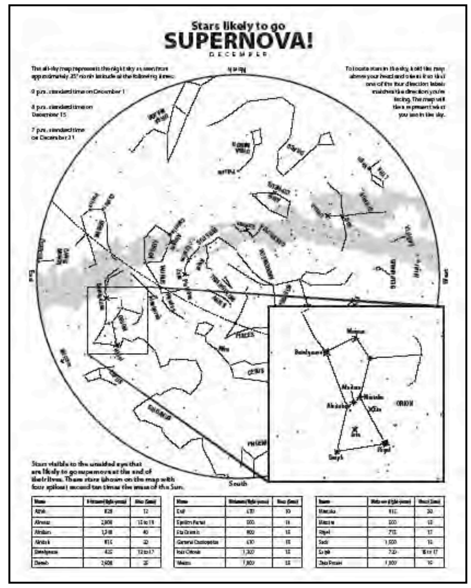
Supernova Star Maps

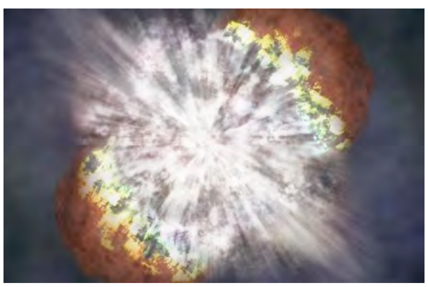
Which Stars in the Night Sky Will Go Supernova?



About the Activity
Allow visitors to experience finding stars in the night sky that will eventually go supernova.

Topics Covered
Observation of stars that will one day go supernova

Materials Needed
- Copies of this month's Star Map for your visitors– print the Supernova Information Sheet on the back.
- *(Optional)* Telescopes



Credit NASA

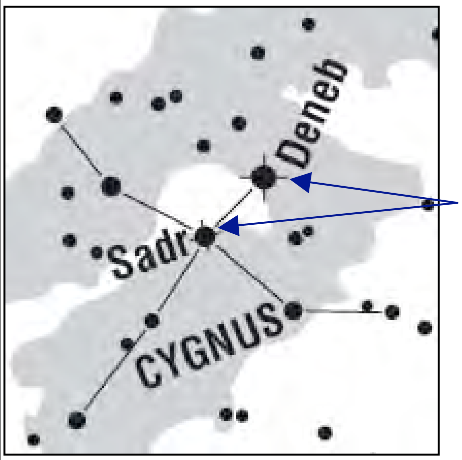
Location and Timing
This activity is perfect for a star party outdoors and can take a few minutes, up to 20 minutes, depending on the length of the discussion about the questions on the Supernova Information Sheet. Discussion can start while it is still light.

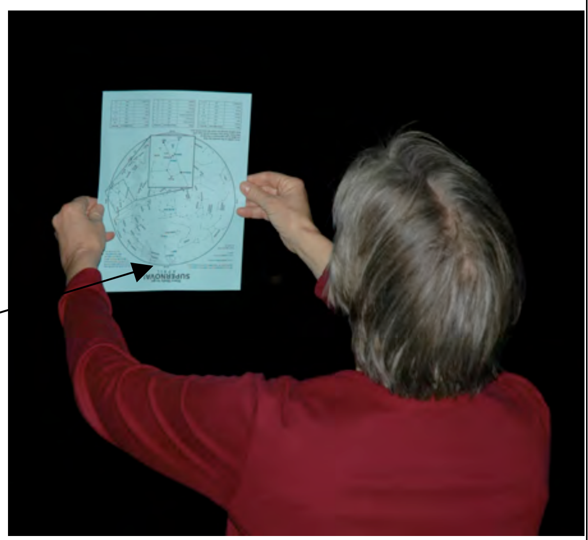
Participants
Activities are appropriate for families with children over the age of 9, the general public, and school groups ages 9 and up. Any number of visitors may participate.

Included in This Packet	Page

Background Information
There is an Excel spreadsheet on the Supernova Star Maps Resource Page that lists all these stars with all their particulars. Search for Supernova Star Maps here:
http://nightsky.jpl.nasa.gov/download-search.cfm

Star Maps: Stars likely to go Supernova!

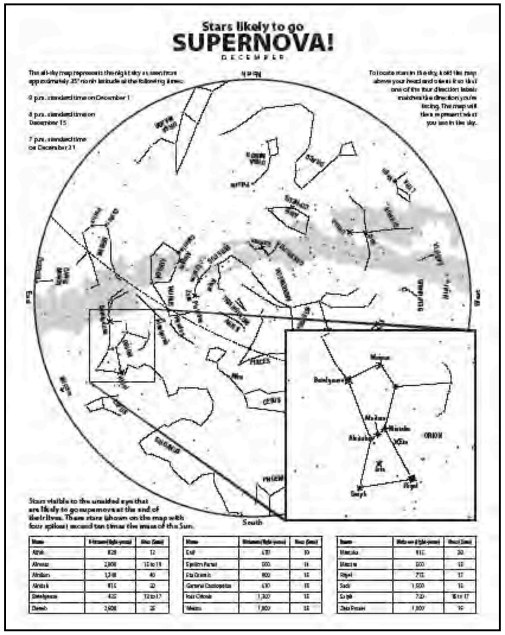
Leader's Role	**Participants' Role (Anticipated)**
Materials: Star Map with Supernova Information sheet on back	
Objective: Allow visitors to experience finding stars in the night sky that will eventually go supernova.	
To do: Pass out star maps with supernova information sheet on the back.  *To say:* Look on the side with the star map. It is marked with the brightest stars that will one day go supernova. These stars are marked with four spikes. It may look like a lot of the stars will go supernova. But we need to remember that we can only see the biggest and brightest of all the stars out there. Over 85% of the stars in our galaxy are small stars – stars like our Sun or smaller. But the stars are so far away that we can only see the brightest ones without a telescope. And the brightest stars also tend to be the most massive stars – the ones much more massive than our Sun. And it's the most massive stars that will go supernova.	Wow! There's a lot.
To say (if you'd like to use an analogy) It's like looking up at a commercial airplane, flying overhead at cruising altitude (about 7 miles or 11 km up). Do you see any lights on the airplane? Yes, the bright lights the airplane has on its wings and body. What lights wouldn't you be able to see? Would you see the light coming from the windows of the airplane? Light from the cockpit where the pilots are? Why not? It's the same with the stars. There are many more smaller, dimmer stars than there are bright stars, we just can't see them without a telescope.	Yes. White, red and green lights. Some are flashing. No. No! Too far away, too dim.

Leader's Role	**Participants' Role (Anticipated)**
To say: Let's look at the information on the other side. The next one to go is probably Betelgeuse or Antares – they could go anytime: tomorrow or a million years from now. Both are over 400 light years away. They would look really bright and would probably even be visible during the day. But they are too far away to affect us. Only a supernova happening within about 30 light years could damage life on Earth. For the rest of the marked stars, it'll be at least a few million years before they explode. Let's find a few of these stars in the sky. *To do:* Use the star maps and point out the stars that are likely to go supernova.	Someone may ask: "When will these stars blow up?"
To Do: You may want to provide a quick training on how to use a star map. *To Say:* Road maps are read with the map oriented down, where the roads are. A star map is oriented up, where the stars are. Let's all face north. Rotate your star map so the side of the map marked "North" is down toward the northern horizon. All the constellations in that quarter of the map will be visible in front of you.  Now let's turn toward the east. Rotate the map so the side of the map marked "East" is down toward the eastern horizon. All the constellations in that quarter of the map will be visible in front of you.	Visitors follow directions.

Leader's Role	Participants' Role (Anticipated)
To Say: Now look straight up. What part of the map will show the stars over your head? Right! Now, who can find [name a constellation]?	 The center of the map? Visitors use star map.

