# UCAC2 42913552, a Double Star Discovered During an Asteroidal Occultation

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**Abstract**: The occultation of the star UCAC2 42913552 by the asteroid 388 Charybdis on December 3rd, 2012 has shown the duplicity of the star. Six observations carried out from Catalonia, Spain enable the determination of the parameters of this double star. A separation of 28.6 ± 0.6 milliarcseconds (mas) and a position angle (PA) of 110.2 ± 3.6 degrees has been calculated. From the steps in the light curve the estimated magnitudes without filter are 11.7 and 12.0. We suggest that this pair be included in the WDS catalog.

## Introduction

On December 3, 2012 the asteroid 388 Charybdis occulted the star UCAC2 42913552. This occultation, predicted by Steve Preston (Figure 1), was observable from northern Spain.

UCAC2 42913552 is a 11.3 magnitude star with the equatorial coordinates RA 6h 50m 29.57s, Dec. +31º 55' 48.76" (J2000.0).

The magnitude of the asteroid 388 Charybdis in the moment of the occultation was 13.4. This value has been obtained in the ephemeris web page of the Minor Planet Center (http://www.minorplanetcenter.net).

## Observations

Six stations observed this occultation with positive

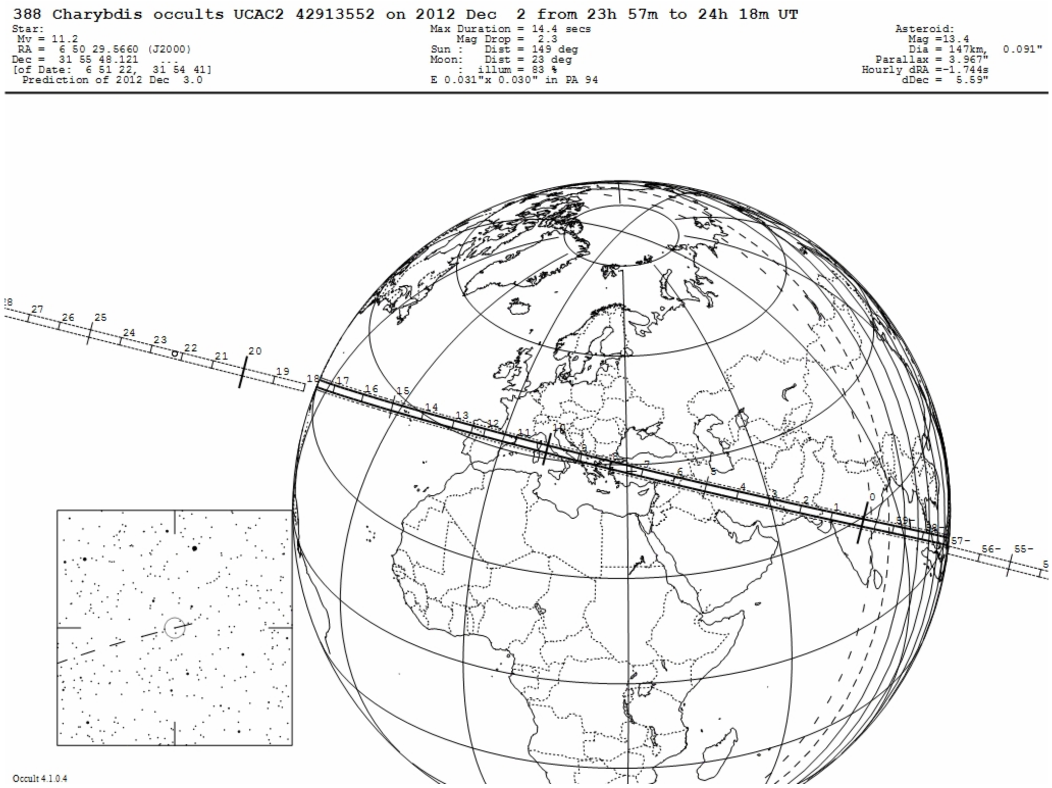


*Figure 1. Prediction of the occultation of the star UCAC2 42913552 by the asteroid 388 Charybdis on December 3rd, 2012 predicted by Steve Preston (http://www.asteroidoccultation.com/)*

results. Table 1 gives the geographical coordinates and instrumentation used.

