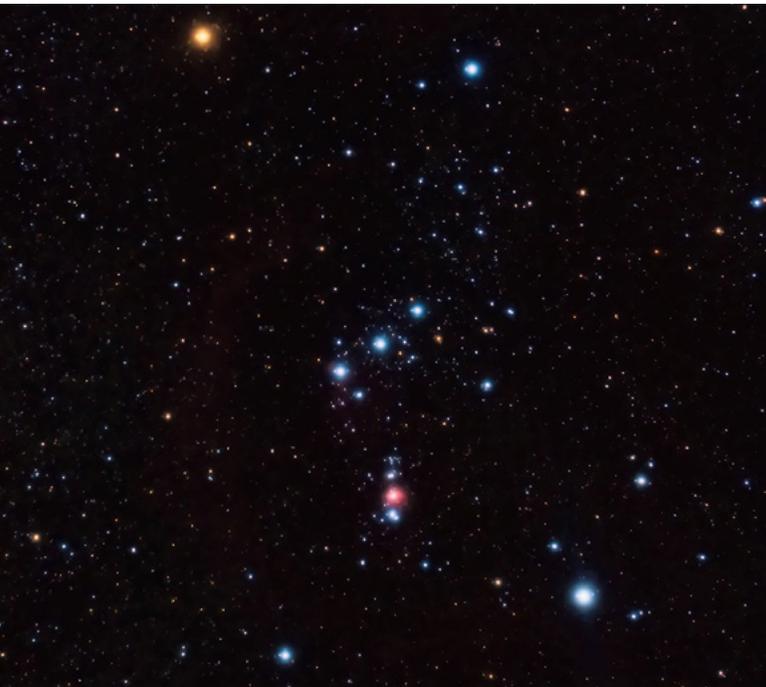




## UNIVERSE DISCOVERY GUIDES

January

# BETELGEUSE



Orion Constellation. Credit: P. Sanz.

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The universe is a place of change. NASA missions advance our understanding of the changing universe.

[www.nasa.gov](http://www.nasa.gov)

## BETELGEUSE, RED SUPERGIANT WORKAHOLIC

Stars change with time. Like people, stars are born, work hard, and grow old.

The bright reddish star marking the shoulder of Orion, the mighty hunter, is a mighty workaholic.

Born as a super-massive star millions of years ago, Betelgeuse is now nearing the end of its life and has expanded to become a red supergiant star. But it is still working hard to build the wealth needed to support future generations of stars within our galaxy.

Imagine you could be deep inside Betelgeuse, near its core — the star's storehouse.

You could watch the star constructing heavier and heavier elements — hydrogen to helium to carbon to oxygen to calcium eventually all the way to iron.

It is assembling and storing away many of the elements needed to build the next generations of stars, rocky planets, and life — like you!

But how does that wealth of elements get out of that storehouse deep inside the star?

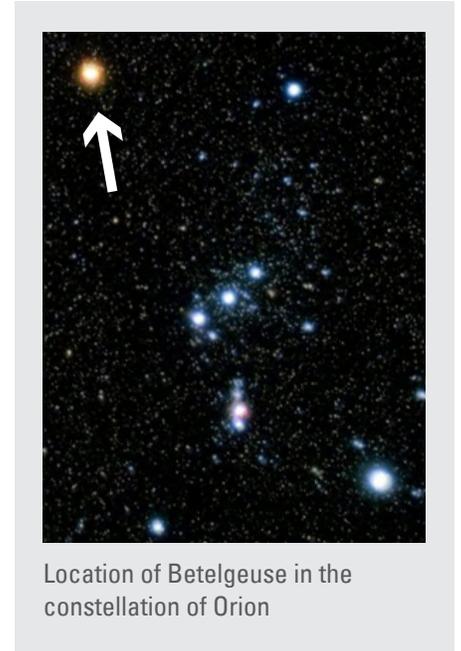
Well, that's the next phase in the life of Betelgeuse.

Betelgeuse will eventually explode as a supernova blasting its store of heavy elements out into our galaxy — providing the raw materials for future stellar generations.



