The bright star Betelgeuse has faded to a historic low as astronomers try to figure out why.

Orion, with Betelgeuse in tow, climbs the southeastern sky during evenings in late December and January.
*Bob King*

Betelgeuse, Orion's most famous star, has been in the news recently. As we wait for this supergiant to explode as a supernova, it has been doing the opposite — fading away! If you check the list of the brightest nighttime stars, Betelgeuse ranks 10th. But that's only an average: the variable star's brightness typically varies from magnitude 0.2 (roughly like Rigel in Orion's knee) to about 1.3, only a few tenths of magnitude brighter than neighboring Bellatrix (magnitude 1.6). (Bellatrix and Rigel are also variable stars, but they vary less in brightness than Betelgeuse does.)

As recently as October, Betelgeuse glowed around magnitude 0.5, considerably brighter than its nearby Aldebaran (0.9). But observations made this month by both amateurs and professionals indicate a steep drop in brightness. On December 28.2 UT, I used Aldebaran (magnitude 0.9) and Bellatrix to estimate the star at a feeble magnitude of 1.5, nearly equal in brightness to Bellatrix. In just two months it's

fallen from 10th place to 21st, according to astronomer James Kaler's [26 Brightest Stars](#) list, a remarkable decline — and a historic low.

A Star in Trouble
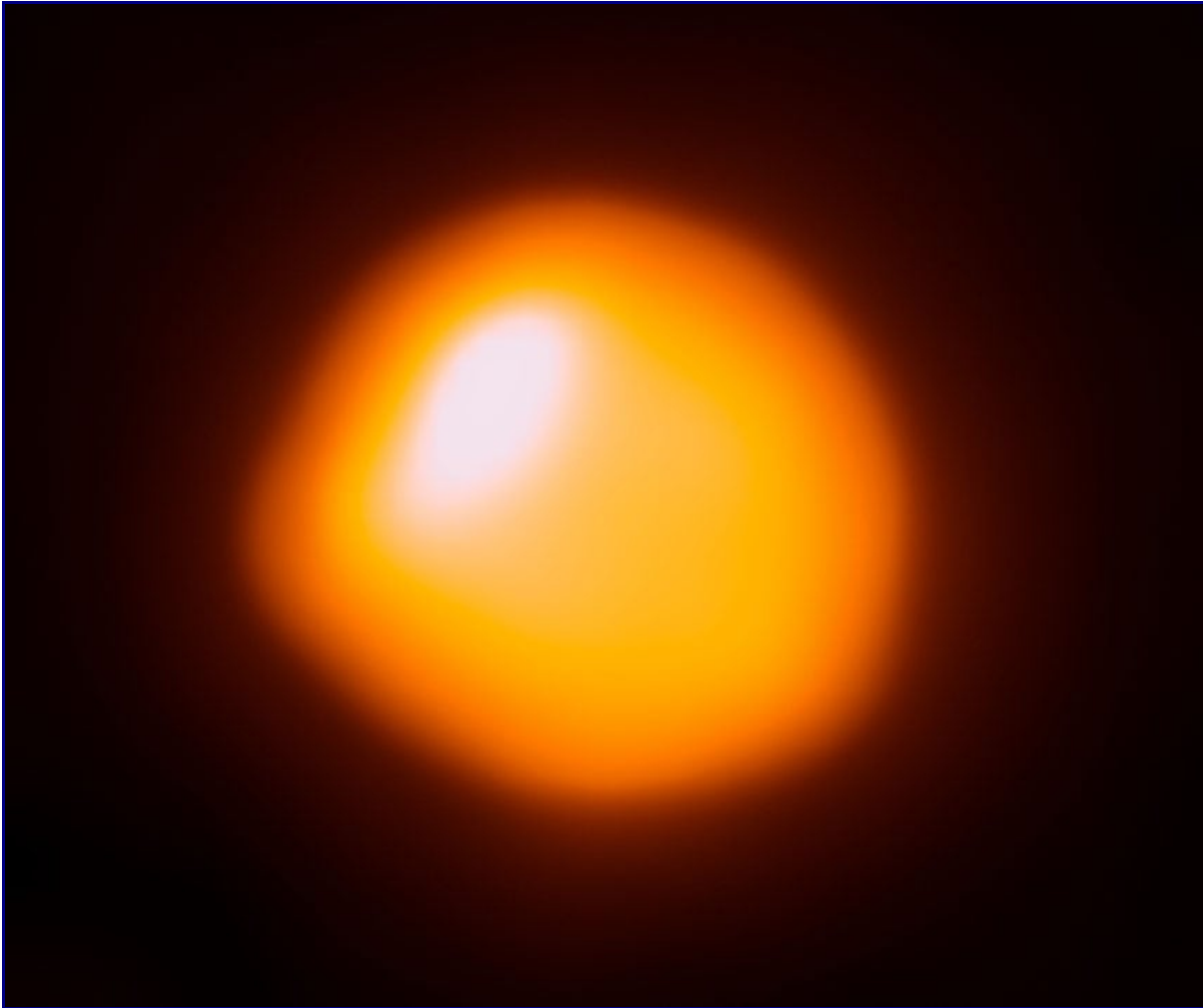
The Atacama Large Millimeter/submillimeter Array (ALMA) captured this image of Betelgeuse, revealing its lopsided shape and a huge bright spot.
ALMA (ESO / NAOJ / NRAO) / E. O'Gorman / P. Kervella

