Fact-Checked Science

PAPER CHECK · ASTRONOMY

Betelgeuse's shape may follow its companion, but six radio campaigns can't confirm it yet

Four astronomers imaged Betelgeuse at seven radio frequencies with the VLA and ALMA in 2021–2026, and find its atmosphere warmer than in 2019, coolest just above the visible star at about 2,220 K, and slightly most oval when its proposed companion, Siwarha, is farthest from it on the sky [1 Abstract]. The temperatures reproduce from the paper's tables, and in our exact test of its six observing campaigns the oval pattern is unlikely to be chance ($p = 0.015$), but each part of the orbit is seen once and the result shifts with the orbit's timing: a first hint, not yet confirmed. NRAO's release calls it "compelling new evidence" and puts the 2019 eruption behind the Great Dimming at a billion tons, hundreds of billions of times too little [2]. S0 News linked the release on November 7, 2026 [3].

By Fact-Checked Science · Published November 7, 2026

OUR ANALYSIS marks our own reasoning and calculations: the values we read from the paper's Fig. 13, our exact test of the pattern in it and the checks around it, every number we recomputed from the paper's tables, and our arithmetic for the companion's radio glow and for a supernova at Betelgeuse's distance. The verdicts are our assessment. Everything else comes from the numbered sources. Ellipticity is how much shorter an oval's short axis is than its long one, as a fraction of the long one; the companion's orbital phase runs from 0, when it passes in front of the star, to 1, when it does so again.

The temperatures reproduce; the companion's mark on the star is a first hint, which the release calls compelling

OUR ASSESSMENT

$p = 0.015$

how often a random ordering of the six observing campaigns follows the companion's orbit as closely as the real one does: 11 of 720, by our exact test of the paper's Fig. 13 [1 Fig. 13]. Our analysis

6 campaigns

behind the figure's 13 points, from 2015 to 2026, with one campaign for each part of the orbit sampled [1 §5.2][1 Table 6]. Our analysis

4–13×

how far apart the ellipticities of repeat observations days or weeks apart are, in three of four pairs, measured in their quoted errors, which are fitting errors only [1 Table 5]. Our analysis

THE CLAIMS

UNCONFIRMED

"We have identified a correlation between the ellipticity of Betelgeuse, as obtained from radio measurements, and the companion's orbital phase."

The paper's abstract [1 Abstract]

The paper gives no test, so we made one. The six campaigns line up with the orbit better than all but 1 in 65 random orderings ($p = 0.015$), and p stays below 0.10 when any one is left out (below 0.05 for four of the six). But each part of the orbit is seen in one campaign, with a different mix of frequencies; within the uncertainty of the orbit's timing, p runs from 0.003 to 0.16; the authors' own four campaigns don't reach the 5% level ($p = 0.125$); and the long axis doesn't point at the companion, as a simple stretch toward it would, though the authors suggest the directions may trace its wake [1 §5.2]. The next greatest separation, in 2027, can test it [6 §5]. Our analysis. See section 3.

OVERSTATED

"the same data reveal compelling new evidence that Betelgeuse's atmosphere is being actively perturbed by the aforementioned close-in stellar companion"

NRAO's release, under the subhead "New Radio Images Reveal Disturbances from Mysterious Companion" [2]

The paper calls its results "consistent with periodic perturbations of the atmosphere by the companion" [1 Abstract], and finds nothing in its images that can be tied to the companion, which it puts down to the images' resolution and the companion's position at the time [1 §5.2]. The evidence is claim 1's pattern, a first hint from one orbit. The release's caption goes further still, saying the star "becomes slightly oblong as a result of Siwarha's perturbations" [2]. Our analysis. See section 4.

TRUE

"has since been supported by direct imaging and spectroscopic studies"

NRAO's release, on the companion proposed in 2024 [2]

Proposed in 2024 to explain the star's 2,100-day cycle [5 Abstract][4 Abstract], the companion was probably seen by speckle imaging on 9 December 2024, at 1.5σ [6 Abstract], and at 6.1σ by the VLT three days earlier, in the same spot [7 §3.1]. Spectra show what may be its wake [8 Abstract]. It is still a candidate: its imagers say that showing it is bound needs a second observation, on the far side of the star [7 §5], and its mass is disputed. See section 5.

TRUE

"the star's extended atmosphere has largely recovered from that episode"

NRAO's release, on the Great Dimming of 2019–2020 [2]

Its radio temperatures have: 3,360 ± 190 K at 22 GHz in 2023–2026 against 2,580 ± 260 K in August 2019, and 3,134 ± 178 K against 2,270 ± 260 K at 44 GHz, by our arithmetic from the papers' tables [1 Table 5][13 Table 3]. The paper sums this up as having "returned to nominal values" [1 §6], and the release's "largely" leaves room for the rest. The comparison rests on a single 2019 session. The paper also notes the Dimming's lasting effect on the star's pulsation, "persistent changes in the atmosphere of the star" [1 §1], and hints that the radio atmosphere may have been reshaped: its warmest layer may sit further out, and the sub-millimetre layer is cooler than in 2015 [1 §4.1.2]. Our analysis. See section 2.

TRUE

"a systematic decrease in T_B from ≈3500 K at ~$2.7R_\star$ to T_B ≈ 2220 K at ~$1.2R_\star$, confirming a previously reported temperature minimum"

The paper's abstract [1 Abstract]; the release gives "roughly 2,200 Kelvin" [2]

All 18 of the paper's temperatures recompute from its own fluxes and sizes to within 0.45%. The 2,220 ± 220 K is one measurement, at 485 GHz on 4 August 2023 [1 Table 5]. It agrees with infrared studies of the "MOLsphere", a layer of molecules around 1.2–1.5 times the star's radius, put at 1,500–2,300 K [1 §4.1.2], and lies below the 2,760 ± 140 K that ALMA found slightly higher up in 2015, which the paper treats as an outlier [14 Table 1][1 §4.1.2]. Our analysis. See section 2.

FALSE

"when Betelgeuse ejected a billion tons of solar material"

NRAO's release, on the Great Dimming [2]

The paper gives no mass [1 §1]. A billion tons is about one ordinary outburst from the Sun: a typical coronal mass ejection carries about 1.6 × 10^{15} g [19 Table 3]. NASA's release on the eruption behind the Dimming put it at 400 billion times a typical one, several times the mass of the Moon [18], and the material was the star's own surface, not the Sun's [17 §5]. See section 4.

1 · WHAT THE TEAM DID

Seven radio frequencies, two arrays and a fitted oval for each observation

Betelgeuse's radio glow comes from gas above its visible surface, and higher frequencies see deeper layers, so seven frequencies give a layer-by-layer picture [1 §1]. The team observed the star 14 times between 2021 and 2026 and fitted a uniform oval disk to each observation [1 Table 1][1 §4.1.1].

