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EFFECTS OF NONLINEAR WAVE-PARTICLE INTERACTION ON
THE ELECTRON DISTRIBUTION FUNCTION DURING ECRH*

Richard Kamendje¹, Sergei V. Kasilov², Winfried Kernbichler¹, Martin F. Heyn¹

¹*Institut für Theoretische Physik, Technische Universität Graz
Petersgasse 16, A-8010 Graz, Austria*

²*Institute of Plasma Physics, National Science Center “Kharkov Institute of Physics and Technology”,
Ul. Akademicheskaya 1, 61108 Kharkov, Ukraine*

One important ECRH scenario is using the 2nd harmonic electron cyclotron resonance of the extraordinary mode launched perpendicularly with respect to the main magnetic field. The applicability of the linear theory of wave absorption and, respectively, of the quasi-linear theory of the evolution of the distribution function is violated for this scenario in typical experimental conditions. In particular, the quasi-linear description of wave-particle interaction remains valid only for particles with relatively large parallel velocities such that particle flight time through the radiation beam, τ_f , is small compared to the oscillation period of particles trapped in the wave, τ_{bE} .

On the other hand, the adiabatic theory of nonlinear wave-particle interaction is also applicable only in a limited region in phase space (small parallel velocities, $\tau_f \gg \tau_{bE}$). Moreover, calculations of the absorbed power within this theory were performed without taking into account the combined effect of wave-particle interaction and collision processes on the formation of the electron distribution function.

In the present report, a model of wave-particle interaction for any arbitrary value of the ratio τ_f/τ_{bE} is proposed and combined with the modeling of collision processes to compute the electron distribution function numerically using the Monte Carlo method. The absorbed power is then computed on the basis of the obtained distribution function.

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Email address: kernbichler@itp.tu-graz.ac.at
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