

## §5. High Density Plasma Experiment HYPER-I

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In the end of March 1998, the construction of Research & Development Laboratory was completed. The High Density Plasma Experiment (HYPER-I) device was moved from the Plasma Diagnostics Laboratory to the new laboratory at the end of May. Minor modification was done for the vacuum chamber and the supporting frame, and a pure water cooling system and a DC power supply (400V, 300A) for the magnetic coils were introduced for the stand-alone operation of the device. The first operation of Hyper-I device in the new laboratory was at the end of July 1998.

Hyper-I is a linear plasma device with the weak magnetic fields ( $< 1\text{kG}$ ) and designed for the basic plasma studies such as wave-plasma interaction near the electron cyclotron range of frequency, and magnetohydrodynamic wave experiments *etc.*. The plasmas are produced by an electron cyclotron wave (ECW) with a frequency of 2.45GHz. Because of no cutoff density for the accessibility of ECW, a plasma density higher than

$1 \times 10^{13} \text{ cm}^{-3}$  is achieved with a 15 kW microwave input. This density is two orders of magnitude higher than the usual density scaling of the ordinary mode with the same frequency. The ongoing experiments are

### *(i) high density plasma production*

High density plasma production experiments have been carried out to obtain detailed information of the production and the energy deposition in the resonance region. For this purpose, we have developed a new antenna, and measured the Poynting flux of ECW.

### *(ii) plasma flow measurement*

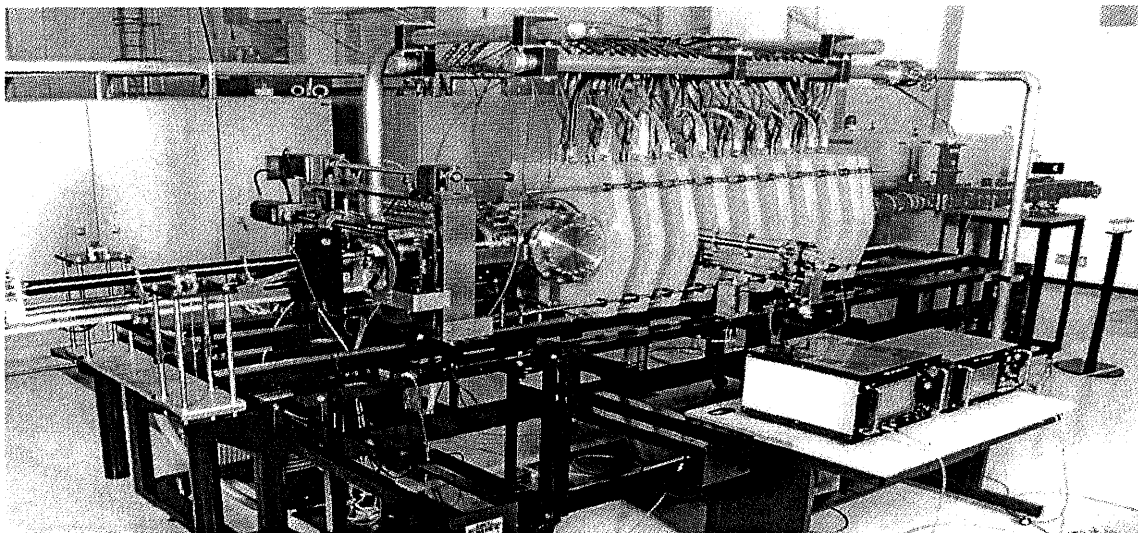
Plasma flow velocity has been measured by the improved directional probe to study macroscopic flow structure in an ECR plasma. The effect of magnetic field on the determination of perpendicular flow velocity to the magnetic field is experimentally examined.

### *(iii) vortex formation in a plasma*

Spiral structures and twin vortex cylinder have been observed in a certain range of background pressure. The mechanism of vortex formation and their interaction are now under investigation

### *(iv) new microwave source*

To obtain much higher plasma densities, we are introducing a klystron amplifier with an output of 80 kW (CW). The high voltage power supply (40kV, 4 A) for the klystron tube has been equipped and the fast shut-down test of the high voltage circuit has been completed.



**HYPER-I device**