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Electrical Valley Excitation by Spin Injection in Monolayer Transition Metal Dichalcogenide Heterojunction YU YE, XIAOBO YIN, University of California, Berkeley, HAILONG WANG, Institute of Semiconductors, Chinese Academy of Sciences, ZILIANG YE, HANYU ZHU, YUAN WANG, University of California, Berkeley, JIANHUA ZHAO, Institute of Semiconductors, Chinese Academy of Sciences, XIANG ZHANG, University of California, Berkeley — Embracing the spin degree of freedom of charge carriers enables nonvolatile electronics with increased operation speed and reduced power consumption. Recently discovered atomic materials of monolayer transition metal dichalcogenides (TMDs) possess unbalanced carrier distribution in the momentum space and introduce a new independent valley of freedom. Here we demonstrate experimentally the unique spin and valley locking relationship in TMDs and report a new scheme of electronic devices taking advantages of the both degrees of freedoms. A valley-polarized light-emitting device is achieved experimentally through spin injection using (Ga, Mn)As as a spin aligner. The electrical generation and the control of valley polarization in TMD semiconductors through spin manipulation opens the new dimension in utilizing both spin and valley degrees of freedom for next-generation electronics and computing.

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