

P5.4015 Scattering of lower hybrid radio frequency waves by cylindrical turbulent structures in the plasma edge in tokamaks

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See full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/P5.4015.pdf>

Lower hybrid (LH) radio frequency (RF) waves are used in fusion tokamak devices to generate non-inductively toroidal currents. LH waves are effective in imparting toroidal momentum to electrons in the core of the confined plasma. Since the LH waves are generated by wave guide structures near the wall of a tokamak, the waves have to propagate through a turbulent plasma in the edge region before coupling to the core. It is especially important to quantify the effect of this plasma region on the propagation characteristics of the LH waves, since fusion reactors like ITER will have an extended edge region. Structures in the plasma edge like filaments and blobs which have highly varying density fluctuations compared to the background density, span radial spatial scales that are comparable to the LH wavelength. We study the scattering of the LH waves by the filamentary structures using Maxwell's equations, in which the plasma permittivity is given by the cold plasma dispersion tensor. The collisional absorption of LH waves in the edge region is included by a modification to the elements of the dispersion tensor. The filaments are assumed to be cylindrical with the axis predominantly aligned along the direction of the toroidal magnetic field. Our studies are both analytical and numerical [1,2] and show that these structures can lead to reflection, refraction, diffraction, and side-scattering of both an incident LH plane wave and a Gaussian beam. We will present a variety of different density variations and collisional absorption rates in plasmas with filamentary structures of varying sizes. The changes in the spectral properties of the LH waves will also be discussed.

References

- [1] S. I. Valvis and others "Scattering of radio frequency waves by cylindrical filaments with general orientation relative to the magnetic field", Journal of Plasma Physics vol. 84, 745840604 (2018)
- [2] Z. C. Ioannidis, A. K. Ram, K. Hizanidis, and I. G. Tigelis, "Computational studies on scattering of radio frequency waves by density filaments in fusion plasmas", Physics of Plasmas 24, 102115 (2017)

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