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Role of neutral gas in Scrape-off Layer of tokamak plasmas

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Role of neutral gas in Scrape-off Layer (SOL) of tokamak plasma is important as it modifies the plasma turbulence. This has been investigated using a simple two-dimensional (2D) model that consists of electron continuity, quasi-neutrality, electron energy and neutral gas continuity equations. Earlier the role of the neutral gas has been studied using uniform electron temperature [1]. However, in this study finite gradient of the electron temperature has been introduced using the electron energy equation. Linear growth rate obtained from these equations has been studied. The neutral gas ionization rate is found to stabilize the linear growth rate. Neutral diffusion has an important role on the linear growth rates as it destabilizes the modes. The nonlinear equations are solved numerically. It is found that the neutral gas reduces/increases fluctuations of the plasma density in the outer/inner region of the SOL. Radial profiles of plasma density, electron temperature, and radial electric field have been studied. It is found that e-folding thickness of the plasma density, and electron temperature is reduced by the neutral gas. The neutral gas also reduces the radial electric field that agrees qualitatively with the Aditya experimental observations.

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Primary author: Dr BISAI, Nirmal Kumar (Institute for Plasma Research, Bhat, Gandhinagar-382428, India)

Presenter: Dr BISAI, Nirmal Kumar (Institute for Plasma Research, Bhat, Gandhinagar-382428, India)

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