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ROTATIONAL PERIOD AND LIGHTCURVE DETERMINATION OF 4625 SHCHEDRIN, (8823) 1987 WS3, (15010) 1998 QL92, (19755) 2000 EH34, AND 21082 ARAIMASARU

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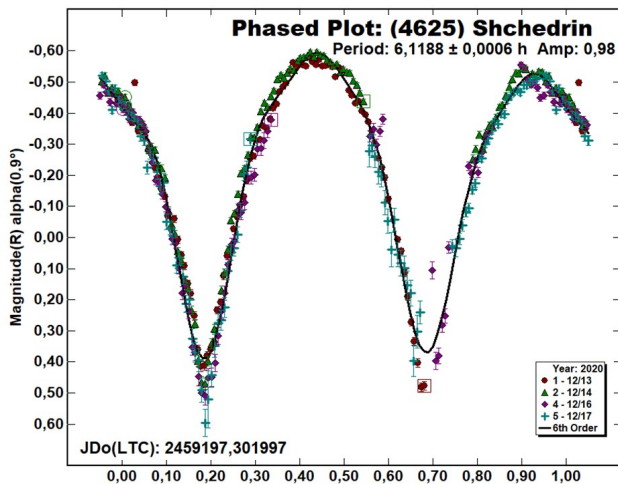
Photometric observations of five asteroids were performed in order to acquire lightcurves and to determine the rotational periods. The synodic period and lightcurve amplitude were found for 4625 Shchedrin, (8823) 1987 WS3, (15010) 1998 QL92, (19755) 2000 EH34, and 21082 Araimasaru.

This asteroid photometry campaign was done from Amateur Astronomers belonging to AstroCampania Association. The targets were selected mainly in order to acquire lightcurves to determine rotational periods not reported before. All the images reported here were unbinned with no filter and had master flats and darks applied. The exposure time depended upon various experimental conditions such as magnitude of the target, sky motion, and Moon illumination. Image processing, measurement, and period analysis were done using *MPO Canopus* (Warner, 2019), which incorporates the Fourier analysis algorithm (FALC) developed by Harris (Harris et al., 1989). The Comp Star Selector feature in *MPO Canopus* was used to limit the comparison stars to near solar color. Night-to-night calibration was done using field stars from the ATLAS catalog (Tonry et al., 2018). Observations of 4625 Shchedrin was carried out at 'Nastro Verde' observatory (C82) located at Sorrento (Naples), Italy by means of a 0.35-m Schmidt-Cassegrain telescope operating at f/6.3 using a SBIG ST-10 XME CCD camera with 2148×1472 array of 6.8-micron pixels with a clear filter.

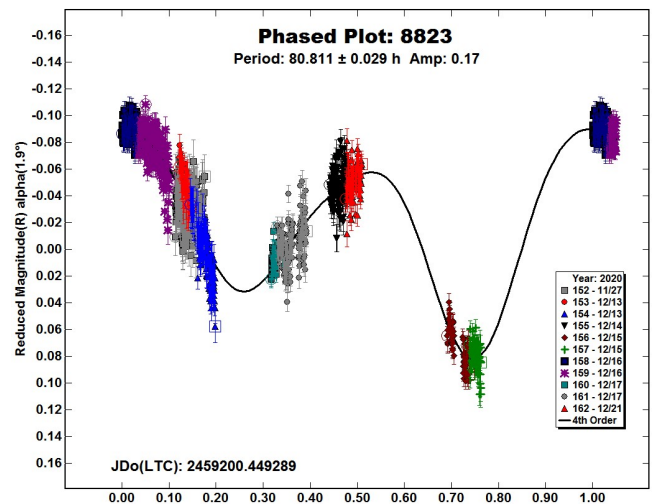
Observations of (15010) 1998 QL92 and (19755) 2000 EH34 were carried out by means of Elianto observatory (K68) located in the south of Italy (Pontecagnano) using a 0.3-m Newton telescope operating at f/4 equipped with a Moravian KAF1603 ME CCD camera (1536×1024 array of 9-micron pixels) with a clear filter.

Observations of (8823) 1987 WS3 and 21082 Araimasaru were conducted using the main telescope of the “Salvatore Di Giacomo” Observatory (L07) in Agerola (NA), a 0.50-m Ritchey Chrétien telescope operating at $f/8$, with a FLI PL 4240 back-illuminated camera, 13.5-micron pixels and 2048×2048 array, Rc filtered.