Helpful Hints

SUPERNOVA Star Maps:



The star map (left) is marked with the brightest stars that are likely to one day go supernova. These stars are shown on the map with four spikes. These are all the stars that are:

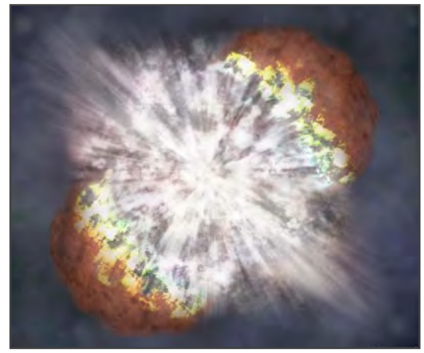
- 3rd magnitude or brighter
- visible from the continental United States
- with at least 10 times the mass of our Sun

Many sources state that stars more than 8 solar masses will go supernova. This limit is somewhat uncertain, but choosing stars that have more than 10 times the mass of the Sun pretty much guarantees that they will go supernova.

On the reverse side of the star map is the Supernova Information Sheet (right) with a list of common questions people ask about supernovae. There is a place at the bottom for you to insert your club information.

National Aeronautics and Space Administration

SUPERNOVA!



What is a supernova?

One type of supernova is the explosion caused when a massive star (more than about 8 to 10 times the mass of our Sun) exhausts its fuel and collapses. During the explosion, the star will blow off most of its mass. The remaining core will form a neutron star or a black hole. Supernova explosions are among the most energetic events in the Universe, and they forge elements such as calcium, silver, iron, gold, and silicon. The supernova explosion scatters the elements out into space. These are the elements that make up stars, planets, and everything on Earth – including us!

Will our Sun go supernova?

No, smaller stars like our Sun end their lives as dense hot objects called white dwarfs. Only stars that contain more than about 8 to 10 times the mass of our Sun will go supernova.

Why do massive stars go supernova?

A star's core is an element factory. It fuses atoms into heavier and heavier elements, all the while producing energy, until it reaches iron. Iron is the end of the line for fusion. When the core is finished producing iron it has no way to keep producing energy. This causes gravity to take over and the core begins to collapse. The atoms smash into each other, forming neutrons. The collapse stops when the neutrons can't be packed together any more tightly. This sudden stop and, the energy released from forming neutrons, causes a shock wave to travel outward, blasting most of the star into space. If the star is very massive nothing can stop the collapse of the core and a black hole is created.

If a star goes supernova near us, is it dangerous?

Yes it would be. Fortunately, there are no stars likely to go supernova that are near enough to be any danger to Earth. Distance is important because the closer the supernova explosion, the more cosmic radiation would reach us. Even if Earth's atmosphere and surrounding magnetic field protect us, an explosion closer than 30 light years would overwhelm this protection. The nearest stars likely to go supernova within the next few million years are Betelgeuse and Antares. Both are over 400 light years away, far more than the 30 light years at which the explosion could become dangerous. Another VERY massive star, Eta Carinae, visible in the southern hemisphere, could go even sooner. But it is 7,500 light years away.

What's a GRB?

Gamma-ray bursts (GRBs for short) are bursts of very high-energy radiation in space. Thanks to NASA missions, astronomers know there are different kinds of GRBs. One kind is produced in supernova explosions where most of the gamma-ray energy is focused into narrow beams. Because the energy is concentrated in these beams, if one of the beams pointed in the direction of Earth, they appear brighter when we detect them (think of the difference between a 100-watt light bulb and the focused energy of a 100-watt metal cutting laser pointed at you!). GRBs have been detected in very distant galaxies, more than a billion light years away, too far away to harm us here on Earth. That distance is like that same laser placed more than twice the distance of the Moon away from you.

Some of the NASA missions that study supernovae and high-energy radiation from space:
GLAST: http://www.nasa.gov/glast Swift: http://swift.gsfc.nasa.gov Chandra: http://chandra.harvard.edu
Suzaku(with JAXA): http://suzaku-epo.gsfc.nasa.gov/ XMM-Newton(with ESA): http://xmm.sonoma.edu
For more information on supernovae and high-energy radiation: http://imagine.gsfc.nasa.gov/docs/science/

Stars likely to go SUPERNOVA!

JANUARY

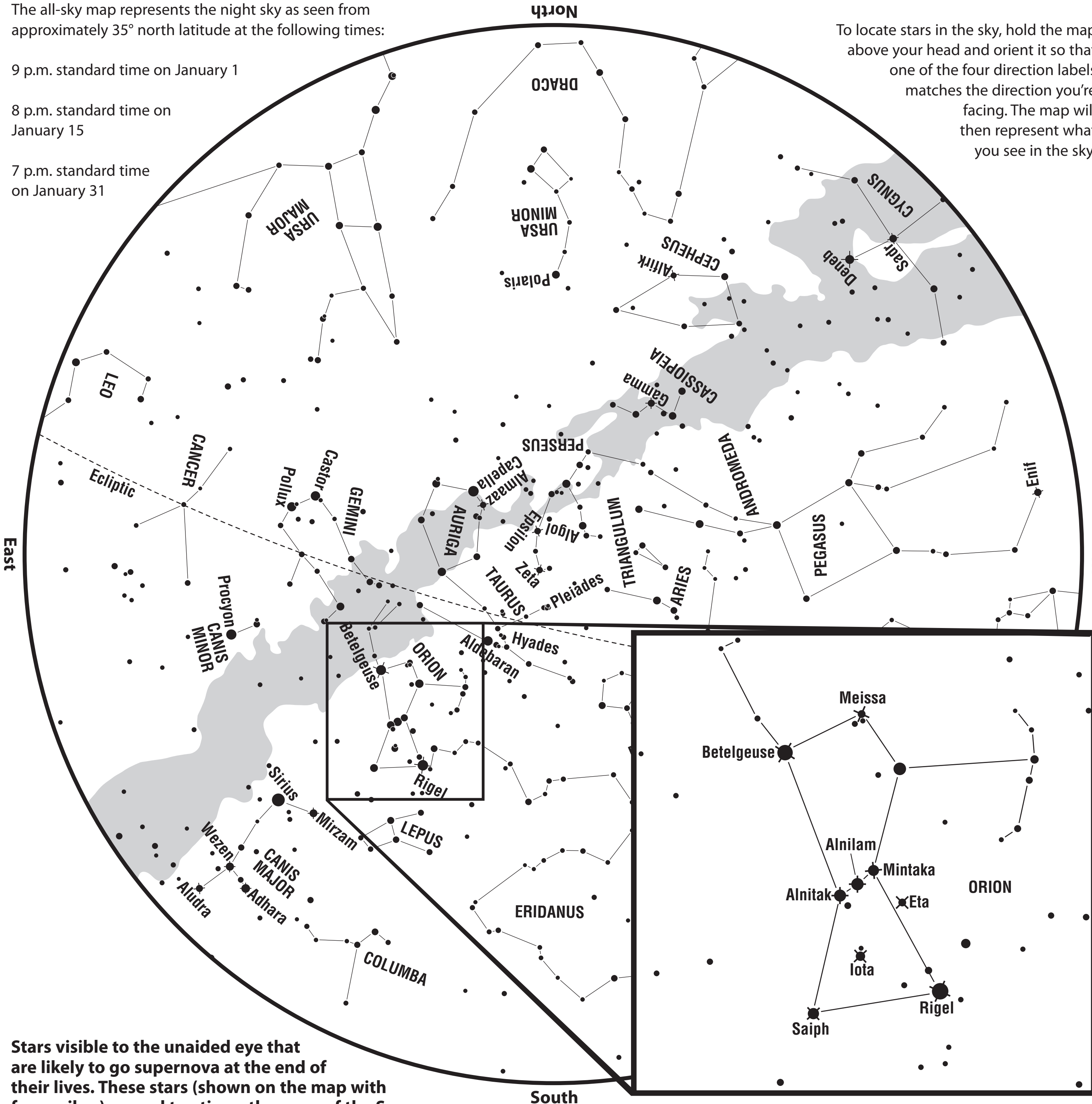
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

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.



Stars visible to the unaided eye that are likely to go supernova at the end of their lives. These stars (shown on the map with four spikes) exceed ten times the mass of the Sun.

Name	Distance (light-years)	Mass (Suns)
Adhara	430	10 to 12
Alfirk	820	12
Almaaz	2,000	15 to 19
Alnilam	1,340	40
Alnitak	815	20
Aludra	3,200	15
Betelgeuse	425	12 to 17

Name	Distance (light-years)	Mass (Suns)
Deneb	2,600	25
Enif	670	10
Epsilon Persei	500	14
Eta Orionis	900	15
Gamma Cassiopeiae	610	15
Iota Orionis	1,300	15
Meissa	1,000	25

Name	Distance (light-years)	Mass (Suns)
Mintaka	915	20
Mirzam	500	15
Rigel	775	17
Sadr	1,500	12
Saiph	720	15 to 17
Wezen	1,800	17
Zeta Persei	1,000	19

Stars likely to go

SUPERNOVA!

