

ROTATION PERIOD FOR 4221 PICASSO

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CCD photometric observations of the main-belt asteroid 4221 Picasso were made at the Studios Observatory over five nights from 2018. The rotation period was found to be 3.111 ± 0.001 h with a lightcurve amplitude of 0.31 ± 0.05 mag.

The main-belt asteroid 4221 Picasso (previous designations: 1954 GD, 1984 JH1, and 1988 EJ) was discovered at Palomar on 1988 March 13 by J. Alu. CCD photometric observations were made from The Studios Observatory, Grantham, U.K. (Z52) over five nights between 2018 May 26 and June 10.

The observations were made using a Meade 0.36-m LX200 ACF OTA operating at $f/7$. The OTA was mounted on a Paramount MEII robotic mount and equipped with a Moonlite CSL motorized focuser, Astro Physics AP CCDT67 focal reducer, and a QSI 683 cooled CCD camera (binned 2x2). All measurements were unfiltered due to the faint magnitude of the target, $V = 15.7$ - 15.9 . The CCD is based on an 8.3 Mpix (3326x2504) Kodak KAF-8300 sensor with square $5.4 \mu\text{m}$ pixels. The image scale after 2x2 binning was 0.86 arcsec/pixel.

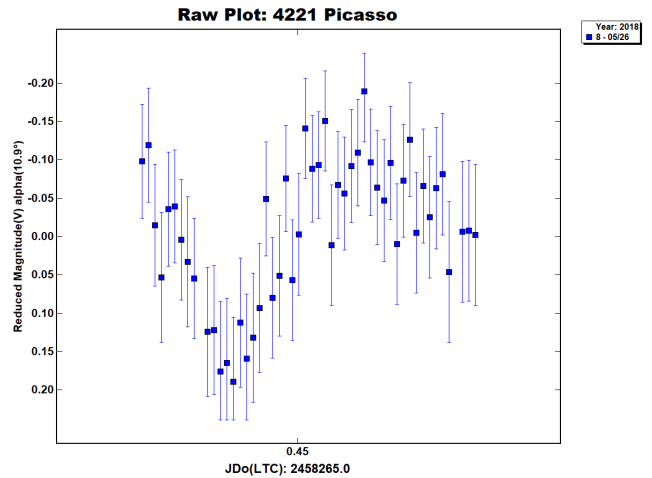
TheSkyX Professional software (Software Bisque, 2018) was used for all telescope, focuser, and camera control. This software was also used to calibrate all science images using dark, dark-for-flat, and flat field frames. All flat field images were taken at the end of the observing sessions using a wall-mounted whiteboard illuminated by an A4-size electroluminescent (EL) panel. A recent library of dark and dark-for-flat frames was used in the calibration process; no scaling of dark frames was necessary.

All data processing of the calibrated images and subsequent period analysis was performed using *MPO Canopus* (Warner, 2018). Differential photometry measurements were performed using the Comp Star Selector (CSS) and Star-B-Gone procedures of *MPO Canopus*. The asteroid and five solar-like stars were used for all photometric comparisons. Period analysis was performed using the Fourier analysis algorithm (FALC) of *MPO Canopus* developed by Alan Harris (Harris et al., 1989).

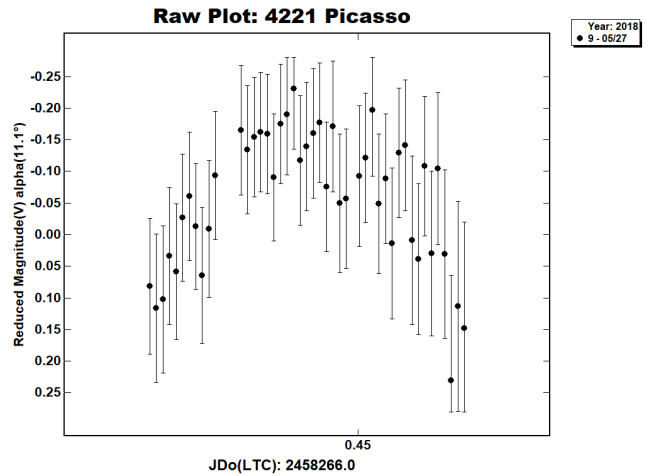
More than 11 hours of observations produced 393 data points for analysis. All likely periods between 2 and 10 hours were examined. The rotation period was found to be 3.111 ± 0.001 h with a lightcurve amplitude of 0.31 ± 0.05 mag. A search of the asteroid lightcurve database (LCDB; Warner et al., 2009) indicated no previously reported lightcurve data for this asteroid.

The first two observing sessions on May 26 and 27 were plagued by poor seeing and terminated early due to clouds. The final three observing sessions benefited from improved seeing, although the June 8 session was still hampered by occasional cloud cover.

