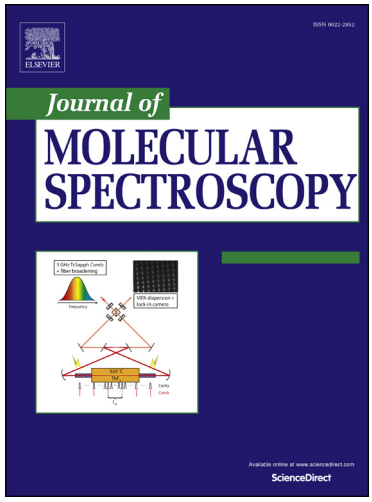

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Impact of H_2O broadening effect on atmospheric CO and N_2O detection near 4.57 μm

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Abstract

A tunable quantum cascade laser spectrometer (QCLS) was used to study H_2O broadening coefficients for CO and N_2O transitions at 4.57 μm region, which contains well-characterized and relatively isolated transitions of appropriate line strengths for sensitive gas detection. The influence of H_2O broadening effect on CO R(11) and N_2O P(38e) transitions at 2186.639 cm^{-1} and 2187.099 cm^{-1}, respectively, was detailed investigated. Our measurements indicate that H_2O broadening coefficients are 1.8 and 1.9 times higher than the corresponding air-broadening parameters, respectively. Based on the experimental data, our simulation confirmed that the WMS-2f shapes of CO and N_2O lines will be significantly affected by variations of the water vapor mixing ratio, while no significant dependence on target concentration, and prove that the difference between air- and H_2O-broadenings thus cannot be neglected if one wants to measure gas concentrations in a high humid environment with a sub-percent precision.

Keywords: QCLS; Nitrous oxide; Carbon monoxide; H_2O broadening effect