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Enhanced Valley Zeeman Splitting in MoS2/EuS due to interfacial exchange field CHUAN ZHAO, THOMAS SCRACE, PAYAM TAHERI, PEIYAO ZHANG, TENZIN NORDEN, BRETT BLIZZARD, ATHOS PETROU, HAO ZENG, Department of Physics, University at Buffalo, SUNY, PUQIN ZHAO, Nanjing Tech University, GEORGE KIOSEOGLOU, University of Crete, Greece — A monolayer transition metal dichalcogenides such as MoS_2 with broken inversion symmetry possesses two degenerate yet inequivalent valleys that can be selectively excited by circularly polarized light. The ability to manipulate valley degrees of freedom with light or external magnetic field makes them attractive for optoelectronic and spintronic applications. On the other hand, it has been demonstrated recently that a magnetic insulator such as EuS can induce magnetic exchange field (MEF) on graphene through proximity effect. Thus, construction of a magnetic insulator/TMDC heterostructure may induce large MEF on TMDC, which may lead to giant valley Zeeman splitting. In this work, we report the observation of valley Zeeman splitting in monolayer MoS_2 and other TMDCs due to the MEF from EuS substrates. Using magneto-reflectivity, we measured a Zeeman splitting of valley exciton of 2 meV at 7 tesla and 4 K, for monolayer MoS_2 on a SiO_2 substrate. This is consistent with values reported in monolayer WSe_2. However, when EuS is used as the substrate, we observed an increase of valley splitting from 2 to 10 meV. We attribute this enhanced valley splitting to the MEF from the EuS substrate. Utilizing MEF of a magnetic insulator can induce magnetic ordering and giant Zeeman splitting in 2D TMDCs, which might enable novel spintronics applications.

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