3841 DICICCO: A BINARY ASTEROID

Daniel A. Klinglesmith III
Etscorn Campus Observatory (719)
New Mexico Tech
101 East Road
Socorro, NM USA 87801
dklinglesmith@mro.mnt.edu

Lorenzo Franco
Balzaretto Observatory (A81), Rome, ITALY

Alessandro Marchini
Astronomical Observatory, University of Siena (K54)
via Roma 56, 53100 Siena, ITALY

Carolyn E. Odden
Phillips Academy Observatory (I12)
Andover MA USA

Petr Pravec
Ondrejov Observatory
Ondrejov, CZECH REPUBLIC

Maurizio Scardella, Angelo Tomassini
Osservatorio Astronomico "F. Fuligni" (D06)
Via Lazio 14, 00040 Rocca di Papa (RM), ITALY

Initial observations of 3841 Dicicco indicated a period of 3.6 hours with three nights being anomalously low over part of the period. Further analysis showed that 3841 is a binary asteroid with a primary period of 3.5950 ± 0.0001 h with an amplitude of 0.19 mag and a secondary period of 21.641 ± 0.002 h with an amplitude of 0.19 mag. Both the primary eclipse and secondary eclipses were visible. We also estimate the *H* and *G* parameters to be $H = 13.63 \pm 0.04$, $G = 0.15 \pm 0.05$.

The S-type asteroid (Bus and Binzel, 2002) 3841 Dicicco was observed on 18 nights from 2014 Nov 21 through 2015 Jan 11. Starting from the first sessions, we noticed some anomalous attenuations in the lightcurves that made us suspect they were due to eclipse and/or occultation events (Figure 1, 2). Five observatories were in the campaign to confirm the initial observations. Table I lists the observers and equipment they used.

Observers	Telescope	CCD
Franco (A81)	0.2-m f/5.5 SCT	SBIG ST-7XME SBIG
Klinglesmith(719)	0.35-m f/10 SCT	STL-1001E SBIG
Marchini (K54)	0.30-m f/5.6 MCT	ST-10XME SBIG
Odden (I12)	0.4-m f/8 R-C	STL-6303E (bin 2x2) Apogee CCD
Scardella,Tomassini (D06)	0.35-m f/10 SCT	SBIG ST-8XE

Table 1. Observers and Equipment. SCT: Schmidt-Cassegrain. R-C: Ritchey-Chretien. MCT: Maksutov-Cassegrain.

All images were calibrated with dark and flat-field frames and processed with *MPO Canopus* version 10.4.7.6 (Warner, 2015). Clear and R filter magnitudes were calibrated to the standard system using the method described by Dymock and Miles (2009) and CMC-15 stars with near-solar color indexes selected by using Vizier (2014).

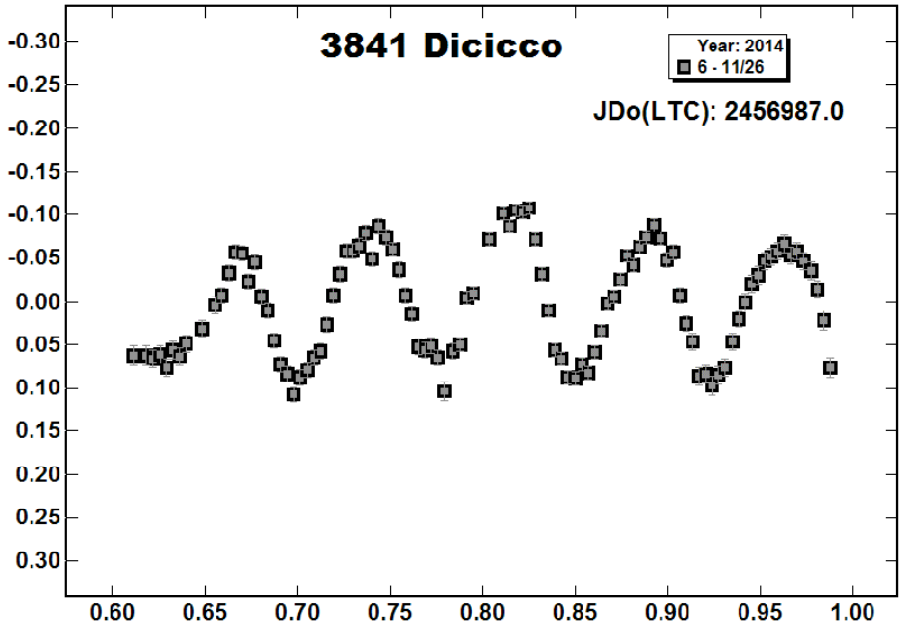

Figure 1. Raw data from 2014 Nov 26. The data cover nine hours, which is more than two complete cycles of the lightcurve. No obvious anomalies are present.

