REVISION: PHOTOMETRIC OBSERVATIONS AND LIGHTCURVE ANALYSIS OF NEAR-EARTH ASTEROIDS (136849) 1998 CS1, 2006 SZ217, AND 2008 UE7

Quanzhi Ye
Department of Atmospheric Science, Sun Yat-sen University,
Guangzhou, China (mainland)
tom6740@gmail.com

(Received 2009 November 12)

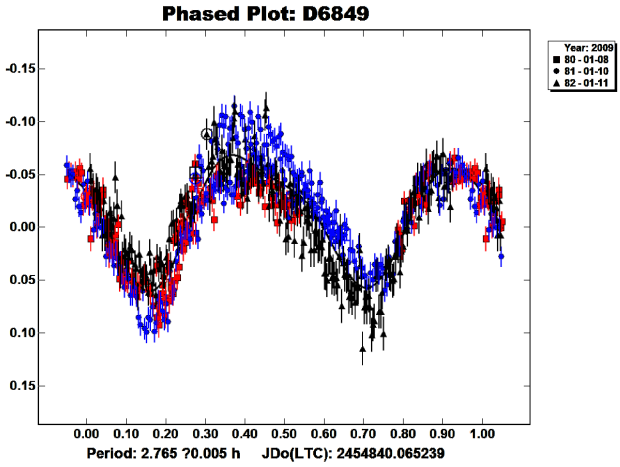
Regarding our published lightcurve analysis result for (136849) 1998 CS1. See Ye et al. (2009; *Minor Planet Bulletin* **36**, 180-181). The result is revised after the availability of further reference information (Benner et al., 2009). The revised rotation period is 2.765 +/- 0.005 hr, which is consistent with the result described by Benner et al. (2009). The wrong estimation in the origingal Ye et al. manuscipt was due to the lack of long observing session (no more than 3hr), thus the short period got filtered out from the period search. For the observers with short observing intervals each night, we recommend to have at least one "long" session in the campaign to ensure to cover the possibility of a short rotation period.

Acknowledgements

This revision is submitted on behalf of all original authors of Ye et al. (2009). We would like to thank Lance A. M. Benner, Michael W. Busch, Alan W. Harris, Brian D. Warner and Petr Pravec for their valuable discussions.

Reference

Benner, L. A. M., Brozovic, M., Giorgini, J. D., Nolan, M. C., Magri, C., Ostro, S. J., Jao, J. S., Lawrence, K. J., Margot, J. L., Busch, M. W., Shepard, M. K., Howell, E. S., Taylor, P. A., and Carter, L. M. (2009). Arecibo and Goldstone Radar Images of Near-Earth Asteroid (136849) 1998 CS1, 41th DPS meeting #43.09.



ROTATION PERIOD DETERMINATION FOR 53 KALYPSO

Frederick Pilcher
4438 Organ Mesa Loop
Las Cruces, NM 88011
Pilcher@ic.edu

Donald P. Pray
Carbuncle Hill Observatory
West Brookfield, MA 01585
dppray@hotmail.com

(Received: 9 January)

New data taken at a different viewing angle have led to a revision in the period for 53 Kalypso. A synodic rotation period and amplitude have been found to be 9.036 ± 0.001 h, 0.14 ± 0.02 mag. Considering all available data, this value is now considered more secure compared with a period exactly twice as long.

Observations by Pilcher at the Organ Mesa Observatory used a Meade 35 cm LX200 GPS S-C, SBIG STL-1001E CCD, differential photometry only, unguided exposures, R filter. Observations by Pray at the Carbuncle Hill Observatory are with a 0.51m f/4 reflector with SBIG ST-10XME CCD at the prime focus. Image measurement and lightcurve analysis were done by *MPO Canopus*.

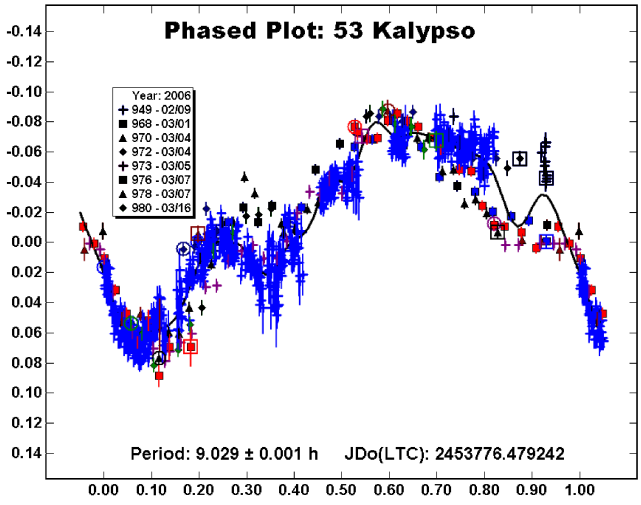
Debehogne et al. (1982) obtained a very sparse lightcurve for which they claimed a period near 27 hours. Surdej et al. (1983) obtained additional observations later in the same opposition and linking the results obtained a possible period of 26.55 hours, but a reexamination suggests alias periods are likely. Harris and Young (1989) obtained additional lightcurves and suggested their own results and those by Debehogne et al. (1982) and Surdej et al. (1983) more likely indicate a period 16-20 hours. Pray et al. (2006) found a period 18.075 ± 0.005 hours, amplitude 0.14 magnitudes.