F E B R U A R Y

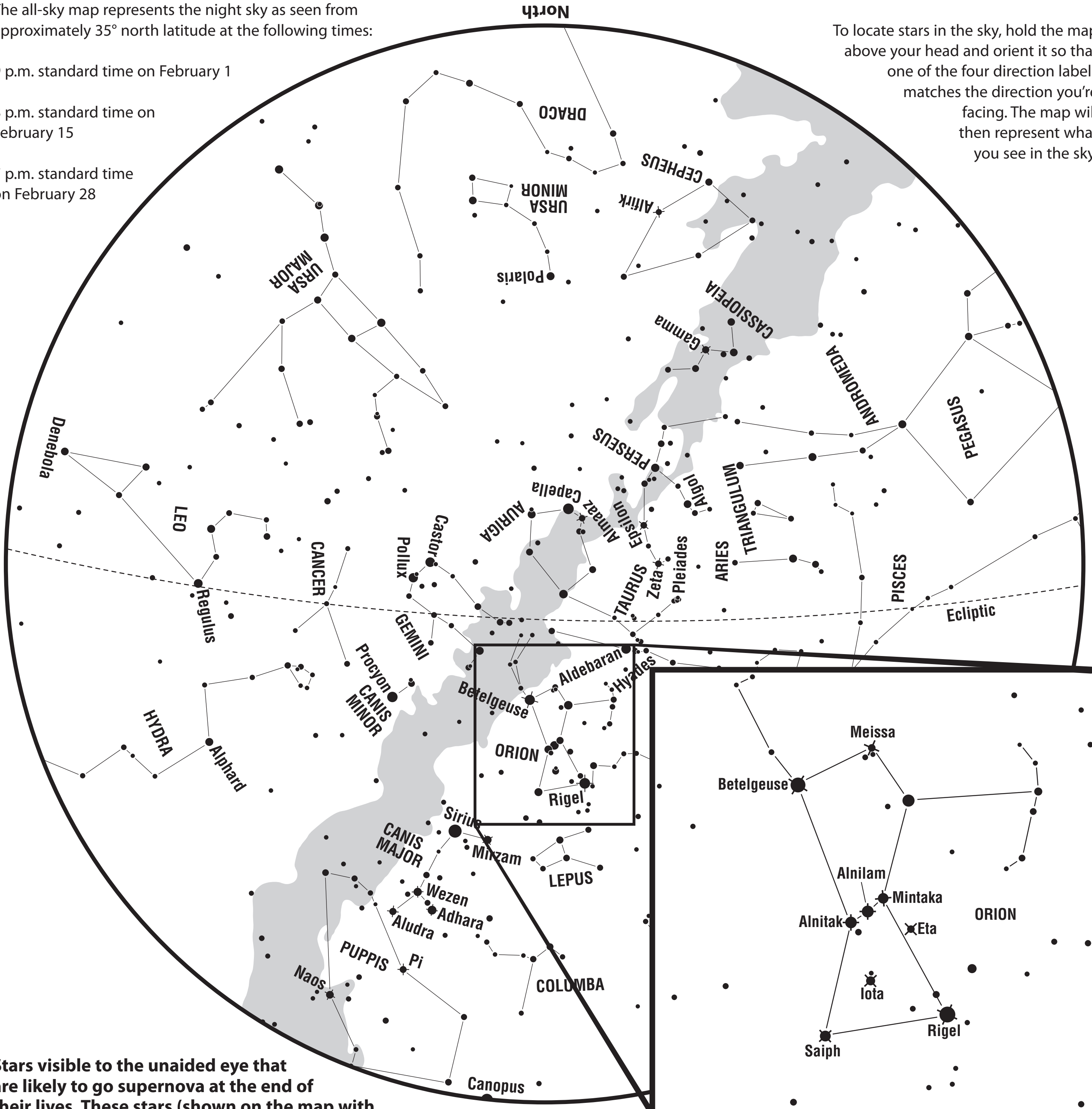
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

9 p.m. standard time on February 1

8 p.m. standard time on February 15

7 p.m. standard time on February 28

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.



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Almaaz	2,000	15 to 19
Alnilam	1,340	40
Alnitak	815	20
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Epsilon Persei	500	14
Eta Orionis	900	15
Gamma Cassiopeiae	610	15
Iota Orionis	1,300	15
Meissa	1,000	25
Mintaka	915	20

Name	Distance (light-years)	Mass (Suns)
Mirzam	500	15
Naos	1,400	60
Pi Puppis	1,100	13 to 14
Rigel	775	17
Saiph	720	15 to 17
Wezen	1,800	17
Zeta Persei	1,000	19

Stars likely to go

SUPERNOVA!

MARCH

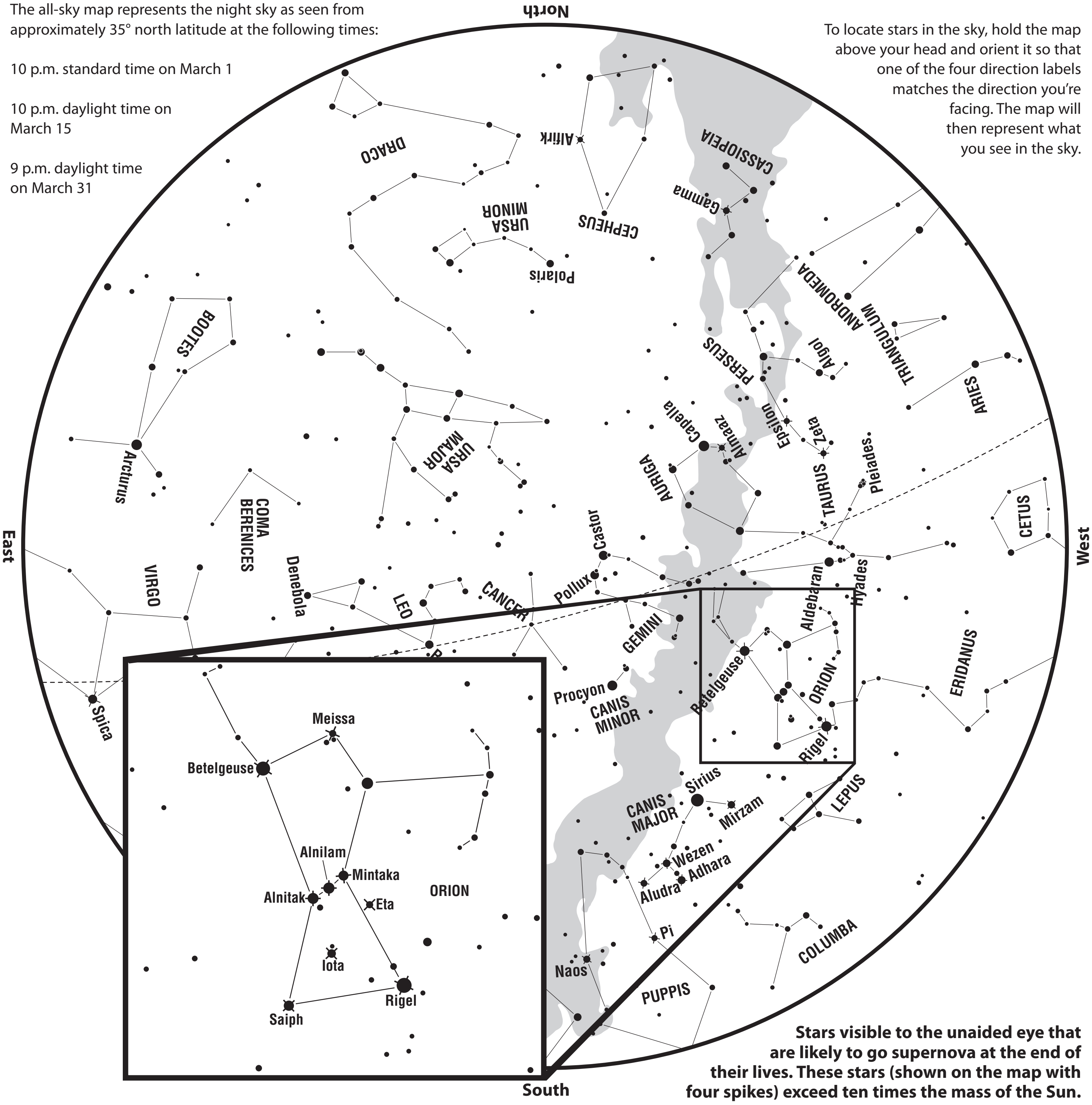
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

10 p.m. standard time on March 1

10 p.m. daylight time on March 15

9 p.m. daylight time on March 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.



