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ヘリウム原子近赤外発光線への磁場効果観測のための干渉型分光器の開発
Development of a near-infrared interference spectrograph for the observations of magnetic field effects on helium atomic emission lines

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Local emission intensity, velocity, and temperature of atoms in the scrape-off layer of tokamak plasma have been measured by means of analyzing the Zeeman patterns in the emission spectral line shapes [1-2]. Since the magnetic field strength in the tokamak device depends on the major radius, the emission position can be determined from the magnitude of the Zeeman splitting.

For a given magnetic field strength, the magnitude of the Zeeman splitting is approximately proportional to the square of the wavelength. In order to improve the spatial and temporal resolutions of the measurements, we have developed a near-infrared interference spectroscopy system for the observation of He I 2^3S-2^3P emission line profile (1083.0 nm). The system consists of a collimating lens, an aperture, a band path filter (peak wavelength 1080.0 nm, FWHM 10 nm), a tunable Fabry-Perot interferometer (peak wavelength 1083.0 nm, FWHM 0.02 nm, FSR 0.6 nm) and a cooled photomultiplier tube detector (Hamamatsu G5509-43, spectral response 300 to 1400 nm). The tuning speed of the interferometer is up to about 10 kHz for one FSR.

The red curve in Fig.1 shows the calculated spectrum expected to be observed in the spherical tokamak, QUEST, with a radial line of sight on the midplane. The curve is calculated by convoluting the instrumental function of the interferometer into the green curve which is summation of two spectra originating from the high-field (blue curve, 0.50 T) and low-field (pink curve, 0.15 T) sides. In the calculation, radially localized emission and Doppler broadening corresponding to an atomic temperature of 0.2 eV are assumed. The emission positions can be identified from the magnitude of the Zeeman splitting. The emission intensities, velocities, and temperatures at those positions can be determined from the areas, the Doppler shifts and the Doppler-broadenings of the spectra, respectively.

For the evaluation of the performance of the spectrograph, we measure the He I emission line from a glow discharge tube installed in a superconducting magnet.

[1] J. L. Weaver, B. L. Welch, H. R. Griem, J. L. Terry, B. Lipschultz, C. S. Pitcher, S. Wolfe, D. A. Pappas and C. Boswell, Rev. Sci. Instrum. **71**, 1664 (2000).
[2] T.Shikama, S.Kado, H.Zushi, M.Sakamoto, A.Iwamae and S. Tanaka, Plasma Phys. Control. Fusion **48**, 1125 (2006).

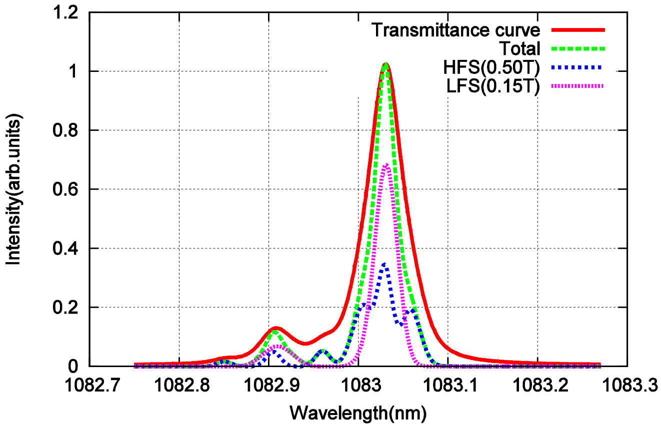

Fig.1 The calculated He I spectra expected to be observed