SOL transport and filamentary dynamics in tokamaks: from L to inter-ELM filaments in high density regimes

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Addressing the role of Scrape Off Layer filamentary transport is presently a subject of intense studies in fusion science. Intermittent coherent structures are found to dominate transport in the L-Mode scenarios and to strongly contribute to particle and energy losses in the ELM and inter-ELM phases in H-mode. The role of convective radial losses towards the first wall has become even more important due to its contribution to the so called process of *shoulder formation* in L-Mode, with the progressive flattening of the density scrape off layer profile at high density [1–4]. Investigation on this process revealed the strong relationship between divertor conditions and the upstream profiles, mediated by filaments dynamics which varies accordingly to the modification of the downstream condition. Preliminary investigation suggested that similar mechanisms are likely to occur in H-Mode as well [5] and even contribute to the so-called H-mode density limit (HDL) [6]. The present contribution will report the results obtained in a coordinated effort between ASDEX-Upgrade and TCV tokamaks, to address the role of filamentary transport in high density regimes both in L and H-Mode. The combination of results from different machines enlarge the operational space explored moving from a device with closed divertor, metallic first wall and an highly efficient cryogenic pumping system to a carbon machine with a complete open divertor. The mechanism of shoulder formation and the role of filamentary transport has been tested against variation of parallel connection length, obtained through a current scan and poloidal flux variation, magnetic configuration, comparing single and double null configuration and against divertor neutral densities, through modification of cryopump efficiency. The resulting picture suggests a complex relationship between divertor and upstream profiles, where filaments are modified by divertor collisionality as well as by neutral particle interaction.

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