OBSERVATIONS

14

at 22 and 44 GHz with the Very Large Array in 2023, 2024 and 2026, and at 107–485 GHz with ALMA in 2021 and 2023 [1 Table 1]

DEPTHS PROBED

OUR ANALYSIS

$1.2–2.6\,R_\star$

the mean radius of the fitted disks, from 485 GHz down to 22 GHz, in units of the visible star's radius, 22.1 milliarcseconds on the sky [1 §1][1 Table 5]

SPECTRAL INDEX, RECOMPUTED

OUR ANALYSIS

1.350 ± 0.022

how fast the radio brightness rises with frequency, from Table 5's 14 single-date fluxes; the paper gives 1.35 ± 0.03 [1 §4.2]

How sizes, shapes and temperatures were measured

For each observation the team fitted a uniform oval disk to the interferometer's raw measurements, giving the disk's flux, its long and short axes and the direction of its long axis [1 §4.1.1]. Ellipticity is how much shorter the short axis is than the long one, as a fraction of the long one; a circle has 0 [1 Table 5]. The disk's brightness temperature, the mean temperature of the gas it shows, follows from its flux and size [1 §4.1.2]. The quoted errors on sizes and directions are fitting errors only; those on fluxes add the uncertainty of each array's flux scale, 5–10% [1 Table 5][1 §4.1.1].

Where the companion's place comes from

The phases come from MacLeod and colleagues' fit to a century of the star's radial velocities: an orbit of 2,109 ± 9 days, with the companion last in front of the star in 2023.12 ± 0.35 [4 §2.3.2][1 Table 6]. Phase 0 is when the companion passes in front of the star, 0.5 when it passes behind, and 0.25 and 0.75 when it is farthest from the star on the sky [1 §5].

OUR ANALYSIS

What the paper does well

It covers more than a factor of 20 in frequency with the two best arrays for the job, sharpens its images by self-calibration, and checked its ALMA processing independently [1 §3]. It says plainly that its size errors are fitting errors only [1 Table 5], sets out the puzzle that the oval's direction changes with frequency, and asks for more epochs [1 §5.2]. It is open access under CC BY 4.0, gives its archive project codes, and was peer reviewed in *The Astronomical Journal* [1].

In the authors' words TB is brightness temperature; R⋆ the star's radius.

> *"The results are consistent with periodic perturbations of the atmosphere by the companion."*
>
> Matthews et al. (2026), abstract [1 Abstract]

> *"Quoted error bars for angular size and position angle measurements reflect only formal fitting uncertainties."*
>
> Note to Table 5 [1 Table 5]

> *"Additional epochs of measurements spanning a wide range of both observing frequency and orbital phase of the companion will be needed to establish whether these frequency-dependent PA values remain consistent over both time and orbital phase."*
>
> Section 5.2 [1 §5.2]

2 · TEMPERATURES

Warmer again since 2019, and coolest just above the visible surface

Because the radio glow is thermal, its brightness temperature measures the mean temperature of the gas [1 §4.1.2]. The paper compares its new values with the low ones of 2 August 2019, measured months before the Great Dimming [13 Abstract].

22 GHZ, 2023–2026

OUR ANALYSIS

3,360 ± 190 K

the weighted mean of four measurements, against 2,580 ± 260 K in 2019: 2.4 standard errors higher [1 Table 5][13 Table 3]

44 GHZ, 2023–2024

OUR ANALYSIS

3,134 ± 178 K

the mean of three, against 2,270 ± 260 K in 2019: 2.7 standard errors higher [1 Table 5][13 Table 3]

COOLEST LAYER

2,220 ± 220 K

at 485 GHz, about 1.2 times the star's radius, a single measurement; the star's surface is at about 3,480–3,650 K [1 Table 5][1 §4.1.2]

Radio temperatures against the low of August 2019

FREQUENCY	2000–2004	AUGUST 2019	2023–2026, EACH	2023–2026, MEAN (OUR ANALYSIS)
22 GHz	2,170–3,160 K	2,580 ± 260 K	3,220, 3,470, 3,320 and 3,460 K, each ± 360–400	3,360 ± 190 K, 2.4σ above 2019
44 GHz	2,760–3,040 K	2,270 ± 260 K	2,930, 3,160 and 3,370 K, each ± 290–330	3,134 ± 178 K, 2.7σ above 2019

2000–2004: O'Gorman and colleagues' VLA values, whose errors leave out the flux scale [15 Table 1]. 2019: Matthews and Dupree [13 Table 3]. 2023–2026: the paper's Table 5 [1 Table 5]. The means are weighted by the tabulated errors, which include a 10% flux-scale uncertainty for each observation; σ is a standard error.

OUR ANALYSIS

What the recovery rests on

Each later measurement alone sits 1.4–2.6 standard errors above its 2019 counterpart, all seven point the same way, and together they sit 2.4 and 2.7 standard errors above 2019. But they share a single 2019 session, so their agreeing isn't independent evidence, and much of each error is the uncertainty of the flux scale, which the paper takes as 10% for the VLA, where its section 3.1 says 10–15% [1 §3.1][1 §4.1.1]. The new temperatures recompute from the paper's own fluxes and sizes to within 0.45%, all 18 of them, and its spectral index, 1.35 ± 0.03, from its fluxes as 1.350 ± 0.022 [1 §4.2]. Fitting the three highest-frequency bands alone, the paper finds no break in the spectrum [1 §4.2].

Lasting changes, by the paper's own account

Since the Dimming the star's visible brightness has returned to normal, but its radial-velocity swings have halved and its 400-day pulsation has given way to one of half that period; the paper concludes that the events "have produced persistent changes in the atmosphere of the star" [1 §1]. At radio wavelengths its warmest layer now seems to sit further out than before 2016, though the paper can't say for sure, and at 338 GHz the temperature is significantly lower than in 2015, which "may reflect a persistent temperature decrease" [1 §4.1.2]. A review describes "a slow ongoing recovery" [34 Abstract].

The coolest layer

From 22 GHz to 485 GHz the temperature falls steadily, from about 3,500 K at 2.7 times the star's radius to 2,220 K at 1.2 [1 Abstract][1 Table 5]. That is "more than 1200 K cooler than the nominal photospheric temperature" of 3,476–3,650 K [1 §4.1.2]. Infrared studies have long put a cool layer of molecules, the MOLsphere, at about 1.2–1.5 radii and 1,500–2,300 K [1 §4.1.2], and an earlier ALMA image found 2,760 ± 140 K at about 1.3 radii [14 Abstract][14 Table 1]. High-resolution ALMA images by the same team put this layer at about 2,300 K, with two hotter patches [16 Abstract].