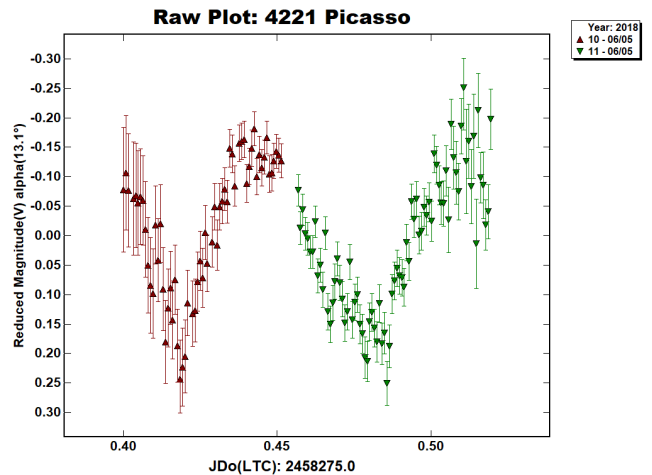
Table I provides an overview of the observed results. The observing schedule and calibrated data are summarized below.



2018 May 26 (Phase 10.92, L_{PAB} 240, B_{PAB} 19). A total of 50 data points (90 s exposures) was acquired over a 1 h 25 min period.



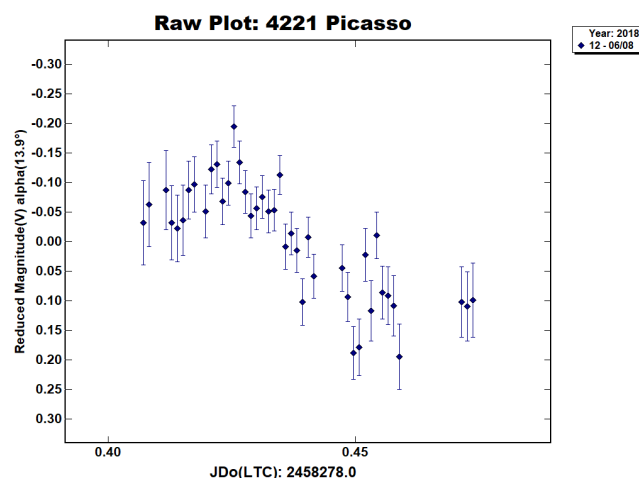
2018 May 27 (Phase 11.08, L_{PAB} 240, B_{PAB} 19.3). A total of 42 data points (90 s exposures) was acquired over a 1 h 19 min period.



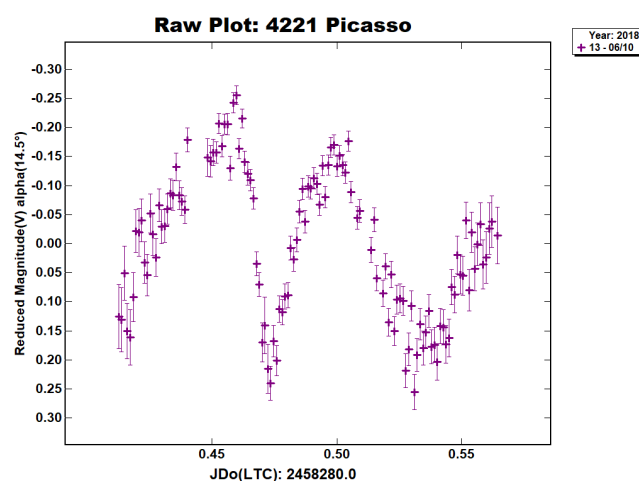
2018 June 5 (Phase 13.08, L_{PAB} 240, B_{PAB} 20). A total of 138 data points (60 s exposures) was acquired over a 2 h 47 min period.

Number	Name	2018 mm/dd	Pts	Phase	L _{PAB}	B _{PAB}	Period (h)	P.E.	Amp	A.E.	Grp
4221	Picasso	05/26-06/10	393	10.9, 14.5	240	20	3.111	0.001	0.31	0.05	MB-M

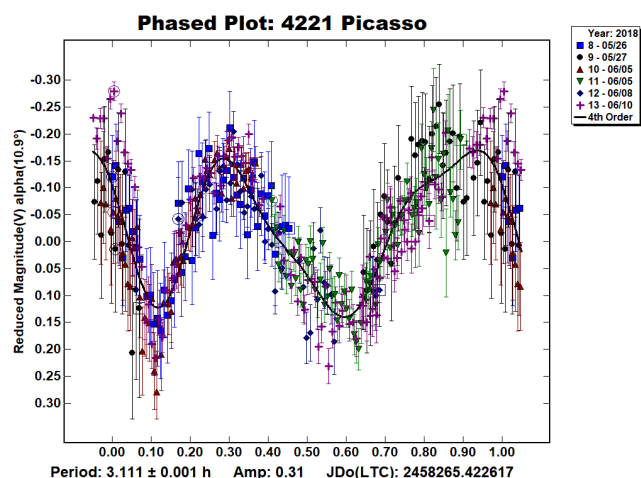
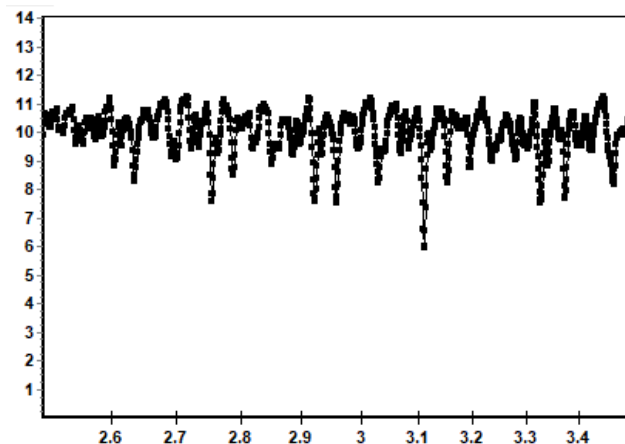
Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).



