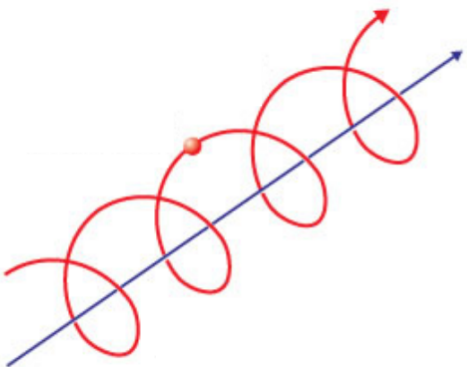
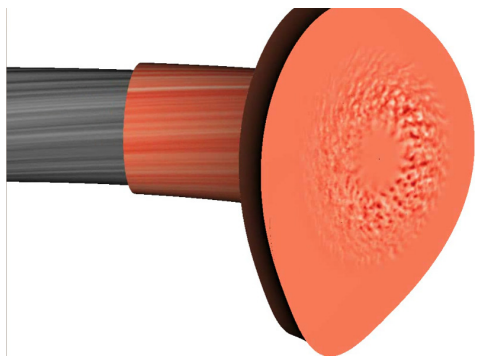
Nonlinear wave-particle dynamics of energetic-particle driven instabilities in tokamak plasmas

Alessandro Biancalani

Max-Planck Institute for Plasma Physics, Garching, Germany

in collaboration with I. Chavdarovski, Z. Qiu, A. Bottino, D. Del Sarto, A. Ghizzo, Ö. Gürcan, P. Morel, I. Novikau.





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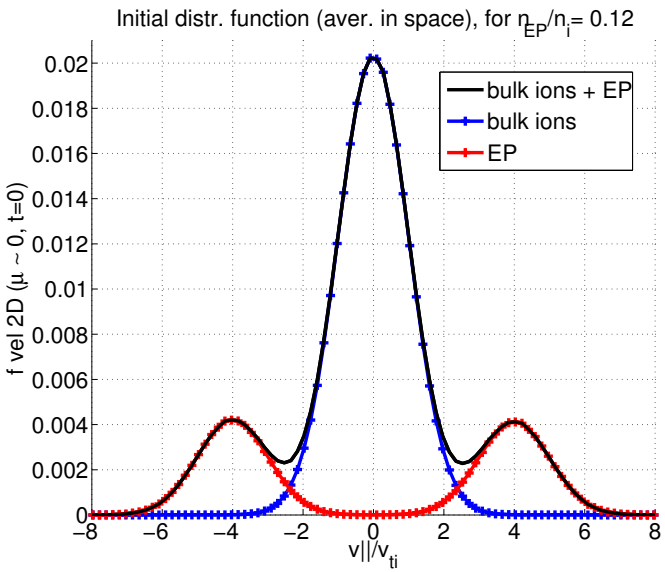
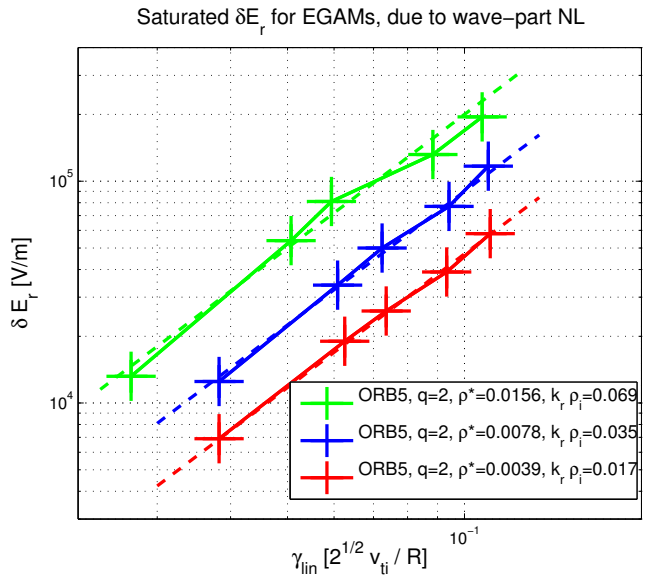
Langmuir waves in 1D vs acoustic modes in tokamaks

Problem: NL saturation of instabilities and EP redistribution in v-space.





Growth and saturation due to nonlinear inverse Landau damping:

$$\omega_b^2 = \alpha_1 \, \delta\bar{E}_r \, , \quad \delta\bar{E}_r = \alpha_2 \gamma_L^2$$

with α_1 derived analytically, and α_2 obtained with gyrokinetic PIC sims with ORB5. We obtain for EGAMs, like for the beam-plasma instability:

$$\omega_b = \beta \, \gamma_L$$

Goal: synergy of numerical modelling and analytical theory to build a more complete understanding of future burning plasmas.