

clear filter with guided exposures ranging from 60 to 180 seconds. *MaxIm DL/CCD*, controlled by DC3 Dreams *ACP5*, was used for automated telescope and camera control and image acquisition whilst calibration and image measurement via differential photometry were undertaken with *MPO Canopus* v9. Organ Mesa Observatory is equipped with a Meade 14" LX2000 GPS f/11 SCT and SBIG STL 1001-E CCD. A red filter was used with unguided 60-second exposures. Differential photometry and data sharing were made with *MPO Canopus*.

48 Doris. This asteroid was chosen due to its reported period being very close to 12 hours and the fact that it had not been observed in more than 20 years. Initial observations indicated that the target period was commensurate with 12 or 24 hours and required observations from widely-spaced longitudes. Higgins requested a collaboration via the CALL website (Warner, 2009) and Pilcher responded. The target was previously observed by Debehogne et al. (1982), Harris and Young (1980), and Schober and Schroll (1982) who published periods ranging from 11.88 to 11.90 h. The period derived from our data agree with those results.

1055 Tynka. Initial observations indicated that the target's period was very close to 12 or 24 hours and required observations from widely-separated longitudes. As with 48 Doris, the authors formed a collaboration via the CALL web site. The distinct dip in the lightcurve at phase 0.25 indicates that the period based on the bimodal curve presented here is the one most likely correct.

References

- Debehogne, H., Lagerkvist, C.-I., and Zappala, V. (1982). "Physical studies of asteroids VIII. Photoelectric photometry of the asteroids 42, 48, 93, 105, 115, and 245." *Astron. Astrophys. Suppl. Ser.* **50**, 277-281.
- Harris, A.W. and Young, J.W. (1980). "Asteroid Rotation III. 1978 Observations." *Icarus* **43**, 20-32.
- Schober, H.J. and Schroll, A. (1982). "The Asteroids 36 Atalante and 48 Doris, Rotation, UB_V-photometry, and Lightcurves." *Astron. Astrophys.* **107**, 402-405.

CCD LIGHTCURVE ANALYSIS OF 511 DAVIDA

Kevin B. Alton
UnderOak Observatory
70 Summit Ave
Cedar Knolls, NJ 07927

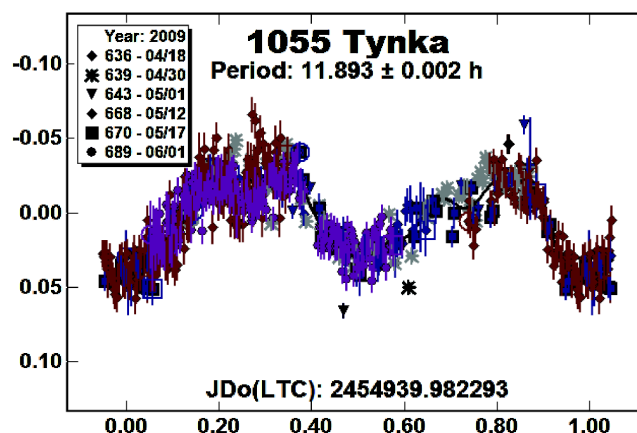
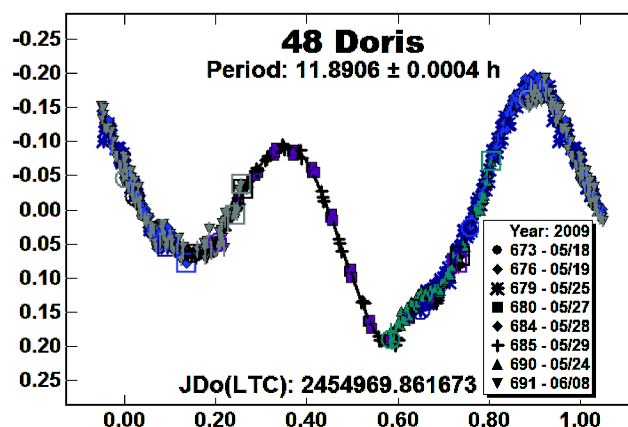
(Received: 2009 Apr 30)

Filtered (Ic) CCD images for 511 Davida were obtained over four sessions in 2009 March. A folded lightcurve was produced and the synodic period estimated by Fourier analysis to be 5.1297 ± 0.0001 h.

