ECTDL BROAD BAND NH_3 SPECTRA IN THE 1.5 μM REGION - A TEST CASE

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NH_3 absorption spectra were recorded from 6459-6525 cm^{-1} at room temperature and a pressure of 9.5 Torr using an external cavity tunable diode laser (ECTDL) combined with multipass optics of about 1 m base length. The spectra were recorded primarily as a proof-of-principle test case for our multipass optical assembly, which is mounted in a large vacuum chamber designed for future slit nozzle experiments, as well as to improve our understanding of the characteristics, stability and accuracy of our commercial ECTDL source and its feasibility for broad band high resolution spectroscopic applications. We can achieve a maximum of 40 transits of our multipass optics, and we found that the signal was equally good with a somewhat smaller number of transits due to the large laser beam size. Although our spectra cover only about 15% of the 500 cm^{-1} span of the previously reported NH_3 FT spectrum from 6400-6900 cm^{-1} [Ref.1], the high sensitivity of our system yields a much higher line density than the FT observations. The observed lines arise mainly from the $\nu_1 + \nu_3$ NH-stretching combination mode of perpendicular character, but also may include hot bands of the umbrella inversion mode. Full rotational analysis in this region is a challenging task due to the high state density, but the lower state quantum numbers were previously established for a number of transitions [Ref.1] via known ground state combination differences [Ref.2]. The distribution of upper state term values has allowed us to group and assign upper state vibrational and l-doubling quantum numbers for most of the previously assigned transitions [Ref.1]. Empirical constants have been obtained for the upper states and are compared with the ground state.

Ref. 1 L. Lundsberg-Nielsen, F. Hegelund, and F.M. Nicolaisen, J. Mol. Spectrosc. **162**, p230-245 (1993).

Ref. 2 S. Urban, R.D. Cunha, K.N. Rao, and D. Papousek, Can. J. Phys. **62**, p1775-1791 (1984).

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