Observations of the Occultation of Mars by the Moon July 6, 2014

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Abstract

We present the results of the observation of the occultation of Mars by the Moon on July 06, 2014. Observations were made from the Observatorio Astronómico AFARI, in the town of Tarma, Peru. A Celestron 8 telescope with a camera WATEC 120N (GPS time inserted) were used. Time measurements for the first and second contact were obtained by analyzing of the variation of the flux of Mars using the software LiMovie. The measurements obtained were reported to the International Occultation Timing Association (IOTA).

Introduction

Lunar occultation observations are of great importance because they allow us to know with great precision the orbit and size of various occulted objects from the analysis of the disappearance and reappearance times. By comparing this two measures with the predictions we can improve each time the theoretical models that give us other predictions about positions in time of these objects. In the case of planets in the Solar System, their trajectory is well known, nevertheless, this kind of observations let us polish our predictions in the long run.

The Mars occultation by the Moon on the July 6th of 2014 was an event visible from a great part of South America, Peru being one of the most favorable locations to observe such event. The data presented in this work is part of a ongoing project of occultations observations that has started to take place in Peru. This is possible thanks to the lending of two fast cameras from the Observatorio de Paris, Francia.

Observational Data

The observations were done at Observatorio Astronómico AFARI (Lat. 11°24´53" South, Long. 75°41'00" West, 3056 m.a.s.l) located in Tarma, Junín-Perú, in the night of July 5th 2014. An 8" Schmidt-Cassegrain telescope was used (Celestron Celestar 8), with a focal ratio *f/10,* installed on a equatorial mount, and a WATEC 120N camera with UT inserted via GPS without a photometric filter. The resultant field of view according to the telescope-camera configuration was of 8.3x11 arcmin.

The contact times predictions shown in Table 1 and the visual configuration of Mars and the Moon in the disappearance and reappearance (se Figure 1) were obtained with the *Occult 4.1* software.

Table 1. Contact times prediction according to *Occult 4.1* Software.

	Event	Date	Time (UT)
Disappearance	First contact	06 Jul 2014	02h14m54.6s
	Second contact	06 Jul 2014	02h15m21.4s
Reappearance	Third contact	06 Jul 2014	03h33m2.60s
	Fourth contact	06 Jul 2014	03h33m25.4s

The first and second contact (disappearance), just as the third and fourth one (reappearance) were registered. Each observation were done under a fairly cloud free sky, with a temperature of 11ºC and a humidity percentage of approximately 60%.

