ON A POSSIBLE RELATION BETWEEN LUNAR TRANSIENT PHENOMENA AND THE EARTH-SHINE

(Research Note)

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Abstract. The brightness of the Earth-shine and the frequency of some categories of lunar transient phenomena show an enhancement near the full Moon, when the latter enters or exits the bow-shock front of the magnetosphere.

As a consequence of a recent work by Cameron (1972) on lunar transient phenomena (LTP) there seems to exist a relation with the Earth-shine (ES) studied many years ago by Danjon (1936).

A long series of Danjon's measurements (1926–1935) with his cat's eye photometer led to the following interpolation formula

$$m = 9.90 + 0.0156\,(180° - a) + 5.1 \times 10^{-7}\,(180 - a)^3\,,$$

giving the difference of stellar magnitudes Earth-Sun observed from the Moon as function of the phase angle a ($=0°$ for the full Moon). The deviations O–C from this formula are represented in the upper part of Figure 1. They do not show any systematic character except in the interval $-60° < a < +60°$, i.e. ± 5 days of the full Moon. The Earth-shine is then brighter than it would be when the mean Earth albedo $A = 0.4$ is adopted. Danjon explained this behaviour by the higher cloudiness over the Atlantic Ocean, where the narrow Earth crecent is located at phase angles $-60° < a < 0°$; but Danjon neglected the same tendency in the interval $0° < a < +60°$ where evidently his explanation fails.

After the first determinations of the Earth cloudiness on planetary scale by meteorological satellites (Arking, 1963) we remarked that the mean cloudiness over the continents (59%) is superior to that over the oceans (50%), and that Danjon's explanation cannot be accepted without reserve. We suggested, therefore, an alternative explanation based on the lunar luminescence excited by solar wind which is deviated by the Earth into the parts of lunar orbit near to the full Moon (Link, 1963).

This suggestion seems now to be corroborated by Cameron's statistics (1972) of LTP. The phenomena ranged by her into the categories gaseous (G), reddish (R) and bluish (B) phenomena display the histograms represented in Figure 1. Both phenomena ES and LTP show a rapid rise at $a = -50°$ at the age of the Moon of 10 days and the decline after $a = +50°$ or at the age of 20 days. These limits are also the limits of the bow-shock front of the magnetosphere. Something happens, therefore, on the

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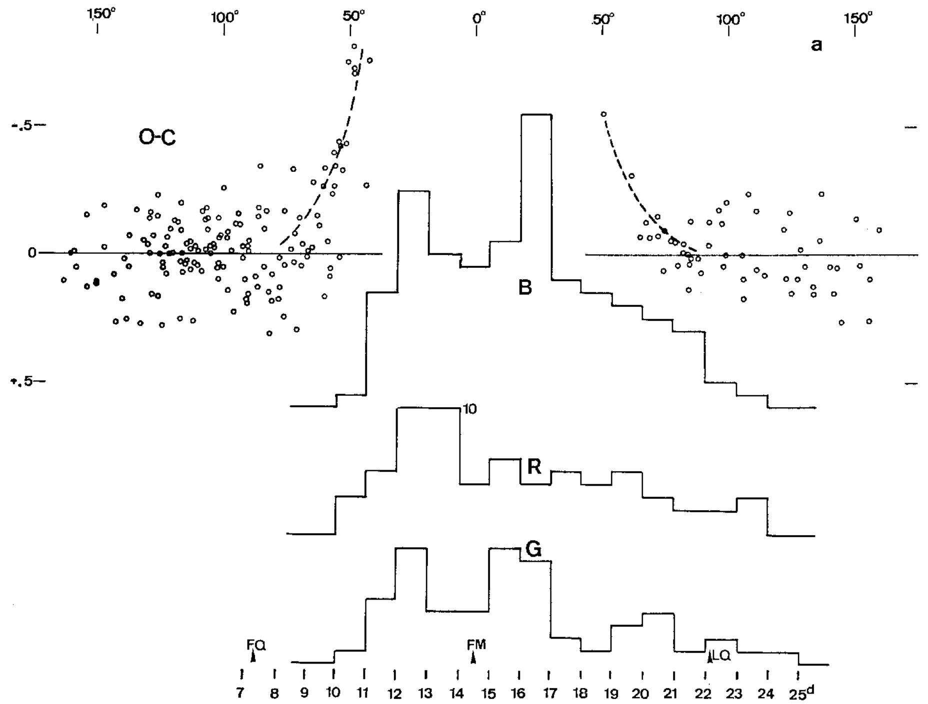

Fig. 1. Common behaviour of the ES (upper part) and the LTP (lower part) during the lunation.

Moon – probably the arrival of solar particles condensed or accelerated within the bow-shock front – what enhances the ES and originates the LTP on several sensitive lunar spots.

References

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