MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, October 10 2024 at 11:00
Online: https://technion.zoom.us/j/99136548029

Spin-Valley Atomically Thin Semiconductor Rashba Lasers

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Direct-bandgap transition metal dichalcogenide (TMD) monolayers are appealing candidates to construct atomic-scale spin-optical light sources owing to their unique valley-contrasting optical selection rules. Here, the photonic Rashba effect is manifested as a spin-split dispersion in momentum space, which provides the opportunity to manipulate the valley degree of freedom. Previously, we achieved an incoherent photonic Rashba-type spin-split emission with peculiarities of spatial separation of the valley degree of freedom [1]. Recently, we further demonstrated a coherent classical spin-qubit Rashba laser with inherent phase correlations between the two valley pseudo-spins [2]. We also demonstrated a room-temperature valley-addressable Rashba monolayer laser in which the spin-symmetry breaking is realized in the absence of the magnetic field [3]. Our work provides a platform to further explore the atomic-scale spin optics, and it can also be an example to stimulate the development of more spin-optical devices utilizing the valley degree of freedom in the TMD monolayers.

[1] K. Rong, B. Wang, A. Reuven, E. Maguid, B. Cohn, V. Kleiner, S. Katznelson, E. Koren, E. Hasman, Photonic Rashba effect from quantum emitters mediated by a Berry-phase defective photonic crystal. *Nat. Nanotechnol.* **15**, 927–933 (2020).
[2] K. Rong, X. Duan, B. Wang, D. Reichenberg, A. Cohen, C. Liu, P. K. Mohapatra, A. Patsha, V. Gorovoy, S. Mukherjee, V. Kleiner, A. Ismach, E. Koren and E. Hasman, Spin-valley Rashba monolayer laser, *Nat. Mater.* **22**, 1085–1093 (2023).
[3] X. Duan, B. Wang, K. Rong, C. Liu, V. Gorovoy, S. Mukherjee, V. Kleiner, E. Koren and E. Hasman, Valley-addressable monolayer lasing through spin-controlled Berry phase photonic cavities, *Science* **381**, 1429–1432 (2023).

Note: the seminar will be given in English