Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Band parameters of 2D semiconductor heterostructures determined by micro-ARPES PAUL NGUYEN, Department of Physics, University of Washington, NEIL WILSON, Department of Physics, University of Warwick, PASQUAL RIVERA, KYLE SEYLER, Department of Physics, University of Washington, ALEXEY BARINOV, Sincrotrone Elettra Trieste, GEETHA BALAKRISHNAN, Department of Physics, University of Warwick, XIAODONG XU, DAVID COBDEN, Department of Physics, University of Washington — Heterostructures made by stacking monolayers of different 2D materials can have unique properties, such as hosting long-lived polarized interlayer excitons. Understanding these depends on knowledge of the band parameters of both the separate monolayers and the hetero-bilayer. Interlayer hybridization can also produce distinct electronic structure dependent on the relative monolayer crystal orientation. The most powerful technique for determining such properties is angle-resolved photoemission (ARPES), which can now be applied to micron-scale samples at the Spectromicroscopy Elettra Trieste beamline. Using this new facility, combined with careful sample design, we have studied heterostructures of WSe2, MoSe2, WS2 and graphene. We determined band offsets, effective masses, and spin-orbit splittings with an energy resolution <50 meV. Interestingly, the bands near the gamma-point in hetero-bilayers oriented near zero degrees are not a superposition of those in the isolated monolayers, but exhibit an additional higher band. However, the valence band edge remains at the K-point, which together with the band offsets is consistent with measurements of strong luminescence from interlayer excitons in MoSe2/WSe2.

Paul Nguyen
Department of Physics, University of Washington

Date submitted: 06 Nov 2015 Electronic form version 1.4