

LIGHTCURVE ANALYSIS OF 5181 SURF

Melissa N. Hayes-Gehrke, Adeseye Afe, Daniel Cha, Ayana Cotton, Jasmine Diedrick, Kevin Liu, Matthew Livas, Katelyn Melone, Samirbhai Mistry, Jacob Murphy, Xin Ren, Philip Romano, Michael Searce, Andrew Smith, Brian Summers, Maliha Zainib

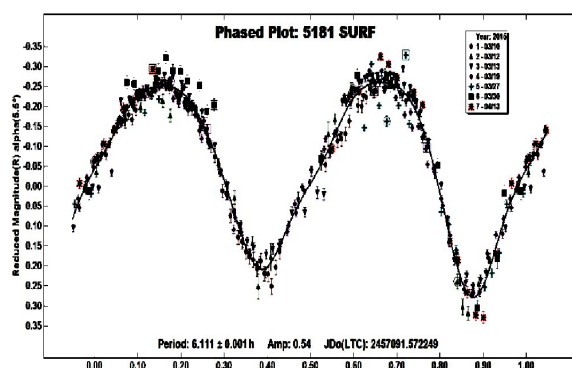
Dept. of Astronomy, University of Maryland
College Park, MD 20742
mhayesge@umd.edu

Donald Pray
Sugarloaf Mountain Observatory
South Deerfield, MA

(Received: 2015 May 12)

A lightcurve was determined for the main-belt asteroid 5181 SURF. The asteroid was observed for seven nights over the course of two months during 2015 March-April. The rotation period was found to be 6.111 ± 0.001 h.

CCD photometric data from a total of seven nights were analyzed with differential photometry to ascertain a rotation period for 5181 SURF. Sixteen student astronomers observed over three nights, combined with four nights of data taken by Don Pray at Sugarloaf Mountain Observatory. The students observed remotely from the T7 telescope in Nerpio, Spain, using the iTelescope observing service. The T7 was a 431-mm $f/6.8$ Planewave CDK telescope, and the imager was a SBIG STL-11000M CCD. Images were exposed for 300 s through a luminance filter. Data from Pray were obtained using a 0.5-m $f/4$ reflector and an SBIG ST-10XME CCD. Differential photometry and period analysis were all accomplished using *MPO Canopus* (Warner, 2013).



Acknowledgements

The authors of this paper would like to thank Donald Pray for willingness to collaborate and share his data. We also thank iTelescope.net for enabling us to use the T7 telescope located in Nerpio, Spain, remotely. This research was made possible by the Astronomy Department at the University of Maryland, College Park. Operations at Sugarloaf Mountain Observatory were supported by a Gene Shoemaker NEO grant from The Planetary Society.

References

Warner, B.D. (2013). MPO Software, *MPO Canopus* version 10.4.3.12. Bdw Publishing. <http://www.bdwpublishing.com>

Minor Planet Bulletin **42** (2015)

LIGHTCURVE OF MINOR PLANET 1492 OPPOLZER

Nico Montigiani, Massimiliano Mannucci, Lapo Ferrini
Associazione Astrofili Fiorentini
Osservatorio Astronomico di San Polo a Mosciano
Via di San Polo, 50018 Scandicci (Florence) – Italy
info@astrofilifiorentini.it

(Received: 2015 May 19)

Lightcurve measurements of 1492 Oppolzer were performed in 2015 May. Data analysis produced a lightcurve with a synodic period of 3.7689 ± 0.00048 h and amplitude about 0.12 mag.

Our lightcurve for 1492 Oppolzer is the first attempt of photometry observations from Osservatorio Astronomico di San Polo a Mosciano, Scandicci (MPC: 632). The target was selected from the list of asteroid photometry opportunities published by Warner *et al.* (2015).

