



## Deliverable

# H2020 COMPET-05-2015 project "Small Bodies: Near And Far (SBNAF)"

**Topic:** COMPET-05-2015 - Scientific exploitation of astrophysics, comets, and planetary data

**Project Title:** Small Bodies Near and Far (SBNAF)

**Proposal No:** 687378 - SBNAF - RIA

**Duration:** Apr 1, 2016 - Mar 31, 2019

|                            |  |
|----------------------------|--|
| <b>WP</b>                  | <b>WP 5</b>  |
| <b>Del. No</b>             | <b>D5.1</b>  |
| <b>Title</b>               | <b>Occultation candidates for 2016</b>                                     |
| <b>Lead Beneficiary</b>    | CSIC   |
| <b>Nature</b>              | Report   |
| <b>Dissemination Level</b> | Public   |
| <b>Est. Del. Date</b>      | 01 May 2016  |
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| <b>Lead Author</b>         | Rene Duffard, Instituto de Astrofísica de Andalucía – CSIC, duffard@iaa.es |

### WP5 Ground based observations

Objectives: WP5 has the main objective to execute observations from ground-based telescopes with the objective to acquire more data on the targets. One of this observation is the occultation of a star by an asteroid or TNO. On this particular point the main tasks are to coordinate observations and produce results on physical parameters of the asteroids and TNOs.

## Description of deliverable

In a short description, stellar occultation are produced when solar system targets - mainly asteroids and trans-Neptunian objects - move in the plane of the sky and pass in front of a star. As seen from the observer, the star disappears (or fades considerably) for a few seconds, and reappears again. The star is considered as a point-like source placed at infinity, so the shadow projected onto the Earth surface has the same size as the moving body itself. For the main belt targets, this shadow is less than 200 km in size (with few exceptions) and for the TNOs this shadow is larger than 600 km for the potential TNOs targets.

Once the identification of a possible occultation is done, the next step is to identify the ones that are useful; this means the shadow path is over a “telescope populated” area. In this report, two specific areas are identified, South America and Europe, as in these regions the SBNAF team has well-recognized telescope networks to observe the event.

In the presented list we describe the candidates of asteroids and trans-Neptunian objects (TNOs) that will produce a stellar occultation during the year 2016. Its fair to clarify that this prediction has a certain grade of uncertainty and this is the reason that the list is done on a yearly basis.

For the main belt asteroids the uncertainty is smaller and the shadow path can be trusted, while for TNOs the orbits are less known with the consequence that the shadow path is only estimated and more telescopic observations (astrometry of stars and TNOs) are needed until the event is confirmed.

The list presented here is produced using the free software Occult<sup>1</sup>. The results on the TNOs list are unique as the Granada group are (in collaboration with Paris observatory and Rio de Janeiro Observatory) the only group, which produces such predictions for TNOs.

For the selection of the asteroid list, the criteria were to select asteroids being larger than 100 km and stars to be occulted brighter than 14 mag. For a good coverage of the occultation, amateur astronomers have to be involved, however they can only observe bright stars with normal equipment. The criterion of asteroid size was to choose only large asteroids, as these can be observed with several chord (observatories).

From the large list of possible occultation to be produced into the Earth, the ones happening in Europe, mainly over Spain, and in South America, mainly over Argentina and Chile, were selected.

The occultations presented here are only during night-time (the sun below the local horizon). For each event it is reported the occultation time, diameter of the asteroid, duration of the event, star magnitude, magnitude drop (difference between star and body magnitudes), elongation of the Sun, name of star and asteroid, altitude over local horizon, Moon illumination and distance from the

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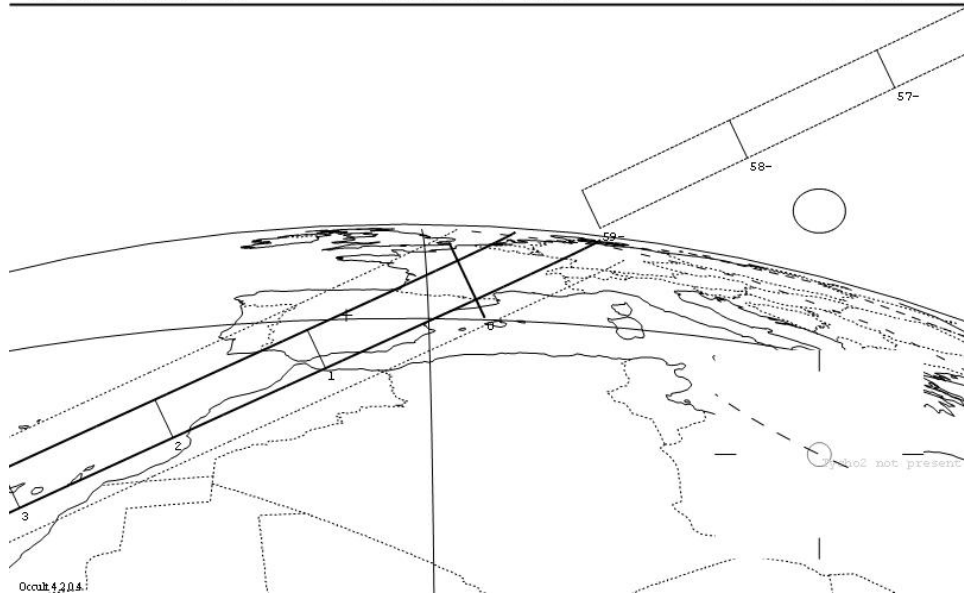
<sup>1</sup> <http://www.lunar-occultations.com/iota/occult4.htm>

telescope to the center of the shadow, and finally the star coordinates. Three examples are presented in the next page.

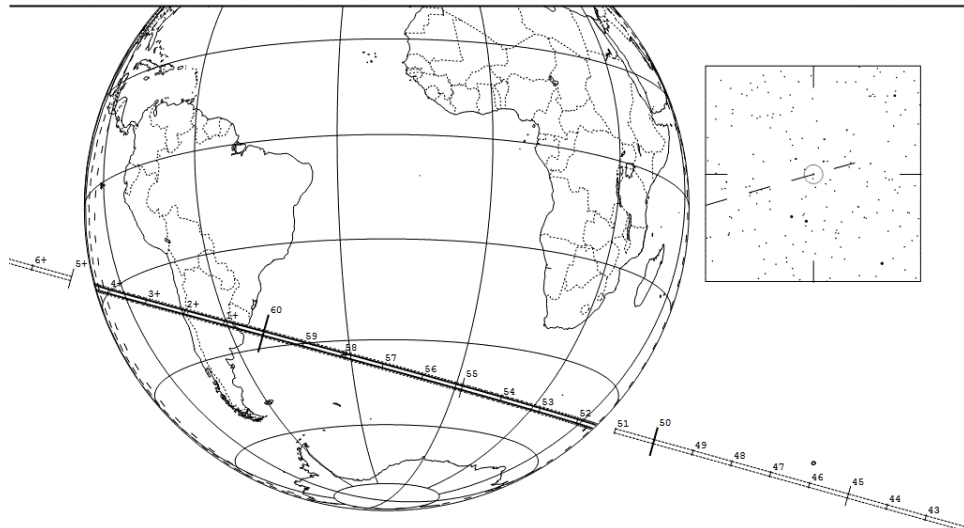
This list can be modified and specific targets (asteroids and TNOs) can be added for any particular interest.

Two examples of typical predictions for occultation's produced by an asteroid over Spain and over Argentina. Information on the star is provided (coordinates and magnitude) and on target (magnitude, diameter) and also distances of the Sun and the Moon. In the case of Princentonia, an error ellipse is shown in the upper right, in both cases an in-lay showing the star map of the event is presented.

508 Princentonia occults 2UCAC 18722253 on 2016 May 9 from 1h 59m to 2h 10m UT  
 Star: Max Duration = 15.4 secs Asteroid: Mag = 13.3  
 Mv = 11.6 Mag Drop = 1.9 Dia = 160km, 0.099"  
 RA = 17 8 22.2084 (J2000) Sun : Dist = 149 deg Moon: Dist = 167 deg Parallax = 3.947"  
 Dec = -31 5 20.917 Moon: illum = 8 % Hourly dRA = -1.631s  
 [of Date: 17 9 26, -31 6 24] Prediction of 2016 Apr 25.0 E 0.062"x 0.052" in PA 90 dDec = -9.94"

