

A New Double Star from an Asteroidal Occultation: TYC 4677-00696-1

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Abstract: An occultation of TYC 4677-00696-1 by the asteroid (1048) Feodosia on 2009 November 18 showed this star to be a double star. Only one component of the double star was occulted and no separation or position angle could be calculated. The magnitude of the second component is estimated from visual observations to be 12.7.

Observation

On 2009 November 18 Alan Whitman observed the asteroid (1048) Feodosia occult the star TYC 4677-00696-1 from his observing site in Penticton, BC, Canada. The observations were made with a 40.6 cm Newtonian telescope, using visual observation, tape recorder, and time transfer from National Research Council 10am time signal on CBC radio. The star is of magnitude 10.06 V-TYC (9.98 GSC), 9.69 (R-NOMAD) and appeared to be this magnitude to the observer prior to occultation. The predicted magnitude drop at occultation was 4.7 magnitudes. The observed magnitude of the target star during the occultation was estimated to be 12.7 magnitude based on comparison with 12.9 magnitude GSC 4677-806. Using the estimated magnitude of the target star, the observed magnitude drop was 2.72. This is significantly less than the expected magnitude drop. The asteroid was later viewed to be approximately magnitude 14.8 as predicted. Therefore, the star seen during the occultation could not have been the asteroid. The star is not listed in the Fourth Interferometric Catalog, nor the Washington Double Star catalog. Figure 1 is of the field of view of the occulted star.

The report of the observation by Alan Whitman is as follows [note, some minor editing was performed to correct typos and data errors]:

On November 17, 2009 I discovered a previously unknown double star by means of an aster-



Figure 1: The field of view at the time of occultation is approximated by a C2A (Computer Aided Astronomy) planetarium software with a background image from the ESO Digitized Sky Survey. Upon extreme magnification of the DSS image, no duplicity in the target star is seen.

oid occultation. That is, the star TYC 4677-00696-1 is not shown as a binary in my Guide 7 software.

With my 16-inch Newtonian equatorial I observed the occultation by the magnitude 14.8 asteroid (1048) Feodosia of the magnitude 10.1 star TYC 4677-00696-1 in Cetus at RA 0h 58.26' Dec - 4d 52.8' (J2000). The occultation was thus predicted to have a magnitude drop of 4.7 magnitudes. The duration was predicted to be up to 6.5 seconds. I used ultra low power, only 45x,

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to dim the target star enough that there should be a clear cut disappearance, not just a dimming. The event was forecast to occur at my location south of Penticton, BC at 04:28:06 UT on November 18, 2009 (2028 PST on November 17). I was located north of the predicted path, 111km North of the centerline of what was expected to be a 80km wide path. Thus IOTA gave me only a 10 percent chance of experiencing an occultation.

At 04:28:01.0 the magnitude 10.1 target star TYC 4677-00696-1 crisply faded but did NOT disappear. It remained at least as bright as magnitude 12.9 GSC 4677-806 located 1.7' northeast. This failure to dim the predicted 4.7 magnitudes completely surprised me and resulted in a very long reaction time that I estimated to be 0.75 seconds. (This estimate is on the tape, a couple of minutes after the event.) I recovered from my surprise enough to make a conscious effort to compare the magnitudes of the two stars during the brief occultation. Reappearance was at 04:28:04.9, after correction for the much better reaction time of 0.25 seconds at the crisp, unmistakable reappearance. [These event

times may be slightly changed when I check my digital watch against the National Research Council 10am time signal on CBC radio. I cannot receive WWV in this mountain valley.]

Transparency was excellent and the seeing was fair since the 1.8" double star Alpha Psc was only occasionally split at 366x. Nevertheless, the stars looked crisp at the ultra low power used to monitor the asteroid occultation.

I observed the asteroid 54 minutes after the event, when it had moved 18" away from the target star, and the asteroid was barely visible with direct vision at 366x. So the asteroid was as faint as it should be. The asteroid could not have been seen with the ultra low power of only 45x used during the occultation. Therefore the object which was at least magnitude 12.9 during the asteroid occultation must have been a companion star.

