EX/P3-17 · High Confinement Plasma by Lower Hybrid Current Drive on HT-7 Superconducting Tokamak

Bojiang Ding, Institue of Plasma Physics, Chinese Academy of Sciences, Hefei, China
Contact: bjding@mail.ipp.ac.cn

Abstract: A high confinement plasma by using LHCD has been obtained on HT-7 superconducting Tokamak. An obvious internal transport barrier has been observed. Energy confinement time increases from 14.6 ms (OH phase) to 24.5 ms (LHCD phase). The H confinement factor reaches to 2.11 (LHCD phase). The improved confinement is due to current density profile contributed by LHCD. The experimental results are in good agreements with the simulations of ray tracing code and 2-dimensional Fokker-Planck equation. The edge plasma characteristics around the last closed flux surface were investigated by Langmuir probes. The results indicate that turbulence and transport are suppressed greatly by lower hybrid wave. Studies show that the high confinement plasma is mainly ascribed to a sheared flow resulted from the varied radial electric field.

EX/P3-18 · Scaling and Modeling Studies of High-Bootstrap-Fraction Tokamaks

F. W. Perkins, Princeton Plasma Physics Laboratory, Princeton, USA
Contact: perkins@fusion.gat.com

Abstract: A steady-state tokamak reactor will depend almost entirely on bootstrap current as a source for the poloidal magnetic field. Examination of a model for a tokamak with plasma current arising solely from the bootstrap current finds a steady-state solution to the coupled heat- and poloidal-flux-diffusion equations. The model uses a gyroBohm heat diffusivity that depends on the poloidal field, coupling heat diffusion and poloidal field diffusion physics. The problem is cast in terms of coupled, nondimensional ODEs and associated eigenvalues. Numerical solution of these equations yields a rather flat relative q-profile and a triangular temperature profile. The eigenvalues produce the scaling expressions $T(0) = 1.2 \cdot P^{0.667} \cdot (R/a)^{0.33}$ and $I_p = 0.23 \cdot n^{0.5} \cdot P^{0.33} a$ [P:MW, T:keV, I_p:MA, a:m, n:$10^{19} m^{-3}$]. Experimental plans call for DIII-D and C-Mod discharges heated by a source with no direct current drive capability. Extrapolation from DIII-D discharges indicates that $\beta_p = 3$ (required for unity bootstrap fraction) can be attained with MHD stability if $I_p \sim 0.6$ MA. *Work supported by U.S. DOE Contracts DE-AC02-76CH03073, DE-AC03-99ER54463, W-7405-ENG-48.

EX/P3-19 · Fast Electron Dynamics during Lower Hybrid Current Drive Experiments in the HT-7 Tokamak

Yuejiang Shi, Institue of Plasma Physics, Chinese Academy of Sciences, Hefei, China
Contact: yjshi@mail.ipp.ac.cn

Abstract: The behavior of fast electron were studied in several kinds LHCD experiments. In long pulse LHCD discharge, the global improved confinement and temperature transition were observed after the broadening of HX-ray emission profile, which means a significant current profile modification. In high power LHCD experiments, the local HX-ray emission shows the formation of ITB correlated with the deposition profile of LH wave. The profiles of HX-ray emission broaden in accord with the increase of plasma current in ramp-up experiments. In synergistic experiments, the HX-ray spectra show the IBW interacts with electron strongly and accelerates the fast electrons produced by LHCD. In counter-LHCD experiments, the temperature of HX-ray (THX) and the decrease of loop voltage, which are lower than those in normal LHCD experiments, show the effects of counter current drive. The SX-ray emission profile becomes more peaked in counter-LHCD, which suggests the improvement of the core electron confinement.