EX/S3-1 · Investigation of the Beta-Limit in the W7-AS Stellarator

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Abstract: Investigations of the performance and stability of high-beta plasmas have been restarted in W7-AS utilizing higher heating powers and the new divertor system. The combination of beneficial effects resulted in a significant increase of the volume averaged β from 2 % up to 3.1 % and in MHD-quiescent, quasi-stationary discharges at low radiation levels. Experimental studies of equilibrium effects and of MHD mode activity have been performed with the X-ray tomography system. In addition results of computational MHD stability studies are presented, which show an increase of the stability with increasing β due to the pressure induced deepening of the magnetic well in combination with increasing magnetic shear, in qualitative agreement with the experimental data. The maximum achieved β is limited by the available heating power and not by stability effects. The equilibrium β-limit is approached in the case of low-iota configurations. Particularly with regard to current carrying stellarators and comparisons with tokamaks the modification of the stability of high-beta plasmas by significant OH-currents has been investigated.

EX/S3-2 · MHD Instabilities and Their Effects on Plasma Confinement in the Large Helical Device Plasmas

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Abstract: MHD stability of NBI heated plasmas and impacts of MHD modes on plasma confinement are intensively studied in the Large Helical Device (LHD). Three characteristic MHD instabilities were observed, that is, (1) pressure driven modes excited in the plasma edge, (2) pressure driven mode in the plasma core, and (3) Alfvén eigenmodes (AEs) driven by energetic ions. MHD mode excited in the edge region accompanies multiple satellites, and is called Edge Harmonic Modes (EHMs). EHM sometimes has a bursting character. The bursting EHM transiently decreases the stored energy by about 15 percents. In the plasma core region, m=2/n=1 pressure driven mode is typically destabilized. The mode often induces internal collapse in the higher beta regime more than 1 percent. The internal collapse appreciably affects the global confinement. Energetic ion driven AEs are often detected in NBI-heated LHD plasmas. Particular AE with the frequency 8-10 times larger than TAE-frequency was detected in high beta plasmas more than 2 percent. The AE may be related to helicity-induced AE. Excitation of these three types of MHD instabilities and their impacts on plasma confinement are discussed.

EX/W-1 · Heating, Current Drive and Energetic Particles Studies on JET in Preparation of ITER Operation

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Abstract: The paper summarizes the work that has been done on JET in the three areas of heating, current drive and energetic particles. The achievements have extended the possibilities of JET, have a direct connection to ITER operation and provide new and interesting physics. Toroidal plasma rotation was investigated while heating with little or no refueling or momentum input (as will be the case in ITER). With LH current drive the magnetic shear was varied from slightly positive to negative. The improved coupling (through the use of plasma shaping and CD4) allowed up to 3.4 MW of PLH in ITB plasmas with more than 15 MW of NBI and ICRF heating. The q profile with negative magnetic shear and the ITB could be maintained for the duration of the high heating pulse (8 s). Fast ions have been produced in JET using different ICRF scenarios to simulate alpha particles and the effects related to the presence of such fast ions have been investigated. Third harmonic heating of beam injected ^{4}He at 120 kV produced energetic alpha particles with energies above 2 MeV. This takes advantage of the unique capability of JET both to use NBI with ^{4}He and to confine MeV class particles.