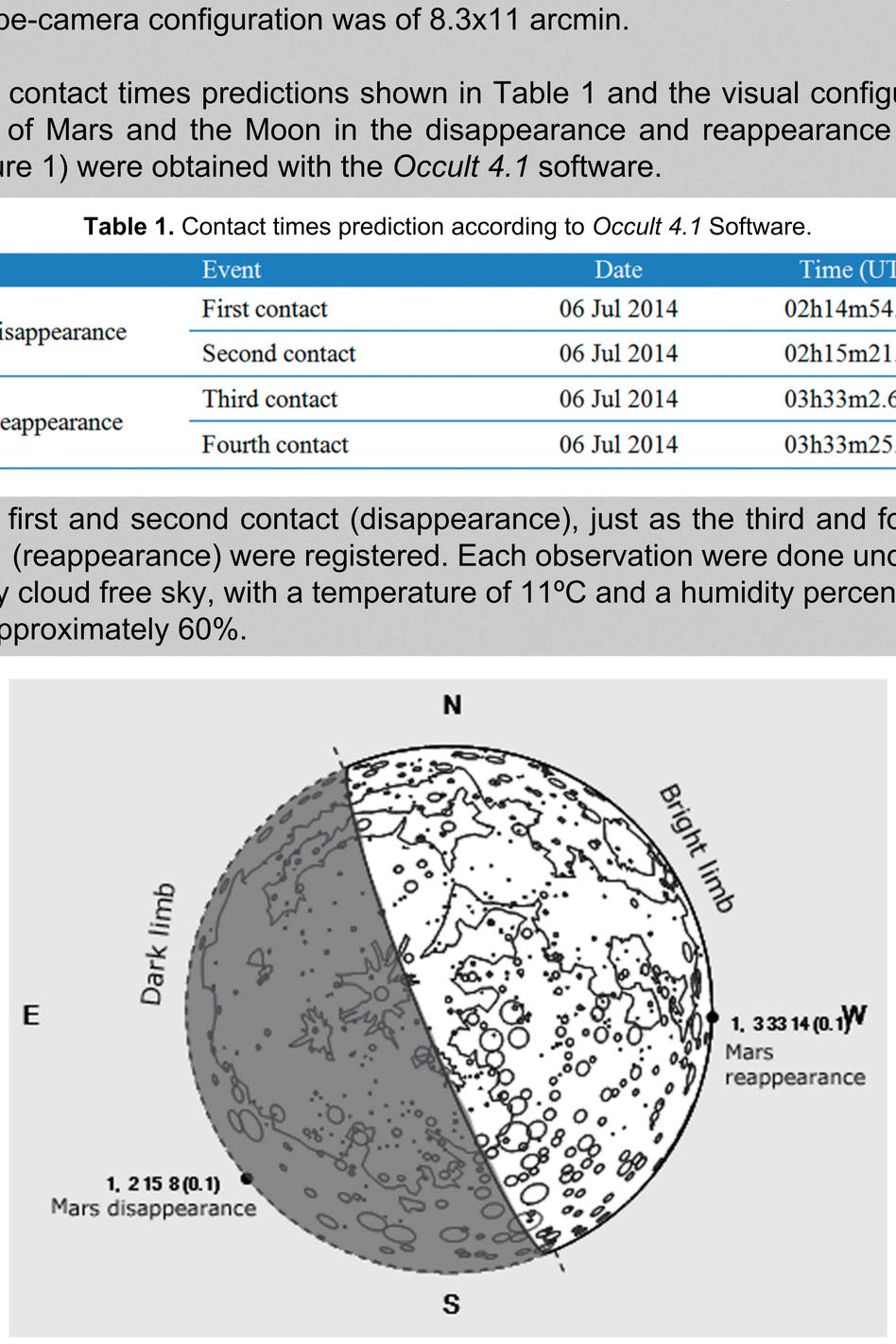

Figure 1. View of the lunar surface generated with *Occult 4.1* in the moments of Mars disappearance and reappearance.

Data Processing

To obtain the contact times we analized flux variation curve of Mars in each frame, this process was used using the *LiMovie* software. This flux variation showed a greater noise level at the moment of reappearance, due to the contrast generated between the brightened lunar limbo and the planet. Because of this the analysis was focused on the first and second contact (disappearance).

To choose the frames that contain the times of the first and the second contact, we didn't consider Fresnel diffraction correction that is usually used in lunar occultations of star like punctual objects. In this case, as it is a greater angular size object, Mars flux intensity drop was fairly gradual (see Figure 2). Therefore, to determine the contact times we chose the first point that was below the noise level in the track the object followed, the corresponding frame to this point was the one that allowed us to get the time for the first contact. The same procedure yielded the second contact time in the corresponding disappearance frame.

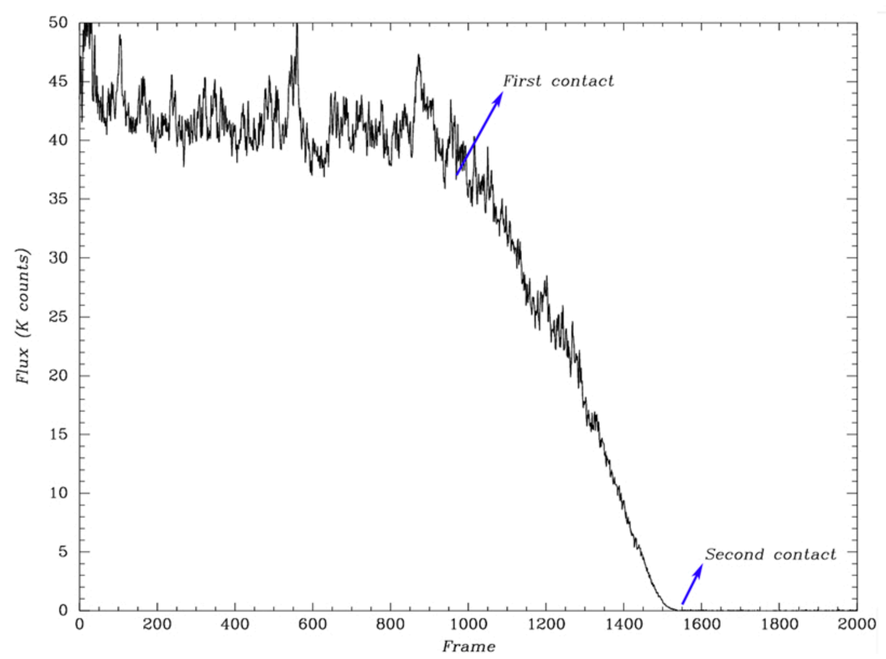

Figure 2. Mars flux variation curve according to frame, the first and second contact times are noted. Graphic generated with IGI (Interactive Graphics Interpreter) in the IRAF environment.

After sending the report, IOTA calculates the O-C parameter (Observed vs Calculated difference). In Figure 3 one can see the O-C , in particular, the O-C for the first contact shows a value much greater than 1 (8.05). This value should be considered normal in the case of planet occultations due to the gradual drop in flux intensity that is produced by the great angular size of the planet, which makes the analysis to be more statistical with a considerable uncertainty. This O-C value for planets detail was not properly informed by IOTA, since this report, this information has was included in their response formats.

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Telescopes:
 Aperture   Longitude      Latitude   Alt
#   cm        o  '  "        o  '  "     m
A   20     - 75 41  0.     -11 24 53.   3056

ref Tel Observer              Star No.     y  m  d  h  m   s    PhGrMrCeDb    O-C

001  A  Jose Ricra             P   4000  2014  7  6  2 14 50.78  DD   G 1      8.05
002  A  Jose Ricra             P   4000  2014  7  6  2 15 13.54  DD   G 1      0.84
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Figure 3. Report sent to IOTA, we show geographical coordinates from Tarma, instruments used, times measured and O-C value calculated by the IOTA.

Conclusssions

Mars occultation registrations from July 6th 2014 was done successfully, the measurements and information obtained were reported to IOTA.

References

[1] Stephenson, F. R. 2000, *JHA*, xxxi, 342.
[2] Hamon, A. 1972, LAstr., 86, 518.

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