An unresolved 4.534-day eclipse: TIC 415460747 and TIC 2015971564

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Tustin, California. 28 October 2026. Not submitted to VSX. One note for the pair.

Abstract

Two TIC stars 0.75 arcsec apart, TIC 415460747 (V = 12.13, TYC 3987-00764-1) and TIC 2015971564 (V = 12.28), both fade on one clock. Neither star is a VSX entry. The QLP aperture cannot tell them apart, and the Gaia solutions are poor, so the host is not assigned. 27 minima of TIC 415460747 give

$$\mathrm{BJD_{TDB}} = 2459855.58848 + 4.533641\ E$$

with an rms O−C of 19 minutes. The ring search quoted BTJD 2855.589 + 4.533641 E, a depth of 0.13 mag, a width of about 3.6 hours, and residuals of 27 minutes. The period matches to the last quoted digit. The epoch is 0.8 minutes earlier. The rms of the well-bottomed minima is 19 minutes, not 27. Three minima still sit 29 to 47 minutes off. The local depth is 0.133 mag in the TYC star's aperture and 0.113 mag in the companion's. The time below 98 percent of normal light is 4.5 hours. The time below half depth is 3.4 hours, which is the 3.6-hour figure. No secondary is adopted.

1. How the stars were found

Same screen as TIC 422108500: 357 stars, V < 12.5, ring 1.50 to 1.60 degrees, QLP sectors 16, 17, 56, 57, 83 and 84. The pair lies 1.522 degrees, 91 arcmin, east of V345 Lac. The dip finder flagged both TIC numbers, 29 dips each, on the same dates. Sectors 16 and 17 are 30-minute cadence (KSPSAP_FLUX). The later sectors are 200-second cadence (DET_FLUX).

2. The two stars

TIC 415460747 is TYC 3987-00764-1, Gaia DR3 2006430088714032000, 2MASS J22290774+5456088, UCAC4 725-091546. TIC v8.2 J2000, MAST, 28 October 2026: 22h 29m 07.77s, +54° 56′ 08.8″ (RA 337.282384°, Dec 54.935791°). V = 12.134 ± 0.026, B = 12.58, T = 12.228, l = 103.39°, b = −2.44°. No TIC contamination ratio and no TIC parallax. The TIC proper motion, −8.8 and −7 mas $\mathrm{yr^{-1}}$, is a rounded value.

TIC 2015971564 is Gaia DR3 2006430084414311168. It has no TYC and no 2MASS entry in TIC. TIC position: RA 337.282051°, Dec 54.935705°, which is 0.755 arcsec from the TYC star. V = 12.281 ± 0.048, T = 12.055. The TIC parallax, −3.7 ± 1.4 mas, is not usable.

Gaia DR3, ESA TAP, 28 October 2026, puts the two sources 0.66 arcsec apart at epoch 2016. The companion lies at position angle 244° from the TYC star. DR3 parallax is 0.76 ± 0.18 mas for 2006430088714032000 and 0.47 ± 0.23 mas for 2006430084414311168. RUWE is 9.1 and 17.3. Those solutions are not good enough to decide whether the stars are at the same distance, and they are not used here. G magnitudes are 12.72 and 12.54.

3. The ephemeris

Minima were timed on TIC 415460747. A bottom whose sector-median flux is fainter than 0.91 was kept. Two detections with flux 0.92 and 0.96, whose lowest point is a real dip but whose vertex fell on the shoulder, were left out. 27 minima give

$$T_0 = 2855.58848\ \mathrm{BTJD},\ P = 4.533641 \pm 0.000016\ \mathrm{d}.$$

The formal error on T_0 is 3.8 minutes. The rms residual is 19 minutes and the largest is 47 minutes. The three large residuals are sector 17 at cycle −240 (+29 min), sector 57 at cycle 5 (−47 min), and sector 84 at cycle 165 (+43 min). The 30-minute cadence in the early sectors is part of that scatter. The same times, forced onto the ring-search epoch 2855.589, leave the same 19-minute rms. The quoted "27 minutes" is the right size of error. It is not the rms of this fit.

The local depth on 200-second sectors is 0.133 mag. The time below 98 percent is 4.5 hours. The time below half depth is 3.4 hours.

The companion light curve, reduced the same way, gives T_0 = 2855.59089 BTJD and P = 4.533634 ± 0.000021 d from 29 minima, rms 25 minutes, largest residual 70 minutes, local depth 0.113 mag. At the primary times of the TYC star the companion aperture falls to 0.906 of its light, and at the companion's times the TYC aperture falls to 0.890. The two curves are the same eclipse.