Watch what will happen to Betelgeuse!  
<http://youtu.be/Q5UEMkvdnAc>

This explosion is likely to happen within the next few hundred thousand years. Possibly even tonight. When Betelgeuse does go supernova, it could briefly become brighter than the full moon. Keep watching — you might witness the moment Betelgeuse flings its wealth back into the community of stars.



Location of Betelgeuse in the constellation of Orion

## SKY FEATURE: BETELGEUSE

### How to Find it

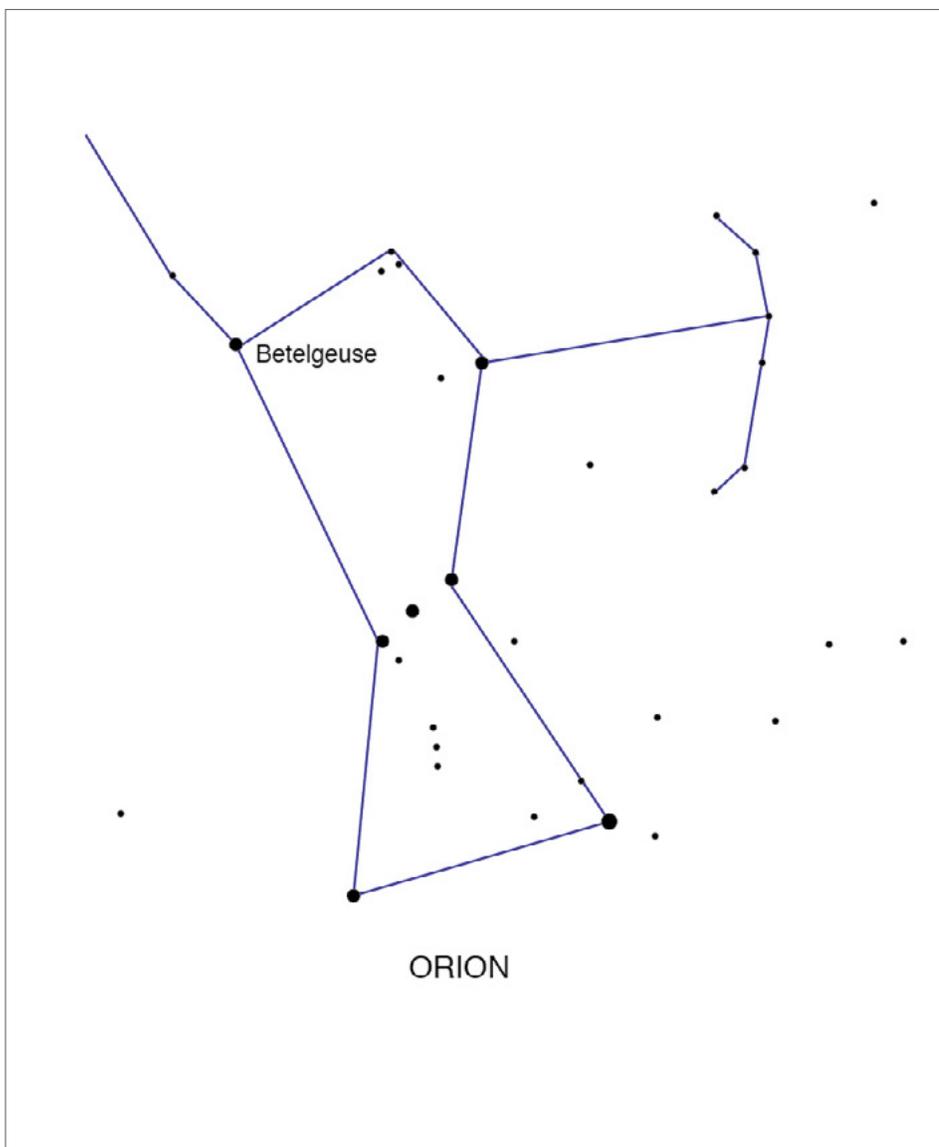
**Distance:** approx 650 light-years

**Visual Magnitude:** 0.4

**Actual dimension:** 8 – 20 solar masses, over 850 solar radii

**To view:** Visual — just your eyes

[Click here to jump to the full-sky January Star Map.](#)



On January evenings, from the Northern Hemisphere, face south and you'll easily spot three stars in a row that mark the belt of Orion, the Hunter. Above them, on the left, is the bright star Betelgeuse. Notice its reddish cast. Compare Betelgeuse to the other stars in Orion. Its reddish glow marks it as a hard-working red supergiant star.

