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Ultrafast spectroscopy of exciton and exciton dynamics in mono to few layers of WS_2[1] SUDIKSHA KHADKA, SHROUQ ALEITHAN, MAX LIVSHITS, JEFFERY RACK, MARTIN KORDESCH, ERIC STINAFF, Ohio Univ
— 2D materials, beyond Graphene, having a direct band gap in visible spectrum are monolayer of group 6 transitional metal dichalcogenides (MX_2) that have possibile application in optoelectronic devices, photovoltaics and photodetection, molecular sensing, 'valleytronics', and flexible transparent electronics. Tungsten Disulphide (WS_2), one of the MX_2 , has direct band gap of 2.2 eV and a large valley splitting of about 0.4 eV. This leads to the existence of two distinct and direct excitons A and B. Here, we present a detailed study of exciton states and their decay mechanisms in mono and few layer WS_2 using femto-second transient absorption spectroscopy. Originally, this set up was designed for the study of macroscopic samples, so we modified it to perform microscopic FTAS on CVD grown flakes of WS_2. Here, we report a new peak at 3.01 +/- 0.1 eV whose origin in k space is under further investigation. The tri-exponential fitting of decay curve of the exciton A reveals three time components as 1.7+/-0.3 ps, 33.5+/-10 ps and 670+/-15 ps, most likely corresponding to carrier-carrier scattering, carrier-phonon scattering, and radiative relaxation respectively.

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