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Addressing the effect of E×B on closure diveror detachment onset by SOLPS

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Abstract
The closed divertor (such as small angle slot-SAS, C-Mod)[1] can well trap neutral (D, D2) and carbon impurity from erosion particles in target region, so that the impurity and recycling neutral particles can radiate a large quantity of power[2]. As a result, the closed divertor very easily achieves detachment with relative small upstream density. However, experimental results in DIII-D and C-Mod [3]showed that the direction of Grad-B has very big influence on the closed diveror detachment onset. As we known, the electric drift- E×B is much related with the direction of Grad-B, and can drive a large number of particles from outer into inner target region along the poloidal flux tubes in private flux region when Grad-B toward divertor. The E×B strongly depends on the radial and polodial gradients of electron temperature-Te and static pressure-neTe[4]. Since the closed divertor can well screen impurity and neutral recycling particles, the polodial gradients of Te and neTe are much larger in closed divertor than that open divertor. Thus, the E×B may have a great effect on the detachment onset in closed divertor. In this work, we will employ the edge plasma code SOLPS to address the effect of E×B on the closed diveror detachment onset in HL-2M. The preliminary modeling results reveal that the effect of E×B on detachment onset in closed divertor is much larger than open divertor, and the closed divertor is very difficult to achieve detachment when Grad-B toward divertor when activating E×B. This work will excite great interests in advancing scientific understanding of the interplay between E×B and impurity energy dissipation for detachment control in closed divertor.

References
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