北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Order parameter steering by light

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Time: 10:00 am, Dec. 29, 2020 (Tuesday)

Tencent Meeting Link： https://meeting.tencent.com/s/EqGNuJ3lzBBZ

Tencent Meeting ID：375 408 636

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Abstract

An emerging subject in nonequilibrium dynamics is "order parameter steering" where experimentally controllable perturbations (such as light) can drive the order parameter of symmetry broken phases to evolve. We theoretically demonstrate this phenomenon in two scenarios. In the first scenario, we show that in excitonic insulators with s-wave electron-hole pairing in the ground state, an applied electric field (either pulsed or static) can induce a p-wave component to the order parameter, and further drive it to rotate in the s+ip plane, realizing a topological Thouless charge pump. In one dimension, each cycle of rotation pumps exactly two electrons across the sample while higher dimensional systems are similar. In the second scenario, we study the dynamics of a competing order system which is rapidly heated up by a pump and then cools down to its equilibrium temperature. Exponentially growing thermal fluctuations lead the system into the phase associated with the faster-relaxing order parameter which is not necessarily the ground state. This theory offers a natural explanation for the widespread experimental observation that metastable states may be induced by laser induced collapse of a dominant order.

References

Z. Sun and A. J. Millis, arXiv:2008.00134 (2020, PRL in press),

Z. Sun and A. J. Millis, Phys. Rev. X 10, 021028 (2020)

About the speaker

Dr. Zhiyuan Sun graduated from University of Science and Technology of China in 2012 and obtained his PhD at UC San Diego with Prof. Michael Fogler in 2018. Since then, he has been working as a postdoc at Columbia University. His research interest covers collective excitations in nano (2D) materials, electron hydrodynamics, and nonequilibrium dynamics of novel states of matter.