Report on MERIT long-term Overseas Dispatch

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I have stayed in Lausanne from January 7th to April 6th, 2018 by using MERIT long-term overseas dispatch program. Lausanne is an old city in the Switzerland, which is situated on the shores of Lake Léman. Due to a difference in elevation in the city, we can enjoy a dramatic panorama over the lake and the Alps on sunny days.

During stay, I have collaborated with Prof. Mila and Dr. Danu at Swiss Federal Institute of

Pic.1 Lausanne Cathedral: Symbol of the city

Technology in Lausanne (EPFL). We have studied frustrated 1-dimentional spin chain by Exact Diagonalization method. Since the study theme is different from my research in Japan, it was great opportunity to acquire a new insight in this research region. Thanks to kind guiding of collaborators, I got some results and new techniques (following page).

In addition to my research life, I enjoyed life of Switzerland as well. Members of laboratory were so kind to me; we went snow hiking, bouldering, gathering, music concert and so on. Especially, Easter Holiday (It was just my last holiday in Switzerland!), which we spent at a cottage together was so memorable. We enjoyed community life for four days at picturesque village (Pic.3).

Pic.2 Snow hiking with members of laboratory

Pic.3 View from the cottage

Research theme

Parity of site dependence of level crossing on frustrated quantum spin system

Abstract

Inspired by the experiments [1,2], we seek the experimental set-up which shows non-trivial quantum phenomena. In this work, we focus on finite size of 1-dimentional J_1-J_2 XXZ model which can be realized in the experiment of Co atoms on Cu_2N/Cu(100)[1].

In this model, when there are frustration such that J_1 is ferromagnetic and J_2 is anti-ferromagnetic, there is unusual quantum phase. The most important feature is completely difference of level crossing and magnetization depending on parity of the number of site N. While, in N odd case, there are level crossing and magnetization jump like previous research [2], in N even case, there are not. We argue this points in terms of parity. We also discuss the feasibility of our model in experiment.

Reference

[1] A. Spinelli, et al., Nat. Commun. **6**, 10046 (2015).
[2] R. Toskovic, et al., Nat. Phys. **12**, 656 (2016).

Pic.4 Photo with collaborators: Dr. Danu (left), Author (center), Prof. Mila (right)