SUB-PERMILLE MEASUREMENTS AND CALCULATIONS OF 3-0 BAND CO LINE INTENSITIES

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Here we present new measurements and calculations of line intensities in the 3 - 0 band of $^{12}C^{16}O$. These experimental results and calculations exhibit unprecedented consistency and low uncertainty. Calibration-free agreement at the 1 permille level relative standard deviation level has been demonstrated between theoretical ab initio calculations and three sets of independent experiments, corresponding to a nearly twenty-fold reduction in uncertainty by comparison to literature values. The experimental techniques cover a broad range of rotational quantum numbers from J = 5 to 30, including three separate laser-based measurements of high-J lines performed at two institutions, along with independent Fourier transform spectroscopy measurements for J = 5 to 18. The most accurately determined intensity is that of the R23 transition determined to within 0.4 permille. The intensity of this transition is a possible intrinsic reference for evaluating and reducing biases in future spectroscopic determinations of molecular line intensities.