The asteroid occultation has thus revealed that TYC 4677-00696-1 is a previously unknown binary star.

Based on the data presented in this report, the double star characteristics are:

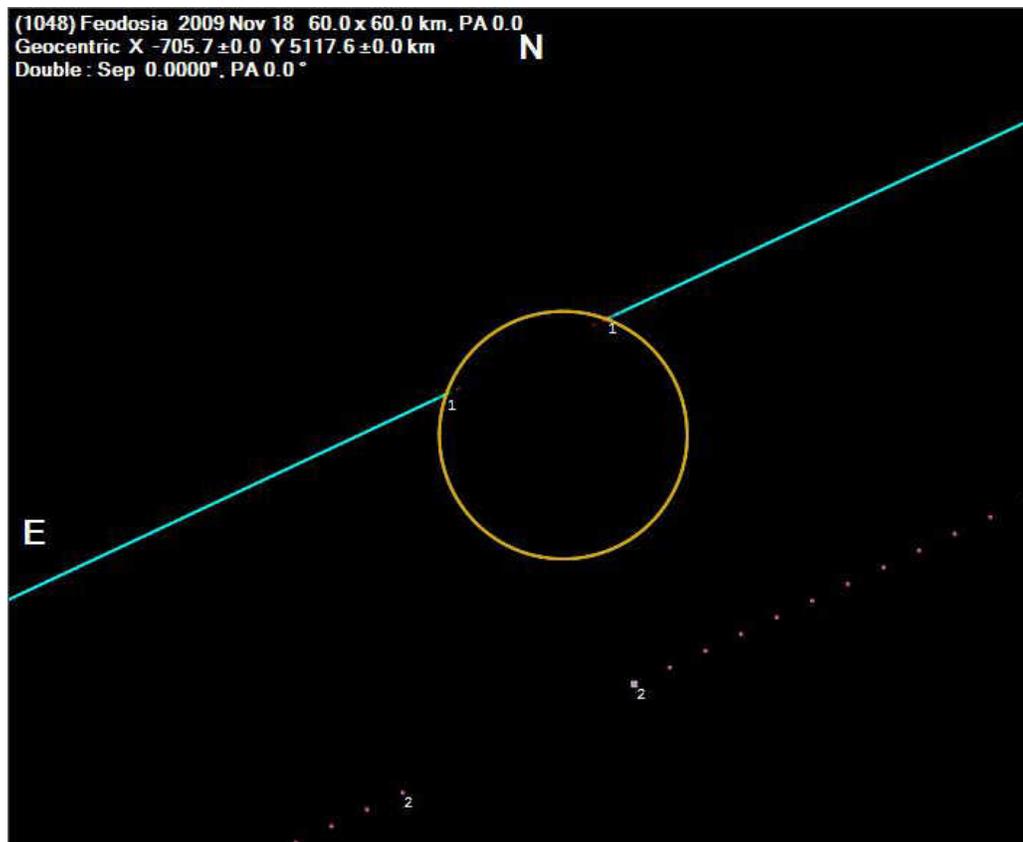


Figure 2: Occultation (1048) Feodosia occultation of TYC 4677-00696 plot

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Star TYC 4677-00696-1
PPM 182881
BD -05 deg. 161
HD 5667
UCAC2 30123903
3UC 58783340
NOMAD 0851-0000248
spectral type F5V

Coordinates (J2000)

00 58 15.728, -04 52 41.02 (Vizier)

Mag A 10.07 ±? (GSC)

Mag B 12.7 ±? (GSC)

Separation not reported but estimated to be no less than 5.5-30 mas (milli-arcseconds) based on the chord fit and minimum-maximum distance to graze

edge. The reported chord profile is shown in Figure 2. Since there was a single observer of the occultation, a circle with the asteroid's expected diameter of 60 km was fitted to the single chord, assuming that the asteroid's center passed south of the observing site, which is the side closest to the predicted centerline.

Position Angle not reported