A box search on the TYC fold, outside the primary, is deepest at phase 0.524 and only 0.74 percent down. The box noise is 0.04 percent, so the bin is not empty, but it is not adopted as a secondary. The companion fold's deepest off-primary bin is 0.66 percent at phase 0.523.

Sector	Cycle	Mid-eclipse (BTJD)	UTC	Min. flux	O−C (min)
16	-246	1740.3054	2019-09-13 19:14	0.890	-10.7
16	-245	1744.8472	2019-09-18 08:14	0.893	+0.9
16	-243	1753.9306	2019-09-27 10:14	0.893	+24.2
16	-242	1758.4306	2019-10-01 22:14	0.891	-24.2
17	-240	1767.5348	2019-10-11 00:44	0.894	+28.9
17	-239	1772.0556	2019-10-15 13:14	0.895	+10.4
17	-237	1781.1180	2019-10-24 14:44	0.894	+3.4
17	-236	1785.6387	2019-10-29 03:14	0.897	-15.2
56	-6	2828.3820	2022-09-05 21:04	0.889	-6.6
56	-5	2832.9154	2022-09-10 09:52	0.892	-7.0
56	-3	2841.9805	2022-09-19 11:26	0.890	-10.1
56	-2	2846.5139	2022-09-24 00:14	0.889	-10.5
56	-1	2851.0545	2022-09-28 13:12	0.892	-0.4
57	0	2855.5954	2022-10-03 02:11	0.889	+9.9
57	1	2860.1346	2022-10-07 15:08	0.890	+17.9
57	3	2869.1899	2022-10-16 16:27	0.889	+0.7
57	4	2873.7309	2022-10-21 05:26	0.888	+11.3
57	5	2878.2239	2022-10-25 17:17	0.891	-47.2
83	156	3562.8195	2024-09-09 07:34	0.891	-24.3
83	157	3567.3562	2024-09-13 20:27	0.890	-19.9
83	159	3576.4478	2024-09-22 22:39	0.890	+15.0
84	161	3585.5187	2024-10-02 00:21	0.896	+20.3
84	162	3590.0254	2024-10-06 12:30	0.891	-18.5
84	163	3594.5765	2024-10-11 01:44	0.893	+6.7
84	164	3599.0983	2024-10-15 14:15	0.891	-10.4
84	165	3603.6690	2024-10-20 03:57	0.897	+43.0
84	166	3608.1816	2024-10-24 16:16	0.893	+12.6

Table 1. Minima of TIC 415460747. The companion is not tabulated separately. UTC uses JD 2457000.0 = 2014-12-08 12:00. Cycle 0 is the minimum nearest the quoted epoch.

