TIC 415156851: three planet-sized dips, fitting periods ruled out, unconfirmed

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Tustin, California. Research note from the 2.4 degree repeating-dip scan around V345 Lac, 18 November 2026.

Status: Unconfirmed dips. Not a planet claim. Found 18 Nov 2026. Not filed with VSX. Not yet checked from the ground.

Abstract

TIC 415156851 (Tmag 11.076) showed 3 clean dips of at least 0.5 percent in TESS Quick-Look Pipeline photometry, median depth 1.20 percent, median duration 3.4 hours. The dips are shallow enough that, on a star of the TIC radius 1.55 $R_{\odot}$, a dark body of about 1.69 R_{Jup} could produce them. That is a depth conversion only; it is not a planet measurement. The star is 1.393 degrees from V345 Lac, in the 1.30–1.40° ring. Every period that fits all the dips is ruled out by TESS coverage. This one, 19.6329 days (the gap divided by 1), missed the fewest predicted times (3). As of 18 November 2026, 12:00 UTC, the next listed time is 26 Nov 2026, 16:00 UTC with a window of ± 4.0 hours. Nothing in this note has been checked from the ground or submitted to VSX. This is not a planet claim.

1. How the star was found

A repeating-dip scan of TESS stars around V345 Lacertae (TIC 421726141) ran on 18 November 2026. It covered every TESS Input Catalog star within 2.4 degrees of V345 Lac with a TESS magnitude of 13.0 or brighter, 20,840 stars. The light curves are QLP SAP_FLUX, cadences with a quality flag of exactly zero, each sector divided by its own median. The period search uses the multiharmonic χ^2 periodogram approach of Rutkowski & Poleski (2026), run with 12 harmonics: a 12-term Fourier series is fitted at every trial frequency. Rutkowski & Poleski (2026) also introduced the fast Toeplitz-solver technique that accelerates this periodogram (their Toeplitz-LS code). The scan did not run the Toeplitz-LS code. It computed the same 12-harmonic periodogram with the finufft_chi2 backend of nifty-ls (Garrison et al. 2024), a separate package, which matched the Toeplitz-LS results in a test on our own TESS eclipsing binaries on 17 November 2026 and ran about twice as fast. The trial periods run from 0.4 to 30 days, with a frequency step of 1/(10T), where T is the time span of the light curve. The periodogram uses the median-normalized flux with no detrending. A box least-squares (BLS) search (Kovács, Zucker & Mazeh 2002), as implemented in Astropy, is the cross-check. It runs on a copy divided by a one-day running median and binned to 30 minutes, with trial durations of 1.5, 3, 5 and 8 hours. A star is kept as a candidate when at least two separate eclipses fall on the adopted period, the folded eclipse has a signal-to-noise ratio of at least 8, and the depth is at least 0.2 percent. TIC 415156851 did not pass as a periodic eclipse candidate under those cuts, but it had 3 clean dips of at least 0.5 percent. Its median dip depth was small enough that, on a star of its TIC radius, the body that would cause a transit of that depth could be under two Jupiter radii, so it is listed on the Planet-sized dips page. That page is a depth test only. None of these stars is a confirmed planet. The measurements below are made again from the scan's cached QLP light curves (Huang et al. 2020; Kunimoto et al. 2021). Sectors 16 and 17 are 30-minute cadence; later sectors used here are 200-second cadence. SAP_FLUX is used with the quality flag exactly zero, and each sector is divided by its own median. No detrending is applied unless a caption says otherwise. Catalog values are from the TESS Input Catalog (Stassun et al. 2019) as held in the scan catalog. No new observations were obtained.

2. The star

TIC 415156851 is Gaia DR3 2004873592564608512 in the scan catalog. The TIC v8.2 position used by the scan is 22h 28m 20.49s, +54° 36′ 30.1″ (J2000), RA 337.08537°, Dec +54.60835°. The TIC lists Tmag = 11.076, R = 1.55 $R_\odot$, and a contamination ratio of 0.282. T_{eff} = 7050 K from TIC v8.2. The TIC record used by the scan does not give a spectral type, so the spectral type is unknown here. Those catalog values assume a single star and are copied as published. From the scan positions of this star and of V345 Lac, the separation is 1.393 degrees, 83.6 arcmin, at position angle 92°, to the east. In 0.1-degree rings around V345 Lac it sits in the 1.30–1.40° ring. There is no VSX entry within 30 arcsec and no Gaia DR3 eclipsing binary within 5 arcsec recorded in the scan.

