Impurity transport studies at Wendelstein 7-X by means of x-ray imaging spectrometer measurements

This paper reports on the effect of on- and off-axis heating power deposition on the impurity confinement in purely electron cyclotron resonance heated He plasmas on the stellarator Wendelstein 7-X. Therefore, impurity transport times $\tau_I$ have been determined after Fe impurity injections by laser ablations and monitoring the temporal impurity emissivities by the x-ray imaging spectrometer HR-XIS. A significant increase of $\tau_I$ has been observed when changing the power deposition from on- to off-axis heating with energy confinement times $\tau_E$ being mainly unaffected. In addition, the scaling of impurity transport properties with respect to a variation of heating power $P_{ECRH}$ and electron density $n_e$ has been investigated by keeping the heating power deposition on-axis. The observed $\tau_I$ scaling compares well to known $\tau_I$ scaling laws observed in other machines. A comparison of $\tau_I$ and $\tau_E$ yields an averaged ratio of $\tau_E/\tau_I = 1.3$ and transport times in the range of $\tau_I = 40–130$ ms and $\tau_E = 40–190$ ms. Comparing those absolute values to neoclassical predictions supports the recently observed nature of anomalous transport in Wendelstein 7-X, given within the up to now investigated operational parameters.

General information
State: Published
Organisations: Department of Physics, Max-Planck-Institut für Plasmaphysik, Forschungszentrum Jülich GmbH, Laboratorio Nacional de Fusión, Princeton Plasma Physics Laboratory, Auburn University
Number of pages: 8
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Plasma Physics and Controlled Fusion
Volume: 61
Issue number: 1
Article number: 014030
ISSN (Print): 0741-3335
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes