

A New Double Star from an Asteroid Occultation TYC 6356-00058-1

Dave Gault¹, Tony Barry¹, Peter Nosworthy¹, William Hanna²,
Steve Messner², David Oesper², Robert Dunford², Randy Trank²,
Steve Preston², and Dave Herald²

- 1) Trans-Tasman Occultation Alliance
- 2) International Occultation Timing Association (IOTA)

Abstract: On May 2nd 2020, (259) Aletheia was predicted to occult TYC 6356-00058-1, and four observers at sites in Eastern Australia attempted to observe the event. Observers at three sites each observed an occultation while one observer observed the star during the occultation period but did not observe an occultation. Close examination of the disappearance at each of the three sites revealed that the star has a faint companion of magnitude 13.5, at a separation of 2.6 mas.

Prediction

The occultation was predicted by Preston using Occult software. Figure 1 shows the path of the asteroid's shadow across the Earth and the location of the

observing sites. It should be noted that sites N (Peter Nosworthy) and B (Tony Barry) perfectly overlapped with respect to the path of the asteroid's shadow.

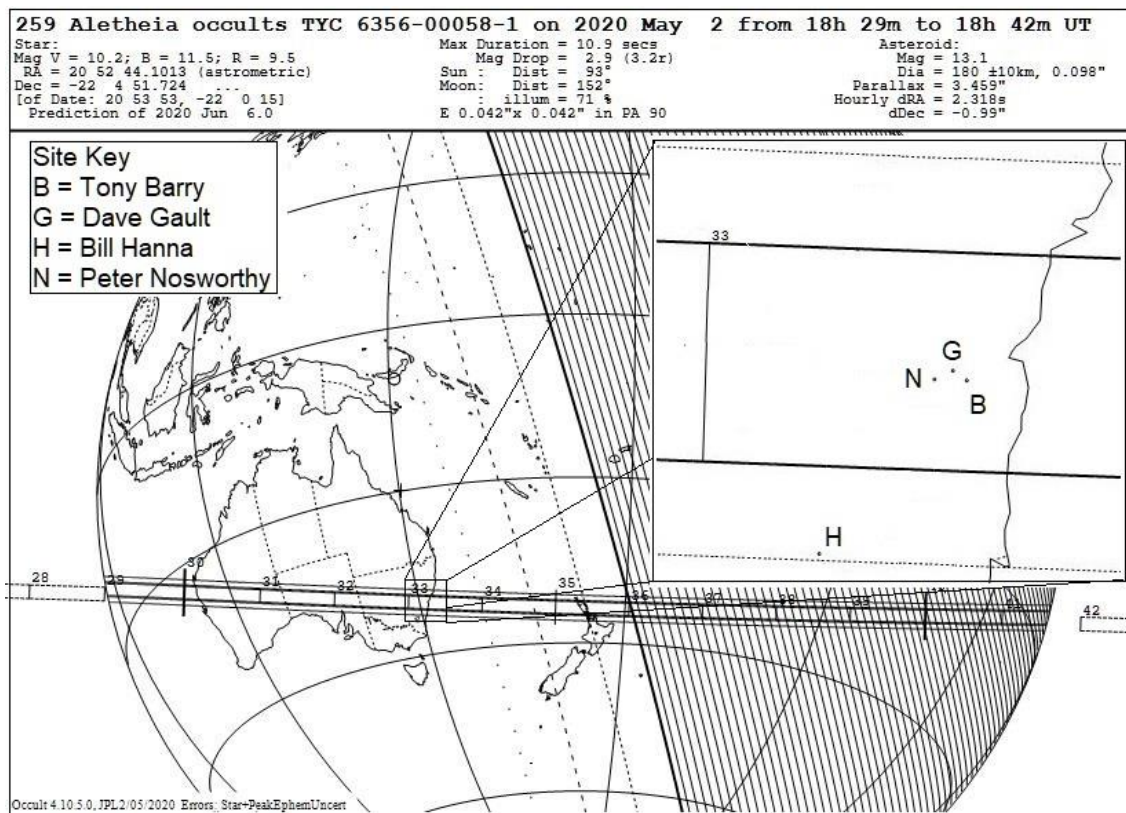


Figure 1: Occultation period and location of observing sites.

A New Double Star from an Asteroid Occultation TYC 6356-00058-1

Observations

Nosworthy and Gault used GPS time inserted PAL (analogue) video.

Barry used a GPS disciplined digital video system.

Hanna used a QHY174 camera system with built in GPS receiver.

Positive detections were observed at three sites as shown in Figure 2.

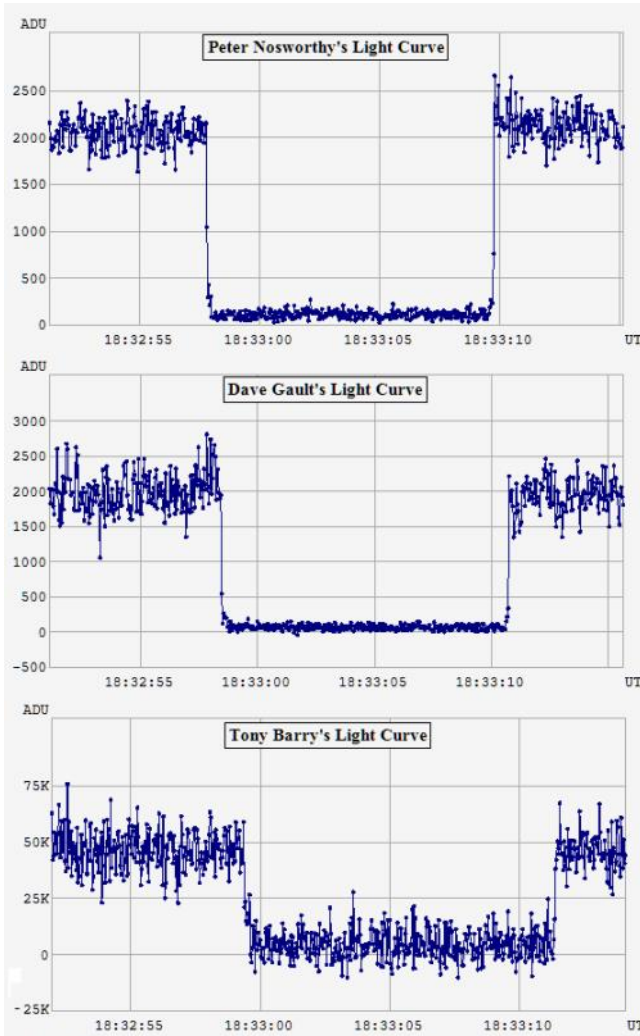


Figure 2: The complete light curves of the three observers

Nosworthy and Barry both observed occultations of 11.96 seconds duration, while Gault observed an occultation of 12.28 seconds duration.

All three observations revealed a step event at Disappearance shown at the bottom of the curve near extinction but well clear of the noise level. Further discussion of the disappearance steps will occur later in this paper.

Nosworthy’s reappearance showed a 2-frame hesitation marginally above the noise level, before complete reappearance

Gault’s reappearance showed an increasing reappearance over 3-frame duration

Barry’s reappearance was instantaneous.

Examination of the Disappearance Steps

Figure 3 shows the disappearance light curves in detail with the measures of the step shown in red which depicts the detected light from the new stellar companion.

Nosworthy detected the companion for 0.20 seconds after the disappearance of the prime star.

Gault detected the companion for 0.24 seconds after the disappearance of the prime star.

Barry detected the companion for 0.26 seconds after the disappearance of the prime star.

Analysis of the Occultation Fit

The basis for analysis of asteroid occultations involving double stars is presented by Herald, et al 20103, in addition the present observation has the complication of two chords superimposed and an additional close chord, means that a circular ellipse is typically used to determine the companion’s separation and position angle, however this produced a very poor fit of circular ellipse.

It was noted that a previous 4-chord occultation observation by (259) Aletheia was observed in 2018, production a Best-Fit-Ellipse of 210.0 x167.0km (Figure 4).

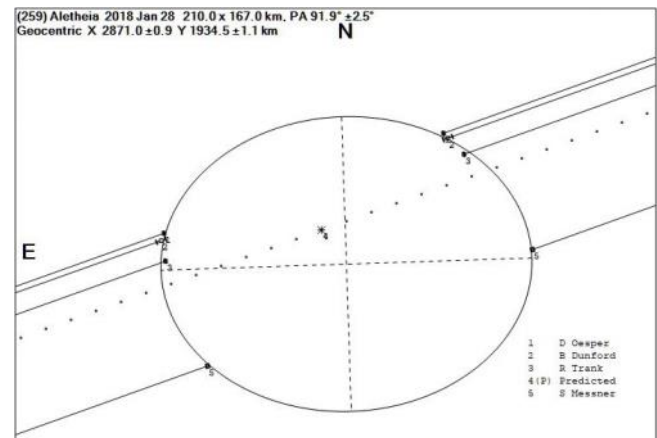


Figure 4: 2018 January 28, 4 chord occultation by (259) Aletheia

Figure 5 shows applying the 2018 observed Best-Fit-Ellipse dimensions to the present observation produced an excellent fit of all chords from both stellar components, giving a double star separation of 2.6 +/- 0.3 mas, at PA 174° +/- 3.5°

