# LETTERS TO THE EDITOR

## ASTRONOMY

### A Corrugated Model for the Lunar Surface

We would like to suggest that a number of previously uncorrelated visual and infra-red lunar observations may be explained by assuming that the surface of the Moon has indentations the scale of which is too small to be resolved optically by terrestrial observations. For simplicity of argument, we consider the shape of the indentations to be as shown in Fig. 1. In addition, for the arguments given here to be rigorously true, the linear dimensions of the indentations must be appreciably greater than the parametric distance for thermal conduction during a lunar cycle ($\sim$ 3 cm).

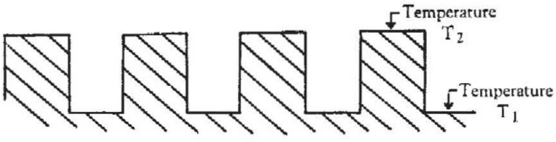

Fig. 1

It is clear from radiation considerations that during an eclipse the temperature $T_1$ of the bases of the indentations of our model vary very much less than will the temperature $T_2$ of the upper surfaces. Eclipse measurements[1,2] show a greater variation of effective temperature for regions close to the lunar limb than for regions at the centre of the lunar disk. This result is in agreement with the proposed model since radiation received from the lunar limb would come only from the top of the indentations, whereas that from the centre of the disk would consist of equal contributions from the base and top.

A similar argument may be applied to the results of observations of the effective temperature of the centre of the disk measured as a function of time throughout a complete lunar period[3,4]. With the model considered, the variation of temperature of the base of the indentations would be very much less than for a simple flat surface, for in addition to radiation considerations the bases of the indentations would receive solar radiation for only a small fraction of the Moon's period. The observed variation of effective temperature during lunation is less than that predicted from the application of the results of eclipse measurements to a simple plane surface, a result which would be expected from the model here proposed.

Infra-red measurements[1] show that when the sub-solar point is near the lunar limb (first and last quarters) its effective temperature is about 50° C lower than when it coincides with the centre of the lunar disk at full Moon. Previously, this effect has been attributed to the large-scale mountainous nature of the lunar surface, but an examination of lunar topography shows that the average lunar slope ($\sim$ 0·01 radian) is insufficient to account for the large effective temperature change, although such a change could well be accounted for by an indented model.

Finally, photometric measurements of radiation of wave-length 3000 Å–9000 Å show deviations of the Moon's surface from that of a simple diffuse reflector. In particular, at full Moon the radiation received from the lunar limbs is relatively greater than that expected from a diffusely reflecting sphere, while the sub-solar point appears considerably brighter than would be expected from observations of this point at other times during the lunar period. Models similar to that suggested here have, in fact, already been investigated both experimentally[5] and theoretically[6,7] and they have been found to give good agreement with lunar photometric measurements.

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## PHYSICS

### Slicks on Lake Huron

While examining the movement and dispersion of groups of drift-bottles released simultaneously at Douglas Point, on Lake Huron, we came upon some pronounced 'slicks', well known to oceanographers. These can be recognized by eye as streaks of smooth water from which the capillary waves are absent and in which quantities of organic matter and other floating debris collect. There are apparently a number of possible mechanisms for the production of slicks, all leading to accumulation of surface material through confluence of the surface water layers, which sink at the slick, leaving any floating material to collect on the surface.

In our experiments a group of small cylindrical jars, 5 cm in diameter, 8 cm high, lids painted fluorescent yellow and weighted so that the lid floats level with the surface, were released from a boat, with the intention of following their dispersion by turbulent diffusion. In the initial phase the growth of the 'cloud' exhibited the typical features of 'relative' turbulent diffusion in that the rate of growth increased with the size of the cloud. This is in accordance with the observations of Richardson and Stommel[1] and the theory of Batchelor[2]. At some stage of this regular turbulent diffusion then the group would typically arrive at a slick and the bottles would re-collect along a line oriented at some angle against the original direction of mean drift. When this angle was not too far from 90°, the whole group became quite concentrated again, because the diffusion in a direction perpendicular to the direction of the mean drift was typically much less