Effects of Particle Deposition Profile on L→H Transition and Hysteresis Dynamics

M.A. Malkov[(1)], P.H. Diamond[(1,2)], W.W. Xiao[(2)]
[(1)] *CMTFO and CASS, UCSD; USA and*
[(2)] *WCI Center for Fusion Theory, NFRI; Korea*

The necessary ingredients in minimal model of the L→H transition are:
i.) heat and particle transport
ii.) electric field shear suppression, feedback determined by radial force balance
iii.) heating and fueling sources.

Of these, the most sensitive element seems to be the spatial structure of the fueling profile. Moreover, it is known that deeper fueling (i.e. shallow pellet injection) can lower the transition threshold, and that SMBI (Supersonic Molecular Beam Injection) can maintain an H-mode reduced firing repetition rate, once the transition is achieved. This suggests hysteresis occurs in fueling, as well as heating.

Given these observations, we generalize earlier work on transition modeling to treat two component fueling. In particular, we model fueling as occurring *both* by edge neutral penetration, localized to a narrow edge layer, *and* internal deposition (by SMBI, for example) at a finite depth within the separatrix. We also consider the possibility of periodic repetitive internal deposition by SMBI firing. We then can explore the sensitivity of the transition criterion. A further extension of previous analyzes is to replace the "constant χ,D" approximation by gradient dependent transport coefficients.

As an initial step, we determine the L→H 'phase co-existence criterion' for a two component fueling model. In particular, we explore the dependence of co-existence on the depth, relative strength and frequency of SMBI fueling.