N66-22175
(ACCESSION NUMBER) (THRU)
4 1
(PAGES) (CODE)
TMX 56088 30
(NASA CR OR TMX OR AD NUMBER) (CATEGORY)
FACILITY FORM 602

HC $1.00
MF .50

The Possibility of Radio Noise from the Lunar Red Spots

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The small red spots which have been reported near Aristarchus and some other lunar craters are now well attested. It is not easy to explain them.

The most important piece of evidence with regard to them is furnished by the spectrogram obtained by Kozyrev (1) which indicates that the spot near Aristarchus showed the lines of molecular hydrogen. At first sight this seems very natural. Water is the commonest volatile in rock melts; and in a vacuum, under excitation, water dissociates and recombines as H_2 and OH; in fact, this is a standard method for producing the H_2 spectrum. It happens that the H_2 spectrum is concentrated in the red, almost like the neon spectrum. It is, however, extremely difficult to explain the excitation as the result of solar radiation, whether corpuscular or electromagnetic. The red spots have, in general, been seen against the bright lunar disk. Hence the total red light is comparable with the total white light reflected by a comparable area of the moon. The moon reflects with low efficiency--about 6 percent--but fluorescence processes are rarely as efficient as this. What is far more serious is that the H_2 lines demand about 15 volts excitation even to the lower levels. Thus for each quantum of red light we should require a quantum in the far UV. The sun's spectrum in the UV is now reasonably well known; and it fails by 5 or 6 orders of magnitude to supply adequate energy. Corpuscular radiation fails by a similar factor. It is true that mechanisms involving magnetic focussing of corpuscular radiation have been suggested for the particles, but these mechanisms need to be implausibly precise, and it is hard to see why they should concentrate on the Aristarchus region.

It is far more reasonable to suppose that the source of energy is the moon's interior. In any ordinary volcanic process the energy produced per cm^2 of the surface may exceed the energy from incident solar radiation by a large factor. It is not suggested, however, that the red spots are due to thermal excitation, since the temperatures required to excite the H_2 spectrum would be in the tens of thousands of degrees. It seems more likely that volcanism has somehow produced electrical excitation as a byproduct, as it commonly does on the earth. It has been pointed out (2, 3) that volcanic ash flow phenomena may play an important part on the moon, both in shaping the sinuous rills and in the formation of the maria. It has also been pointed out that the evidence from tektites indicates that volcanic processes may still occur on the moon. It may be significant, therefore, to note that the classic ash flow of May 8, 1902, from Mt. Pelée in Martinique was accompanied by lightning on a large scale. Lightning was also described by Perret (4) for Vesuvius. It is plausible that static electricity should be generated by solid particles in a hot environment where electrically conducting films of water cannot exist.

It is therefore suggested that the red spots are produced by discharges of static electricity through the H_2 which is emerging above small lunar ash flows. Calculations have shown that the gas pressures in these flows

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reach levels as high as 1 atm. at moderate depth. It is interesting that Greenacre (5) remarks that the glows appear to "sparkle." In short, the lunar red spots may be a sort of lightning.

Lunar lightning would be expected to produce some static. Let us attempt to estimate very crudely the amount of the static. In a severe thunderstorm the intensity of the light from the lightning may average something like the full moon. Since the red spots cover about one millionth of the moon's surface, and since they are visible, though with difficulty, against the bright face of the moon, it is clear that the light that they send us is of the order of one millionth that of the full moon. We estimate, therefore, that the intensity of the radio noises will be similar to those of a small but violent thunderstorm at a distance of the order of 1000 km. This appears to be within the capability of modern radio telescopes, and a search for these storms might therefore be rewarding.

It is the possibility of radio noise which justifies the making of the present, somewhat tenuous, speculation. Even if the actual mechanism is different from that suggested here, it is reasonable to expect on general principles that a source producing high-excitation lines will also produce significant radio noise.

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