S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

12th October,2022 **4.00 PM** **ONLINE/ FERMION**

SPEAKER

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TITLE OF THE TALK

DEFECT-INDUCED TRION IN MONOLAYER WS2 AT ROOM TEMPERATURE

ABSTRACT

Remarkably high exciton binding energies (BEs) at room temperature in monolayer transition-metal dichalcogenide, provide opportunities for exploring exotic and stable excitonic many-body effects. These include many-body neutral excitons, trions, biexcitons, and defect-induced excitons at room temperature, rarely realized in bulk materials. Nonetheless, the defect-induced trions correlated with charge screening have never been observed, and the corresponding BEs remain unknown. Here we report defect-induced A-trions and B-trions in monolayer tungsten disulfide (WS2) via carrier screening engineering with photogenerated carrier modulation, external doping, and substrate scattering. Defect-induced trions strongly couple with inherent SiO2 hole traps under high photocarrier densities and become more prominent in rhenium-doped WS2. The absence of defect-induced trion peaks was confirmed using a trap-free hexagonal boron nitride substrate, regardless of power density. Moreover, many-body excitonic charge states and their BEs were compared via carrier screening engineering at room temperature. The highest BE was observed in the defect-induced A-trion state (~214 meV), comparably higher than the other exciton species, and additionally tuned by external photoinduced carrier density control. This investigation permits us to demonstrate defect-induced trion BE localization via spatial BE mapping in the monolayer WS2. [Details attached]

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