6615 PLUTARCHOS, A SUSPECT BINARY ASTEROID

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(Received: 17 June)

6615 Plutarchos was observed from Leura and Carbuncle Hill Observatories in April and May 2007. The synodic period is reported to be 2.3247 ± 0.0001 h. This asteroid also has a partial solution as a binary with asynchronous orbital period of 40.02h ± 0.1h.

6615 Plutarchos was selected from the list of suggested targets for the Photometric Survey of Asynchronous Binary Asteroids, Pravec (2006). Observations were started on April 10, 2007, from Leura Observatory. By then the asteroid was past opposition and receding. Since the target was fading, it was possible with the available instruments to follow it until only the end of May. At that time it was no longer possible to reach the level of detection required by the survey. All nightly observations were sent to Pravec for analysis, which included checking for signs of attenuations of more then 0.02 magnitude (see Fig. 2). In this lightcurve, the attenuations are plotted into a half orbit for clarity. In a near-zero eccentricity orbit, these attenuations are caused by a primary and secondary event. In addition to that, at moderate solar phase angle, when these events occurred, the incidences of both occultations and eclipses were unlikely. This, in effect, explained the similarity in the depth of the attenuations observed on the three occasions.

During this recent campaign, the three attenuations that were captured consisted of two transit events and one occultation event or vice versa. Therefore, from the above observations, it was deduced that the orbital period is 40.02h ± 0.10h and the amplitude of the events is 0.07 mag. An orbital period of 20h or less is not likely due to geometrical constraints. The lightcurve in Fig. 1 shows the rotation period of the primary body to be 2.3247h ± 0.0001 hr with an amplitude of 0.06m ± 0.01m. September 2008 and February 2010 are the dates of the next close approaches of this asteroid.

The location and instruments used at Leura Observatory have been previously described (Oey 2006). Pray joined in the search when it was determined that the asteroid was a suspect binary. His data are shown as sessions 8 and 9. Carbuncle Hill Observatory's location and its instrumentation were documented by Pray et al (2006).

Acknowledgement

Thanks are given to Brian Warner for his tireless work in improving the Canopus program and great support for its users.

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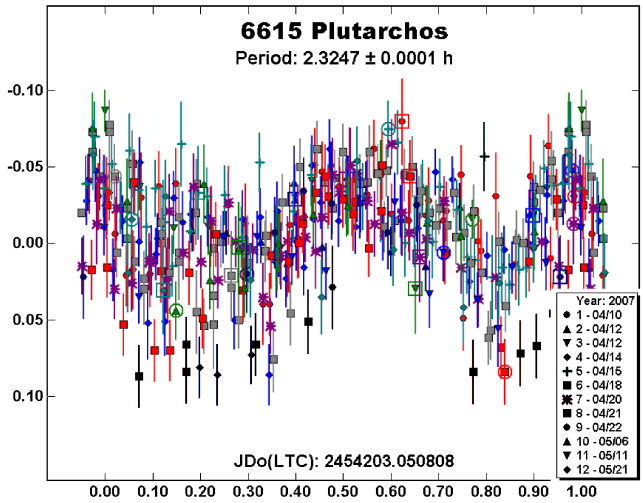

Fig. 1 Rotation period of the main body showing signs of primary or secondary events around phase 0.20.

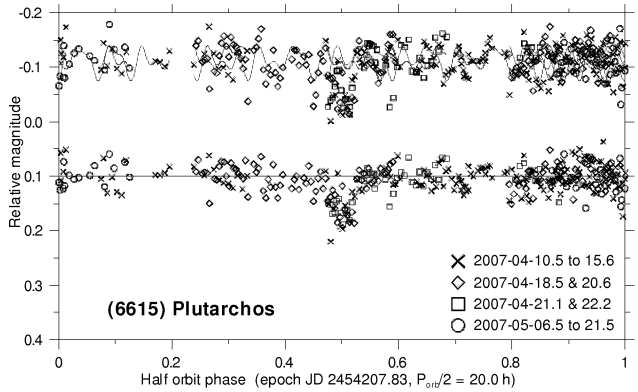

Fig. 2 The lightcurve illustrating the event captured during the campaign as shown in phase 0.50.

Date (2007)	Session	PA	LPAB	BPAB
April 10	1	13.5	179.9	2.2
April 14	4	15.7	180.4	2.2
April 18	6	17.7	181.0	2.3
April 21	8	19.2	181.4	2.3
May 21	12	29.0	188.4	2.2

Table 1. Aspects of 6615 Plutarchos during the start, the three observed events, and the end of campaign.