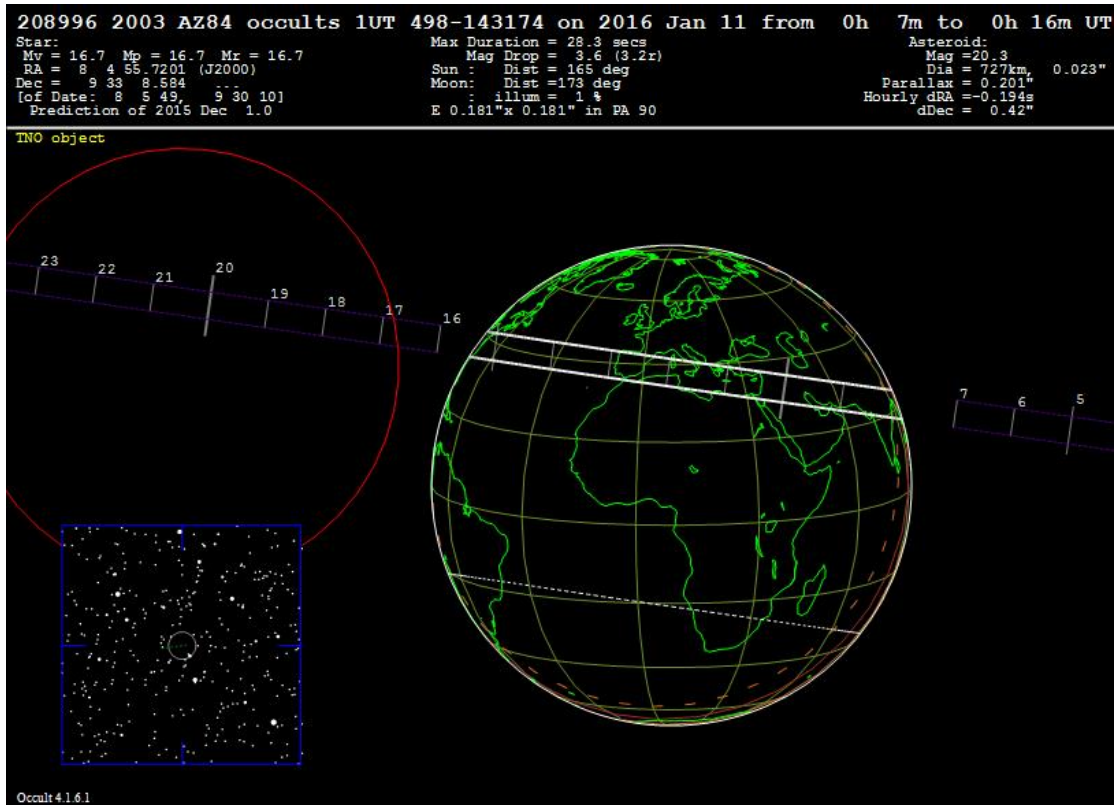


358 Apollonia occults TYC 5606-01023-1 on 2016 May 19 from 0h 51m to 1h 4m UT  
 Star: Max Duration = 6.3 secs Asteroid: Mag = 13.8  
 Mv = 9.3 Mp = 9.2 Mr = 9.4 Mag Drop = 4.5 (4.0r) Dia = 89km, 0.053"  
 RA = 15 23 14.7022 (J2000) Sun : Dist = 172 deg Moon: Dist = 28 deg Parallax = 3.829"  
 Dec = -13 58 7.580 Moon: illum = 53 % Hourly dRA = -2.026s  
 [of Date: 15 24 10, -13 58 31] Prediction of 2016 Mar 26.0 E 0.024"x 0.015" in PA 77 dDec = 8.23"



Occult420.1

**Example of a typical prediction of a stellar occultation produced by a TNO. As can be seen the red error ellipse is larger than the one in the asteroids predictions. Information on the event is similar as in the previous asteroid cases.**



| Spain       |         |          |         |       |      |           |         |                |               |     |      |           |              |              |  |  |
|-------------|---------|----------|---------|-------|------|-----------|---------|----------------|---------------|-----|------|-----------|--------------|--------------|--|--|
| Date        | U.T.    | Diameter | Angular | Dur   | Star | Mag-Drop  | Elion % | Star           | Planet        | Alt | Dist | Moon      | R.A. (J2000) | Dec.(J2000)  |  |  |
| y m d       | h m     | km       | "       | sec/m | mag  | V R       | o Ill   | No.            | No Name       |     | km   | Ill Elion | h m s        | o ' "        |  |  |
| 2016 Mar 29 | 23 29.6 | 105      | 0.088   | 16.2s | 11.3 | 0.10 0.10 | 145     | 2UCAC 29846292 | 42 Isis       | 27  | 523  | 66 38     | 14 54 23.994 | -5 30 34.19  |  |  |
| 2016 Apr 2  | 1 56.8  | 185      | 0.126   | 20.5s | 10.9 | 0.03 0.03 | 106     | 2UCAC 24898729 | 8 Flora       | 15  | 293  | 35 33     | 17 46 10.812 | -18 6 9.57   |  |  |
| 2016 Apr 3  | 3 28.4  | 202      | 0.097   | 7.6s  | 12.9 | 0.5 0.5   | 73      | 2UCAC 27573949 | 59 Elpis      | 13  | 676  | 24 15     | 20 4 38.906  | -12 23 45.07 |  |  |
| 2016 Apr 7  | 20 13.7 | 153      | 0.062   | 3.8s  | 12.6 | 0.46 0.46 | 43      | 2UCAC 39261244 | 106 Dione     | 23  | 446  | 0 38      | 3 55 26.011  | 21 14 20.71  |  |  |
| 2016 Apr 7  | 22 39.7 | 136      | 0.055   | 4.6s  | 13.2 | 1.1 1.1   | 61      | 2UCAC 39623891 | 268 Adorea    | 11  | 35   | 0 55      | 5 15 27.508  | 22 7 51.92   |  |  |
| 2016 Apr 7  | 24 0.2  | 105      | 0.064   | 11.7s | 12.4 | 0.9 0.9   | 106     | 2UCAC 39312269 | 171 Ophelia   | 32  | 414  | 0 99      | 8 30 26.374  | 21 10 43.21  |  |  |
| 2016 Apr 10 | 1 46.9  | 122      | 0.065   | 10.5s | 11.9 | 0.7 0.7   | 146     | 2UCAC 26009045 | 216 Kleopatra | 33  | 200  | 10 177    | 15 31 16.077 | -15 56 22.35 |  |  |
| 2016 Apr 11 | 21 17.9 | 125      | 0.065   | 7.4s  | 10.8 | 3.6 3.6   | 145     | 2UCAC 41028615 | 164 Eva       | 53  | 395  | 26 102    | 13 9 43.615  | 26 10 15.96  |  |  |
| 2016 Apr 19 | 20 20.4 | 207      | 0.088   | 6.3s  | 11.1 | 0.5 0.5   | 58      | 2UCAC 39451734 | 16 Psyche     | 35  | 122  | 95 96     | 5 53 0.805   | 21 31 15.16  |  |  |
| 2016 Apr 19 | 21 44.9 | 137      | 0.085   | 27.1s | 12.3 | 1.0 1.0   | 108     | 2UCAC 35574847 | 419 Aurelia   | 50  | 323  | 95 47     | 9 18 24.941  | 10 57 58.46  |  |  |
| 2016 Apr 25 | 20 32.7 | 105      | 0.058   | 6.5s  | 12.5 | 1.0 1.0   | 92      | 2UCAC 38971208 | 171 Ophelia   | 59  | 110  | 88 128    | 8 43 17.132  | 20 20 10.62  |  |  |
| 2016 Apr 26 | 21 27.2 | 207      | 0.085   | 6.0s  | 11.1 | 0.5 0.5   | 54      | 2UCAC 39454547 | 16 Psyche     | 19  | 350  | 81 176    | 6 3 14.804   | 21 37 17.11  |  |  |
| 2016 May 1  | 22 1.2  | 132      | 0.061   | 5.6s  | 12.1 | 0.7 0.7   | 71      | 2UCAC 36634107 | 12 Victoria   | 22  | 621  | 31 138    | 7 34 3.348   | 13 50 6.83   |  |  |
| 2016 May 19 | 24 1.5  | 105      | 0.098   | 11.3s | 10.9 | 0.08 0.08 | 151     | 2UCAC 30707777 | 42 Isis       | 42  | 739  | 97 9      | 14 9 59.854  | -3 15 57.06  |  |  |
| 2016 May 22 | 0 45.1  | 170      | 0.153   | 21.0s | 11.2 | 0.10 0.10 | 156     | 2UCAC 20637392 | 139 Jewea     | 15  | 507  | 100 29    | 14 14 48.567 | -27 28 28.27 |  |  |
| 2016 May 28 | 20 45.5 | 131      | 0.044   | 3.4s  | 13   | 1.7 1.7   | 37      | 2UCAC 40173010 | 618 Eufiede   | 17  | 39   | 57 136    | 7 7 20.388   | 23 47 7.15   |  |  |
| 2016 May 29 | 3 9.3   | 105      | 0.087   | 10.8s | 11.6 | 1.0 1.0   | 161     | 2UCAC 26266798 | 58 Concordia  | 30  | 463  | 54 68     | 17 41 31.586 | -15 23 56.43 |  |  |
| 2016 Jun 3  | 20 52.0 | 104      | 0.066   | 7.5s  | 12.2 | 1.6 1.6   | 163     | 2UCAC 30038967 | 365 Corduba   | 25  | 115  | 3 160     | 16 51 13.863 | -5 3 9.88    |  |  |
| 2016 Jun 8  | 0 24.5  | 290      | 0.156   | 44.4s | 10.6 | 0.03 0.03 | 131     | 2UCAC 32210029 | 3 Juno        | 33  | 92   | 11 94     | 14 9 44.212  | 1 21 35.74   |  |  |
| 2016 Jun 10 | 20 49.6 | 185      | 0.181   | 16.2s | 9.4  | 0.01 0.01 | 175     | 2UCAC 24880809 | 8 Flora       | 14  | 70   | 36 107    | 17 21 58.722 | -18 0 55.78  |  |  |
| 2016 Jun 12 | 1 26.9  | 185      | 0.182   | 16.1s | 9.4  | 0.02 0.02 | 175     | 2UCAC 24879970 | 8 Flora       | 29  | 555  | 47 92     | 17 20 37.341 | -18 2 9.94   |  |  |
| 2016 Jun 12 | 1 26.9  | 185      | 0.182   | 16.1s | 9.4  | 0.02 0.02 | 175     | 2UCAC 24879970 | 8 Flora       | 29  | 555  | 47 92     | 17 20 37.341 | -18 2 9.94   |  |  |
| 2016 Jun 12 | 1 26.9  | 185      | 0.182   | 16.1s | 9.4  | 0.02 0.02 | 175     | 2UCAC 24879970 | 8 Flora       | 29  | 555  | 47 92     | 17 20 37.341 | -18 2 9.94   |  |  |
| 2016 Jul 3  | 21 22.9 | 429      | 0.203   | 17.9s | 11   | 0.05 0.05 | 76      | 2UCAC 30859310 | 10 Hygiea     | 19  | 642  | 1 83      | 11 47 29.771 | -2 42 28.48  |  |  |
| 2016 Jul 6  | 1 17.9  | 102      | 0.066   | 7.1s  | 12.7 | 0.5 0.5   | 173     | 2UCAC 25175448 | 53 Kalypso    | 29  | 26   | 3 154     | 18 38 45.894 | -17 57 18.06 |  |  |
| 2016 Jul 24 | 2 57.5  | 122      | 0.109   | 17.6s | 12   | 0.22 0.22 | 144     | 2UCAC 23037238 | 521 Briskia   | 28  | 227  | 80 23     | 22 48 10.150 | -22 0 31.99  |  |  |
| 2016 Jul 31 | 2 14.4  | 177      | 0.096   | 13.4s | 10.3 | 2.0 2.0   | 162     | 2UCAC 27014301 | 24 Themis     | 35  | 434  | 9 126     | 21 55 54.974 | -13 39 50.15 |  |  |
| 2016 Aug 3  | 2 57.1  | 108      | 0.045   | 3.4s  | 12.9 | 0.6 0.6   | 60      | 2UCAC 36237526 | 221 Eos       | 16  | 564  | 0 63      | 4 46 23.367  | 12 40 13.30  |  |  |
| 2016 Aug 8  | 1 55.2  | 125      | 0.055   | 3.9s  | 12.2 | 2.3 2.3   | 63      | 2UCAC 44099025 | 328 German    | 23  | 82   | 26 121    | 4 40 52.983  | 35 12 16.11  |  |  |
| 2016 Aug 13 | 20 56.0 | 184      | 0.094   | 16.3s | 12.3 | 0.8 0.8   | 99      | 2UCAC 23393302 | 241 Germania  | 20  | 650  | 78 26     | 15 52 35.125 | -21 22 23.91 |  |  |
| 2016 Aug 27 | 22 14.5 | 105      | 0.064   | 9.4s  | 10.4 | 3.4 3.4   | 103     | 2UCAC 25113843 | 58 Concordia  | 16  | 420  | 21 157    | 17 9 52.014  | -17 38 41.03 |  |  |
| 2016 Aug 30 | 21 12.0 | 208      | 0.24    | 28.8s | 10.3 | 0.09 0.09 | 152     | 2UCAC 32289031 | 85 Io         | 47  | 523  | 2 163     | 20 51 15.320 | 1 20 42.18   |  |  |
| 2016 Sep 3  | 22 51.9 | 168      | 0.162   | 12.4s | 10.6 | 0.06 0.06 | 171     | 2UCAC 27589875 | 185 Eunike    | 31  | 188  | 6 155     | 23 24 24.365 | -12 25 40.04 |  |  |
| 2016 Sep 11 | 4 33.1  | 131      | 0.043   | 3.2s  | 12.2 | 2.5 2.5   | 29      | 2UCAC 38794395 | 618 Eufiede   | 13  | 755  | 66 137    | 9 35 44.946  | 19 30 38.75  |  |  |
| 2016 Sep 14 | 3 5.9   | 207      | 0.129   | 14.5s | 10.1 | 2.2 2.2   | 157     | 2UCAC 29567855 | 372 Palma     | 13  | 11   | 91 13     | 21 56 58.836 | -6 43 45.02  |  |  |
| 2016 Sep 14 | 3 29.5  | 102      | 0.044   | 2.8s  | 10   | 4.3 4.3   | 50      | 2UCAC 35747376 | 266 Aline     | 14  | 296  | 91 164    | 8 10 46.434  | 11 17 58.84  |  |  |

