Abstract Submitted
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Self-consistent model of an inductive negative ion source[1] GERJAN HAGELAAR, NICOLAS KOHEN, JEAN-PIERRE BOEUF, LAPLACE (LAboratoire Plasma et Conversion d Energie), CNRS and Universite de Toulouse — The experimental fusion reactor ITER will be heated by injection of a fast neutral beam generated by acceleration and neutralization of negative ions. The negative ion source used for this purpose, developed by the IPP Garching, consists of a driver where radio-frequency (RF) power is inductively coupled to the plasma electrons and an expansion chamber containing a magnetic filter. This paper presents the principles of a self-consistent two-dimensional model of this source. The different particle species are described by fluid equations including magnetic fields, inertia, and viscosity, with boundary conditions accounting for surface processes. The charged particle equations are coupled with the Maxwell equations for a fully self-consistent description of the (pre)sheath and RF coupling. We present results for simple configurations to illustrate the main mechanisms controlling the plasma properties: neutral gas depletion in the plasma center due mainly to ionization, compression of the plasma in the source driver by the ponderomotive force, plasma transport in the magnetic filter region. We also discuss several fundamental limitations of the model in describing realistic source conditions.

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