OUR ANALYSIS

How much to read into it

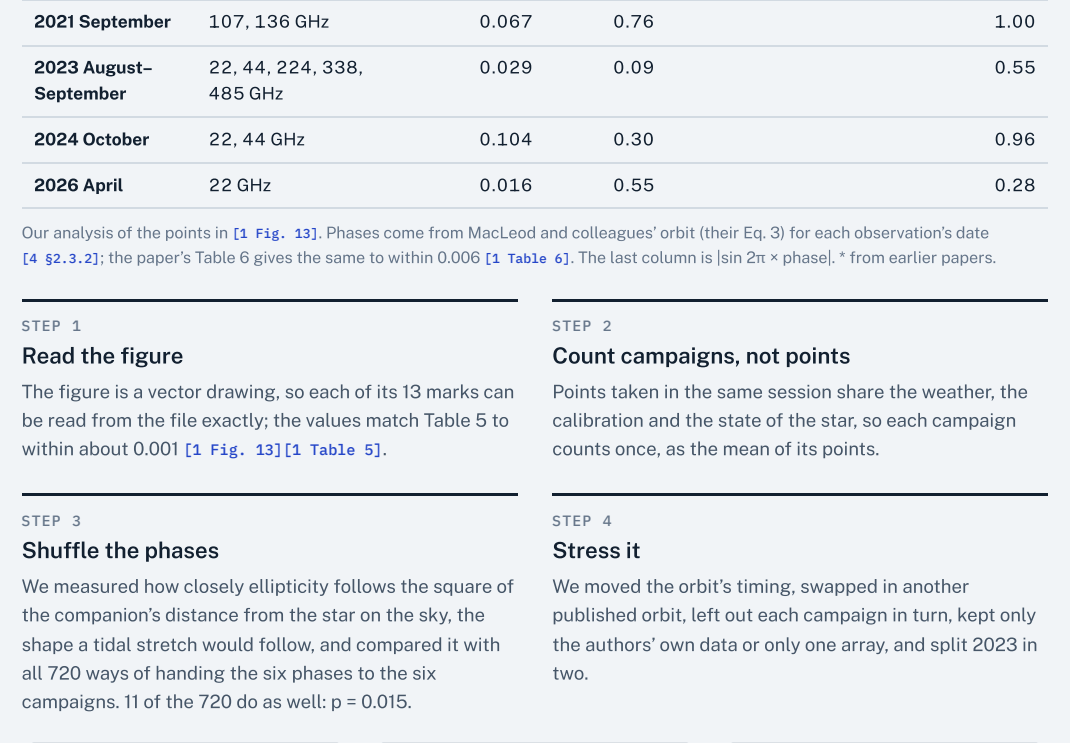
The 2,220 K is one measurement in one band on one night, with a 10% error [1 Table 5], so the minimum's exact depth isn't pinned down; the paper asks for ALMA's two highest bands to look deeper still [1 §6]. Its existence doesn't hang on it: the steady fall through the six higher bands, and the independent infrared and 2015 values, point the same way. The release's "roughly 2,200 Kelvin, over 1,000 degrees cooler than the photosphere" is right [2].

3 · THE COMPANION'S MARK

Six campaigns line up with the orbit, but one orbit can't confirm it

The paper plots each observation's ellipticity against the companion's orbital phase. It sees the star more oval near the companion's greatest separations and close to round when the companion is in front of or behind it [1 §5.2][1 Fig. 13]. It gives no test of the pattern, so we made one, with rules written before we ran it, though after we had seen the figure.

Ellipticity against the companion's orbit, as the paper plots it



Adapted from Fig. 13 of [1], CC BY 4.0: the 13 points as plotted there, read from the figure's vector drawing, with the observing campaigns labelled by us. ★ marks campaigns from earlier papers: 2015 from O'Gorman and colleagues [14 Table 1], 2019 from Matthews and Dupree [13 Table 3]. Points that coincide are nudged sideways. The paper's error bars for its own points, fitting errors only, are smaller than the marks [1 Fig. 13]; the 2015 value carries about ±0.008, from its axis ratio of 1.09 ± 0.01 [14 Table 1], and the 2019 values ±0.04 and ±0.07, which include systematic errors [13 Table 3].

The six campaigns behind the figure

CAMPAIGN	FREQUENCIES	MEAN ELLIPTICITY	ORBITAL PHASE	COMPANION'S DISTANCE FROM THE STAR ON THE SKY, SHARE OF GREATEST
2015 November*	338 GHz	0.080	0.74	1.00
2019 August*	22, 44 GHz	0.042	0.39	0.64
2021 September	107, 136 GHz	0.067	0.76	1.00
2023 August–September	22, 44, 224, 338, 485 GHz	0.029	0.09	0.55
2024 October	22, 44 GHz	0.104	0.30	0.96
2026 April	22 GHz	0.016	0.55	0.28

Our analysis of the points in [1 Fig. 13]. Phases come from MacLeod and colleagues' orbit (their Eq. 3) for each observation's date [4 §2.3.2]; the paper's Table 6 gives the same to within 0.006 [1 Table 6]. The last column is |sin 2π × phase|. * from earlier papers.

STEP 1

Read the figure

The figure is a vector drawing, so each of its 13 marks can be read from the file exactly; the values match Table 5 to within about 0.001 [1 Fig. 13][1 Table 5].

STEP 2

Count campaigns, not points

Points taken in the same session share the weather, the calibration and the state of the star, so each campaign counts once, as the mean of its points.

STEP 3

Shuffle the phases

We measured how closely ellipticity follows the square of the companion's distance from the star on the sky, the shape a tidal stretch would follow, and compared it with all 720 ways of handing the six phases to the six campaigns. 11 of the 720 do as well: $p = 0.015$.

STEP 4

Stress it

We moved the orbit's timing, swapped in another published orbit, left out each campaign in turn, kept only the authors' own data or only one array, and split 2023 in two.

OUR EXACT TEST

OUR ANALYSIS

$p = 0.015$

six campaigns; leaving out any one keeps p below 0.10, and the three campaigns nearest greatest separation are the three most oval, a 1-in-20 chance

THE AUTHORS' OWN FOUR

OUR ANALYSIS

$p = 0.125$

with only the campaigns of 2021–2026; four campaigns can't give less than 1 in 24, 0.042

DIRECTION OF THE LONG AXIS

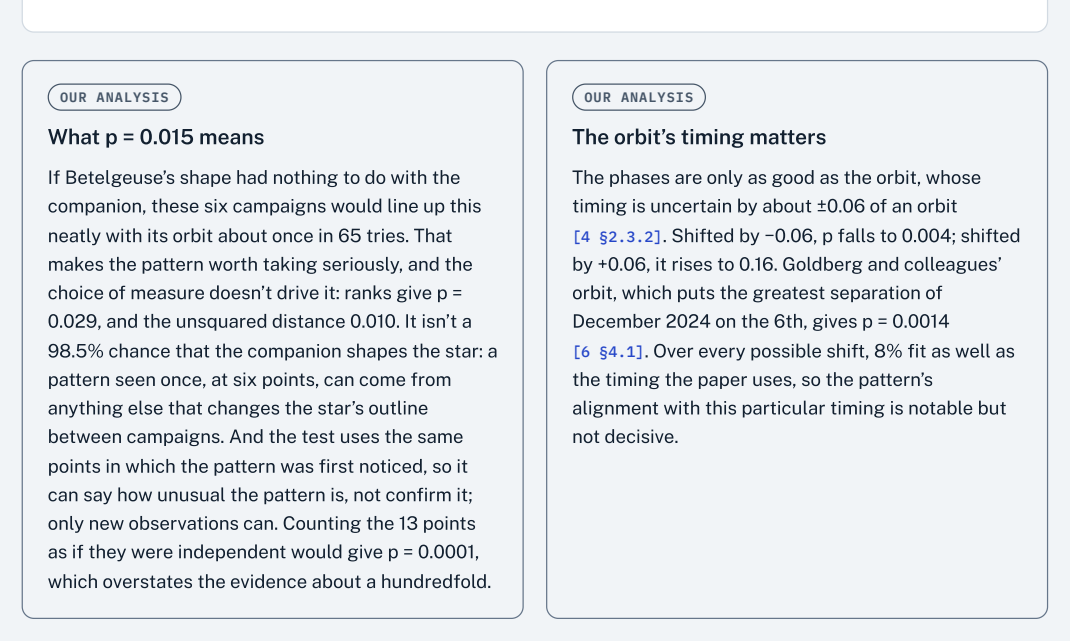
OUR ANALYSIS

36°

average angle from the companion's direction near greatest separation, against 45° for no relation: $p = 0.29$

How the test's p changes if the orbit's timing is shifted

OUR ANALYSIS



Our analysis, added after our first run: the same exact test, with the same shift added to every campaign's phase. The timing's standard error, 0.35 years, is MacLeod and colleagues' [4 §2.3.2].

