DPP06-2006-000459

Abstract for an Invited Paper
for the DPP06 Meeting of
the American Physical Society

Energetic ion-driven instabilities on JET and on MAST.[1]

SERGEI SHARAPOV, Euratom/UKAEA Fusion Association, Culham Science Centre, Abingdon, UK

Measurements and understanding of energetic ion driven instabilities such as TAE, Alfven cascades (ACs), and chirping modes are crucial for assessing all aspects of such instabilities in burning plasmas. Ion loss and Alfven spectroscopy associated with energetic ion-driven modes were investigated in experiments on JET and on MAST with a wide range of new diagnostics. In JET with monster sawteeth, 'tornado' modes (TAE inside the q=1 radius) are observed with mode numbers decreasing one-by-one before sawtooth crash. The effect of the tornado modes on fast ions is investigated with improved X-mode reflectometry, new lost ion scintillator and Faraday cups, and gamma-ray and NPA diagnostics. Modelling with the HAGIS code shows the importance of the frequency sweep of tornado modes for depleting the fast ion density inside the q=1 radius. JET reversed-shear plasmas reveal ACs, which provide information on the time evolution of the minimum safety factor, q(min). X-mode reflectometry detecting ACs provides now information on the mode localisation region, allowing determination of the q(min) evolution in space and time and facilitating the development of ITB scenarios. Alfven spectroscopy aiming at kinetic information on electron and ion pressures, as well as the use of sub-Alfvenic NBI for exciting ACs is reviewed. TAEs and chirping modes are excited by super-Alfvenic NBI in MAST discharges. In addition, there are indications of ACs in MAST discharges targeted at ITB formation. The super-Alfvenic NBI makes MAST a good test bed for testing diagnostics for Alfven instabilities. MAST is now equipped with magnetic coils with frequency range up to 5 MHz, soft X-ray camera with frequency range up to 250 kHz, and multi-channel (in energy and in lines-of-sight) NPA.

[1]Work conducted partly under EFDA and partly funded by the UK EPSRC and by Euratom.