EX/W-5 · Electron Cyclotron Current Drive and Suprathermal Electron Dynamics in the TCV Tokamak

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Abstract: Electron cyclotron current drive (ECCD) is an important prospective tool for tailoring the current profile in next-step devices. To fill the remaining gaps between ECCD theory and experiment, especially in the efficiency and localisation of current drive, a better understanding of the physics of suprathermal electrons appears necessary. On TCV, the fast electron population is diagnosed by a multi-chordal, spectrometric hard X-ray camera and by a high field side ECE radiometer. The main modeling tool is the quasi-linear Fokker-Planck code CQL3D, which is equipped with a radial particle transport model. Systematic studies of fast electron dynamics have been performed in TCV by square-wave modulation of the electron cyclotron power, followed by coherent averaging, in an attempt to identify the roles of collisional relaxation and radial diffusion in the dynamics of the suprathermal population. The temporal evolution on turn-on and turn-off is found to involve multiple and disparate time scales. The role of radial diffusion has been evidenced by CQL3D modeling, which is able to reproduce the experimental current drive efficiency only if a modest diffusivity is included.

EX/W-6 · Property of Alfvén Eigenmode in JT-60U Reversed Shear and Weak Shear Discharges

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Abstract: This paper reports results of Alfvén eigenmode (AE) experiments in the JT-60U reversed shear (RS) and weak shear (WS) plasmas. The observation of rapid frequency chirping modes in low-β_h RS discharges with Negative-ion-based NBI (NNBI) or ICRH can be explained by considering the properties of reversed-shear-induced AE (RSAE) near q_{min} and their coupling to toroidal AEs (TAEs). We verify the existence of RSAEs and their coupling to TAEs for the first time from magnetic fluctuations and measured q-profile in JT-60U plasmas. Significant drop of the neutron emission rate and increase in fast neutral fluxes have been observed during the presence of bursting modes with large amplitude (ALE: Abrupt Large-amplitude Event) in high-β_h WS plasmas. The recently installed diagnostic of a neutron emission profile measurement reveals the transport of energetic ions associated with bursting modes.

EX/P1-01 · Study of Current Oscillations and Hard X-ray Emissions in Pre-cursor Phase of Major Disruptions in Damavand Tokamak

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Abstract: We notice that the hard x-ray activity before disruption consists of a series of spikes, uniformly distributed in time domain forming an orderly periodic series of oscillations at a frequency of 6.0 kHz. Disruption starts with an initial fast rise followed by decay. Current decay occurs in two regimes: the first corresponds to slow decay, in which the current is oscillating and reducing down to ~70% its max value, and the second corresponds to fast decay, in which it totally vanishes abruptly in about 0.2 ms. In the first regime, the loop voltage also oscillates with considerable amplitude. The frequency of oscillations in the first regime is measured to be also about 6.0 kHz. As well, they follow the oscillation phase of hard x-rays. Thus the micro-instabilities driven by runaway electrons, being responsible for the production of hard x-rays bursts and small current oscillations, play a significant role in the disruption.