

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)

Date: 13:30-15:00, Wednesday, 30 September 2015

“Quantum Monte Carlo simulations of multicomponent Fermi systems”

Speaker: Mr. **Masaru Sakaida** (Condensed Matter Theory Group)

Abstract:

The multicomponent Fermi systems composed of the atoms with many low-lying hyperfine states have been realized in cold atomic systems [1,2]. Due to many degrees of freedom, the feature of multicomponent Fermi systems should be different from that of usual electron systems. For example, the density-wave (DW) state becomes more robust over spatial nonuniformity as the number of degrees of freedom of systems is larger. It is naturally expected from this result that the transition temperature of the DW state of $SU(N>2)$ systems is also higher than that of the $SU(2)$ systems. If this statement is true, it might give a road map to experimentally observe the ordered state in cold atoms.

Motivated by these backgrounds, we investigate the $SU(3)$ -symmetric systems with an isotropic and attractive interaction. To give a good guideline for experiments, we use the determinant quantum Monte Carlo method which is one of quantitatively reliable numerical methods. The order parameter of the DW state, the density-density correlation function, and the density structure factor are calculated. Hence the transition temperature is estimated and the phase diagram of $SU(3)$ systems is determined. Comparing our results with the results of previous studies, we will discuss the change of the transition temperature with an increase of the number of components.

References:

[1] E. R. I. Abraham, *et al.* : Phys. Rev. A **55**, R3299(1997).

[2] S. Taie, *et al.* : Nat. Phys. **8**, 825(2012).