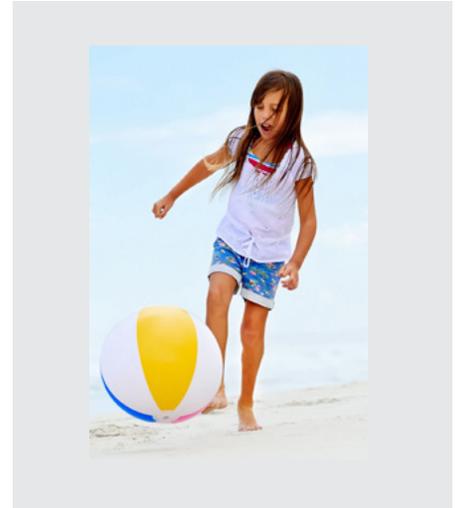
## TRY THIS!

If we reduce the Sun to the size of a grain of sand, an 18" diameter beach ball would be about the size of Betelgeuse.

Next time you are at the beach, pick up a grain of sand and compare it to your beach ball.

Oxygen and silicon are the elements in that grain of sand and were made inside stars like Betelgeuse billions of years ago.

If Betelgeuse were placed where the Sun is, the orbits of all our planets from Mercury through Jupiter would be inside of Betelgeuse.

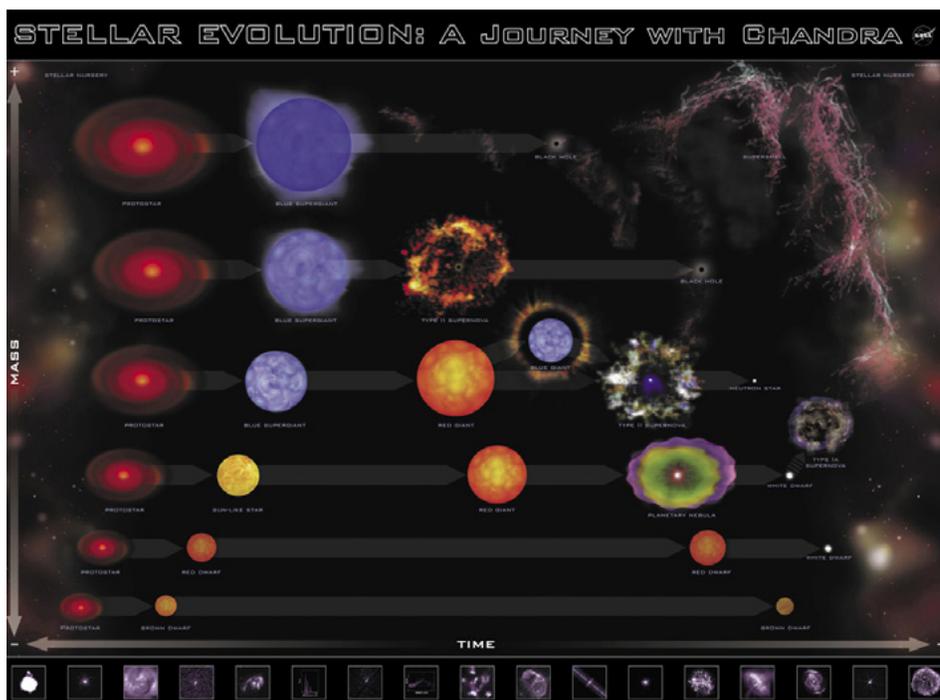


## Explore Pathways in the Lives of Stars (Appropriate for high school to adult)

Explore the stages of stellar evolution with this interactive guide from the Chandra X-Ray Observatory:

[http://chandra.harvard.edu/edu/formal/stellar\\_ev/stellar\\_ev\\_flash.html](http://chandra.harvard.edu/edu/formal/stellar_ev/stellar_ev_flash.html)

(Requires Flash)



## ACTIVITY: NUCLEAR FUSION ... WITH MARSHMALLOWS

Time: Less than 10 minutes

Age: 10 and up

This simple activity explains how nuclear fusion in the core of a star generates elements in the universe.

