Fluid Modeling of an ELMing H-mode and a RMP H-mode*

S. Mordijck[1], X. Bonnin[2], J. Canik[6], D. Coster[3], T.E. Evans[4], M. Groth[5], R. Maingi[6], R.A. Moyer[1], T.H. Osborne[4], L.W. Owen[6], T.W. Petrie[4], D. Reiter[7], G.R. Tynan[1], E.A. Unterberg[8], and J.G. Watkins[9]

[1]*University of California San Diego, La Jolla, California, USA*
[2]*Laboratoire d'Ingénierie des Matériaux et des Hautes Pressions-CNRS, Paris, France*
[3]*Max-Planck Institut für Plasmaphysik, Garching, Germany*
[4]*General Atomics, San Diego, California 92186-5608, USA*
[5]*Lawrence Livermore National Laboratory, Livermore, California, USA*
[6]*Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA*
[7]*Forschungszentrum Juelich, Juelich, Germany*
[8]*Oak Ridge Institute for Science Education, Oak Ridge, Tennessee, USA*
[9]*Sandia National Laboratories, Albuquerque, New Mexico, USA*

In this paper, we model the particle balance during an ELMing H-mode and a RMP ELM-free H-mode. When resonant magnetic perturbations (RMP) are applied during low collisionality experiments, a density pump-out is observed. Data shows that during an ELMing H-mode, in a three second period, 15 torr liters are unaccounted for and are probably in the scrape-off layer (SOL) or the wall, while in a similar experiment with the RMP coils on, 45 torr liters are lost. This suggests that there is an increased particle flux to non-divertor walls or SOL. In comparison, during the first second of the same experiments, 53 torr liters are unaccounted for.

To study the impact of neutrals on the particle balance, B2-EIRENE [1,2] is used. B2-EIRENE is a 2D-fluid code coupled to a Monte Carlo neutral code. First, we need to find a transport model for the ELMing H-mode in between two ELMs [3]. Next, we use the derived diffusion coefficients and carry out numerical experiments, where we independently change the cryopumping efficiency and the wall recycling coefficient. Observations show that the cryopump through-put depends on the neutral pressure in the divertor and is not the cause of the core density pump-out during the RMP phase. In the final numerical experiment, we incorporate the information obtained from the previous parameter variations, and also enhance the radial transport upstream, as observed in experiments in RMP H-mode. B2-EIRENE indicates that changing the recycling coefficient in the divertor has a much larger impact on the upstream profiles, than changing the pumping efficiency. The physical interpretation of these parameter changes is discussed and linked to observations.

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