Abstract Submitted
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Exciton diamagnetic shifts and valley Zeeman effect in monolayer WS_2 and MoS_2 to 65Tesla A. V. STIER, NHMFL, Los Alamos, K. A. MCCREARY, B. T. JONKER, Naval Research Laboratory, J. KONO, Rice University, S. A. CROOKER, NHMFL, Los Alamos — We report circularly-polarized optical reflection spectroscopy of monolayer WS_2 and MoS_2 at low temperatures (4 K) and in high magnetic fields to 65 T [1]. Both the A and the B exciton transitions exhibit a clear and very similar Zeeman splitting of approximately -230 μeV/T (g $\simeq$ -4), providing the first measurements of the valley Zeeman effect and associated g-factors in monolayer transition-metal disulphides. These results complement and are compared with recent low-field photoluminescence measurements of valley degeneracy breaking in the monolayer diselenides $MoSe_2$ and WSe_2. Further, the very large magnetic fields used in our studies allows us to observe the small quadratic diamagnetic shifts of the A and B excitons in monolayer WS2 (0.32 and 0.11 $\mu eV/T^2$, respectively), from which we calculate exciton radii of 1.53 nm and 1.16 nm. When analyzed within a model of non-local dielectric screening in monolayer semiconductors, these diamagnetic shifts also constrain and provide estimates of the exciton binding energies (410 meV and 470 meV for the A and B excitons, respectively), further highlighting the utility of high magnetic fields for understanding new 2D materials. [1] A. V. Stier et al., submitted, arxiv:1510.07022 (2015)

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