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Study on particle pinch mechanism for DEMO

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The particle transport is an important research topic for burning control in DEMO reactors. For example, the hollow density profile is often seen after pellet injection or gas-puff. In such a case, the inverted density gradient appears in the edge region which produces the particle pinch. To understand particle pinch mechanism, we have performed local gyrokinetic simulation using DEFEFI code[1, 2] with the inverted density gradient (dn/dr > 0). We have observed inward particle flux for such condition. To understand the mechanism of particle pinch, we have revisited the ion-mixing mode theory proposed by B. Coppi[3]. It is found that the electron drift wave contributes to the particle pinch rather than the ion-mixing mode for the inverted density gradient. In this paper, we introduce the trapped electron response which is not considered in the previous analysis. In DEMO, we expect trapped electron mode (TEM) is dominant in the core region with the normal density gradient (dn/dr <0) . However, for the inverted density gradient in the edge region, it should be stabilized so that the particle pinch may come from the passing electron response rather than trapped electron response. We will clarify parameter regime in which the particle pinch is produced by passing or trapped electron response relevant to DEMO.

[1] B. Scott, Phys. Plasmaas 17 (2010) 102306.
[2] K. Miki, et al., Proc. of M&C 2017, Korean Nuclear Society, 2017-01.
[3] B. Coppi and C. Spight, Phys. Rev. Lett. 41 (1978) 551.

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