While the observation of station #1 had a poor SNR, the other five stations obtained good light curves of the event, shown in Figures 2–6.

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*Table 1. Geographical coordinates and equipment of each station*

| # | Station Team | Longitude, Latitude & Altitude | Telescope | Equipment | Integration used |
|---|---|---|---|---|---|
| 1 | R. Casas | 2º 07′ 14.7″ E<br>41º 32′ 22.1″ N<br>165 m | Schmidt-Cassegrain<br>20 cm f/10 | TV Camera<br>Mintron 12V6H-EX + KIWI inserter time | 0.24 s |
| 2 | J. Juan | 1º 45' 55" E<br>41º 32′ 21″ N<br>423 m | Newton<br>40.6 cm | TV Camera<br>Watec 120N+ + KIWI inserter time | 0.04 s |
| 3 | R. Naves | 2º 23′ 07.6″ E<br>41º 31′ 11.3″ N<br>114 m | Schmidt-Cassegrain<br>30 cm f/10 | CCD Camera<br>ST8-MXE + NTP +<br>Driftscan method | N/A |
| 4 | C. Perelló – A. Selva | 2º 05′ 24.8″ E<br>41º 33′ 00.2″ N<br>224 m | Newton<br>50 cm f/4 | TV Camera<br>Mintron 12V6H-EX + KIWI inserter time | 0.04 s |
| 5 | J. Rovira | 2º 05′ 45.1″ E<br>41º 49′ 05.4″ N<br>827 m | Newton<br>20 cm f/5 | Mintron 12V6H-EX + KIWI inserter time | 0.16 s |
| 6 | C. Schnabel | 1º 52′ 25.7″ E<br>41º 29′ 41.5″ N<br>180 m | Newton<br>40 cm f/4 | TV Camera<br>Mintron 12V6H-EX + KIWI inserter time | 0.08 s |

