

JSPS Short-term Invitation Fellowship

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The JSPS short-term invitation Fellowship allowed me to spend two months in Prof. Toshiro Takabatake's research group, who has the world class single crystals growth facility, at Hiroshima University as well travel in various places in Japan, especially for research discussions, giving seminars and initiate new research collaborations with various groups. I gave total 7 seminars at various places in Japan and had very interesting and fruitful discussion with both experimentalist and theoreticians. At Hiroshima University, I gave two talks to physics graduate students on introduction of muon spin rotation and relaxation technique and on introduction to neutron scattering. I also attend one day conference, at Hiroshima University, on Strongly Correlated Kondo Insulator systems and gave an invited talk on neutron scattering investigations of Kondo insulators. I had many interesting discussions with Prof. T. Takabatake and Prof. T. Onimaru that allowed us to plan future experiments on neutron scattering and muon spin rotation as well as synthesize of new caged type Kondo insulator compounds both in single crystals form and polycrystalline form. I had a detailed discussion with our collaborator Prof. Y. Muro (Toyama) on single crystals alignments for our neutron scattering experiments at ISIS. I had very interesting discussion with Prof. K. Suekuni on Cu-S based thermoelectric materials and Prof. K. Umeo on high pressure techniques and Prof. T. Ekino and Mr Kawabata on tunneling measurements on Kondo insulators.

I had very interesting discussion and exchange of unpublished research results with Prof. M. Sera, Dr H. Tanida and Prof. T. Matsumura at Hiroshima University on Kondo insulator systems as well as on Bose-Einstein condensation in Yb-based system. From these discussions we have planned future neutron scattering investigations on Kondo insulators at ISIS facility, UK and ILL, France. It was exciting to meet Prof. A. Tanaka from theory group at Hiroshima University and discuss about his software that allows to analyse data obtained from x-ray based technique for transition metal and rare earth based systems. I would like to thank Prof. Tanaka for providing his program. The visit to Hiroshima Synchrotron Radiation Center (HiSOR) and discuss with Prof. T. Okuda on their world best facility of ARPES measurements allow me to plan future experiments at HiSOR. I also visited Rama research laboratory of Prof. M. Udagawa and after discussion we have planned to investigate phonon in a Yb-based system, which exhibits structural and quadrupole transition at low temperature. During Hiroshima conference, I had a detailed discussion with Dr A. Kondo (ISSP Tokyo) on high field magnetization measurements, Prof. S Kimura (Osaka) on optical spectroscopy and Prof. T. Yokoya (Okayama) on XPS

study of Kondo insulators as well as with Prof. H Amitsuka (Hokkaido) on U-based compounds. I also had chance to see our collaborator Prof. J. Akimitsu at Hiroshima and discussed on various projects on superconductors.

I visited Prof. I. Watanabe's group at RIKEN, Wako, Tokyo, gave a talk and had a technical discussion with his group members on muon site calculations and also muon induced change in the magnetic ground state. At Saitama University I had very interesting discussion with Prof. S Katano and his group members on short range and frustration effect in Shastry-Sutherland lattice (SSL). It was very interesting to have theoretical discussion with Prof. T. Saso on hybridization effect and opening of a Kondo gap in strongly correlated electron systems. I also gave a talk at Saitama University and also provided training to doctorate students on neutron data analysis and how to submit proposals at ISIS. We have planned neutron and musr experiments on SSL compounds. I visited Profs. F. Iga and K. Iwasa at Ibaraki University, Mito. At Ibaraki University I had very interesting discussion with Prof. F. Iga on single crystal growth of topological insulators and very high pressure and high temperature synthesis technique, Prof. K. Iwasa on a structure phase transition in a cubic Ce-based system, Prof. M. Yokoyama on unconventional superconductivity in Ce-based system, Prof. K Kuwahara on thermoelectric materials. From these discuss we have planned a joint experiment of neutron scattering investigation on thermoelectric materials at ISIS. I also had a chance to discuss with Prof. K. Ohyama on his work on powder neutron diffraction technique and Prof. H. Hiraka on transition metal magnetism. I visited J-PARC, Material and Life Science Experimental Facility and had very interesting discussion with Dr W. Higemoto on use of muon in condensed mater physics as well as on elemental analysis. I gave a talk at the Frontier Center of Ibaraki University and J-PARC. Finally I visited Spring-8 X-ray synchrotron facility, gave a seminar and had very interesting discussion with Dr S. Tsutsui on inelastic x-ray scattering technique and with Prof. Shin-ichi Fujimori on ARPES study on strongly correlated electron systems.

