A 4.586-day shallow dip, not adopted as a planet: TIC 428180639

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Tustin, California. Research note from the 1.80°–2.00° ring around V345 Lac, 5 November 2026. Nothing in this note has been submitted to VSX.

Abstract. TESS QLP aperture photometry of TIC 428180639 shows one repeating dip. Thirty-three minima give a period of 4.58649 days. The aperture falls to 0.966 of its sector median, 3.4 percent, 0.038 mag. The dip is rounded. The times scatter by 30 minutes. There is no second minimum at phase 0.5 that this note will claim. The star is hot and large. A 3.4 percent dip on that star has the size of a stellar companion, so the dip is not adopted as a planet. The note is not a VSX submission.

The star

TIC 428180639 is Gaia DR3 2007554713011699072. It has no Tycho match in the TESS Input Catalog. The catalog place is 22h 24m 56.42s, +56° 24′ 18.5″ (J2000). Gaia DR3 lies 0.1 arcsec from that place. V = 12.434 and the TESS magnitude is 12.09. The star is 1.940° from V345 Lac, 116 arcmin to the north-northeast, in the 1.80°–2.00° ring. Gaia DR3 gives G = 12.33, BP − RP = 0.55, parallax 0.386 ± 0.012 mas, and RUWE 0.92. Gaia did not publish a GSP-Phot radius or temperature. The TESS catalog lists 9664 K and a radius of 5.20 solar radii. Surface gravity, mass, and metallicity are blank in that header (the stored value is −1). The contamination ratio is blank. The parallax puts the star near 2600 parsecs. Ignoring extinction, the absolute G magnitude is about +0.3.

How it was found

The search is the same 1.80°–2.00° pass described for TIC 328038154. Sectors 16, 17, 56, 57, 77, 83, and 84 have QLP files, and sector 77 is the v02 file. The curves are SAP_FLUX divided by the sector median, quality flag exactly zero. The same dips are in the detrended column. No Lomb–Scargle period from the ring search was kept; the period below is a linear fit to the dip times.

Ephemeris

$$\text{Min} = \text{BTJD } 1741.13688 + 4.58649\ E$$

Thirty-three dips, from BTJD 1741 to 3608, were fit by linear least squares. The root-mean-square residual is 30 minutes. The largest residual is 62 minutes. The median minimum is 0.966 of the sector median, which is 3.4 percent and 0.038 mag. In the 200-second sectors the light stays under 98 percent for a median of 1.3 hours. That threshold sits near the bottom of a 3 percent dip, so it times the floor and misses the wings. The individual eclipses in sectors 56 and 84 are rounded scoops, visible for about a fifth of a day, with no flat floor. The 30-minute sectors show the same dip and cannot time its width.

Sector	Cycle	BTJD	UTC	Min. flux	O−C (min)
16	0	1741.118	2019-09-14 14:49	0.973	-27.5
16	3	1754.910	2019-09-28 09:49	0.973	+19.1
16	4	1759.514	2019-10-03 00:19	0.973	+44.6
17	6	1768.639	2019-10-12 03:19	0.971	-24.5
17	7	1773.243	2019-10-16 17:49	0.974	+0.9
17	9	1782.430	2019-10-25 22:19	0.971	+21.7
17	10	1787.014	2019-10-30 12:19	0.973	+17.0
56	237	2828.126	2022-09-05 15:01	0.966	-13.3
56	238	2832.689	2022-09-10 04:32	0.960	-47.6
56	239	2837.326	2022-09-14 19:48	0.965	+24.6
56	240	2841.863	2022-09-19 08:42	0.966	-46.5
56	241	2846.460	2022-09-23 23:02	0.960	-31.0
56	242	2851.062	2022-09-28 13:29	0.966	-8.8
57	243	2855.618	2022-10-03 02:49	0.962	-53.3
57	244	2860.268	2022-10-07 18:25	0.964	+38.8
57	246	2869.411	2022-10-16 21:52	0.966	-3.7
57	247	2874.006	2022-10-21 12:09	0.963	+8.4

