

Is Venus Cloud Covered? By J. Evershed.

With reference to Mr. Clayden's note on the "Blue-Violet Absorption of Venus" (*M.N.*, 79, 507), I would like to make the following observations:—

My suggestion that the atmosphere of Venus may be devoid of clouds was based on the surprising fact that in photographing the spectrum of the planet I found that a much longer exposure time was needed than was necessary to impress a spectrum when the image of a brightly illuminated cumulus cloud was brought on to the slit of the spectrograph, and this applies also to the green region of the spectrum.

As Venus is distant from the Sun 0.72 of an astronomical unit, the intensity of sunlight falling on the planet is 1.92 times greater than that received by the Earth at mean distance; but the double passage through the upper part of the Venus atmosphere will perhaps deplete the green light by as much as 30 per cent., assuming the atmosphere above her clouds to be somewhat more opaque than the terrestrial atmosphere above Mount Wilson, say at the 6000 feet level.* The ratio of exposure time for a terrestrial cloud and a Venus cloud will therefore be 1.3 to about 1, the absorption in the Earth's atmosphere being the same for both.

Actually I have not been able as yet to determine this ratio experimentally, owing to the very small number of days available in this moist climate when the sky is clear enough. All I can say is that a considerably longer time was found necessary for the

* For coefficients of atmospheric transmission see Abbot, *Annals of the Astrophysical Observatory of the Smithsonian Institution*, 3, 138.

Venus spectrum than for the cloud spectrum when the altitude of Venus was greater than the altitude of the Sun when photographing the cloud.

The large discrepancy is either due to an absence or partial absence of clouds in Venus or, perhaps more probably, to the fact that owing to bad definition it is difficult, when Venus is not near full phase, to keep the brightest part of her disk continuously on the spectrograph slit during an exposure of about ten minutes; and when near full phase the small size of the image and low altitude of the planet impose still greater difficulties.

According to H. N. Russell, the reflective power of Venus is comparable with that which might be expected from a cloudy surface.* But this is perhaps not altogether conclusive, since it is deduced from indirect evidence of a not very certain nature.

If the atmosphere of Venus were cloudless but the lower strata heavily dust-laden, the reflective power would be less than for a cloudy atmosphere, and under these conditions it is almost certain that no surface features of the planet would be visible to us through the haze.

With regard to the absorption in the violet part of the spectrum, it is difficult to believe that the value of the colour index ($0^m.78$) given by Russell † can be correct, in view of his statement on p. 188 of the article referred to below, that the Sun has a colour index of $+0^m.79$; for this would mean that no selective absorption of violet light takes place in the planet's atmosphere above the reflecting layer of clouds or dust haze, and this is contrary to the evidence of my spectrum photographs, which show a marked falling off in relative intensity in the violet compared with the cloud spectrum.

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