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Enhanced mobility electrons at the monolayer / multilayer MoS_2 homo-interface[1] Y. JIA, E.J. LENFERINK, T. STANEV, N.P. STERN, Department of Physics and Astronomy, Northwestern University, Evanston, IL, US 60208
— Energy band alignment at interface of heterostructures can give rise to non-trivial local electronic structure and charge states with low dimensionality. In transition metal dichalcogenides (TMDCs), the optical band gap depends on the number of 2D crystal layers, transitioning from 1.29 eV in bulk to 1.88 eV for a monolayer of MoS_2, for example, and providing the possibility to create unusual charge state at the monolayer/multilayer homo-interface. Here, we examine the boundaries between MoS_2 monolayers and multilayers using scanning photocurrent microscopy and gate-dependent transport. Enhanced photocurrent and conductance were observed at the 1D homo-interface, which can be explained as accumulated carriers in the bent-band region of the junction. Our heterojunction modeling suggests a high local carrier density and enhanced mobility at the homo-interface. Our work presents an opportunity to achieve a 1D electron state in a homojunction and a pathway to break the mobility limit of TMDC monolayer transistors.

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