MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

Wednesday, March 8, 2017
4:10 – 5:00 PM
Barnard/EPS 103

Exploring the exciton landscape of 2D atomically thin semiconductors in energy, space and time

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Abstract:

Transition metal dichalcogenide semiconductors such as monolayer MoS_2 are atomically thin direct band gap semiconductors which host a compelling combination of crystalline order and tightly bound exciton complexes with intense light-matter interactions. While it is tempting to assume that these exciton states are analogous to excitons in conventional two-dimensional quantum wells, the atomically thin width, tunable many-body interactions and intricate band structure of monolayer MoS_2 combine to produce a unique collection of unanticipated phenomena that defy such simplifications. Exploiting their strong light-matter interactions, my research has been focused on exploring and developing a better understanding of this rich suite of photoexcitations through a broad arsenal of near-field and conventional optical microscopy and spectroscopy tools. Identified phenomena from these studies such as efficient broadband coupling, large renormalization of excitation energies and tunable relaxation dynamics set the stage for incorporating monolayer MoS_2 into model optoelectronic systems where strong optical interactions and precise control of energy transport are paramount. At microscopic to nanometer length scales, a striking diversity of photophysical behavior and distinct optoelectronic regions such as disordered peripheral edges, nanoscale charge puddles and defective grain boundaries are found in synthetic monolayer MoS_2. The spatially-dependent behavior — which can be traced to a combination of external stimuli, a complex interplay between excitons and defect states, as well as the temporal dynamics of the growth process — highlights the potential of using two-dimensional transition metal dichalcogenide semiconductors as a canvas in which specific excitonic functionalities can be patterned.

Host: Rufus Cone

****** Refreshments served in the EPS second floor atrium at 3:45 ******

Dr. Borys is a candidate for a Physics Faculty Position