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# Graphene under Ultrafast LASER

: An avenue for Quantum Technologies

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日 時: 2023年3月6日(月) 14:00~15:30

場 所: 工学部3号館4階439号室(34講義室) (事前登録制)

**【概要】** Analogues to spin, electrons in graphene endow an additional quantum attribute: valley pseudospin, which is associated with the two degenerate valleys in the energy landscape of graphene. Similar to 0 and 1, two valleys can be seen as two units of operations. Not only that, operations in between the two units, i.e., the superposition of 1 and 0, can also be realised using two valleys. Thus, these valleys have potential to encode, process, and store quantum information at room temperature – A holy grail for quantum computing.

In this talk, I will discuss how valley-selective excitation in graphene with zero bandgap can be achieved by an all-optical means. Ultrashort laser pulses are employed to obtain a desired control over valley polarisation. By tailoring the waveforms of the laser pulses to the symmetry of the graphene's sub-lattice, first I will demonstrate that it is possible to induce and read valley polarization in graphene – a medium where light-driven valleytronics was thought to be impossible. In the later part of this talk, I will show a coherent protocol to initiate valley-selective excitation, de-excitation and switch the excitation to another valley within tens of femtoseconds. Coherent switching of electronic excitation from one valley to another on a timescale faster than the valley decoherence is quintessential for valleytronics-based emerging quantum technologies at ambient conditions.

[1] M. S. Mrudul *et al.*, **Optica** 8, 422 (2021).

[2] M. S. Mrudul and G. Dixit, **J. Phys. B** 54, 224001 (2021). (Invited article for Emerging Leader 2021).

[3] N. Rana, M. S. Mrudul and G. Dixit, **Physical Review Applied** 18, 064049 (2022).

[4] N. Rana and G. Dixit (Under review).

使用言語 : English / 英語

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