OUR ANALYSIS

What $p = 0.015$ means

If Betelgeuse's shape had nothing to do with the companion, these six campaigns would line up this neatly with its orbit about once in 65 tries. That makes the pattern worth taking seriously, and the choice of measure doesn't drive it: ranks give $p = 0.029$, and the unsquared distance 0.010. It isn't a 98.5% chance that the companion shapes the star: a pattern seen once, at six points, can come from anything else that changes the star's outline between campaigns. And the test uses the same points in which the pattern was first noticed, so it can say how unusual the pattern is, not confirm it; only new observations can. Counting the 13 points as if they were independent would give $p = 0.0001$, which overstates the evidence about a hundredfold.

OUR ANALYSIS

The orbit's timing matters

The phases are only as good as the orbit, whose timing is uncertain by about ±0.06 of an orbit [4 §2.3.2]. Shifted by −0.06, p falls to 0.004; shifted by +0.06, it rises to 0.16. Goldberg and colleagues' orbit, which puts the greatest separation of December 2024 on the 6th, gives $p = 0.0014$ [6 §4.1]. Over every possible shift, 8% fit as well as the timing the paper uses, so the pattern's alignment with this particular timing is notable but not decisive.

OUR ANALYSIS

One orbit, one campaign for each phase

The near-round values just after the companion passed in front all come from the five frequencies of the 2023 campaign; the one value just after it passed behind is a single 22-GHz measurement of 2026; the most oval, from 2015, 2021 and 2024, come from different frequencies again [1 Fig. 13]. So the phase can't be told apart from whatever else differed between campaigns. The authors' own data alone, four campaigns, give $p = 0.125$, and the VLA's alone $p = 0.042$, the smallest four campaigns allow.

OUR ANALYSIS

Repeat observations scatter more than the errors say

In 2023 four bands were observed twice, 1 to 24 days apart, at nearly the same phase [1 Table 5]. At 44 and 224 GHz the two ellipticities differ by 0.019, 6.7 and 13 times their combined quoted errors; at 338 GHz by 4.2 times; at 22 GHz they agree. The directions of the long axis differ by 1–17°, 4–30 times their errors. Repeat observations scatter by about 0.010 per measurement, not the 0.001–0.003 quoted, which is why we let the data, not the errors, set the test.

The direction puzzle

If the companion stretched the star toward itself, the long axis would point along the companion's direction, about 115° east of north [1 Table 6][6 Abstract]. The paper notes instead that the direction changes with frequency, 31–47° at the highest ALMA bands, about 140° at the lowest and 90–120° at the VLA's, perhaps because each band sees a different part of a wake trailing the companion [1 §5.2]. The star's rotation axis has been put at 48°, so its equator runs along 138° [7 §4.2].

What a companion could do, and what else could

A tidal bulge on the visible star would be tiny, a distortion of about 0.003 by MacLeod and colleagues' estimate [4 §4.4], far below the 0.02–0.10 seen in radio. But the companion orbits inside the radio-emitting gas, at about 2.3 times the star's radius [1 §5.2], where its wake could matter more [8 Abstract]; the paper doesn't model how large an effect to expect, or in which direction [1 §5.2]. Other causes of an oval outline exist: ALMA images by the same team show long-lived hot patches and departures of up to ±6% in radius, which they tie to convection [16 Abstract].

What would settle it

The companion's next greatest separation, on the north-west side of the star [1 Table 6], is predicted for 26 November 2027 by Goldberg and colleagues' orbit [6 §5]; by our arithmetic, MacLeod and colleagues' orbit puts it in June 2027, give or take four months [4 §2.3.2]. Radio observations then, and at the next times it passes in front and behind, at several frequencies at once, would test the pattern on a second orbit. The same observations, in the optical, are what its imagers say would show it is bound to the star [7 §5].

4 · THE RELEASE AGAINST THE PAPER

The release follows the paper on temperatures, calls its hint "compelling", and shrinks the 2019 eruption

NRAO's release of 26 October 2026 summarises the paper for the public. It follows the paper closely on the temperatures, and goes further on the companion [2].

In the release's words

> *"New Radio Images Reveal Disturbances from Mysterious Companion"*
>
> The release's subhead [2]

> *"compelling new evidence that Betelgeuse's atmosphere is being actively perturbed"*
>
> The release [2]

> *"when Betelgeuse ejected a billion tons of solar material"*
>
> The release [2]

A TYPICAL SOLAR OUTBURST

1.6 × 10^{15} g

the typical (geometric-mean) mass of the 1,704 coronal mass ejections of 1996–2009 whose mass, as the LASCO coronagraphs measured it, peaked beyond 15 solar radii: 1.6 billion tonnes [19 §3.2][19 Table 3]

BETELGEUSE'S 2019 ERUPTION

400 billion

times a typical solar ejection, "roughly several times as much as our Moon", in NASA's release [18]

THE COMPANION IN RADIO

OUR ANALYSIS

16–60×

too faint for a 3–5σ detection in the ALMA bands where it would be brightest, and 600–1,400 times at the VLA's

OUR ANALYSIS

"Compelling", and images that reveal

The paper's title claims evidence, and its abstract calls the results "consistent with periodic perturbations" [1 Abstract]; its conclusions say "This suggests that the companion is shaping the structure and density of the atmosphere" [1 §6]. It uses "compelling" only for the VLT's images of the companion [1 §5], never for its own evidence of the perturbation. Its images show no feature it could tie to the companion, which it puts down to their resolution and the companion's position at the time [1 §5.2], so no image "reveals" a disturbance; the evidence is the oval pattern of section 3, from one orbit. The lead author's quoted "convincing result" and the caption's statement that the star "becomes slightly oblong as a result of Siwarha's perturbations" go beyond what the paper claims [2].

OUR ANALYSIS

A billion tons

A billion tons, 10^{15} g, is about one coronal mass ejection from the Sun [19 Table 3]. The ejection that led to the Great Dimming is put at 400 billion times that, several Moon masses [18], so the release is low by a factor of hundreds of billions. And the material wasn't "solar": it was part of Betelgeuse's own surface [17 §5]. The paper gives no mass at all, only that the Dimming "has since been attributed to a surface mass ejection" [1 §1].

OUR ANALYSIS

What the release gets right

Its temperatures follow the paper: about 3,500 K near 2.7 stellar radii, where the 22-GHz disks measure 3,220–3,470 K at a mean radius of 2.6 by our arithmetic, and a layer at about 2,200 K [1 Table 5]. Its "tens to hundreds of times too faint" for the companion matches the paper's numbers, which we recomputed (section 5). The paper is, as it says, published in *The Astronomical Journal* [1], and the release passes on the team's caution that more observations over "a fuller range of the companion's orbit" are needed "to confirm and refine these findings" [2].

"Largely recovered"

The release says the atmosphere "has largely recovered from that episode" [2]. The radio temperatures at 22 and 44 GHz have; the paper says they "have returned to nominal values" [1 §6]. The release's "largely" leaves room for what the paper also reports: the Dimming's lasting effect on the star's pulsation, and hints of a reshaped radio atmosphere (section 2).

