

MEASURED LIGHTCURVES AND ROTATIONAL PERIODS OF (16579) 1992 GO, (25660) 2000 AO88, AND (37652) 1994 JS1

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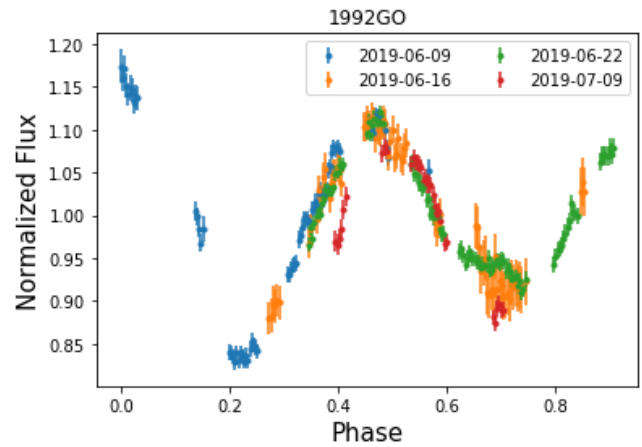
We determined the rotational periods of (16579) 1992 GO, (25660) 2000 AO88 and (37652) 1994 JS1, with the 1.2 m telescope at the Fred L. Whipple Observatory. We found the rotational periods to be 10.9887 ± 0.0004 h, 2.63705 ± 0.00004 h, and 17.4433 ± 0.0007 h, respectively. The former two were previously undetermined periods. The period that we determined for 1994 JS1 agrees well with the previously measured periods of 17.4501 ± 0.0014 (Noschese et al., 2019) and 17.459 ± 0.002 h (Marchini et al., 2019).

KeplerCam is a 23×23 arcmin CCD mounted on the 1.2-meter telescope at the Fred L. Whipple Observatory in Arizona. We made photometric observations of (16579) 1992 GO, (25660) 2000 AO88 and (37652) 1994 JS1 in the Sloan i-band.

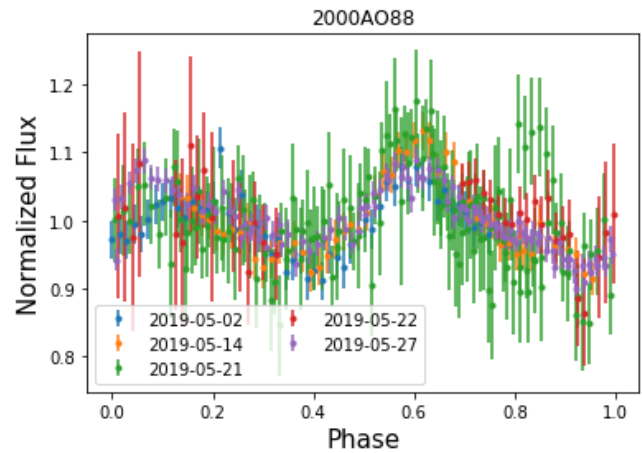
The three asteroids were selected by searching *Minorplanet.info* for the brightest asteroids with (at the time) unknown rotational periods that would still be relatively bright and observable for multiple months.

Following the same procedure as Abrams et al. (2020), we first reduced the data using standard *IDL* procedures and produced a lightcurve using the *AstroImageJ* multi-aperture photometry software (Collins et al., 2017). The python package, *gatspy*, was used to calculate the Lomb-Scargle periodogram and determine the rotational period (VanderPlas and Ivezić, 2015). We measured uncertainties in the rotational periods by finding the maximum and minimum rotational period at which the phased lightcurve no longer had a clear modulation. Amplitudes were determined by the absolute magnitude of $-2.5 \log(\max \text{ flux}/\min \text{ flux})$.

1992 GO was discovered 1992 April 3 by Ueda, S. and Kaneda, H. at the Kushiro Observatory in Hokkaido, Japan. It was observed for four nights in June and July 2019, and there are gaps in the data due to crowded fields and weather. The images in which the asteroid passed over bright objects were removed from the analysis. We determined the period to be 10.9887 ± 0.0004 h and the amplitude to be 0.38 ± 0.01 .



