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Tailoring the Valley-Polarized Emission of Monolayer TMDs at Room Temperature for Future Quantum Information Technology

Date: **2023/12/18 (Mon)**

Venue: **S4-208**

Time: **11:00-12:00**

Abstract:

Monolayer transition metal dichalcogenides (TMDs) have intrinsic valley degrees of freedom, making them appealing for exploiting valleytronic applications in information storage and processing. WS2 monolayer possesses two inequivalent valleys in the Brillouin zone, each valley coupling selectively with a circular polarization of light. The degree of valley polarization (DVP) under the excitation of circularly polarized light (CPL) is a parameter that determines the purity of valley polarized photoluminescence (PL) of monolayer WS2. In this talk, I will show three methodologies to tailor valley polarization at room temperature (RT) for more suitable and practical applications. First, I will demonstrate large circular polarizations of our monolayer CVD-grown h-WS2 single crystals via defect engineering under off-resonant illumination at RT. In the second part of my talk, I will present that ultra-compact plasmonic Archimedes spiral (PAS) nanostructures can enhance the light matter interaction via surface plasmon to efficiently tailor the valley-polarized PL of monolayer WS2 at RT. In the end, I will show new strategies to efficiently tailor the valley-polarized PL from semiconducting monolayer 1H-WTe2xS2(1-x) at RT through chemical and electrostatic doping. The methodologies describe in this talk provide a promising platform to manipulate the valley degrees of freedom in TMDs efficiently at RT, paving ways for future applications of opto-valleytronic/spintronic devices based on these 2D materials.