First discovered in 1903 by R.S. Dugan, 511 Davida is a C-type main belt asteroid which ranks seventh in mass amongst all minor planets (Michalak, 2001). Recent ground-based investigations on 511 Davida using adaptive optics and infrared imaging (Conrad et al., 2006, 2007) have confirmed a triaxial ellipsoidal shape with a mean diameter of $D = 289$ km.

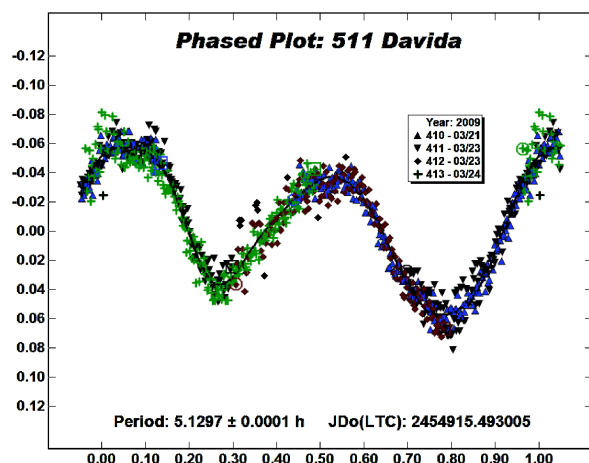
Warner, B.D. (2009) "Collaborative Asteroid Lightcurve Link (CALL)" web site.

<http://www.MinorPlanetObserver.com/astlc/default.htm>



The equipment for this photometric study included a focal-reduced (f/6.3) 0.2-m Schmidt-Cassegrain telescope with a thermoelectrically cooled (-5°C) SBIG ST-402 ME CCD camera mounted at the Cassegrain focus. Filtered (Ic) imaging was conducted on four nights with exposures automatically taken every 45 seconds. Image acquisition (raw lights, darks, and flats) was performed by *CCDSof* 5 (SBIG) while calibration and registration were accomplished with *AIP4WIN* (Berry and Burnell, 2006). Further data reduction with *MPO Canopus* (Warner, 2008) used at least two non-varying comparison stars to generate lightcurves by differential aperture photometry. Data were light-time corrected but not reduced to standard magnitudes.

A total of 908 data points was generated over 4 days. Relevant aspect parameters for 511 Davida taken at the mid-point from each session are tabulated below. *MPO Canopus* provided a period solution for the folded data sets using Fourier analysis (Harris, 1989). The calculated synodic period of 5.1297 ± 0.0001 h is in good agreement with the most recent value for 511 Davida reported at the JPL Solar System Dynamics website. Peak amplitude was estimated at 0.11 ± 0.02 mag. Phased data are available by request at <http://underoakobservatory.com>.



UT Date (2009)	Obs	Phase Angle	L_{PAB}	B_{PAB}
Mar 21	276	14.8	143.1	13.2
Mar 23	239	15.3	143.3	13.2
Mar 24	187	15.5	143.3	13.2
Mar 25	206	15.7	143.4	13.2

Acknowledgement

Special thanks are due to the NASA Astrophysics Data System hosted by the Computation Facility at the Harvard-Smithsonian Center for Astrophysics.

References

Berry, R., Burnell, J. (2006). AIP4WIN version 2.1.10, Willmann-Bell, Inc, Richmond, VA.

Harris, A.W., Young, J.W., Bowell, E., Martin, L. J., Millis, R.L., Poutanen, M., Scaltriti, F., Zappala, V., Schober, H.J., Debehogne, H., and Zeigler, K. (1989). "Photoelectric Observations of Asteroids 3, 24, 60, 261 and 863." *Icarus*, **77**, 171-186.

Conrad, A.R., Dumas, C., Merline, W.J., Campbell, R.D., Goodrich, R.W., Le Mignant, D., Chaffee, F.H., Fusco, T., Kwok, S., and Knight, R. I. (2006). "Rotation and morphology of asteroid 511 Davida." 37th Lunar and Planetary Science Conference, abstract 1955.

