

P5.1094 Particle-In-Cell simulation of parallel blob dynamics in the near scrape-off-layer plasma of a generic medium-size tokamak with divertors

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1094.pdf>

Blob transport is subject to intense study in fusion energy research for the understanding and prediction of particle and heat fluxes onto the plasma-facing components (PFC) [1]. Blobs originate around the separatrix at the outer midplane, forming filaments which expand and propagate in the parallel and, respectively, perpendicular (outwards) direction, with respect to the total magnetic field. Although considerable work has been done to address the perpendicular (radial and poloidal) transport in the scrape-off-layer (SOL) plasma, both experimentally and numerically, the dynamics of these filaments along the flux tube did not receive sufficient investigative attention. Up to now, flux tube dynamics simulations assumed constant temperatures, forced Maxwellian-distributed species and/or no divertor physics. Experimentally, mean parallel flows can only be estimated by using Mach probes [2]. We have studied the evolution of a blob along a magnetic field line in the near scrape-off-layer (SOL) plasma of a generic diverted medium-size tokamak (MST) and its contribution to the recorded heat flux at the divertors, using the 1D3V PIC BIT1 code [3]. We have observed that most of the blob's hot electrons are immediately screened by the cold electrons of the SOL plasma and that they can reach the two divertors depending on the density of the SOL plasma, due to Coulomb collisions. Secondly, we showed, in terms of density, that a SOL plasma can be built by a train of blobs shot in vacuum when ion-recycling at the divertors is activated (i.e. ions touching the divertors become neutrals, with 99% probability). In this case, the built SOL plasma is made of cold electrons due to the inelastic collision between the blob's electrons and the neutrals formed by recycling, and of cold ions formed by the ionization of slow neutrals or by charge-exchange between blob's ions and the slow neutrals.

References

- [1] H.W. Müller et al., Nuclear Fusion 51 (2011), 073023.
- [2] B. LaBombard et al., Nuclear Fusion 44 (2004), 1047.
- [3] D. Tskhakaya, Plasma Phys. Control. Fusion 59 (2017), 114001.

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