

§9. Development of Far-Infrared Lasers for LHD Diagnostics and Construction of Data-Base on Laser Characteristics

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Far-Infrared (FIR) lasers of 25 to 1000 μm wavelength region are useful for optical sources of plasma diagnostics, spectroscopy, metrology and THz technology. FIR lasers more than 4000 lines from over 100 species by CO_2 laser pumping have been reported. However, the details on the characteristics of available lasing line have not been so well known. Laser output strongly depend on laser components such as laser tube (diameter and length) and output coupling mirror, operation parameter such as pressure and pump-offset frequency, and internal coupling of lasing lines.

We have constructed FIR laser system as shown in Fig.1 in Chubu University to establish the laser source for LHD diagnostics and to construct reliable data-base on FIR laser characteristics. In Fig.1, FIR laser A is the laser system used to develop the 119- μm optical source for a multi-channel interferometer of LHD[1-3]. FIR laser B is newly developed laser system, which can equip the laser tube of 25 to 54 mm in diameter and 2 to 3 m in length[4]. In this laser system, the mirror displacement in cavity tuning can be measured by 1 μm in accuracy. In this system, laser tubes of four different diameter can be used by switching the pump CO_2 laser beam. The laser wavelength is measured by using a Fabry-Perot interferometer and a grating spectrometer of Czerny-Turner type in addition to detuning curve of the laser cavity.

Lasing wavelength and the characteristics for about 50 powerful lines from CH_3OH and isotopes, CH_2F_2 , NH_3 and HCOOH have been measured. A few new laser lines have been observed. Figure 2 shows the detuning curve of the new line from CH_2DOH pumped by 10R(46) cw CO_2 laser.

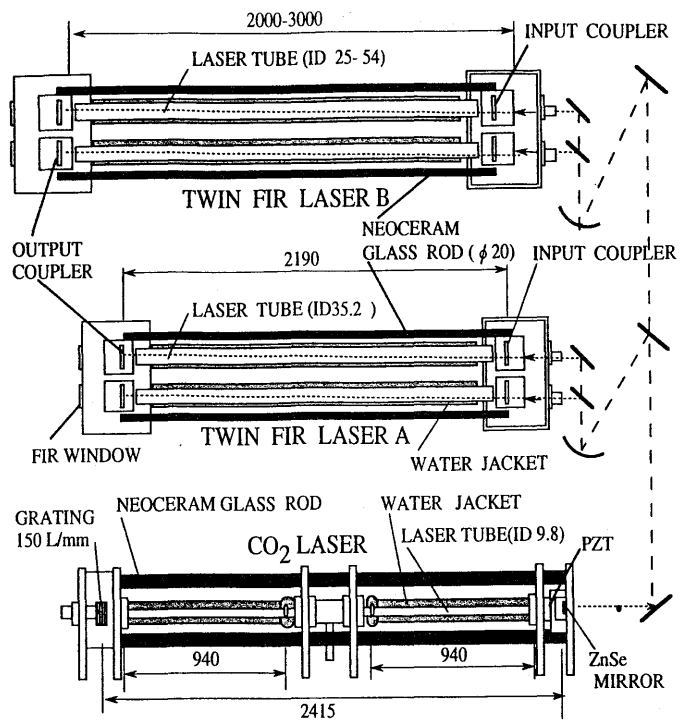


Fig.1 FIR laser system in Chubu University.

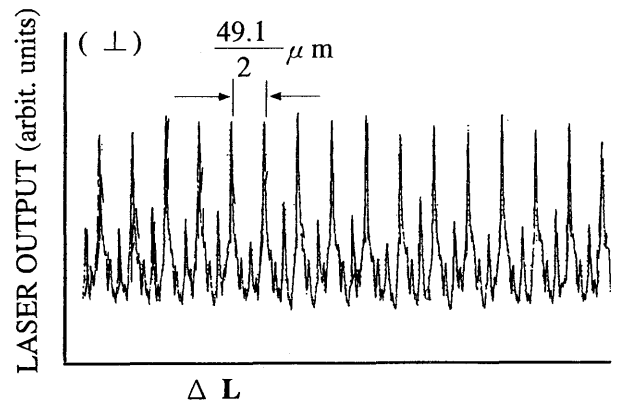


Fig.2 Detuning curve of 49.1 μm CH_2DOH laser pumped by 10P(46) cw CO_2 laser.

References

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