TRANSITION FREQUENCIES WITH MHZ ACCURACY OF LINES WITH INTENSITY LESS THAN 10^{-29} CM/MOLECULE

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Series of spectra of the O(3), O(2) and Q(2) transitions of D_2 were measured near 8500 cm^{-1}, by comb-referenced cavity ring-down spectroscopy. These very weak electric-quadrupole transitions are the first to be detected in the second overtone band of D_2. Their calculated intensity ranges between 1.0 and 8.7×10^{-30} cm/molecule. Recordings performed at different pressures up to 600 Torr were made challenging by strong interference with water lines which are six orders of magnitude stronger than the D_2 lines in the considered region.

The transition frequencies of the three D_2 transitions were determined applying a fitting procedure using beyond-Voigt profiles including strong Dicke narrowing. Considering statistical fit errors and possible biases due to the interference with water lines, total uncertainties on the frequencies extrapolated at zero pressure were estimated below 5 MHz. The derived experimental frequencies and intensities are compared to ab initio values. An overall agreement within the experimental error bars is achieved confirming the accuracy of the theoretical calculations.