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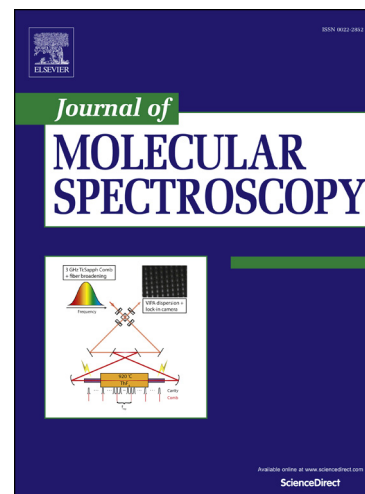
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Impact of H₂O broadening effect on atmospheric CO and N₂O detection near 4.57 μm

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Abstract

A tunable quantum cascade laser spectrometer (QCLS) was used to study H₂O broadening coefficients for CO and N₂O 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 H₂O broadening effect on CO R(11) and N₂O P(38e) transitions at 2186.639 cm⁻¹ and 2187.099 cm⁻¹, respectively, was detailed investigated. Our measurements indicate that H₂O 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 N₂O 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 H₂O-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; H₂O broadening effect

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