## COLLABORATIVE ASTEROID PHOTOMETRY FROM UAI: 2022 OCTOBER-DECEMBER

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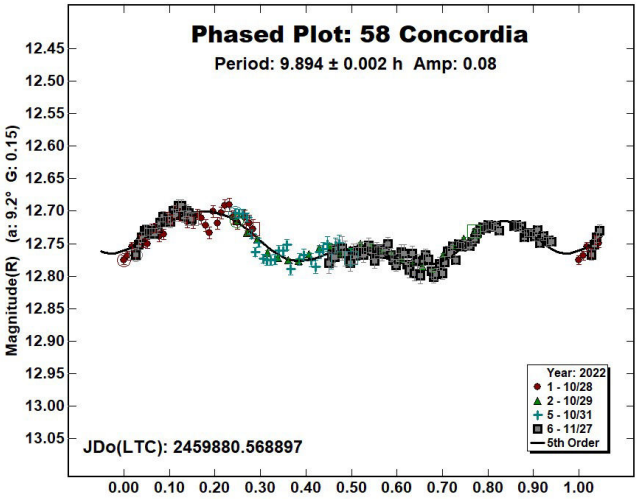
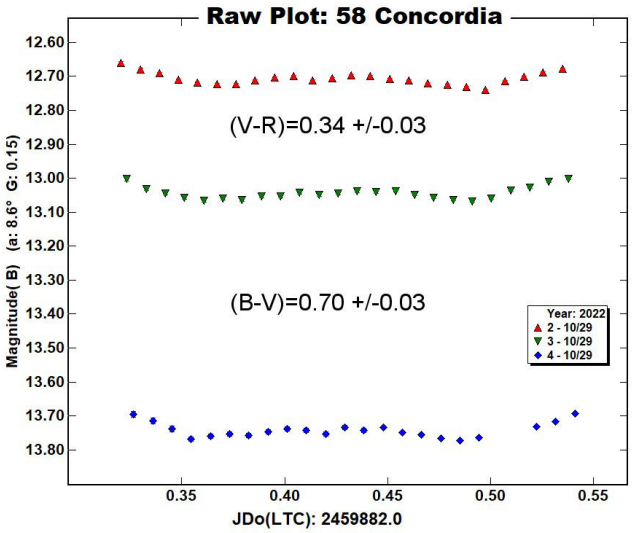
Photometric observations of eight asteroids were made in order to acquire lightcurves for shape/spin axis modeling. The synodic period and lightcurve amplitude were found for 58 Concordia, 397 Vienna, 929 Algunde, 1589 Fanatica, 1660 Wood, 1756 Giacobini, (85713) 1998 SS49, 2015 RN35. We also found color indices for 58 Concordia and 397 Vienna.

Collaborative asteroid photometry was done inside the Italian Amateur Astronomers Union (UAI; 2022) group. The targets were selected mainly in order to acquire lightcurves for shape/spin axis modeling. Table I shows the observing circumstances and results.

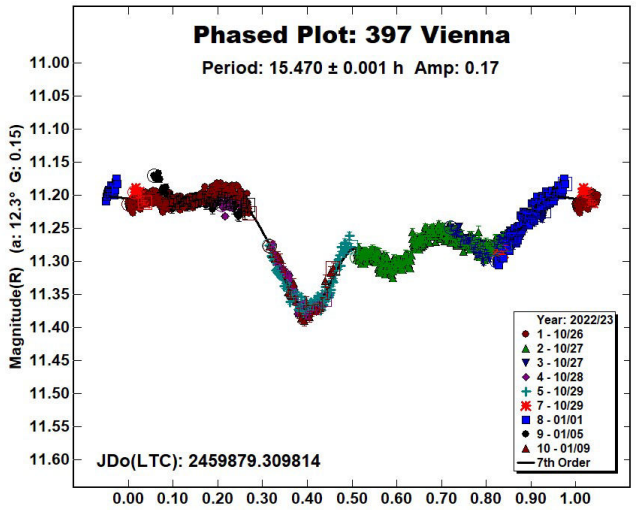
The CCD observations of eight asteroids were made in 2022 October-December using the instrumentation described in Table II. Lightcurve analysis was performed at the Balzaretto Observatory with *MPO Canopus* (Warner, 2021). All the images were calibrated with dark and flat frames and converted to standard magnitudes using solar colored field stars from CMC15 and ATLAS catalogues, distributed with *MPO Canopus*. For brevity, the following citations to the asteroid lightcurve database (LCDB; Warner et al., 2009) will be summarized only as "LCDB".

