Numerical modeling of the transition from low to high confinement in magnetically confined plasma - DTU Orbit (08/11/2017)

Numerical modeling of the transition from low to high confinement in magnetically confined plasma

The transition dynamics from low (L) to high (H) mode confinement in magnetically confined plasmas is investigated using a four-field drift fluid model—HESEL (Hot Edge-Sol-Electrostatic). The model includes profile evolution and is solved in a 2D domain at the out-board mid-plane of a tokamak including both open and closed field lines. The results reveal different types of L–H-like transitions in response to ramping up the input power by increasing the ion temperature in the edge region. For a fast rising input power we obtain an abrupt transition, and for a slow rising power we obtain a L–I–H transition with an intermediate I-phase displaying limit-cycle oscillations (LCO). The model recovers the power threshold for the L–H transition, the scaling of the threshold with the density and with the loss-rate in the SOL, indicating a decrease in power threshold when switching from single to double null configuration. The results hold promises for developing full predictive modeling of the L–H transition, which is an essential step in understanding and optimizing fusion devices.

General information

State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Chinese Academy of Sciences
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Number of pages: 10
Pages: 014031
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: Plasma Physics and Controlled Fusion
Volume: 58
ISSN (Print): 0741-3335
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 0.583 SNIP 0.617
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.734 SNIP 0.864 CiteScore 1.1
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.318 SNIP 1.235 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.088 SNIP 1.227 CiteScore 1.54
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.391 SNIP 1.142 CiteScore 1.63
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.512 SNIP 1.592 CiteScore 2.69
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.477 SNIP 1.41
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.589 SNIP 1.32
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.872 SNIP 1.603

Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.971 SNIP 1.389
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.833 SNIP 1.403
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.73 SNIP 1.55
Scopus rating (2004): SJR 2.232 SNIP 1.377
Scopus rating (2003): SJR 2.016 SNIP 1.247
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.667 SNIP 1.022
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.507 SNIP 1.23
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.388 SNIP 1.124
Scopus rating (1999): SJR 2.148 SNIP 1.515
Original language: English
L–H transition, Fluid simulations, Braginskii equations, Turbulence and flows
Electronic versions:
Rasmussen_L_H_transition_EPS15_rev_1.pdf
DOIs:
10.1088/0741-3335/58/1/014031
Source: FindIt
Source-ID: 276531742
Publication: Research - peer-review › Journal article – Annual report year: 2015