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Van der Waals Engineering of Ferromagnetic Semiconductor Heterostructures for Spin and Valleytronics DING ZHONG, KYLE SEYLER, XIAYU LINPENG, University of Washington, RAN CHENG, NIKHIL SIVADAS, Carnegie Mellon University, BEVIN HUANG, EMMA SCHMIDGALL, University of Washington, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science, Japan, MICHAEL MCGUIRE, Oak Ridge National Laboratory, WANG YAO, University of Hong Kong, DI XIAO, Carnegie Mellon University, KAI-MEI FU, XIAODONG XU, University of Washington — Monolayer transition metal dichalcogenides host easily accessible spin and valley degrees of freedom that can be used to encode and process information. With the advent of van der Waals heterostructures, there are new opportunities to engineer spin and valleytronic devices with more advanced functionalities. In this talk, we will describe a van der Waals heterostructure composed of a monolayer semiconductor, WSe2, and an ultrathin layered ferromagnetic semiconductor, CrI3. The integration of the two materials enables a strong magnetic proximity effect in WSe2 and spin-selective charge transfer from WSe2 to CrI3. Our photoluminescence measurements reveal large valley splitting at zero applied magnetic field, as well as rapid switching of WSe2 valley splitting and polarization within small changes of the applied magnetic field. Moreover, the photoluminescence detection of WSe2 valley pseudospin provides us with a simple yet powerful tool to probe the magnetization dynamics in the ultrathin CrI3.

Ding Zhong
University of Washington

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