FREQUENCY COMB-REFERENCED MEASUREMENTS OF SELF- AND NITROGEN-PERTURBED LINE SHAPES IN THE ν_1 + ν_3 BAND OF ACETYLENE

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Frequency comb technology has the potential to dramatically improve precision and accuracy in measured spectra, but few applications have yet been reported. One application that can benefit from the high stability of spectrometers referenced to frequency combs is the measurement of spectral line shapes. We have built an absorption spectrometer based on an extended cavity diode laser locked to an Er-fiber-based frequency comb operating near 1550 nm. Here we report the first measurements of line shapes using a frequency comb as a reference. We studied the P(11) line in the ν_1 + ν_3 combination band of acetylene at 195 739.649 513(8) GHz at several temperatures from 296K down to 175K. This talk focuses on the data taken at 296K. We used a hard collision model (Rautian-Sobel'man) fit to the measurements to determine self- and nitrogen- pressure broadening, pressure shift and Dicke narrowing parameters that are at least 2 orders of magnitude more precise than those reported in previous measurements. We compare these hard collision model results with those of two other widely-used models: the Galatry (soft collision) and the Voigt function. The temperature- and rotational level-dependence of these parameters have been measured and some of the results will be discussed in a separate talk.

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