Studies on Electron Cyclotron Heating at WVII-A/AS Stellarators

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The aim of this paper is both a theoretical investigation of plasma produced and sustained by electron cyclotron waves and comparison with experimental data obtained from the WVII-A stellarator (R=2.0m , $< a >$ = 0.1m , l=2 , m=5).
Nearly 170 KW of radio frequency power were launched nearly perpendicularly, with a pulse length of 0.1s, from low-field-side in two main heating scenarios:

(O)-mode first harmonic ($B_{res} = 2.5T$, $n_{e,cut-off} = 6.2\text{x}10^{13} cm^{-3}$)
$n_{e0} = 1.7 - 5.4\text{x}10^{13} cm^{-3}$ $T_{e0} = 2.3 - 0.6$ KeV (respectively)

(X)-mode second harmonic ($B_{res} = 1.25T$, $n_{e,cut-off} = 3.1\text{x}10^{13} cm^{-3}$)
$n_{e0} = 1.1 - 2.4\text{x}10^{13} cm^{-3}$ $T_{e0} = 1.0 - 0.7$ KeV (respectively)

At 'sufficiently high density' the experimental heating efficiency can be interpreted on the basis of a 3D-ray tracing code (modelling the electron distribution function as a weakly relativistic Maxwellian characterized by the local measured density and temperature and taking into account multiple wall reflection).
At lower densities, (typically in case of $n_{e0} \leq 2.5\text{x}10^{13} cm^{-3}$ for (O)-mode 1^{st} harmonic and $n_{e0} \leq 1.5\text{x}10^{13} cm^{-3}$ for (X)-mode 2^{nd} harmonic) the ray tracing code tends to overestimate the absorbed power and, at the same time, experimental evidences of deviation from a Maxwellian distribution arises.
With the aim of investigating effects related to quasi-linear deviation from Maxwellian plasmas (radio-frequency generation of suprathermal particles, radio-frequency induced current-drive...) Fokker-Planck equation is solved in a linearized form for different magnetic surfaces.
Effects arising from this theoretical description and experimental measurements (current and ECE) are compared.