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Betelgeuse	425	12 to 17

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Epsilon Persei	500	14
Eta Orionis	900	15
Gamma Cassiopeiae	610	15
Iota Orionis	1,300	15
Meissa	1,000	25
Mintaka	915	20
Mirzam	500	15

Name	Distance (light-years)	Mass (Suns)
Naos	1,400	60
Pi Puppis	1,100	13 to 14
Rigel	775	17
Saiph	720	15 to 17
Spica	260	11
Wezen	1,800	17
Zeta Persei	1,000	19

Stars likely to go SUPERNOVA!

APRIL

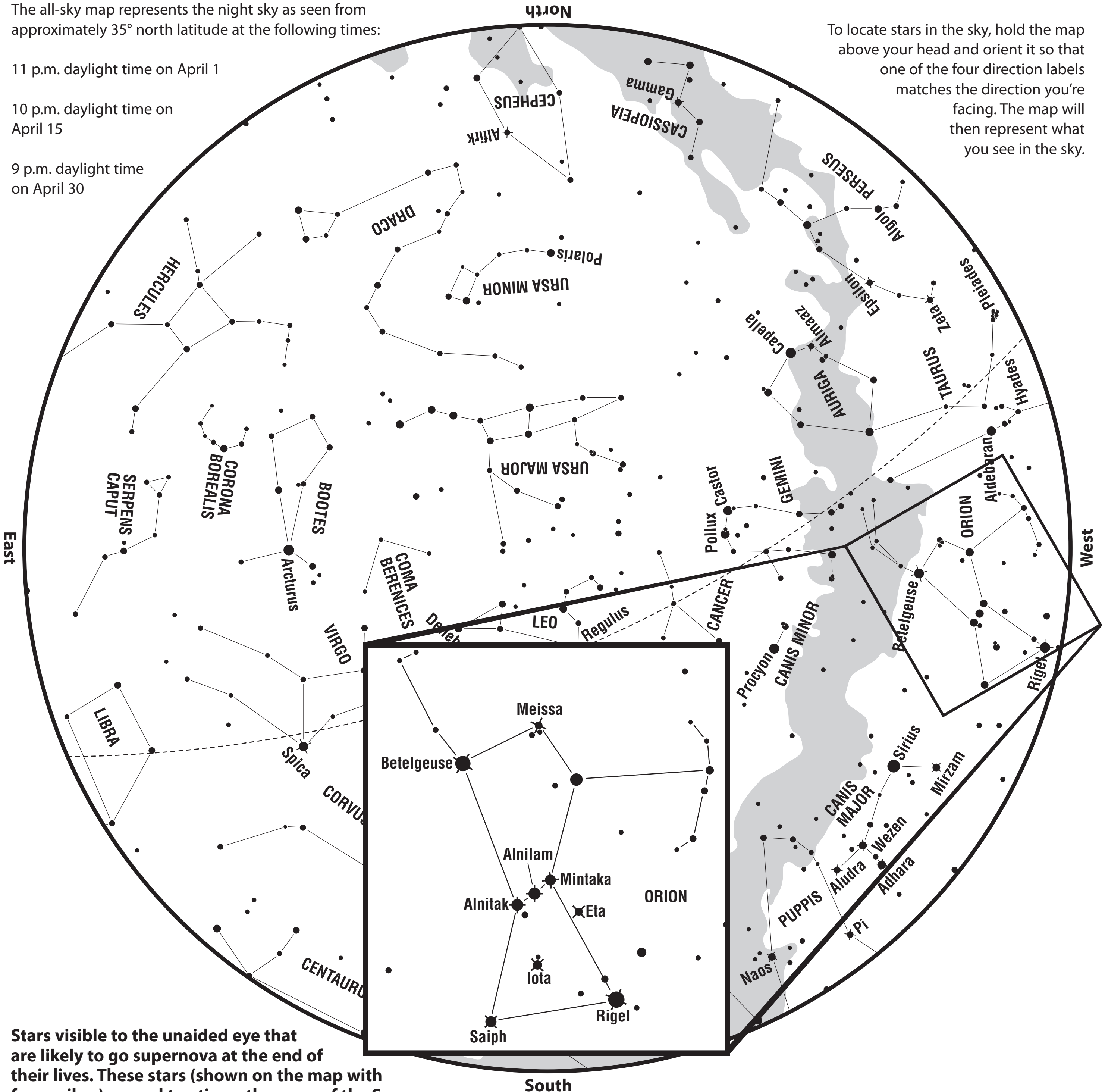
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

11 p.m. daylight time on April 1

10 p.m. daylight time on April 15

9 p.m. daylight time on April 30

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.



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Betelgeuse	425	12 to 17

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Eta Orionis	900	15
Gamma Cassiopeiae	610	15
Iota Orionis	1,300	15
Meissa	1,000	25
Mintaka	915	20
Mirzam	500	15

Name	Distance (light-years)	Mass (Suns)
Naos	1,400	60
Pi Puppis	1,100	13 to 14
Rigel	775	17
Saiph	720	15 to 17
Spica	260	11
Wezen	1,800	17
Zeta Persei	1,000	19

Stars likely to go SUPERNOVA!

MAY

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

midnight daylight time on May 1

11 p.m. daylight time on May 15

10 p.m. daylight time on May 31

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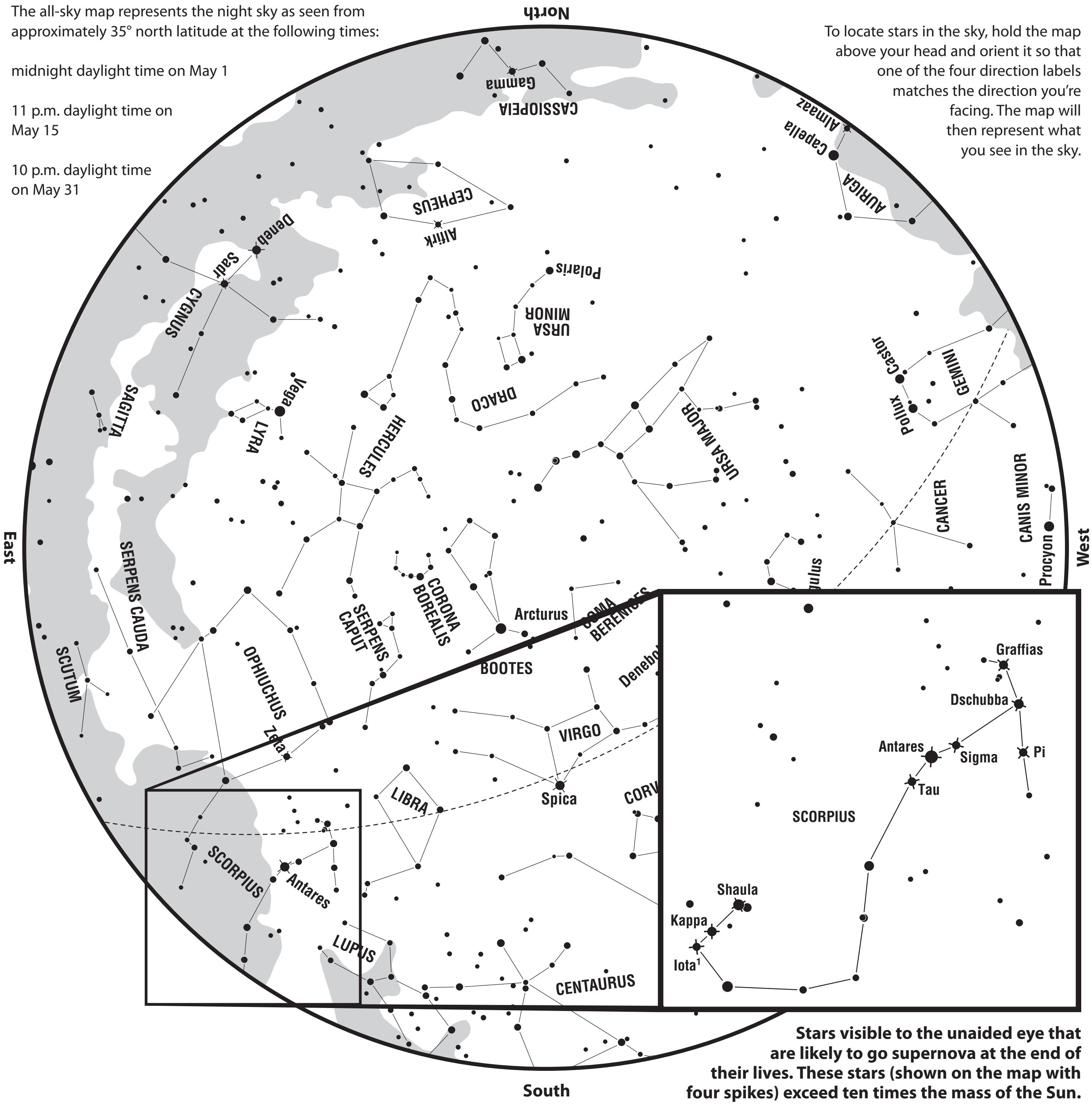