|             |        |     |       |       |      |      |      |     |                |               |    |     |     |     |    |    |       |     |     |       |       |
|-------------|--------|-----|-------|-------|------|------|------|-----|----------------|---------------|----|-----|-----|-----|----|----|-------|-----|-----|-------|-------|
| 2016 Sep 16 | 331.8  | 102 | 0.038 | 4.7s  | 10.9 | 4.4  | 4.4  | 76  | 2UCAC 43946397 | 1093 Freda    | 47 | 537 | 99  | 113 | 6  | 38 | 20    | 919 | 34  | 39    | 33.34 |
| 2016 Sep 18 | 334.2  | 101 | 0.042 | 2.9s  | 12.9 | 1.4  | 1.4  | 48  | 2UCAC 37178195 | 74 Galatea    | 15 | 147 | 97  | 113 | 8  | 37 | 18    | 067 | 15  | 4     | 6.06  |
| 2016 Sep 23 | 320.7  | 215 | 0.123 | 8.4s  | 11.6 | 0.08 | 0.08 | 78  | 2UCAC 43088316 | 13 Egeria     | 45 | 361 | 53  | 22  | 6  | 59 | 46    | 777 | 32  | 28    | 14.79 |
| 2016 Sep 24 | 047.7  | 154 | 0.07  | 11.0s | 12.8 | 1.2  | 1.2  | 93  | 2UCAC 42901581 | 187 Lamberta  | 29 | 471 | 43  | 17  | 5  | 53 | 23    | 639 | 31  | 57    | 26.83 |
| 2016 Sep 24 | 054.3  | 184 | 0.095 | 14.9s | 10.9 | 2.1  | 2.1  | 96  | 2UCAC 37495387 | 45 Eugenia    | 24 | 520 | 43  | 15  | 5  | 39 | 27    | 426 | 16  | 6     | 27.08 |
| 2016 Sep 24 | 134.4  | 108 | 0.055 | 4.4s  | 12   | 0.7  | 0.7  | 72  | 2UCAC 39658821 | 21 Lutetia    | 15 | 487 | 43  | 11  | 7  | 25 | 0.035 | 22  | 21  | 14.04 |       |
| 2016 Sep 26 | 5 4.8  | 125 | 0.068 | 7.7s  | 12.9 | 1.2  | 1.2  | 96  | 2UCAC 45962370 | 328 Gudrun    | 83 | 645 | 22  | 46  | 5  | 44 | 43    | 074 | 40  | 40    | 1.54  |
| 2016 Oct 3  | 441.2  | 129 | 0.051 | 3.2s  | 12.6 | 1.4  | 1.4  | 42  | 2UCAC 35396577 | 762 Pullovera | 21 | 757 | 4   | 66  | 10 | 0  | 21    | 995 | 10  | 21    | 57.32 |
| 2016 Oct 7  | 2353.9 | 215 | 0.133 | 10.3s | 11.4 | 0.07 | 0.07 | 88  | 2UCAC 43609046 | 13 Egeria     | 15 | 282 | 38  | 157 | 7  | 22 | 30    | 823 | 33  | 40    | 9.12  |
| 2016 Oct 11 | 154.5  | 109 | 0.056 | 13.2s | 12.6 | 1.9  | 1.9  | 111 | 2UCAC 32492598 | 286 Iclea     | 37 | 273 | 69  | 133 | 5  | 43 | 56    | 226 | 2   | 14    | 6.65  |
| 2016 Oct 12 | 446.8  | 104 | 0.074 | 12.0s | 12.8 | 0.46 | 0.46 | 132 | 2UCAC 45299190 | 98 Ianthe     | 66 | 322 | 79  | 98  | 3  | 52 | 34    | 771 | 38  | 43    | 39.78 |
| 2016 Oct 16 | 2340.7 | 165 | 0.084 | 11.4s | 12.7 | 0.46 | 0.46 | 94  | 2UCAC 44301119 | 96 Aegle      | 18 | 748 | 99  | 76  | 7  | 35 | 36    | 086 | 35  | 41    | 56.71 |
| 2016 Oct 17 | 258.6  | 167 | 0.139 | 17.7s | 11.4 | 0.17 | 0.17 | 133 | 2UCAC 30132299 | 194 Prokne    | 45 | 354 | 99  | 34  | 4  | 31 | 20    | 736 | -4  | 38    | 9.37  |
| 2016 Oct 17 | 2128.5 | 202 | 0.13  | 14.8s | 11.7 | 1.0  | 1.0  | 98  | 2UCAC 26350589 | 59 Elpis      | 23 | 60  | 95  | 106 | 20 | 19 | 8     | 669 | -15 | 28    | 28.25 |
| 2016 Oct 26 | 259.2  | 122 | 0.093 | 32.7s | 12.4 | 0.42 | 0.42 | 121 | 2UCAC 34979663 | 360 Carlota   | 56 | 786 | 18  | 72  | 6  | 5  | 41    | 350 | 9   | 19    | 53.14 |
| 2016 Oct 27 | 032.7  | 102 | 0.055 | 9.1s  | 12.3 | 2.0  | 2.0  | 148 | 2UCAC 40469698 | 769 Tajana    | 64 | 503 | 12  | 107 | 4  | 15 | 31    | 987 | 24  | 32    | 40.69 |
| 2016 Oct 31 | 1836.1 | 135 | 0.062 | 8.3s  | 11.8 | 2.7  | 2.7  | 97  | 2UCAC 32969111 | 276 Adelheid  | 53 | 707 | 1   | 85  | 20 | 52 | 38    | 333 | 3   | 16    | 12.35 |
| 2016 Nov 2  | 452.6  | 215 | 0.155 | 16.2s | 11.1 | 0.06 | 0.06 | 106 | 2UCAC 44479834 | 13 Egeria     | 82 | 331 | 6   | 130 | 7  | 53 | 9     | 072 | 36  | 17    | 41.44 |
| 2016 Nov 3  | 255.4  | 122 | 0.084 | 29.4s | 11.3 | 0.19 | 0.19 | 124 | 2UCAC 42040448 | 68 Leto       | 73 | 237 | 10  | 158 | 6  | 31 | 11    | 004 | 29  | 23    | 20.73 |
| 2016 Nov 6  | 3 4.8  | 208 | 0.11  | 37.1s | 12.7 | 0.42 | 0.42 | 131 | 2UCAC 43423433 | 165 Loreley   | 82 | 286 | 33  | 154 | 6  | 9  | 9     | 171 | 33  | 24    | 31.89 |
| 2016 Nov 10 | 538.9  | 101 | 0.032 | 2.4s  | 13.4 | 2.0  | 2.0  | 25  | 2UCAC 30863432 | 1015 Christa  | 10 | 84  | 75  | 143 | 13 | 42 | 31    | 859 | -2  | 44    | 55.81 |
| 2016 Nov 12 | 547.6  | 109 | 0.038 | 2.6s  | 12.5 | 1.1  | 1.1  | 30  | 2UCAC 29841692 | 250 Bettina   | 15 | 218 | 92  | 177 | 13 | 18 | 41    | 951 | -5  | 53    | 3.52  |
| 2016 Nov 18 | 1837.7 | 104 | 0.085 | 8.5s  | 12.4 | 0.29 | 0.29 | 158 | 2UCAC 46090343 | 98 Ianthe     | 35 | 16  | 76  | 62  | 3  | 15 | 48    | 248 | 41  | 2     | 17.20 |
| 2016 Nov 20 | 524.8  | 121 | 0.082 | 11.2s | 12.6 | 0.39 | 0.39 | 147 | 2UCAC 47623035 | 426 Hippo     | 48 | 783 | 62  | 58  | 5  | 15 | 43    | 973 | 47  | 18    | 23.78 |
| 2016 Nov 22 | 18 3.8 | 121 | 0.082 | 10.6s | 12.5 | 0.36 | 0.36 | 149 | 2UCAC 47622541 | 426 Hippo     | 18 | 543 | 36  | 86  | 5  | 13 | 2     | 733 | 47  | 17    | 56.51 |
| 2016 Nov 29 | 2157.6 | 122 | 0.108 | 14.3s | 11.3 | 0.8  | 0.8  | 155 | 2UCAC 34790466 | 360 Carlota   | 32 | 214 | 0   | 161 | 5  | 55 | 44    | 796 | 8   | 35    | 41.47 |
| 2016 Nov 30 | 027.7  | 122 | 0.108 | 14.2s | 11.5 | 0.6  | 0.6  | 155 | 2UCAC 34790445 | 360 Carlota   | 55 | 287 | 0   | 162 | 5  | 55 | 40    | 097 | 8   | 35    | 46.99 |
| 2016 Dec 1  | 4 3.0  | 110 | 0.112 | 8.6s  | 11.3 | 0.39 | 0.39 | 167 | 2UCAC 34777091 | 814 Tauris    | 30 | 584 | 3   | 160 | 4  | 37 | 56    | 506 | 8   | 44    | 13.37 |
| 2016 Dec 1  | 444.0  | 117 | 0.098 | 10.2s | 11.9 | 0.24 | 0.24 | 169 | 2UCAC 36947054 | 34 Circe      | 31 | 505 | 3   | 168 | 5  | 5  | 47    | 250 | 14  | 35    | 28.92 |
| 2016 Dec 4  | 2 6.0  | 121 | 0.084 | 9.2s  | 12.1 | 0.7  | 0.7  | 155 | 2UCAC 47511822 | 426 Hippo     | 70 | 242 | 19  | 129 | 4  | 59 | 35    | 611 | 46  | 55    | 52.19 |
| 2016 Dec 5  | 049.0  | 194 | 0.097 | 33.0s | 10.9 | 2.1  | 2.1  | 130 | 2UCAC 40684287 | 121 Hermitone | 50 | 301 | 26  | 166 | 8  | 28 | 5     | 510 | 25  | 6     | 36.33 |
| 2016 Dec 8  | 1945.8 | 202 | 0.101 | 6.3s  | 12.5 | 0.6  | 0.6  | 62  | 2UCAC 27012244 | 59 Elpis      | 19 | 542 | 66  | 46  | 21 | 25 | 17    | 077 | -13 | 45    | 34.51 |
| 2016 Dec 8  | 22 6.8 | 117 | 0.099 | 10.0s | 11.8 | 0.21 | 0.21 | 171 | 2UCAC 36767271 | 34 Circe      | 54 | 701 | 67  | 68  | 4  | 58 | 25    | 126 | 14  | 16    | 55.19 |
| 2016 Dec 13 | 23 7.3 | 108 | 0.082 | 12.8s | 11.5 | 0.13 | 0.13 | 144 | 2UCAC 39663288 | 21 Lutetia    | 41 | 395 | 100 | 37  | 8  | 2  | 9     | 059 | 22  | 24    | 19.90 |
| 2016 Dec 14 | 351.4  | 165 | 0.115 | 18.3s | 11   | 1.1  | 1.1  | 148 | 2UCAC 44655423 | 96 Aegle      | 73 | 84  | 100 | 33  | 7  | 42 | 31    | 177 | 36  | 50    | 24.53 |
| 2016 Dec 15 | 443.0  | 150 | 0.061 | 5.4s  | 12.7 | 1.3  | 1.3  | 63  | 2UCAC 28379988 | 247 Eukrate   | 23 | 311 | 98  | 101 | 13 | 14 | 59    | 917 | -9  | 52    | 29.36 |
| 2016 Dec 15 | 24 5.1 | 215 | 0.196 | 22.0s | 10.2 | 0.10 | 0.10 | 144 | 2UCAC 46821984 | 13 Egeria     | 61 | 259 | 94  | 26  | 8  | 3  | 54    | 635 | 43  | 34    | 56.17 |

