

The impact of edge radial electric fields on edge–scrape-off layer coupling in the TJ-II stellarator

G. Grenfell, B.Ph. van Milligen, U. Losada, T. Estrada, B. Liu, C. Silva, M. Spolaore, C. Hidalgo and the TJ-II Team rces of negative ions for future NBIs.

Nucl. Fusion **60** (2020) 014001; <https://doi.org/10.1088/1741-4326/ab538c>

Abstract:

In this letter, we investigate the impact of edge radial electric fields (E_r) on turbulence propagation and the coupling between the plasma edge and the scrape-off layer (SOL) during slow electron–ion–electron root transitions in the TJ-II stellarator. The plasma edge was monitored with a set of electrostatic probes and Doppler reflectometry. It is shown, for the first time, that E_r does not only affect the radial turbulence correlation length—a well-known effect—but it is also capable of reducing and nearly blocking the propagation of turbulence from the edge into the SOL. Specifically, in the ion root phase ($E_r < 0$ in the edge), the SOL turbulence penetration depth was strongly reduced, as compared to the electron root phase ($E_r > 0$). This result was obtained using a technique based on the transfer entropy, which quantifies the propagation of information. These observations are considered highly relevant in the framework of the understanding of the mechanisms that determine the SOL width, a vital parameter for future fusion reactors.