Observing the Minima of Betelgeuse

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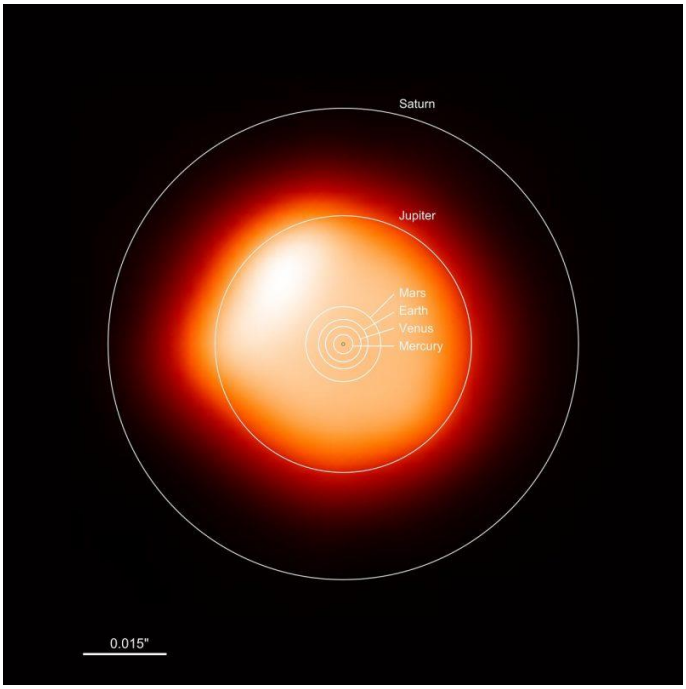
Lately there's been a lot of buzz not only in the astronomical community about Alpha Orionis, named Betelgeuse. The star has dimmed quite precipitously from it's normal range of variation (magnitude 0.7 to 1.0) to a very low minimum of 1.614 as of February 2020. Does this mean the star is about to explode? While that would be very cool, most astronomers now feel it's not likely, although they do predict that Betelgeuse will go supernova within the next 100,000 years. For an 8 million year old star, that's a very brief life in astronomical terms of not human terms!

Betelgeuse is a pulsating semiregular variable Red Supergiant (type SRc) star with two superimposed periods – one of about 400 days and one of about 2100 days. These stars are variable through pulsations of their atmospheres – radial velocity measurements through doppler shifted spectra of the stars demonstrate that as they dim, the atmosphere is moving outward and as it brightens, inward. The main and second overtone periods of variability are typical in this kind of star.

The fluctuations of this massive star are such that if we were to transport it into our Solar System, at minimum the surface of the star would extend out to the orbit of Mars, completely engulfing the inner planets. At maximum the star would extend to the orbit of Jupiter!



Betelguese at maximum - Credit: ALMA (ESO/NAOJ/NRAO)/E. O'Gorman/P. Kervella

With two periods of variance, inevitably the two periods will coincide with the two minimums happening at the same time, which results in a very low overall minimum like the one we're seeing now.