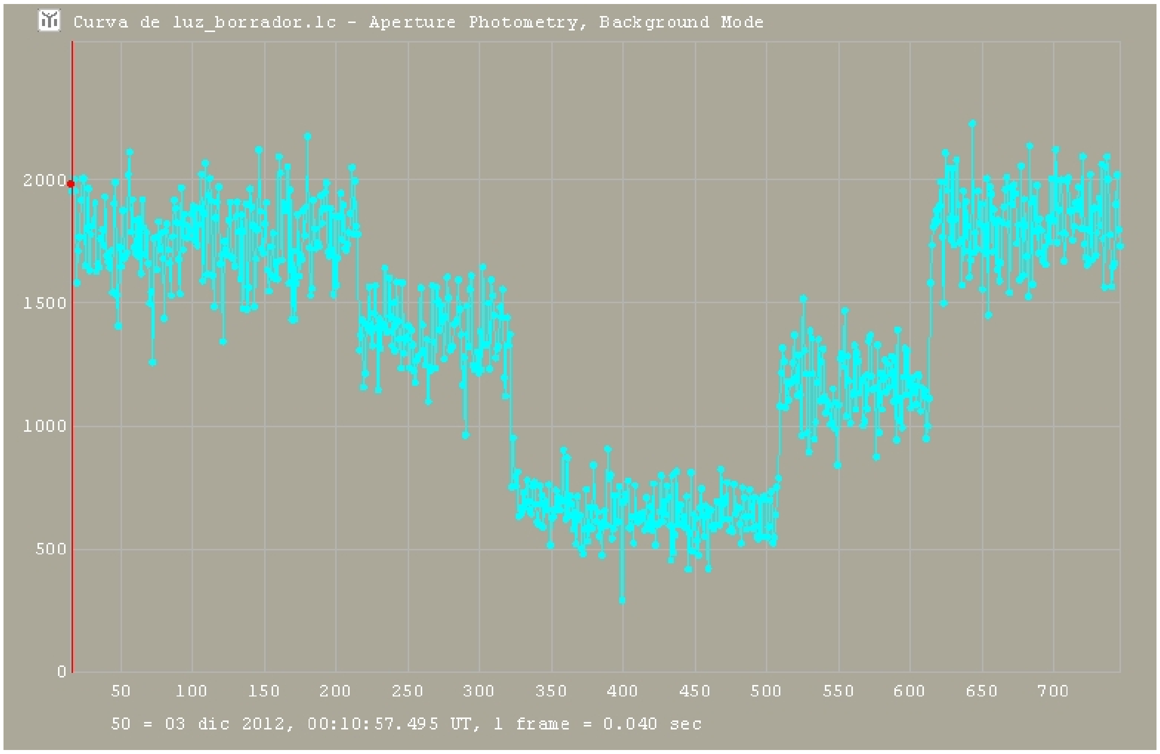


*Figure 2. Light curve obtained by J. Juan, station #2, using the software Tangra written by H. Pavlov (http://www.hristopavlov.net/Tangra/Tangra.html).*

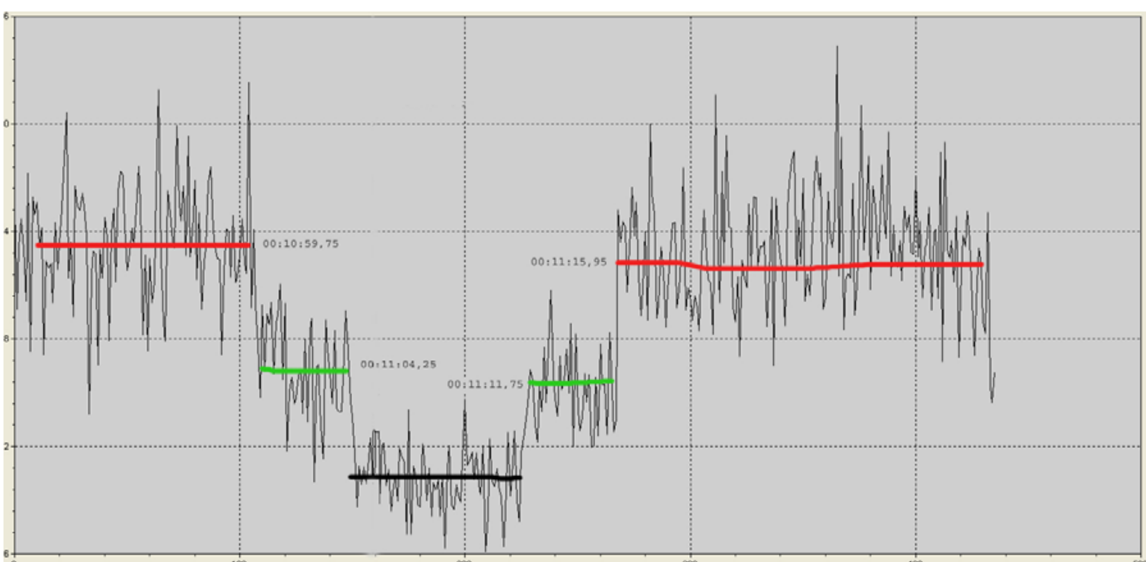


*Figure 3. Light curve obtained by R. Naves, station #3, using the software Winscan written by C. Flohr (http://www.driftscan.com/).*