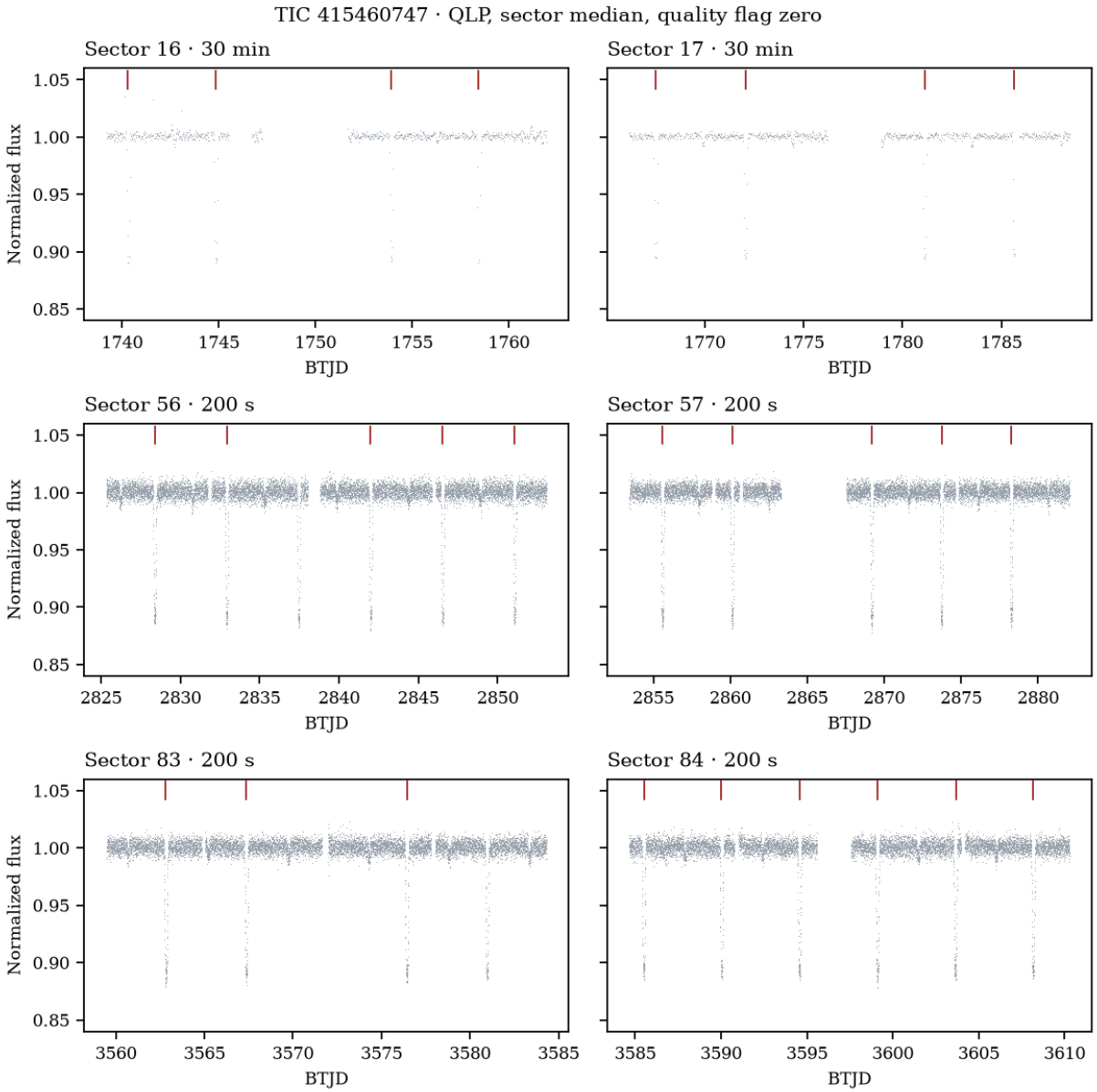

Figure 1. QLP light curves of TIC 415460747. Red ticks are the minima in Table 1.

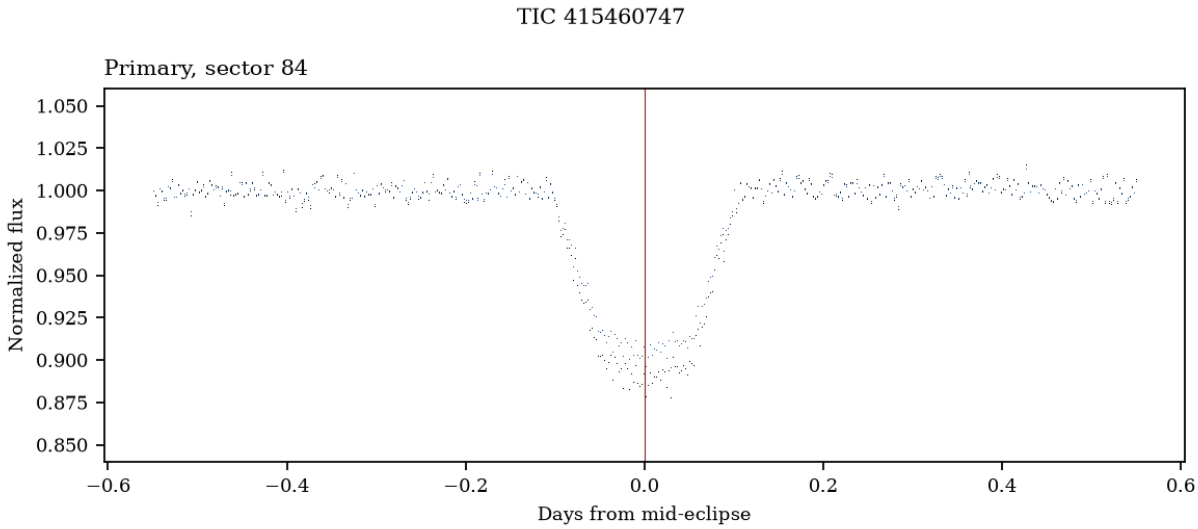

Figure 2. One minimum in sector 84. Black is TIC 415460747. Blue is TIC 2015971564, 0.75 arcsec away. Both fade.

