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Transient Photoluminescence in MoS_2 layered crystals TUNG-WU HSIEH, CHIH-WEI LAI, Michigan State University — We report sub-10-ps transient exciton photoluminescence (PL) in mechanically exfoliated few- and monolayered crystals of MoS_2. We characterize layered crystals with thickness of $\sim 1\mu$m, 100 nm, 10nm, and down to few-layers on SiO2/Si and mica substrates using luminescence and Raman spectroscopy spectroscopy. A frequency shift of ~ 2 cm^{-1} is observed on sub-10-nm-thick samples for the in-plane E^1_{2g} and the out-of-plane A_{1g} Raman modes. The relative intensities of Stokes and Anti-Stokes Raman components are used to determine the lattice temperature under a laser excitation with a spot diameter of 1 μm and an average power 0.5 to 20mW. PL spectra are measured for lattice temperatures from $\sim$70K to 500K. We observe two groups of luminescence emissions with comparable peak intensities centered at 1.85eV (VIS) and 1.35eV for samples of a thickness 1 μm down to 10 nm under a cw laser excitation at a wavelength of 532nm (2.33eV). The VIS luminescence emissions are enhanced under a 2-ps pulsed laser excitation at a wavelength of 633nm (1.96eV). The rise and decay times of the luminescence are found to be less than 5 ps. Our results suggest that excitonic effects play a role in enhancing the luminescence quantum efficiency.

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