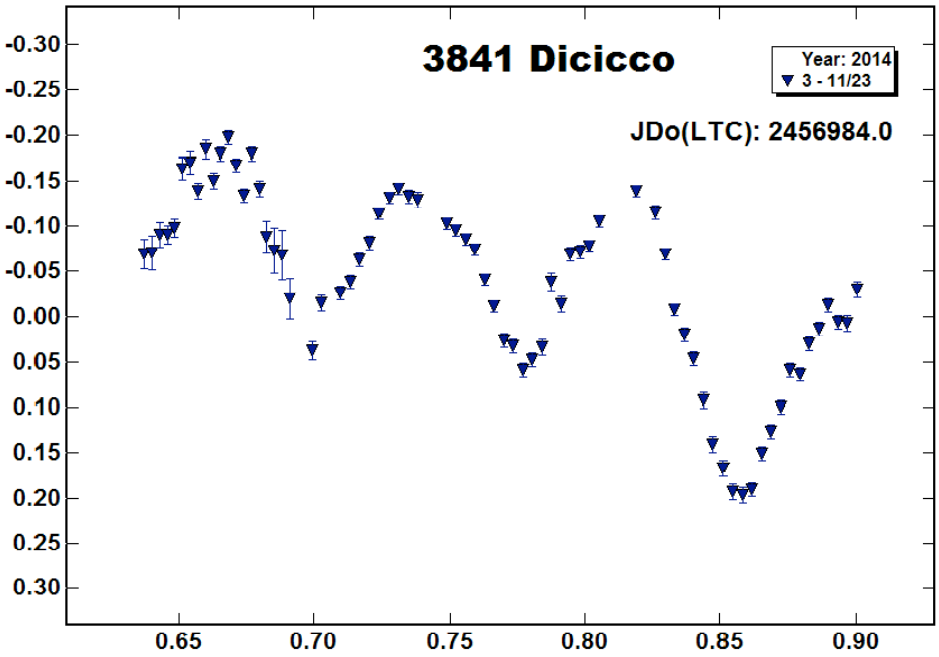

Figure 2. Raw data from 2014 Nov 23. The data more than six hours, which is almost two complete cycles of the lightcurve. An eclipse or occultation is present at the end of the night.