2018 June 8 (Phase 13.89, L_{PAB} 241, B_{PAB} 20). A total of 42 data points (90 s exposures) was acquired over a 1 h 33 min period.



2018 June 10 (Phase 14.47, L_{PAB} 241, B_{PAB} 20). A total of 121 data points (90 s exposures) was acquired over a 4 h 14 min period.



The period spectrum for 4221 Picasso covered all likely solutions between 2 and 10 hours. The Fourier analysis consistently indicated an optimum period of 3.111 h. The lightcurve shows the data phased to the solution of 3.111 h. Its amplitude is 0.31 mag.

All new data were uploaded to the ALCDEF database (<http://alcdef.org>).

Acknowledgements

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[EDITOR'S NOTE: The readers of the *Minor Planet Bulletin* also convey their thanks to Mr. Shortland.]

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LIGHTCURVE ANALYSIS OF MINOR PLANETS OBSERVED AT THE OAKLEY SOUTHERN SKY OBSERVATORY: 2017 JUNE–JULY

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From 2017 June 20 to July 25, images of nine minor planets were collected to investigate their rotational lightcurve periods. The minor planets observed were 1049 Gotho, 1184 Gaea, 1737 Severny, 1887 Virton, 2672 Pisek, 3995 Sakaino, 6358 Chertok, (13538) 1991 ST, and 14339 Knorre.

We used an STX-16803 camera with 3x3 binning and a luminance filter attached to a 0.5-m Planewave telescope operating at $f/6.7$ (plate scale 1.63 arcseconds) to collect images on the nights of 2017 June 20–23, 25, 26, 29, 30, July 11–18, 20–25. The targeted minor planets were 1049 Gotho, 1184 Gaea, 1737 Severny, 1887 Virton, 2672 Pisek, 3995 Sakaino, 6358 Chertok, (13538) 1991 ST, and 14339 Knorre. The images were processed using standard techniques with *MaxIm DL*. The images were measured and lightcurves generated with *MPO Canopus*.

Table I lists the targets, range of dates, phase angle, phase angle bisector longitude, and latitude as well as the period if we were able to determine one. Unfortunately, we were not able to determine periods for 1887 Virton, 2672 Pisek, or 6358 Chertok, so only an estimate of the amplitude is given.

1049 Gotho. Our period of 8.468 ± 0.002 h is in close agreement with the Albers *et al.* (2010) period of 8.470 ± 0.007 h.

1184 Gaea. The period of 2.8735 ± 0.0005 h we found is just outside the uncertainty range of the period of 2.94 ± 0.06 h found by Behrend (2011). We tried the 2.94 h period on our data and it does not fit.

1737 Severny. Behrend (2005) gives a period of 14.11 ± 0.07 h while Waszczak *et al.* (2015) lists 9.25 ± 0.06 h. We tried to fit our data with both periods, and derived a good fit with a period of 9.223 ± 0.004 h.

References

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Number	Name	2017 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period (h)	P.E.	Amp	A.E.
1049	Gotho	07/12–07/25	227	6.1, 5.5, 6.0	296	–14	8.468	0.002	0.35	0.05
1184	Gaea	07/11–07/25	250	7.4, 6.7, 7.3	295	–13	2.8735	0.0005	0.15	0.05
1737	Severny	07/12–07/25	154	4.4, 2.2, 2.4	299	–6	9.223	0.004	0.10	0.05
1887	Virton	07/12–07/25	190	4.7, 4.0, 4.7	296	–10			0.5	0.1
2672	Pisek	06/20–06/30	81	13.2, 16.3	251	15			0.04	0.04
3995	Sakaino	07/12–07/25	201	5.6, 2.1, 2.3	300	–4	4.5529	0.0002	0.75	0.05
6358	Chertok	07/11–07/25	175	5.7, 5.1, 6.9	294	–9			0.06	0.04
13538	1991 ST	07/12–07/25	211	9.6, 6.4, 6.6	300	–7	12.3206	0.0014	0.82	0.03
14339	Knorre	06/20–06/30	166	13.2, 16.3	251	15	3.7963	0.0003	0.20	0.06

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984).