凝縮系物理学ゼミナール
Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 2 October 2024

Title: Photoinduced non-reciprocal magnetism

Speaker: Dr. Ryo Hanai (YITP)

Abstract:

In equilibrium, the free energy minimization principle states that the action-reaction symmetry of the interparticle interactions must be present. However, this symmetry can be broken once the system is driven out of equilibrium. Indeed, such non-reciprocal interactions are ubiquitously observed in various soft active systems, ranging from ecological systems, neuro systems, and living matter to chemically or optically active colloidal systems. Recent studies revealed that non-reciprocal interactions may lead to collective phenomena unique to non-equilibrium many-body systems, such as the emergence of non-reciprocal phase transitions [1] and phenomena analogous to geometrically frustrated systems [2]. However, non-reciprocal interactions have not been implemented in electronic systems.

In this talk, inspired by the recent advance in soft matter physics, we theoretically propose a way to engineer non-reciprocal interactions between the localized spins in a magnetic metal by driving the system out of equilibrium. We show that the itinerant electrons may mediate non-reciprocal spin-spin interaction when a light source that controls the dissipation is appropriately injected. Our work provides a novel tool to engineer non-equilibrium states of matter in electronic systems.

References :

[1] M. Fruchart*, R. Hanai*, P. B. Littlewood, V. Vitelli, Nature 592, 363 (2021).
[2] R. Hanai, Phys. Rev. X 14, 011029 (2024).
[3] R. Hanai, D. Ootsuki, and R. Tazai, arXiv: 2406.05957