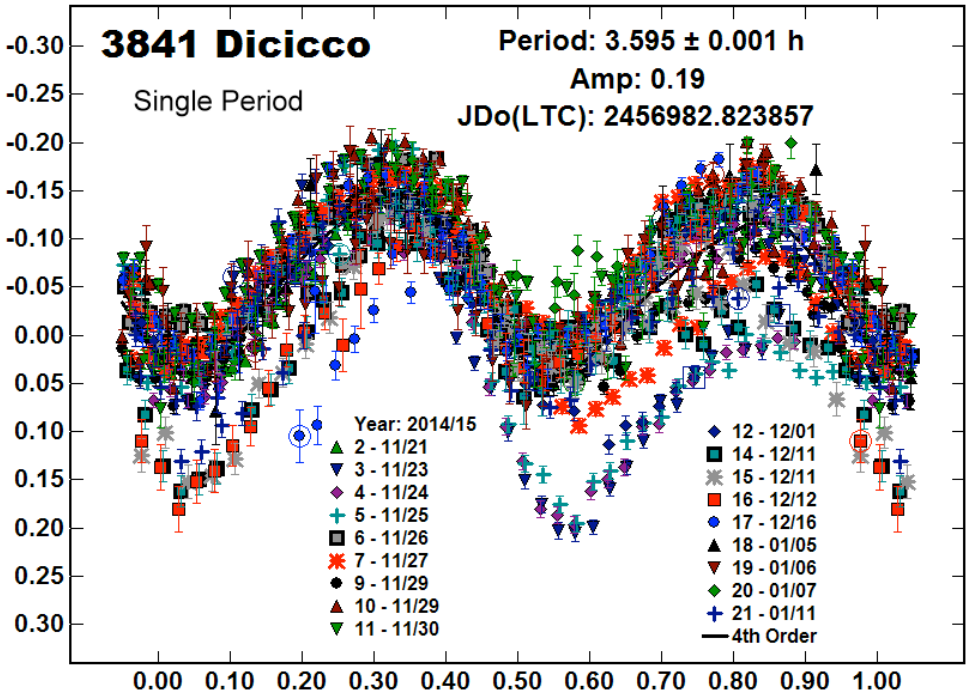

Figure 3. Sixteen nights of data fit to a single period. Note that 3 nights show an obvious lowering of the lightcurve.

Using the single period solution from *MPO Canopus* we obtained a period of 3.595 ± 0.001 h and an amplitude of 0.19 mag (Figure 3). However it was obvious that the data from at least three nights did not fit well. Using the iterative dual period solution from *MPO Canopus* we obtained a primary period of 3.5950 ± 0.0001 h with an amplitude of 0.19 mag (Figure 4) and a secondary period (Figure 5) of 21.641 ± 0.002 h. The mutual eclipse/occultation events have amplitudes of 0.08 to 0.15 magnitudes. The first value gives a lower limit on the secondary-to-primary effective diameter ratio of Ds/Dp ≥ 0.28.
The data were sent then to Pravec who confirmed that it was a binary system. Authors DK, LF, and PP announced the discovery through the *CBET* 4033, published on 2014 Dec 8.

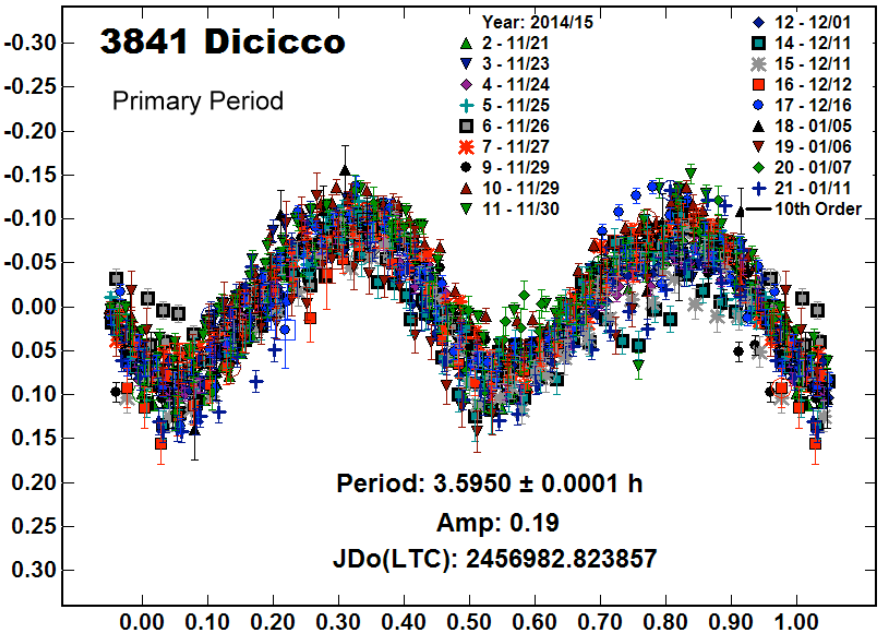

Figure 4: Using the 2-period search within MPO Canopus we obtain the primary period after subtracting out the secondary period.

