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Generation and electric control of spin–valley-coupled circular photogalvanic current in WSe_2[1] HONGTAO YUAN, HAROLD Y. HWANG, YI CUI, Stanford University and SIMES SLAC — Compared to the weak spin-orbit-interaction (SOI) in graphene, layered transitionmetal chalcogenides MX_2 have heavy 4d/5d elements with strong atomic SOI, providing a unique way to extend functionalities of novel spintronics and valleytronics devices. Such a valley polarization achieved via valley-selective circular dichroism has been predicted theoretically and demonstrated with optical experiments in MX_2 systems. Despite the exciting progresses, the generation of a valley/spin current by valley polarization in MX_2 remains elusive and a great challenge. A spin/valley current in MX_2 compounds caused by such a valley polarization has never been observed, nor its electric-field control. In this talk, we demonstrated, within an electric-double-layer transistor based on WSe_2, the manipulation of a spin-coupled valley photocurrent whose direction and magnitude depend on the degree of circular polarization of the incident radiation and can be further greatly modulated with an external electric field. Such room temperature generation and electric control of valley/spin photocurrent provides a new property of electrons in MX_2 systems, thereby enabling new degrees of control for quantum-confined spintronics devices. (In collaboration with S.C. Zhang, Y.L. Chen, Z.X. Shen, B Lian, H.J. Zhang, G Xu, Y Xu, B Zhou, X.Q. Wang, B Shen X.F. Fang) Acknowledge the support from DoE, BES, Division of MSE under contract DE-AC02-76SF00515.

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