PHOTOMETRY FROM GMARS AND SANTANA OBSERVATORIES – APRIL TO JUNE 2007

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Lightcurve period and amplitude results from Santana and GMARS Observatories are reported for 2007 April-June. 348 May: 7.3812 ± 0.0008 hr, 0.16 mag. 502 Sigune: 10.922 ± 0.002 hr, 0.44 mag. 542 Susanna: 10.069 ± 0.003 hr, 0.11 mag. 1096 Reunerta: 13.036 ± 0.002 hr, 0.26 mag. 3028 Zhangguoti: 4.826 ± 0.001 hr, 0.20 mag. (7055) 1989 KB: 4.16845 ± 0.00005 hr, 0.20 mag. 2006 VV2: 2.413 ± 0.002 hr, 0.32 mag.

The author operates telescopes at two observatories. Santana Observatory is located in Rancho Cucamonga, California and GMARS (Goat Mountain Astronomical Research Station) located at the Riverside Astronomical Society's observing site. Details of the equipment are in Stephens (2007).

Asteroids 348 May, 502 Signue, and 3028 Zhangguoti were selected from the list of asteroid photometry opportunities published by Brian Warner and Alan Harris on the Collaborative Asteroid Lightcurve Link website (CALL 2007). 1096 Reunerta was selected to follow up on the author's observations described in Stephens (2001). (7055) 1989 KB was selected from the Binary Asteroid Survey list Parvec (2007). 2006 VV2 was a target of opportunity. The author measured the images using MPO Canopus, which employs differential aperture photometry to produce the raw data. Period analysis was done using Canopus, which incorporates the Fourier analysis algorithm (FALC) developed by Harris (1989).

The results are summarized in the table below. Column 2 gives the dates over which the observations were made, Column 3 gives the number of actual runs made during that time span and column 4 gives the number of observations used. Column 5 is the range of phase angles over the full data range. If there are three values in the column, this means the phase angle reached a minimum with the middle valued being the minimum. Columns 6 and 7 give the range of values for the Phase Angle Bisector (PAB) longitude and latitude respectively. Column 8 gives the period and column 9 gives the error in hours. Columns 10 and 11 give the amplitude and error in magnitudes.

348 May. The period of 7.3812 hours agrees with the 7.38528 hour period of Demeautis (Behrend 2007).

502 Sigune. The period of 10.922 hours appears to update the 10.5 hour period estimate by Tedesco (1979).

542 Susanna. The 10.069 hour period agrees with a 10.084 hour period obtained by Don Pray between May 23 and June 7, 2007 (private communications) and a 10.0747 hour period reported by Sheridan (CALL 2007).

1096 Reunerta. The period of 13.036 hours agrees with previously reported periods of 13.02 hours by the author (Stephens 2001) and 13.03 hours by Crippa and Manzini (Behrend 2007).

3028 Zhangguoxi. The period of 4.826 hours does not support the previously reported period of 4.401 hours by Gross (CALL 2007).

(7055) 1989 KB. The data presented is the author's only. It was combined with other observers of the Binary Asteroid Survey to generate the reported period of 4.16845 hours.

2006 VV2. This asteroid was imaged during its close flyby on March 31, 2007. Due to its rapid motion, twelve sessions were created using different comparison stars. These sessions were normalized to each other. However, Session 119 had an unknown 0.06 magnitude shift which could not be reconciled.

Acknowledgements

Thanks are given to Dr. Alan Harris of the Space Science Institute, Boulder, CO, and Dr. Petr Pravec of the Astronomical Institute, Czech Republic, for their ongoing support of all amateur asteroid. Also, thanks to Brian Warner for his continuing work and enhancements to the software program "Canopus" which makes it possible for amateur astronomers to analyze and collaborate on asteroid rotational period projects and for maintaining the CALL Web site which helps coordinate collaborative projects between amateur astronomers.

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Asteroid	Dates (2007)	Sess	Phase	L_{PAB}	B_{PAB}	Per (h)	PE	Amp	AE
348 May	05/15-06/07	4	13.0,17.5	199.3,201.2	10.5,9.6	7.3812	0.0008	0.16	0.04
502 Sigune	06/10-15	7	13.2,12.0	275.2,275.1	22.6,22.2	10.922	0.002	0.44	0.04
542 Susanna	06/19-26	6	9.8,11.6	246.0,246.1	14.6,14.4	10.069	0.003	0.11	0.04
1096 Reunerta	04/26-05/11	8	6.6,11.6	203.7	9.9,9.3	13.036	0.002	0.26	0.05
3028 Zhangguoti	04/17-04/25	4	5.0,8.0	194.3	1.4,1.7	4.826	0.001	0.20	0.04
(7055) 1989 KB	05/12-13	2	9.9,9.5	242.3	12.4,12.2	4.16845	0.00005	0.20	0.02
2006 VV2	03/31	1	43.9,42.9	169.2,169.5	9.9,9.1	2.413	0.002	0.32	0.03