Weekly seminar
Non-equilibrium dynamics in a quantum-Hall Tomonaga-Luttinger liquid

Toshimasa Fujisawa

Department of Physics, Tokyo Institute of Technology

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地点：北京大学物理楼，西563会议室

Abstract

Interacting electrons in one-dimensional (1D) conductors can be described by non-interacting plasmons in the Tomonaga-Luttinger model [1]. For spin-full 1D channels, spin and charge degree of freedom can travel independently as collective modes, known as spin-charge separation. More importantly, non-interacting nature of the modes suggests that the system does not experience thermalization as long as coupling to external degree of freedom can be neglected [2]. This means that 1D channels should be considered as a transmission medium for free plasmons rather than electrons. Characteristics plasmon transport appears particularly in non-equilibrium conditions, such as when a time-dependent potential or a large bias voltage is applied to the system. Quantum Hall edge channels are attractive for studying non-equilibrium transport as various functional devices can be attached to 1D channels for investigating non-equilibrium states.

In this talk, I would like to introduce some recent experiments that characterize the Tomonaga-Luttinger behaviours in the edge channels. For example, an electrical pump-and-probe scheme is employed to measure waveforms of plasmon wave packets, from which one can identify plasmon eigenmodes and velocities in the spin and charge modes of the Tomonaga-Luttinger liquid [3,4]. Quantum-dot spectroscopy allows us to investigate the energy distribution function, from which non-thermalizing character of 1D channels can be studied [5]. These experiments elucidate plasmon transport in quantum Hall edge channels.

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[3] H. Kamata et al., Nature Nanotechnology 9, 177 (2014).
[4] M. Hashisaka et al., in preparation.
[5] K. Washio et al., Phys. Rev. B 93, 075304 (2016).

About the Speaker

Dr. Fujisawa is a professor in Department of Physics in Tokyo Institute of Technology (TIT), Japan. He graduated TIT in 1988 and was granted a PhD from TIT in 1991. After working in the NTT basic research laboratory from 1991 to 2008, he became a professor in TIT. His research area broadly ranges over experimental semiconductor physics, such as single electron dynamics in quantum dots and transport properties in quantum Hall systems. Because of his research on electron dynamics and its quantum control in quantum dot, he was awarded the Sir Martin Wood Prize (Millenium Science Forum) in 2003 and JSPS (Japan Society for the Promotion of Science) Prize in 2005. He was an author of more than 150 papers with their total citations being more than 8000 and h-index 36, i-10 index 68 (from Google scholar).