| Date        | U.T.    | Diameter | Angular | Durm  | Star | Mag-Drop  | Eilon % | Star            | Planet        | Alt | Dist | Moon      | R.A. (J2000) | Dec.(J2000) |
|-------------|---------|----------|---------|-------|------|-----------|---------|-----------------|---------------|-----|------|-----------|--------------|-------------|
| y m d       | h m     | km       | "       | sec/m | mag  | V R       | o III   | No.             | No Name       | o   | km   | Ill Eilon | h m s        | o ' "       |
| 2016 Dec 15 | 24 5.1  | 215      | 0.196   | 22.0s | 10.2 | 0.10 0.10 | 144     | 2UCAC 46821984  | 13 Egeria     | 61  | 259  | 94 26     | 8 3 54.635   | 43 34 56.17 |
| 2016 Dec 16 | 20 36.5 | 113      | 0.075   | 9.3s  | 12.3 | 0.46 0.46 | 162     | 2UCAC 34964052  | 490 Veritas   | 41  | 781  | 89 51     | 4 55 36.933  | 9 9 7.42    |
| 2016 Dec 18 | 3 10.8  | 116      | 0.08    | 17.4s | 12.7 | 0.46 0.46 | 119     | 2UCAC 32367583  | 156 Xanthippe | 49  | 341  | 78 12     | 9 40 9.466   | 1 31 15.89  |
| 2016 Dec 19 | 2 58.0  | 210      | 0.139   | 14.4s | 11.5 | 0.26 0.26 | 99      | 2UCAC 300159847 | 41 Daphne     | 33  | 246  | 69 17     | 11 3 26.853  | -5 2 37.70  |
| 2016 Dec 20 | 3 21.4  | 132      | 0.117   | 14.9s | 11.7 | 0.15 0.15 | 156     | 2UCAC 41877645  | 300 Dynamene  | 69  | 741  | 59 56     | 7 39 35.751  | 28 56 34.02 |
| 2016 Dec 22 | 23 40.4 | 122      | 0.109   | 11.5s | 11.6 | 0.26 0.26 | 164     | 2UCAC 35156886  | 260 Carliova  | 59  | 265  | 32 119    | 5 36 7.672   | 9 33 42.45  |
| 2016 Dec 23 | 19 19.4 | 125      | 0.092   | 11.1s | 11.9 | 1.1 1.1   | 154     | 2UCAC 47723908  | 328 Gudrun    | 47  | 669  | 25 124    | 5 16 57.098  | 47 31 55.02 |
| 2016 Dec 24 | 22 6.0  | 209      | 0.17    | 16.9s | 8.6  | 1.5 1.5   | 169     | 2UCAC 43600794  | 22 Kalliope   | 61  | 537  | 17 128    | 6 27 54.650  | 33 54 58.84 |
| 2016 Dec 25 | 19 11.5 | 216      | 0.119   | 16.4s | 11.4 | 1.2 1.2   | 153     | 2UCAC 44480973  | 375 Ursula    | 14  | 468  | 11 116    | 8 10 17.333  | 36 26 49.23 |
| 2016 Dec 30 | 0 15.2  | 127      | 0.094   | 9.1s  | 11.4 | 0.6 0.6   | 174     | 2UCAC 41516680  | 146 Lucina    | 77  | 49   | 1 166     | 6 24 21.666  | 27 44 7.17  |
| 2017 Jan 6  | 19 33.5 | 127      | 0.094   | 9.6s  | 11.4 | 0.8 0.8   | 166     | 2UCAC 41687043  | 146 Lucina    | 41  | 664  | 61 65     | 6 16 9.694   | 28 17 30.60 |

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|             |         |     |       |     |      |           |     |                |            |    |     |        |              |              |
|-------------|---------|-----|-------|-----|------|-----------|-----|----------------|------------|----|-----|--------|--------------|--------------|
| 2016 May 30 | 20 36.3 | 146 | 0.005 | 6   | 12.3 | 11.3 12.3 | 176 | 2UCAC 22730725 | 1998 HP151 | 9  | 799 | 35 103 | 16 50 58.017 | -22 58 35.12 |
| 2016 Jun 11 | 0 19.7  | 151 | 0.005 | 6.3 | 8.6  | 8.6 8.6   | 170 | 2UCAC 22727033 | 2003 LB7   | 29 | 181 | 37 96  | 16 37 27.549 | -22 57 42.07 |
| 2016 Jul 3  | 23 8.8  | 133 | 0.006 | 5.8 | 7.7  | 7.7 7.7   | 168 | 2UCAC 20463899 | 1998 HK151 | 25 | 569 | 0 170  | 18 6 11.658  | -27 30 13.15 |

