RF beam scattering by cylindrical filaments and interfacial density fluctuations (*)

S. I. Valvis[1], A. Zisis[2], A. Papadopoulos[1], P. Papagiannis[1], A. K. Ram[3], K. Hizanidis[1], I. G. Tigelis[2], E. Glytsis[1]

[1] *National Technical University of Athens, Athens, Greece*

[2] *National and Kapodistrian University of Athens, Athens, Greece*

[3] *Plasma Science and Fusion Center, MIT, Cambridge MA, USA*

Radio Frequency (RF) waves are routinely used in tokamaks for heating, current drive, NTM control, as well as for diagnostics purposes. Frequently, RF waves, aiming towards the plasma core, propagate through a turbulent environment. The latter can exhibit strong coherent density fluctuations as well as filamentary structures mainly (though, not perfectly) aligned along the local magnetic field lines. The scattering process of RF waves by these structures is studied both analytically and numerically. RF waves can be either single plane waves or spatially confined beams. For that purpose, the filaments are considered to have cylindrical shape with infinite length with the cylinder axis not aligned with the local magnetic field and the results are compared to the ones from the study of the aligned case [1,2]. On the other hand, the interfacial density fluctuations are considered periodic with spatial periods larger, smaller or of the same order of the wavelength of the incident RF waves. The frequency range of the RF waves studied is mainly in the Electron Cyclotron (EC) range of frequencies for ITER-like and Medium Size Tokamak applications. Furthermore, the study covers a variety of density contrasts, filament sizes and fluctuation strengths.

References

[1] A. K. Ram and K. Hizanidis, "Scattering of radio frequency waves by cylindrical density filaments in tokamak plasmas", Physics of Plasmas 23, 022504 (2016)

[2] Z. C. Ioannidis, A. K Ram, K. Hizanidis, I. G. Tigelis, "Computational studies on scattering of radio frequency waves by density filaments in fusion plasmas", Physics of Plasmas 24, 102115 (2017)

(*) This work was supported in part by the Hellenic National Programme on Controlled Thermonuclear Fusion associated with the EUROfusion Consortium.