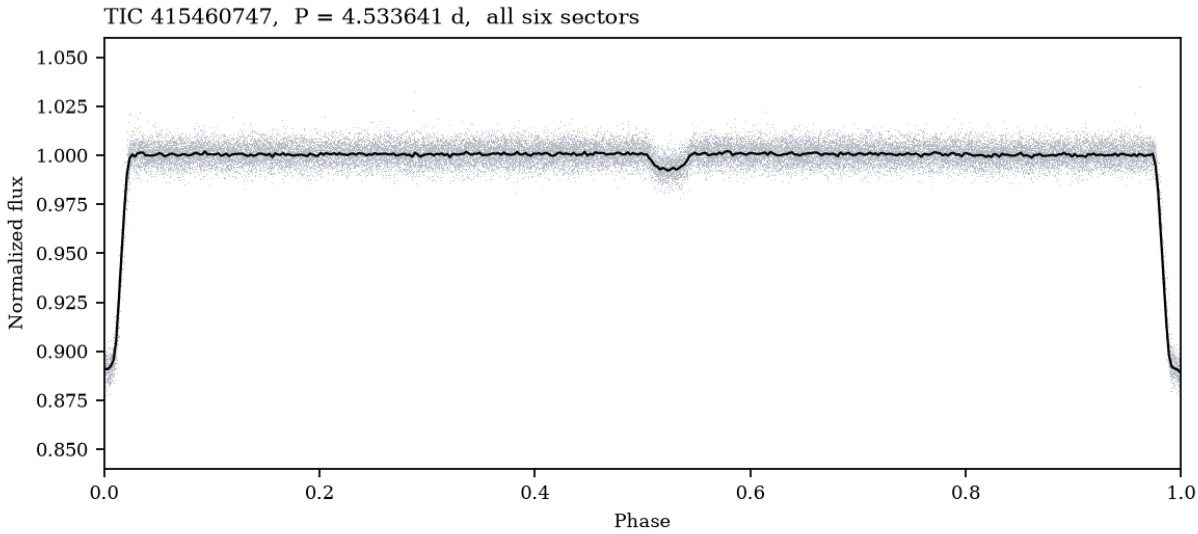

Figure 3. TIC 415460747, all six sectors, folded on the period above.

4. The host is not assigned

The two stars are a third of a TESS pixel apart. A centroid test cannot pick one of them. Shifts of the TIC 415460747 centroid during eclipse are under 0.3 arcsec in the 200-second sectors, inside a scatter of 0.4 to 0.9 arcsec. Sector 16, at 30-minute cadence, shifts by 0.85 arcsec against a scatter of 0.60 arcsec. That does not point from one star to the other. The companion centroid moves by the same amounts, which is what one blended aperture should do.

A star 107 arcsec away, TIC 415156996 (V = 12.21), stays at full light. No other V < 12.5 star sits inside 3 arcmin. Stars inside 15 arcsec are G = 15.7 or fainter, several magnitudes below the pair, and cannot be the whole dip. The eclipse is one of these two stars, or both. This note does not choose.

The VSX cone of 5 arcmin on 28 October 2026 does not list either TIC star. The nearest entry is Gaia DR3 2006430054363645568, a rotator 47 arcsec away.

5. Status

Not submitted to VSX, and not ready to submit until a ground observation separates the pair. TIC 330739083 is the one star in review on this account.

6. The other new stars in this ring

TIC 422108500, TIC 328546841, and the candidate TIC 328548852 are the other three notes from this ring.

7. The next minima

One clock, the ephemeris above. There is no secondary to predict. Counted from 2026-10-29 04:25 UTC.

- primary: BTJD 4347.1563, 2026-11-02 15:39 UTC, 2026-11-02 07:39 PT
- primary: BTJD 4351.6899, 2026-11-07 04:28 UTC, 2026-11-06 20:28 PT
- primary: BTJD 4356.2235, 2026-11-11 17:17 UTC, 2026-11-11 09:17 PT
- primary: BTJD 4360.7572, 2026-11-16 06:05 UTC, 2026-11-15 22:05 PT
- primary: BTJD 4365.2908, 2026-11-20 18:54 UTC, 2026-11-20 10:54 PT
- primary: BTJD 4369.8245, 2026-11-25 07:43 UTC, 2026-11-24 23:43 PT
- primary: BTJD 4374.3581, 2026-11-29 20:31 UTC, 2026-11-29 12:31 PT

The largest residual is 47 minutes, and the early sectors are timed on 30-minute cadences, so the middle can be off by about an hour. The fade lasts about 4.5 hours below 98 percent. Separate apertures, at a scale of about an arcsecond per pixel, are the useful measurement. A blended aperture will only repeat TESS.

References

- Gaia Collaboration, 2023, A&A;, 674, A1 (DR3). ESA TAP cone, 28 October 2026.
- Huang C. X. et al., 2020, RNAAS, 4, 204 (QLP)
- Stassun K. G. et al., 2019, AJ, 158, 138 (TIC). MAST, 28 October 2026.
- Watson C., Henden A., Price A., 2006–, AAVSO VSX. Cone of 5 arcmin, 28 October 2026.