gave suitable signal levels and provided the highest practical resolution on the disk of Mars. Figure 3 shows the appearance of Mars during the measurements with the appropriate size of the diaphragm superimposed. The innermost circle is the actual projected diameter of the entrance diaphragm, and the outer circle represents the degree of smearing by seeing. The guiding of the telescope was exceedingly accurate.

The observed points on Mars were centered over a dark area (approximate coordinates 35°W longitude, +45°N latitude) and a light region (100°W longitude, +10°N latitude). Many integrations were made over the dark area (Mare Acidalium) and over the bright region which was equidistant from the limb of the planet (Amazonis desert), each with a sky background integration for comparison. An attempt at absolute calibration of the measurements was made by observing a bright star, but only the relative measurements are of interest here. From observations of the same bright and dark regions over two nights (June 8–9 and 9–10, 1969), there was clear indication that the intensity of the two CO_2 bands was greater over the dark Mare Acidalium than over the comparison desert region. Averaging the data of both nights, we find that the absorption in the dark area is stronger by a factor 1.32 than in the bright region.

In the simplest interpretation of these data, we can find the elevation difference knowing only this ratio of band intensities and the atmosphere scale height. If N_0 is the number of molecules in the atmosphere at some datum h_0, then the number of molecules at height h_1 is $N_0 \exp(-h_1/H)$ and at height h_2 is $N_0 \exp(-h_2/H)$. Then, the ratio of the absorption band strength at the two levels h_1 and h_2 is given by $\exp[-(h_1-h_2)/H]$. H is the scale height, taken here as 9 km. The difference in elevation, $h_2-h_1=H \ln 1.32=2.5$ km.

The uncertainties in this last quantity depend on the probable errors in the scale height (about 10%) and in the observed ratio of band strengths (10–12%). Thus, the observed elevation difference with its probable error is 2.5 ± 1.2 km.

Two further sources of error exist, both considered minor. First, the low altitude of Mars during the observation results in atmospheric dispersion of the image seen in the telescope. This means that the infrared image is displaced slightly from the visual light image, and while the observer positions the visual image correctly with respect to the entrance diaphragm, the infrared image (detected by the spectrometer) lies in another position. During the observations reported here, the effect of image displacement was tested by moving the image around with respect to the diaphragm and noting the signal level received by the detector. For the Mare Acidalium point, the signal level was the lowest that could be seen for any region of the planet, and from this it is concluded that atmospheric dispersion was a minor effect, displacing the infrared image of the dark region less than one diaphragm diameter from the visual image.

The second source of error is in the assumption of an isothermal lower atmosphere on Mars. This assumption considerably simplifies the analysis of the present observations and any reasonable departure from isothermal conditions will not significantly affect the results given here, especially since the observed elevation difference is relatively small.

It is instructive to compare the results of the present measurements with those reported by other investigators. The radar ranging data of Pettengill *et al.* (1969) indicate that the relative elevation difference at the longitudes of the regions observed here is 9 ± 2 km. The radar data refer to a rather narrow strip centered at latitude $+21°$N, and extrapolation to the latitudes of the spots observed spectroscopically is uncertain. In an independent analysis of an early version of Pettengill's data, Binder (1969) made an extrapolation in latitude, and found that the elevation difference near the two regions observed here was 7–8 km. The important thing is that analyses of both Pettengill *et al.* and Binder agree with the present study in the *sense* of the difference in elevation of these two regions, i.e. the dark Mare Acidalium is lower than nearby desert Amazonis.

Spectrographic detection of elevation differences near the regions discussed in the present paper were reported by Belton and Hunter (1969). On a solid relief map made from their observations of approximately 200 points on Mars, Mare Acidalium is seen as a low area compared with the region in the Amazonis desert at 100° longitude. The elevation difference estimated from the map is 5 km. The map was made from preliminary reductions of the observations and is subject to refinement.

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Note Added in Proof. Two detailed studies of the observational data reported here with additions have been submitted for publication in the *Astronomicheskii Zhurnal* (U.S.S.R.). In the first, 'An Attempt to Determine Differences in Height on Mars from the Intensity of the CO_2 Bands at 1.6 Microns', by V. I. Moroz, N. A. Parfentev, D. P. Cruikshank, and L. V. Gromova, it is shown that dark regions on the planet can be higher, lower, or the same in elevation as the bright regions. The maria Acidalium and Cimmerium were compared with bright regions Amazonis, Isidis, and Cebrenia. The maximum elevation difference found was in the comparison of Mare Cimmerium with Cebrenia, the mare being 7.2 km higher in elevation.

In the second paper, 'A Spectroscopic Determination of the Pressure in the Atmosphere of Mars from the CO_2 Band at 1.22 Microns', by V. I. Moroz and D. P. Cruikshank, new laboratory spectra of carbon dioxide bands at 1.22, 1.6, and 2.1 microns were used to determine a composite curve of growth. This technique reduces the error of extrapolating the laboratory curve of growth to longer path lengths (corresponding to the Martian absorption) than are physically possible in the laboratory. The result of that analysis gives the Martian surface pressure for a pure CO_2 atmosphere not substantially different from the result of the more simple analysis in the present paper.