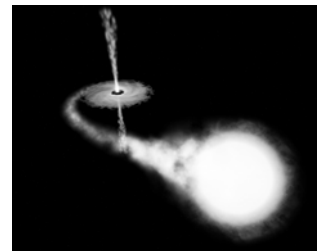


BLACK HOLE FAQ's

- 1. What is a black hole?** A black hole is a region of space that has so much mass concentrated in it that there is no way for a nearby object to escape its gravitational pull. There are three kinds of black hole that we have strong evidence for:
 - a. Stellar-mass black holes are the remaining cores of massive stars after they die in a supernova explosion.
 - b. Mid-mass black hole in the centers of dense star clusters
 - c. Supermassive black hole are found in the centers of many (and maybe all) galaxies.
- 2. Can a black hole appear anywhere?** No, you need an amount of matter more than 3 times the mass of the Sun before it can collapse to create a black hole.
- 3. If a star dies, does it always turn into a black hole?** No, smaller stars like our Sun end their lives as dense hot stars called white dwarfs. Much more massive stars end their lives in a supernova explosion. The remaining cores of only the *most* massive stars will form black holes.
- 4. Will black holes suck up all the matter in the universe?** No. A black hole has a very small region around it from which you can't escape, called the "event horizon". If you (or other matter) cross the horizon, you will be pulled in. But as long as you stay outside of the horizon, you can avoid getting pulled in if you are orbiting fast enough.
- 5. What happens when a spaceship you are riding in falls into a black hole?** Your spaceship, along with you, would be squeezed and stretched until it was torn completely apart as it approached the center of the black hole.
- 6. What if the Sun became a black hole without gaining or losing any mass?** The Sun can't turn into a black hole, but if it did, the Earth would get very dark and very cold. The Earth and the other planets would not get sucked into the black hole; they would keep on orbiting in exactly the same paths they follow right now.
- 7. Is a black hole a portal ("wormhole") to another part of the universe?** In some science fiction shows, people sometimes travel through wormholes. This leads many people to think black holes are wormholes and therefore lead to other places. There is no evidence that wormholes exist.
- 8. Can I see a black hole?** No. The light produced or reflected by objects makes them visible. Since no light can escape from a black hole, we can't see it. Instead, we observe black holes indirectly by their effects on material around them.
- 9. What evidence is there that black holes exist?** Fast-moving stars orbiting "unseen" objects and strong X-rays emitted from a very small area of space. NASA missions and projects are in the process of discovering more about black holes.



