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 Japanese universities in a long-term schedule.

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 research collaborators can devote themselves to R&D's more efficiently and enthusiastically by spending much more time.

From nine 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 a few subjects for supporting research in universities to drive forward the deuterium experiment scheduled to start in a few years effectively.

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

1. Development of Cesium-Free Negative Hydrogen Ion Source Based on Plasma-Assisted Catalytic Ionization
2. Static and Dynamical Spectroscopy on Neutral Hydrogen Transport in a Fusion Plasma
3. Two frequency wave excitation experiments using two antennas
4. First Performance of Energy Resolved X-ray Video Camera in LHD
5. Development of Neutron Diagnostic Systems Leading to Extended Physics of Energetic Particle Confinement in LHD
6. Development of a compact 14 GHz ECR plasma production unit for a negative hydrogen ion source
7. Laser-induced Fluorescence (LIF) Spectroscopy with an Aid of Femtosecond Laser
8. Measurements of Charge Exchange Cross Sections for highly charged tungsten ions with hydrogen atoms
9. Development of the multi-pass Thomson scattering system in the GAMMA 10 tandem mirror
10. Development of the Liquid-Crystal-Based Tunable Lyot Filter Spectra Camera System Combined with Color CCD Detector
11. Positional stabilization of torus plasma with simple helical coils
12. Study of high power sub terahertz pulse gyrotron for application to collective Thomson scattering diagnostics in LHD
13. Study of Atomic Excitation by Optical Vortex and Its Application to a Novel Laser Spectroscopy
14. Electron Bernstein wave heating in extremely overdense plasmas
15. Development of a microwave frequency comb reflectometer for multi-scale turbulence measurement

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

1. Fabrication of REBCO coil and Application for Fusion Plasma Experimental Device Mini-RT
2. Analysis of tritium transfer dynamics for helical prototype nuclear reactor system design.
3. Investigation on Environmental Behavior of Organically Bound Tritium
4. A proposal of in-situ diagnostics methods for PFMs under multiple irradiation
5. Study on Mechanisms of Superconductivity Change by Neutron Irradiation
6. R&D of Joining Technology between Dissimilar Materials for Metallic Components in Blanket
7. Fundamental Study of Energy Conversion Divertor for Helical Reactors
8. Study of selective exhaust of particles on LHD closed divertor
9. Production and development of tungsten materials for high heat flux components corresponding to neutron irradiation environment of fusion reactor
10. Plasma wall interactions under inert gas puffing for reduction of heat flux
11. Development of a helical winding using advanced superconductors for high magnetic fields
12. A New Approach for Estimation of the Biological Effects of Low Level Tritium Radiation
13. Retention dynamics in damaged tungsten
14. Development of Compact Divertor Plasma Simulator for Hot Laboratory
15. Development of Hydrogen Isotope Separation Technologies for DEMO Fuel Cycle

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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