Marshmallows are used to represent protons.

BONUS: You can eat the elements you make!

Find the activity here:

[https://nightsky.jpl.nasa.gov/download-view.cfm?Doc\\_ID=340](https://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=340)



## Will our Sun go Supernova?

Time: 20–30 minutes

Age: 13 and up

Play the Solar Supernova interactive game by the Sonoma State University's NASA Education and Public Outreach Group. Your mission is to help Professor Starzapoppin determine if the Sun will go supernova by going through his notes and interactively checking his data. Will you be the super sleuth to set the record straight?

<http://mystery.sonoma.edu/solarsupernova/>



For more education and public outreach activities from Sonoma State University's NASA education and public outreach group, see the Space Science Education and Public Outreach website:

<http://epo.sonoma.edu/projects.php>

### Find more NASA Activities

Looking for more Earth and Space Science formal and informal education activities?

Try out NASA's digital collection of resources at NASA Wavelength:

<http://nasawavelength.org>



## CONNECT TO NASA SCIENCE

### How do we know?

How do red supergiants build carbon, nitrogen, oxygen, calcium, and iron from little ol' hydrogen? Find out at NASA's Imagine the Universe:

<http://imagine.gsfc.nasa.gov/docs/teachers/elements/imagine/05.html>

How is the size, brightness, and color of a star related to its mass and age? Use this resource from the Chandra X-ray Observatory, developed for those with some previous knowledge of how stars change from birth to death. Learn how astronomers classify stars into different categories.

[http://chandra.harvard.edu/edu/formal/stellar\\_ev/story/index3.html](http://chandra.harvard.edu/edu/formal/stellar_ev/story/index3.html)

For the latest news from Chandra, visit

<http://chandra.harvard.edu/press/>

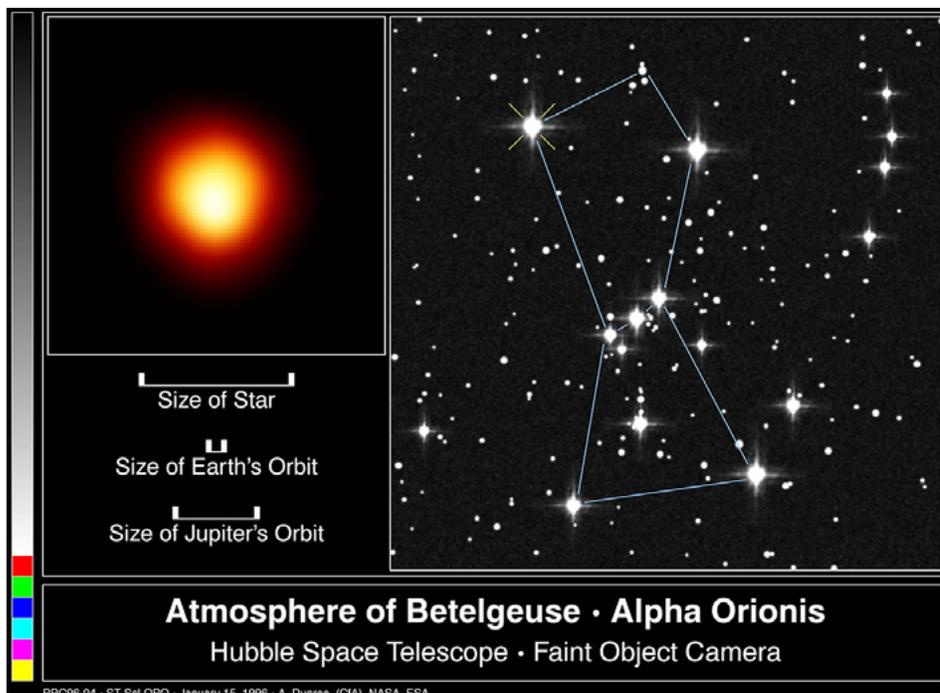


<http://imagine.gsfc.nasa.gov>

### The Hot Spots of Betelgeuse

The Hubble Space Telescope image of Betelgeuse in 1995 was the first ever to resolve a direct image of a star besides our Sun. There was enough detail to notice a clear hot spot on Betelgeuse.

