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Low Temperature Optical Spectroscopy of Excitons and Trions in Monolayer MoS2 CHANGJIAN ZHANG, Cornell.University, HAINING WANG, FARHAN RANA, Cornell University — Monolayer MoS2 is a two-dimensional (2D) semiconductor with optical properties different from conventional inorganic semiconductors. We will present our results on low temperature absorption and photoluminescence (PL) spectroscopy of monolayer MoS2 crystals. As a result of the large carrier effective masses and low dielectric screening in the 2D geometry, the excitons in MoS2 are tightly bound with large binding energies. We find that the prominent peak at $\sim$1.9 eV in both PL and absorption spectra at low temperatures is split in two: an exciton peak and a trion peak. The binding energies of trions, measured relative to the excitons, are extremely large and in the 30-35 meV range. We find that the trion peak acquires more spectral weight than the exciton peak as the electron density increases, and also broadens due to increased scattering with electrons. The temperature dependence of the exciton and trion PL intensities enables us to determine the radiative recombination efficiencies as a function of the temperature. We also observe Stokes shifts of $\sim$5 meV of both exciton and trion peaks, indicative of lattice distortions accompanying the quasiparticles (i.e. polarons) in this highly polar crystal.

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