degenerate but quantum mechanically distinct valleys in the momentum space resembles spin polarization in many regards, including the valley magnetic moment, optical selection rule, and valley hall effect. Monolayer transition metal dichalcogenides (TMDs) with broken inversion symmetry can host robust valley polarization and therefore become an important platform for studying valley related physics. We demonstrated that the valley polarization in the TMD can not only be initialized and measured but also be manipulated coherently by light. [1] Ultrafast valley pseudospin rotation was achieved by leveraging the intense electric field in the fs laser pulse. Both the direction and speed of rotation can be controlled by fine-tuning the dynamic phase difference between the exciton wavefunction in opposite valleys. The pseudospin rotation was reflected in the shift of the photoluminescence polarization direction. By varying the time delay between the excitation and control pulses, we were able to directly probe the lifetime of the intervalley coherence in monolayer WSe2. In addition, I will discuss how the lifetime of TMD excitons can be significantly improved by the hexagonal boron nitride encapsulation, which allows us to observe both neutral and charged biexciton species with non-trivial spin-valley configurations. [2]

[1] Z. Ye, D. Sun, T. F. Heinz, Nature physics, 13 26 (2017)
[2] Z. Ye, et al., Nature communications, 9 3718 (2018)

Bio: Ziliang Ye got his physics bachelor at Fudan University and PhD at UC Berkeley with Prof. Xiang Zhang. Since 2014, he was a postdoc with Prof. Tony Heinz at Columbia University, and later moved with the group to Stanford University, department of applied physics. In December 2017, he joined the physics and astronomy department in UBC as an assistant professor, where he also holds a tier II Canada research chair and is a member of Stewart Blusson Quantum Matter Institute. His research interest includes ultrafast optical spectroscopy, nearfield optics, and nanophotonic devices, with an emphasis on two-dimensional van der Waals materials such as graphene and transition metal dichalcogenides.

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