Conrad, A.R., Dumas, C., Merline, W.J., Drummond, J.D., Campbell, R.D., Goodrich, R.W., Le Mignant, D., Chaffee, F.H., Fusco, T., Kwok, S.H., and Knight, R.I. (2007). "Direct measurement of the size, shape, and pole of 511 Davida with Keck AO in a single night." *Icarus*, **191**, 616-627.

Michalak, G. (2001), "Determination of asteroid masses. II. (6) Hebe, (10) Hygiea, (15) Eunomia, (52) Europa, (88) Thisbe, (444) Gyptis, (511) Davida and (704) Interamnia." *Astron. Astroph.*, **374**, 703-711.

Warner, B.D. (2008), MPO Software, Canopus version 9.5.0.3. Bdw Publishing, Colorado Springs, CO.

JPL Solar System Dynamics website:
(<http://ssd.jpl.nasa.gov/sbdb.cgi>)

PHOTOMETRIC OBSERVATIONS OF 1998 OR2, 1999 AQ10, AND 2008 TC3

Alberto Silva Betzler^{1,2}, Alberto Brum Novaes¹

1- Projeto "Descobrimos o Céu", Departamento de Física da Terra e do Meio Ambiente, Instituto de Física, Universidade Federal da Bahia (IF-UFBA), Salvador, Estado da Bahia, BRASIL

2- Projeto "Astronomia no Campus", Coordenação de Física, Departamento de Ciências Aplicadas, Instituto Federal da Bahia (IFBA), Salvador, Estado da Bahia, BRASIL

(Received: 2009 Jun 14 Revised: 2009 Jul 18)

The near-Earth asteroids 1999 AQ10 and 1998 OR2 were observed by the authors between 2009 February and March to determine their basic physical parameters. The absolute magnitudes are, respectively, $H = 20.4 \pm 0.5$ and 16.1 ± 0.2 using $G = 0.15$. The lightcurve parameters for 1999 AQ10 are $P = 2.79 \pm 0.02$ h, $A = 0.205 \pm 0.005$ mag and, for 1998 OR2, $P = 3.198 \pm 0.006$ h, $A = 0.29 \pm 0.01$ mag. The linear phase coefficient for 1999 AQ10 is $\beta = 0.034 \pm 0.002$ mag/deg. For 2008 TC3, we obtain $B-V = 0.608 \pm 0.002$.

The Aten type asteroid, 1999 AQ10, and Amor type, 1998 OR2, were observed in 2009 February and March in Salvador (Brazil), using a 0.3-m LX200 GPS Meade telescope operating at f/3.3, combined with a CCD SBIG ST-7XME detector. Our goal was to determine the lightcurve parameters, linear phase coefficient (β), absolute magnitude (H), slope parameter (G), and diameter (D). Because of the fast sky motion of the two asteroids, exposure times were 30 seconds or less in order to avoid excessive trailing. This resulted in SNR values of 30-50. To reduce the noise in the lightcurves, three consecutive differential instrumental magnitudes in the dataset were binned to form a single data point. All images taken in Salvador were corrected with bias, dark, and flat-field frames. The period search was done using the Fourier analysis algorithm in *MPO Canopus* v. 9.3.10.

Photometric calibration was done using 2MASS stars in the asteroid's field. The 2MASS J-K field star color index were converted to the equivalent V magnitude and B-V index of Johnson-Cousins system using the transformation equations from Warner (2007) and Gary (2008). The T_{B-V} transformation coefficient between the instrumental and Johnson-Cousins photometric system was calculated using definitions by Gary (2006). The B-V color index of the object's field stars were used to calculate this last parameter. The H and G parameters were estimated using the mean V magnitude calculated from photometric data publish in MPEC and the FAZ routine available in *MPO Canopus*. These V magnitudes were used to calculate the object's linear phase coefficient (β), excluding the opposition effect.

1998 OR2. 1998 OR2 was observed on 2009 March 15 and 16 UT with a total of 106 unfiltered images obtained. From our data, we found a synodic rotation period of 3.198 ± 0.006 h and amplitude of 0.29 ± 0.01 mag, assuming a bimodal lightcurve (Fig.1). The absolute magnitude is $H = 16.1 \pm 0.2$ using $G = 0.15$. When both values are allowed to "float", the results are $H = 15.7 \pm 0.1$ and $G = -0.18 \pm 0.06$ (Fig. 2). These are consistent the value