Cold pulse and rotation reversals with turbulence spreading and residual stress - DTU Orbit (09/11/2017)

Cold pulse and rotation reversals with turbulence spreading and residual stress

Transport modeling based on inclusion of turbulence spreading and residual stresses shows internal rotation reversals and polarity reversal of cold pulses, with a clear indication of nonlocal transport effects due to fast spreading in the turbulence intensity field. The effects of turbulence spreading and residual stress are calculated from the gradient of the turbulence intensity. In the model presented in this paper, the flux is carried by the turbulence intensity field, which in itself is subject to radial transport effects. The pulse polarity inversion and the rotation profile reversal positions are close to the radial location of the stable/unstable transition. Both effects have no direct explanation within the framework of classical transport modeling, where the fluxes are related directly to the linear growth rates, the turbulence intensity profile is not considered and the corresponding residual stress is absent. Our simulations are in qualitative agreement with measurements from ohmically heated plasmas. Rotation reversal at a finite radius is found in situations not displaying saturated confinement, which we identify as situations where the plasma is nearly everywhere unstable. As an additional and new effect, the model predicts a perturbation of the velocity profile following a cold pulse from the edge. This allows direct experimental confirmation of both the existence of residual stress caused by turbulence intensity profiles and fundamental ideas of transport modeling presented here. Published by AIP Publishing.

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