Seminar

Ultrafast control of quantum materials with terahertz-frequency light

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Time: 15:00pm, September 06, 2023 (Wednesday)

时间： 2023年9月6日 （周三） 下午 15:00

Venue : Room W563, Physics Building, Peking University

地点： 北京大学物理楼 西563

Abstract

A considerable portion of quantum mechanics' potency is obscured in thermal equilibrium. Diverse realms rely on creating quantum phases far from equilibrium, such as quantized particles and many-body systems with applications in quantum information processing and storage. Ultrafast terahertz-frequency (THz) laser pulses offer an enticing capability to achieve nonequilibrium phases dictated by collective quantum effects as their timescales are commensurate with nanoscopic dynamics of electrons, spins, lattice ions, etc. In this talk, I will show that THz-frequency pulses can control the universal photoluminescence blinking in single quantum dots [1,2], which remains an ongoing challenge despite two decades of research. Then, I will present a novel nonresonant excitation approach for selective phase controls, exemplified by ferroelectric reversal in $LiNbO_3$ and polymorphic transition in SnSe and $MoTe_2$ intertwined with nontrivial band topology [3,4]. Finally, I will illustrate how the fundamental comprehension of THz-matter interaction can be leveraged to design a nanophotonic device for polarization-sensitive THz imaging [5].

[1] Shi, J. *et al. Nat. Nanotechnol.* 16, 1355 (2021).
[2] Shi, J. *et al. Nano. Lett.* 22, 1718 (2022).
[3] Shi, J. *et al. Nat. Commun.*, in press. *arXiv*: 1910.13609 (2023).
[4] Shi, J. *et al. Nat. Phys.*, under review.
[5] Shi, J. *et al. Nat. Nanotechnol.* 17, 1288 (2022).

About the Speaker

Jiaojian Shi earned his B.S. in physics from Peking University. He obtained his Ph.D. degree in physical chemistry from Massachusetts Institute of Technology under the supervision of Prof. Keith A. Nelson. He is now a postdoctoral researcher at SLAC National Accelerator Laboratory/Stanford University, working with Prof. Aaron M. Lindenberg. His research interests are using strong-field THz-frequency laser pulses to drive low-dimensional quantum materials far from equilibrium and probe the associated electronic and lattice dynamics with femtosecond resolution and single-particle sensitivity.