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Impurity transport and plasma flow in a mixed collisionality stellarator plasma

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Neoclassical accumulation of impurities in the core of hot stellarator plasmas is a known problem. The complexity of neoclassical transport in stellarators means that few analytic studies are available to support numerical modelling efforts, and a robust understanding of the parameter dependence of the impurity flux is still lacking. Therefore we present an extension of the existing analytic treatment for highly collisional plasmas, into the experimentally relevant mixed collisionality regime - where a dominant heavy, collisional, impurity is present in a collisionless bulk plasma, taken here to be in the $1/\nu$ regime. We find that temperature screening of the impurity flux by the bulk ion temperature gradient will arise. We also determine the bulk ion flow in the flux surface, and thus the effect of the impurity on the bulk ion contribution to the bootstrap current.

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Primary author: Dr NEWTON, Sarah (Chalmers University of Technology)

Co-authors: Dr MOLLÉN, Albert (Max-Planck-Institut für Plasmaphysik, Greifswald); Dr SMITH, Håkan (Max-Planck-Institut für Plasmaphysik); Prof. HELANDER, Per (Max Planck Institute for Plasma Physics); Dr TURKIN, Yuriy (Max-Planck-Institut für Plasmaphysik, Greifswald)

Presenter: Dr NEWTON, Sarah (Chalmers University of Technology)

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