# *Spring 2020 Physics & Astronomy Seminar*

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***Montana State University***

***February 13, 2020***

***4:10-5:00 pm***

***Classroom Building, Room 222***

## *"Excitons in 2D Atomically Thin Semiconductors"*

**Abstract:** Transition metal dichalcogenide semiconductors, such as monolayer $MoS_2$, are an emergent class of ultrathin thin semiconductors that are only three atomic layers thick yet host a rich suite of photophysical phenomena that provides new opportunities ranging from fundamental investigations of many-body physics to the development of new optoelectronic and quantum devices. In these atomically thin semiconductors, the absorption of light creates an "exciton," which is an excited electronic state composed of a negatively charged conduction band electron that is tightly bound to a positively charged valence band hole. Like molecules, excitons govern light-matter interactions such as absorption and emission in 2D semiconductors and are fundamental packets of energy that can be leveraged for next-generation technologies. Using time-resolved and nano-optical spectroscopy techniques to access excitonic physics at extreme length and time scales, a striking diversity of excitonic phenomena has been identified in these 2D materials. Building on previous results, our newest findings in these regimes highlight how exciton populations can be coerced into interacting to form bound states of multiple electrons and holes as well as how strain localizes excitons on length scales that are commensurate with their size. These new results demonstrate the exciting potential of monolayer semiconductors to be utilized for model optoelectronic and quantum devices with unique functionalities derived from 2D excitonic physics.

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