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A two-dimensional model for the effects of EXB drifts near the divertor target

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Since most of the heating power from plasma core crossing the separatrix must flow inside a narrow power width on open field lines in the scrape-off layer (SOL) connecting directly to the divertor target plates, a two-dimensional (2D) model could be developed by considering the toroidal symmetry of tokamak. The model focuses on the region near the divertor target, in which the ion continuity equation and parallel momentum equation are coupled through the ExB drift velocity and parallel momentum [1]. It is revealed that the strong temperature gradient near the divertor plate lead to strong radial electrical field. To satisfy the sheath boundary condition and maintaining the pressure balance, the radial electric field could accelerate the parallel flow to supersonic and thus generate strong poloidal electric field. Just as illustrated in the figure, with or without the ExB drift, the pressure profiles associated with the divertor surface heat load result in different distributions. The model also has capacity to integrate the atomic processes including ionization, recombination, and charge exchange which could give a self-consistent recycling particle source from the target. The modelling analysis may improve the understanding on EXB drifts in SOL physics

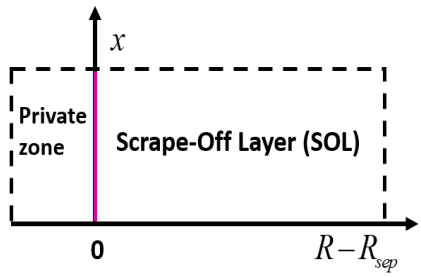

Figure 1, the solution domain of the model for the region near the divertor target.

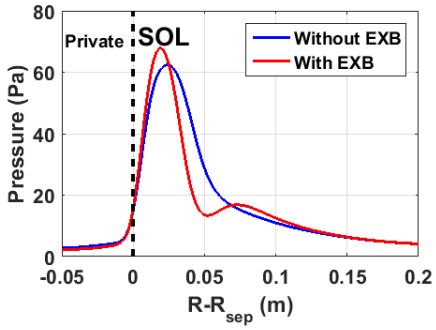

Figure 2, the target pressure profile with or without EXB drifts.

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References

[1] Wang H Q et al 2020 Phys. Rev. Lett. 124 195002