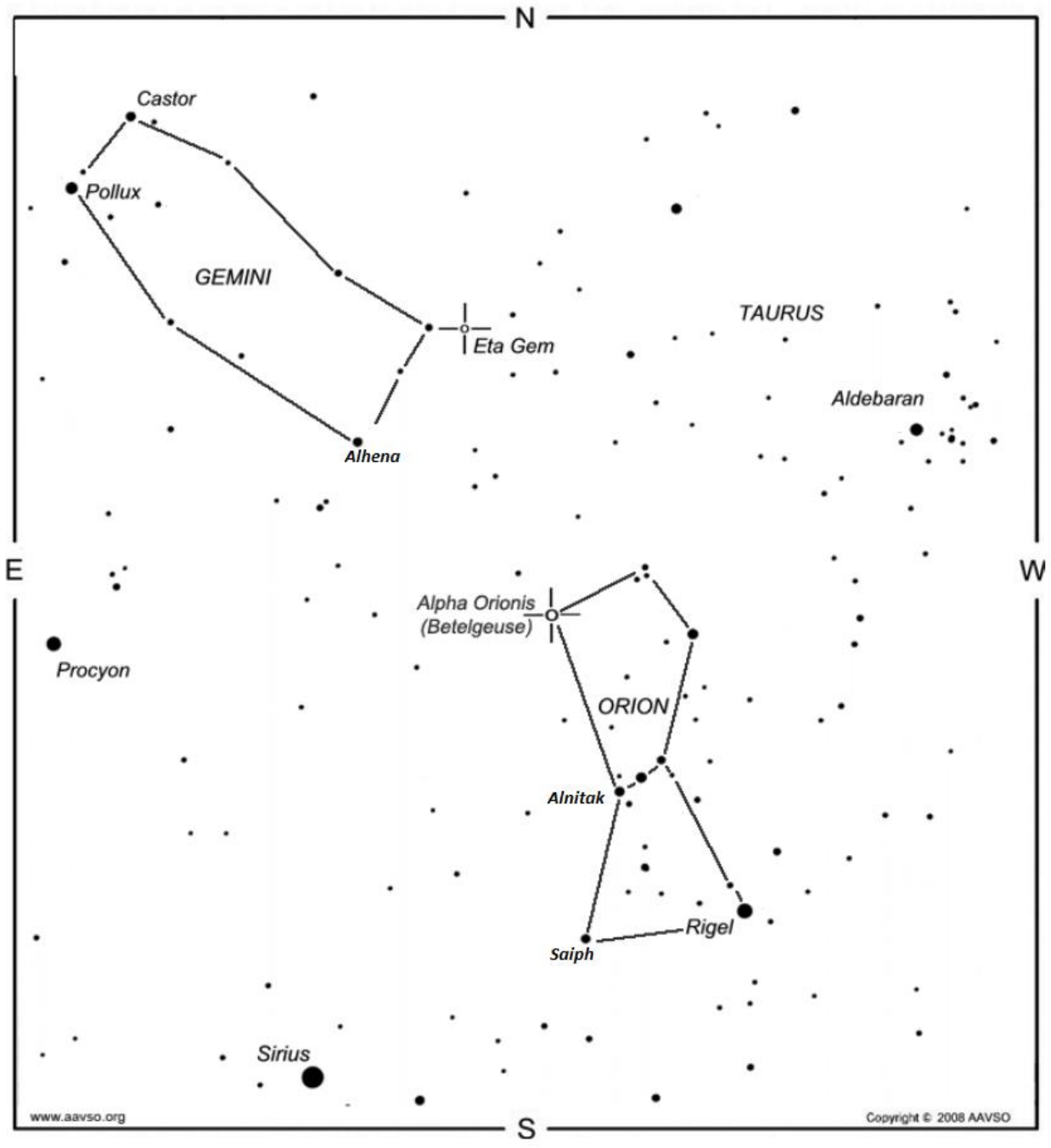
Other effects such as gas or dust eruptions on the star and other surface brightness changes may also have an impact, but astronomers are not seeing other signs of imminent explosion.

How can you observe this phenomena for yourself? You can use a technique known as differential photometry, which compares known similar brightness of other non-variable stars to estimate the brightness of a target star. Normally, the American Association of Variable Star Observers (AAVSO) recommends using Procyon (alpha CMi, magnitude 0.5) and Aldebaran (alpha Tauri, magnitude 1.1) for comparison stars but given the dimness of Betelgeuse at present, in a recent Alert Notice the organization recommends the following stars instead (V stands for Visual):

Rigel (bet Ori) - 0.12 V mean mag - note that color is blue; use with caution
Procyon (alf CMi) - 0.36 V
Aldebaran (alf Tau) - 0.87 V
Pollux (bet Gem) - 1.14 V
Alnitak (zet Ori) - 1.79 V
Alhena (gam Gem) - 1.92 V
Saiph (kap Ori) - 2.06 V

The attached chart adapted from the AAVSO Chart for the area shows the positions of these stars. To estimate the magnitude of the star, look at each comparison star – is Betelgeuse brighter or dimmer? If you compare the target star to a variety of similar stars it's easy with a bit of practice to get pretty close to the actual brightness. Compare your results to data coming from other observers at AAVSO using the light curve generator at: https://www.aavso.org/LCGv2/ - use the star designator ALPHA ORI and select only the V band for the chart. Have fun!

Note: Castor (alf Gem) at 1.58 V and Bellatrix (gam Ori) at 1.64 V are not recommended due to color of star leads observers to overestimate their brightness. Visual observers also need to be aware of the Purkinje effect and use the quick-glance method to make their observations; do not stare at alf Ori or the comparison stars, as doing so may make them become artificially bright. The Purkinje effect is the tendency for the peak luminance sensitivity of the eye to shift toward the blue end of the color spectrum at low illumination levels as part of dark adaptation.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Pollux
GEMINI
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Alhena
TAURUS
Aldebaran
Alpha Orionis
(Betelgeuse)
Procyon
ORION
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