

Development of Kinetic Integrated Simulation Code for Toroidal Plasmas

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【Outline of survey】

The construction of the International Thermonuclear Experimental Reactor (ITER) has started and the Broader Approach (BA) activities aiming at early realization of fusion energy are in progress. In order to accurately predict the behavior of burning fusion plasmas and to develop reliable schemes controlling them, the development of integrated simulation codes for burning plasmas is urgently needed. Fusion reactions and external plasma heating and control modify the velocity distribution functions of electrons and ions and affect transport phenomena and various instabilities as well as the heating and current-drive efficiencies. The aim of this research project is to develop a kinetic integrated simulation code based on the time evolution of the velocity distribution functions and, through the time-dependent integrated analysis of toroidal plasmas including non-axisymmetric effects, to conduct the performance prediction of burning plasmas and the development of control schemes. This project will also contribute to the international collaboration for the development of ITER integrated modeling codes and the domestic collaboration for the code development intended for computer simulations in the BA activities.

【Expected results】

The integrated modeling code, TASK, describing the time evolution of toroidal plasmas will be upgraded by implementing advanced physics models, such as kinetic analyses based on the time-evolution of the velocity distribution functions and three-dimensional analyses including non-axisymmetric effects, and high-performance computing with distributed parallel processing. After validation of the physics models by comparing simulation results with experimental observations, the upgraded code will be used for performance prediction, planning of operation scenario and development of control schemes, of burning plasmas.

【References by the principal investigator】

- A. Fukuyama, M. Yagi: Burning Plasma Simulation Initiative and its Progress, Journal of Plasma and Fusion Research, **81** (2005) 747-754 [in Japanese].
- M. Honda, A. Fukuyama: Dynamic transport simulation code including plasma rotation and radial electric field, Journal of Computational Physics, **227** (2008) 2808-2844.

【Term of project】 FY2008– 2012

【Budget allocation】

75,800,000 yen (direct cost)

【Homepage address】

<http://bpsl.nucleng.kyoto-u.ac.jp/kisc/en/>