1-4. LHD Project Research Collaboration

The LHD project research collaboration program has been contributed to develop basic research activities of the fusion technology and the plasma physics in a long-term schedule. This program requires collaborations with scientists and researchers from universities and institutes in Japan and also from all over the world.

The aim of the LHD Project Research Collaboration, being reported here, is to research and develop both technology and the scientific foundations that are useful for both the LHD group and the universities, and then, to apply these results to LHD experiments for the improvement of LHD. The characteristic of this collaboration program is that some R&D's are performed in each domestic university or institute, instead of in NIFS as conventional research collaborations. The advantage of this type collaboration over conventional one is that co-workers can devote themselves to R&D's more efficiently and enthusiastically by spending much more time.

From seven years before, the LHD Project Research Collaboration started to invited public participation from universities and institutes in Japan. Three committees and one advisory council participate in selection process of collaboration subjects. At the beginning, the committees of the Fusion Network in Japan select and recommend some proposed plans to the committee of the LHD Project Research Collaboration in NIFS. NIFS has partnerships with Fusion Network linking three major research fields in Japan: fusion engineering, fusion science and plasma science. Although these fields have been developed independently, intimate collaboration between them is essential for further progress of fusion research. NIFS, as a Center of Excellence (COE) should develop a network of fusion research activities of universities and government institutions, including information exchange, planning, collaboration with foreign institutions and education of graduate course students. An important point to choose a subject of collaboration is a new attempt, which is useful for the LHD project and is not planned in NIFS.

From 2007, LHD team proposed three subjects for supporting research in universities to drive forward the future deuterium experiment in LHD effectively. Another important point is whether that program can contribute to stimulate university researches and LHD programs.

As the fusion-plasma science program, following subjects were approved last year and reported in this book.

1. Control of Rotational Transform by Electron Cyclotron Current Drive in Helical Systems
2. Development of Doppler-free spectroscopy for plasma diagnostics.
3. Spectroscopy of highly charged tungsten ions using electron beam ion traps
4. Formation of minimum-B torus by ECH
5. Development of Electron Bernstein Emission diagnostics for electron temperature measurement in high beta plasmas
6. Wall Plasma Interaction Using Ablated Plasma Plumes Induced with Laser and Ion Beams
7. Statistical characteristics of dynamics and field structure on magnetized plasmas
8. Effect of outboard helical field on toroidal plasmas
9. Suppression of carbon dust growth and hydrogen retention in multi-species low temperature plasmas with nitrogen
10. Development of a compact volume production type 14 GHz negative hydrogen ion source
11. Physics study on 3-D helical equilibrium plasmas with 2-D imaging diagnostics
12. Two frequency wave excitation experiments
13. Development of polarization controlled multi-pass Thomson scattering system in the GAMMA 10 tandem mirror
14. Positional stabilization of torus plasma with simple helical coils
15. Development of cesium-free hydrogen negative-ion source based on plasma-assisted catalytic ionization
16. Laser-induced Fluorescence Spectroscopy with Femtosecond Laser Pulses
17. Experimental verification of helium line spectroscopy models by inter-machine and inter-method comparison

As the fusion-engineering program, following subjects were also approved last year and reported here.

1. Deuterium retention of plasma facing walls under DD discharge
2. Development of Neutron Diagnostic System for LHD Deuterium Experiment
3. Heat Removal Demo-research for Flibe Blanket Development
4. W-coating on Low Activation Structural Materials
5. Investigation on Environmental Behavior of Organically Bound Tritium
6. Study on biological effects of tritium at animal level
7. Local Strain and Its Influence on Mechanical - Electromagnetic Properties of Nb3Sn and Nb3Al Strands
8. Design Support and Sophistication of Trapping and Recovery System for Low-concentration Gaseous Tritium
9. Experiments on the excitation of an Electron Bernstein Wave in the internal coil device
10. Development of the tungsten materials for high heat flux components application to neutron irradiation conditions in fusion reactor
11. Analysis of tritium transfer dynamics for helical prototype nuclear reactor system design.
12. R&D of Joining Technology between Dissimilar Materials for Metallic Components in Blanket
13. A proposal of in-situ diagnostics methods for PFMs under multiple irradiation
14. Study on Mechanisms of Superconductivity Change by Neutron Irradiation

These subjects are planned basically as the three years program. Therefore, the reports presented here represent one portion of the total subjects.

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