Simulation Study of Energetic Ion Distribution during Combined NBI and ICRF Heating in LHD

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ICRF heating generates highly energetic tail ions, which drift around the torus for a long time (typically on a collisional time scale). Thus, the behavior of these energetic ions is strongly affected by the characteristics of the drift motions, that depend on the magnetic field configuration. In particular, in a three-dimensional (3D) magnetic configuration, complicated drift motions of trapped particles would play an important role in the confinement of the energetic ions and the ICRF heating process. Therefore a global simulation of ICRF heating is necessary for the accurate modeling of the plasma heating process in a 3D magnetic configuration.

In this paper we study the energetic ion distribution during combined NBI and ICRF heating in LHD using two global simulation codes: a full wave field solver TASK/WM[1] and a drift kinetic equation solver GNET[2,3]. GNET solves a linearized drift kinetic equation for energetic ions including complicated behavior of trapped particles in 5-D phase space. TASK/WM solves Maxwell's equation for RF wave electric field with complex frequency as a boundary value problem in the 3D magnetic configuration.

We apply the global simulation codes to a LHD configuration (R_{ax} = 3.6m) assuming 2nd harmonic ICRF heating with the perpendicular injection NBI heating, which will be installed in the 9th campaign of LHD experiment (FY2005). The higher number of energetic ions (~MeV) is obtained in the 2nd harmonic heating case than that in the fundamental heating case. The synergy effect of perpendicular NBI and 2nd harmonic ICRF heating in LHD is discussed.

References

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