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Optoelectronics with electrically tunable PN diodes in monolayer WSe₂ HUGH CHURCHILL, BRITTON BAUGHER, YAFANG YANG, PABLO JARILLO-HERRERO, Massachusetts Institute of Technology — We describe the transport and optoelectronic behavior of ambipolar monolayer WSe₂ devices in which two local gates are used to define a PN junction exclusively within the sheet of WSe₂. With these electrically tunable PN junctions, we demonstrate both PN and NP diodes with ideality factors better than 2. Under excitation with light, the diodes show photodetection responsivity of 210 mA/W and photovoltaic power generation with a peak external quantum efficiency of 0.2%, promising numbers for a nearly transparent monolayer sheet in a lateral device geometry. Finally, we demonstrate a light-emitting diode based on monolayer WSe₂. These devices provide a fundamental building block for ultra-thin, flexible, and nearly transparent optoelectronic and electronic applications based on ambipolar dichalcogenide materials.

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