Quantity	Value
TESS sectors in the cached light curve	16, 17, 56, 57, 83, 84
Sectors with a counted dip	57, 83, 84
12-harmonic χ^2 periodogram peak	27.65037 d, SNR 63
BLS peak	0.52973 d, SNR 89.8, depth 0.20%
Clean dips ≥ 0.5%, off systematic times	3, depths 1.16–1.24%, median 1.20%
Median listed duration	3.4 h
BTJD range of the counted dips	2879.071 – 3585.757
TIC radius and implied body (depth only)	1.55 R_sun, about 1.69 R_Jup
TIC contamination ratio	0.282
Scan flags	broad_dips(EW/ellipsoidal/rotation-like); chi2_peak_is_other
Period confidence on the page	low
Adopted period used for the listed next time	19.6329 ± 0.0012 days; fallback reason: ruled

Table 1. Scan quantities for TIC 415156851, from the scan's own result file and the Planet-sized dips records. Depths are not corrected for light from other stars.

3. Dip times and shape

Each counted dip below is taken from the scan's dip list: barycentric time, depth in percent of the local light, a duration in hours, and the TESS sector. The shapes are judged by eye from the individual panels of Figure 2, each normalized to a line or median through the nearby light. An automatic comparison of box, V, U and sine models was also computed; it is not used as the verdict, because a sine can appear to fit a shallow, noisy fade. The verdicts below are the visual ones.

#	BTJD	Sector	Depth (%)	Duration (h)
1	2879.071	57	1.20	3.2
2	3566.292	83	1.16	3.4
3	3585.757	84	1.24	4.1

Table 2. Counted dips of TIC 415156851 from the 18 November 2026 scan.

Three dips of 1.16 to 1.24 percent were counted, one each in sectors 57, 83 and 84, lasting about 3.2 to 4.1 hours. They are V-shaped or rounded U-shaped, with no clear flat bottom. The third event, in sector 84, is the cleanest of the three and is still a V or rounded U, not a box. A fold on the 19.6329-day fallback is not a reliable test: that period is already ruled out by coverage.

4. The adopted period and the next times

The Planet-sized dips page predicts a next time for every star when the page loads. The method is the one written on that page: gaps between dips are divided by 1 through 10, trial periods of 0.4 days or longer that fit every dip and are not ruled out by TESS coverage come first, and when none survive the page falls back to a low-confidence period, either the one that missed the fewest predicted times or the longest gap. A period is ruled out when the

TESS light curve has good data at another predicted time and shows no dip there. The window is four hours either side, or the timing error carried forward to that cycle if that is larger: σ_t (hours) = 24 × √(v_{T0} + E^2 v_P + 2 E cov), using the values stored with the period. For TIC 415156851 the period used for the listed next time is low confidence. The times below are computed for 18 November 2026, 12:00 UTC, BTJD 4363.0, the same clock zero as the pages, without a new fit. The live pages recompute the next cycle when they load.

Min ≈ BTJD 3585.85565 + E × 19.63285710, with P ± 0.00122474 d.

Every period that fits all the dips is ruled out by TESS coverage. This one, 19.6329 days (the gap divided by 1), missed the fewest predicted times (3).

Because this period is a ruled-out fallback, the listed window should not be read as a reliable observing window. TESS already had good data at other times when a dip was predicted on this period, and those dips were not seen.

E	BTJD	UTC	Pacific	Window (1σ floor 4 h)
40	4371.1699	26 Nov 2026, 16:00 UTC	26 Nov 2026, 08:00 PST	± 4.0 hours
41	4390.8028	16 Dec 2026, 07:13 UTC	15 Dec 2026, 23:13 PST	± 4.0 hours
42	4410.4356	4 Jan 2027, 22:26 UTC	4 Jan 2027, 14:26 PST	± 4.0 hours
43	4430.0685	24 Jan 2027, 13:39 UTC	24 Jan 2027, 05:39 PST	± 4.0 hours

Table 3. The next four times on the adopted period for TIC 415156851, as of 18 November 2026, 12:00 UTC. Times are converted from BTJD for this star's position, as on the pages. Pacific times are America/Los_Angeles.