South America

| Date        | U.T.    | Diameter | Angular | Durm  | Star | Mag-Drop  | Eilon % | Star           | Planet        | Alt | Dist | Moon      | R.A. (J2000) | Dec.(J2000)  |
|-------------|---------|----------|---------|-------|------|-----------|---------|----------------|---------------|-----|------|-----------|--------------|--------------|
| y m d       | h m     | km       | "       | sec/m | mag  | V R       | o III   | No.            | No Name       | o   | km   | Ill Eilon | h m s        | o ' "        |
| 2016 Mar 24 | 0 45.0  | 136      | 0.065   | 9.7s  | 12.6 | 1.2 1.2   | 91      | 2UCAC 43943390 | 70 Panopaea   | 17  | 22   | 100 94    | 6 22 6.389   | 34 39 11.30  |
| 2016 Mar 26 | 6 22.5  | 134      | 0.087   | 4.2s  | 12.4 | 0.31 0.31 | 71      | 2UCAC 26996720 | 56 Melete     | 15  | 495  | 93 78     | 19 41 23.419 | -13 50 46.28 |
| 2016 Mar 29 | 1 32.9  | 127      | 0.117   | 14.9s | 10.5 | 1.2 1.2   | 150     | 2UCAC 22011058 | 78 Diana      | 33  | 419  | 75 36     | 14 0 55.735  | -24 9 56.16  |
| 2016 Mar 30 | 5 55.3  | 174      | 0.09    | 13.5s | 9.8  | 3.4 3.4   | 99      | 2UCAC 18746405 | 120 Lathesis  | 40  | 148  | 64 15     | 18 6 2.440   | -31 13 5.98  |
| 2016 Mar 31 | 9 42.2  | 185      | 0.124   | 19.1s | 10.9 | 0.12 0.12 | 105     | 2UCAC 24897801 | 8 Flora       | 76  | 211  | 52 12     | 17 45 6.471  | -18 7 4.16   |
| 2016 Mar 31 | 9 42.2  | 185      | 0.124   | 19.1s | 10.9 | 0.12 0.12 | 105     | 2UCAC 24897801 | 8 Flora       | 76  | 211  | 52 12     | 17 45 6.471  | -18 7 4.16   |
| 2016 Apr 2  | 7 48.6  | 122      | 0.063   | 13.4s | 12.4 | 0.34 0.34 | 138     | 2UCAC 25551024 | 216 Kleopatra | 73  | 765  | 33 68     | 15 34 39.613 | -16 31 50.80 |
| 2016 Apr 3  | 1 53.4  | 125      | 0.097   | 5.9s  | 10.9 | 0.24 0.24 | 88      | 2UCAC 40333995 | 27 Euterpe    | 15  | 285  | 25 148    | 6 50 12.852  | 24 0 16.34   |
| 2016 Apr 3  | 2 35.3  | 170      | 0.152   | 24.0s | 11.1 | 0.42 0.42 | 142     | 2UCAC 20641827 | 139 Juewa     | 39  | 103  | 25 84     | 14 59 33.444 | -27 3 38.72  |
| 2016 Apr 3  | 22 54.9 | 131      | 0.053   | 5.9s  | 13.2 | 1.3 1.3   | 76      | 2UCAC 39635255 | 618 Elfriede  | 33  | 777  | 17 125    | 6 3 12.109   | 22 26 53.54  |
| 2016 Apr 7  | 5 4.5   | 102      | 0.048   | 7.6s  | 11.7 | 2.9 2.9   | 92      | 2UCAC 25194780 | 53 Kalypso    | 19  | 179  | 0 89      | 19 4 24.380  | -17 57 14.65 |
| 2016 Apr 11 | 8 16.0  | 117      | 0.113   | 24.6s | 12   | 0.46 0.46 | 119     | 2UCAC 28046564 | 404 Arsinoe   | 69  | 641  | 21 171    | 17 27 46.258 | -10 57 56.65 |
| 2016 Apr 11 | 23 34.0 | 132      | 0.067   | 8.1s  | 11.4 | 1.2 1.2   | 86      | 2UCAC 36629934 | 12 Victoria   | 41  | 187  | 27 23     | 7 15 8.492   | 13 52 7.49   |
| 2016 Apr 11 | 23 34.0 | 132      | 0.067   | 8.1s  | 11.4 | 1.2 1.2   | 86      | 2UCAC 36629934 | 12 Victoria   | 41  | 187  | 27 23     | 7 15 8.492   | 13 52 7.49   |
| 2016 Apr 19 | 1 12.4  | 429      | 0.288   | 71.1s | 10.1 | 0.02 0.02 | 140     | 2UCAC 31507984 | 10 Hygiea     | 59  | 566  | 91 8      | 11 14 23.471 | -0 52 25.87  |
| 2016 Apr 19 | 8 36.9  | 130      | 0.05    | 5.5s  | 11.2 | 3.2 3.2   | 73      | 2UCAC 26580770 | 159 Aemilia   | 45  | 149  | 93 138    | 21 13 59.996 | -14 32 39.61 |



