Theory of turbulent reflectometry

J.T.Mendonça[1], R.M.O. Galvão[2] and C. Amador[3]

[1]IPFN, Instituto Superior Técnico, 1049-001 Lisboa, Portugal

[2]Instituto de Física, Universidade de São Paulo, São Paulo SP, 05508-090 Brasil

[3]Universidade Tecnolgica Federal do Paran, Brasil

Abstract

We present the theory of O and X-modes reflectometry in tokamaks, which takes into account phase modulation contributions due to the presence of turbulence in different ranges of the plasma cross-section. The theory includes contributions from both the cut-off region and the far-away plasma regions. In the cut-off region, our discussion avoids the use of the Born approximation, and stays valid for a generic turbulence spectrum. In the far-away region, the turbulence contributions to the reflected signal are mainly due to resonant Bragg scattering processes. Two of these processes are retained, one is due to Bragg back-scattering of the incident wave, and other is due to Bragg forward-scattering of the reflected wave. They satisfy different Bragg conditions, and contribute to different frequencies of the reflected wave spectrum.