<http://hubblesite.org/newscenter/archive/releases/1996/04/image/a/>

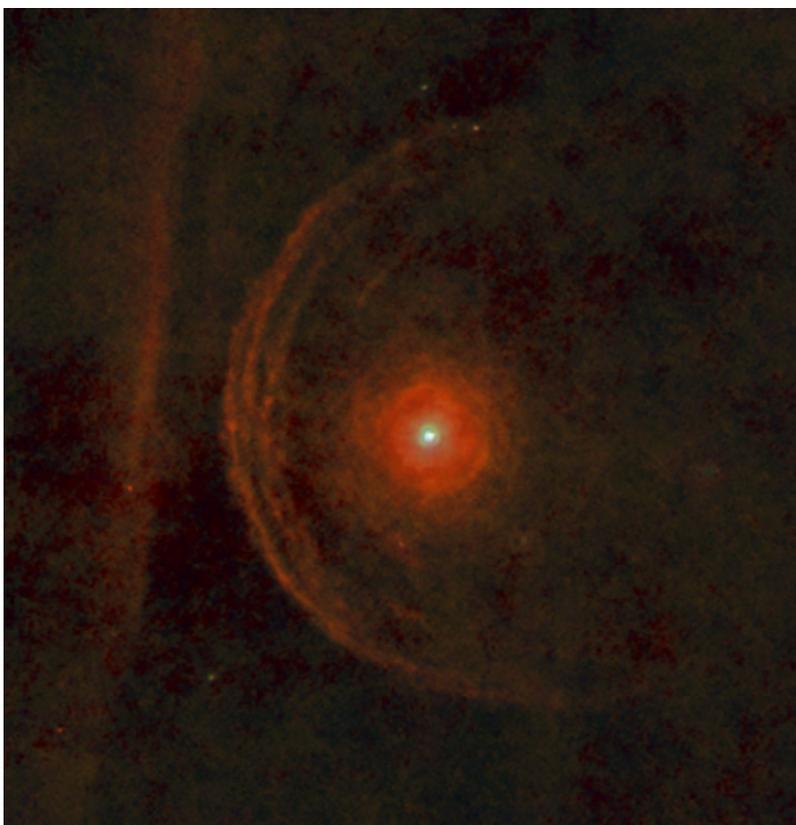


Since then, images from other telescopes have resolved further hot spots on Betelgeuse.

<http://apod.nasa.gov/apod/ap100106.html>

For the latest news from Hubble, visit  
<http://hubblesite.org/newscenter/>

## Betelgeuse Heads for a Collision



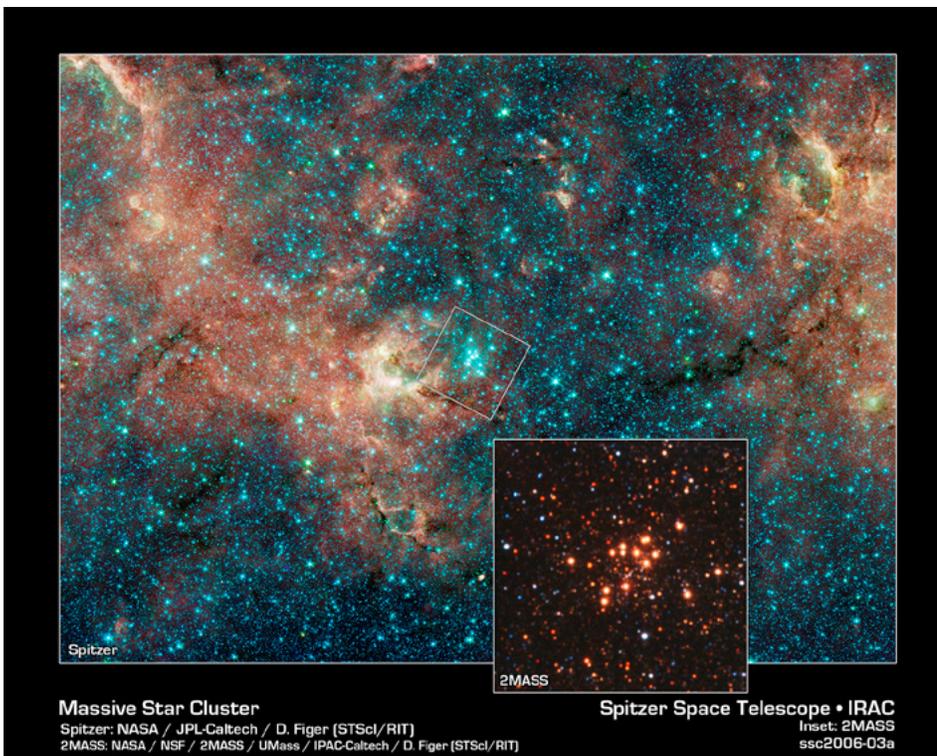
This view of Betelgeuse from the Herschel Space Observatory shows how the winds flowing off the star are crashing against the surrounding dust and gas, creating a bow shock as the star moves through space at speeds of around 30 kilometers per second. That's as fast as speeding from San Francisco to Denver in about a minute!