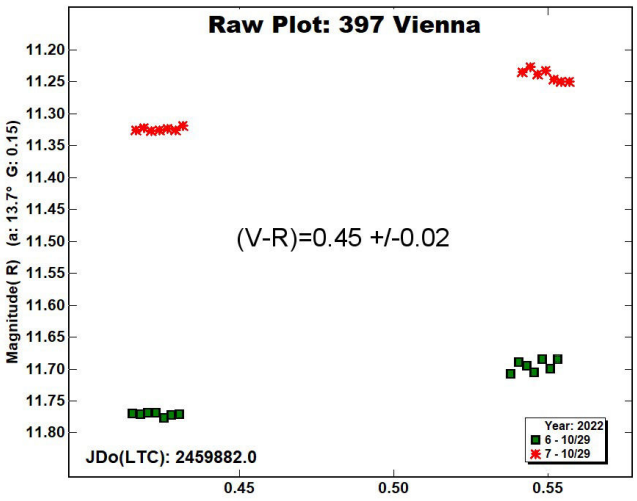
58 Concordia is a Ch-type (Bus and Binzel, 2002) middle main-belt asteroid. Collaborative observations were made over four nights. The period analysis shows a synodic period of $P = 9.894 \pm 0.002$ h with an amplitude $A = 0.08 \pm 0.03$ mag. The period is close to the previously published results in the LCDB. Multiband photometry was made by N. Montigiani and M. Mannucci (A57) on 2022 October 29. We found the color indices (B-V) = 0.70 ± 0.03; (V-R) = 0.34 ± 0.03, consistent with a C-type asteroid (Shevchenko and Lupishko, 1998).



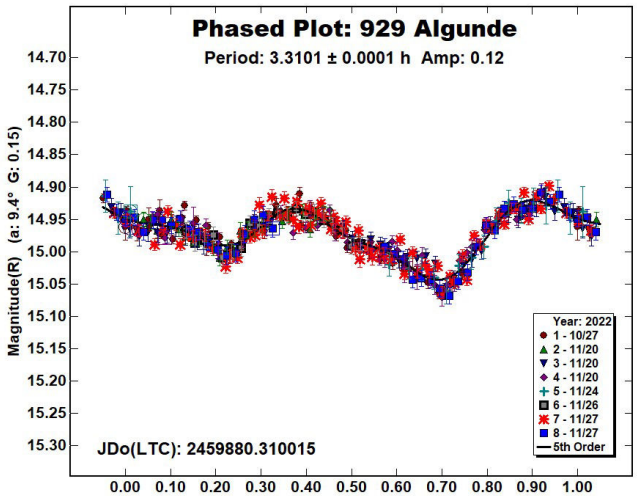




397 Vienna is a K-type (Bus and Binzel, 2002) middle main-belt asteroid. Collaborative observations were made over seven nights. The period analysis shows a synodic period of $P = 15.470 \pm 0.001$ h with an amplitude $A = 0.17 \pm 0.03$ mag. The period is close to the previously published results in the LCDB. Multiband photometry was made by G. Scarfi (K78) on 2022 October 29. We found the color index (V-R) = 0.45 ± 0.02, consistent with a S-type asteroid (Shevchenko and Lupishko, 1998).

