# Experimental dependence of ECR plasma breakdown on wave polarization in the TJ-II stellarator

A. Cappa[1], F. Castejón[1], K. Nagasaki[2], F. Tabarés[1], A. Fernández[1],
D. Tafalla[1], E. de la Cal[1], T. Estrada[1]

[1] *Laboratorio Nacional de Fusión, Madrid, Spain*

[2] *Institute of Advanced Energy, Kyoto University, Japan*

Recently, second harmonic ECRH plasma breakdown and its dependence on the initial conditions such as neutral gas pressure, injected power or beam polarization has been the subject of theoretical as well as experimental work [1, 2, 3]. Although those studies have been carried out in the context of stellarators, they are particularly relevant in the case of large tokamaks, such as ITER, where conventional inductive breakdown is expected to be strongly improved if ECRH is used. A matter of interest is the dependence of breakdown time on wave polarization. In the existing theoretical models, wave polarization is not taken into account because it is assumed that the injected ECRH power is initially scrambled by the vessel walls and that the energy source for breakdown is only due to the non-linear wave-particle interaction between deeply trapped electrons and the averaged electric field. However, while this seems reasonable for the very beginning of the discharge, it may not be so as we progress towards breakdown. Actually, as experiments in Heliotron J have demonstrated, wave polarization must be taken into account in the description of the energy source.

Breakdown experiments in TJ-II were performed in order to get a deep insight into this matter and part of the results of breakdown dependence on wave polarization were already discussed in [4]. In particular, it was demonstrated that the hypothesis about the energy source used in the models is failing long before full ionization is completed. But more information in relation with our understanding of the second harmonic ECRH breakdown, such as the toroidal and radial breakdown propagation, which is seen to be non-diffusive, can be extracted. Thus, the experiment results provide valuable data that can be used not only to improve the energy source but also to include spatial dimensions in the breakdown models.

**References**

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