Analytical and numerical studies on enhanced scattering due to wave trapping in the reflectometry experiment.

S. Heuraux*, E. Gusakov, A. Popov

Ioffe Institute, Politekhnicheskaya 26, 194021 St.Petersburg, Russia

**IJL, Nancy-Université CNRS UMR 7198, BP70239, F-54506 Vandoeuvre CEDEX, France*

The collective microwave scattering effect is often used for the purpose of plasma wave and fluctuation diagnostics in magnetic fusion devices. The most sensitive and local modifications of this method are based on the so called enhanced scattering effect first proposed by A.D. Piliya in relation with backscattering in the plasma resonance [1]. This effect is justified in [2] for the upper hybrid resonance backscattering. As it was shown in [3] the effect persists where and when the local amplification of both incident and scattered field exists. The same idea can be applied to explain the localization of the fluctuation reflectometry measurements by the enhanced scattering effect due to the growth of the probing and scattered wave amplitude in the cut off vicinity. However in the later case the field amplification stays small and therefore the localization remains weak.

A way to improve the measurements done by reflectometry is to find an addition mechanism able to amplify locally the electric field of the probing wave. A possible amplification can be induced by the wave trapping due to a strong Bragg backscattering (BBS) of quasi coherent density perturbations. Two ways of the wave trapping in the artificial cavity are considered. In the first, typical for the reflectometry experiment, the trapping occurs between the BBS point and the cut off, whereas in the second it takes place between two fluctuations. Both configurations have been studied first numerically and then analytically. 1D full-wave computations give results on amplification factor and phase behavior in agreement with analytical predictions. And it has been shown that the scattering off the turbulence localized in the cavity region is strongly enhanced compared to the standard reflectometry or microwave scattering. Such probing electric field amplification can explain also phase jumps seen in reflectometry data. The merits of this possible way to improve the reflectometry measurements will be presented and discussed.

Financial support of RFBR grants 09-02-00453-a, 07-02-92162-CNRS is acknowledged

[1] Piliya A D 1966 Zh. Tekh. Fiz. **36**, 2195

[2] Novik K M and Piliya A D 1994 *Plasma Phys. Control. Fusion* **35** 357

[3] Gusakov E.Z. , Surkov A.V. 2003 Technical Physics Letters **29** 698