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Electron density dependent Zeeman splitting in WS_2 single layer
TENZIN NORDEN, PEIYAO ZHANG, THOMAS SCRACE, CHUAN ZHAO, HAO ZENG, ATHOS PETROU, State Univ of NY - Buffalo, IOANNIS PARADISANOS, EMMANUEL STRATAKIS, GEORGE KIOSEOGLOU, University of Crete, MAREK KORKUSINSKI, National Research Council - Canada, MACIEJ BIENIEK, LUDMILA SZULAKOWSKA, PAWEL HAWRYLAK, University of Ottawa — We report an experimental and theoretical study of the magnetic field dependence of the circular polarization P and the Zeeman splitting ΔE_z of the photoluminescence (PL) due to recombination of charged excitons (X^-) formed because excess electrons are present. Results from three WS_2 monolayers are reported. For one sample the circular polarization at $B = 0$ T is finite while P is zero for the other two samples. The slope $\frac{dP}{dB}$ in all samples is similar ($\approx$2.4 % per Tesla). In contrast, the Zeeman splittings are: -0.13 meV/T, -0.30 meV/T and -0.47 meV/T. The experimental results are compared with those from the microscopic tight binding model to evaluate spin, valley and orbital contribution to the Zeeman splitting. The effect of carrier density on ΔE_z is included in a Hartee-Fock picture assuming inhomogeneous carrier distribution. The electron droplets present are divided into spin-valley polarized and spin-valley unpolarized. The spin-valley polarized droplets contribute to Zeeman splitting and are responsible for the carrier density and sample dependent Zeeman splitting in WS_2.

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