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dependencies and understanding behaviour in devices and confinement modes that appear to deviate from these observations. Impurity behaviour, especially He, needs to be systematically documented.

CDB 10 L-H threshold power vs. density

The threshold power has been seen to have a minimum value at low density in many tokamaks including AUG, C-Mod, DIII-D, JET and JT-60U, but the physics and scaling of the minimum threshold and the density at which it occurs is not clear and thus projections to ITER are uncertain. Joint experiments are expected to focus on density scans to study the physics and parametric dependence of the minimum threshold and density at which it occurs.

CDB 11 Scaling of the density at the H-mode threshold in D plasmas

At intermediate to high densities in D plasmas, the H-mode threshold increases gradually with increasing density. At low densities, however, there is a sudden increase in the power required to achieve H-mode that can be two to three times the nominal threshold scaling. On ASDEX-Upgrade, DIII-D, JET, and JT-60U D plasmas, the density below which the H-mode threshold power increases sharply is around 0.25×10^{20} m^{-3}. On Alcator C-Mod, however, which operates at the ITER toroidal field, this low density limit occurs at between 0.8 and 1×10^{20} m^{-3}. ITER intends to operate at an L-mode target density of 0.5×10^{20} m^{-3}. So, it is imperative to know how this low density limit scales with plasma parameters, and with plasma species (H and D). C-Mod performed some initial experiments with D plasmas in 2007 to see if the low density limit scales with plasma current and no dependence was found. This indicates that the limit does not depend on the Greenwald density limit.

CDB 12 H-mode transition and confinement dependence on ion species

This proposal call for joint experiments to determitdh

held in early September that focussed on data structures and code interfaces. The work on transport solvers was expected to start at the Naka meeting but this discussion was delayed as an IMAGE venture although activities are maintained in the partners' work programmes. As Naka IMAGE meeting was held fairly shortly after the ITER session on data structures only a smaller IMAGE session was needed to report on the outcome of the ITER IM meeting (W. Houlberg), and provide updates on the status of the IM projects through presentations by M. Yagi (JA), S. Konovalov (RF), P. Strand (EU) and G. Bateman (US).

Particle Transport WG

This session covered three topics: impurity profiles under conditions of peaked density profiles, density peaking in low aspect ratio plasmas, gyro-kinetic simulations of peaked density profiles to help discover the physics basis of density peaking. C. Giroud reported some first results from the analysis of impurity transport experiments from the 2006-2007 JET database. A wide dataset of He, Ar, Ne, Ni has been collected, but some discharges could not be analyzed because of changing conditions or MHD activity. L-mode and H-mode exhibit similar impurity peaking, which increases with . A comparison of Hybrid and H-mode cases showed the same peaking from C to Ar. Ni transport analysis is to be extended and He transport analysis started. Future plans also include beta and ν scaling, and systematic comparison with theoretical models. H. Takenaga reported on impurity transport in JT-60U ELMy H-mode plasmas. Carbon density profiles are flatter than the electron density profiles in H-mode plasmas, but there is no clear change in the C density profiles with varying plasma density or collisionality: the C density profile does not peak with reduced collisionality as the electron density profile peaks. Peaking of the C and electron density profiles both increase as the toroidal rotation shifts from co- to counter, but the C peaking dependence is much weaker. The central C density is higher with low central fuelling and electron heating. The Ar density profiles are similar to the electron density profiles. Tungsten radiation from the core increased with ctr-rotation electron density peaking, but the W source was not evaluated.

S. Kaye reported on initial analysis of a new database for MAST and NSTX density profile peaking studies. The peaking is somewhat stronger in the low A machines than in higher A machines at the same effective collsionality. There are also some differences between the low A machines: While MAST data shows a dependence of the peaking on the current profile, NSTX does not. M. Valovic reported that pellet deposition profiles on MAST confirm the presence of the ∇B -drift effect. The pellet deposition creates a zone with distinct gradients – positive ∇n and doubled $\nabla \quad < 0$ - which provide a favourable inward diffusion and a new boundary for core confinement according to turbulence codes. The retention time for the particles introduced by the pellet correlates with the state of the edge transport barrier and deposition radius. Extrapolation to ITER conditions yields $\tau_p \quad / \tau \quad \sim 0.2$, i.e. ~70% of the designed throughput.

D. Mikkelsen reported on GYRO simulations of peaked density plasmas in C-Mod. Usually EDA H-mode plasmas in C-Mod have a very flat density profile, but operation with JFT-2M shape produced low-density H-mode plasmas with strong density peaking, which is a surprising result because the density profile is never peaked at higher densities. The peaking factor and collisionality are similar to AUG & JET, which breaks the co-linearity of several parameters. GYRO simulations point to differences in the and profiles in C-Mod. Is collisioneollplIsakh t ie dehlat dmraomparalir g folam

dilution also scales similarly to collisionality, and this might be shutting off the ITG turbulence via fast-ion dilution in NBI shots. The proposed C-Mod mechanism (low electron-ion energy exchange and relaxed profile gradients) may not work for ITER and beyond where the temperatures are better coupled. The reality of the new profile shapes in C-Mod still need to be confirmed, followed by simulations based on the full measured profile.

Joint CDBM/PEP/TP sessions on toroidal rotation, tearing modes, and NBI on ITER

Rotation is governed by both intrinsic properties and by application of external torque. The question is whether it can be controlled in reactors, particularly in ITER where the applied neutral beam torque is low. As ITER proceeds from its basic operation through the more advanced hybrid and steady-state operating phases, the potential needs for rotation control increase – rotation is known to influence the core and pedestal confinement, ELMs and resistive walls modes – and the more advanced operating regimes will be successful only if the best confinement characteristics can be assured. The core and pedestal intrinsic (spontaneous) rotation properties have to be distinguished from the response of the core to applied toroidal torque. Recent results from several experiments indicate the intrinsic rotation will likely be very strong for ITER, while the incremental rotation from NBI will likely be low. However, the rotational shear may be more strongly affected by NBI, depending on the strength of the velocity pinching of both the intrinsic rotation and response to the applied torque. There is presently very strong experimental, theory and modelling efforts addressing rotation that will undoubtedly lead to rapid progress in basic understanding of toroidal rotation and its projections to ITER conditions.

Summary of the 14th ITPA CDBM Topical Group Meeting, Oak Ridge, TN

Introduction

The 14th meetings of the ITPA Confinement Databases and Modelling (CDBM) and Transport Physics Topical Groups were held in Oak Ridge, TN, 22-25 April 2008 with 28 participants. All sessions were held jointly as a prelude to the merger of the two groups.

International collaborations under the ITPA/IEA

On CDB-9 (density profiles at low collisionality),

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