|             |         |     |       |       |      |           |     |                |                 |    |     |        |              |              |
|-------------|---------|-----|-------|-------|------|-----------|-----|----------------|-----------------|----|-----|--------|--------------|--------------|
| 2016 Apr 19 | 9 50.8  | 167 | 0.079 | 3.45  | 11.9 | 0.39 0.39 | 26  | 2UCAC 31260973 | 194 Prokne      | 14 | 371 | 93 175 | 0 20 16.849  | -1 2 59.71   |
| 2016 Apr 21 | 2 34.9  | 127 | 0.119 | 11.95 | 11.2 | 0.09 0.09 | 168 | 2UCAC 22239549 | 78 Diana        | 70 | 157 | 99 19  | 13 38 28.047 | -23 34 58.05 |
| 2016 Apr 30 | 7 48.9  | 154 | 0.063 | 6.95  | 11.7 | 2.4 2.4   | 78  | 2UCAC 27765000 | 211 Isolda      | 38 | 672 | 48 10  | 21 36 11.805 | -11 36 18.61 |
| 2016 May 1  | 7 4.8   | 187 | 0.067 | 6.85  | 11.6 | 2.4 2.4   | 67  | 2UCAC 30779727 | 153 Hilda       | 17 | 378 | 38 10  | 22 13 39.908 | -3 11 35.28  |
| 2016 May 6  | 6 10.3  | 148 | 0.101 | 15.45 | 10.9 | 1.8 1.8   | 153 | 2UCAC 30214573 | 381 Myrrha      | 63 | 474 | 1 149  | 16 33 6.511  | -4 56 17.44  |
| 2016 May 15 | 4 24.6  | 185 | 0.166 | 26.55 | 9.9  | 0.06 0.06 | 147 | 2UCAC 25139018 | 8 Flora         | 58 | 585 | 64 105 | 17 46 59.960 | -17 46 25.58 |
| 2016 May 15 | 4 24.6  | 185 | 0.166 | 26.55 | 9.9  | 0.06 0.06 | 147 | 2UCAC 25139018 | 8 Flora         | 58 | 585 | 64 105 | 17 46 59.960 | -17 46 25.58 |
| 2016 May 15 | 22 23.4 | 116 | 0.048 | 2.95  | 11.3 | 2.9 2.9   | 40  | 2UCAC 34062814 | 105 Artemis     | 27 | 524 | 71 78  | 6 11 21.607  | 6 42 12.68   |
| 2016 May 18 | 22 42.2 | 105 | 0.052 | 4.25  | 11.8 | 1.9 1.9   | 75  | 2UCAC 38434419 | 171 Ophelia     | 38 | 104 | 92 72  | 9 7 28.683   | 18 37 16.01  |
| 2016 May 19 | 4 47.6  | 185 | 0.169 | 22.95 | 9.9  | 0.01 0.01 | 152 | 2UCAC 25136178 | 8 Flora         | 66 | 560 | 93 57  | 17 44 14.264 | -17 46 57.07 |
| 2016 May 19 | 9 17.4  | 185 | 0.169 | 22.85 | 9.9  | 0.02 0.02 | 152 | 2UCAC 25136043 | 8 Flora         | 46 | 666 | 94 55  | 17 44 5.505  | -17 46 59.11 |
| 2016 May 23 | 2 28.8  | 160 | 0.102 | 12.65 | 12.3 | 0.7 0.7   | 163 | 2UCAC 18467872 | 508 Princesonia | 56 | 577 | 98 14  | 16 57 24.243 | -31 53 56.93 |
| 2016 May 23 | 6 34.6  | 185 | 0.054 | 10.75 | 12.6 | 2.8 2.8   | 154 | 2UCAC 12470588 | 911 Agamemnon   | 52 | 558 | 98 36  | 15 16 30.458 | -45 15 13.80 |
| 2016 May 24 | 7 53.6  | 113 | 0.045 | 4.35  | 13.6 | 1.6 1.6   | 71  | 2UCAC 29942305 | 909 Ulla        | 30 | 244 | 94 81  | 23 35 55.782 | -5 43 36.04  |
| 2016 May 26 | 1 58.9  | 185 | 0.174 | 19.25 | 9.7  | 0.03 0.03 | 160 | 2UCAC 25130952 | 8 Flora         | 38 | 728 | 83 28  | 17 38 31.074 | -17 49 12.58 |
| 2016 May 26 | 1 58.9  | 185 | 0.174 | 19.25 | 9.7  | 0.03 0.03 | 160 | 2UCAC 25130952 | 8 Flora         | 38 | 728 | 83 28  | 17 38 31.074 | -17 49 12.58 |
| 2016 May 29 | 24 7.7  | 105 | 0.087 | 10.75 | 12.3 | 0.31 0.31 | 162 | 2UCAC 26266277 | 58 Concordia    | 16 | 35  | 45 80  | 17 40 50.075 | -15 22 46.89 |
| 2016 May 31 | 4 17.7  | 114 | 0.076 | 8.45  | 12   | 0.6 0.6   | 173 | 2UCAC 19686608 | 38 Leda         | 87 | 533 | 32 110 | 16 33 35.852 | -29 24 51.46 |
| 2016 May 31 | 9 55.2  | 110 | 0.054 | 2.55  | 11.9 | 1.8 1.8   | 47  | 2UCAC 29764732 | 814 Taurus      | 31 | 157 | 29 26  | 2 1 32.346   | -5 50 1.73   |
| 2016 Jun 1  | 6 18.3  | 185 | 0.054 | 11.15 | 12.6 | 2.8 2.8   | 151 | 2UCAC 12698459 | 911 Agamemnon   | 47 | 393 | 20 132 | 15 10 47.312 | -44 52 56.13 |
| 2016 Jun 6  | 23 45.8 | 124 | 0.096 | 11.75 | 11.6 | 0.39 0.39 | 175 | 2UCAC 22279125 | 90 Antiope      | 26 | 19  | 5 159  | 17 23 31.000 | -23 45 54.08 |
| 2016 Jun 7  | 5 3.1   | 110 | 0.067 | 13.65 | 12.3 | 0.6 0.6   | 131 | 2UCAC 13473721 | 595 Polyxena    | 54 | 264 | 6 147  | 20 42 15.220 | -43 7 29.74  |
| 2016 Jun 8  | 23 18.1 | 137 | 0.069 | 5.65  | 11.7 | 2.0 2.0   | 71  | 2UCAC 35027217 | 419 Aurelia     | 39 | 127 | 11 32  | 9 56 45.645  | 9 7 38.00    |
| 2016 Jun 8  | 4 49.4  | 253 | 0.188 | 18.85 | 9.5  | 0.02 0.02 | 168 | 2UCAC 22724485 | 7 Ihs           | 70 | 243 | 12 127 | 16 16 24.455 | -22 42 38.08 |
| 2016 Jun 8  | 5 6.7   | 185 | 0.181 | 16.35 | 9.4  | 0.01 0.01 | 174 | 2UCAC 25122504 | 8 Flora         | 75 | 694 | 12 143 | 17 24 57.488 | -17 58 16.19 |
| 2016 Jun 8  | 22 31.5 | 116 | 0.046 | 2.75  | 12.2 | 1.9 1.9   | 29  | 2UCAC 34254691 | 105 Artemis     | 14 | 535 | 18 28  | 6 50 21.422  | 7 17 5.67    |
| 2016 Jun 10 | 2 47.4  | 105 | 0.088 | 9.65  | 12.1 | 0.31 0.31 | 171 | 2UCAC 26258525 | 58 Concordia    | 61 | 428 | 28 119 | 17 31 12.075 | -15 13 16.18 |
| 2016 Jun 11 | 1 25.7  | 185 | 0.181 | 16.25 | 9.4  | 0.01 0.01 | 175 | 2UCAC 24880692 | 8 Flora         | 48 | 707 | 37 105 | 17 21 45.705 | -18 1 0.17   |
| 2016 Jun 11 | 1 31.1  | 160 | 0.103 | 12.45 | 12.4 | 0.46 0.46 | 167 | 2UCAC 17983792 | 508 Princesonia | 63 | 548 | 37 96  | 16 39 26.584 | -32 30 26.46 |
| 2016 Jun 12 | 6 41.2  | 114 | 0.075 | 8.85  | 12.5 | 0.34 0.34 | 165 | 2UCAC 19934992 | 38 Leda         | 46 | 331 | 49 78  | 16 22 10.789 | -28 40 43.92 |
| 2016 Jun 13 | 4 27.3  | 185 | 0.182 | 16.15 | 9.4  | 0.02 0.02 | 174 | 2UCAC 24879069 | 8 Flora         | 76 | 580 | 58 78  | 17 19 20.850 | -18 3 16.83  |
| 2016 Jun 13 | 4 27.3  | 185 | 0.182 | 16.15 | 9.4  | 0.02 0.02 | 174 | 2UCAC 24879069 | 8 Flora         | 76 | 580 | 58 78  | 17 19 20.850 | -18 3 16.83  |
| 2016 Jun 13 | 5 13.4  | 122 | 0.082 | 10.85 | 11.2 | 2.1 2.1   | 109 | 2UCAC 24991849 | 521 Brixia      | 32 | 607 | 58 150 | 22 35 9.543  | -18 28 29.11 |
| 2016 Jun 13 | 8 23.3  | 208 | 0.19  | 26.45 | 11.2 | 0.09 0.09 | 118 | 2UCAC 32798331 | 85 Io           | 56 | 262 | 60 136 | 21 20 50.588 | 2 39 51.10   |
| 2016 Jun 15 | 9 20.9  | 174 | 0.119 | 14.75 | 11.3 | 0.7 0.7   | 169 | 2UCAC 17565215 | 120 Laethestis  | 30 | 772 | 77 61  | 17 50 48.598 | -33 30 52.38 |
| 2016 Jun 16 | 9 6.4   | 133 | 0.037 | 8.15  | 12.5 | 3.9 3.9   | 157 | 2UCAC 18204903 | 588 Achilles    | 12 | 644 | 85 30  | 16 4 33.029  | -32 25 29.80 |
| 2016 Jun 17 | 5 51.1  | 195 | 0.116 | 13.45 | 12   | 0.7 0.7   | 173 | 2UCAC 25807159 | 95 Arethusa     | 63 | 18  | 90 34  | 17 35 58.685 | -16 17 6.72  |
| 2016 Jun 17 | 6 22.1  | 105 | 0.088 | 9.75  | 12.2 | 0.22 0.22 | 171 | 2UCAC 26255125 | 58 Concordia    | 54 | 378 | 90 31  | 17 24 42.741 | -15 11 12.60 |