Sector	Cycle	BTJD	UTC	Min. flux	O−C (min)
57	248	2878.596	2022-10-26 02:18	0.966	+13.7
77	361	3396.875	2024-03-27 09:00	0.966	+20.9
77	362	3401.408	2024-03-31 21:46	0.960	-57.0
77	363	3406.056	2024-04-05 13:20	0.965	+31.8
77	366	3419.786	2024-04-19 06:51	0.966	-10.4
83	397	3561.986	2024-09-08 11:39	0.968	+16.6
83	398	3566.555	2024-09-13 01:19	0.969	-7.9
83	399	3571.136	2024-09-17 15:16	0.964	-15.6
83	400	3575.734	2024-09-22 05:36	0.963	-0.0
83	401	3580.363	2024-09-26 20:43	0.966	+61.9
84	402	3584.887	2024-10-01 09:16	0.970	-29.1
84	403	3589.486	2024-10-05 23:40	0.962	-10.3
84	404	3594.083	2024-10-10 14:00	0.966	+5.2
84	405	3598.688	2024-10-15 04:30	0.964	+30.6
84	406	3603.236	2024-10-19 17:39	0.966	-24.1
84	407	3607.877	2024-10-24 09:03	0.965	+54.6

Could this be a planet?

A planet was the question these dips raised, and the measurements do not support one. The square root of a 3.4 percent depth is a radius ratio of 0.185. On the catalog radius of 5.2 solar radii that companion is 0.96 solar radii across, about 9.6 Jupiter radii, which is a star. A Jupiter in front of an A star of two or three solar radii removes well under one percent of the light. The phase median at phase 0.5 is 0.996, a four-tenths-of-a-percent notch, and it is not adopted as a secondary eclipse. A sine fit to the points outside phase 0.08 to 0.92 has an amplitude of 0.09 percent, so the dip is not the bottom of a spot wave of the same size. Feeding the time spent under 98 percent into the formula for a central circular transit returns a mean density near 8 solar densities. An A star at 9664 K with a radius of several solar radii is nowhere near that dense. The 98 percent width is the floor of a shallow rounded dip, not the full contact-to-contact time, so that density is not the star’s density. A grazing eclipse of a stellar companion produces a short rounded dip, a loose minimum time, and a missing or very shallow secondary. That is the reading adopted here.

Which star fades

The centroid shifts by 0.006 pixel between the dips and the light an hour away. The dip stays in this aperture. Inside 16 arcsec the other Gaia stars are G ≈ 20, except Gaia DR3 2007554511163206784 at 10.7 arcsec, G = 16.46. That neighbor is 4.1 magnitudes fainter, about 2.2 percent of the target’s light. A total eclipse of it is a little shallower than the 3.4 percent dip, so it does not by itself explain the dip. The nearest VSX object is Gaia DR3 2007554820400974080, type VAR, period 0.60814 days, G = 16.17–16.31, 76 arcsec away. It is not this clock.

