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THE TRANSPORT MODEL FOR OFF-AXIS ECR HEATING IN TOKAMAKS *)

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Experiments with off-axis electron cyclotron resonance (ECR) heating at low currents and moderate plasma density in the DIII-D tokamak [1, 2] have shown that when the resonance point r_{res} is located at the half of small radius, the central electron temperature $T_e(0)$ is 3-4 times higher than the temperature $T_e(r_{res})$. At the same time, in the T-10 tokamak, in discharges with off-axis ECR heating at high current and low density, rather flat profiles with $T_e(0) \sim T_e(r_{res})$ were observed.

Here we use the Canonical profile transport model (CPTM) [3] to describe the plasma steady state in these experiments. It was shown that for nonzero boundary and initial conditions, even in absence of ohmic and ECR heating, the steady solutions with high central electron temperatures and without the radial heat fluxes exists. Analysis of experiments [1, 2] with the CPTM shows that in the range (0, r_{res}) the whole ohmic power Q_{OH} is transferred to the ions due to the large value of the electron-ion exchange term Q_{ei}, and the outward radial heat flux via the electron channel in this range is very small. As a result, the solution of transport equation for T_e practically coincides with T_e^{can} that provides a high electron temperature value in the core. The necessary condition for such a transfer is $Q_{ei} > Q_{OH}$. In T-10, this condition is not satisfied.

Figures 1 and 2 show profiles of the experimental, calculated and canonical electron temperatures: T_e^{exp}, T_e and T_e^{can}, and the profile of deposited ECRH power P_{EC} for DIII-D (Fig. 1) and T-10 (Fig. 2). We see that in DIII-D the T_e profile is close to the canonical profile T_e^{can}, while in T-10 the experimental and calculated temperature profiles lie far from the canonical one.

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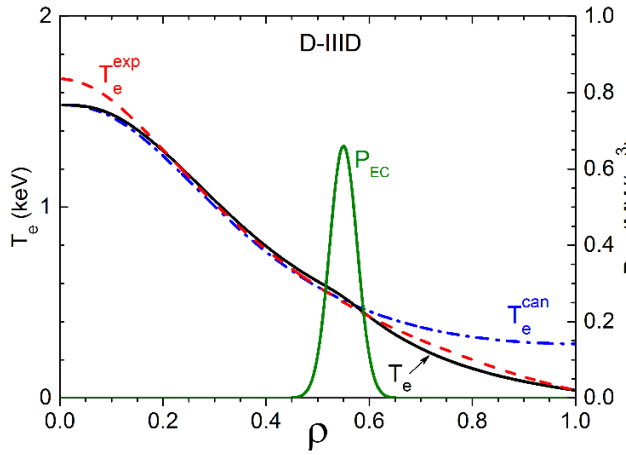

Figure 1.

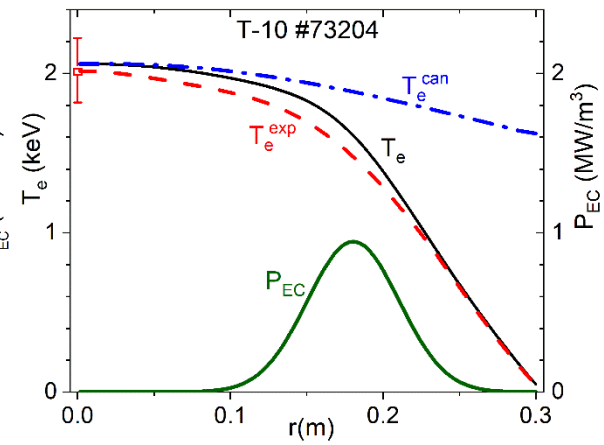

Figure 2.

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