

## §10. Faraday Rotation Measurements using a Heterodyne Polarimeter on CHS

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A heterodyne polarimeter proposed by Howard<sup>1)</sup> was installed on CHS. By using this system, Faraday rotation angle of the incident laser beam is measured from the phase variation between right and left circularly polarized waves, which originate in the linearly polarized incident laser beam. Since the polarimeter was modified from the interferometer, this system can measure the electron density as well. The Faraday rotation is described by the following equation.

$$\phi f(\text{rad}) = 2.62 \times 10^{-13} \lambda(m)^2 \int n_e(m^{-3}) B_{//}(T) dz \quad (1)$$

Here,  $\lambda$  is the wavelength of the incident laser,  $B_{//}$  is the magnetic field parallel to the laser beam axis.

When the magnetic field is well known (like a low  $\beta$  helical plasma), the electron density is measured from eq.(1) by this system as well as by an interferometer, when the magnetic field is not known (like a high  $\beta$  helical plasma or tokamak plasma),  $B_{//}$  is measured using simultaneously measured density data. In the former case, density measurements are free from the phase jump, which is a problem for the conventional interferometer. In the latter case,  $B_{//}$  gives the poloidal magnetic field, then, plasma current profiles can be obtained from this.

Figure 1 shows the Faraday rotation angle measured by the polarimeter and that calculated by using the measured density profile and the vacuum magnetic field. Since Fig. 1 was obtained from a currentless low  $\beta$  ECH plasma, where the magnetic field is same as the vacuum one, the measured and calculated angle should be the same value. However, there are some discrepancies

between them. These are supposed to be by the phase shift caused by the refraction of the probe beam. The resolution is about 1 degree at present. This is determined by the laser instability and a mechanical vibration of the rotational grating. In order to remove these effect, optimization of the alignment, stabilization of the laser and replacement of rotational grating is under going. Finally, the measurement of the current profile of the ohmic H mode<sup>2)</sup> is planned.

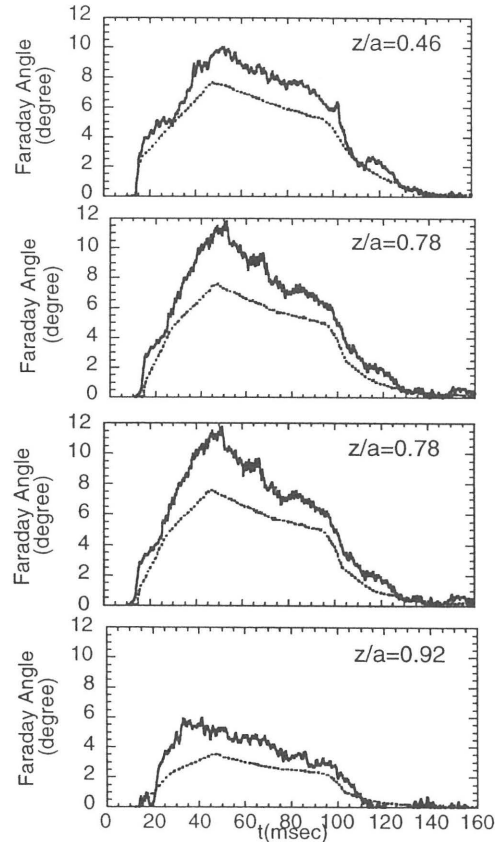


Fig.1. Measured (plain line) and calculated (dotted line) Faraday rotation. These were obtained from  $B_t=1.8T$  ECH plasmas

### References

- 1) J. Howard, Infrared Phys. Vol.34, No.2, p175,(1993)
- 2) Toi, K., et al., Proc. 14th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Research, Wurzburg, 1992 (IAEA, Vienna, 1993), 2, p461