|             |         |     |       |       |      |      |      |     |                |                |    |     |         |              |              |
|-------------|---------|-----|-------|-------|------|------|------|-----|----------------|----------------|----|-----|---------|--------------|--------------|
| 2016 Jun 19 | 2 45.8  | 174 | 0.119 | 14.65 | 11.7 | 0.34 | 0.34 | 170 | 2UCAC 17791512 | 120 Lachesis   | 71 | 287 | 98 21   | 17 47 19.455 | -33 28 13.79 |
| 2016 Jun 19 | 3 42.0  | 185 | 0.182 | 16.55 | 9.5  | 0.01 | 0.01 | 169 | 2UCAC 24874639 | 8 Flora        | 77 | 216 | 98 5    | 17 12 37.244 | -18 10 27.06 |
| 2016 Jun 19 | 7 6.7   | 253 | 0.185 | 21.75 | 9.6  | 0.06 | 0.06 | 155 | 2UCAC 23157160 | 7 Irs          | 29 | 2   | 98 13   | 16 6 8.880   | -21 56 43.76 |
| 2016 Jun 19 | 7 6.7   | 253 | 0.185 | 21.75 | 9.6  | 0.06 | 0.06 | 155 | 2UCAC 23157160 | 7 Irs          | 29 | 2   | 98 13   | 16 6 8.880   | -21 56 43.76 |
| 2016 Jun 19 | 22 22.9 | 110 | 0.042 | 4.35  | 13.5 | 1.5  | 1.5  | 68  | 2UCAC 37719149 | 357 Ninina     | 39 | 542 | 100 105 | 10 47 37.130 | 16 41 21.74  |
| 2016 Jun 21 | 3 40.9  | 185 | 0.053 | 13.65 | 13.4 | 2.2  | 2.2  | 138 | 2UCAC 13153105 | 911 Agamemnon  | 60 | 584 | 99 51   | 15 0 54.765  | -43 43 35.68 |
| 2016 Jun 22 | 23 59.0 | 263 | 0.153 | 20.65 | 10.8 | 1.0  | 1.0  | 165 | 2UCAC 21585357 | 87 Sylvia      | 46 | 35  | 93 45   | 17 4 55.130  | -25 13 10.83 |
| 2016 Jun 23 | 4 11.0  | 263 | 0.153 | 20.65 | 11.6 | 0.19 | 0.19 | 165 | 2UCAC 21585271 | 87 Sylvia      | 76 | 479 | 92 47   | 17 4 46.717  | -25 13 25.95 |
| 2016 Jun 24 | 0 29.9  | 185 | 0.181 | 17.25 | 9.6  | 0.01 | 0.01 | 164 | 2UCAC 24871832 | 8 Flora        | 51 | 227 | 87 58   | 17 7 19.866  | -18 17 17.08 |
| 2016 Jun 25 | 22 22.9 | 174 | 0.054 | 10.05 | 13   | 2.6  | 2.6  | 161 | 2UCAC 14060524 | 1437 Diomedes  | 25 | 629 | 70 73   | 17 54 57.110 | -41 46 53.28 |
| 2016 Jun 26 | 9 56.4  | 109 | 0.05  | 4.25  | 10.5 | 2.2  | 2.2  | 73  | 2UCAC 36227604 | 57 Mnemosyne   | 42 | 267 | 65 34   | 1 13 55.209  | 12 33 44.26  |
| 2016 Jun 26 | 7 28.0  | 185 | 0.179 | 18.65 | 9.7  | 0.01 | 0.01 | 158 | 2UCAC 24869713 | 8 Flora        | 26 | 544 | 32 132  | 17 1 56.421  | -18 25 45.30 |
| 2016 Jun 29 | 8 3.9   | 145 | 0.122 | 12.35 | 11.8 | 0.21 | 0.21 | 167 | 2UCAC 16701851 | 141 Lumen      | 45 | 566 | 32 110  | 18 37 32.652 | -35 52 24.97 |
| 2016 Jul 4  | 4 50.9  | 253 | 0.177 | 33.85 | 10   | 0.02 | 0.02 | 139 | 2UCAC 23393797 | 7 Irs          | 43 | 392 | 0 142   | 15 56 11.095 | -21 2 20.83  |
| 2016 Jul 6  | 9 8.5   | 108 | 0.066 | 4.75  | 10.1 | 3.4  | 3.4  | 81  | 2UCAC 36934066 | 345 Terditina  | 39 | 589 | 5 106   | 1 20 34.437  | 14 38 21.18  |
| 2016 Jul 12 | 9 3.9   | 102 | 0.065 | 7.45  | 12   | 1.4  | 1.4  | 166 | 2UCAC 24933772 | 53 Kalyppo     | 14 | 741 | 53 73   | 18 33 2.843  | -18 10 1.87  |
| 2016 Jul 16 | 0 55.2  | 145 | 0.123 | 13.25 | 11.9 | 0.19 | 0.19 | 157 | 2UCAC 17132745 | 141 Lumen      | 64 | 85  | 85 31   | 18 18 47.796 | -34 54 42.89 |
| 2016 Jul 17 | 3 28.1  | 110 | 0.073 | 9.55  | 9.9  | 2.6  | 2.6  | 154 | 2UCAC 11898882 | 595 Polyxena   | 67 | 102 | 92 45   | 20 16 2.094  | -46 59 24.65 |
| 2016 Jul 19 | 1 32.1  | 105 | 0.08  | 21.35 | 12.6 | 0.5  | 0.5  | 139 | 2UCAC 26020247 | 58 Concoridia  | 74 | 786 | 99 30   | 17 3 8.833   | -15 44 11.91 |
| 2016 Jul 22 | 0 39.8  | 114 | 0.034 | 14.75 | 11.6 | 4.4  | 4.4  | 129 | 2UCAC 19935133 | 3063 Makhaon   | 87 | 99  | 95 77   | 16 23 15.800 | -28 52 54.99 |
| 2016 Jul 22 | 24 8.2  | 145 | 0.121 | 14.65 | 12   | 0.21 | 0.21 | 150 | 2UCAC 17354231 | 141 Lumen      | 61 | 433 | 89 67   | 18 12 14.895 | -34 18 42.30 |
| 2016 Jul 27 | 22 45.7 | 170 | 0.103 | 11.45 | 12   | 0.7  | 0.7  | 97  | 2UCAC 21099899 | 139 Juewa      | 82 | 285 | 39 163  | 14 25 43.455 | -26 21 44.52 |
| 2016 Jul 28 | 7 43.0  | 147 | 0.11  | 11.75 | 11.7 | 0.24 | 0.24 | 172 | 2UCAC 23510502 | 111 Ate        | 38 | 298 | 35 116  | 19 59 10.294 | -21 21 11.20 |
| 2016 Jul 29 | 5 34.3  | 230 | 0.242 | 27.55 | 10   | 0.07 | 0.07 | 166 | 2UCAC 27584544 | 19 Fortuna     | 70 | 585 | 25 106  | 21 28 45.498 | -12 2 46.88  |
| 2016 Aug 6  | 6 12.8  | 106 | 0.057 | 9.65  | 10.7 | 3.9  | 3.9  | 140 | 2UCAC 36923691 | 663 Gerlinde   | 14 | 489 | 23 92   | 22 10 19.345 | 14 11 26.23  |
| 2016 Aug 7  | 2 16.5  | 177 | 0.097 | 12.55 | 11.7 | 0.42 | 0.42 | 170 | 2UCAC 26798824 | 24 Themis      | 48 | 69  | 12 99   | 18 15 35.363 | -19 3 9.40   |
| 2016 Aug 7  | 9 58.3  | 135 | 0.047 | 3.25  | 12.2 | 2.2  | 2.2  | 30  | 2UCAC 36277189 | 489 Comacina   | 13 | 535 | 18 140  | 21 51 4.701  | -14 5 26.39  |
| 2016 Aug 9  | 0 48.4  | 263 | 0.132 | 95.15 | 12.2 | 0.36 | 0.36 | 117 | 2UCAC 21122716 | 87 Sylvia      | 77 | 779 | 20 82   | 7 9 3.218    | 12 52 55.57  |
| 2016 Aug 9  | 2 43.4  | 135 | 0.078 | 10.05 | 13   | 0.7  | 0.7  | 150 | 2UCAC 36936510 | 444 Gyphtis    | 40 | 732 | 34 46   | 16 46 43.562 | -26 8 34.10  |
| 2016 Aug 11 | 8 21.7  | 193 | 0.144 | 15.65 | 11.4 | 0.7  | 0.7  | 102 | 2UCAC 36737464 | 276 Adelheid   | 42 | 177 | 56 160  | 2 16 40.616  | 14 42 48.29  |
| 2016 Aug 21 | 4 52.6  | 185 | 0.14  | 21.65 | 10.6 | 0.03 | 0.03 | 105 | 2UCAC 23656108 | 8 Flora        | 14 | 105 | 90 112  | 16 51 23.507 | -20 56 6.92  |
| 2016 Aug 25 | 7 43.9  | 184 | 0.083 | 7.75  | 11.8 | 1.5  | 1.5  | 74  | 2UCAC 37664942 | 45 Eugenia     | 20 | 275 | 48 14   | 5 13 39.670  | 16 39 16.06  |
| 2016 Aug 26 | 8 13.0  | 106 | 0.059 | 7.35  | 13.2 | 1.2  | 1.2  | 155 | 2UCAC 36566404 | 663 Gerlinde   | 13 | 655 | 37 105  | 21 51 6.578  | 13 5 0.73    |
| 2016 Aug 31 | 7 16.9  | 110 | 0.078 | 6.15  | 11.5 | 1.6  | 1.6  | 90  | 2UCAC 32651188 | 814 Tauris     | 35 | 514 | 1 78    | 4 38 5.591   | 2 52 38.21   |
| 2016 Sep 3  | 8 25.3  | 215 | 0.111 | 6.95  | 11.3 | 0.6  | 0.6  | 66  | 2UCAC 42563011 | 13 Egeria      | 11 | 304 | 4 88    | 6 26 8.981   | 30 59 37.34  |
| 2016 Sep 3  | 8 25.3  | 215 | 0.111 | 6.95  | 11.3 | 0.6  | 0.6  | 66  | 2UCAC 42563011 | 13 Egeria      | 11 | 304 | 4 88    | 6 26 8.981   | 30 59 37.34  |
| 2016 Sep 3  | 22 47.9 | 160 | 0.074 | 9.85  | 13.2 | 1.0  | 1.0  | 89  | 2UCAC 18212853 | 508 Pincetonia | 79 | 314 | 6 61    | 16 32 17.908 | -32 14 38.80 |