5 · SIWARHA

A strong candidate, imaged twice in one week of December 2024, still awaiting proof that it is bound

Two 2024 studies proposed that Betelgeuse's 2,100-day cycle in brightness and velocity is an orbit, of a star circling at little more than twice the giant's radius [5 Abstract][4 Abstract]. Since then it has been searched for in X-rays, ultraviolet, visible light and radio.

The case for the companion, 2024–2026

STUDY	HOW	WHAT IT FOUND	HOW FIRM
Goldberg, Joyce and Molnár (2024)	The 2,170-day cycle and its timing against velocity	Predicts a companion with a minimum mass (M sin i) of 1.17 solar masses at 2.43 stellar radii [5 Abstract]	Prediction
MacLeod et al. (2025)	A century of radial velocities, and positions	An orbit of 2,110 days and a companion under a solar mass; the position data a preliminary detection [4 Abstract][4 §6]	Indirect
O'Grady et al. (2025)	Chandra X-ray images	No X-rays: not a feeding white dwarf or neutron star, likely a young star [9 Abstract]	Non-detection
Goldberg et al. (2025)	Hubble ultraviolet spectra	No signal; a young star above about 1.5 solar masses excluded [10 Abstract]	Non-detection
Howell et al. (2025)	Speckle imaging, Gemini North, 9 December 2024	A source 52 mas from the star at 115°, about six magnitudes fainter; "only a 1.5σ detection" [6 Abstract]	Probable
Dupree et al. (2026)	Optical and Hubble ultraviolet spectra, 2019–2025	Absorption and outflows that rise after the companion passes in front, read as its wake [8 Abstract]	Indirect
Montargès et al. (2026)	VLT adaptive optics, 6 December 2024	A source at 52.32 ± 0.18 mas and 117.1°, at 6.1σ, and 5.1σ by a second method; a star of 2.6–3.1 solar masses if as old as Betelgeuse [7 Abstract][7 §4.3]	Strong candidate
Matthews et al. (2026)	Radio, this paper	The star's shape seems to follow the orbit [1 §5.2]	Indirect, section 3
Goldberg et al. (2026)	Models, not yet peer reviewed	The light seen could be Betelgeuse's own, reflected off the companion's bow shock [11 Abstract]	Preprint

Goldberg and colleagues' orbit predicted the greatest separation for 6 December 2024 [6 §4.1]; by our arithmetic, MacLeod and colleagues' orbit, used for the phases on this page, puts it in July 2024, give or take four months [4 §2.3.2]. Both images were taken within three days of 6 December [7 Abstract][6 §3.2].

How firm the imaging is

The VLT team detected the source at 6.1σ and 5.1σ with two methods [7 Abstract]. Its properties agree with Howell and colleagues' 1.5σ detection three days later: "We thus confirm their analysis", they write [7 §3.1]. Howell and colleagues judged a chance background star negligibly likely, but the VLT team still calls it a candidate, "until the candidate Betelgeuse B is observed on the other side of the primary after half an orbital period" [7 §3.1]; "formal confirmation that Betelgeuse B is indeed gravitationally bound awaits a second observing epoch" [7 Abstract].

What kind of star

The estimates disagree. MacLeod and colleagues' velocities suggest under one solar mass [4 Abstract]; Goldberg and colleagues' give a minimum of about 1.2 [5 Abstract]; Hubble's ultraviolet search excludes young stars above about 1.5 [10 Abstract]. The VLT team's brightness implies a 2.6–3.1 solar-mass star of type B8.5–B9.5, just arrived on the main sequence, a range they say is probably broader because of dust, and which they say fits Goldberg and colleagues' prediction once the orbit's tilt is allowed for [7 §4.3]. A 2026 preprint proposes that the light is reflected from the companion's bow shock, which would reconcile its brightness with a lower mass [11 Abstract]. The radio paper calls the companion's nature "still controversial" [1 §5.1].

The distance matters

Seen at 52.3 mas, the companion is at least 8.8 au from the star if Betelgeuse is 168 pc away, which fits an orbit of about six years; at 222 pc, the distance the radio paper uses, it would be at least 11.6 au away, implying an orbit of at least eight years, which fits the 2,100-day cycle less well [7 §4.1][1 §1]. The VLT team prefers 168 pc for that reason [7 §4.1].

OUR ANALYSIS

The release's description, and the radio estimate

The release's "whose existence was proposed in 2024 … and has since been supported by direct imaging and spectroscopic studies" is a fair summary [2]; "recently discovered" is a little ahead of its imagers' "candidate". The paper's estimate of the companion's radio glow takes a star of 2 solar radii at 12,000 K [1 §5.1], the VLT team's 3.1-solar-mass model, 2.01 radii at 12,000 K [7 Table E.1]. We get 0.093 μJy at 44 GHz and 5.45 and 11.2 μJy at 338 and 485 GHz, as the paper does: 5–12 times below the noise of its two highest-frequency ALMA images, and 16–60 times below a 3–5σ detection [1 Table 4]. At 168 pc it would be 1.75 times brighter, still far out of reach. The paper gives the companion's place only in angles, so its test doesn't depend on which distance is right.

The name

The name Betelgeuse means "Hand of the Giant", and since the companion orbits the hand, Howell and colleagues suggested it be named "Siwarha, or 'Her Bracelet'" [6 §5]. The International Astronomical Union's Working Group on Star Names adopted Siwarha for α Ori B on 22 September 2025, among 59 names it announced on 12 February 2026 [12].

6 · THROUGH THE CATASTROPHISM LENS

Is Betelgeuse about to explode? Almost certainly not for a very long time, and even then it would be a sight, not a danger

A red supergiant near the end of its life that dimmed dramatically in 2020 invites the question. The radio paper says nothing about the star's remaining life; the literature does.

TIME LEFT, MOST LIKELY

≈ 100,000 years

from models that put the star early in burning helium in its core [25 §2.12][22 Abstract]

DISTANCE

168–222 pc

550–720 light-years, by two methods [22 Abstract][26 Abstract]

AS A SUPERNOVA

OUR ANALYSIS

mag −10 to −11

at its brightest, for an average type II supernova at that distance, about as bright as a quarter Moon [31 §4.1][25 §5]

What the Great Dimming was

In early 2020 the star fell to magnitude 1.6, its faintest in more than a century [1 §1]. A shock had thrown off part of its surface in 2019, a "surface mass ejection" [17 Abstract], which cooled into a cloud of dust over the southern half of the star [20 Abstract], with extra absorption by molecules [21 Abstract]. NASA's account of the ejection adds that the star's behaviour "is not evidence the star is about to blow up anytime soon" [18].

How long it has

Models matched to its pulsations place Betelgeuse early in burning helium in its core [22 Abstract], which a review sums up as about 100,000 years before it explodes [25 §2.12]. If the 2,100-day cycle isn't a pulsation, Goldberg and colleagues write, the star is "not due for an explosion for hundreds of thousands of years" [5 §1].

The short-fuse claim, and the reply

A 2023 study read the 2,200-day cycle as the star's slowest pulsation, which would put it late in burning carbon, with carbon gone in under about 300 years and collapse a few decades later [23 Abstract][23 §6]. The reply: a pulsation that slow needs a radius of about 1,400 solar radii, but the star's measured size, under 45 mas across, caps it below 1,100 even at 222 pc [24 §1][24 §2]. The companion work since then explains the cycle as an orbit, which removes the claim's premise [5 §1].