Credit : ESA, NASA, and F. Mirabel

For more info: <https://www.nasa.gov/black-holes>

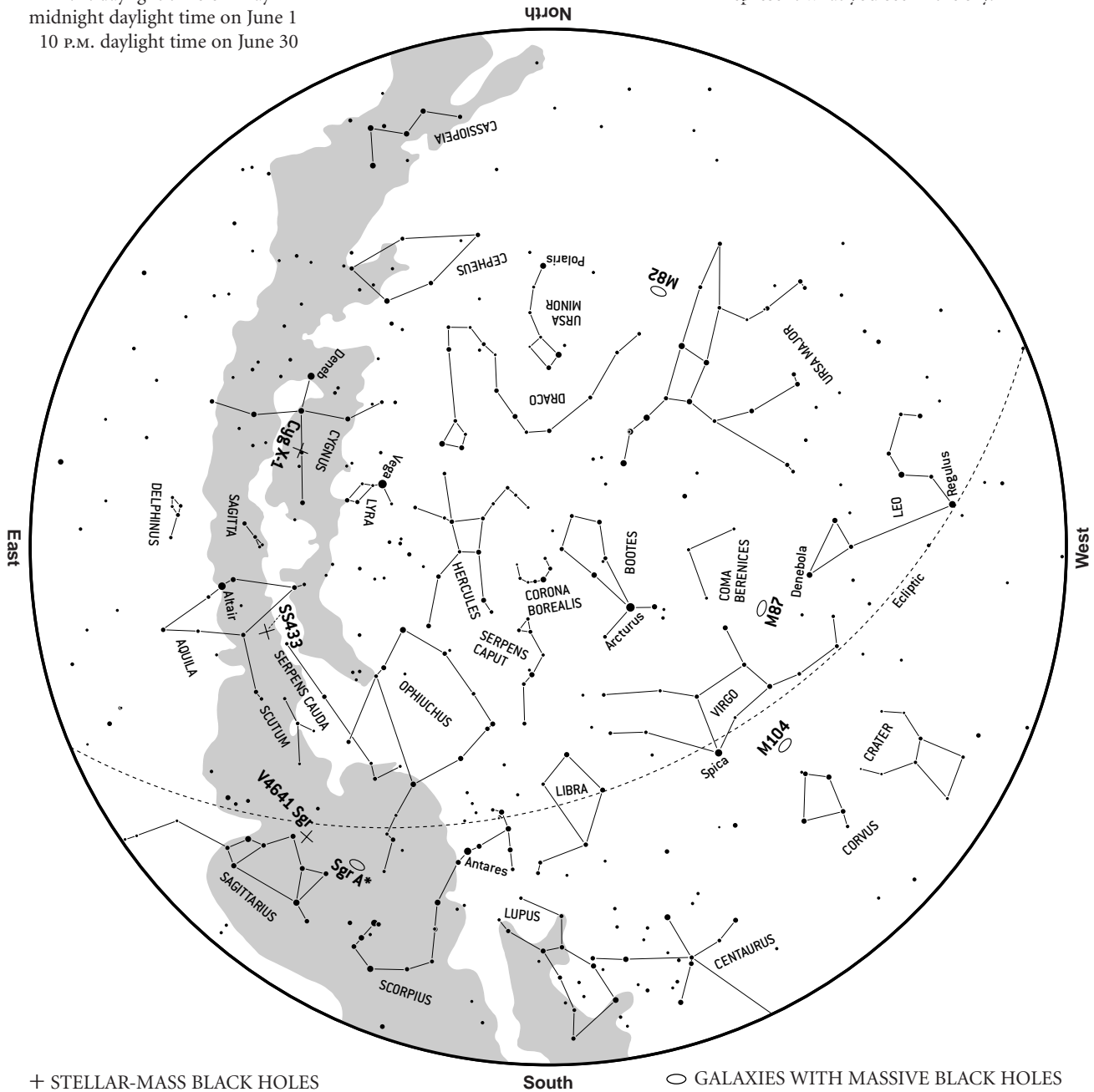
Where Are the Black Holes?

May/June

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

- 2 A.M. daylight time on May 1
- midnight daylight time on June 1
- 10 P.M. daylight time on June 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.



+ STELLAR-MASS BLACK HOLES

Object	Distance	Mass
V4641 Sagittarii	32,000 light-years	7 Suns
SS433	16,000 light-years	10 Suns
Cygnus X-1	7,000 light-years	10 Suns

o GALAXIES WITH MASSIVE BLACK HOLES

Object	Distance	Mass
M82	12 million light-years	> 460 Suns
M87	52 million light-years	3 billion Suns
M104	30 million light-years	500 million Suns
Sgr A*	26,000 light-years	2 million Suns (center of Milky Way Galaxy)

