

# Seminar

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## Institute for Plasma Research

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**Title :** Effect of multiple-sources on toroidal plasma in BETA: Current filament, ECR and Electron Drift Injector

**Speaker:** Dr. Umesh Kumar  
Institute for Plasma Research, Gandhinagar

**Date :** 16th July 2020 (Thursday)

**Time :** 11:00 AM

**Venue :** Online - Join the talk:

[https://meet.ipr.res.in/Umesh\\_PostdocExtension](https://meet.ipr.res.in/Umesh_PostdocExtension)

### Abstract :

A currentless toroidal device (CTD) is one 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 CTD 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 a CTD 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]. Thus, the conditions are akin to Tokamak edge.

In addition to hot cathode source, Microwave plasma source is used in producing plasma. The hot cathode source uses thermionic emission of electron to produce the plasma and the discharge is struck between grounded wall and the hot cathode. Plasma produced by Microwave source involves launching of Microwave of frequency of around 2.45 GHz with average launched power of around 1 kW. It has been observed that using these two sources in tandem in the presence of an external vertical field can provide a control over density profile [3]. This helps in controlling the density gradient on the outboard side and hence controlling the nature of instabilities. The detailed experimental study of controlling the nature of plasma profiles using two sources and external vertical field in presence of flows will be presented.

Apart from above mentioned work, an electron drift injection (EDI) source has also been commissioned on BETA. This source can be useful in generating enough electrons to initiate a breakdown in a Tokamak [4]. Preliminary experiments using EDI as a primary plasma source show plasma discharges in BETA [5]. Some of the aspects of this work will also be presented.

### References

- [1] T S Goud, PhD Thesis, Institute for Plasma Research, Gandhinagar, Gujarat, India (2012).
  - [2] Umesh Kumar, PhD Thesis, Institute for Plasma Research, Gandhinagar, Gujarat, India (2018).
  - [3] Umesh Kumar, R Ganesh, K Sathyanarayana, Y C Saxena, S G Thatipamula, D Raju, Manuscript under preparation, (2020).
  - [4] N Wang et al, Review of Scientific Instruments, **85**, 073505 (2014).
  - [5] Bhavesh R Kadia, Jasraj Dhongde, P Prasad Rao, Tushar Raval, Ankur Jaiswal, Yuvakiran Paravastu, Siju George, Umesh Kumar, Rajesh Kumar, YSS Srinivas, Sunil Kumar, D Raju, E Rajendra Kumar, Manuscript under preparation (2020).
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