Improved lines positions for the (1,1) band of the $b\ ^1\Sigma^+ - X\ ^3\Sigma^-$ transition of O_2

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INTRODUCTION

Molecular oxygen, O_2, is an essential life-supporting component in our atmosphere and oceans. Both the concentration and the distribution of gas-phase oxygen in the atmosphere are of interest to many science disciplines, including planetary scientists. We report improved line positions for the (1,1) vibrational band of the $b\ ^1\Sigma^+ - X\ ^3\Sigma^-$ transition of O_2, recorded using intracavity laser absorption spectroscopy.

EXPERIMENTAL METHOD

The absorption spectra were recorded using intra-cavity laser spectroscopy (ILS). A plasma discharge was used to enhance absorption from v=1 in the ground state of oxygen.

RESULTS AND DISCUSSION

A portion of the spectrum with ^{R}R- and ^{R}Q-branch spectral features is shown in Figure 1. High lines of the (0,0) band of this transition can be seen in the spectral region of the (1,1) band, and the ^{P}P(29) and ^{P}Q(28) lines of the (0,0) band are labeled in Figure 1. A total of 66 lines with *J*'s up to 36 were fitted in this analysis. Molecular constants obtained from the fit are presented in Table 1 and compared with previous literature values. In summary, improved lines positions for the (1,1) band of the $b\ ^1\Sigma^+ - X\ ^3\Sigma^-$ transition of O_2. Additionally, we report a new method of producing vibrationally hot molecules for use in absorption spectroscopy of stable gas phase molecules.

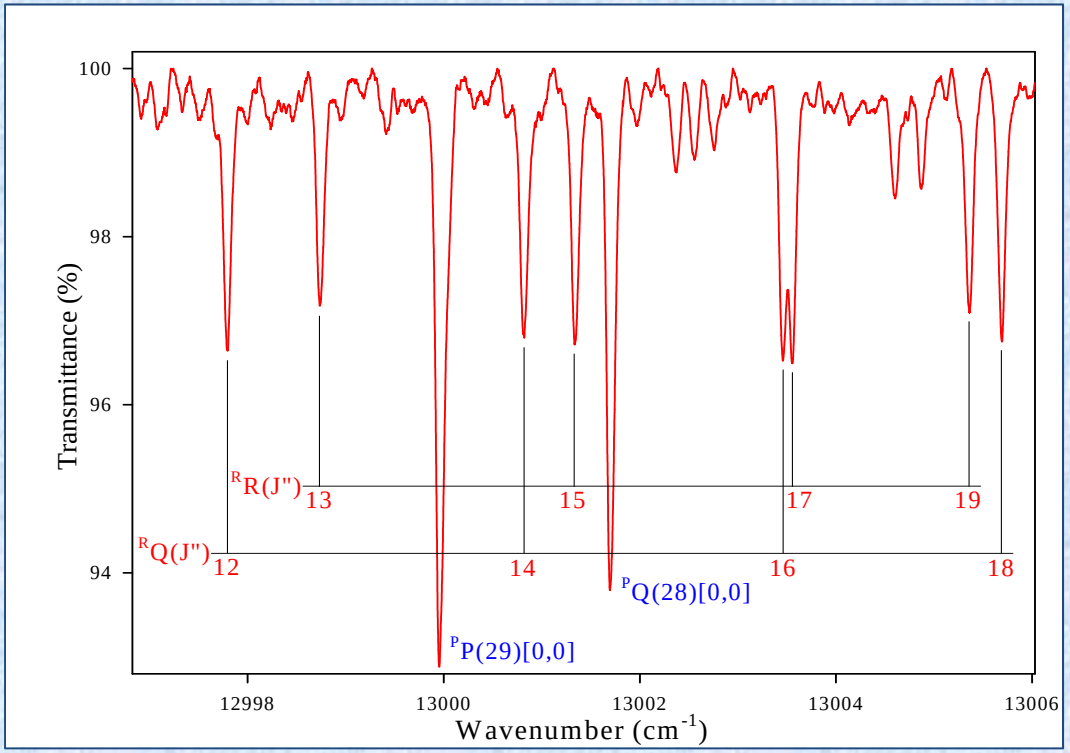

Figure 1. A portion of the the (1-1) band of the $b\ ^1\Sigma^+ - X\ ^3\Sigma^-$ transition of O_2 (in cm^{-1}): $P_{discharge}$=4.70 torr, $P_{background}$=4.26 torr, and t_g=200 µsec.

Table 1. Molecular Constants for the v=1 of the $b\ ^1\Sigma^+$ state of O_2 (in cm^{-1}). The constants of the $X\ ^3\Sigma^-$ v=1 state were held fixed to the values of Rouillé *et al.* [16].

Molecular Constant	E_1	B_1	$D_1 \times 10^5$
This Work	14526.98928(84)	1.3729747(37)	0.54157(31)
Ref. 2	14525.6602	1.373054	0.5409