What the companion means

Its orbit should decay until it is "swallowed by Betelgeuse in the next 10,000 years" [4 Abstract]. A 2026 preprint models the merger as a luminous red nova, brighter than Venus for about two days, that throws off 6–11 solar masses of the envelope [33 Abstract]. That is a merger's outburst, not the supernova. The radio paper says only that the companion may shape the atmosphere where the star's wind begins [1 §6].

If it did explode

Published estimates of how close a supernova must be to harm life on Earth: within about 8 pc for ozone loss that would double the Sun's harmful ultraviolet [27 Abstract]; around 20 pc, just beyond what one study calls the "kill distance" [28 Abstract]; up to about 50 pc for rare supernovae that stay bright in X-rays [29 Abstract]. At 50 pc, cosmic rays would rise a few hundredfold and return to normal within 10,000 years [30 Abstract]. Betelgeuse would also give hours of warning: neutrino detectors could raise an alert up to 12 hours before the collapse [32 Abstract].

OUR ANALYSIS

What it means

Betelgeuse is 3.4–4.4 times further away than the largest of those danger distances, so its radiation would reach us 11–20 times weaker than at 50 pc, and 440–770 times weaker than at 8 pc. At its peak, an average type II supernova, magnitude −16.7 [31 §4.1], would shine at about −10 to −11 from here: "about as bright as a quarter Moon" for around three months, a review says, with a neutrino dose far below a lethal one [25 §5]. Apart from the disputed 2023 study, neither the paper nor the literature suggests the explosion is near. Nothing here supports a catastrophist reading of Betelgeuse.

7 · REPEAT OUR NUMBERS

One script fetches the paper's source files, reads its figure and tables, and reruns every test

The rules came first, with their hash; what came after them is labelled in the log. Run from an empty folder, the script gave our outputs byte for byte.

PY **betelgeuse_pipeline.py**

Fetches the paper's arXiv source files by URL, checks them against our copy's hash, runs every step and compares each output with our log; standard library only · 5 KB

PY **read_eprint.py**, **dump_fig_pdf.py**, **extract_fig13.py** and **build_data.py**

Read the source files in memory, without compiling or running anything in them; find the 13 marks of Fig. 13; parse Tables 4–6 · 3 KB, 2 KB, 5 KB and 7 KB

PY **analysis.py**

Every pre-registered test: P1–P2, N2–N4, S1–S8, C1 and C3–C11, and the lens arithmetic · 22 KB

PY **summarize.py** and **chart_data.py**

The numbers this page uses, and its two charts, with the shifted-timing strip added after our first run · 3 KB and 11 KB

TXT **RULES_analysis.txt**

The rules, written before any test was run · 9 KB

TXT **analysis-log.txt**

The SHA-256 of the rules, the data and every script and output, in the order they were made, with the bugs we fixed on the way · 10 KB

JSON **fig13-points.json**

The 13 points of the paper's Fig. 13 as read from its vector drawing. Adapted from Fig. 13 of [1], CC BY 4.0 · 4 KB

JSON **results-summary.json** and **chart-data.json**

The numbers on this page, and the charts' numbers · 15 KB and 5 KB

PY **posthoc_older_shapes.py**

Added after a fresh review, and not pre-registered: where O'Gorman and colleagues' 2000–2004 disk fits [15 Table 1] fall on the orbit, and how large their errors are, with its output, posthoc-older-shapes.txt · 5 KB and 2 KB

JSON **analysis-results.json** and **ellipticity-data.json**

The full output of `analysis.py`, and the tables it reads, parsed from the paper's source files, CC BY 4.0 [1] · 22 KB and 13 KB

PY **posthoc.py** and **independent_check.py**

Checks added after the first run, and a separate re-check of the small points in section 9, with their outputs, posthoc-results.json and independent-check.txt · 5 KB, 5 KB, 3 KB and 1 KB

Run it

`python3 -I betelgeuse_pipeline.py <folder>`, with the other scripts beside it, downloads the paper's source files from arXiv (747 KB) into that folder, checks them, and writes every output to its `out` folder, then compares each with our log. It takes about a minute. One check, C11, compares the published tables with arXiv's; give the text of the published PDF, made with `pdftotext -enc UTF-8 -layout`, as a second argument to include it.

The data and their terms

The paper: CC BY 4.0, so Fig. 13 is redrawn and its values are hosted, with credit [1]. We don't host its source files or PDF; the script fetches them. **Everything else** on this page comes from the published papers and releases in the list below, quoted or summarised; we host none of their text.

8 · LIMITS

What we couldn't check

The raw measurements

We worked from the paper's fitted disks, not its interferometer data, so we can't say how much of the scatter between observations comes from calibration, coverage or the star itself, or how a fit with realistic errors would change the figure [1 §4.1.1].

Two campaigns from other fits

The 2015 ellipticity is that of the main disk in a four-part model [14 Table 1]; the 2019 values carry errors of ±0.04 and ±0.07 in their own paper, which include systematic errors [13 Table 3].

One orbit, one model

The phases rest on a circular orbit fitted to radial velocities, whose eccentricity the authors could not pin down [4 §2.3.1].

Older radio shapes

O'Gorman and colleagues fitted the star's disk at 22 and 44 GHz eight times in 2000–2004 [15 Table 1], fits that Fig. 13 doesn't include. By our post-hoc arithmetic they sample earlier orbits, at phases 0.17–0.83, but none within a tenth of an orbit of the companion passing in front or behind, and their ellipticities, 0.07–0.24, carry errors of ±0.02–0.07, two to seven times the scatter of the paper's repeat observations. They neither support nor contradict the pattern.

The size of the 2019 eruption

We have it from NASA's release [18]. The study it reports gives no mass in absolute terms in its text [17], and the publisher's site answered our request for its published version with a bot check.

Abstracts only

Several of the studies in sections 5 and 6 were read only as abstracts, as the source list marks.

What would change these verdicts

01
A second orbit in radio. Ellipticity measured near the next greatest separation, predicted for 2027 [6 §5], and near the next passages in front and behind, with errors from repeat observations. The same pattern again would move claim 1 toward True; none would undo it.

02
The companion on the far side. An image of it on the other side of the star half an orbit later, which its imagers say would confirm it is bound [7 §5].

03
A model of the effect. How much, and in which direction, a companion orbiting inside the radio-emitting gas should distort it, tested against the frequency-dependent directions the paper finds [1 §5.2].

The authors ask for "Additional epochs of measurements spanning a wide range of both observing frequency and orbital phase of the companion" [1 §5.2].

9 · SMALL POINTS IN THE PAPER

Five small inconsistencies, none of which changes a conclusion

Each was confirmed with separate code or against the cited source, and each has an ordinary explanation. None has been put to the authors.