5. Light curves and a finder chart

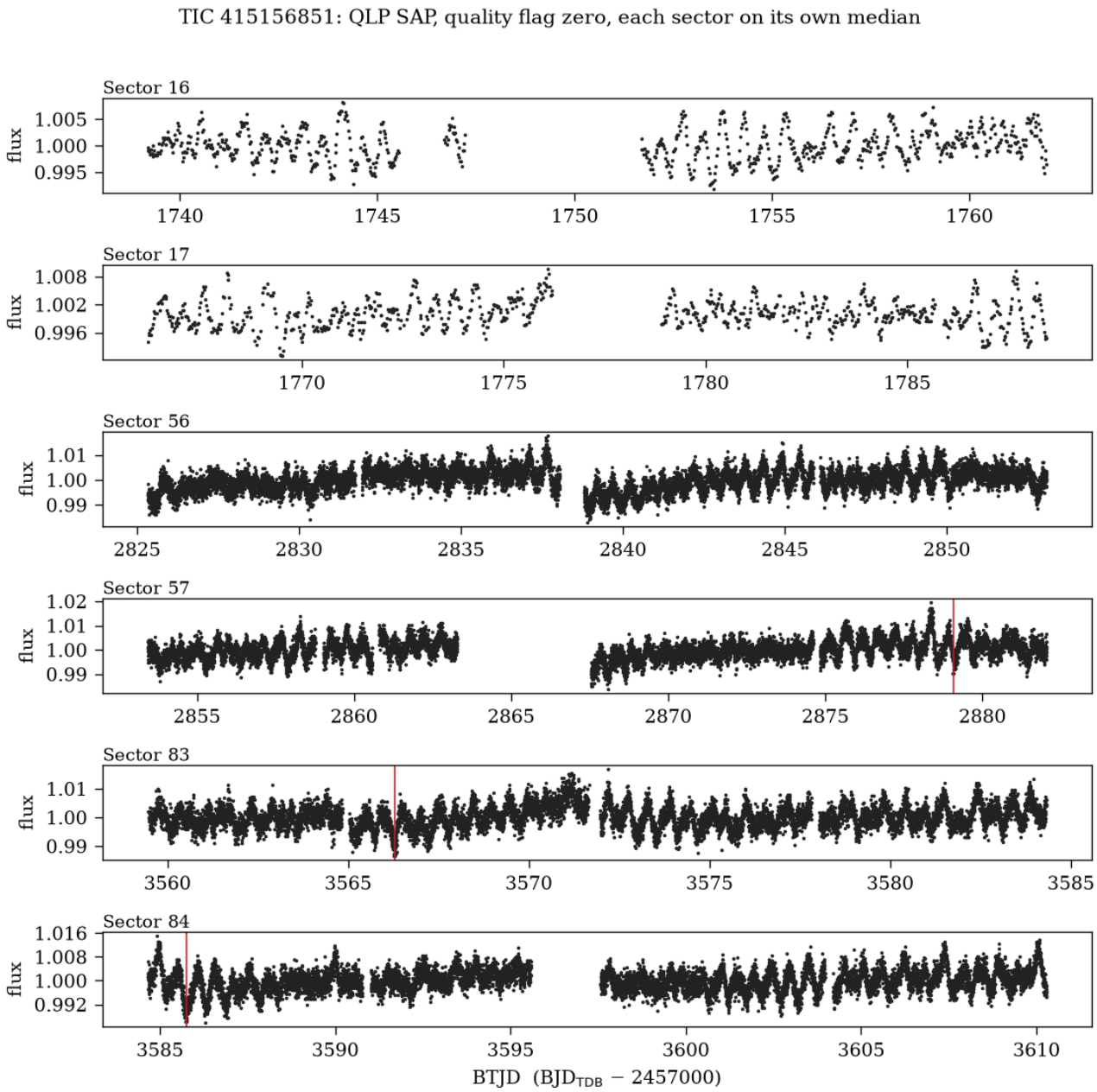


Figure 1. QLP SAP light curves of TIC 415156851, quality flag zero, each sector on its own median. Red lines mark the counted dips of Table 2.