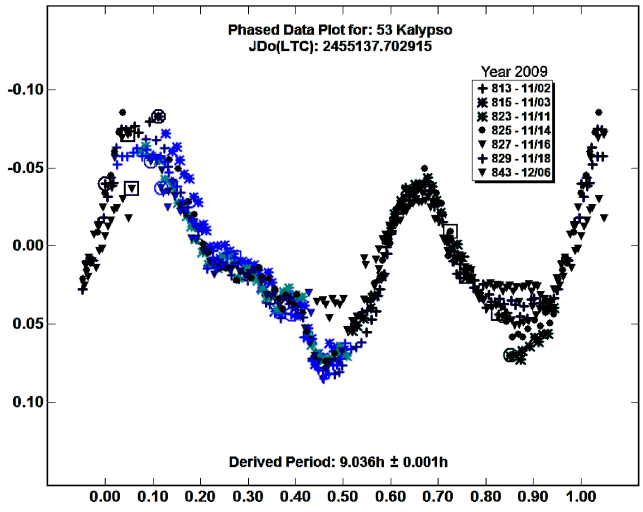
Observations by first author Pilcher on 6 nights 2009 Nov. 2 – 18 at phase angles 18 – 12 degrees show a somewhat asymmetric bimodal lightcurve with period 9.034 ± 0.001 hours, amplitude 0.14 ± 0.02 magnitudes. Pray et al. (2006) also show a bimodal lightcurve with twice the period. This discordance should be resolved. When the data of these six nights are phased to 18.068 hours, the two halves of the resulting quadrimodal lightcurve look nearly identical to each other and to the 9.034 hour lightcurve. The coefficients of the odd harmonics of the Fourier series for the 18.068 hour period are systematically considerably lower than for the even harmonics. Both of these considerations suggest that 9.034 hours, not twice as long, is the correct period. A seventh session was added 2009 Dec. 6 at phase angle 4.4 degrees with amplitude decreased to 0.10 ± 0.01 magnitudes. Such a decrease with phase angle is usually found due to lesser shadowing by topographic irregularities. The best period for all seven sessions increased to 9.036 ± 0.001 hours. This is likely due to the prograde motion of the phase angle bisector slowing upon approaching opposition. Such an increase in synodic period is suggestive of retrograde rotation, but the observed amount is too small to be definitive. Also for the lightcurve set including Dec. 6 the coefficients of the odd higher order harmonics of the Fourier series for the double period, now 18.069 hours, were not

systematically smaller than for the even harmonics. A nine hour session on one night necessarily includes only half of an 18 hour lightcurve. Combined with the aforementioned increase in synodic period, this does not constitute strong evidence against the shorter period.

When informed of the new 2009 observations, second author Pray re-examined his 2006 results and included an additional session 2006 Feb. 9. These could be fitted to both a 9.029 hour monomodal slightly irregular lightcurve or an 18.058 hour bimodal lightcurve in which the two halves closely resembled each other and the 9.029 hour lightcurve. Again a period near 9.03 hours is favored, with the considerably different forms of the 2006 and 2009 lightcurves a consequence of viewing at very different longitudes.

The lightcurves from 2006 rephased to 9.029 hours and from 2009 are separately presented.





Acknowledgments

Operations at Carbuncle Hill Observatory were partially funded by a Gene Shoemaker NEO Grant from the Planetary Society.

References

Debehogne, H., De Santis, G., and Zappala, V. (1982). "Photoelectric Photometry of Three Dark Asteriods." *Astron. Astrophys.* **108**, 197-200.

Harris, A. W. and Young, J. W. (1989). "Asteroid Lightcurve Observations from 1979-1981." *Icarus* **81**, 314-364.

Pray, D. P. and 9 collaborating observers (2006). "Lightcurve analysis of asteroids 53, 698, 1016, 1523, 1950, 4608, 5080, 6170, 7760, 8213, 11271, 14257, 15350, and 17509." *Minor Plan. Bull.* **33**, 92-95.

Surdej, J., Surdej, A., and Louis, B. (1983). "UBV photometry of the minor planets 86 Semele, 521 Brixia, 53 Kalypso, and 113 Amalthea." *Astron. Astrophys. Suppl. Ser.* **52**, 203-211.

LIBRARY ARCHIVE DONATION ACKNOWLEDGED

As previously announced (see *MPB* Volume 36, Number 4, page 194), *MPB* print subscriptions, except for library archives, will be discontinued after Volume 37 Issue Number 4. All future *Minor Planet Bulletin* issues will continue, as at present, to be available "free" in electronic format. A very generous donation, by a requested to remain anonymous contributor, will substantially perpetuate the ongoing library archives of future issues of the *Minor Planet Bulletin.* We offer our thanks for this support.

CALL FOR OBSERVATIONS

Frederick Pilcher
4438 Organ Mesa Loop
Las Cruces, NM 88011 USA
pilcher@ic.edu

Observers who have made visual, photographic, or CCD measurements of positions of minor planets in calendar year 2009 are encouraged to report them to the author on or before 2010 April 1. This will be the deadline for receipt of reports that can be included in the "General Report of Position Observations for 2009," expected to be published in *MPB* Vol. 37, No. 3.