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Studies of the gas puff effect on edge plasma of Aditya tokamak using coupled DEGAS2-UEDGE code

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Fuel neutral penetration and dynamics in the edge and scrape of layer (SOL) plasma region of tokamaks shape the plasma properties in these regions which play an important role in determining the core plasma confinement. Experiments in Aditya and Aditya-U tokamaks have shown that fuelling by periodic multiple gas puffs led to improved core plasma properties [1]. These experimental results warrants a detailed understanding of the edge and SOL plasmas during and after the gas puffs to understand the physics behind improvement of plasma properties. Modelling of edge and SOL plasmas of Aditya and Aditya-U tokamaks has been carried out using the coupled UEDGE and DEGAS2 code. Neutral hydrogen penetration into the Aditya [2] and Aditya-U plasmas has been obtained using the neutral particle transport code, DEGAS2 during the gas-puff. The modifications in plasma parameters in the SOL and edge regions due to these neutrals have been modelled using the UEDGE code, which is a 2D edge-plasma transport code. Both these codes are coupled to obtain the dynamics of edge and SOL plasmas during and after the gas-puffs of different magnitudes. The Aditya tokamak is operated with a poloidal ring limiter located at one toroidal location, whereas the Aditya-U tokamak is operated with a toroidal belt limiter on the high field side. Geometries of both limiter configurations are successfully integrated with both the codes, which are run for many discharges with different operational parameters. The coupled code has successfully reproduced the measured temporal evolution of Hα emission and the variations in density and temperature in the edge and SOL regions due to the gas puff. It has been observed that the gas puffs significantly modify the density and temperature profiles in the SOL and edge regions of Aditya and Aditya-U. The results show that the periodic gas-puffs of proper magnitudes can be used to control the SOL and edge plasma parameters in order to obtain improved core properties.

[1] R. L. Tanna et al, NF 57, 102008 (2017).
[2] R. Dey et al, NF 57, 086003 (2017).

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Author: Dr DEY, Ritu (Institute for Plasma Research)

Co-authors: STOTLER, Daren (Princeton Plasma Physics Laboratory); Mrs SHARMA, Deepti (Institute for Plasma Research); Ms RAJ, Harshita (Institute for Plasma Research); Mr RAVAL, Jayesh (Institute for Plasma Research); Dr GHOSH, Joydeep (Institute for Plasma Research); Mr PATEL, K M (Institute for plasma Research); Mr JADEJA, Kumarpalsinh (Institute for plasma Research); Dr CHOWDHURI, Malay Bikas (Institute for Plasma Research); Mr PATEL, Narendra (Institute for Plasma Research); Mr ATREY, P K (Institute for Plasma Research); Dr CHATTOPADHYAY, P K (Institute for Plasma Research); Dr SRINIVASAN, R (Institute for Plasma Research); Mr TANNA, Rakesh (Institute For Plasma Research); Mrs MANCHANDA, Ranjana (Insitute for Plasma Research); Mr JOISA, S (Institute for Plasma Research); Dr BANERJEE, Santanu (Institute for Plasma Research); Mr ROGNLIEN, T D (Lawrence Livermore National Laboratory); Mr NAGORA, U C (Institute for Plasma Research)

Presenter: Dr DEY, Ritu (Institute for Plasma Research)

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