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Alfirk	820	12
Almaaz	2,000	15 to 19
Antares	600	15 to 18
Deneb	2,600	25
Dschubba	400	12

Name	Distance (light-years)	Mass (Suns)
Gamma Cassiopeiae	610	15
Graffias	530	10
Iota[1] Scorpii	4,000	12
Kappa Scorpii	450	10.5
Pi Scorpii	500	11
Sadr	1,500	12

Name	Distance (light-years)	Mass (Suns)
Shaula	365	11
Sigma Scorpii	520	12 to 20
Spica	260	11
Tau Scorpii	400	12
Zeta Ophiuchi	460	20

Stars likely to go SUPERNOVA!

JUNE

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

midnight daylight time on June 1

11 p.m. daylight time on June 15

10 p.m. daylight time on June 30

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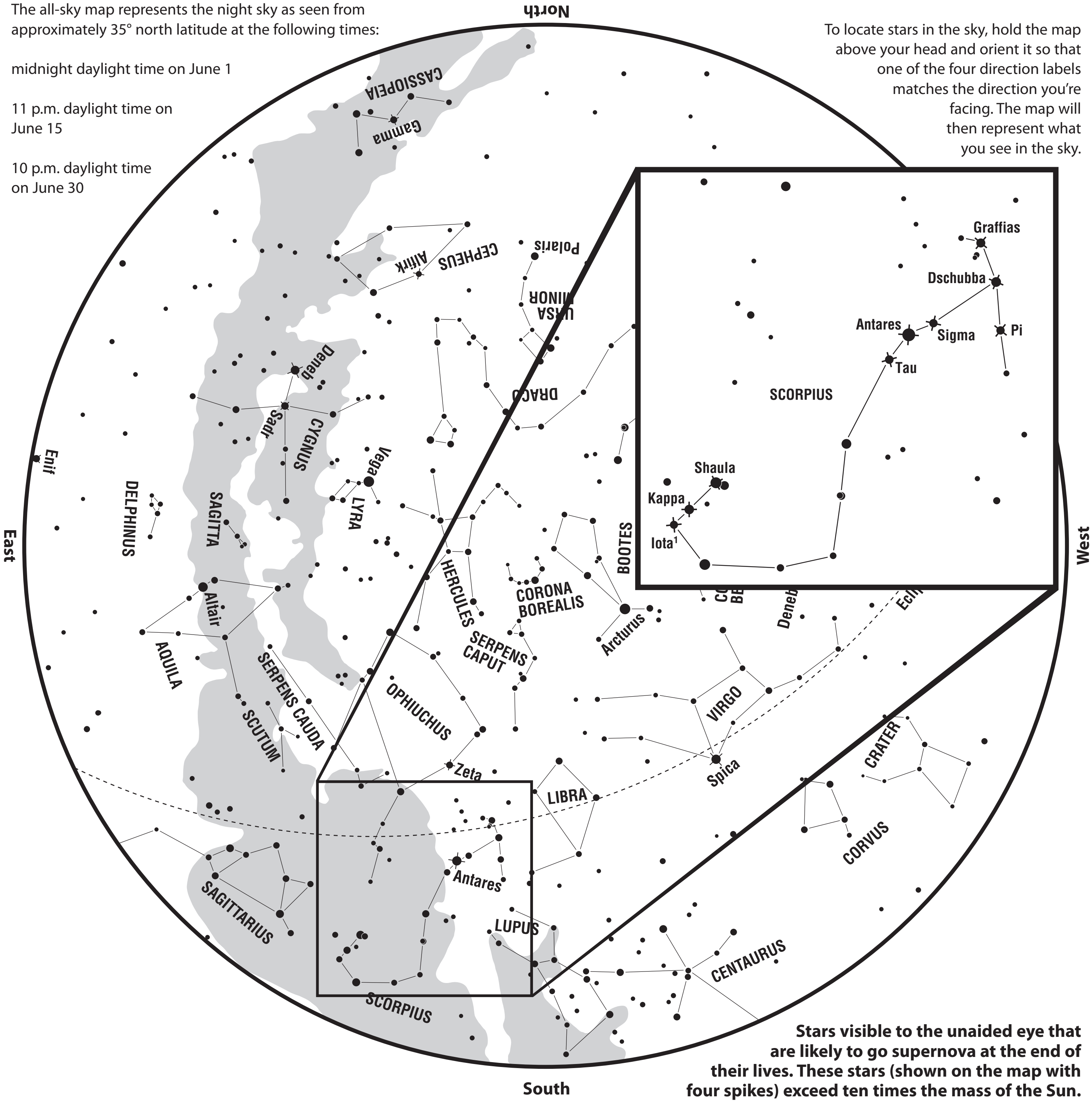

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Alfirk	820	12
Antares	600	15 to 18
Deneb	2,600	25
Dschubba	400	12
Enif	670	10

Name	Distance (light-years)	Mass (Suns)
Gamma Cassiopeiae	610	15
Graffias	530	10
Iota[1] Scorpii	4,000	12
Kappa Scorpii	450	10.5
Pi Scorpii	500	11
Sadr	1,500	12

Name	Distance (light-years)	Mass (Suns)
Shaula	365	11
Sigma Scorpii	520	12 to 20
Spica	260	11
Tau Scorpii	400	12
Zeta Ophiuchi	460	20

