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Technical Report

New World Record for Observing New Moon in The Kingdom of Saudi Arabia

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ABSTRACT

Observing the new Moon is of vital importance for Muslims, Jews and Hindus. In previous work we were able to observe the crescent at about 4° above the horizon at the time of sunset. Herein, we are reporting the success observation of the crescent at 1.5°.

KEY WORDS: Moon, Crescent, Young moon.

INTRODUCTION

In Saudi Arabia, King Abdulaziz City for Science and Technology (KACST) is the scientific research organization that supports and promotes scientific research of an applied nature, and coordinates such activities in line with the development requirements of the country. The Astronomy and Geophysics Research Institute is one of the institutes at KACST and is responsible for sighting the new Moon "crescent" at the beginning of each lunar month.

In our previous work, Al-Mostafa and Kordi (2003), we compared our local record for the lowest elevation of the crescent moon with that of Pepin (1996). In this work we believe that we have observed the lowest crescent yet seen.

DESCRIPTION

On 14th September 2004, at the top of Fegrah mountain (elevation 1904m) north of Medina - (Saudi Arabia) (long. 38° 56' 9" E, lat. 24° 19' 44" N, time zone +3), a site only about 90km west of the Red sea, it was easy to see the Sun setting into the sea. This is a remarkably young moon to be observed, just 58mins old; the new moon was on Tuesday 14th September 2004 at 17:30 local time (14:30 UT). Our previous record was 12^{h} 58^{m} old (Al-Mostafa and Kordi, 2003).

Table (1) shows the data for the Moon and the Sun on the day of observation taken from THESKY software and compared with the U.S. Naval Observatory Astronomical Applications Department findings. Table (2) shows the Moon's apparent topocentric positions, local zenith and true north at the time of Moon's set.

Table 1. Comparison between the new record and KACST's (Al-Mostafa & Kordi, 2003). All times quoted are local for Saudi Arabia (+3). Results are rounded to the nearest minute.

MOON	New Record 9/14/04	KACST Record 3/14/02
New Moon	17:30	05:04
Age of the Moon at the time of sunset	00:58	12:58
Rise	05:48	06:27
Transit	12:15	12:23
Set	18:37	18:24
Azimuth of the moon at the time of sunset	275°40'22"	262°32'43"
Altitude of the moon at the time of sunset	+01°00'27" (with refraction: 01°24'42")	+04°09'01" (With refraction: 04°20'26")
Physical ephemeris		
Phase	0.09 %	0.45 %
Phase angle	176.64°	172.31°
Position angle of the bright limb	211.7°	286.5°
Angular separation from Sun	02°37'43"	07°01'42"
	SUN	
Rise	06:10	06:04
Transit	12:19	12:03
Set	18:28	18:02
Sun's azimuth at sunset	273°47'57"	267°38'03"
Sun's altitude at sunset	-00°50'10"	-00°42'04"
Earth-Moon distance	386226.2 km	406596.4 km
Observer(s)	Zaki A. Al-Mostafa, Mosaed S. Al-Ahmadi, Hamzah A. Mustafa	Zaki A. Al-Mostafa, Moataz Kordi

Table 2. Moon's apparent topocentric positions, local zenith and true north at the time of Moon's set.

	Zenith Distance °	Azimuth (E of N) °
New Record 9/14/04	90.77282	276.43726
KACST Record 3/14/02	90.64686	264.86574
Arizona Record 1/20/96	90.83505	253.58733

First, two colleagues, Mr. Hamzah A. Mustafa (HAM) and Mr. Mosaed S. Al-Ahmadi (MSA), saw the moon with their naked eyes; then I saw it through a 10" Mead telescope Schmidt-Cassegrain, together with MAA who confirmed my observation. The naked eye report was immediately after sunset, and through the telescope was three minutes after sunset. It was very thin, unbroken and without a cusp. It was easy for HAM to see Vega in the day time around five O'clock with the naked eye.

Table (3) lists the variables significantly affected on observing the crescent in order to find those factors that should be most helpful in observing the crescent at a very low altitude.

Table 3. weight comparison between the new record and the previous ones.

	New Record 9/14/04	**weight**	**KACST's Record 3/14/02**	**weight**	**Arizona's Record 1/20/96**	**weight**
DAZ	1°52'25"	2	5°5'20"	3	1°48'50"	1
Age	00:58	1	12:58	3	12:53	2
a_l	02°37'43"	1	07°01'42"	2	07°32'52"	3
Phase	0.09 %	1	0.45 %	2	0.56 %	3
dis	386226.2	2	406596.4	3	358379.7	1
Pha	176.64°	3	172.31	2	171.45°	1
Poa	211.7°	1	286.5°	3	221.6°	2
a_d	+01°00'27	1	+04°09'01"	2	+06°34'45"	3
Lag	9	1	22	2	39	3

DAZ: the difference between Sun's azimuth and Moon's azimuth at the time of sunset.
Age: the age of the Moon given in hours from the instant of conjunction to the time of the evening observation.
a_l: angular separation.
Phase: the calculated apparent size of the Moon (illumination).
dis: Earth-Moon distance in km.
Pha: Phase Angle of the Moon, which means the angle subtended in the Moon's sky between Earth and Sun (0 at full moon and 180 at new moon), which is almost exactly the angle between the Moon and the Sun's antipodes from our perspective as an observer at the center of the ecliptic
Poa: Position angle of the bright limb.
a_d: altitude.
Lag: the interval in minutes between the time of sunset and moonset.

