§8. Effect of Island and Beam on the ITB. (II)

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With further increase in ECRH power, a small ITB appears in the center of the core flattening region. With higher ECR power two side peaks sometimes appears in addition to the central peak (even though further confirmation of their existence is needed). These observations may suggest an island structure (n/m=1/2), as shown in the core region of Fig. 4(a) magnetic configuration. Such island (Fig. 4(b)) certainly hampers a smooth rise of the core temperature.

If such structure exits, then plasma will response sensitively to addition of the resonant perturbation field (n/m=1/2). We add the resonant field which creates the vacuum island i.e., without plasma, as depict in Fig. 4(a). In Fig. 5, effect of the external resonant field on the ITB profile is seen, making the ITB width narrower and the central electron temperature lower compared with that in Fig. 4.

For the co-beam heated discharges, the profile is immune to the resonant field, i.e., no change is seen in the profile measured by the Thomson scattering system even with the resonant field as large as that in Fig.4(a). This is not simply due to disappearance of the $\iota/2\pi=1/2$ when Ip > 25kA. We find that co-beam suppresses the external imposed island significantly during a fairly stationary phase of co-beam and ECR heating with negative current (-35 kA), corresponding to $\iota/2\pi=0.5$ surface at $\rho=0.45$.

With above observations, our models for beam and island effects on ITB are as follows: In low density discharges ($n<2.0\times10^{19}m^{-3}$) heated only by ctr-beam, island grows and causes core flattening of the Te-profile. Even with core ECR power, the island structure hampers rise of the core temperature until ECR power exceeds a certain threshold power (which increases with density). With stronger external resonant field, island effect becomes even stronger, i.e., ITB width becomes narrower and Te(0) becomes lower. For co-beam discharges, island structure (n/m=1/2), created by combination of the natural error field and plasma effects is suppressed. The foot location extends from $\iota/2\pi\leq1/2$ to $\iota/2\pi\approx2/3$ (This may be partly due to shift of the $\iota/2\pi=0.5$ surface). Unlike ctr-beam discharges, the temperature rises more smoothly with ECR power because of non-existence or small size of the island. And furthermore the effect of strong externally imposed resonant field is minimized.

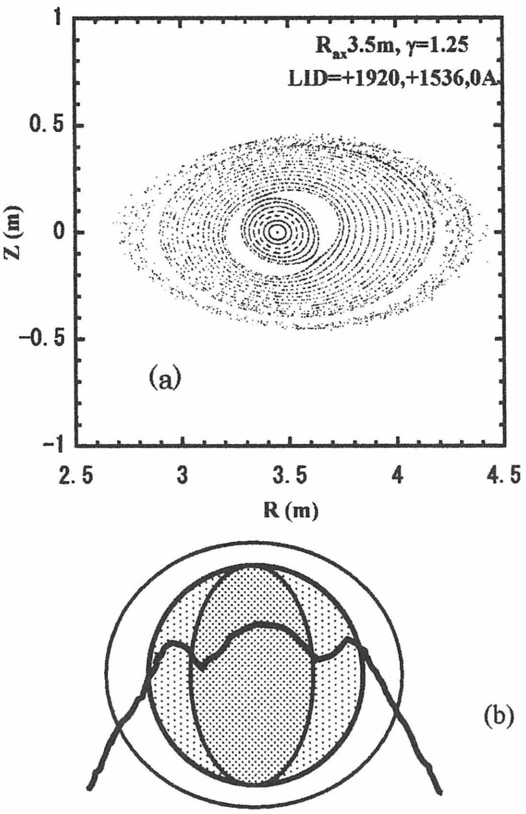

Fig. 4 (a) Island structure in the vacuum configuration. (b) Speculated temperature profile in the island region

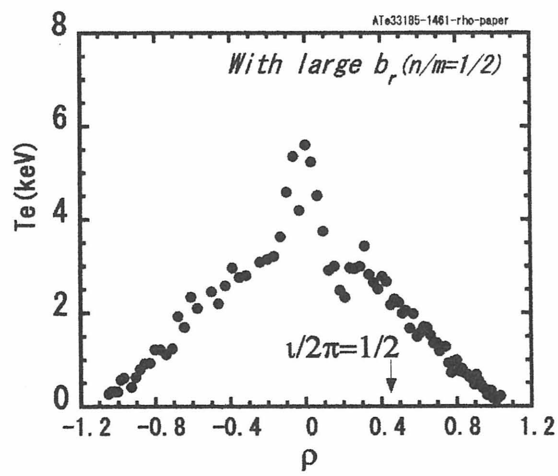

Fig. 5 Te-profile in the ctr-beam heated discharge in which large externally imposed island (n/m=1/2) reduces the ITB region.