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3D simulations of edge impurity flow obtained in the vacuum ultraviolet emission experiment in LHD with EMC3-EIRENE

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The edge impurity flow in the stochastic layer of the Large Helical Device (LHD) has been investigated with the three-dimensional (3D) edge transport code EMC3-EIRENE [1-3]. The simulation results of the carbon impurity flow velocity show a good agreement with the vacuum ultraviolet (VUV) emission measurements. The up-down asymmetry of the radial velocity of the impurity flow observed by the VUV spectroscopic measurements can be interpreted by the EMC3-EIRENE modelling. The detailed analysis of the measured impurity flow directions by the VUV spectrometer system has been performed by the 3D studies of the magnetic field structure and the parallel impurity flow velocity. The transport behaviour of the edge impurity flow with different magnetic field structures are studied based on the recent development of computational grids. The radially outward shift of the magnetic axis position leads to a change of the distribution of the radial velocity of the impurity flow. It is found that the variation of the edge impurity flow for the high upstream plasma density is induced by the change of the edge plasma flow behaviour under different magnetic field structures. Further, the impact of the plasma density on the edge impurity flow is studied, which shows that the radial velocity of impurity flow is strongly affected by the force balance between the thermal force and friction force.

References

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