Figures

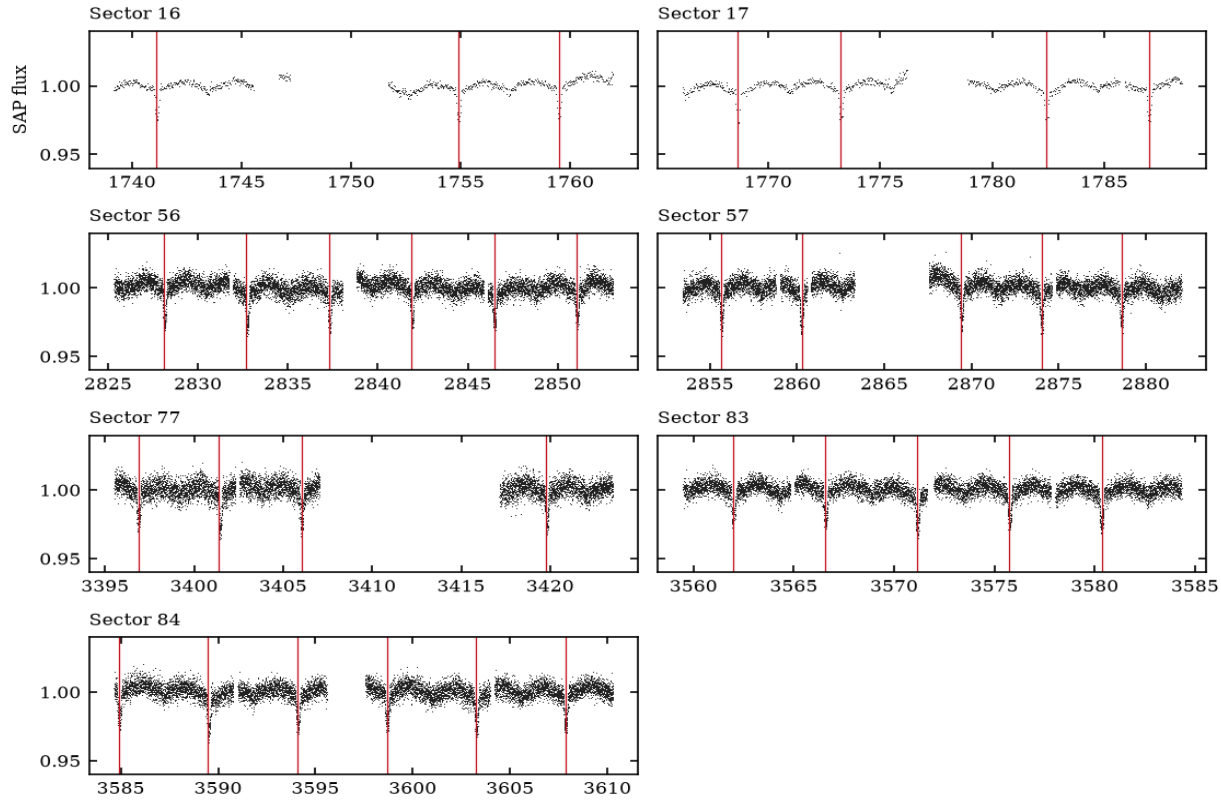


Figure 1. Seven TESS sectors. QLP SAP flux divided by the sector median, quality flag zero. Red ticks are the dips.

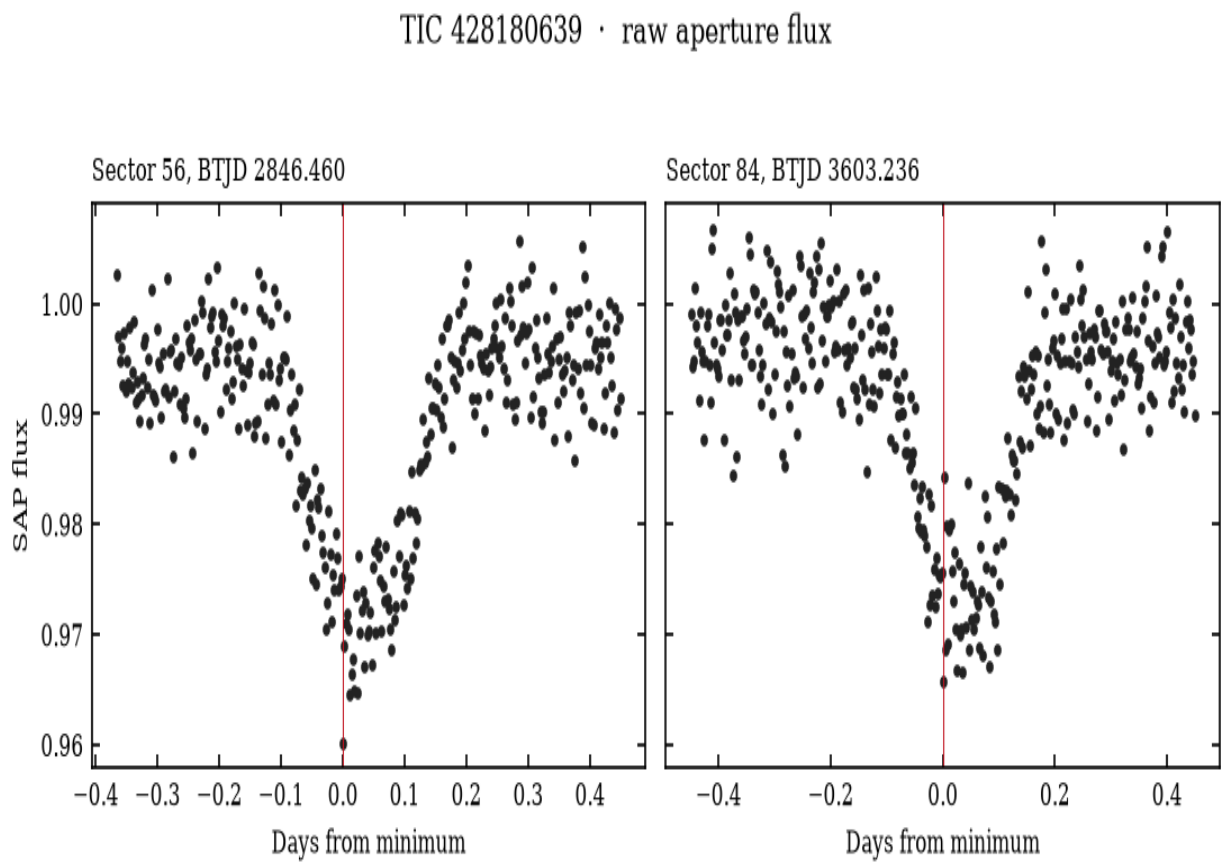


Figure 2. Two dips at 200-second cadence. Both are rounded. Neither has a flat floor.

