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Giant and tunable valley degeneracy splitting in $MoTe_2$ XIAO LI, The University of Texas at Austin, JINGSHAN QI, Jiangsu Normal University, QIAN NIU, The University of Texas at Austin, JI FENG, Peking University — Valleys in monolayer transition-metal dichalcogenides seamlessly connect two basic carriers of quantum information, namely, the electron spin and photon helicity. Lifting the valley degeneracy is an attractive route to achieve further optoelectronic manipulations. However, the magnetic field only creates a very small valley splitting. We propose a strategy to create giant valley splitting by the proximity-induced Zeeman effect. Our first principles calculations of monolayer $MoTe_2$ on a EuO substrate show that valley splitting over 300 meV can be generated. Interband transition energies become valley dependent, leading to selective spin-photon coupling by optical frequency tuning. The valley splitting is also continuously tunable by rotating the substrate magnetization. The giant and tunable valley splitting adds a different dimension to the exploration of unique optoelectronic devices based on magneto-optical coupling and magnetoelectric coupling.

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