|            |         |     |       |       |      |         |      |     |                |                |    |     |         |              |              |
|------------|---------|-----|-------|-------|------|---------|------|-----|----------------|----------------|----|-----|---------|--------------|--------------|
| 2016Sep 4  | 2331.0  | 105 | 0.062 | 3.55  | 11.7 | 0.46    | 0.46 | 66  | 2UCAC 25776822 | 42 Isis        | 45 | 526 | 12 25   | 15 6 12.866  | -16 2 49.38  |
| 2016Sep 6  | 4 2.2   | 185 | 0.128 | 12.65 | 10.4 | 0.42    | 0.42 | 93  | 2UCAC 23168762 | 8 Flora        | 15 | 534 | 20 40   | 17 4 28.222  | -21 55 1.43  |
| 2016Sep 6  | 4 2.2   | 185 | 0.128 | 12.65 | 10.4 | 0.42    | 0.42 | 93  | 2UCAC 23168762 | 8 Flora        | 15 | 534 | 20 40   | 17 4 28.222  | -21 55 1.43  |
| 2016Sep 7  | 1 16.6  | 117 | 0.079 | 6.55  | 12.8 | 0.8 0.8 |      | 93  | 2UCAC 21134896 | 404 Arshnoe    | 51 | 755 | 28 31   | 17 7 12.645  | -26 2 14.17  |
| 2016Sep 7  | 2 1.2   | 207 | 0.13  | 13.45 | 11.9 | 0.22    | 0.22 | 165 | 2UCAC 29568221 | 372 Palma      | 60 | 692 | 28 102  | 22 3 18.644  | -6 48 6.47   |
| 2016Sep 9  | 1 11.0  | 185 | 0.126 | 11.85 | 10.8 | 0.04    | 0.04 | 91  | 2UCAC 22954027 | 8 Flora        | 49 | 797 | 46 7    | 17 7 29.297  | -22 5 23.62  |
| 2016Sep 14 | 1 54.4  | 147 | 0.092 | 84.75 | 12.1 | 0.8 0.8 |      | 120 | 2UCAC 23504937 | 111 Ate        | 66 | 104 | 90 24   | 19 34 4.198  | -21 14 51.28 |
| 2016Sep 15 | 7 27.1  | 125 | 0.064 | 6.35  | 12.5 | 1.7 1.7 |      | 88  | 2UCAC 45479831 | 328 Gudrun     | 10 | 747 | 97 110  | 5 33 19.330  | 39 27 16.10  |
| 2016Sep 15 | 9 29.0  | 116 | 0.047 | 3.25  | 13.3 | 1.1 1.1 |      | 50  | 2UCAC 36640076 | 156 Xanthippe  | 23 | 617 | 97 149  | 8 15 58.127  | 13 44 52.28  |
| 2016Sep 16 | 24 1.3  | 175 | 0.077 | 5.05  | 11.9 | 0.21    | 0.21 | 53  | 2UCAC 19917949 | 89 Julia       | 29 | 446 | 100 129 | 14 39 29.215 | -28 46 59.17 |
| 2016Sep 17 | 0 48.5  | 134 | 0.158 | 29.55 | 11   | 0.12    | 0.12 | 142 | 2UCAC 29378600 | 56 Melete      | 63 | 402 | 100 41  | 21 8 37.137  | -7 6 54.16   |
| 2016Sep 19 | 7 15.0  | 102 | 0.055 | 4.75  | 10.2 | 3.2 3.2 |      | 77  | 2UCAC 40669802 | 135 Hertha     | 11 | 170 | 91 69   | 6 45 11.603  | 25 18 13.62  |
| 2016Sep 20 | 1 41.8  | 357 | 0.17  | 20.45 | 11.7 | 0.16    | 0.16 | 86  | 2UCAC 22961588 | 704 Interamnia | 39 | 775 | 85 139  | 17 32 46.265 | -22 20 56.48 |
| 2016Sep 21 | 3 1.6   | 174 | 0.082 | 9.45  | 12.5 | 1.0 1.0 |      | 88  | 2UCAC 19727825 | 120 Lathesis   | 26 | 294 | 75 150  | 17 42 15.926 | -29 24 29.24 |
| 2016Sep 23 | 2 49.5  | 117 | 0.071 | 5.05  | 10.4 | 3.4 3.4 |      | 83  | 2UCAC 20680942 | 404 Arshnoe    | 23 | 156 | 53 170  | 17 29 14.742 | -27 14 4.84  |
| 2016Sep 24 | 7 56.4  | 122 | 0.12  | 25.95 | 11.8 | 0.17    | 0.17 | 139 | 2UCAC 20054968 | 521 Brmia      | 17 | 534 | 40 136  | 22 5 45.955  | -28 56 55.07 |
| 2016Sep 27 | 23 39.7 | 174 | 0.079 | 8.25  | 12.3 | 1.2 1.2 |      | 82  | 2UCAC 19731832 | 120 Lathesis   | 64 | 404 | 9 116   | 17 49 6.519  | -29 10 3.64  |
| 2016Oct 5  | 4 49.0  | 184 | 0.101 | 23.85 | 12.1 | 0.8 0.8 |      | 106 | 2UCAC 37318421 | 45 Eugenia     | 12 | 92  | 15 152  | 5 45 12.907  | 15 45 25.75  |
| 2016Oct 8  | 3 55.5  | 108 | 0.117 | 11.75 | 10.9 | 0.7 0.7 |      | 162 | 2UCAC 36935719 | 345 Terdina    | 41 | 132 | 40 119  | 1 59 57.553  | 14 38 39.23  |
| 2016Oct 10 | 4 46.3  | 167 | 0.136 | 18.45 | 11.5 | 0.16    | 0.16 | 127 | 2UCAC 30633473 | 194 Prokne     | 42 | 439 | 60 125  | 4 32 57.280  | -3 26 29.71  |
| 2016Oct 12 | 7 51.2  | 132 | 0.083 | 7.85  | 12.1 | 0.9 0.9 |      | 91  | 2UCAC 41875803 | 200 Dynamene   | 21 | 126 | 81 141  | 7 25 14.643  | 28 40 29.93  |
| 2016Oct 13 | 0 19.1  | 174 | 0.074 | 6.55  | 11   | 2.7 2.7 |      | 71  | 2UCAC 19990272 | 120 Lathesis   | 46 | 459 | 86 65   | 18 6 18.270  | -28 37 48.90 |
| 2016Oct 17 | 23 53.0 | 169 | 0.069 | 7.55  | 12.5 | 1.8 1.8 |      | 78  | 2UCAC 14942233 | 536 Merapi     | 60 | 552 | 95 124  | 19 2 20.419  | -39 38 35.19 |
| 2016Oct 19 | 8 45.1  | 122 | 0.089 | 19.75 | 11.5 | 1.4 1.4 |      | 115 | 2UCAC 35164734 | 360 Carlota    | 49 | 40  | 85 21   | 6 3 39.446   | 9 38 53.86   |
| 2016Oct 20 | 24 1.0  | 151 | 0.154 | 22.95 | 9.7  | 0.02    | 0.02 | 153 | 2UCAC 29761758 | 11 Parthenope  | 45 | 514 | 70 92   | 0 18 53.911  | -5 50 34.67  |
| 2016Oct 20 | 24 1.0  | 151 | 0.154 | 22.95 | 9.7  | 0.02    | 0.02 | 153 | 2UCAC 29761758 | 11 Parthenope  | 45 | 514 | 70 92   | 0 18 53.911  | -5 50 34.67  |
| 2016Oct 29 | 0 32.1  | 106 | 0.035 | 2.95  | 11.5 | 2.4 2.4 |      | 42  | 2UCAC 19956504 | 674 Rachele    | 19 | 541 | 3 61    | 17 6 1.180   | -28 49 56.82 |
| 2016Nov 5  | 1 33.1  | 128 | 0.053 | 6.65  | 13   | 1.5 1.5 |      | 82  | 2UCAC 32783538 | 895 Helio      | 22 | 88  | 24 29   | 20 4 55.249  | 2 43 57.05   |
| 2016Nov 10 | 0 48.3  | 117 | 0.055 | 3.25  | 12.7 | 1.6 1.6 |      | 54  | 2UCAC 20023092 | 404 Arshnoe    | 27 | 308 | 73 64   | 18 52 14.063 | -28 34 23.73 |
| 2016Nov 15 | 0 11.3  | 102 | 0.04  | 3.15  | 11.6 | 3.2 3.2 |      | 54  | 2UCAC 23743533 | 53 Kalypso     | 32 | 728 | 100 132 | 19 12 2.066  | -20 44 1.52  |
| 2016Nov 19 | 0 51.7  | 554 | 0.239 | 28.55 | 10.2 | 0.02    | 0.02 | 84  | 2UCAC 30114067 | 2 Pallas       | 39 | 569 | 74 157  | 21 22 12.705 | -5 11 49.42  |
| 2016Nov 20 | 1 14.5  | 174 | 0.065 | 4.65  | 13.1 | 0.7 0.7 |      | 45  | 2UCAC 20962757 | 120 Lathesis   | 15 | 230 | 64 150  | 18 59 16.444 | -26 51 46.27 |
| 2016Nov 21 | 1 23.9  | 185 | 0.094 | 4.85  | 11   | 0.06    | 0.06 | 47  | 2UCAC 22338328 | 8 Flora        | 12 | 749 | 53 140  | 19 9 6.634   | -23 40 12.55 |
| 2016Nov 28 | 4 3.4   | 113 | 0.054 | 12.35 | 13.2 | 1.5 1.5 |      | 102 | 2UCAC 25450065 | 909 Ulla       | 27 | 670 | 2 118   | 23 43 6.897  | -17 11 29.47 |
| 2016Nov 30 | 6 3.0   | 117 | 0.065 | 8.05  | 12.1 | 1.5 1.5 |      | 136 | 2UCAC 29764825 | 772 Tanele     | 25 | 317 | 1 130   | 2 4 45 896   | -5 53 32.10  |
| 2016Dec 6  | 1 44.0  | 208 | 0.119 | 14.75 | 11.4 | 1.2 1.2 |      | 163 | 2UCAC 43418609 | 165 Loreley    | 10 | 574 | 36 119  | 5 49 3.571   | 33 21 18.54  |
| 2016Dec 6  | 4 34.0  | 547 | 0.42  | 17.85 | 7.2  | 0.00    | 0.00 | 129 | 2UCAC 38790874 | 4 Vesta        | 21 | 724 | 38 155  | 8 31 44.629  | 19 35 35.38  |
| 2016Dec 8  | 5 29.4  | 184 | 0.13  | 13.75 | 11.5 | 0.13    | 0.13 | 170 | 2UCAC 36592790 | 45 Eugenia     | 43 | 112 | 59 83   | 5 22 36.626  | 13 54 45.27  |

|             |        |     |       |       |      |      |      |     |                |                 |    |     |    |     |              |              |
|-------------|--------|-----|-------|-------|------|------|------|-----|----------------|-----------------|----|-----|----|-----|--------------|--------------|
| 2016 Dec 9  | 4 2.3  | 108 | 0.062 | 17.55 | 12.9 | 1.0  | 1.0  | 137 | 2UCAC 38250171 | 147 Protogeneia | 22 | 150 | 69 | 110 | 8 8 22.485   | 18 29 17.20  |
| 2016 Dec 9  | 6 53.8 | 208 | 0.12  | 14.35 | 11.1 | 1.4  | 1.4  | 166 | 2UCAC 43417793 | 165 Loreley     | 19 | 317 | 71 | 76  | 5 46 1.512   | 33 16 19.75  |
| 2016 Dec 25 | 5 35.1 | 102 | 0.081 | 7.65  | 11   | 0.9  | 0.9  | 172 | 2UCAC 41007016 | 135 Hertha      | 32 | 771 | 15 | 127 | 6 50 55.573  | 26 12 2.71   |
| 2016 Dec 27 | 7 51.0 | 127 | 0.094 | 9.15  | 11.8 | 0.19 | 0.19 | 176 | 2UCAC 41517475 | 146 Lucina      | 13 | 435 | 4  | 156 | 6 27 13.385  | 27 31 35.24  |
| 2017 Jan 1  | 1 48.0 | 208 | 0.115 | 6.15  | 11.8 | 0.6  | 0.6  | 63  | 2UCAC 30620658 | 85 Io           | 11 | 709 | 8  | 31  | 22 55 48.488 | - 3 35 44.23 |
| 2017 Jan 4  | 5 14.1 | 122 | 0.106 | 12.95 | 11.8 | 0.34 | 0.34 | 154 | 2UCAC 35522398 | 360 Carlota     | 36 | 606 | 33 | 87  | 5 26 20.201  | 10 34 15.25  |
| <b>TNOS</b> |        |     |       |       |      |      |      |     |                |                 |    |     |    |     |              |              |
| 2016 Apr 25 | 9 2.6  | 138 | 0.004 | 5.55  | 14.7 | 8.7  | 8.7  | 175 | 2UCAC 26462879 | 2004 HI79       | 27 | 272 | 91 | 30  | 14 32 18.746 | -14 39 27.05 |
| 2016 Jul 14 | 8 57.3 | 121 | 0.005 | 14.85 | 15   | 8.5  | 8.5  | 111 | 2UCAC 34764501 | 1999 RZ215      | 50 | 330 | 71 | 132 | 23 51 26.856 | 8 24 53.83   |