



Current carrying Edge Localized Modes fine structure in the Scrape-Off Layer of tokamak discharges

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The presence of filamentary structures widely characterizes the edge region of fusion devices, independently from their magnetic configuration. These structures are generally revealed by pressure peak locally emerging on the cross-field plane from the plasma background and the name filaments is due to their extended size along the magnetic field line.

Filamentary structures emerging from turbulence background share their general features with Edge Localized Modes (ELMs) filaments, which are responsible of a large fraction of transport towards the plasma wall and divertor plates. The filament electromagnetic features were experimentally studied in the recent years due to their relevance on transport properties [1-6], considering as an example the transition between closed and open magnetic field line topology, i.e X-points and advanced divertor magnetic configurations, or the possible magnetic field line bending effect when enough high current is associated to ELM filaments, enhancing their interaction with the first wall. A further aspect to be considered is the enhancement of the electromagnetic effect expected at high beta plasmas: in particular, an increasing current density associated to turbulent structures was experimentally observed to characterize turbulent filaments as beta increases [1].

Local magnetic fluctuations were experimentally detected in presence of ELMs in different tokamaks such as MAST, ASDEX-U, EAST, DIII-D and JET[7-11]. In this contribution a direct measurement of the current density associated to ELMs in the two experiments COMPASS tokamak [12] and RFX-mod [13], operated as a tokamak, will be presented. Measurements were performed on both devices with specifically designed insertable probe heads, properly equipped with 2D arrays of electrostatic and magnetic sensors [2][14]. The diagnostic set is completed in both experiments with arrays of probes located on the divertor or first wall. The plasmas analyzed are based on SN shaped tokamak discharges where the H-mode was achieved in ohmic or NBI heated plasmas, in COMPASS, or stimulated by edge biasing in RFX-mod [15]. The latter represents a

newly explored scenario with this technique, where ELM electromagnetic composite filamentary structures are observed, characterized by clear vorticity and parallel current density patterns [15].

On the other side, recent preliminary analysis revealed the presence of parallel current associated to the COMPASS ELMs and evidenced their fragmented structure within the Scrape-Off Layer (SOL) region [16]. The comparative analysis of the experimental results will be based on the same method applied on the two devices [17], aiming at the insight of possible common physics.

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