

Transient Lunar Phenomena

by K.E.Chilton

Is the Moon a cold, lifeless, changeless body? Or, are there changes from time to time? Recently, there has been much interest in amateur astronomical circles, in investigating changes on the Moon which seem to be of a transitory or impermanent nature.

Changes on the Moon have been seen for many years. For example, a luminous point was seen on the Moon by an observer named d'Angos, in Malta, in December 1787. In 1794 a report circulated in the press that you could see, with the naked eye, a volcano on the Moon. Such reports have been made from time to time, right up until the present. Even science-fiction writers make use of these phenomena, one reporting in 1961 that a flashing light could be seen in the crater Aristarchus, followed by objects leaving the eastern edge of the moon at 15 second intervals. However, our discussion here is concerned only with the scientific analysis of these transient features.

The visual nature of TLPs (the usual abbreviation of Transient Lunar Phenomena) is not agreed upon by many observers, as there seems to be many kinds of phenomena. Mrs.W.Cameron of the N.A.S.A. Goddard Space Flight Centre noticed a great many star-like points, glittering on the Moon during the April 13,1968 eclipse. These were also seen by a group of observers who accompanied her. (Here, I must confess that I observed the same eclipse and saw nothing of these star-like points.) It is interesting to note that Herschel saw a similar occurrence during an eclipse in 1790. (Ref.1)

Other observers report reddish glows from time to time. These seem to be the most common reports. Plato, Gassendi, Aristarchus and Eratosthenes seem to be the most susceptible areas for the appearance of TLPs. I observed such a glow in Eratosthenes on the night of October 31, 1968. These glows seem to last 5 or 6 minutes and then fade to obscurity.

Another form of TLP is the hazy spot. Objects on the Moon seem to be obscured by a haze or are impossible to focus. J.C. McConnell reported that the northeast wall of Posidonius seemed hazy and obscured. The rest of the crater was clearly visible but that one particular section could not be seen. (Ref. 2)

Then there are bright flashes. These appear with blinding suddenness and then are gone. One such was reported recently by T. Moseley of the Armagh Observatory who saw a flash in the area of Parrot. (Ref. 3)

At times, there are areas of polarization on the Moon. One was seen by me on the night of Sept. 18, 1966. I was observing the crater Gauss through a polaroid filter to cut down glare, when I noticed that the eastern wall of the crater was not visible. When I rotated the filter, it appeared, indicating that the area was reflecting polarized light. I have observed the same area since and have not observed that phenomenon again.

An ingenious device for detecting the glow-type phenomena has been built by Peter Sartory of the British Astronomical Association. This device consists of a series of filters, mounted on a wheel. These filters, when turned, intercept the optical train of the telescope. Usually there are two filters, red and blue, as well as a clear area in each system. The observer rotates the wheel, observing

first through one filter and then the other. Any coloured feature, especially a red one, will be suppressed by the red filter and enhanced by the blue. This causes a blink effect, as the object seems to blink on and off.

Considerable conjecture has been raised as to the causes of the phenomena. There are two main ones and several subsidiary ones. The truth would seem to be that there are as many causes as there are types of phenomena.

One of the main theories conjectures that TLPs are gaseous emissions caused by disruptions in the lunar surface by gravitation, especially when the Moon is at perigee or at apogee. The Earth raises a tidal bulge on the Moon, which, though it does not rotate around the surface as the Earth's tidal bulge does, gets more or less pronounced as the Moon travels around its elliptical orbit. Further, the position of the bulge changes slightly on the lunar surface due to libration effects. Coupled with the newly-discovered "mascons", which seem to indicate that the moon is not of uniform density, the gravitational stresses could cause the lunar surface to crack, releasing sub-surface gases. The sudden change from cold darkness to the brilliant light and heat of the lunar surface could cause the gases to emit radiation. Eventually, the gases would dissipate and be seen no longer.

A similar, but not widely-held, theory is that the gases are released through cracks caused by thermal activity, that is, by the sudden heating of the surface as it reaches the terminator. This could also account for TLPs seen during eclipses.

The other main theory connects TLPs with solar activity. There seems to be some correlation between sunspots, auroral activity and the appearance of changes on the Moon. TLPs usually occur just after outbreaks of sunspots. It is possible that the same particles which cause the aurorae on Earth cause glows on the Moon. Two mechanisms for the production of luminescence come to mind. The solar particles could bombard pockets of heavy gases still extant on the Moon, causing them to glow. Or, the particles could bombard the lunar surface directly, exciting certain particles there into light production. More investigation into the properties of the lunar surface will provide an answer.

Other theories include true vulcanism, meteor landings, and the releasing of gases through the cracking of the lunar surface by settling and cooling. Much has been written concerning volcanic activity on the Moon and need not be repeated here. It should also suffice to say that the landing of meteors may cause the flash-type phenomena. However, the idea of luminescence caused by the settling and cooling of the surface may need further exposition. It is a statistical fact that the majority of TLPs occur around the edges of the lunar maria or in craters with mare-type floors. The theory has it, especially since the discovery of "mascons", that the maria were created by collisions with asteroid-like bodies, which then buried themselves in the lunar surface. The heat generated by the impact of the asteroid caused the lunar surface to melt, and then cool off, creating a smooth surface. It may be that the mascons are settling and cooling, causing emissions of gases.

Whatever are the causes of TLPs, a great deal of further investigation is needed. To this end, a world-wide chain of observers has been set up, largely through the instigation of Miss Barbara Middlehurst, formerly of the University of Arizona and now with Encycopedia Britannica. These observers are to keep the Moon under constant scrutiny and report their findings. During the recent Apollo 8 mission to the Moon, the National Aeronautics and Space Administration called upon the services of the observers to watch for TLPs during the mission.

The cooperation of the big observatories is needed, with their large apertures and spectroscopic equipment. A spectrogram of a TLP could indicate a great deal about its properties. Regardless

Regardless of what theory is advanced, what arguments are put forward, and what newfound information is produced, the investigation of Transient Lunar Phenomena will provide an interesting, and sometimes exciting past-time for amateur astronomers.

References:

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May 1968, p. 42- Posidonius Hazy? by J. C. McConnell
3. British Astronomical Association: Lunar Section Circular: Vol. 2 No. 11
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