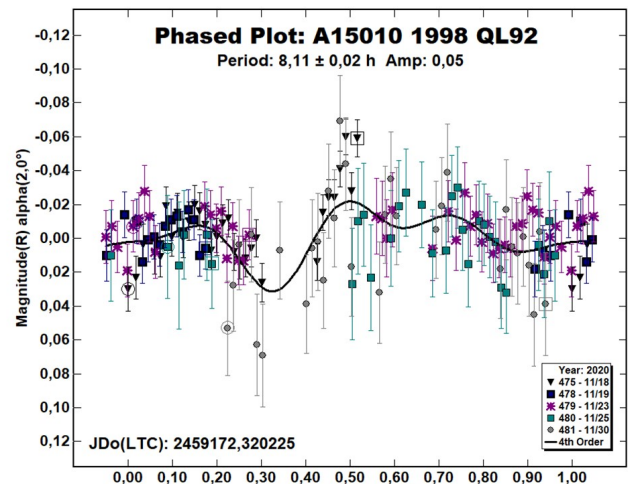
4625 Shchedrin was discovered on October 20, 1982 by L. G. Karachkina, Crimean Astrophysical Observatory at Nauchnyj. It is a main-belt asteroid with a semi-major axis of 2.60 AU, orbital period of 4.2 years, eccentricity of 0.237 and inclination of 1.595° . This asteroid has an estimated diameter ranging from 4.837 to 10.815 kilometers and an absolute magnitude of 13.7 (JPL, 2020). There were no previous lightcurve entries in the LCDB for this asteroid. CCD photometric observations were performed between 2020 December 13 and 2020 December 17. Four observation sessions were produced for lightcurve analysis to collect 363 data points and adopting an exposure time of 150 s. Our observations led to a well-defined period of 6.1188 ± 0.0006 h with an amplitude of 0.98 magnitudes.



(8823) 1987 WS3 is a main-belt asteroid, discovered by S. McDonald at Anderson Mesa, in 1987. It has a semi-major axis of 2.570 AU, orbital period of 4.12 years, eccentricity of 0.240 and inclination of 13.557° . This ten-kilometer body has an absolute magnitude of 12.80 and a geometric albedo of 0.142 (Neowise_diameters_albedo 2.0). No rotational period and lightcurve were reported for this object at the best of our knowledge (JPL, 2020). A total of 1167 lightcurve data points were collected in seven observing sessions between 2020 November 26th and 2020 December 21th, with 90 s exposure time. All but three sessions (152,155 and 162), were divided into pre- and post-meridian flip, so that the total number shown is eleven. We found a period of 80.811 ± 0.029 h with a lightcurve amplitude change of 0.17 magnitudes. Sessions 153 and 154 were corrected for 0.22-0.26 mag in order to align respect to the others. Data shown are not enough to guarantee an unambiguous result and a greater coverage of the curve would be desirable. Unfortunately, due to weather related issues, we were unable to extend the observation campaign. However, based on the measurements we have, the rotational period found is the most plausible one (thus with lowest RMS in the period spectrum).



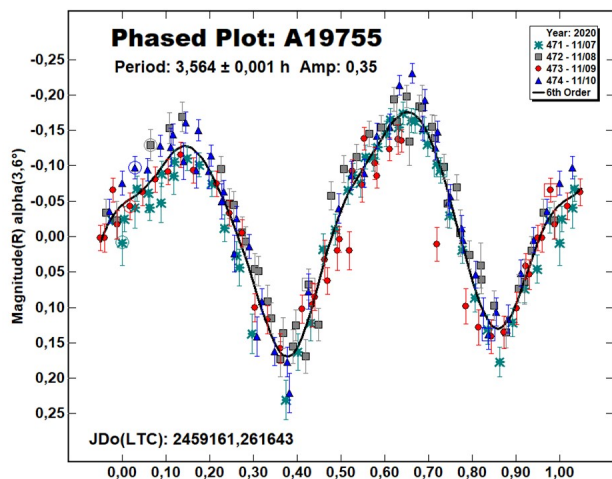
(15010) 1998 QL92 was discovered on August 28, 1998 by LINEAR at Socorro. It is a main-belt asteroid with a semi-major axis of 2.375 AU, orbital period of 3.66 years, eccentricity of 0.211, inclination of 2.021° . It has a diameter of 4.590 kilometers and an absolute magnitude of 14.0 and geometrical albedo of 0.275 (JPL, 2020). There were no previous lightcurve entries in the LCDB for this asteroid. CCD photometric observations were performed between 2020 November 18 and 2020 November 30. Five observation sessions were produced for lightcurve analysis to collect 149 data points and adopting an exposure time of 360 s. (15010) 2000 EH34 is a very difficult low amplitude asteroid. We were unable to resolve a rotational period unambiguously. The period spectrum showed several possible solutions and we adopted the one (8.11 ± 0.02 h) with the lowest RMS.