[http://www.esa.int/Our\\_Activities/Space\\_Science/Betelgeuse\\_braces\\_for\\_a\\_collision](http://www.esa.int/Our_Activities/Space_Science/Betelgeuse_braces_for_a_collision)

## Red Supergiants Abound in our Galaxy

Betelgeuse is not the only hard-working red supergiant in our Milky Way Galaxy. These infrared Spitzer and 2MASS images reveal a wealth of workaholics in a distant star cluster:

[http://www.spitzer.caltech.edu/images/1551-ssc2006-03a-A-Hidden-Massive\\_Star\\_Cluster\\_Awash-with-Red-Supergiants](http://www.spitzer.caltech.edu/images/1551-ssc2006-03a-A-Hidden-Massive_Star_Cluster_Awash-with-Red-Supergiants)



For the latest news from Spitzer, visit  
<http://www.spitzer.caltech.edu/news>

For the latest news from 2MASS, visit  
<http://www.ipac.caltech.edu/2mass/overview/news.html>

## ACKNOWLEDGEMENTS

The Universe Discovery Guides are a collaborative effort between members of the NASA Astrophysics education and public outreach (E/PO) community and the NASA Astrophysics Science Education and Public Outreach Forum. We also gratefully acknowledge the informal educators from the Astronomy from the Ground Up (AFGU) and the Sky Rangers communities who field-tested the guides.