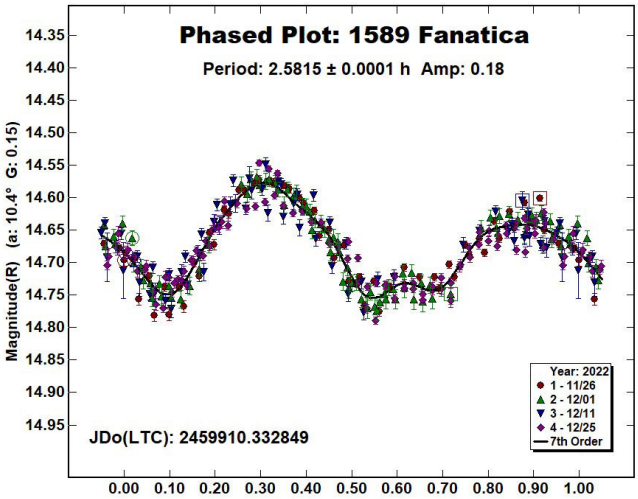


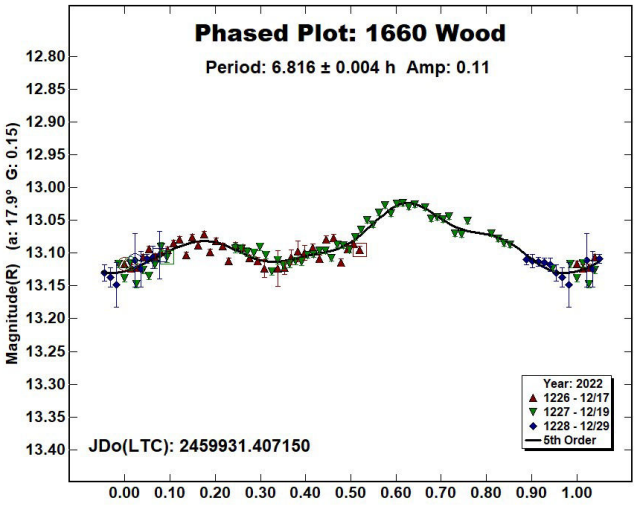

929 Algunde is a S-type (Bus and Binzel, 2002) inner main-belt asteroid. Collaborative observations were made over five nights. The period analysis shows a synodic period of $P = 3.3101 \pm 0.0001$ h with an amplitude $A = 0.12 \pm 0.03$ mag. The period is close to the previously published results in the LCDB.



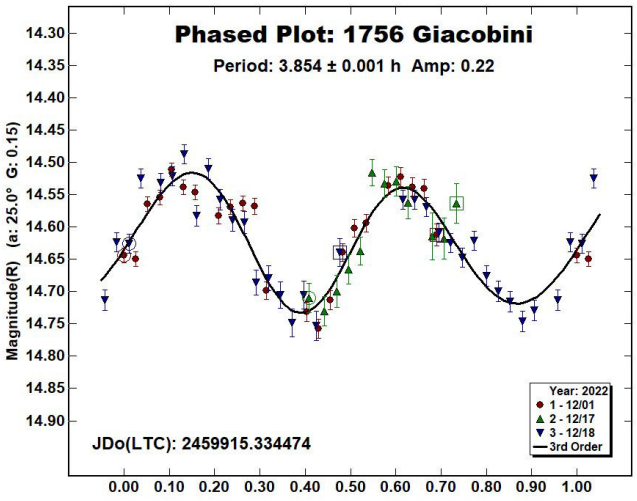

1589 Fanatica is a medium albedo inner main-belt asteroid. Collaborative observations were made over four nights. We found a synodic period of $P = 2.5815 \pm 0.0001$ h with an amplitude $A = 0.18 \pm 0.04$ mag. The period is close to the previously published results in the LCDB.

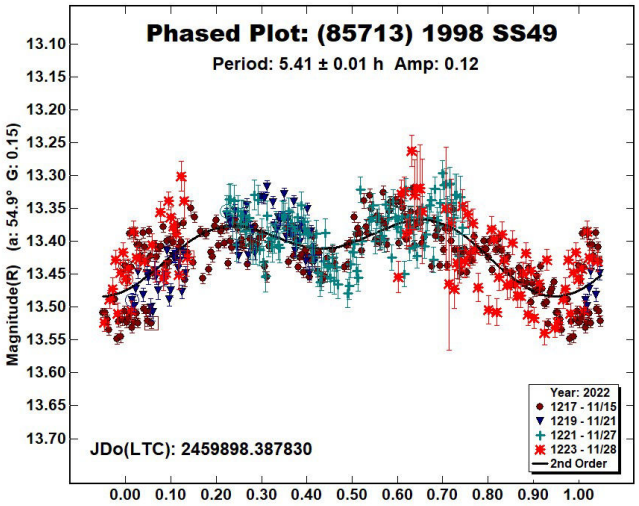



1660 Wood is a S-type (Bus and Binzel, 2002) inner main-belt asteroid. Observations were made over three nights by A. Marchini (K54). We found a synodic period of $P = 6.816 \pm 0.004$ h with an amplitude $A = 0.11 \pm 0.03$ mag. The period is close to the previously published results in the LCDB.




