Abstract Submitted
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Anomalous temperature dependence of charged exciton photoluminescence polarization in monolayer WS_2[1] A.T. HANBICKI, Naval Research Laboratory, G. KIOSEOGLOU, University of Crete, M. CURRIE, C.S. HELLBERG, A.L. FRIEDMAN, K.M. MCCREARY, B.T. JONKER, Naval Research Laboratory — Monolayer WS_2 is a direct-gap transition metal dichalcogenide semiconductor. Its low-dimensional hexagonal structure leads to two inequivalent K-points in the Brillioun zone. The valley index and spin are intrinsically coupled with spin-dependent selection rules that enable populating and interrogating each valley using circularly polarized light. Here, we probe the degree of circular polarization of the emitted photoluminescence (PL) as function of the photo-excitation energy and temperature to elucidate spin-dependent inter- and intra-valley relaxation mechanisms. Monolayer WS_2 flakes have PL emission from the free and charged exciton near 2.0 eV. We reproducibly isolate these excitons via appropriate sample preparation. With excitation using positive helicity light, we analyze the PL for positive and negative helicities to determine polarization. Unlike MoS_2 [2], we measure significant polarization from the charged exciton for high excitation energies, even at room temperature. There is also an enhancement of polarization of the charged exciton at intermediate temperatures. We discuss the polarization behavior in terms of phonon assisted intervalley scattering processes.

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[2]G. Kioseoglou, et al. *Appl. Phys. Lett.* **101**, 221907 (2012).

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