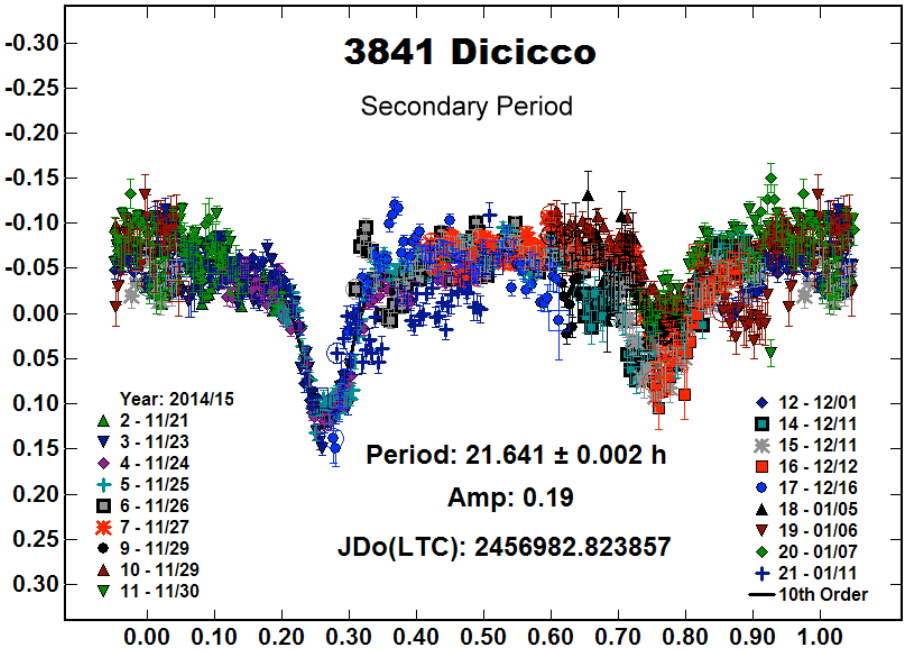

Figure 5: Using the 2-period search within MPO Canopus we obtain the secondary period after subtracting the primary period.

H and G Determination

For each lightcurve, the R mag was measured using half peak-topeak amplitude with Peranso (Vanmunster, 2014) via a second order polynomial fit and excluding any eclipse/occultation events. The V mag was derived adding the typical color index V-R = 0.49 for an S-type asteroid (Shevchenko and Lupishko, 1998) to the R mag. Using the H-G Calculator function of *MPO Canopus*, we derived $H = 13.63 \pm 0.04$ mag and $G = 0.15 \pm 0.05$ (Figure 6). This H value is quite different from $H = 13.1$ published on the JPL Small-Body Database Browser (JPL, 2015).

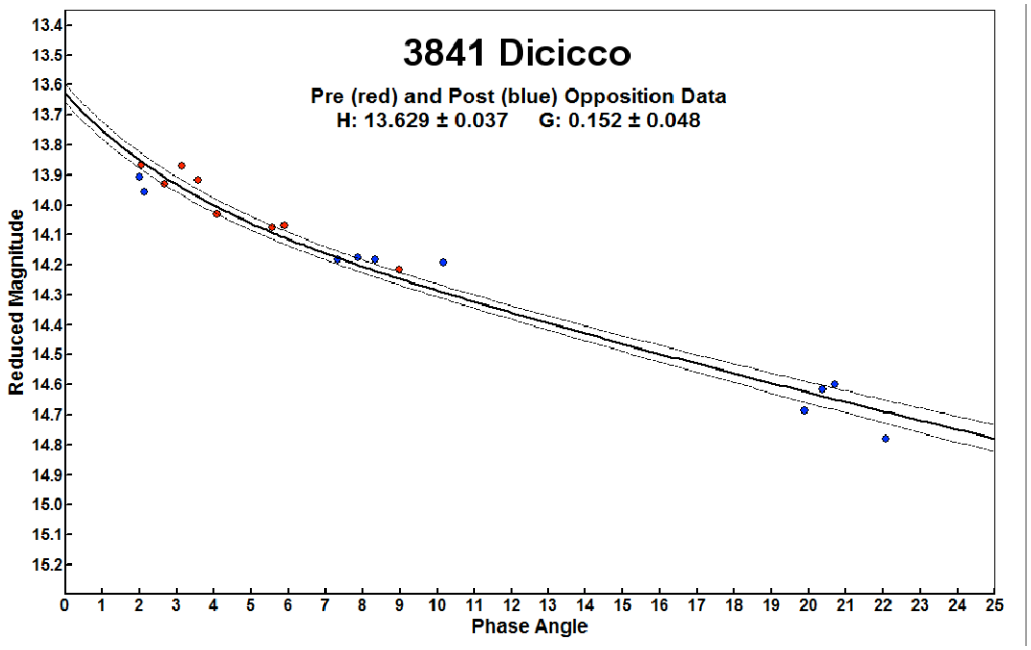

Figure 6: H and G curve for 3841 Dicicco.

Acknowledgements

The Etscorn Campus Observatory operations are supported by the Research and Economic Development Office of New Mexico Institute of Mining and Technology (NMIMT).

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