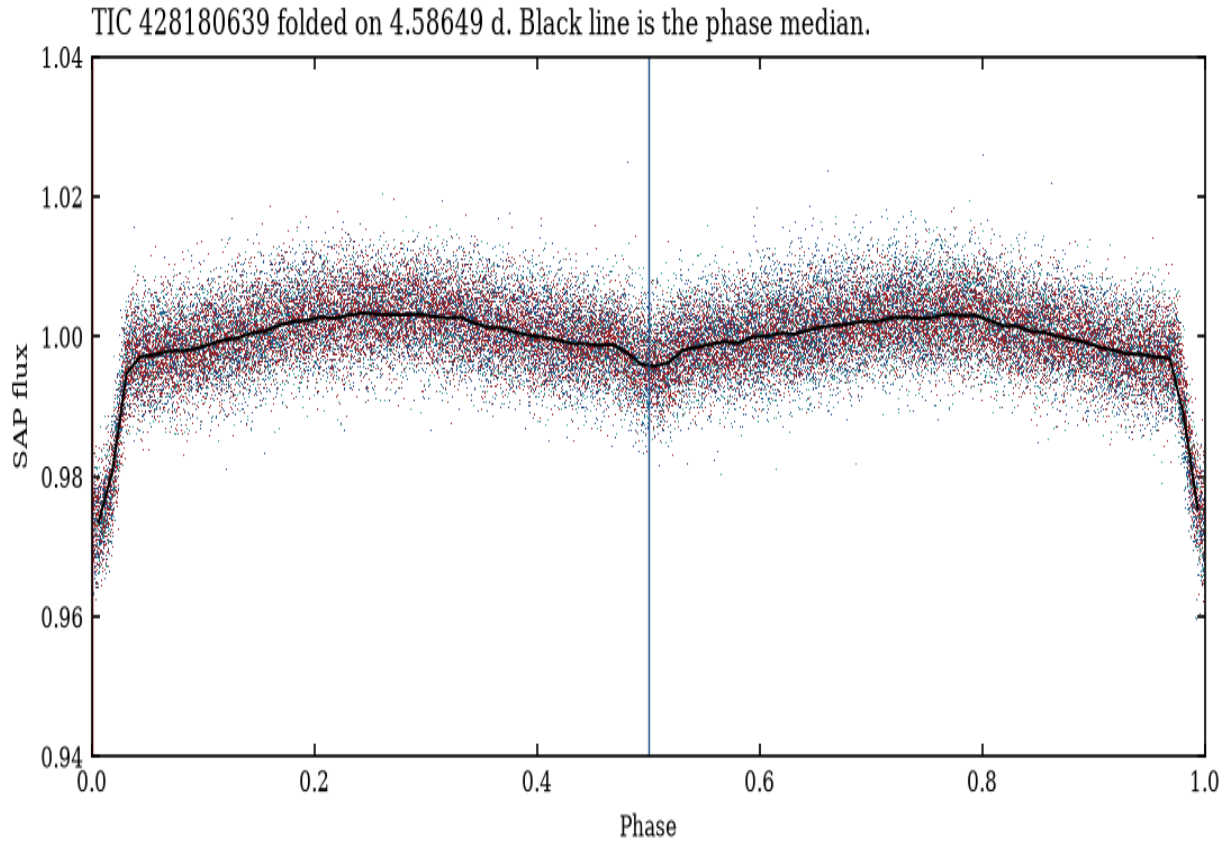


Figure 3. Folded on 4.58649 days. The black line is the phase median. The blue line is phase 0.5, where a secondary eclipse would sit.

Nothing in this note has been submitted to VSX. The dip repeats, and it is still a candidate: the shape is shallow, the timing scatter is half an hour, and no ground light curve exists. TIC 330739083 is still the one New submission on this account.

References

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