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 11 years before, the LHD Project Research Collaboration started to invite 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 2016FY effectively.

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

1. Study of Atomic Excitation by Optical Vortex and Its Application to a Novel Laser Spectroscopy
2. Electron Bernstein wave heating in extremely over-dense plasmas
3. Measurement of spatial structures of density fluctuations using a microwave frequency comb reflectometer
4. Establishment of wavenumber measurement method of electron gyro-scale density fluctuation with the use of microwave scattering at UHR layer
5. Study of high power sub terahertz pulse gyrotron for application to collective Thomson scattering
6. Study on tokamak-helical hybrid configurations with a low aspect ratio
7. Determination of the response function for a particle recycling system and its application to steady state operation using perturbation methods
8. Study of shielding effect of resonant magnetic perturbation and the interaction with MHD instabilities
9. Development of a large negative ion source and a photo-neutralizer for the continuous operation
10. New reconstruction method for eddy current distribution in toroidal machine: verification from real experiments
11. Study of RF Generated Fast Electrons and Their Behavior in the Low Collisionality Regime
12. Development of electron cyclotron emission imaging system using LO-integrated horn antenna mixer array
13. Development of plasma diagnostics in detached plasmas
14. Development of MeV neutron diagnostic for LHD deuterium operation
15. Experiments on high density plasma production by helicon waves in toroidal devices
16. Design study on electron temperature profile measurement for RT-1
17. Isotope effect in dissociation processes of deuterated molecules
18. Toroidal flow velocity fluctuation measurements based on development in ultra-fast charge recombination spectroscopy

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

1. Development of Compact Divertor Plasma Simulator for Hot Laboratory
2. Plasma wall interactions under inert gas puffing for reduction of heat flux
3. Development of a helical winding using advanced superconductors for high magnetic fields
4. A new spproach for estimation of the biological effects of low level tritium radiation
5. Retention dynamics in damaged tungsten
6. Development of hydrogen isotope separation technologies for DEMO fuel cycle
7. In-situ LIBS measurements of hydrogen isotope retention and material mixing
8. Control of heat and hydrogen transfer by improvement of interface structure in heat exchanger of fusion blanket
9. Development of plasma-spray technique and evaluation of coating properties for LHD
10. Tritium accumulation and its decontamination of deposition layer

11. Study on development of environmental tritium behavior model incorporating organically bound tritium in plant
12. Investigation of helical winding application of Nb3Sn Cable-In-Conduit Conductor after heat treatment
13. H, D and T quantitative analyses for plasma facing walls exposed during deuterium experiment
14. Knowledge and technology transfer from IFMIFEVEDA accomplishment to systemization of liquid blanket research

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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