1756 Giacobini is a medium albedo middle main-belt asteroid. Observations were made over three nights by M. Iozzi (L63). We found a synodic period of $P = 3.854 \pm 0.001$ h with an amplitude $A = 0.22 \pm 0.04$ mag. The period is close to the previously published results in the LCDB.




(85713) 1998 SS49 is a low albedo Apollo near-Earth asteroid classified as Potentially Hazardous Asteroid (PHA). Observations were made over four nights by A. Marchini (K54). We found a synodic period of $P$ = 5.41 ± 0.01 h with an amplitude $A$ = 0.12 ± 0.08 mag. The period is close to the previously published results in the LCDB.

2015 RN35 is an Apollo near-Earth asteroid. Collaborative observations were made over two nights, in the following few days to its close approach to the Earth. We found a bimodal solution with a synodic period of $P$ = 0.3193 ± 0.0001 h and an amplitude $A$ = 0.63 ± 0.30 mag. For this asteroid none period were found in

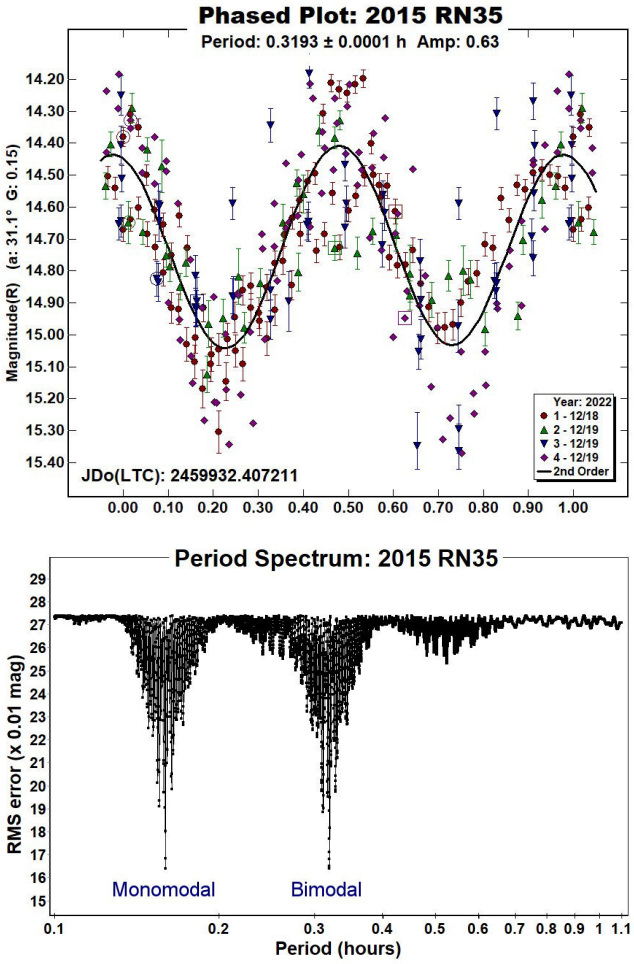
| Number | Name | 2022-23 mm/dd | Phase | $L_{PAB}$ | $B_{PAB}$ | Period(h) | P.E. | Amp | A.E. | Grp |
|---|---|---|---|---|---|---|---|---|---|---|
| 58 | Concordia | 10/28-11/27 | *8.9, 4.9 | 56 | -6 | 9.894 | 0.002 | 0.08 | 0.03 | MB-M |
| 397 | Vienna | 10/26-01/09 | 12.3, 28.1 | 23 | 4 | 15.470 | 0.001 | 0.17 | 0.03 | MB-M |
| 929 | Algunde | 10/27-11/27 | *9.3, 6.0 | 53 | 0 | 3.3101 | 0.0001 | 0.12 | 0.03 | MB-I |
| 1589 | Fanatica | 11/26-12/25 | *10.3, 5.0 | 84 | -1 | 2.5815 | 0.0001 | 0.18 | 0.04 | MB-I |
| 1660 | Wood | 12/17-12/29 | 17.8, 21.4 | 81 | -26 | 6.816 | 0.004 | 0.11 | 0.03 | MB-I |
| 1756 | Giacobini | 12/01-12/18 | 25.0, 28.2 | 27 | 6 | 3.854 | 0.001 | 0.22 | 0.04 | MB-M |
| 85713 | 1998 SS49 | 11/15-11/28 | 54.9, 100.9 | 100 | 24 | 5.41 | 0.01 | 0.12 | 0.08 | NEA |
| | 2015 RN35 | 12/18-12/19 | 31.0, 31.2 | 101 | -7 | 0.3193 | 0.0001 | 0.64 | 0.30 | NEA |

