Seminar

Institute for Plasma Research

Title : Studies on Neon Gas Seeding in Tokamak Plasma

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Date : 9th January 2020 (Thursday)

Time : 02:30 PM

Venue : Seminar Hall, IPR

Abstract :

Investigation on medium Z impurity ions during impurity seeding in a tokamak plasma has become an intensive research area. Normally, two-dimensional (2D) interchange turbulence in the edge and Scrape-off Layer (SOL) regions of a tokamak plasma has been used for describing impurity gas interaction, which is capable to include anomalous transport effects [1]. Basic model equations related to the interchange plasma in the edge and SOL coupled with the Neon gas have been solved numerically using BOUT++ code in Refs [2, 3]. Typical fluid equations have been used for the description of plasma and the impurity gas. Physics of Neon gas has been investigated by the authors in the past and in this context few results related to the Aditya tokamak had been described. Earlier, we had considered only one ionization state of Neon gas for the simplicity of the problem. Actually, all the ionization sates (Ne^{1+} - Ne^{10+}) are possible to exist inside the tokamak plasma during Neon gas seeding by the electron impact ionization. In this work, we have considered all the species together. 0D and 1D studies have been done as the benchmark studies for the 2D model. The relative concentration of all the charge states has been presented in this work. In the 0D and 1D models, the Neon gas interaction with the plasma turbulence was absent. Therefore, we have studied 2D model of the Neon gas in the presence of coupling with the turbulent plasma in the edge and SOL regions. The presence of all the charge states and their relative concentration of the Neon ions will be presented from the three models. Aditya results indicate an increase in the global electron energy confinement time only when the gas seeding becomes effective in changing the global tokamak plasma parameters [2], but details investigation of this issue was not done. In this work it is found that the low recombination rate of Neon ions in the edge and recycling of the gas in the SOL with radiative cooling make an electron temperature gradient higher in the edge-to-SOL transition region. This is responsible for the increase of confinement time even after switching off the Neon gas; results will be presented in detail. Modification of poloidal, and power spectra in the presence of Neon ions in the SOL region are discussed.

References

[1] N. Bisai, Santanu Banerjee, and Abhijit Sen. Phys. Plasmas, 26:020701, 2019. 1

[2] N. Bisai, M.B. Chowdhuri, S. Banerjee, Harshita Raj, Ritu Dey, R.L. Tanna, R. Manchanda, K.A. Jadeja, J. Ghosh, and Aditya Team. Nucl. Fusion, 59:126013, 2019.

[3] R.L. Tanna, Harshita Raj, J. Ghosh, Rohit Kumar, Suman Aich, Tanmay Macwan, D. Kumawat, K.A. Jadeja, K.M. Patel, M.B. Kalal, D.S. Varia, D.H. Sadharakiya, S.B. Bhatt, K. Sathyanarayana, B.K. Shukla, P.K. Chattopadhyay, M.N. Makawana, K.S. Shah, S. Gupta, V. Ranjan, V. Balakrishnan, C.N. Gupta, V.K. Panchal, Praveenlal Edappala, B. Arambhadiya, Minsha Shah, V. Raulji, M.B. Chowdhuri, S. Banerjee, R. Manchanda, G. Shukla, K. Shah, R. Dey, Nandini Yadava, Sharvil Patel, N. Bisai, D. Raju, P.K. Atrey, S.K. Pathak, U. Nagora, J. Raval, Y.S. Joisa, Manoj Kumar, K. Tahiliani, S.K. Jha, M.V. Gopalkrishana, and A. Sen. Nucl. Fusion, 59:112006, 2019.