

OBSERVATION OF COMBINATION BANDS INVOLVING INTERMOLECULAR VIBRATIONS OF N₂O-N₂, N₂O-OCS AND N₂O-CO₂ COMPLEXES USING AN EXTERNAL CAVITY QUANTUM CASCADE LASER

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Spectra of the weakly-bound N₂O-CO₂, N₂O-OCS, and N₂O-N₂ complexes in the region of the N₂O ν_1 fundamental band (~ 2224 cm⁻¹) are observed in a pulsed supersonic slit jet expansion probed with a quantum cascade laser. One new band is observed for each complex: two combination bands involving the intermolecular in-plane bending for N₂O-CO₂ and N₂O-N₂ complexes, and the out-of-plane torsional vibration for N₂O-OCS. The resulting intermolecular frequencies are 34.17,^a 17.11 and 22.33 cm⁻¹ for N₂O-CO₂, N₂O-OCS, and N₂O-N₂ complexes, respectively. The intermolecular vibrations provide clear spectroscopic data against which theory can be benchmarked. These results will be discussed, along with a brief introduction to our pulsed-jet supersonic apparatus which has been retrofitted by an infrared cw external-cavity quantum cascade laser (QCL) manufactured by Daylight Solutions. The QCL is used in the rapid-scan signal averaging mode. Although the repetition rate of the QCL is limited by its PZT scan rate, which is 100 Hz, we describe a simple technique to increase the effective repetition rate to 625 Hz. In addition, we have significantly reduced the long term frequency drift of the QCL by locking the laser frequency to the sides of a reference line.

^aLimin Zheng, Soo-Ying Lee, Yunpeng Lu, and Minghui Yang, *J. Chem. Phys.* **138**, 044302 (2013).