A New Double Star from an Asteroid Occultation TYC 6356-00058-1

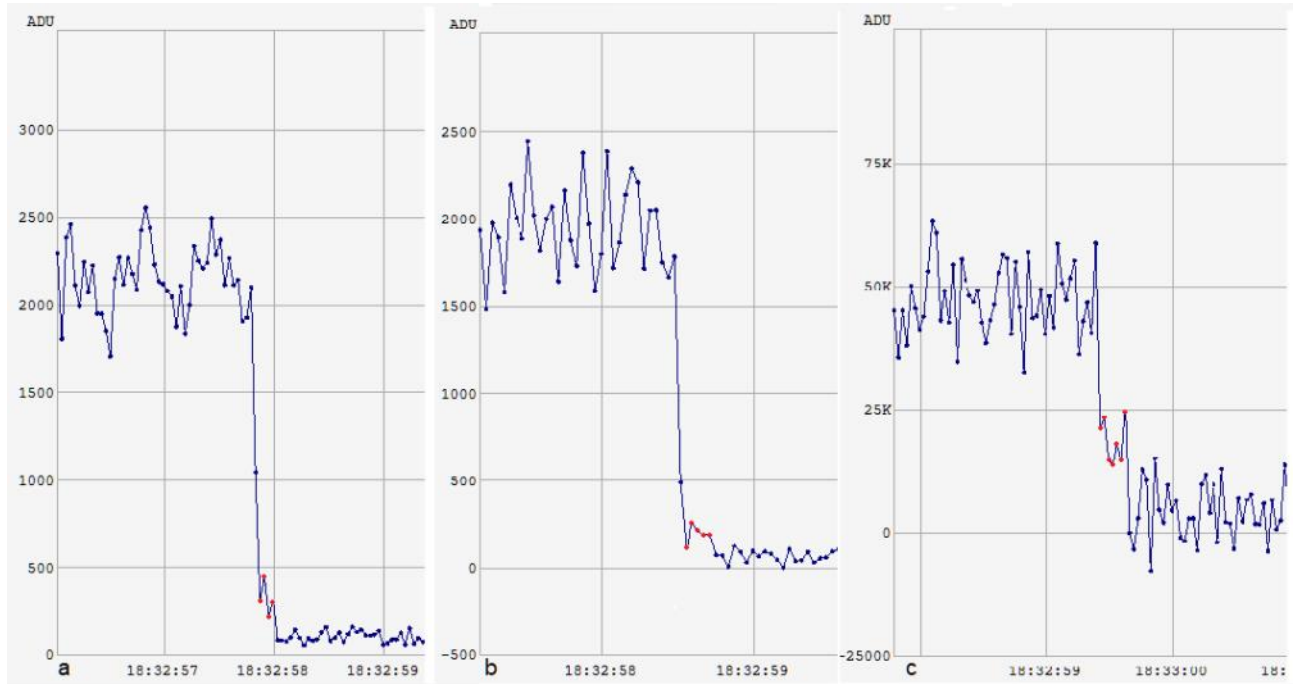


Figure 3: Detail light curves of (a) Peter Nosworthy, (b) Dave Gault, and (c) Tony Barry.

