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Do the temperature dependencies of spectral line parameters change when we approach cryogenic temperatures?

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We have recently studied a set of 40 spectra of carbon monoxide in pure state and mixed with air, recorded at temperatures between 79 to 296 K. Our aim was to investigate if the temperature dependencies of line parameters, such as half widths and pressure induced shifts, stay the same at very low temperatures, close to 79 K. The spectra were all recorded over two decades using the 1-m Fourier Transform spectrometer located at Kitt Peak, AZ, USA and two temperature controlled gas cells. The spectra were calibrated using the line positions for residual carbon dioxide and water vapour and referencing them to the HITRAN database.
The constrained analysis technique was used together with the software Labfit [2]. Three line shape models were employed: Voigt, speed-dependent Voigt and Rautian. In the absence of experimental narrowing parameters, we have calculated them using computed diffusion constants [3].
The theoretical half-width coefficients for CO-N2 have been determined at several temperatures employing a potential energy surface of Tipping-Herman type, vibrationally independent potentials and by taking into account the electrostatic interactions. We will discuss what laws were fund to best represent the temperature dependencies over a wide range of temperatures, approaching cryogenic temperatures.
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