

§6. Development of Optically-Pumped cw CD₃OH Laser

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FIR (Far-Infrared) lasers are useful for optical sources of plasma diagnostics, molecular and solid-state spectroscopy, and research of astronomy and metrology. We have developed two FIR lasers of twin type pumped by cw CO₂ lasers. One is the laser for R&D[1], and another is 119- μ m CH₃OH laser of 620 mW for the interferometer of LHD[2].

For the higher density operations of LHD and for future large machine such as ITER, FIR lasers of from 40 to 100 μ m in wavelength may be useful rather than the lasers mentioned above and 10- μ m CO₂ laser from the view points of refraction and vibration effects and fringe shifts in the interferometer. On this wavelength region of FIR laser spectrum, methanol (CH₃OH and the isotopes) lasers have a dominant role because of the high efficiency and many available lines. However, the details of the characteristics for the power, the pressure dependence and the coupling of the lasing lines have not been so well known. To construct the data-base for the lasers, the characteristics of the CD₃OH lasers are being measured with R&D laser system.

Table 1 shows the CD₃OH laser lines observed

and some of the characteristics. In these lasers, the output power is fairly low because the output coupler of the FIR laser cavity is not optimized yet. Figure 1 shows a typical example of the detuning curve of 254- and 419- μ m lines from CD₃OH pumped by 10R(36) CO₂ laser. The 419- μ m line is strongly modulated by competitive internal coupling.

References

- 1) Okajima, S., Kawahata, K., et al., Proc. of 19th Int. Conf. IR and MM Waves, (1994) 161.
- 2) Kawahata, K., Ejiri, A., et al., Ann. Rev. NIFS, 1993-1994 (1994) 81.

Fig.1. Detuning curve of CD₃OH lasers pumped by 10R(36) cw CO₂ laser.

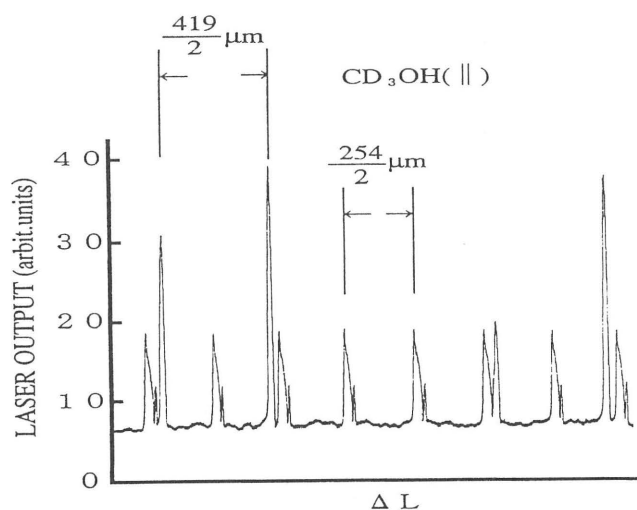


Table 1. FIR CD₃OH lasers pumped by cw CO₂ laser.

CO ₂ laser		CD ₃ OH laser			
line	power(W)	wavelength(μ m)	pol.	pressure(torr)	power(mW)
9R(34)	63	52.9	⊥	0.35	10
9R(28)	81	55.6	⊥	0.3	4
	78	42.6		0.4	
9P(40)	42	198.6		0.33	
10R(36)	85	253.7	⊥	0.35	28
	57	254			
	57	418.7		0.27	2
10R(34)	71	128.0	⊥	0.3	9
	76	168.1	⊥	0.17	3
10R(18)	100	41.4	⊥	0.3	
	107	43.7		0.3	6
10R(16)	98	81.6		0.30	5
	99	86.4	⊥	0.3	
10P(24)	83	286.6		0.26	