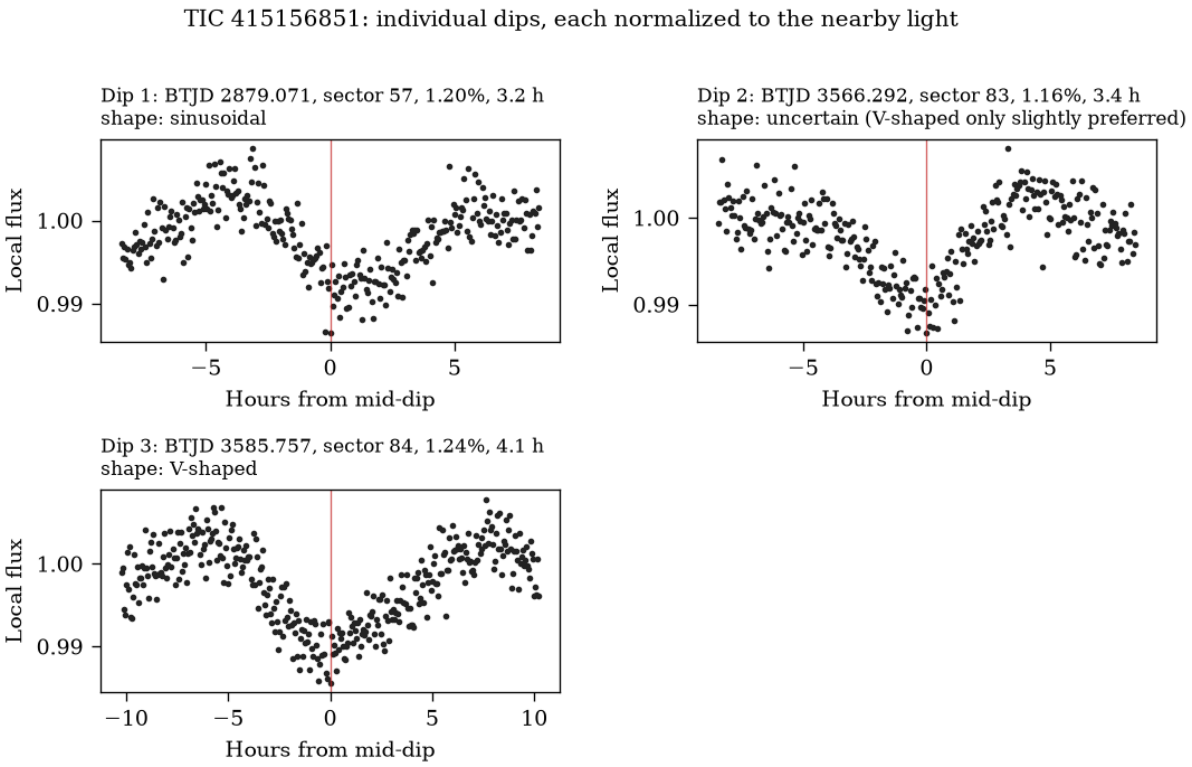


Figure 2. Individual counted dips of TIC 415156851, each normalized to the nearby light. The vertical line is the scan mid-time. These panels, not the fold, are the basis of the shape notes in Section 3.