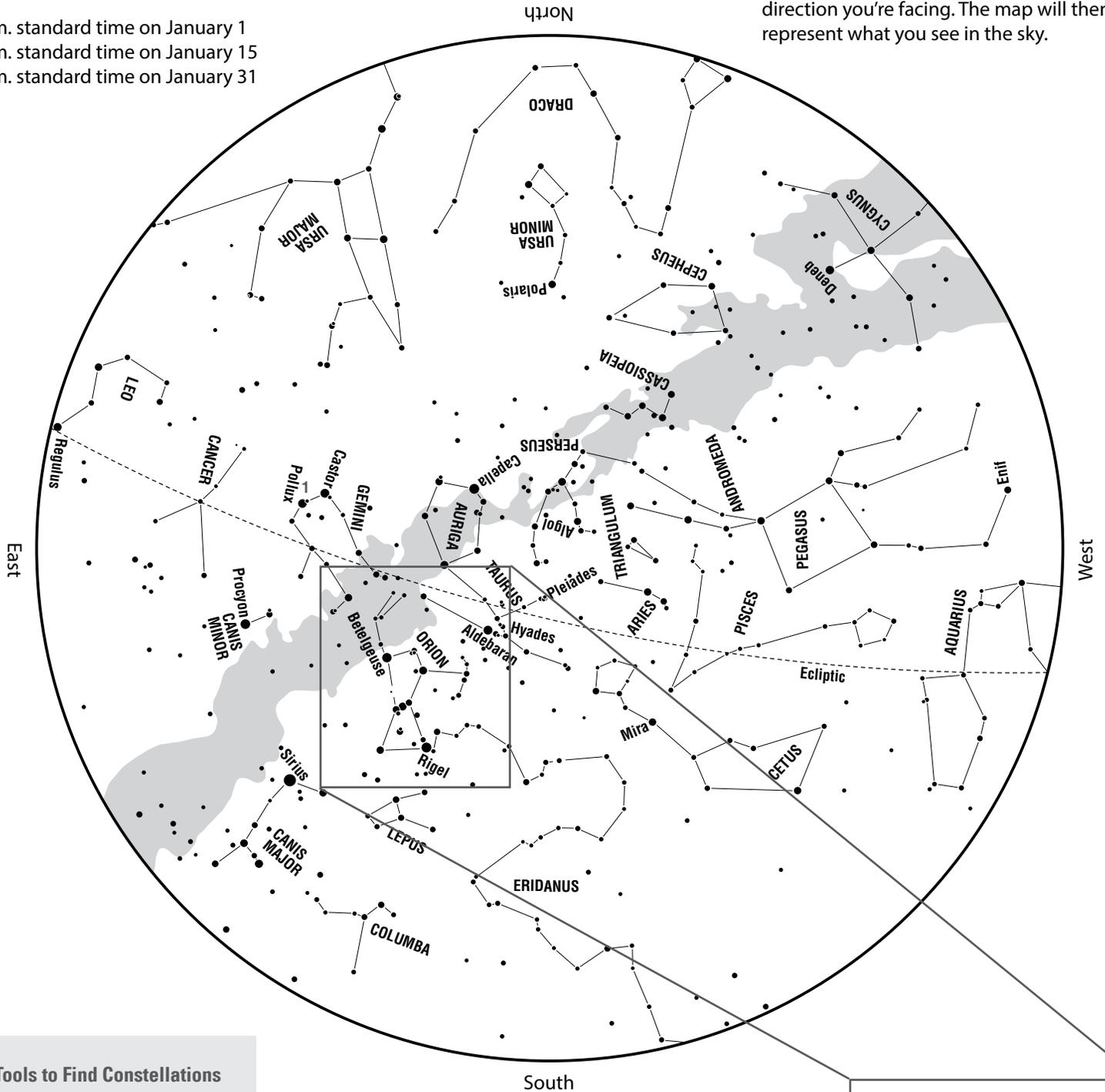
Contributing NASA Astrophysics E/PO programs include: Afterschool Universe, Alien Earths, Astronomy Picture of the Day (APOD), the Chandra X-ray Observatory, the Cosmic Background Explorer (COBE), Cosmic Questions, the Euclid mission, Exoplanet Exploration, the Fermi Gamma-ray Space Telescope, the Galaxy Evolution Explorer (GALEX), the Herschel Space Observatory, the High Energy Astrophysics Science Archive Research Center (HEASARC), the Hubble Space Telescope, Imagine the Universe, the Infrared Processing and Analysis Center (IPAC), the James Webb Space Telescope, the Kepler Mission, the Milky Way Project, the Night Sky Network (NSN), the Nuclear Spectroscopic Telescope Array (Nu-STAR), Observing with NASA (OwN), Other Worlds, the Planck mission, PlanetQuest, Planet Hunters, the Spitzer Space Telescope, StarChild, the Stratospheric Observatory for Infrared Astronomy (SOFIA), the Swift mission, the Two Micron All-Sky Survey (2MASS), the Wide-Field Infrared Survey Explorer (WISE), the Wilkinson Microwave Anisotropy Probe (WMAP), the X-ray Multi-Mirror Mission (XMM-Newton), and Zooniverse.

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The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

- 9 p.m. standard time on January 1
- 8 p.m. standard time on January 15
- 7 p.m. standard time on January 31

To locate stars in the sky, hold the map above your head and orient it so that one of the four direction labels matches the direction you're facing. The map will then represent what you see in the sky.



### Tools to Find Constellations

#### For mobile device users:

Search your app store for “planetarium” or “sky map” to find free or low-cost apps. These help you more easily locate constellations.

[View a video on how to read a star map.](#)

### January Sky Feature: Betelgeuse

[Jump to Sky Feature to find out about Betelgeuse](#)