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Electrically Tunable Excitonic Light Emitting Diodes based on Monolayer WSe2 p-n Junctions JASON ROSS, univ of washington, PHILIP KLEMENT, Univ of Giessen, AARON JONES, univ of washington, NIRMAL GHIMIRE, JIAQIANG YAN, DAVID MANDRUS, Univ of Tennessee Knoxville, TAKASHI TANIGUCHI, KENJI WATANABE, KENJI KITAMURA, National Institute for Materials Science, WANG YAO, Univ of Hong Kong, DAVID COBDEN, XIAODONG XU, Univ of Washington — Light-emitting diodes (LEDs) are of vital importance for lighting, displays, optical interconnects, logic and sensors. The development of new systems that allow improvements in their efficiency, spectral properties, compactness and integrability could have dramatic ramifications. Monolayer transition metal dichalcogenides have recently emerged as interesting candidates for optoelectronic applications due to their unique optical properties. Electroluminescence (EL) has already been observed from monolayer MoS2 devices. However, the EL efficiency was low and the linewidth broad due both to the poor optical quality of MoS2 and ineffective contacts. In this talk, we present EL from lateral p-n junctions in monolayer WSe2 induced electrostatically using a thin boron nitride dielectric layer with multiple metal gates beneath. This structure allows effective injection of electrons and holes, and combined with the high optical quality of WSe2 it yields bright EL with 1000 times smaller injection current and 10 times smaller linewidth than in MoS2. Further, by increasing the injection bias we can tune the EL between regimes of impurity-bound, charged, and neutral excitons. This system has the required ingredients for new kinds of optoelectronic devices such as spin- and valley-polarized LEDs, on-chip lasers, and two-dimensional electro-optic modulators.

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