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P5.1027 The impact of modeling the separatrix in 3D slab edge simulations

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Edge simulations until recently focussed on simulating only the scrape-off layer (SOL) and including appropriate boundary conditions to the numerical domain to mimic effects like the presence of a separatrix on the inner radial boundary. To a large extent, flux-driven 3D simulations have had considerable success in recovering the statistical behaviour of plasma fluctuations in the SOL [1]. However, explicitly incorporating a separatrix is a non-tivial addition to the already complex physics of edge transport, and needs a detailed study. It provides insights into how cross-field transport is balanced across the separatrix via parallel transport in the open fieldline region. The separatrix also plays an important role in some of the instabilities common to the edge like filamentation, and in shear flows. In this paper, slab simulations with a separatrix are compared to slab simulations where the separatrix is absent. The differences observed in the transport of the two cases is crucial to singling out and understanding the role of the separatrix. In these simulations, it is seen that the separatrix triggers a strong velocity gradient which possibly plays a role in establishing global poloidal flows. Filamentation is also seen to occur in the vicinity of the separatrix, which poses new questions about the physical description of filamentation with respect to the separatrix - whether the ingredients of filamentation are unique to the presence of a separatrix, or if filamentation (as reproduced in simulation without a separatrix) is independent of the separatrix. This paper describes the analysis of these simulations performed using the TOKAM3X fluid code [2], and outlines the role of the separatrix for an electrostatic isothermal edge plasma.

[1] J. Anderson et al, Physics of Plasmas (1994-present) 21, 122306 (2014)
[2] P. Tamain et al, J. Comp. Phys., 321, 606-623 (2016)

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