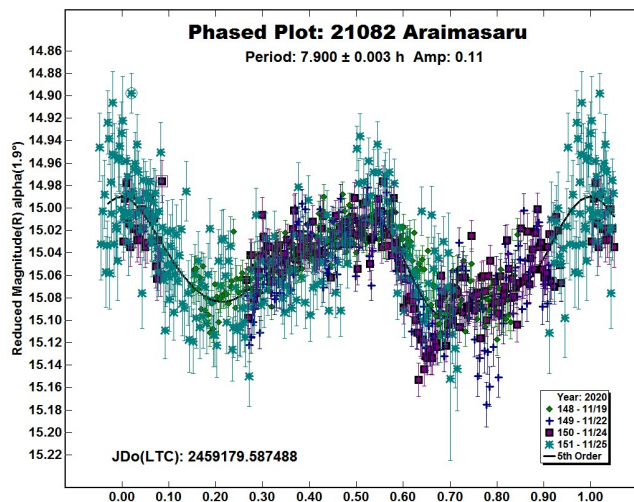
(19755) 2000 EH34 was discovered on March 05, 2000 by LINEAR at Socorro. It is a main-belt asteroid with a semi-major axis of 2.669 AU, orbital period of 4.36 years, eccentricity of 0.189, inclination of 15.483° . It has a diameter of 6.718 kilometers and an absolute magnitude of 13.0 and geometrical albedo of 0.471 (JPL, 2020). There were no previous lightcurve entries in the LCDB for this asteroid. CCD photometric observations were performed between 2020 November 7 and 2020 November 10. Four observation sessions were produced for lightcurve analysis to collect 179 data points and adopting an exposure time of 360 s. Our observations led to period of 3.564 ± 0.001 h with an amplitude of 0.35 magnitudes.

Number	Name	20yy mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
4625	Shchedrin	20/12/13-20/12/17	363	0.87-2.99	196.5	1.0	6.1188	0.0006	0.98	0.02	MB
8823	1987 WS3	20/11/26-20/12/21	1167	1.86,13.17	68.4	-2.8	80.811	0.029	0.17	0.01	MB
15010	1998 QL92	20/11/18-20/11/30	149	1.99-8.33	56.5	-2.7	8.11	0.02	0.05	0.02	MB
19755	2000 EH34	20/11/07-20/11/10	179	3.60-2.09	51.5	-2.4	3.564	0.001	0.35	0.02	MB
21082	Araimasar	20/11/18-20/11/25	834	1.94-6.19	55.3	1.9	7.900	0.003	0.11	0.01	MB

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 (Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).



21082 *Araimasar* is a main-belt asteroid, discovered by T. Hioki and S. Hayakawa at Okutama, in 1991, named after the famous Japanese amateur astronomer, a devoted observer of small bodies. It has a semi-major axis of 2.573 AU, orbital period of 4.13 years, eccentricity of 0.305 and inclination of 5.980°, absolute magnitude of 14.9 (JPL, 2020). We have not found any data regarding geometric albedo and physical dimension for this body. No rotational period and lightcurve are previously reported for this object to the best of our knowledge. A total of 834 lightcurve data points were collected in four observing sessions between November 18, 2020 and November 25, with 90 s exposure time. We found a period of 7.900 ± 0.003 h. The data indicate a lightcurve amplitude change of 0.11 magnitudes. We believe that the data are barely sufficient to guarantee, without great ambiguity, that the period found is the most plausible one. From the data shown, it is clear that the phased curve has a nearly multiple coverage. The whole process has been quite straightforward, providing a result without any particular ambiguity.



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