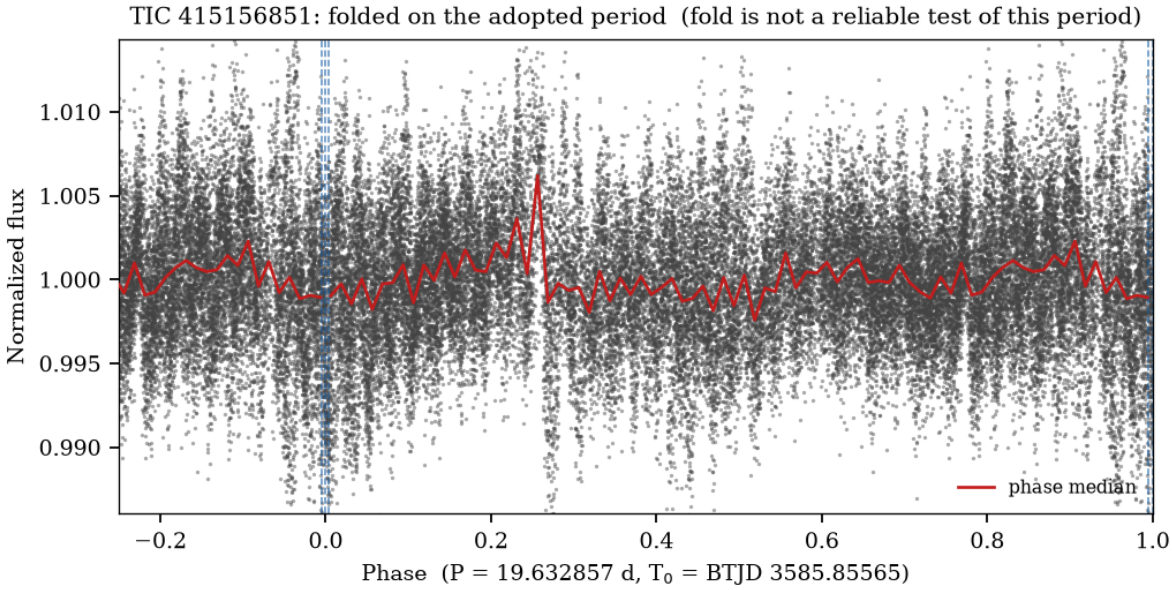


Figure 3. TIC 415156851 folded on the adopted period P = 19.632857 d, counted from BTJD 3585.85565. Black points are the cached QLP cadences; the red line is a phase median; the dashed blue lines are the phases of the counted dips. This fold is not a reliable test of the period: the period is a fallback, or a two-dip alias, or already ruled out. The individual dips in Figure 2 should be used instead.

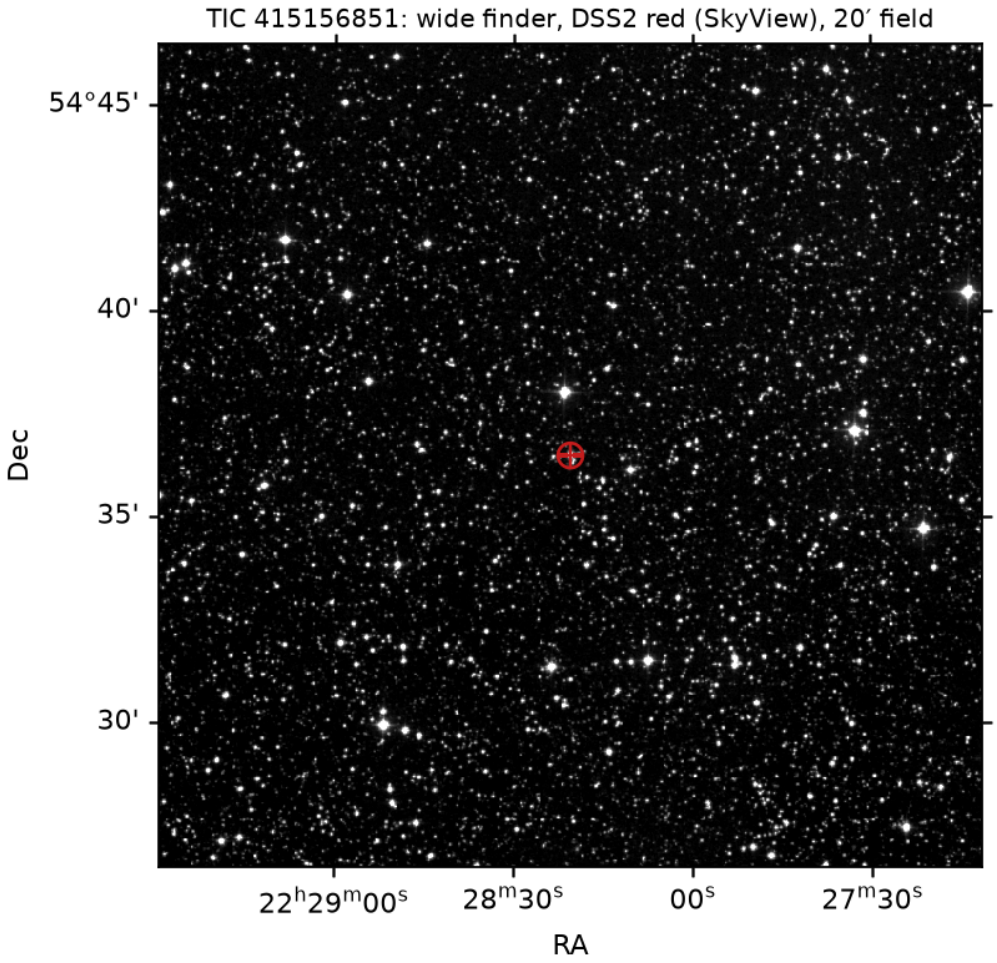


Figure 4. Wide finder for TIC 415156851, DSS2 red via NASA SkyView, 20 arcmin field. The red marks are the TIC position. TESS pixels are 21 arcseconds wide.

