Numerical calculations of collisional impurity transport in stellarators

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Impurity transport is an important topic in stellarator physics as the traditional theory predicts strong impurity accumulation driven by the inward pointing radial electric field. However, there are experimental observations in which the strong impurity peaking is absent [1, 2], and which to date have not found a satisfactory explanation in the standard theory. The collisional transport channel has a prominent role in stellarator plasmas and in recent years there has been a revived interest in neoclassical impurity physics, which have led to advances in both analytical [3, 4] and numerical [5, 6, 7] modeling indicating that the standard neoclassical theory lack several effects that can be crucial when analyzing the impurity transport.

One important result of the recent development is that flux-surface variations of the electrostatic potential can in general not be neglected when calculating the neoclassical impurity transport, as shown by numerical [5, 6] and analytical [8] work. The number of tools capable of accounting for this effect is limited. Moreover, only a few comparisons of results from the different tools have been made. The purpose of the present work is to perform a joint neoclassical impurity study of experimental stellarator plasmas using the EUTERPE [5], SFINCS [6, 9] and KNOSOS [7] codes, which can all include the extended physics.

References

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