§33. Setup of Zeeman Polarimeter for Measurement of Internal Magnetic Field

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In the heliotron/torsatron the magnetic surface is basically generated by external coil currents such as helical and poloidal coils. However, the field structure such as radial profiles of rotational transform, magnetic shear and magnetic well is considerably modified by a finite beta or by a net plasma current. It is important to observe the rotational transform profile when it is modified by the plasma current[1]. The direct measurement is also important in the experiments of the rotational transform profile.

We install a single channel Zeeman polarimeter which is composed of a photo elastic modulator, beam splitter and a scanning Fabry-Perot interferometer and so on. This polarimeter system has successfully been applied to the JIPP T-IIU tokamak, and has achieved high time resolution up to 1.5ms[2]. This high time resolution enables us to study the radial diffusion of a plasma current density in rapid current ramp-up or ramp-down plasmas.

In CHS, we monitor HeII line emitted from a He-doped plasma through electron impact excitation, which is the same approach in JIPP T-IIU. We also use the active beam emission through charge exchange recombination with hydrogen heating beam. Charge exchange process between fully ionized ions He^{2+} and hydrogen atoms H^0 in a heating beam is expressed as

$$H^0(NB) + He^{2+} \rightarrow H^+ + He^{+*}(n=4)$$
$$\rightarrow H^+ + He^+(n=3) + h\nu$$
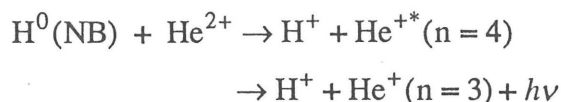
where n is the level of the excited state.

Figure 1 shows a schematic drawing of the polarimeter system installed in CHS. This system views the almost whole plasma cross section by tilting a plane mirror through a upper port.

Reference

[1]Toi,k., *et al.*, Plasma Phys. Control. Fusion **36** (1994)A117.

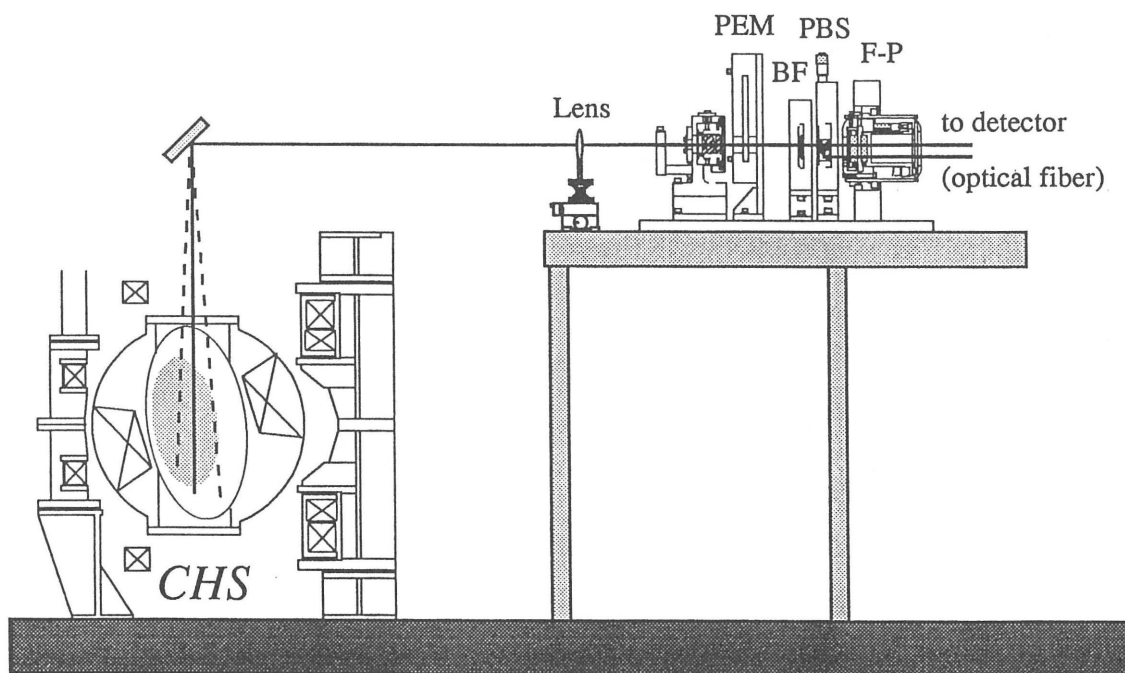[2]Kuramoto,H., *et al.*, J.Plasma Fusion Res.**71** (1995)1020.

Fig.1. A Zeeman polarimeter setup at the CHS.
PEM:photoelastic modulator, BF:bandpass filter, PBS:polarized beam splitter,F-P:the scanning Fabry-Perot interferometer