Figure (1) plots the values in Table (3) to provide a clear comparison, giving weight one for the lower magnitude and weight three for the higher magnitude.

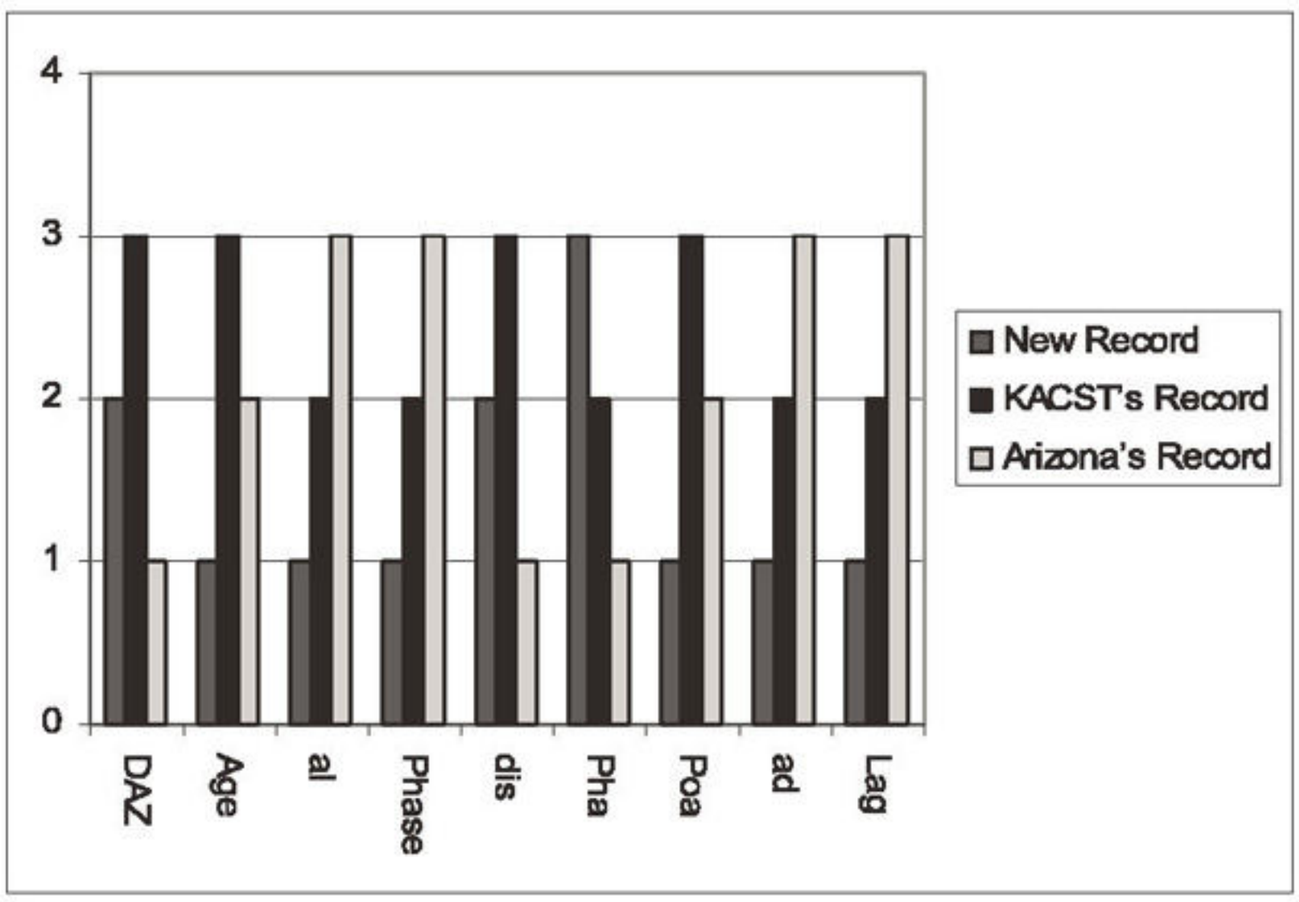

Figure1. Comparison of the new observation and the previous ones.

RESULTS AND DISCUSSION

Although the age, a_l, phase, *Poa*, a_d and *lage* were the lowest for the new observation, *DAZ* and *dis* lay between the two previous observations. The only factor which seems to be significantly affected in the new work is *Pha*, which was highest of all.

CONCLUSION AND FUTURE WORK

Although it is very difficult to observe the crescent at very low altitude, the effort should not stop and attempts to break the record should continue. In future work we will concentrate on the effect, on the observation, of the reflection of the Moon's surface, taking into account the irregularity of the lunar surface, which more resembles a golf ball than a smooth ball.

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رقم قياسي عالمي في رصد قمر وليد في المملكة العربية السعودية

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ملخص

يعتبر رصد القمر الوليد مهم لدى المسلمين واليهود الهندوس. ففي دراسة سابقة تم رصد الهلال على ارتفاع حوالي 4° من الأفق. وفي هذا البحث نسلط الضوء على عملية ناجحة لرصد الهلال على ارتفاع حوالي 1.5°، وهو رقم قياسي عالمي.