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2D Semiconductors for Valley-Polarized LEDs and Photodetectors TING YU, Nanyang Technological University — The recently discovered two-dimensional (2D) semiconductors, such as transitional-metal-dichalcogenide monolayers, have aroused great interest due to the underlying quantum physics and the appealing optoelectronic applications like atomically thin light-emitting diodes (LEDs) and photodetectors. On the one hand, valley-polarized electroluminescence and photocurrent from such monolayers have not caused enough attention but highly demanded as building blocks for the new generation valleytronic applications. On the other hand, most reports on these devices are based on the mechanically exfoliated small samples. Considering real applications, a strategy which could offer mass-product and high compatibility to the current planar processes is greatly demanded. Large-area samples prepared by chemical vapour deposition (CVD) are perfect candidates towards such a goal. Here, we report electrically tunable valley-polarized electroluminescence and the selective spin–valley-coupled photocurrent in optoelectronic devices based on monolayer WS2 and MoS2 grown by CVD, exhibiting large electroluminescence and photocurrent dichroisms of 81% and 60%, respectively. The controllable valley polarization and emission components of the electroluminescence have been realized by varying electrical injection of carriers. For the observed helicity-dependent photocurrent, the circular photogalvanic effect at resonant excitations has been found to take the dominant responsibility.

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