



量子物理学・ナノサイエンス第 311 回セミナー

Spin transport in ultracold atomic gases

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日程 : 5月11日(火) 14:00 -

場所 : Zoom*

概要

Ultracold atomic gases are pure and highly controllable systems, providing us an ideal platform to examine physical properties of quantum many-body system. Recently, transport properties in ultracold atoms have been actively investigated. In this talk, we present our theoretical research on spin transport, which indicates that the spin transport measurements become novel probes in ultracold atom experiments.

In the first part, we present our study on mesoscopic spin transport for strongly interacting Fermi gases through a quantum point contact [1]. By employing the linear response theory and many-body T-matrix approximation, we investigate how a strong interaction affects the spin current. For a small spin-bias regime, the current in the vicinity of the superfluid transition temperature is strongly suppressed due to the formation of pseudogaps, which are dip structures in single-particle densities of states. For a large spin-bias regime where the gases become highly polarized, on the other hand, the current is enhanced by the appearance of Fermi polarons, which are quasiparticles consisting of minority atoms dressed by majority atoms.

In the second part, frequency-resolved bulk spin transport is considered [2]. We show that an optical spin conductivity being a small AC response of a spin current can be directly measured with existing methods in ultracold atom experiments. For systems with arbitrary spin degrees of freedom, we then construct a general formalism of the optical spin conductivity. To demonstrate the availability of the optical spin conductivity, the formalism is applied to a spin-1/2 Fermi superfluid and a spin-1 Bose-Einstein condensate. It turns out that both superfluids show nontrivial responses that cannot be captured with the Drude conductivity.

[1] Y. Sekino, H. Tajima, and S. Uchino, Phys. Rev. Research **2**, 023152 (2020).

[2] Y. Sekino, H. Tajima, and S. Uchino, arXiv:2103.02418.

*本 ZOOM セミナーに参加されます場合には、事前に下記より登録を済ませてください。

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ご来聴を歓迎いたします。

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