Abstract Submitted
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Photocurrent spectroscopy of excitons in ultraclean two-dimensional semiconductors - Part I A.K.M. NEWAZ, A.R. KLOTS, BIN WANG, SOKRATES PANTELIDES, KIRILL BOLOTIN, Department of Physics and Astronomy, Vanderbilt University — The intrinsic properties of a monolayer materials can be perturbed by substrate-related disorder. To decrease the amount of disorder in a representative 2D material, monolayer molybdenum disulfide (MoS_2), we have fabricated suspended field effect devices. Upon suspension, we have observed a tenfold increase in carrier field effect mobility. Further cleaning of suspended devices through thermal annealing renders them nearly insulating at small bias voltages, which is expected for a pristine semiconductor with its Fermi energy in the middle of the bandgap and precludes detailed electrical characterization. To probe the intrinsic properties further, we have conducted photocurrent (PC) spectroscopy measurements. In every measured device, we have observed the following universal features: (i) sharp peaks in PC at $\sim$ 1.9eV and $\sim$ 2.1eV attributable to the optical transitions due to band edge excitons; (ii) a rapid onset of PC above $\sim$ 2.5eV peaked at $\sim$ 2.9eV, which we attribute to an excitonic absorption due to the van Hove singularity of MoS_2.

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