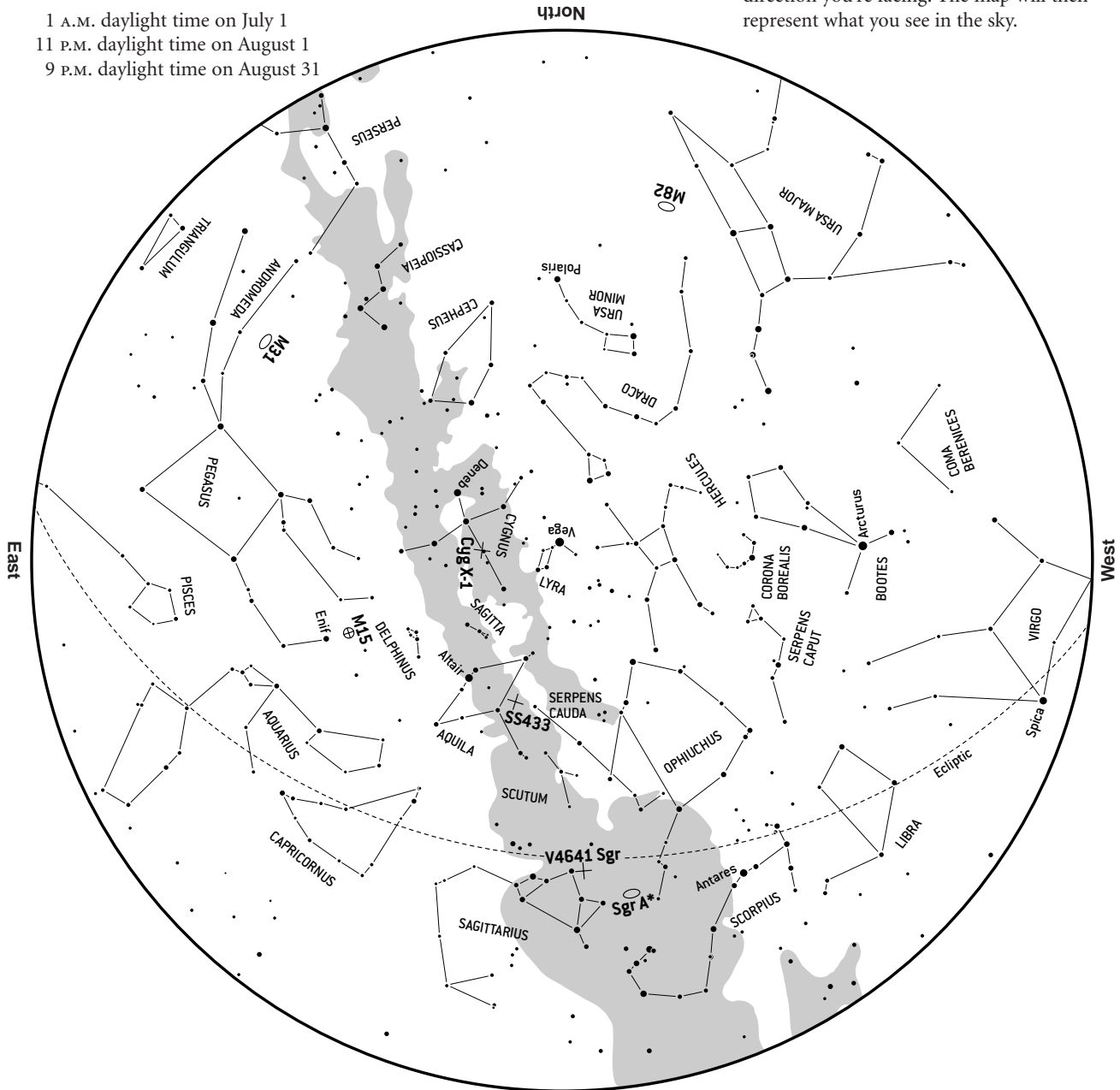
Where Are the Black Holes?

July/August

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

- 1 A.M. daylight time on July 1
- 11 P.M. daylight time on August 1
- 9 P.M. daylight time on August 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.



+ STELLAR-MASS BLACK HOLES

Object	Distance	Mass
V4641 Sagittarii	32,000 light-years	7 Suns
SS433	16,000 light-years	10 Suns
Cygnus X-1	7,000 light-years	10 Suns

○ GALAXIES WITH MASSIVE BLACK HOLES ⊕ GLOBULARS WITH LARGE BLACK HOLES

Object	Distance	Mass
M31	2.5 million light-years	30 million Suns
M82	12 million light-years	> 460 Suns
Sgr A*	26,000 light-years (center of Milky Way Galaxy)	2 million Suns
M15	33,000 light-years	2,500 Suns

