6. Network-Type Collaboration

The NIFS General Collaboration has been basically based on a one-to-one (NIFS-to-University) collaborative system. Some collaborations, however, require the use of more than one experimental facilities in different Universities and Institutes to achieve their objectives. For example, a special sample that was prepared in a University is exposed to plasmas produced in LHD, then it can be analyzed using a diagnostic instrument in another University. In the network-type collaboration, this type collaboration becomes practicable by admitting travel expenses for moving between Universities, which have not been admitted as a rule in the general collaboration projects. In FY 2011, NIFS employed this network-type collaboration on trial as one of nine categories of the General Collaboration, and three themes of the different fields were selected from eleven proposals and accepted.

Before starting the collaborations, each program for the year was submitted to inquire how the collaborations between research institutes were planned, ie, who goes when and where by what kind of purpose.

Challenges of these collaborations spread over various fields. Those researches and their activities are outlined below.

1. "Effect of Active Control on Plasma Performance in Magnetically Confined Toroidal Plasmas", Masamune, S (Kyoto Inst. Tech.)

   In order to realize the improvement of plasma performance or to control plasma dynamics during MHD relaxation in high β machines, they weighed various methods for active control which have been used in many magnetically confined plasma devices, for example, magnetic helicity injection for current profile control, neutral beam injection for heating or density profile control, inductive current drive for current density profile control, magnetic boundary control for MHD stability manipulation, Compact Torus (CT) plasma injection for helicity injection, and so on.

   In this program, collaborative experiments were planned among HIST (SP) at Univ. of Hyogo, NUCTE (FRC) at Nihon U., TS-3 and 4 (SP, FRC, ST) and UTST (ST) at Univ. of Tokyo, and RELAX (RFP) at KIT, LHD at NIFS, with research topics related to active control. Theoretical activities on particle simulation at Gunma Univ., 3-D MHD simulation at NIFS, two-fluid MHD equilibrium and stability at JCGA are also included in these collaborations. In FY 2011, they performed some review trips for mutual understanding and discussion on the specific topics to be focused in the collaborative experiments, as well as to encourage young students to participate in the collaboration.

2. "Hydrogen isotope – materials dynamics for recycling evaluation", Oya,Y (Shizuoka Univ.)

   Understanding of Plasma-Wall Interaction (PWI) is one of the most important subjects, especially, from viewpoint of the estimation of Hydrogen recycling rate. Basic researches have been performed in many Universities and Institutes. In order to understand the Hydrogen recycling phenomena and the behavior of Tritium in the actual fusion reactor, it is particularly important to evaluate the Hydrogen retention rate of samples exposed to plasmas in the fusion-intended big devices. In this collaboration, they have a plan to utilize the plasmas in LHD (NIFS), QUEST (Univ. of Kyushu) and GAMMA 10 (Univ. of Tsukuba) as exposure sources and evaluate the sample using the analyzing instruments and/or small-scale irradiation devices in Universities of Shizuoka, Hokkaido, Toyama, Shimane and Nagoya. Therefore, this collaboration is expected to be a typical one in which the network-type collaboration will effectively work.

   In this fiscal year, they investigated a Tungsten material which is a primary candidate for plasma facing materials due to its lower tritium retention and high thermal conductivity. Tungsten samples were experienced to hydrogen discharges during the plasma experimental campaign in LHD. Thereafter, the deuterium ion was implanted into these samples and hydrogen isotope retention enhancement was estimated by means of TDS. The surface morphology and depth profiles of atomic concentration were also observed by TEM and GD-OES.

3. "Collaborative Research of Magnetic Reconnection among Laboratory, Observation and Simulation", Ono, Y. (Univ. of Tokyo)

   Experimental and theoretical researches on the magnetic reconnection has been independently proceeded in many Universities, NIFS, JAEA, ISAS , NAOJ and so on. In this collaboration, these researches are regrouped and networked in the accreted form of laboratory plasma experiments, theory/simulation researches and observations of the sun, magnetosphere, celestial body.

   In FY 2011, they successfully completed style of collaborative plasma research of magnetic reconnection among laboratory experiment, solar and magnetosphere observation and theory/simulation by starting several joint research groups composed of Hinode solar satellite team, laboratory experiments at Univ. Tokyo, NIFS simulation team and NIFS diagnostic team, JAERI simulation team, AIST NBI team.

(Shimozuma, T.)