DEPENDENCE OF THE PERTURBED ELECTRON TRANSPORT ON HEAT FLUX AND Q-PROFILE IN NSTX

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The T_e profiles are observed to flatten with increasing beam power P_b, in the 'standard' NSTX H-mode. In addition, at high power, the Type-I ELMs produce global, ms scale T_e crashes of large amplitude. Besides being unusual, these phenomena raise the question how they will scale to a next step ST. The T_e flattening is associated with changes in the q-profile, with lower q-values in lower power shots. To try and separate the roles of the heating power and of q(r) in this effect, we performed experiments in which P_b and q(r) were independently varied and the electron transport perturbed with Li pellets. A multi-energy SXR diagnostic was used to follow the cold pulse propagation.

The results of P_b variation at fixed q show that at high power the cold pulse affects the entire plasma, while at low power the pulse is strongly damped in the central plasma, indicating a substantial reduction in central electron transport. This is also apparent from the power balance analysis, which shows χ_e decreasing several times in the plasma center. An interesting observation is also that the transport change occurs *without* a change in the T_e gradient. This seems to suggest that the heat flux itself can drive electron transport and might explain the large central χ_e in the absence of significant T_e gradients, a phenomenon also seen inside ITBs in conventional tokamaks.

The q change at fixed P_b has also profound effects on electron transport. With the high q values resulting from early heating at high P_b (the 'standard' NSTX H-mode scenario), a global and rapid T_e perturbation is observed following the pellet injection, similar to that from Type-I ELMs. With the low q values resulting from early heating at low P_b, the cold pulse propagation is slowed down inside the q=2 surface ($r/a \approx 0.7$), while T_e transiently increases inside the q=1 surface ($r/a \approx 0.3$). Since the magnetic shear is comparable in the two cases, these observations seem to suggest a major role for low order, integer q-surfaces in ITB formation on NSTX. This effect was also observed in conventional tokamaks, being attributed to the interplay between zonal flows and magnetic geometry (Austin *et al*., PoP 2006). Due its large rho-star and low B, zonal flows may indeed play a larger role in NSTX.