IAEA FEC 2014

Contribution ID: **418** Type: **Poster**

Comprehensive Understandings of Energy Confinement in LHD Plasmas through Extensive Application of the Integrated Transport Analysis Suite

Thursday 16 October 2014 14:00 (4h 45m)

The integrated transport analysis suite, TASK3D-a, has enhanced energy transport analyses in LHD. It has elucidated the systematic dependence of ion and electron energy confinement on a wide variation of plasma parameters, and the fitting expressions for ion and electron heat diffusivities with local plasma parameters.
Conventionally, scaling laws for the global energy confinement time (tau_E) have been one of the approaches to systematically understand the energy confinement, and then also to design/predict future devices. However, recent extensive application of TASK3D-a to a wide-ranging LHD experiment database has provided a breakthrough to improve this situation; from scaling laws for tau_E to fitting expressions for ion and electron heat diffusivity.
NBI-heated high ion-temperature plasmas and medium-to-high density plasmas have been mainly analyzed. The general tendency is recognized to be that the normalized ion (electron) heat diffusivity increases (decreases) as the temperature ratio, Te/Ti, is increased.
Accumulation of TASK3D-a analyses results has led to the attempt at deducing functional fittings for kai_e and kai_i with local parameters. This approach has remarkable advantages such as the fitting can be performed separately for ions and electrons, and gradients of profiles can be taken into account. Thus, it is much more relevant to interpret the physics mechanism of the energy confinement than the conventional scaling approach for tau_E. Moreover, such deduced fitting functions for heat diffusivities can be directly implemented into the predictive modelling, so that the transport model assumption (like a Gyro-Bohm) is no longer required. These attempts have been on-going through multivariate nonlinear regression analysis by assuming the predictor variables such as the normalized collision frequency, Te/Ti, and normalized scale lengths of temperature gradient. So far, the fitting expressions for ion and electron heat diffusivities have been successfully obtained.
These results are significant in terms of deducing comprehensive understandings of energy confinement based on "big data"which are created through a close-link between TASK3D-a and the LHD experiment. This approach should be applicable to any other fusion experiments.

Paper Number

EX/P6-27

Country or International Organisation

Japan

Author: Dr YOKOYAMA, MASAYUKI (National Institute for Fusion Science)

Co-authors: Dr SUZUKI, CHIHIRO (National Institute for Fusion Science); Prof. YAMADA, Hiroshi (National Institute for Fusion Science); Dr IDA, Katsumi (National Institute for Fusion Science); Prof. OSAKABE, Masaki (National Institute for Fusion Science); Dr SEKI, RYOSUKE (National Institute for Fusion Science); Dr SATAKE, SHINSUKE (National Institute for Fusion Science); Dr MURAKAMI, Sadayoshi (Departement Nuclear Engineering, Kyoto University)

Presenter: Dr YOKOYAMA, MASAYUKI (National Institute for Fusion Science)

Session Classification: Poster 6