B. CO$_2$ ABSORPTION
AN INTERPRETATION OF THE MARS SPECTRUM TAKEN BY THE CONNES*

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Abstract. Lines of the 2-0 and 3-0 bands of carbon monoxide and (many) bands of carbon dioxide appear prominently in the Connes’ Mars spectrum [1]. Five carbon dioxide bands were measured to construct a curve of growth for CO$_2$ lines formed in the Martian atmosphere [2]. A similar curve of growth was constructed for the 2-0 band of carbon monoxide. From these curves, we have computed the rotational temperature of the atmosphere, the surface pressure, and the abundance of CO and CO$_2$. The surface pressure is found to be approximately equal to the CO$_2$ partial pressure, i.e. $p_s$ ~ 5 mb. The CO concentration by volume was found to be slightly less than one part per thousand.

Fig. 1. Curves of growth for CO lines and CO$_2$ lines formed in the Martian atmosphere. The upper abscissa corresponds to CO lines and the lower abscissa to CO$_2$ lines. The open circles at the lower left of the figure refer to the CO$_2$ band at 5951 cm$^{-1}$ while the open circles at the upper right refer to the 6347 cm$^{-1}$ CO$_2$ band uncorrected for telluric absorption; the solid circles are for the corrected 6347 cm$^{-1}$ CO$_2$ lines. The CO$_2$ bands have the following intensities in cm$^{-7}$km atm: 4656, $S_V = 2.5$; 5951, $S_V = 0.47$; 6075, $S_V = 123$; 6119, $S_V = 7.8$; 6347, $S_V = 1150$. Lorentz half-widths of $\gamma_L$(CO) = 0.07 cm$^{-1}$ and $\gamma_L$(CO$_2$) = 0.10 cm$^{-1}$ (at stp) were used. The uncertainty in the half-widths is estimated to be ten percent.

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Fig. 2. Part of the 3-0 band of CO with computed positions of the $P_6$, $P_7$ and $P_8$ lines marked with arrows. Lower curves (and lower baseline) are two independent averages of Mars spectra (with mean secant $Z = 2.4$). Upper curve (and upper baseline) is solar spectrum. Middle curve (and upper baseline) is ratio of Mars to solar spectrum. All scales are in units of cm$^{-1}$. The differences between the two spectra of Mars is partly due to noise and partly due to differences in the Doppler shift and telluric absorption.

References
