

DOUBLE RESONANCE EXCITATION OF OVERTONES AND COMBINATION BANDS IN JET-COOLED N₂O

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Propylene oxide (PO) is one of the most discussed chiral molecules since its astronomical detection ¹. For future applications such as chiral detection of PO by three-wave mixing techniques we would like to acquire its ro-vibrationally resolved spectrum. In our investigations we found the ro-vibrationally resolved spectrum of PO to be quite complex and thus the assignment of ro-vibrational transitions relying solely on an IR cavity ring-down spectrometer not feasible.

In a first step we present the proof of principle concept of combining an IR cavity ring-down (2.7-4.0 μm) and chirped-pulse Fourier transform millimeter wave (100-112 GHz) spectrometer to excite double resonance processes in jet-cooled N₂O. In our setup the three components IR, MW and molecular jet are each aligned along the axis of a cartesian coordinate system and both excitation sources are linearly polarized, the polarization angle of the IR source is freely adjustable. We observed rotational transitions in the vibrational ground state (00⁰), the first overtone of the symmetric stretching mode (20⁰) around 3.9 μm and the combination band of symmetric and asymmetric stretching mode (10⁰1) around 2.875 μm ². Next a racemic mixture and pure enantiomers of PO are probed with the same setup. The double resonance procedure allows for precise assignment of the ro-vibrationally resolved spectrum. Results will be compared to theoretical predictions.

¹[doi:10.1126/science.1270883](https://doi.org/10.1126/science.1270883), B. A. McGuire et al., "Discovery of the Interstellar Chiral Molecule Propylene Oxide (CH₃CHCH₂O)", *Science* **352** (2016)

²[doi:10.1021/ed085p121](https://doi.org/10.1021/ed085p121), M. Bryant, S. Reeve, W. Burns, "Observation and Analysis of N₂O Rotation Vibration Spectra", *J. Chem. Educ.*, **85** (2008)