B. CO_2 ABSORPTION

https://doi.org/10.1017/S007418090010275X Published online by Cambridge University Press

AN INTERPRETATION OF THE MARS SPECTRUM TAKEN BY THE CONNES*

L. D. KAPLAN† and L. D. GRAY YOUNG

Space Sciences Division, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif., U.S.A.

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. $p_s \sim 5$ mb. The CO concentration by volume was found to be slightly less than one part per thousand.

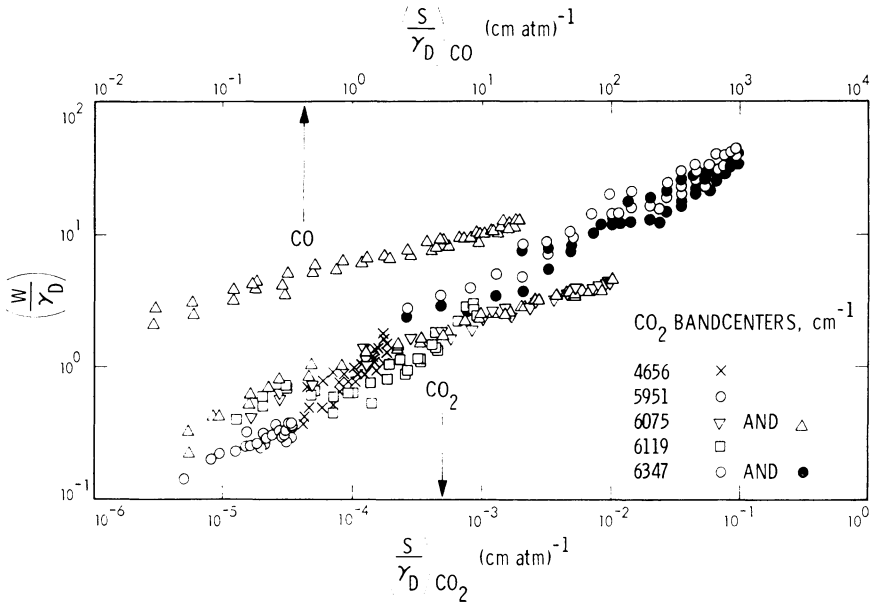

Fig. 1. Curves of growth for CO lines and CO_2 lines formed in the Martian atmosphere. The upper abscissa corresponds to CO lines and the lower abscissa to CO_2 lines. The open circles at the lower left of the figure refer to the CO_2 band at 5951 cm^{-1} while the open circles at the upper right refer 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^{-1}/km atm: 4656, Sv = 2.5; 5951, Sv = 0.47; 6075, Sv = 123; 6119, Sv = 7.8; 6347, Sv = 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.

* This paper presents the results of one phase of research carried out at the Jet Propulsion Laboratory, California Institute of Technology, under Contract Number NAS 7-100, sponsored by the National Aeronautics and Space Administration.

† Faculté des Sciences de Paris, Laboratoire de Spectroscopie Moléculaire, 9, Quai Saint-Bernard, Tour 13, 75-Paris (5E).

Sagan et al. (eds.), Planetary Atmospheres, 189–190.

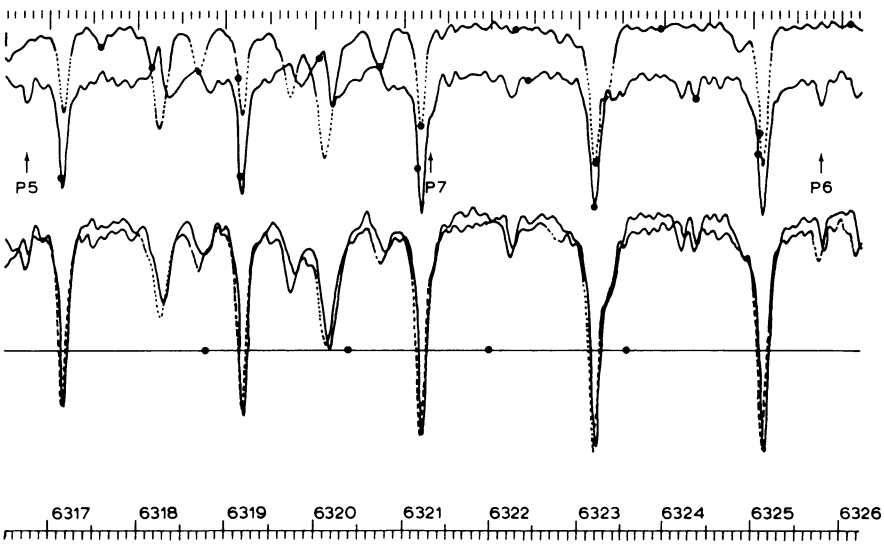

Fig. 2. Part of the 3-0 band of CO with computed positions of the P_6, P_7 and P_8 lines marked with arrows. Lower curves (and lower baseline) are two independent averages of Mars spectra (with mean secant $Z = 2.4$). Upper curve (and upper baseline) is solar spectrum. Middle curve (and upper baseline) 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

[1] Kaplan, L. D., Connes, J., and Connes, P.: 1969, 'Carbon Monoxide in the Martian Atmosphere', *Astrophys. J.* **157**, L187–192.

[2] Young, L. D. G.: 1969, 'Interpretation of High Resolution Spectra of Mars: I. CO_2 Abundance and Surface Pressure Derived from the Curve of Growth', *Icarus*.

https://doi.org/10.1017/S007418090010275X Published online by Cambridge University Press