Condensed Matter Seminar
物性論セミナー

2023年8月30日 (水), Aug 30 (Wed), 2023, 15:00-16:00

自然系学系棟B棟６階: ６０２号室

[地図]

Hyperuniformity in quasiperiodic electron systems
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Electron distribution on a quasiperiodic structure shows an aperiodic but orderly spatial pattern, which can be varied by changing temperature, pressure, and external fields. This is distinct from the electron distribution in periodic crystals, which is spatially uniform, as well as from that in random systems (amorphous), which is statistically uniform. Thus, the spatial distribution in quasicrystals can give a unique knob to control physical properties.

  To discuss such a change of the spatial distribution, we need a quantification capturing the inhomogeneous pattern. It has been known that the wavefunction amplitude in quasiperiodic tight-binding models often shows a multifractality [1,2]. However, this is not necessarily true for other quantities. In fact, we have shown that the charge density distribution is not multifractal and instead hyperuniform [3,4].

  Hyperuniformity [5] is a general framework to quantify the regularity of a point or density distribution in space. In this talk, I will introduce hyperuniformity to quasiperiodic electron systems, showing its usefulness in quantifying and categorizing the charge distribution on quasiperiodic structures. We find a phase transition between two different inhomogeneous charge distributions which are characterized by different hyperuniformity classes.

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[2] T. Tokihiro, T. Fujiwara, M. Arai, PRB 38 (1988), 5981.
[3] S. Sakai, R. Arita, and T. Ohtsuki, Phys. Rev. B 105 (2022), 054202.
[4] S. Sakai, R. Arita, and T. Ohtsuki, Phys. Rev. Research 4 (2022), 033241.
[5] S. Torquato, Phys. Rep. 745 (2018), 1..

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