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Towards valley transistor in MoS2/EuS through interfacial magnetic exchange field PENG WEI, Dept. of Physics, Univ. of California, Riverside, AHMAD ZUBAIR, TOMAS PALACIOS, Electrical Engineering and Computer Science, MIT, JAGADEESH MOODERA, Dept. of Physics and Francis Bitter Magnet Lab, MIT — Intense Zeeman field (ZF) in transitional metal dichalcogenides (TMD) can lift valley degeneracy and give rise to novel transistor devices carrying pure valley polarization. Such ZF has been shown to exist at the interface between 2D materials, for example graphene, and ferromagnetic insulator (FI) EuS due to magnetic proximity effect. Taking this approach, our research work focuses on investigating new valley transistor phenomena in TMD coupled to FI. We have successfully built high quality MoS2/EuS heterostructures and fabricated mesoscopic MoS2/EuS transistors. We found appreciable charge transferring effect that is taking place between EuS and MoS2, which significantly modifies the transistor behavior compared to pristine device. Furthermore, we have achieved ambipolar gating in such devices, and point out to the successful tuning into the hole doped regime. Such conductivity gating demonstrated fine features inside MoS2 band gap that might be associated to the neighboring EuS layer. Our results thus serve to achieve the yet to be reached full-valley-operating nano devices, and will lead to the discovery of unexplored physics phenomena on valley controlled charge and spin transport. Work supported by NSF and ONR grants.

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