NEW INFRARED SPECTRA OF THE NITROUS OXIDE TRIMER

M. DEHGHANY, MAHIN AFSHARI, J. N. OLIAEE, N. MOAZZEN-AHMADI, Department of Physics and Astronomy, University of Calgary, Calgary, AB T2N 1N4, CANADA; A.R.W. MCKELLAR, Steacie Institute for Molecular Sciences, National Research Council of Canada, Ottawa, ON K1A 0R6, CANADA.

Infrared spectra of N₂O trimers are studied using a tunable diode laser to probe a pulsed supersonic slit-jet expansion. A previous observation by R.E. Miller and L. Pedersen [J. Chem. Phys. 108, 436 (1998)] in the N₂O ν₁+ν₃ combination band region (3480 cm⁻¹) showed the trimer structure to be noncyclic, with three inequivalent N₂O monomer units which could be thought of as an N₂O dimer (slipped antiparallel configuration) plus a third monomer unit lying above the dimer plane. The present observations cover the N₂O fundamental band regions ν₅ (1280 cm⁻¹) and ν₁ (2230 cm⁻¹). In the ν₅ region, two trimer bands are assigned with vibrational shifts and other characteristics similar to those in the ν₁+ν₃ region, but in the ν₁ region all three possible trimer bands are observed. Relationships among the various bands such as rotational intensity patterns, vibrational shifts, and the properties of the related N₂O dimer, generally support the conclusions of Miller and Pedersen. Three trimer bands are also observed for the fully ¹⁵N-substituted species in the ν₁ region, and these results should aid in detection of the as-yet-unobserved pure rotational microwave spectrum of the trimer. Finally, three combination bands involving the intermolecular van der Waals modes at 2253.7, 2255.5, and 2269.4 cm⁻¹ have been measured. The analyses of these bands and the identification of the nature of the intermolecular modes involved are currently underway.