凝縮系物理学ゼミナール
Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 9 November 2022

Title: Temperature dependence of the non-Hermitian skin effect with Kondo crossover

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Abstract:

Strongly correlated systems have many interesting phenomena, such as the Mott transition and the Kondo effect. They arise from the Coulomb interaction of electrons in matter. The Kondo effect, in particular, has been the subject of vigorous research. The interaction between conduction electrons and localized impurities causes the specific behavior of physical quantities around the Kondo temperature.

Recently, systems described by non-Hermitian Hamiltonians, such as cooled atomic systems, have attracted much attention. The interaction between the system and the environment causes particle and energy dissipation, which breaks the Hermitianity of the Hamiltonian. Therefore, novel non-equilibrium phenomena are expected, which do not have counterparts in Hermitian systems. The non-Hermitian skin effect (NHSE) originates from the structure of the complex energy bands, where the bulk modes are localized near the boundaries. The NHSE is a topological phenomenon unique to non-Hermitian systems and has been studied theoretically and experimentally.

On the other hand, the equivalence between strongly correlated electron systems and open quantum systems has been pointed out. This fact means that quasiparticles have lifetimes due to interactions between particles. In particular, the Kondo temperature is related to the appearance of exceptional points in the effective Hamiltonian. Therefore, the Kondo effect will provide a new development in the non-Hermitian skin effect [1].

In this study, we numerically study the impact of the Kondo effect on the NHSE using an f-electron system described by the periodic Anderson model. The spin-orbit interaction induces the NHSE, protected by the time-reversal symmetry. We also show that the behavior of localized modes changes near the Kondo temperature in terms of generalized Brillouin zones [2] and pseudo-spectra [3].

Reference:

[1] Y. Michishita, R. Peters, Phys. Rev. Lett. 124, 196401 (2020)
[2] K. Yokomizo and S. Murakami, Phys. Rev. Lett. 123, 066404 (2019)
[3] N. Okuma and M. Sato, Phys. Rev. Lett. 126, 176601 (2021)