During my stay at Hiroshima I was able to write two research papers in collaboration with Prof. Takabatake and participated in writing many other research papers. I also participated in a single crystal growth of $\text{CeRh}_{0.9}\text{Pd}_{0.1}\text{Sn}$ using the world class facility in Prof. Takabatake's group and we have planned future neutron scattering experiments. A new project on electron doping effect in Kondo insulator, $\text{CeFe}_2\text{Al}_{10}$ has been started and I have synthesized many polycrystalline samples of $\text{CeFe}_2\text{Al}_{10-x}\text{Si}_x$ ($x=0, 0.025, 0.05, 0.1, 0.2$) and characterized them using XRD, heat capacity, magnetization, resistivity measurements at Hiroshima. We have planned to submit neutron scattering and musr proposals at ISIS, J-PARC, ILL and PSI. We have been given beam time at ILL to investigate magnetic structure of Y-doped $\text{CeRu}_2\text{Al}_{10}$ and $\text{CeOs}_2\text{Al}_{10}$ and I was able to prepare these samples and characterized them at Hiroshima University. I would like to thank Prof. Takabatake and doctorate students, Mr Kawabata, Mr Chongli, Mr Hayashi and My Yamane for their help during the measurements and Profs. Takabatake, Iga, Iwasa, Katano and Watanabe and Drs Tsutsui and Michimura for organizing my visit to various places in Japan. Finally I would like to thank JSPS for award of their fellowship and ISIS facility for sabbatical leave.



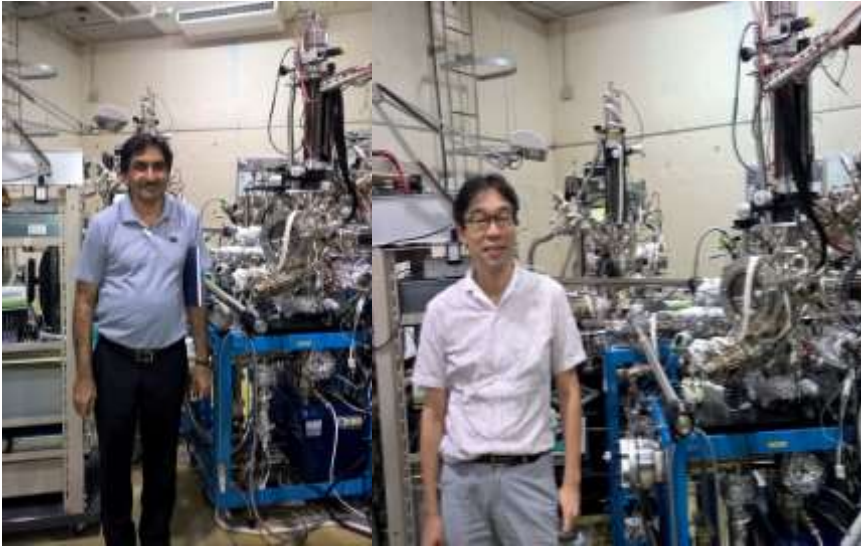
Prof. Toshiro Takabatake's group at



Single crystal growth of $CeRh_{0.9}Pd_{0.1}Sn$ using the Czochralski method at Hiroshima University in Prof. Toshiro Takabatake's group. Prof. Takabatake observing the crystal growth (right)



Visit to J-PARCK, Dr W. Higemoto (left), Dr D.T. Adroja (Prof. F. Iga) (middle) and Prof. K. Iwasa



Visit to Hiroshima Synchrotron Radiation Center (HSRC), Dr D.T. Adroja (left) and Prof. T. Okuda



Visit to SPring-8, Dr S. Tsutsui (left) and Dr D.T. Adroja (right)