

## Search for new physics in transition metal compounds by spectroscopies

*The novel physics generated by the electronic correlation and the orbital degree of freedom in transition metal compounds was intensively discussed in this workshop. The importance of the material research and the spectroscopy such as neutron, X-ray, Raman, photoemission, STM/STS, NMR, and  $\mu$ SR, were also addressed for the study of the exotic electronic states in the real, momentum and energy spaces.*

The international workshop "Recent Progress on Spectroscopies and High- $T_c$  Superconductors" was held on July 28<sup>th</sup>-30<sup>th</sup>, 2011 in the Lecture Hall of Institute for Materials Research (IMR), Tohoku University. This workshop aimed to discuss novel physics generated by the electronic correlation and the orbital degree of freedom in transition metal compounds. Recently, the multi-orbitals character has been realized in newly discovered iron-based superconductors for the understanding of their electronic states. Furthermore, the orbital degeneracy is recognized to play a crucial role in the mechanism of giant thermoelectric power in carrier doped cobalt oxides. These issues related orbitals are important to be studied from a microscopic way to understand their novel physics. Therefore, we selected the following topics as the main target of discussion.

- 1: High- $T_c$  superconductivity in transition metal compounds
- 2: Giant thermoelectric power in cobalt oxide
- 3: Magnon Hall effect in vanadium oxide
- 4: Advanced spectroscopic techniques.



Fig. 1. A picture of workshop. 90 researchers including many young scientists participated in the workshop and exchanged the information.

There were 35 oral presentations (29 experimental and 6 theoretical works) and ~90 researchers participated in the workshop. We invited 8 outstanding speakers from abroad, who introduced many new results and overviews on superconductors. The research results in the above exciting fields were discussed to share what are the important and fundamental issues to be solved by spectroscopies. The complementary use of quantum beam spectroscopies was also discussed. The participants actively discussed and exchanged the information during the workshop, and we confirmed the pivotal contribution of spectroscopy to the orbital-related physics. We note that the opening of this workshop at a relatively early stage after the big earthquake, which was occurred on March 2011, was a very good opportunity to show our activity in Tohoku University to our research fields. The workshop has actually received favorable impressions and opinions. We would like to thank all participants for their active contributions in the workshop, and the support from ICC-IMR.

### Key Words

Quantum Beam spectroscopy, J-PARC, SPring-8, Orbital physics, Strongly correlate electron system

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Fig. 1. A picture of get together party.