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Effect of the Controlled Density Gradient on Equilibrium and Confinement in a Simple Toroidal Device with two plasma sources

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A simple toroidal device (SMT) is a toroidal device in which plasma is confined by the application of toroidal and vertical magnetic field only resulting in absence of a conventional effective rotational transform. Such devices provide a simple and well diagnosable test-bed for studies related to equilibrium, fluctuations and particle confinement for Tokamak edge. The device BETA at the Institute for Plasma Research (IPR) is one such SMT with a plasma major radius of 45 cm and minor radius of 15 cm and a maximum toroidal field of 0.1 Tesla. Quasi-static equilibrium in an SMT is controlled by the nature of fluctuation and flow [1, 2]. As observed in hot cathode discharges studied earlier [1, 2], density gradient provide fluctuation in the plasma and hence the instabilities [2]. Whereas radial electric field provides poloidal flow. Thus, the conditions are akin to Tokamak edge.

To experimentally understand the effect of the density gradient, it is desirable to be able to control the local gradient at the outboard side by an additional plasma source. To this end, a new microwave source of frequency 2.4 GHz and power about 0.5 kW has been developed [3]. Hot cathode and microwave sources are used in tandem such that the upper hybrid resonance falls at the outboard density gradient region, which in turn allows us to control the density gradient locally. The details of the experiment will be presented.

References

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Author: Mr KUMAR, Umesh (Institute for Plasma Research, Gandhinagar, Gujarat, India)

Co-authors: Dr GANESH, Rajaraman (Institute for Plasma Researh, Bhat Village, Gandhinagar 382428, Gujarat, INDIA); Dr DANIEL, Raju (Institute for Plasma Research, Gandhinagar, India); Mr KRISHNAMACHARI, Sathyanarayana (Institute for Plasma Research, Gandhinagar, India); Dr THATIPAMULA, Shekar G. (National Fusion Research Institute, Daejeon, South Korea); Prof. SAXENA, Yogesh C. (Institute for Plasma Research, Gandhinagar, India)

Presenter: Mr KUMAR, Umesh (Institute for Plasma Research, Gandhinagar, Gujarat, India)

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