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## フェムト秒レーザー光とプラズマの相互作用
## Interaction of femto-second laser pulses with a plasma

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Laser induced fluorescence (LIF) spectroscopy using a narrow-bandwidth tunable diode laser can directly measure the velocity distribution function. The flow field of neutral particles with a velocity less than 10 m/s has been measured in an electron cyclotron resonance plasma [1]. The potential usability of LIF spectroscopy as a basic tool of plasma physic is becoming well-known, and the method has been widely introduced in plasma researches.

The applicability of LIF method, however, depends on the population of the target particles. Usually, the excited atoms, which are produced by electron impacts, have been chosen as the LIF target particles, and the population is strongly affected by the experimental conditions. Therefore, the LIF system without restriction on the experimental conditions has been needed. We have developed an active-LIF spectroscopy system with a femto-second laser (FS laser). The FS laser is capable of generating the excited atoms by non-linear optical effects with the very strong electric field.

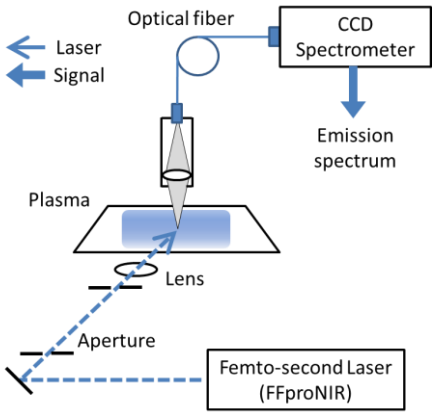


Fig. 1. Schematic diagram of the optical system measurement

We have experimentally studied the interaction between the FS laser and an argon plasma by measuring the plasma emission spectrum with a CCD spectrometer (see Fig. 1). The FS laser having a wavelength of 780±20 nm, repetition rate of 80 MHz, and a pulse width 70 fs was introduced into the plasma. Using a beam focusing optics, we obtained a laser intensity of the order of $10^9$ W/cm$^2$.

Figure 2 shows the increment of emission spectrum, where the spontaneous emission intensities without the FS laser pulses are subtracted from that with the FS laser pulses. As seen in the figure, there are significant increases in emission spectrum of Ar I lines (e.g., 826.6794 nm). This result indicates that the population of the excited atoms is increased through the interaction with the FS laser. The detailed information will be given in the poster session.

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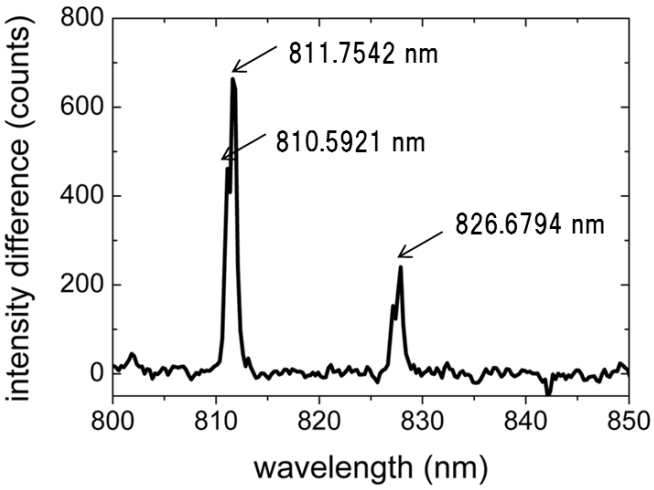


Fig. 2. Increment in emission spectrum with the FS laser

[1] M. Aramaki et al., Rev. Sci. Instrum. **80** (2009) 053505