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Optically Induced PN Junction Diode and Photovoltaic Response on Ambipolar MoSe2 Field-effect Transistor NIHAR PRADHAN, ZHENGGUANG LU, DANIEL RHODES, National High Magnetic Field Laboratory, Tallahassee, Florida, USA, MAURICIO TERRONES, Department of Physics, Pennsylvania State University, University Park, PA, USA, DMITRY SMIRNOV, LUIS BALICAS, National High Magnetic Field Laboratory, Tallahassee, Florida, USA — Transition metal dichalcogenides (TMDs) have emerged as an attractive material for electronic and optoelectronic devices due to their sizable band gap, flexibility and reduced dimensionality, which makes them promising candidates for applications in translucent optoelectronics components, such as solar cells and light emitting diodes. Here, we present an optically induced diode like response and concomitant photovoltaic effect in few-atomic layers molybdenum diselenide ($MoSe_2$) field-effect transistors. Compared to recently reported PN junctions based on TMDs, ambipolar $MoSe_2$ shows nearly ideal diode rectification under illumination, with a sizable photovoltaic efficiency. The observed light induced diode response under fixed gate voltage, yields a maximum open circuit voltage 0.28V and short circuit current 230nA at 30uW incident laser power. The sense of current rectification can be altered by changing the polarity of the applied gate voltage (V_{bg}). At V_{bg} =0V the highest electrical power obtained is 175pW corresponding to a maximum photovoltaic efficiency of 0.01%. These values increased to 11nW and 0.05% under a V_{bg} =-7.5V. At an excitation voltage 1V we observed maximum photocurrent responsivity surpassing 100mA/W with corresponding external quantum efficiency $\sim$ 30%.

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