SPECTROSCOPIC DETERMINATION OF SURFACE PRESSURE AND ELEVATION DIFFERENCES ON MARS

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Abstract. Observations of a carbon dioxide band at 1.2206 μ (8192.6 cm^{-1}) made at the opposition of Mars in June, 1969, are used with laboratory data to derive a value for the pressure at the surface of Mars. This band is especially suitable because it is sensitive to pressure, lying in the transition region of the curve of growth, but is relatively free of telluric contamination. The pressure derived is $5.3^{+2.2}_{-2.6}$ mb, corresponding to the Martian desert region Amazonis.

Using a five-channel spectrometer, the strengths of two carbon dioxide bands at 1.5753 and 1.6057 μ (6347.8 and 6227.9 cm^{-1}) were compared over a Martian dark area (Mare Acidalium) and a nearby bright area in Amazonis. The bands were 1.32 times stronger in the dark area than in the bright area. Interpreting this as evidence for elevation differences on the Martian surface, it is found that the dark Mare Acidalium is 2.5 km lower in elevation than the bright area with which it was compared.

1. Introduction

The observations described in this paper were made jointly with V. I. Moroz using his equipment on the 125-cm reflector of the Southern Station of the Sternberg State Astronomical Institute (Moscow, U.S.S.R.) in the Crimea, while the author was a guest of the Soviet Academy of Sciences. The laboratory measurements and the interpretations in this paper were made by the present author, and the appearance of the data here does not preclude their elaboration and further interpretation elsewhere, either by Moroz alone or jointly with other investigators. The author wishes to record his gratitude to V. I. Moroz for his generosity in making the observational material freely available.

2. Determination of the Surface Pressure

Previous spectroscopic investigations of the Martian surface pressure have been made in two steps. First, the CO_2 abundance is determined from observations of weak lines which are essentially independent of the pressure. Then, strong bands, frequently those near 1.6 and 2.0 μ, which are sensitive to pressure broadening are used for deriving the surface pressure. Reviews of earlier studies of this problem are given by Cann *et al.* (1965) and Chamberlain and Hunten (1965).

Contradictory and uncertain values for the Martian surface pressure resulting from analyses of various CO_2 bands made it seem desirable to study previously neglected bands in order to establish an independent pressure value. The study of faint bands requires more spectral resolution than can easily be achieved with scanning spectrometers in the infrared, and for this reason the bands we are considering here were not

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