APPLICATION OF CAVITY-ENHANCED SPECTROSCOPY: ULTRA-STABLE FREQUENCY LASERS AND ULTRA-HIGH RESOLUTION SPECTROSCOPY

C. ISHIBASHI, M. L. SILVA, J. YE, and J. L. HALL, *JILA, University of Colorado and National Institute of Standards and Technology, Boulder, CO 80309-0440*.

Cavity-enhanced spectroscopy is a useful technique to achieve high sensitivity, which realizes observation of week absorption such as molecular vibrational overtone bands [a]. Comparing to cavity-ringdown spectroscopy, cavity-enhanced spectroscopy using CW laser is more suitable for laser frequency stabilization or high resolution spectroscopy. High signal to noise ration obtained by cavity-enhanced spectroscopy helps to realize ultra-high stability of laser frequency with a tabletop-compact spectrometer. The expected stability of laser frequency was analyzed and spectrometer was built for Nd:YAG laser stabilized to a hyperfine resolved X-B band transition of iodine at 532 nm. The combination technique of frequency modulation spectroscopy and cavity enhanced spectroscopy called NICE-OHMS (noise immune cavity- enhanced optical heterodyne molecular spectroscopy) [b c d] makes it easy to achieve shot-noise limited detection with an extremely high finesse cavity. NICE-OHMS is being prepared to hyperfine resolved high resolution spectroscopy of v = 0-5 band of HBr at 790 nm region.

[a] M. de Labachelerie, K. Nakagawa, and M. Ohtsu, Opt. Lett. 19, 840 (1994).
[b] J. Ye, L.-S. Ma, and J. L. Hall, Opt. Lett. 21, 1000 (1996).
[c] J. Ye, L.-S. Ma, and J. L. Hall, J. Opt. Soc. Am. B 15, 6 (1998).
[d] L.-S. Ma, J. Ye, P. Dube, and J. L. Hall, J. Opt. Soc. Am. B 16, 2255 (1999).