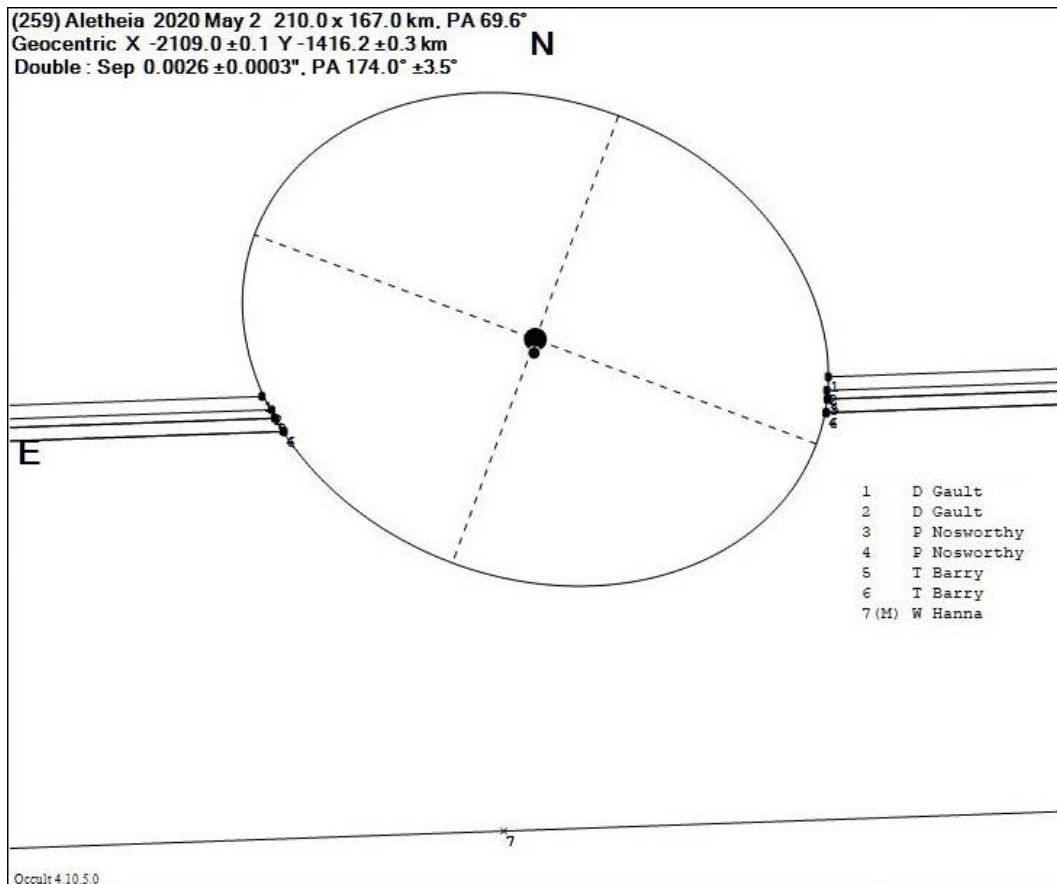


Figure 5: Best fit ellipse of chords from primary and new stellar companion.

A New Double Star from an Asteroid Occultation TYC 6356-00058-1

Estimation of Component Magnitudes

Fig. 6 Shows the estimation of the apparent visual magnitudes of both components, based on Gault's light curve, being;

A: Mag. 10.25 +/- 0.04 Mag.

B: Mag. 13.53 +/- 0.30 Mag.

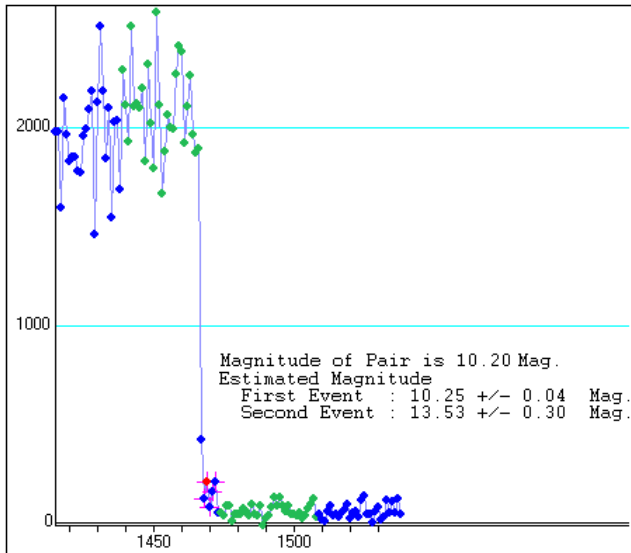


Figure 6: Estimation of component magnitudes.

Double Star Characteristics

Star TYC 6356-00058-1, SAO 189796, BD 22 5555

Coordinates (J2000) 20h 52m 44.1s, -22° 04m 51.9s

Spectral Type G5

Mag. A 10.25 +/- 0.04 (V)

Mag. B 13.53 +/- 0.30 (V)

Separation 2.6 +/- 0.3 mas

Position Angle 174° +/- 3.5°

Epoch 2020.3382

References

Herald D., 2010, Journal of Double Star Observations, 6, 88-96.