

# 凝縮系物理学ゼミナール

## Condensed Matter Seminar

Location: Room 413, School of Science Bldg. 5 (理学 5 号館 413 号室)

Time and date: 13:30 – 15:00, Wednesday, 3 Jul 2013

## Dragging dynamics of few fermions in fermion cloud.

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### Abstract:

Recently, the non-equilibrium dynamics of cold atom systems has attracted much attention, because cold atom systems are ideal isolated quantum systems which can be experimentally designed [1]. Experiments (e.g. [2]) and theories of cold atoms motivated us to research one-dimensional dynamics, and we have revealed the quantum interference effects in 1D collision dynamics of fermion clusters [3]. However, the quantum effects in dynamics (which we call the differences between the full-quantum and the semi-classical theory) have not been completely clarified even in one-dimensional systems.

In this talk, we show the simulation result of dragging few fermions in fermion cloud. Initially, a few fermions are trapped by a species-dependent trap in a cloud of another type of fermions. Next, the trap is suddenly forced to move at a constant speed, and the system is excited by interaction between two species of fermions. We adopt the one-dimensional Fermi-Hubbard model and the time-dependent density matrix renormalization group method [4,5] to simulate these dynamics.

### References:

- [1] D. Jaksch and P. Zoller, *Ann. Phys.* **315**, 52 (2005).
- [2] A. Sommer, M. Ku, G. Roati and M.W. Zwierlein, *Nature* **472**, 201 (2011).
- [3] J. Ozaki, M. Tezuka and N. Kawakami, *Phys. Rev. A* **86**, 033621 (2012).
- [4] S. R. White and A. E. Feiguin, *Phys. Rev. Lett.* **93**, 076401 (2004).
- [5] U. Schollw"ock, *Ann. Phys.* **326**, 96 (2011).