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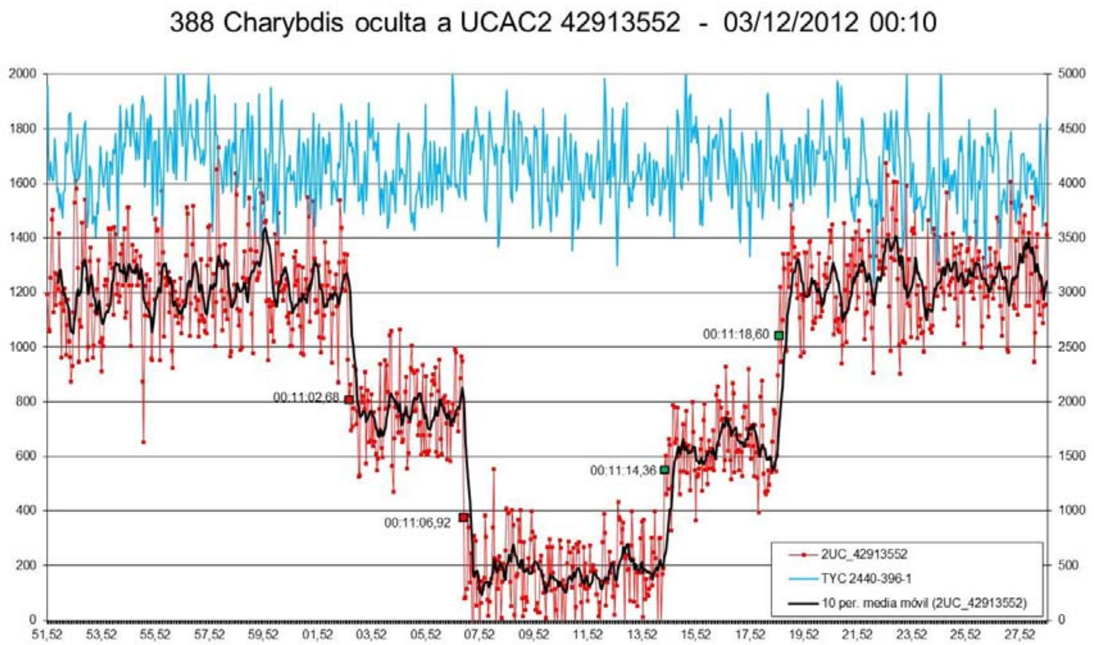


*Figure 4. Light curve obtained by Perelló-Selva, station #4, using the software Limovie written by K. Miyashita (http://www005.upp.so-net.ne.jp/k_miyash/occ02/limovie.html).*

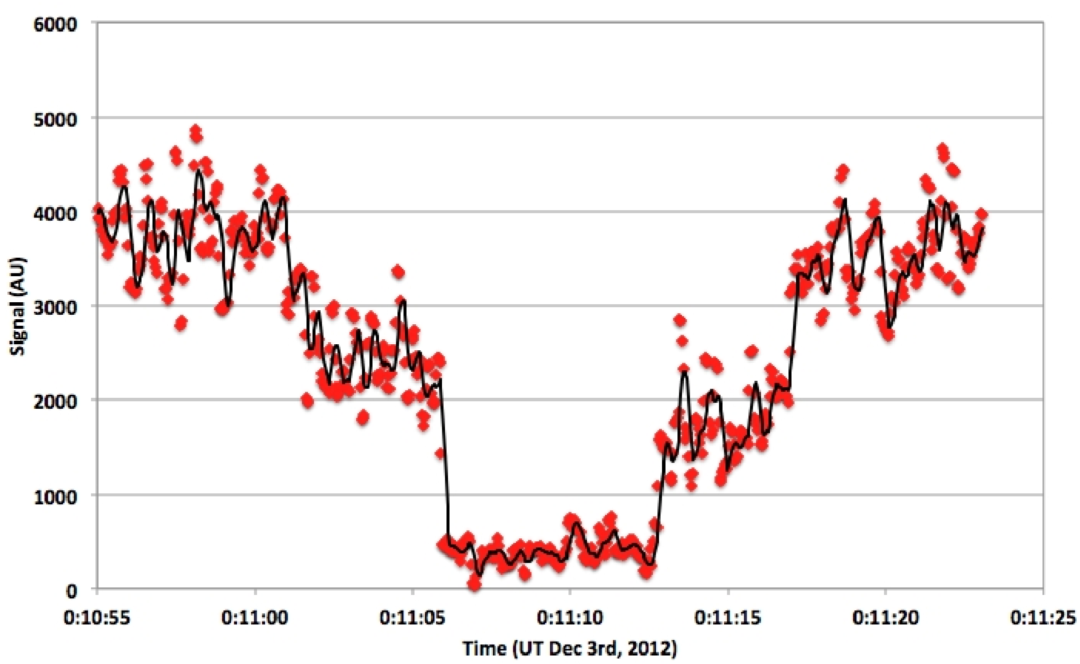


*Figure 5. Light curve obtained by J. Rovira, station #5, using Tangra software.*

