RICC Usage Report for Fiscal Year 2013

Project Title:

Condensed matter physics (theory)

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Currently I am working on new superfluid and superconducting states on one side and on frustrated spin systems on the other. In both cases it is sometimes required to perform numerical calculation (differential and integral equation, etc.) to determine, for example the order parameter and the excitations of the system that are relevant to the experiments.

As for the superfluid problem we aim to solve the Bogoliubov-de Gennes differential equation for quasiparticle spectrum and wavefunctions by simple discretization, varying some external physical parameters such as (pseudo-)spin imbalance, mechanical rotation, etc.. Recently our work related to this topic has focused on the analytic approach, therefore we have not run jobs in FY2013, postponing to FY2014.

As for frustrated magnets, we are studying magnon condensation induced by high magnetic field in several frustrated models, by employing the Bethe-Salpeter equation to determine the interaction among magnons. The problem can be reduced in our approach to evaluating certain integrals over the Brillouin zone and then solve a linear algebraic system given in terms of them. So far we have dealt with two-magnon scattering, which allowed us to perform calculation with just a desktop machine. However we plan to take on the three-magnon scattering problem, which needs considerably more computational power. Hence we would like to continue using RICC for the FY2014 too.