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Repeat Illumination Observations of the Moon

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Abstract

A world wide network of amateur astronomers is attempting to solve some historical observational puzzles known as Transient Lunar Phenomena (TLP), by re-observing specific features on the Moon under very similar illumination conditions to those of the original observations. We now have several examples where we can explain past TLP events as observers being deceived by the natural appearance of the lunar surface.

1. Introduction

Transient Lunar Phenomena (TLP) are reported changes apparently seen against the lunar surface and can take the form of glows, changes in brightness, colours, flashes, and greyness in shadows. Catalogs of such events have been produced [1,2] by NASA, and a modern day analysis[3] has suggested that some craters are more prone to TLP than others, however we now know that the Moon is a pretty inactive place, so many of the effects reported are difficult to explain. At Aberystwyth University, we hold the World's most up-to-date catalog of 2789 TLP reports, and for comparison a database of 23,308 routine observations that we can call upon to calibrate out the effects of observational bias. Each TLP in the database has an associated weight ranging from 1 (least reliable) to 5 (most reliable). We are conducting an analysis, using this data in order to see which of the many TLP theories[3] proposed can be supported, or rejected, according to the statistics.

In order to see if the original observer(s) were mistaken in what they visually described as anomalous, we encourage amateur astronomers to attempt to re-observe under very similar illumination, to within ±0.5˚ in terms of selenographic colongitude and sub-solar latitude. On rare occasions it is even possible to re-observe both under similar illumination and topocentric viewing angles to a tolerance of ±1.0˚, or finer.

The predictions on when to observe are generated each month for different geographic localities around theon: http://users.aber.ac.uk/atc/lunar_schedule.htm . Observations can be submitted through an Amateur Astronomy Outreach web portal: http://support.imaps.aber.ac.uk/aao/login.php, which requires a user login and password, available from the author.

The repeat illumination observing programme has been running since 2003, and monthly reports are published in the Lunar section newsletters of the British Astronomical Association (BAA) and Association of Lunar and Planetary Observers (ALPO). Observers can contribute observations from simple text-based descriptions of what they see, to visual sketches, and monochrome/colour images. Even if the images are at higher resolution than was available to the original TLP observers, we can simulate the effects of the atmosphere/optics on degrading the images captured, by Gaussian blurring, or by offsetting the red and blue colour channels to emulate atmospheric spectral dispersion or chromatic aberration. Three examples of repeat illumination of past TLPs are given in this abstract.

2. The Pictisus Three Spot Effect

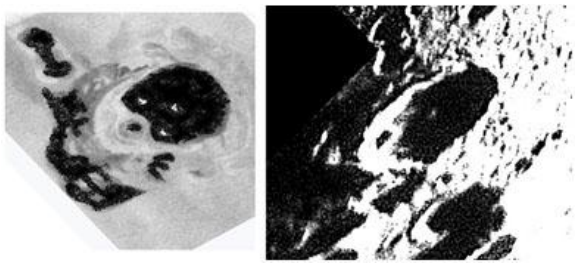

Figure 1 *Pictisus crater orientated with north towards the top.* ***(Left)*** *A sketch made by* Daniel del *Valle Hernandes, (ALPO) from: 2001 Jul 26 UT 00:17-00:45.* ***(Right)*** *A heavily contrast stretched version of an image supplied by Rik Hill (ALPO/BAA) from 2017 Feb 02 UT 01:49.*

Daniel del Valle Hernandes, witnessed three small patches of light on the shadowed floor of Pitiscus crater. Although rated as a low weight 1 TLP, this appearance nevertheless remained unresolved until ALPO astronomer Rik Hill re-imaged the region under similar lighting conditions (Fig 1). Thus proving convincingly that this effect is normal to see.

3. Daniell

On 1979 May 06 UT 20:30-20:46 Marcus Price reported that he had seen an obscuration inside Daniell crater. Whilst the NW interior was normal, the SE was somewhat fainter and less distinct. A repeat illumination image by Derrick Ward (BAA) confirms this appearance as normal (Fig 2). You can quite clearly see why the original observer unknowingly suspected a lack of detail was unusual.

Figure 2: *Daniell crater near the top of this image as imaged by Derrick Ward (BAA) on 2016 May 16 UT 20:34 showing a normal fuzzy appearance of the SE rim and interior of the crater.*

4. Aristarchus

In 1963 Oct 30 Greenacre and Barr, using the 24" Clark refractor, at Lowell Observatory, Flagstaff, witnessed three red coloured spots in the Aristarchus area, that changed in strength and appearance over time. A campaign[4] to re-image under similar illumination, produced images (Fig 3) showed that no natural lunar surface colour could explain the 1963 report. Furthermore, attempts to simulate atmospheric spectral dispersion, or chromatic aberration, also failed to replicate the effects.

5. Discussion

Although it is possible to simulate the appearance of the lunar surface, with software such as LTVT, this cannot replicate colours or ray features well. Because of the nearly three thousand TLP reports, it is not practical to investigate all these in one concentrated effort. Instead analysis occurs of repeat illumination observations, submitted each month in a newsletter, which form part of the ALPO and BAA Lunar Section monthly circulars. After analysis, TLP reports discussed here can either be eliminated from the database or have their weights adjusted accordingly. In view of the fact, that some of the historic TLP reports maybe impact related[5], the TLP database could be of great benefit in future lunar impact related studies.

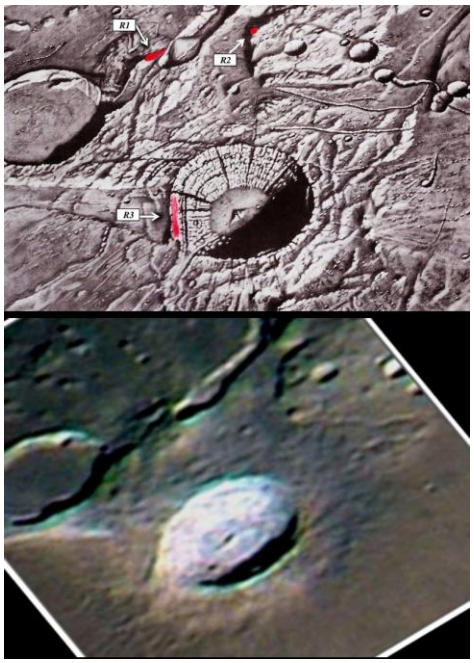

Figure 3: *Aristarchus crater* ***(Top)*** *As sketched by James Greenacre and Edward Barr, in 1963 Oct 30.* ***(Bottom)*** *as imaged by Bev-Ewen Smith on 2011 Apr 15.*

Acknowledgement

To: AEA, ALPO, BAA, GLR, LIADA, RASNZ, UAI observers, and other astronomical observing organisations

References

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