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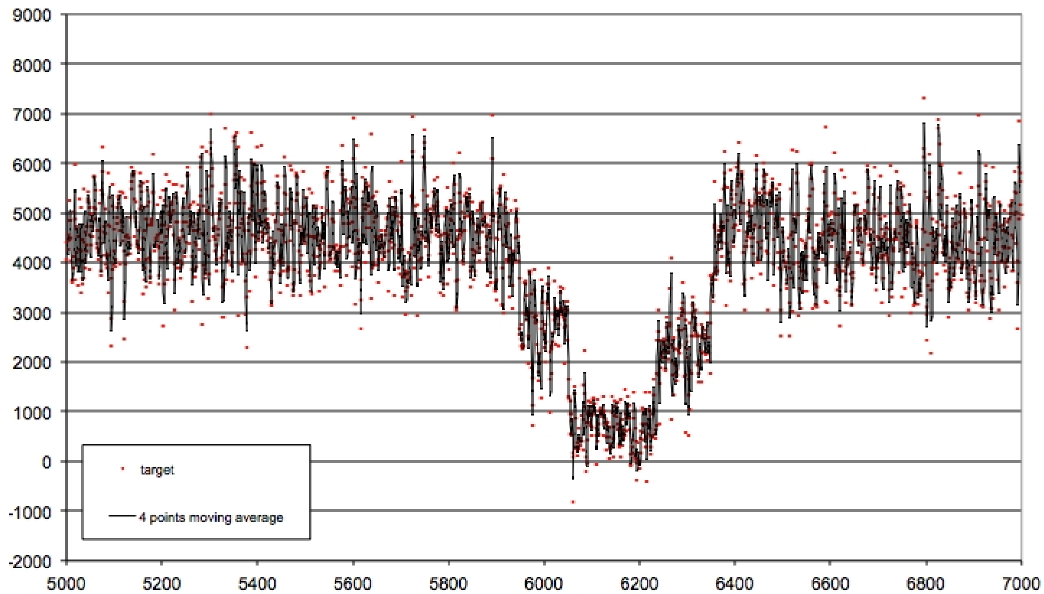


*Figure 6. Light curve obtained by C. Schnabel, station #6, using Limovie software for the analysis.*

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## Data Analysis

The figures clearly show the presence of two stages in the ingress and in the egress. The two stages are a characteristic clear signal of a double star system. Based on the nominal magnitude of the system (double star plus asteroid), 11.2, and the signal measured in these observations, we estimate the magnitude for each station, obtaining a magnitude for the first occulted star of 12.0 ± 0.1 and 11.7 ± 0.1 for the second one. These magnitudes are an approximation, since there were no photometric filters placed in front of the detectors.

Four timings have been registered for each station. As the secondary star (fainter) was the first one to be occulted, we label it as D2 (Disappearance of 2) the first timing, D1 (Disappearance of 1) the second one, R2 (Reappearance of 2) the third one and R1 (Reappearance of 1) the last one. These timings are listed in Table 2.

All timings obtained with TV-cameras (except station #3) have been corrected following the values ob-

*Table 2. Timings of the occultation. D1 and R1 are the disappearance and the reappearance of the brightness component of the double star, while D2 and R2 are, respectively, the disappearance and the reappearance of the secondary component.*

| # | D2 | D1 | R2 | R1 |
|---|---|---|---|---|
| 1 | 00:11:02.34 ± 0.82 | 00:11:05.91 ± 0.51 | 00:11:13.10 ± 0.83 | 00:11:17.79 ± 0.55 |
| 2 | 00:11:04.20 ± 0.53 | 00:11:08.35 ± 0.28 | 00:11:15.77 ± 0.40 | 00:11:20.12 ± 0.38 |
| 3 | 00:10:59.75 ± 0.10 | 00:11:04.25 ± 0.10 | 00:11:11.75 ± 0.10 | 00:11:11.75 ± 0.10 |
| 4 | 00:11:01.74 ± 0.45 | 00:11:05:87 ± 0.28 | 00:11:13.34 ± 0.49 | 00:11:17.70 ± 0.39 |
| 5 | 00:11:01.35 ± 0.43 | 00:11:05.71 ± 0.26 | 00:11:12.69 ± 0.54 | 00:11:16.81 ± 0.55 |
| 6 | 00:11:03.21 ± 0.59 | 00:11:07.82 ± 0.55 | 00:11:15.19 ± 0.66 | 00:11:19.42 ± 0.52 |

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tained by Gerhard Dangl (http://www.dangl.at/ausruest/vid_tim/vid_tim1.htm).