Betelgeuse is classified as a pulsating red supergiant. It physically expands and contracts as its atmosphere alternately traps and releases heat radiating from its core. When the star is smallest and hottest, it would extend to the orbit of Mars if put in place of the Sun. When largest and coolest it https://www.skyandtelescope.com/observing/fainting-betelgeuse/would balloon to span Jupiter's orbit. Although Betelgeuse is 20 times more massive than the Sun, its expanding shell has only 1/10,000 the density of air — it might be better described as a red-hot vacuum.

Betelgeuse is a semi-regular variable star with multiple periods of variation. The primary pulsations repeat every ~425 days, but the star also shows additional changes in brightness with periods of 100-180 days and 5.9 years. Dark patches that resemble monstrous sunspots as well as bright blobs of upwelling gas are behind some of these fluctuations. Betelgeuse is clearly in upheaval and will continue to surprise us before it eventually runs out of fuel, collapses, and explodes as a [Type II supernova](#).

While the supergiant's current behavior is out of the ordinary, it doesn't necessarily mean an eruption is imminent. Astronomers predict a star-shredding blast sometime in the next 100,000 years or so.
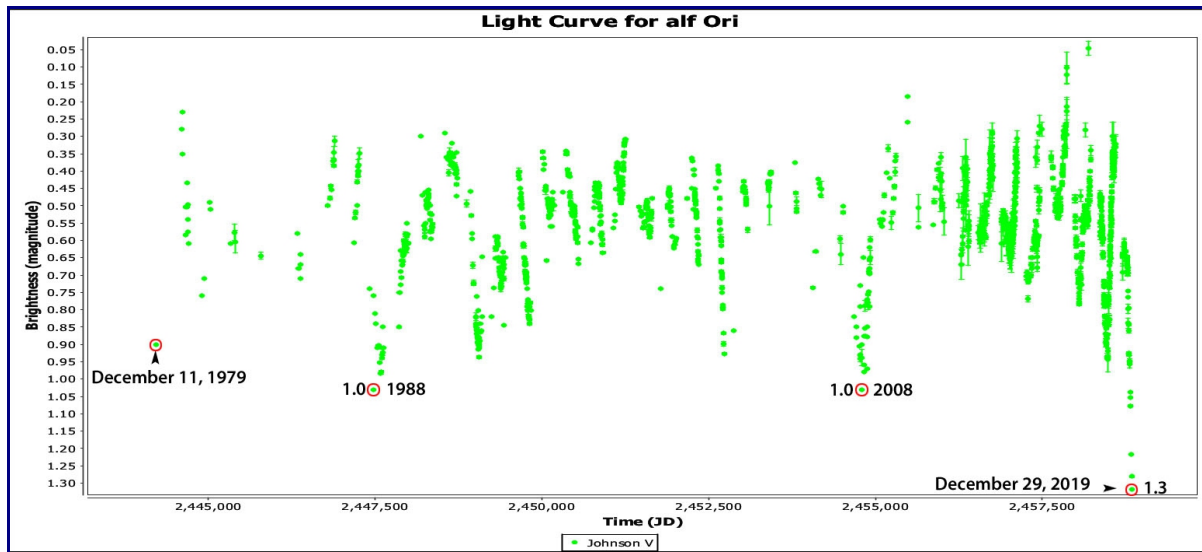
This light curve shows periodic variations in Betelgeuse's brightness from 1979 to the present using V-band photometry. The vertical axis plots magnitude, the horizontal plots the time in Julian dates. I've marked the dates of the oldest and most recent observations as well as the magnitudes of the current and previous minima minima.
*AAVSO*

Earlier this week I spoke with Sara Beck, technical assistant from the American Association of Variable Star Observers (AAVSO), about Betelgeuse. She did a quick plot of the 36,743 observations of the star in the AAVSO database starting with the first one taken on December 10, 1893. While a definitive analysis awaits, Beck agreed that the current minimum appears to be one of the faintest.

