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. Study of wave physics in high beta plasmas
2. Development of real-time control system of MHD instabilities
3. Development of magnetic island detector by magnetic measurement
4. Characteristics of RF-based hydrogen negative ion source with Cs additive
5. Control of Rotational Transform by Electron Cyclotron Current Drive in Helical Systems
6. Study of the physics of IDB plasma and the density limit in helical devices
7. Study of optimum conditions and atomic and molecular reactions on LHD closed divertor
8. Development of Doppler-free spectroscopy for plasma diagnostics.
9. Spectroscopy of highly charged tungsten ions using electron beam ion traps
10. Formation of minimum-B torus by ECH
11. Development of Electron Bernstein Emission diagnostics for electron temperature measurement in high beta plasmas
12. Study on plasma-wall interactions making use of laser and ion beam experimental platforms
13. Statistical characteristics of dynamics and field structure on magnetized plasmas
14. Effect of outboard helical field on toroidal plasmas
15. Suppression of carbon dust growth and hydrogen retention in multi-species low temperature plasmas with nitrogen
16. Extraction of hydrogen negative ions from a 14 GHz microwave ion source
17. Physics study on 3-D helical equilibrium plasmas with 2-D imaging diagnostics
18. Wave measurements utilizing two frequency RF wave excitation

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

1. Dynamic vehavior of tritium release from stainless steel for LHD
2. Li compatibility of Erbium Oxide as a MHD coating material for Liquid Lithium Breeder Blanket
3. Hydrogen isotope retention behavior on the surface of metal-carbon mixture layer under carbon, hydrogen isotopes and helium simultaneous irradiation circumstance
4. Observation of hydrogen permeation in LHD and evaluation of wall leakage for DD experiments
5. Fuel hydrogen retention of plasma facing material and its removal by inert gas glow discharges
6. Development of high heat plasma generator with ion beam analysis and in-situ measurement of hydrogen isotope retention
7. Development of neutron diagnostic systems for LHD deuterium experiment
8. Heat removal demo-research for Flibe blanket development
9. W-coating on low activation structural materials
10. Investigation on environmental behavior of organically bound tritium
11. Study on biological effects of tritium at an animal level
12. Study of stress/strain problem in fusion reactor oriented superconducting strand and conductor by means of quantum beam techniques
13. Design support and sophistication of trapping and recovery system for low-concentration gaseous tritium

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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