The five points

1. **One separation in Table 6.** For 2019 August 2 the table gives phase 1.39 and a separation of 25.9 mas; the formula behind the other rows gives 30.8 mas at that phase. 25.9 mas fits phase 0.41, where Fig. 13 plots the 2019 points, and is also the entry for 2023 August 27 [1 Table 6][1 Fig. 13]. Likely a copying slip or a different date; the test gives $p = 0.017$ with the plotted phases and 0.015 with the orbit's.
2. **One size in Table 5.** For 2026 April 4 the table gives the star's diameter as 24.7 au; its own axes, 114.9 and 113.1 mas, give 25.3 au at 222 pc. The temperature in the same row fits the axes [1 Table 5]. Likely a transcription slip.
3. **The high-band spectral index.** The paper gives 1.40 ± 0.06 for its three highest bands [1 §4.2]; Table 5's fluxes give 1.43–1.47 by every fit we tried, ±0.10–0.15 with the tabulated errors. Perhaps fluxes per spectral window or other weights; the conclusion that the spectrum has no break stands.
4. **"A historic low" at 22 GHz.** Section 4.1.2 says the 2019 measurement at 22 GHz "marked a historic low (L. D. Matthews & A. K. Dupree 2022)" [1 §4.1.2]. That paper called it "at the low end of previously observed values" [13 §5.2], and O'Gorman and colleagues list 2,170 ± 200 K at that wavelength in 2002 April [15 Table 1]. The record low was at 44 GHz, as the paper's introduction says [1 §1]. A wording point, which doesn't affect the rise since 2019.
5. **"Recently confirmed".** The introduction says the companion "was recently confirmed through direct detection" [1 §1]. Its source does write "We confirm the presence of this companion at the 6.1σ level", but calls it a candidate until it is seen on the far side of the star, with proof that it is bound awaiting a second epoch [7 §5][7 §3.1]. Shorthand that follows the source's own wording; the paper's section 5 is more careful [1 §5.1].

Related checks

FALSE Isotopes from the Sun? The Disaster Cycle, Fact-Checked

FALSE Iron-60 "here 50 to 80 million years"? The Disaster Cycle, Fact-Checked

Sources

Bracketed numbers refer to this list. For the paper [1], read in full in its published version, § gives a section, Fig. a figure, Table a table and Abstract its abstract. For [4], [6], [7], [13], [14], [17], [23] and [24], read in full, and for [5], [19], [25] and [31], read in part, § gives a section and Table a table; for [15], Table gives the one table we read. Abstract marks the part of a source we rely on; a source marked "Abstract only" was read no further. R⋆ is the radius of the star's visible surface, 22.1 milliarcseconds (mas) on the sky; a parsec (pc) is 3.26 light-years; σ is a standard error. Links checked November 7, 2026.

1 Matthews, L. D., Dupree, A. K., Richards, A. M. S., and Dent, W. R. F. (2026). New Spatially Resolved Observations of Betelgeuse from the VLA and ALMA: Evidence for Atmospheric Perturbations from a Close Companion. *The Astronomical Journal* 172(3), 184, 16 pages. Received May 29, accepted August 3, published September 1, 2026; peer reviewed. Open access under CC BY 4.0, so its Fig. 13 is redrawn here, with credit. Full text of the published version, and of the accepted manuscript, arXiv:2608.02847v1, with its source files; the two carry the same tables.

2 National Radio Astronomy Observatory (October 26, 2026). What Lurks Within the Shadows of Betelgeuse? News release. Full text; quoted briefly, and its illustration is not reproduced.

3 SpaceWeatherNews (S0) (November 7, 2026). Solar Storm Electrical Explosions, Betelgeuse's Baby | S0 News Nov.7.2026. YouTube video, https://www.youtube.com/watch?v=WXp-m52Qftc, published at 12:50 UT. No transcript was available, so nothing from the episode is rated here.

4 MacLeod, M., Blunt, S., De Rosa, R. J., Dupree, A. K., et al. (2025). Radial Velocity and Astrometric Evidence for a Close Companion to Betelgeuse. *The Astrophysical Journal* 978, 50. Full text, read as arXiv:2409.11332v2.

5 Goldberg, J. A., Joyce, M., and Molnár, L. (2024). A Buddy for Betelgeuse: Binarity as the Origin of the Long Secondary Period in α Orionis. *The Astrophysical Journal* 977, 35. Read in part, as arXiv:2408.09089v2: the abstract and sections 1 and 4.

6 Howell, S. B., Ciardi, D. R., Clark, C. A., Hope, D. A., Littlefield, C., and Furlan, E. (2025). The Probable Direct-imaging Detection of the Stellar Companion to Betelgeuse. *The Astrophysical Journal Letters* 988, L47. Full text, read as arXiv:2507.15749v1.

7 Montargès, M., Boccaletti, A., Flasseur, O., de Koter, A., et al. (2026). VLT/SPHERE images of the candidate companion of Betelgeuse. *Astronomy & Astrophysics* 711, L12, 7 pages. Received May 19, accepted June 19, 2026. Open access under CC BY 4.0. Full text, supplied by the site's owner after the publisher's site answered our own request with a bot check, which we do not attempt.

8 Dupree, A. K., Cristofari, P. I., MacLeod, M., and Kravchenko, K. (2026). Betelgeuse: Detection of the Expanding Wake of the Companion Star. *The Astrophysical Journal* 998, 50. CC BY 4.0. Abstract only, read as arXiv:2601.00470v1.

9 O'Grady, A. J. G., O'Connor, B., Goldberg, J. A., Joyce, M., Molnár, L., et al. (2025). Betelgeuse's Buddy: X-Ray Constraints on the Nature of α Ori B. *The Astrophysical Journal* 992, 107. Abstract only.

10 Goldberg, J. A., O'Grady, A. J. G., Joyce, M., et al. (2025). Betelgeuse, Betelgeuse, Betelgeuse, Betel-buddy? Constraints on the Dynamical Companion to α Orionis from HST. *The Astrophysical Journal* 994, 101. Abstract only.

11 Goldberg, J. A., Joyce, M., O'Grady, A. J. G., et al. (2026). Disco in the Dust: Reflected light at the bow shock around Betelgeuse's companion explains its observed luminosity. arXiv:2608.11672v1, August 12, 2026. A preprint, not peer reviewed. Abstract only.

12 International Astronomical Union (February 12, 2026). IAU Selects New Star Names to Reflect Global Astronomical Culture. Announcement, with the list of the 59 names and their approval dates.

13 Matthews, L. D., and Dupree, A. K. (2022). Spatially Resolved Observations of Betelgeuse at λ7 mm and λ1.3 cm Just prior to the Great Dimming. *The Astrophysical Journal* 934, 131. Full text, read as arXiv:2206.04144v1.

14 O'Gorman, E., Kervella, P., Harper, G. M., Richards, A. M. S., Decin, L., Montargès, M., and McDonald, I. (2017). The inhomogeneous submillimeter atmosphere of Betelgeuse. *Astronomy & Astrophysics* 602, L10. Full text, read as arXiv:1706.06021v1.

15 O'Gorman, E., Harper, G. M., Brown, A., Guinan, E. F., Richards, A. M. S., Vlemmings, W., and Wasatonic, R. (2015). Temporal evolution of the size and temperature of Betelgeuse's extended atmosphere. *Astronomy & Astrophysics* 580, A101. Read for its Table 1, as arXiv:1506.07536v1.

16 Dent, W. R. F., Richards, A. M. S., Harper, G. M., Matthews, L. D., and O'Gorman, E. (2026). ALMA high-resolution observations of Betelgeuse: Persistent structure spanning the inner atmosphere. *Astronomy & Astrophysics* 714, A203. Abstract only, read as arXiv:2608.19339v2.

17 Dupree, A. K., Strassmeier, K. G., Calderwood, T., Granzer, T., et al. (2022). The Great Dimming of Betelgeuse: A Surface Mass Ejection and Its Consequences. *The Astrophysical Journal* 936, 18. Full text, read as arXiv:2208.01676v1; the publisher's site answered our request for the published version with a bot check.