Using the software Occult 4.1.0 from David Herald (http://www.lunar-occultations.com/iota/occult4.htm) we fit the shape of the asteroid to an ellipse, obtaining a result of 150.0 ± 3.6 km × 118.0 ± 0.9 km, see Figure 7. A separation and position angle of the occulted double star were also obtained and the values are listed in table 3.

## Conclusions

The casual occultation caused by an asteroid of the star UCAC2 42913552 revealed its duplicity. The fact that a relatively large number of observers registered it has allowed us to determine the parameters of this binary system.

*Table 3. Parameters of the double star UCAC2 42913552*

| | |
|---|---|
| Distance (mas) | 28.6 ± 0.6 |
| PA (degrees) | 110.2 ± 3.6 |

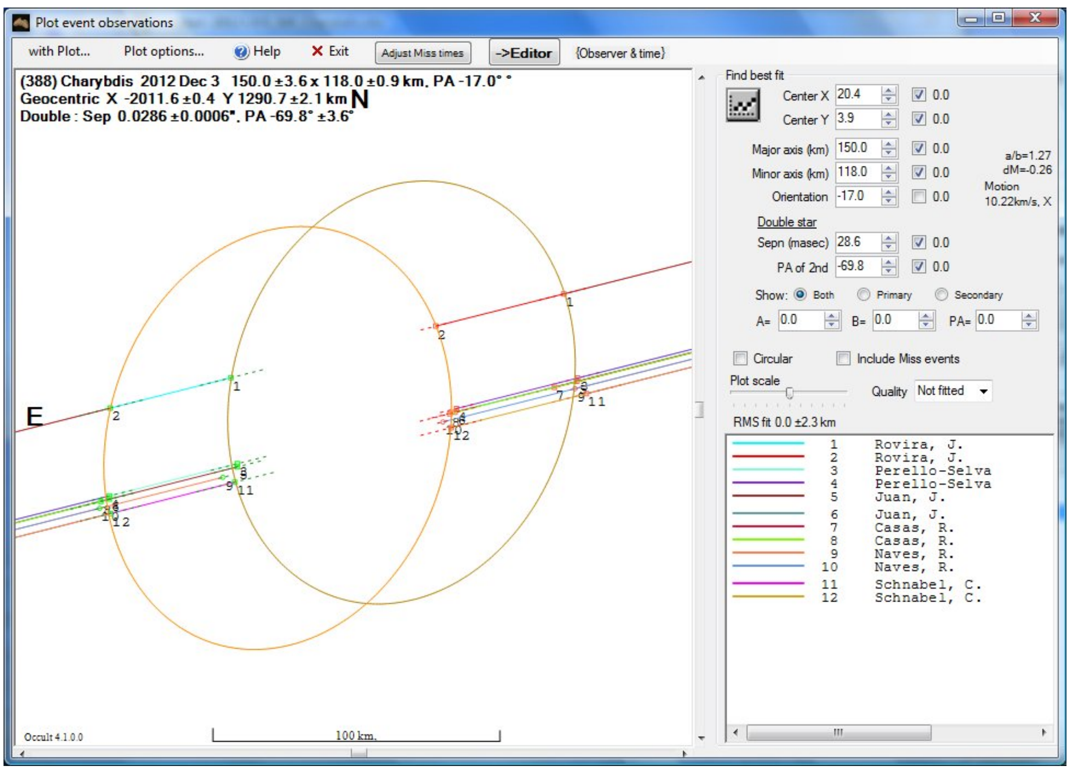


*Figure 7. Plot and fit obtained with Occult 4.1.0 (D. Herald)*