Impurity transport in temperature gradient driven turbulence

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In the present paper the transport of impurities driven by trapped electron (TE) mode turbulence is studied. Non-linear (NL) gyrokinetic simulations using the code GENE are compared with results from quasilinear (QL) gyrokinetic simulations and a computationally efficient fluid model. The main focus is on model comparisons for electron temperature gra- dient driven turbulence regarding the sign of the convective impurity velocity (pinch) and the impurity density gradient R/LnZ (peaking factor) for zero impurity flux. In particular, the scaling of the impurity peaking factors with impurity charge Z and with driving temper- ature gradient is investigated and compared with the results for Ion Temperature Gradient (ITG) driven turbulence. In addition, the impurity peaking is compared to the main ion peaking obtained by a self-consistent fluid calculation of the density gradients corresponding to zero particle fluxes. For the scaling of the peaking factor with impurity charge Z, a weak dependence is obtained from NL GENE and fluid simulations. The QL GENE results show a stronger dependence for low Z impurities and overestimates the peaking factor by up to a factor of two in this region. As in the case of ITG dominated turbulence, the peaking factors saturate as Z increases, at a level much below neoclassical predictions. However, the scaling with Z is weak or reversed as compared to the ITG case.
The scaling of impurity peaking with the background temperature gradients is found to be weak in the NL GENE and fluid simulations. The QL results are also here found to significantly overestimate the peaking factor for low Z values.
For the parameters considered, the background density gradient for zero particle flux is found to be slightly larger than the corresponding impurity zero flux gradient.

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