18 NASA (August 11, 2022). Hubble Sees Red Supergiant Star Betelgeuse Slowly Recovering After Blowing Its Top. News release.

19 Vourlidas, A., Howard, R. A., Esfandiari, E., Patsourakos, S., Yashiro, S., and Michalek, G. (2010). Comprehensive Analysis of Coronal Mass Ejection Mass and Energy Properties Over a Full Solar Cycle. *The Astrophysical Journal* 722, 1522. Read for its sections 2.2 and 3.2 and Table 3, as arXiv:1008.3737v1.

20 Montargès, M., Cannon, E., Lagadec, E., et al. (2021). A dusty veil shading Betelgeuse during its Great Dimming. *Nature* 594, 365–368. Abstract only.

21 Kravchenko, K., Jorissen, A., Van Eck, S., et al. (2021). Atmosphere of Betelgeuse before and during the Great Dimming event revealed by tomography. *Astronomy & Astrophysics* 650, L17. Abstract only.

22 Joyce, M., Leung, S.-C., Molnár, L., Ireland, M., Kobayashi, C., and Nomoto, K. (2020). Standing on the Shoulders of Giants: New Mass and Distance Estimates for Betelgeuse through Combined Evolutionary, Asteroseismic, and Hydrodynamic Simulations with MESA. *The Astrophysical Journal* 902, 63. Abstract only, read as arXiv:2006.09837v5.

23 Saio, H., Nandal, D., Meynet, G., and Ekström, S. (2023). The evolutionary stage of Betelgeuse inferred from its pulsation periods. *Monthly Notices of the Royal Astronomical Society* 526(2), 2765–2775. Full text, read as arXiv:2306.00287v2.

24 Molnár, L., Joyce, M., and Leung, S.-C. (2023). Comment on the Feasibility of Carbon Burning in Betelgeuse. *Research Notes of the AAS* 7(6), 119. Full text, read as arXiv:2306.05600v1.

25 Wheeler, J. C., and Chatzopoulos, E. (2023). Betelgeuse: a review. *Astronomy & Geophysics* 64(3), 3.11–3.27. Read in part, as arXiv:2306.09449v1: the abstract and sections 2.12 and 5.

26 Harper, G. M., Brown, A., Guinan, E. F., O'Gorman, E., Richards, A. M. S., Kervella, P., and Decin, L. (2017). An Updated 2017 Astrometric Solution for Betelgeuse. *The Astronomical Journal* 154, 11. Abstract only.

27 Gehrels, N., Laird, C. M., Jackman, C. H., Cannizzo, J. K., Mattson, B. J., and Chen, W. (2003). Ozone Depletion from Nearby Supernovae. *The Astrophysical Journal* 585, 1169–1176. Abstract only.

28 Fields, B. D., Melott, A. L., Ellis, J., et al. (2020). Supernova triggers for end-Devonian extinctions. *Proceedings of the National Academy of Sciences* 117(35), 21008–21010. Abstract only.

29 Brunton, I. R., O'Mahoney, C., Fields, B. D., Melott, A. L., and Thomas, B. C. (2023). X-Ray-luminous Supernovae: Threats to Terrestrial Biospheres. *The Astrophysical Journal* 947, 42. Abstract only.

30 Melott, A. L., Thomas, B. C., Kachelrieß, M., Semikoz, D. V., and Overholt, A. C. (2017). A Supernova at 50 pc: Effects on the Earth's Atmosphere and Biota. *The Astrophysical Journal* 840, 105. Abstract only.

31 Anderson, J. P., González-Gaitán, S., Hamuy, M., et al. (2014). Characterizing the V-band Light-curves of Hydrogen-rich Type II Supernovae. *The Astrophysical Journal* 786, 67. Read for its section 4.1, as arXiv:1403.7091v2.

32 Abe, S., et al., for the KamLAND and Super-Kamiokande Collaborations (2024). Combined Pre-supernova Alert System with KamLAND and Super-Kamiokande. *The Astrophysical Journal* 973, 140. Abstract only.

33 Leonhardes-Barboza, N., Antoni, A., MacLeod, M., Twum, A., and Ramirez-Ruiz, E. (2026). From Inspiral to Outburst: Modeling a Potential Luminous Red Nova from Betelgeuse. arXiv:2610.31755v1, October 22, 2026. A preprint, not peer reviewed. Abstract only.

34 Dupree, A. K., and Montargès, M. (2025). Betelgeuse, the Prototypical Red Supergiant. *Galaxies* 13(3), 50. CC BY 4.0. Abstract only.

METHOD

How this was checked

On November 7, 2026, we read the paper in full, in its published version and in its accepted manuscript with its source files, and NRAO's release, and checked every statement on this page against them. We read the 13 points of the paper's Fig. 13 from its vector drawing, and its Tables 4–6 from its source files. Fifteen other sources were read in full or in the parts the list marks, and 16 as abstracts. Montargès and colleagues' paper [7] was supplied by the site's owner after the publisher's site refused our script; IOP's site did the same for the published version of [17], which we read in its arXiv version. We didn't retry either. Every quotation was checked word for word against its saved source.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. They cover how the ellipticity pattern fares in an exact test and when the orbit, the campaigns or the data change; how much repeat observations scatter; what the release adds to the paper; the companion's standing; and what the literature says about the star's future and a supernova's danger. No transcript of the S0 News episode that linked the release was available [3], so this page reviews the paper and the release on their own and rates nothing from the episode.

We wrote the rules of our tests before running any of them, though after we had seen the figure, and logged the SHA-256 of the rules, the data and each output; the one chart added after the first run is labelled as such. The tests reproduce all 18 of the paper's brightness temperatures, its spectral index, its estimate of the companion's radio glow and its orbital phases. One hosted script fetches the paper's source files by URL and recomputes everything; run from an empty folder, it gave our outputs byte for byte. We couldn't re-fit the interferometer data themselves, which would show how much of the scatter between observations is the star's and how much the measurement's. Section 9 lists five small inconsistencies we found in the paper, each confirmed with separate code or against its source; none changes a conclusion, and none has been put to the authors.

Before publication, a fresh reviewer re-checked the built page against its sources with separate code of its own: every test and recomputed number reproduced, and the hosted script reran byte for byte. After that review, claim 4 is rated True rather than Partly true, since the paper's own summary is that the 22- and 44-GHz temperatures have returned to normal; the other verdicts stand. We also applied its corrections to wording and references, and added a look at O'Gorman and colleagues' older radio shapes, made after the fact and labelled as such; one small point was withdrawn from section 9, because the plotted value agrees with its source as printed.

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

The verdicts on this page

FALSE	The evidence contradicts the claim.
OVERSTATED	Has some basis but claims much more than the evidence supports.
UNCONFIRMED	Rests on a preliminary result that hasn't been confirmed.
TRUE	The evidence supports the claim.

All ten verdicts, and how we check

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Nov 7, 2026	Published on factchecked.science after a full check against the sources and a fresh review. Built from the paper, NRAO's release, the values plotted in the paper's Fig. 13, our pre-registered tests and the literature. Fig. 13 is redrawn under the paper's CC BY 4.0 licence, and the chart of shifted timings is our own analysis. Section 9 lists five small inconsistencies in the paper, none of which changes a conclusion; none has been put to the authors.

Fact-Checked Science is independent. It isn't affiliated with the channels, presenters or authors whose claims it checks.

Last updated Nov 7, 2026