Stars likely to go SUPERNOVA!
JULY

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

midnight daylight time on July 1

11 p.m. daylight time on July 15

10 p.m. daylight time on July 31

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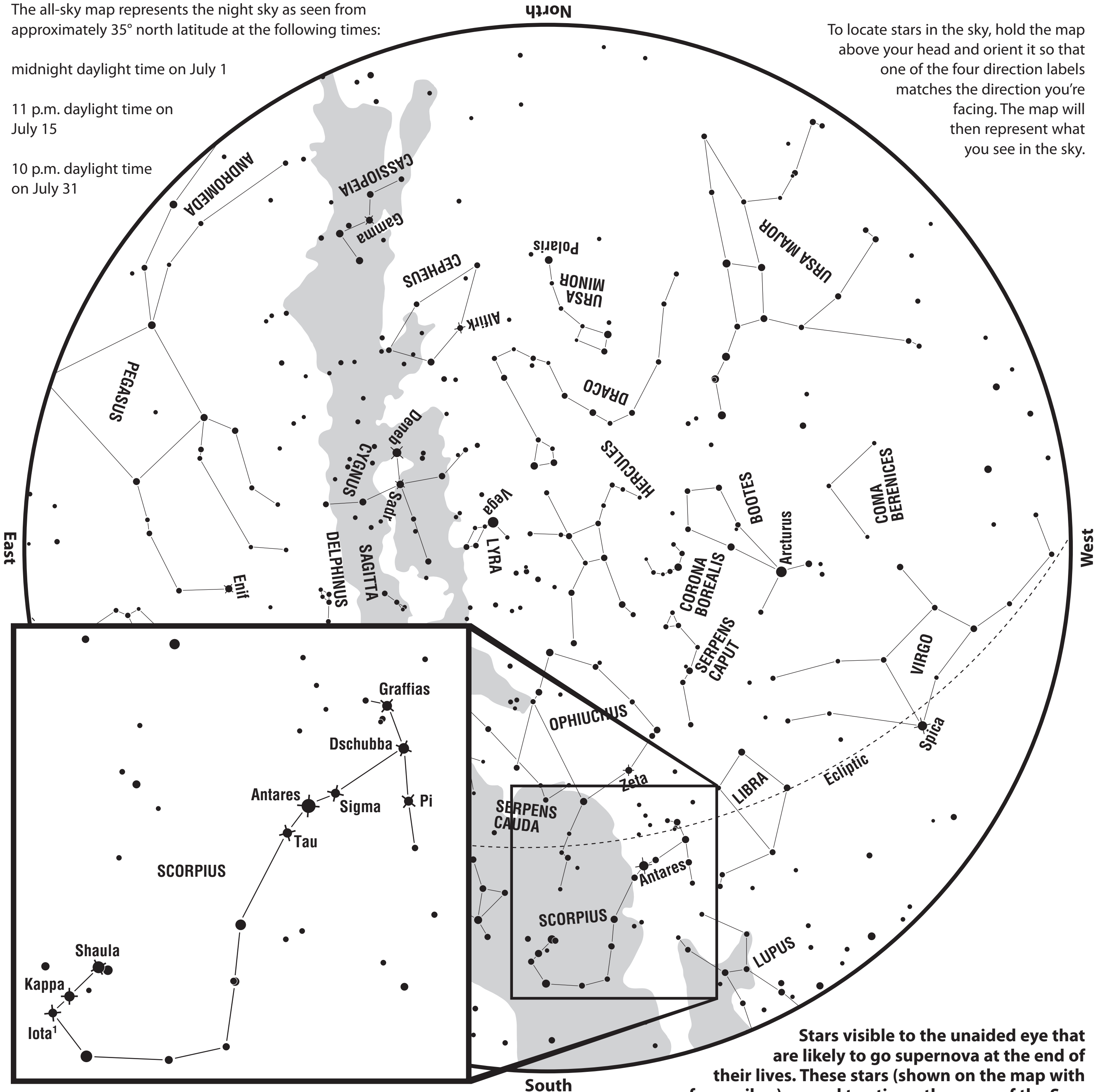

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Deneb	2,600	25
Dschubba	400	12
Enif	670	10

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Kappa Scorpii	450	10.5
Pi Scorpii	500	11
Sadr	1,500	12

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Shaula	365	11
Sigma Scorpii	520	12 to 20
Spica	260	11
Tau Scorpii	400	12
Zeta Ophiuchi	460	20

Stars likely to go SUPERNOVA!

AUGUST

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

11 p.m. daylight time on August 1

10 p.m. daylight time on August 15

9 p.m. daylight time on August 31

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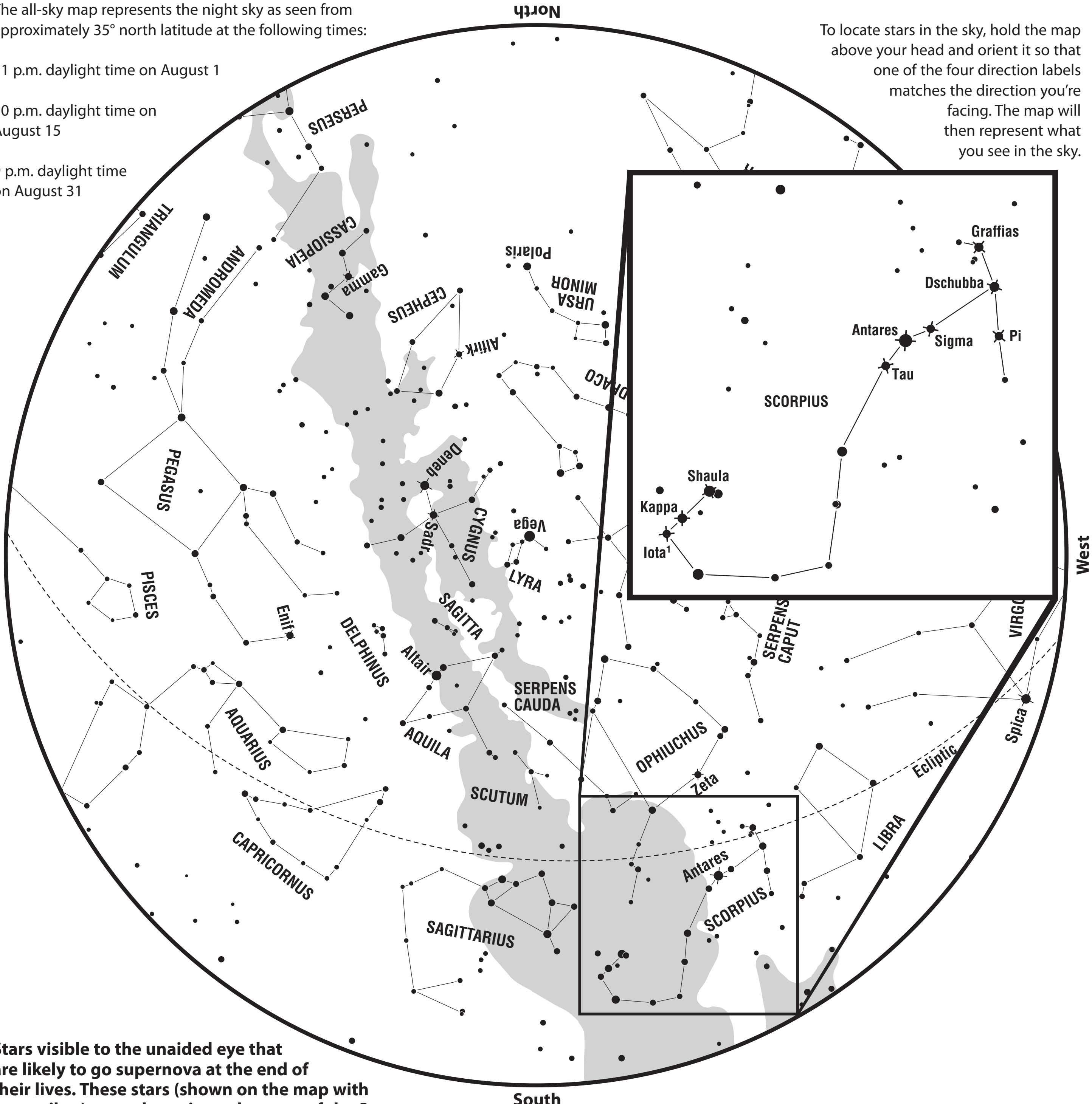

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Shaula	365	11
Sigma Scorpii	520	12 to 20
Spica	260	11
Tau Scorpii	400	12
Zeta Ophiuchi	460	20

