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Calculations of neoclassical impurity transport in stellarators

ALBERT MOLLÉN, HÅKAN M. SMITH, ANDREAS LANGENBERG, YURIY TURKIN, CRAIG D. BEIDLER, PER HELANDER, Max Planck Inst Plasmaphysik, MATT LANDREMAN, Institute for Research in Electronics and Applied Physics, University of Maryland, SARAH L. NEWTON, CCFE, Culham Science Centre, UK, JOSÉ M. GARCíA-REGAÑA, Laboratorio Nacional de Fusión, CIEMAT, Spain, MASANORI NUNAMI, National Institute for Fusion Science, Japan — The new stellarator Wendelstein 7-X has finished the first operational campaign and is restarting operation in the summer 2017. To demonstrate that the stellarator concept is a viable candidate for a fusion reactor and to allow for long pulse lengths of $\sim$ 30 min, i.e. "quasi-stationary" operation, it will be important to avoid central impurity accumulation typically governed by the radial neoclassical transport. The SFINCS code [Landreman et al. *Phys. Plasmas* **21** (2014) 042503] has been developed to calculate neoclassical quantities such as the radial collisional transport and the ambipolar radial electric field in 3D magnetic configurations. SFINCS is a cutting-edge numerical tool which combines several important features: the ability to model an arbitrary number of kinetic plasma species, the full linearized Fokker-Planck collision operator for all species, and the ability to calculate and account for the variation of the electrostatic potential on flux surfaces. In the present work we use SFINCS to study neoclassical impurity transport in stellarators. We explore how flux-surface potential variations affect the radial particle transport, and how the radial electric field is modified by non-trace impurities and flux-surface potential variations.

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