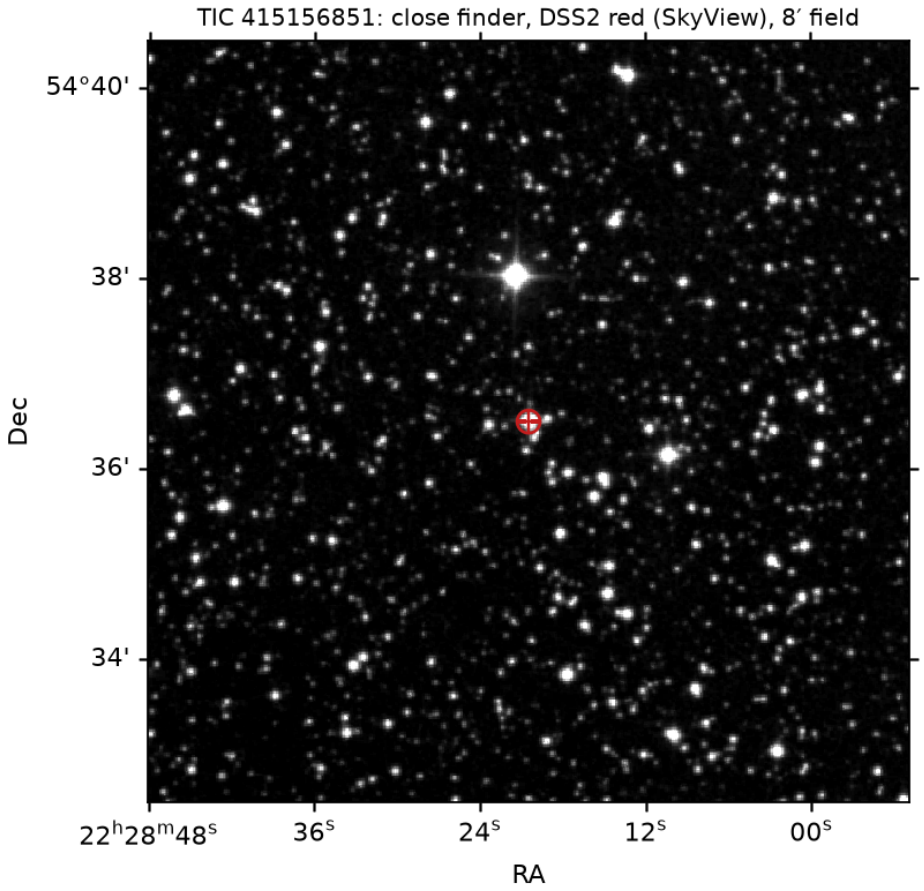


Figure 5. Close finder for TIC 415156851, DSS2 red, 8 arcmin field, to pick out the target and its nearest neighbors.

6. Best-guess classification

Unconfirmed shallow dips. No standing period. Low confidence. Every period that fits all three dips is ruled out by TESS coverage. The pages fall back to 19.632857 days, which missed three predicted times. The formal window of ±4 hours around the next time applies only if that period were correct, which the coverage says it is not. The prediction should not be treated as firm. This is not a planet claim.

This classification uses the TESS light curve and catalog values only. TESS pixels are 21 arcseconds wide, so the star that fades may be a neighbor, and the TIC temperature and radius are photometric estimates. The depths are not corrected for light from other stars. None of this has been checked from the ground. A depth that is consistent with a planet-sized body is not evidence that the body is a planet, or that the dip belongs to this star. This is not a planet claim.

7. Follow-up

Useful next steps are time-series photometry that covers a predicted time, with the close neighbors in the field and with a record of which star was in the aperture, and a low-resolution spectrum for the spectral type, which is not given in the TIC fields used here. Because the period used for the listed time is already ruled out by TESS coverage, it is better to treat the times in Table 3 as a starting guess only, or to wait for more data. Nothing here

has been submitted to VSX.

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