RECENT RESULTS OF DEUTERIUM EXPERIMENT ON THE LARGE HELICAL DEVICE AND ITS CONTRIBUTION TO THE FUSION REACTOR DEVELOPMENT

M. Osakabe1,2, H. Takahashi1,2, K. Makino1, H. Yamada1, T. Kobayashi1, K. Iimura1,5, S. Ohdachi3, S. Murakami4, S. Inagaki5, K. Tanaka1,5, M. Sakamoto6, S. Masuzaki1,2, K. Nagasaki4, Y. Suzuki1, M. Isobe1,2, T. Morisaki1,2 and LHD experiment group

1. National Institute for Fusion Science, NIFS, 322-6, Oroshi, Toki, 509-5292, Japan, 2The Graduate University for Advanced Studies, SOKENDAI, 3The University of Tokyo, 4Kyoto University, 5Kyushu University, 6University of Tsukuba

Osakabe.masaki@nifs.ac.jp

ID:1376

CONTENTS

1. Introduction
   - Objectives of the LHD Deuterium Experiment
   - LHD (Large Helical Device)

2. Recent achievements and activities at D-exp.
   - Extension in temperature domain
   - Isotope Effect and Isotope related studies
   - RMP induced H-mode

3. SUMMARY

Deuterium Experiment

- Positive-NBI (ion-top 3 x 160MeV)
  - ion-top 140MeV
  - ion-top 90MeV

- RPM induced H-mode

The local thermal transport property is also investigated for dimensionally similar plasmas

An application of RMPs/min(T/1): This is the key to maintain stable divertor detachment.

SUMMARY

- Behavior of hydrogen isotopes in their mixture plasmas is investigated.
  - A theory suggests the mixing state will appear for D-T dominant case, while the recent mixing state will appear for D-D dominant case.
  - Monogon-nitrogen-dielectric is observed, experimentally.
  - For the recent mixing state, the density of deuterium is the low-temperature state, while the density of nitrogen is the high-temperature state.
  - The density of hydrogen is the low-temperature state, while the density of nitrogen is the high-temperature state.
  - The density of deuterium is the low-temperature state, while the density of nitrogen is the high-temperature state.

- The extension of high temperature domain in the deuterium experiment.
  - T_D/T_N > 1.2 and T_D > 1.2 x 10^4 keV achieved.
  - The suppression of ECD is the key to extend the domain.
  - The T_D/DN ratio is better to keep below 0.75 to obtain good ion confinement.
  - ECD is efficiently suppressed for D-D supranation and for T_D increase without degradation.

- Isotope effect scaling for L-mode plasmas is observed for H, D, He and their mixture dimensionally similar plasmas.

- Nonlinearity of Measured parameters is confirmed.
  - Plasma density and temperature are observed in the detached phase.
  - confinement of deuterium is observed in the detached phase.
  - Confinement of hydrogen is observed in the detached phase.
  - Clear isotope effect is found when P_X > 2 x 10^16 W/m^2.

- A reduction of divertor flux and good core plasma confinement realized simultaneously.

List of LHD-related presentations (1)

- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.

List of LHD-related presentations (2)

- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.
- Isotope Effect and its related sciences in the LHD deuterium experiment.