Stars likely to go
SUPERNOVA!
SEPTEMBER

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

10 p.m. daylight time on September 1

9 p.m. daylight time on September 15

8 p.m. daylight time on September 30

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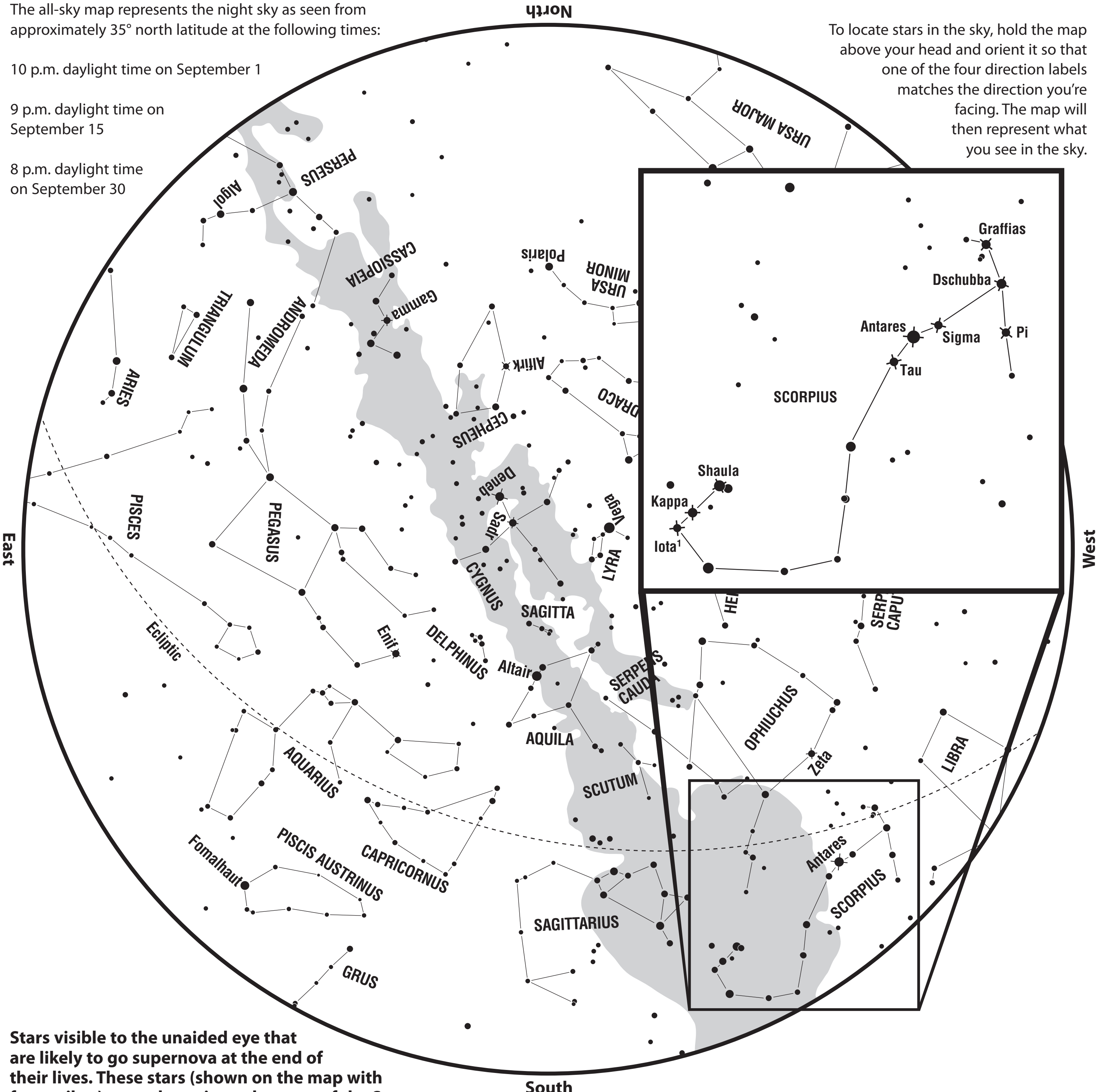

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Tau Scorpii	400	12
Zeta Ophiuchi	460	20

Stars likely to go

SUPERNOVA!

OCTOBER

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

10 p.m. daylight time on October 1

9 p.m. daylight time on October 15

8 p.m. daylight time on October 31

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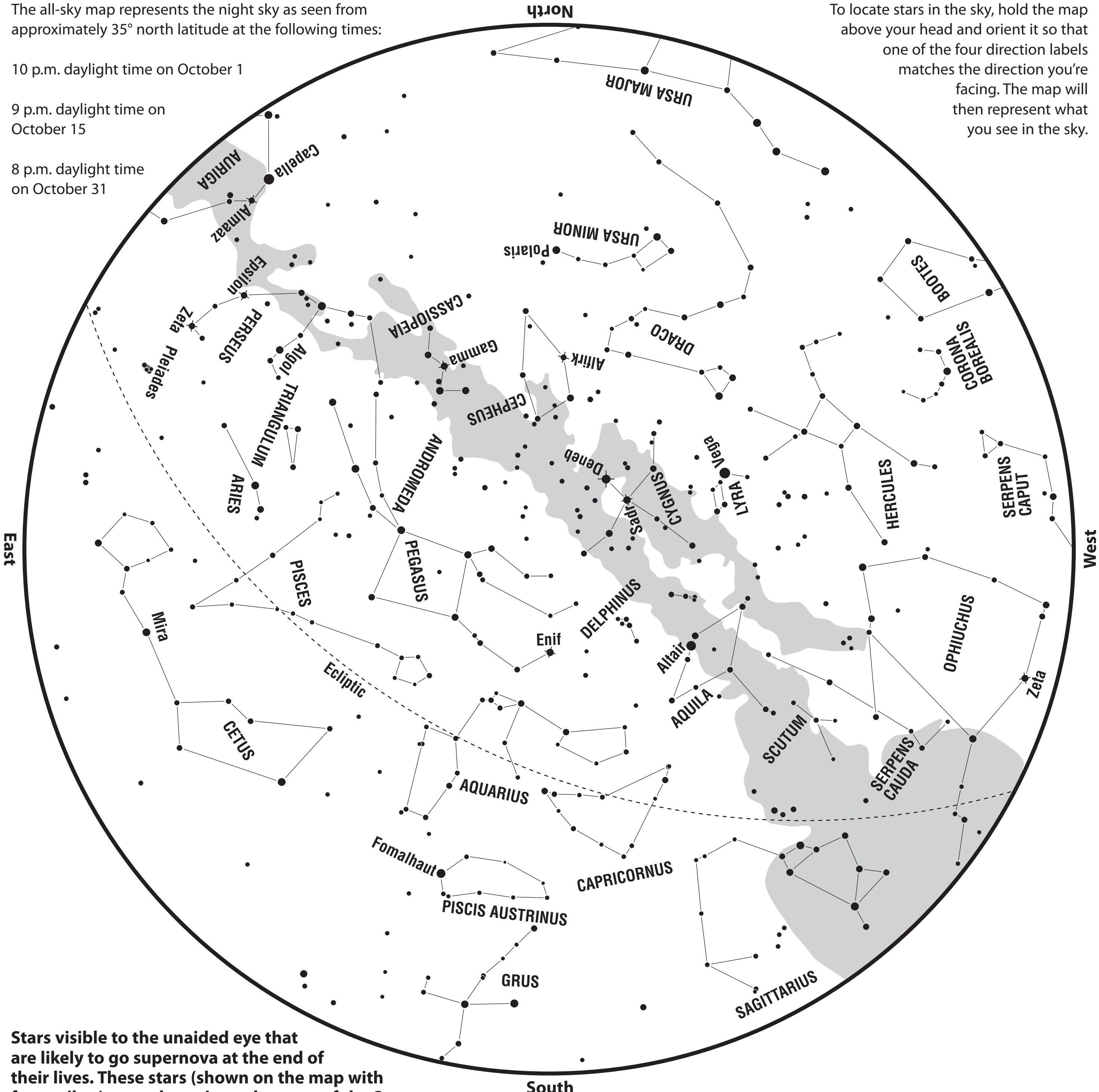

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Name	Distance (light-years)	Mass (Suns)
Sadr	1,500	12
Zeta Ophiuchi	460	20
Zeta Persei	1,000	19

Stars likely to go SUPERNOVA!