Table I. Observing circumstances and results. The first line gives the results for the primary of a binary system. The second line gives the orbital period of the satellite and the maximum attenuation. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. $L_{PAB}$ and $B_{PAB}$ are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

| Observatory (MPC code) | Telescope | CCD | Filter | Observed Asteroids (#Sessions) |
|---|---|---|---|---|
| Astronomical Observatory of the University of Siena(K54) | 0.30-m MCT f/5.6 | SBIG STL-6303e(bin 2x2) | Rc,C | 397(1), 929(3), 58(1), 1660(3), 1589(1), 857713(4) |
| HOB Astronomical Observatory (L63) | 0.20-m SCT f/6.0 | ATIK 383L+ | Rc,C | 397(2), 1756(3). 58(2), 2015 RN35(1) |
| GiaGa Observatory (203) | 0.36-m SCT f/5.8 | MORAVIAN G2-3200 | Rc | 397(1), 929(2) |
| Osservatorio Astronomico Margherita Hack (A57) | 0.35-m SCT f/8.3 | SBIG ST10XME (bin 2x2) | B,V, Rc | 929(1), 58(1), 1589(1) |
| Iota Scorpii(K78) | 0.40-m RCT f/8.0 | SBIG STXL-6303e (bin 2x2) | V,Rc | 397(1), 1589(1) |
| Osservatorio Serafino Zani (130) | 0.40-m RCT f/5.8 | SBIG ST8 XME (bin 2x2) | C | 397(2) |
| San Marco Astronomical Observatory (L78) | 0.25-m RCT f/8.0 | ATIK 383L+ (bin 2x2) | C | 397(1), 2015 RN35(1) |
| Osservatorio Astronomico Nastro Verde (C82) | 0.35-m SCT f/6.3 | SBIG ST10XME (bin 2x2) | C | 1589(1), 2015 RN35(1) |
| M57 (K38) | 0.35-m RCT f/5.5 | SBIG STT1603ME | Rc | 397(1) |

Table II. Observing Instrumentations. MCT: Maksutov-Cassegrain, NRT: Newtonian Reflector, RCT: Ritchey-Chretien, SCT: Schmidt-Cassegrain.

the LCDB. Some discrepancies in the lightcurve could indicate the presence of a tumbling nature.

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## LIGHTCURVE PHOTOMETRY OPPORTUNITIES: 2023 APRIL-JUNE

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We present lists of asteroid photometry opportunities for objects reaching a favorable apparition and have no or poorly-defined lightcurve parameters. Additional data on these objects will help with shape and spin axis modeling using lightcurve inversion. The "Radar-Optical Opportunities" section includes a list of potential radar targets as well as some that might be in critical need of astrometric data.

We present several lists of asteroids that are prime targets for photometry and/or astrometry during the period 2023 April through June. The "Radar-Optical Opportunities" section provides an expanded list of potential NEA targets, many of which are planned or good candidates for radar observations.

In the first three sets of tables, "Dec" is the declination and "U" is the quality code of the lightcurve. See the latest asteroid lightcurve data base (LCDB from here on; Warner et al., 2009) documentation for an explanation of the U code:

*http://www.minorplanet.info/lightcurvedatabase.html*

The ephemeris generator on the MinorPlanet.info web site allows creating custom lists for objects reaching V ≤ 18.0 during any month in the current year and up to five years in the future, e.g., limiting the results by magnitude and declination, family, and more.

*https://www.minorplanet.info/php/callopplcdbquery.php*

We refer you to past articles, e.g., Warner et al. (2021a; 2021b) for more detailed discussions about the individual lists and points of advice regarding observations for objects in each list.

Once you've obtained and analyzed your data, it's important to publish your results. Papers appearing in the *Minor Planet Bulletin* are indexed in the Astrophysical Data System (ADS) and so can be referenced by others in subsequent papers. It's also important to make the data available at least on a personal website or upon request. We urge you to consider submitting your raw data to the ALCDEF database. This can be accessed for uploading and downloading data at