EX/C4-2Ra · Electron Heat Transport in ASDEX Upgrade: Experiment and Modelling

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Abstract: The temperature profile resilience observed in tokamak conventional plasmas has been clearly attributed to a threshold in inverse gradient length: above this threshold transport increases strongly whereas it is very low below. New experiments with ECH in ASDEX Upgrade allow to determine the threshold by varying the heat flux in the confinement region by one of magnitude while keeping the plasma boundary constant. Such experiments at low density with pure electron heating allow to study in detail the electron heat transport. In addition the influence of ion heat flux and coupling between the species is studied. The experimental result are compared with the ITG/TEM Weiland model which shows excellent agreement. The results on threshold seem to support the hypothesis that TEM rather than ETG turbulence is the dominant cause of anomalous electron heat transport. In these experiments power modulation of ECH allow simultaneously the investigation of transient transport which is also well reproduced by the Weiland model. Therefore a single physics-based transport model including ITG/TEM physics reproduces the experimental heat transport results under quite different conditions.

EX/C4-2Rb · Experiments on Electron Temperature Profile Resilience in FTU Tokamak with Continuous and Modulated ECRH

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Abstract: Experiments performed on FTU tokamak, aiming at validation of physics-based transport models of the electron temperature profile resilience, are presented. ECRH is used to probe transport features, both in steady-state and in response to perturbations, while ECCD and LHCD are used for current density profile shaping. Observed confinement behaviour shows agreement with a critical temperature gradient length modelling. Central, low gradient plasma is characterized by low stiffness and low electron thermal diffusivity. Strong stiffness and high conduction are found in the confinement region. Resilience is experimentally characterized by an index of the resistance of the profile to adapt its shape to localized ECRH, while the diffusivity and its low-high transition are measured both by power balance and heat pulse propagation analysis. A particular attention is given to the investigation of the transition layer between low-high diffusivity and low-high stiffness regions. A dependence of LTc on magnetic shear, similar to what found in Tore Supra, and consistent with ETG based anomalous transport, is found.

EX/C4-3 · Increased Understanding of Neoclassical Internal Transport Barrier on CHS

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Abstract: The recent progress of the study on neoclassical internal transport barrier (N-ITB) of Compact Helical System (CHS) is reported. This barrier is formed due to the positive electric field and the electric field shear that are created by bifurcation of radial electric field with the electron cyclotron (EC) heating on helical devices. Previously N-ITB was observed for ECH plasma, recently N-ITB barrier was also observed for EC (53.2 GHz 2nd harmonic) heated NBI plasma. The N-ITB of EC heated NBI plasma is formed at the outer location ($r/a = 0.4 - 0.6$) in comparison with that ($r/a = 0.3$) of ECH plasma, so that the improved confinement region is expanded. The improvement in the ion energy transport is also observed and the ion temperature is increased up to 400 eV along with the electron temperature, that is two times higher than that of the plasma without N-ITB. The particle transport is studied by measuring the peak energy of Titanium $K\alpha$ line intensity with the soft X-ray CCD camera. The energy is shifted from 4.68 kV to 4.73 kV by forming N-ITB. The improvement of the impurity transport has been confirmed inside N-ITB by comparing the experimental result with the MIST code.