NOVEMBER

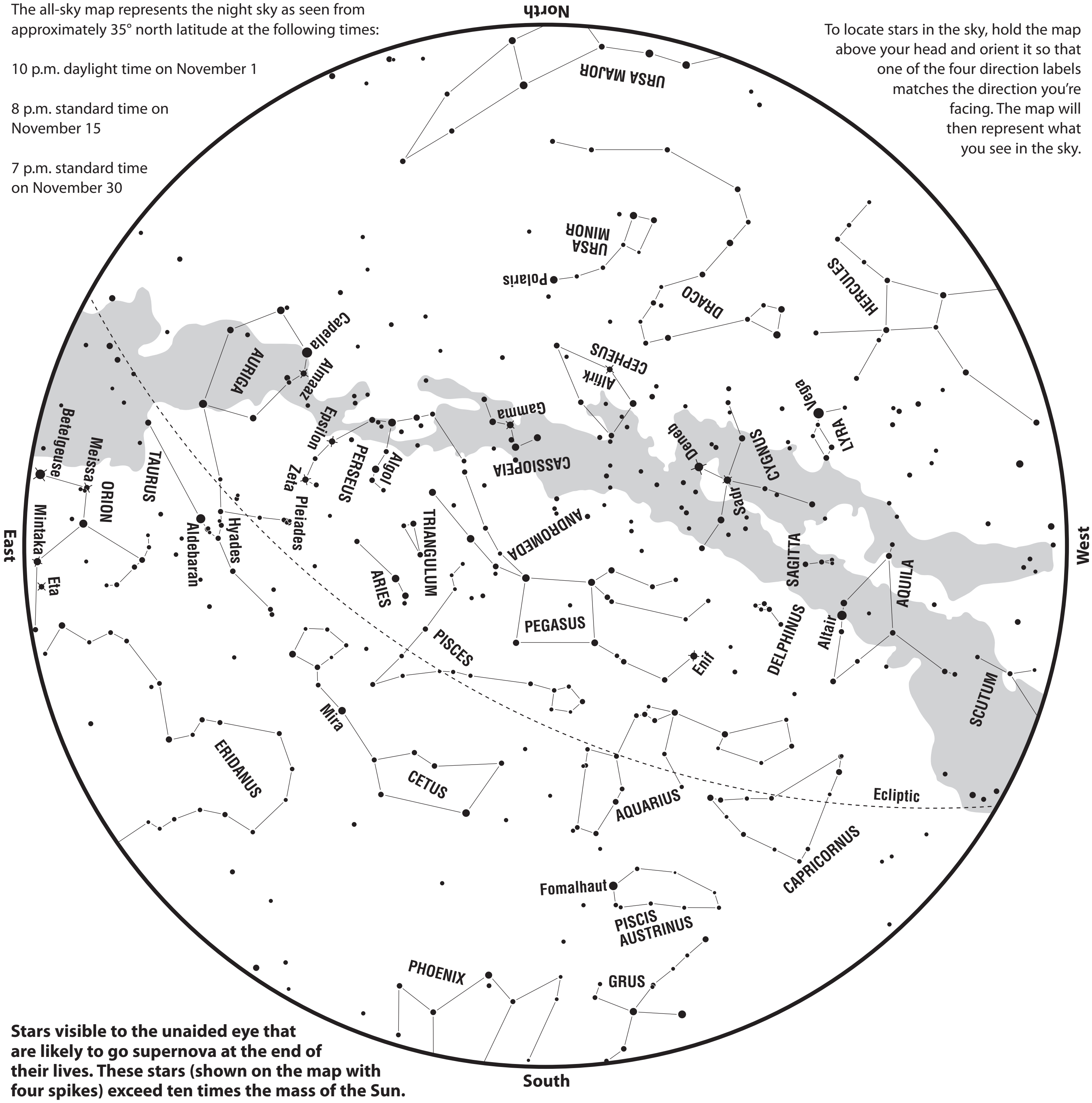
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

10 p.m. daylight time on November 1

8 p.m. standard time on November 15

7 p.m. standard time on November 30

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.



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Sadr	1,500	12
Zeta Persei	1,000	19

Stars likely to go SUPERNOVA!

DECEMBER

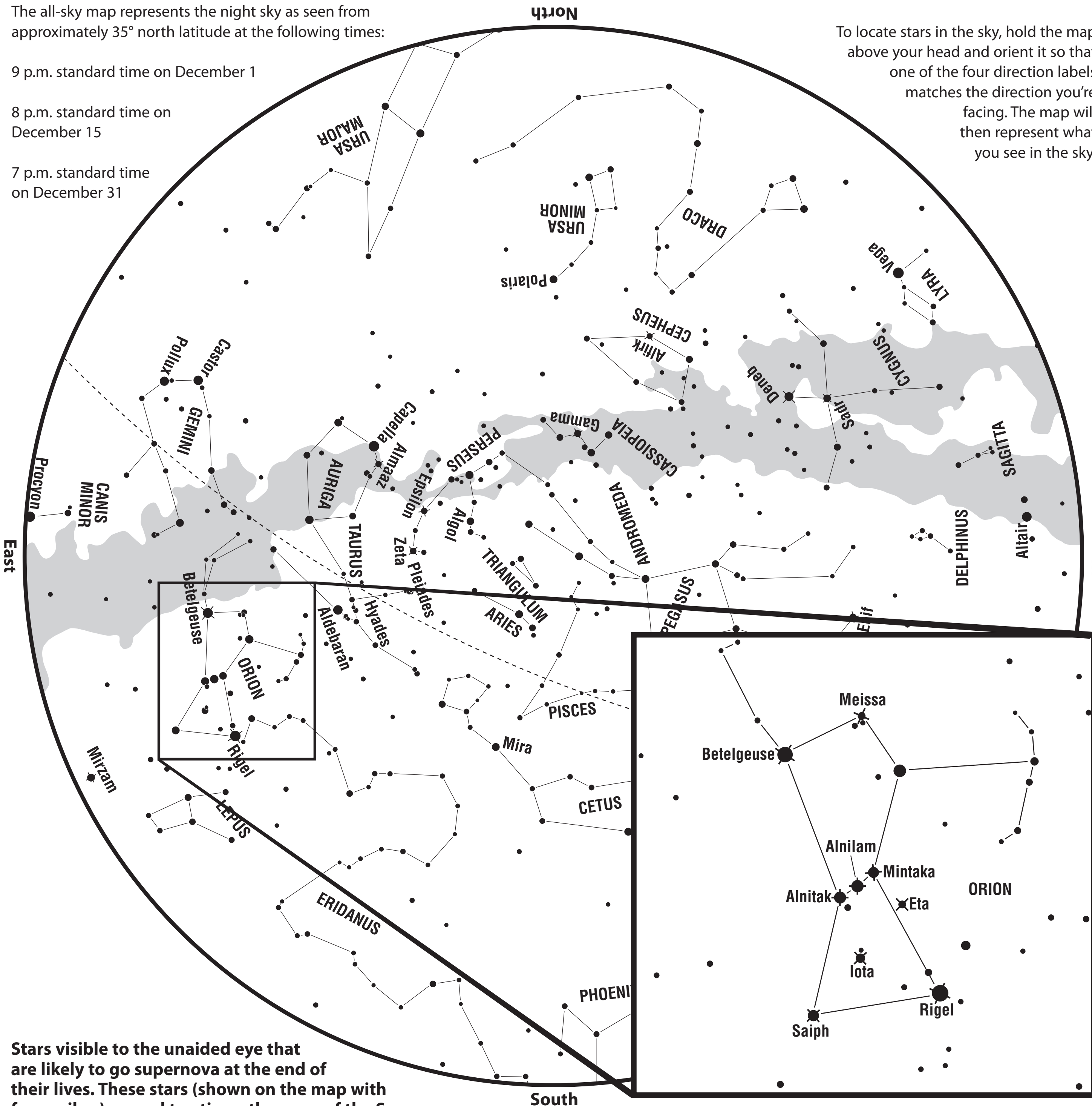
The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

9 p.m. standard time on December 1

8 p.m. standard time on December 15

7 p.m. standard time on December 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.



Stars visible to the unaided eye that are likely to go supernova at the end of their lives. These stars (shown on the map with four spikes) exceed ten times the mass of the Sun.

Name	Distance (light-years)	Mass (Suns)
Alfirk	820	12
Almaaz	2,000	15 to 19
Alnilam	1,340	40
Alnitak	815	20
Betelgeuse	425	12 to 17
Deneb	2,600	25

Name	Distance (light-years)	Mass (Suns)
Enif	670	10
Epsilon Persei	500	14
Eta Orionis	900	15
Gamma Cassiopeiae	610	15
Iota Orionis	1,300	15
Meissa	1,000	25

Name	Distance (light-years)	Mass (Suns)
Mintaka	915	20
Mirzam	500	15
Rigel	775	17
Sadr	1,500	12
Saiph	720	15 to 17
Zeta Persei	1,000	19