The observations were made on three nights between 2015 May 10-18 using a 0.4-m $f/4.5$ Newtonian. The CCD camera was an SBIG ST7 XME binned 2x2 with AO8 adaptive optic system, and yellow filter Wratten n°12. Exposure times were 120 s. Raw images were processed in *Astroart 5* using flats and dark frames. Analysis of the combined data sets was done using *MPO Canopus* software 7.6 version (Warner, 2004). The derived synodic rotation period was 3.7689 ± 0.00048 hrs. These results are in good agreement with those reported by Pravec *et al.* (2015) of $P = 3.7697 \pm 0.0007$ h, $A = 0.11$ mag.

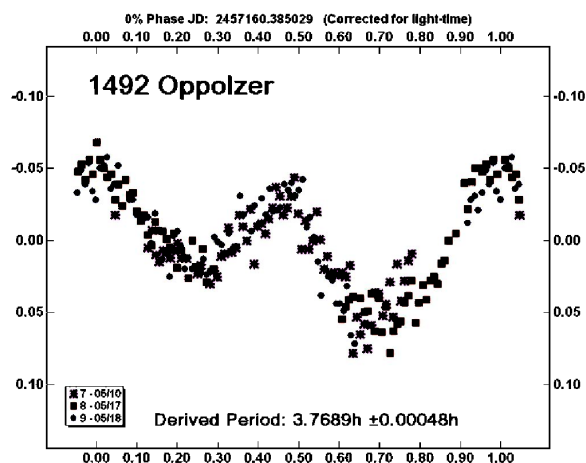


Figure 1. Composite lightcurve of asteroid 1492 Oppolzer derived from 3 nights of observations and 3.7689 ± 0.00048 hours rotation period.

References

Pravec, P., Wolf, M., Sarounova, L. (2015). <http://www.asu.cas.cz/~ppravec/neo.htm>

Warner, B.D. (2004). MPO Software, *MPO Canopus* version 7.6.4.6, Bdw Publishing. <http://www.minorplanetobserver.com/>

Warner, B.D., Harris, A.W., Āurech, J., Benner, L.A.M. (2015). "Lightcurve Photometry opportunities: 2015 April-June". *Minor Planet Bulletin* **42**, 150-153.

PHOTOMETRY OF THREE ASTEROIDS WITH THE ZA-320M TELESCOPE OF PULKOVO OBSERVATORY

Denis Gorshanov, Alexander Devyatkin, Alexandra Martysheva
Pulkovo Observatory
196140, Pulkovskoe sh., 65, Saint-Petersburg, RUSSIA
dengorsh@mail.ru

Rizvan Bekyashev
State Marine Technical University of St. Petersburg, RUSSIA

(Received: 2015 May 20)

Results of photometric observations of 702 Alauda (color-indices), 3737 Beckman (fragment of raw lightcurve), and (251346) 2007 SJ (phased lightcurve) are presented.

Photometric asteroid observations were made at the Laboratory of Observational Astrometry of Pulkovo Observatory with a ZA-320M (Cassegrain reflector, $D = 320$ mm, $F = 3200$ mm). It is situated in Pulkovo Observatory at the edge of the city of Saint Petersburg, Russia. The telescope is equipped with an SBIG STX-16803 CCD camera (4096×4096 pixels of 9×9 μ m) and $BVRI$ filters. We used 3×3 binning. The field-of-view was 39'×39'.

The CCD frames were processed with the *APEX-II* program package developed in Pulkovo Observatory (Devyatkin, 2010). Usually, we send results of astrometric processing of our asteroid observations to MPC. Some photometric results are shown in the present paper.

Star magnitudes on CCD frames are determined using aperture or PSF photometry methods. We use 2MASS as the reference star catalog in accordance with the paper of Warner (2007). We made transformation of observed colour-indices from instrumental colour system to the standard one using coefficients determined previously by observations of Landolt's areas (Landolt, 1992).

702 Alauda is a binary asteroid (Johnston, 2015). It has rotational period of 8.3531 ± 0.0004 h and low amplitude of 0.10 ± 0.01 mag (Alkema, 2014).