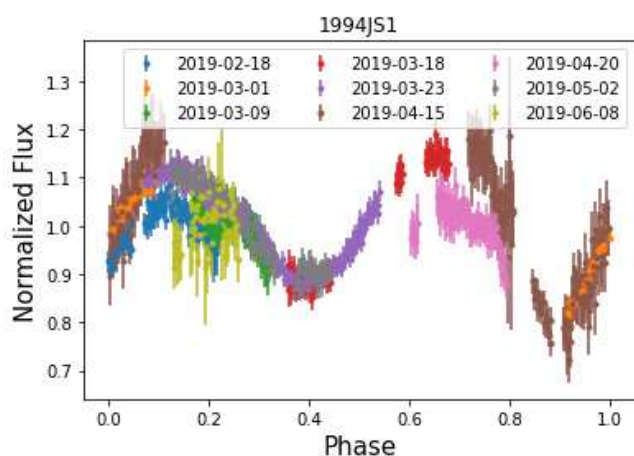
2000 AO88 was discovered 2000 January 5 in Socorro, New Mexico as part of the Lincoln Near-Earth Asteroid Research (LINEAR) project. It was observed with KeplerCam for five nights between 2019 May 02-27. We determined the period to be 2.63705 ± 0.00004 h and amplitude to be 0.36 ± 0.08 .



1994 JS1 was discovered 1994 May 4 at Catalina Station Observatory on Mount Bigelow to the northeast of Tucson, Arizona by Hergenrother, C.W. and Spahr, T.B.. We observed the asteroid for ten nights between February and June 2019, though one night had high scatter due to poor weather conditions and was therefore excluded from the datasets. We found the rotational period to be 17.4433 ± 0.0007 h, which agrees reasonably well with the previously determined rotational periods of 17.4501 ± 0.0014 (Noschese et al., 2019) and 17.459 ± 0.002 h (Marchini et al., 2019).

Number	Name	20yy/mm/dd	Phase	L _{PAB}	B _{PAB}	Period (h)	P.E.	Amp	A.E.	Grp
16579	1992 GO	19/06/09-07/09	12.0, 11.6	247.4	13.9	10.9887	0.0004	0.38	0.01	EUN
25660	2000 AO88	19/05/02-05/27	16.3, 6.5	256.9	5.8	2.63705	0.00004	0.36	0.08	
37652	1994 JS1	19/02/18-06/08	14.8, 34.9	220.2	19.6	17.4433	0.0007	0.56	0.06	

Table I. Observing circumstances and results. 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).



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SPIN-SHAPE MODEL FOR 118 PEITHO

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We present a shape and spin axis model for main-belt asteroid 118 Peitho. The model was achieved with the lightcurve inversion process, using combined dense photometric data acquired from five apparitions between 1977-2020 and sparse data from USNO Flagstaff. Analysis of the resulting data found a sidereal period $P = 7.806397 \pm 0.000009$ hours and two mirrored pole solutions at $(\lambda = 179^\circ, \beta = 60^\circ)$ and $(\lambda = 345^\circ, \beta = 39^\circ)$ with an uncertainty of ± 10 degrees.

The minor planet 118 Peitho has been observed at past oppositions and most recently (2020 opposition) by Pilcher at Organ Mesa Observatory (Pilcher, 2020) and by Marchini and Saya at Astronomical Observatory of the University of Siena. Dense photometric data were downloaded from Asteroid Photometric Catalogue (APC, 1993) and from ALCDEF (ALCDEF, 2019). Moreover, in order to improve the coverage at various aspect angles, we also used sparse data from USNO Flagstaff Station (MPC Code 689), taken from the Asteroids Dynamic Site (AstDyS-2, 2020).

The observational details of the dense data used are reported in Table I with the mid date, number of the lightcurves used for the inversion process, longitude and latitude of phase angle bisector (L_{PAB} , B_{PAB}).

Reference	Mid date	# LC	L_{PAB}°	B_{PAB}°
Stanzel, Schober (1980)	1977-12-05	1	76	5
Warner (2009)	2009-05-13	3	177	6
Audejean (2013) Web	2013-04-16	2	196	5
Pilcher (2017)	2017-05-18	3	216	1
Pilcher (2020)	2020-01-11	2	103	9
Franco et al. (2020)	2020-01-22	1	104	10

Table I. Observational details for the data used in the lightcurve inversion process for 118 Peitho.