Meanwhile, astronomers Edward Guinan and Richard Wasatonic (both at Villanova University), along with amateur Thomas Calderwood, have been monitoring the star for more than 25 years. They reported a decline to magnitude 1.29 on December 20th using precise V-band photometry, making this the faintest minimum since the star was first monitored electronically in the early 20th century.

In Astronomical Telegram #13365 Guinan writes: "The current faintness of Betelgeuse appears to arise from the coincidence of the star being near the minimum light of the ~5.9-yr light-cycle as well as near the deeper than usual minimum of the ~425-d period." In effect, the star's overlapping cycles have created a sort of *superminimum*. Guinan encourages observers to closely monitor the star during this unusually cool and faint state.https://www.skyandtelescope.com/observing/fainting-betelgeuse/

See for Yourself
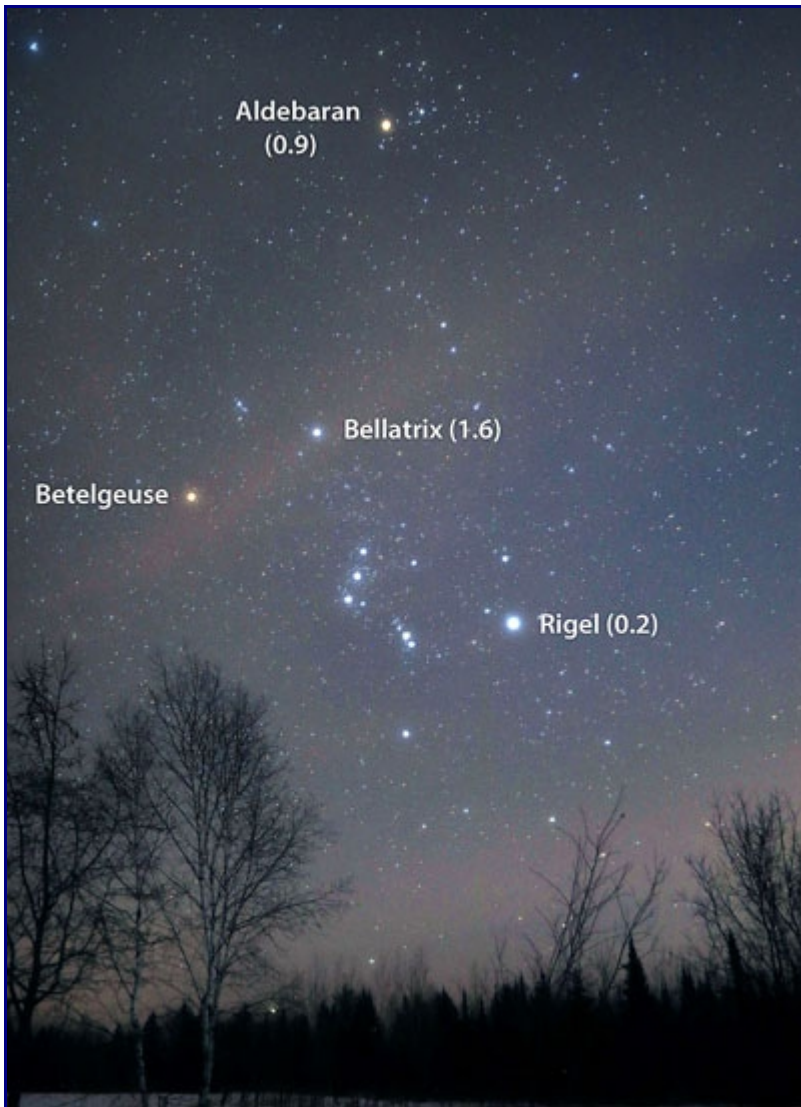
Use this photo to help you find and estimate Betelgeuse's magnitude using Aldebaran, Bellatrix and Rigel. Magnitudes are shown in parentheses.
Bob King

Thankfully, nearly everyone on the planet can do this. Whether you live in the Atacama Desert or downtown New York, Betelgeuse is easy to see. Once you've found it, use Bellatrix and Aldebaran to determine its brightness to an accuracy of one-tenth of a magnitude. For instance, if Betelgeuse appears midway in brightness between Bellatrix and Aldebaran its magnitude would be about 1.3. If a little fainter or brighter one way or the other add or subtract additional tenths of a magnitude.

When making a magnitude estimate look quickly from star to star. If you stare too long, your brain will "inflate" a star's brightness. Near-sighted observers have an additional tool at their disposal. Just take

off your glasses! The stars will expand into disks, making it easier to detect subtle brightness differences.

Then write that number down and return every few nights or maybe every week and make another estimate. Over time you'll see it change right before your eyes. Betelgeuse is expected to continue fading into January and then re-brighten, but you never know what surprises may still be in store. Stars do as they please and that's half the fun.