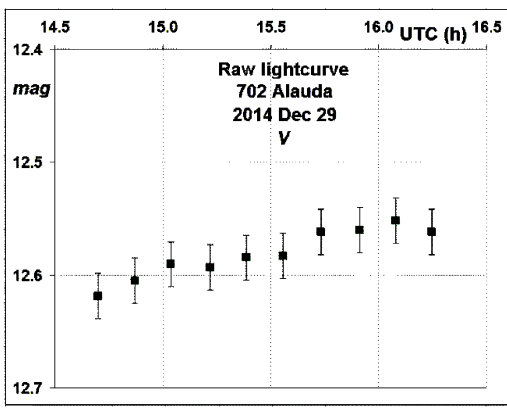
Our observations were made in five nights with the ZA-320M telescope in order to determine color-indices of Alauda. We changed each pair of filters several times. For example, on 2014 Dec 29, we used all four filters in the following order: *VIVIV-VBVB-VBVRVRV*. Thus, a number of the color-index values were observed for each pair of filters in a night. The values were averaged. The results for each night and overall average value of the color-indices are presented in Table I. It contains dates of the observations, phase angles of the asteroid at the time of the observations, average values of the color-indices with their RMS for each night when the indices were observed, and number of averaged values (in parenthesis). Overall averages are in the last line of the table.

Date yyymmdd	Phase (deg)	$B-V$	$V-R$	$V-I$
141225	12.1	0.610 ± 0.015 (5)	0.410 (1)	
141226	12.6		0.411 ± 0.021 (5)	
141229	13.2	0.580 ± 0.014 (5)	0.411 ± 0.012 (5)	0.686 ± 0.005 (5)
150304	17.2			0.519 ± 0.016 (7)
150312	16.6			0.500 ± 0.015 (4)
Avg.	14.3	0.60 ± 0.02	0.41 ± 0.01	0.57 ± 0.10

Table I. Color index results for 702 Alauda.

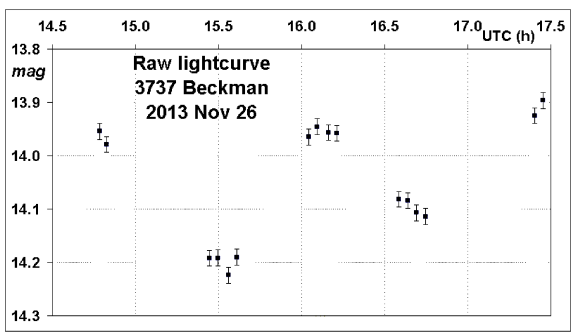
Our value of $B-V$ is somewhat less than value of $B-V = 0.665 \pm 0.022$ published on the JPL small-body database (JPL, 2015). The values of $V-R$ have good agreement for the 3 nights of observations. However, one value of $V-I$ (Dec 29) has a large difference from the other two, although intrinsic accuracy of the night is good and other color-indices of the night have satisfactory agreement with other nights. Thus, the overall RMS of $V-I$ is too large.

Along with color-indices, a fragment of the lightcurve for Alauda in V band was constructed from the observations on 2014 Dec 29. It has average accuracy about 0.02 mag and duration of about 1.5 hours (near 0.2 of the whole rotational period).



3737 Beckman was observed on 2013 Nov 26 along with (251346) 2007 SJ. Beckman is a Mars-crossing asteroid (JPL, 2015). Its rotational period is 3.130 ± 0.002 h and amplitude is 0.27 ± 0.10 mag (Klinglesmith *et al.*, 2014).

We made the observations of 3737 Beckman using the ZA-320M telescope without filters. The magnitudes from 16 CCD frames depict a fragment of the asteroid lightcurve with an average accuracy of about 0.015 mag and duration of about 2.7 h, or about 0.85 of the published rotational period. The lightcurve fragment shows peak-to-peak amplitude of about 0.27 mag.



(251346) 2007 SJ is a potentially hazardous asteroid (JPL, 2015). Our photometric observations were made near its encounter to the Earth in 2014 Jan. We observed fragments of the asteroid's lightcurve during four nights, 2013 Nov 26 and Dec 4, 18, 25, with the ZA-320M telescope without filters. The fragments have duration of 3.5–6.5 h and accuracy of 0.025–0.050 mag.

The observed lightcurve fragments were corrected for heliocentric and topocentric distances. Despite large phase angles ranging from