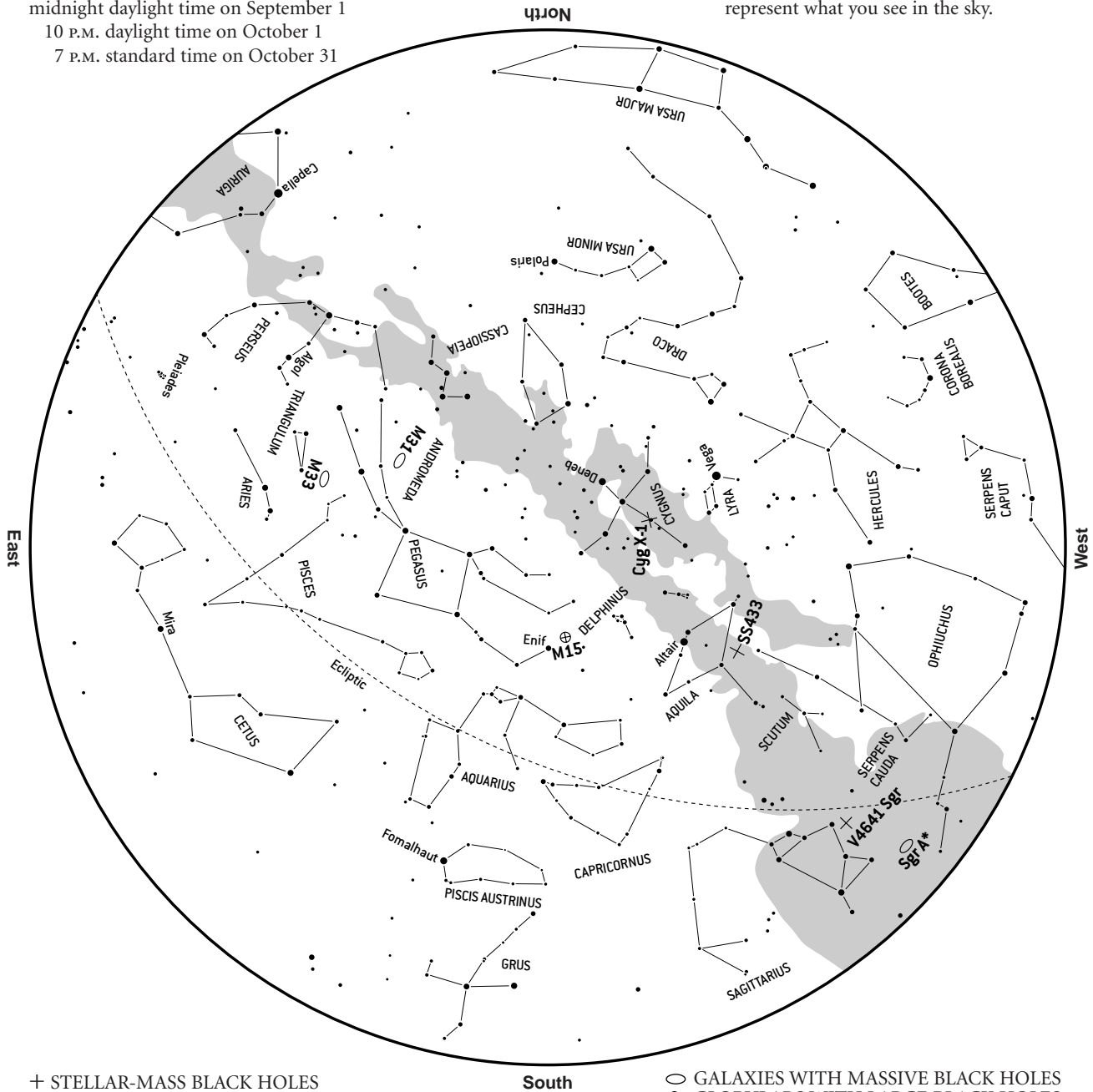
Where Are the Black Holes?

September/October

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

midnight daylight time on September 1
 10 P.M. daylight time on October 1
 7 P.M. standard time on October 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.



+ STELLAR-MASS BLACK HOLES

Object	Distance	Mass
V4641 Sagittarii	32,000 light-years	7 Suns
SS433	16,000 light-years	10 Suns
Cygnus X-1	7,000 light-years	10 Suns

o GALAXIES WITH MASSIVE BLACK HOLES ⊕ GLOBULARS WITH LARGE BLACK HOLES

Object	Distance	Mass
M31	2.5 million light-years	30 million Suns
M33	2.6 million light-years	900,000 Suns
Sgr A*	26,000 light-years (center of Milky Way Galaxy)	2 million Suns
M15	33,000 light-years	2,500 Suns

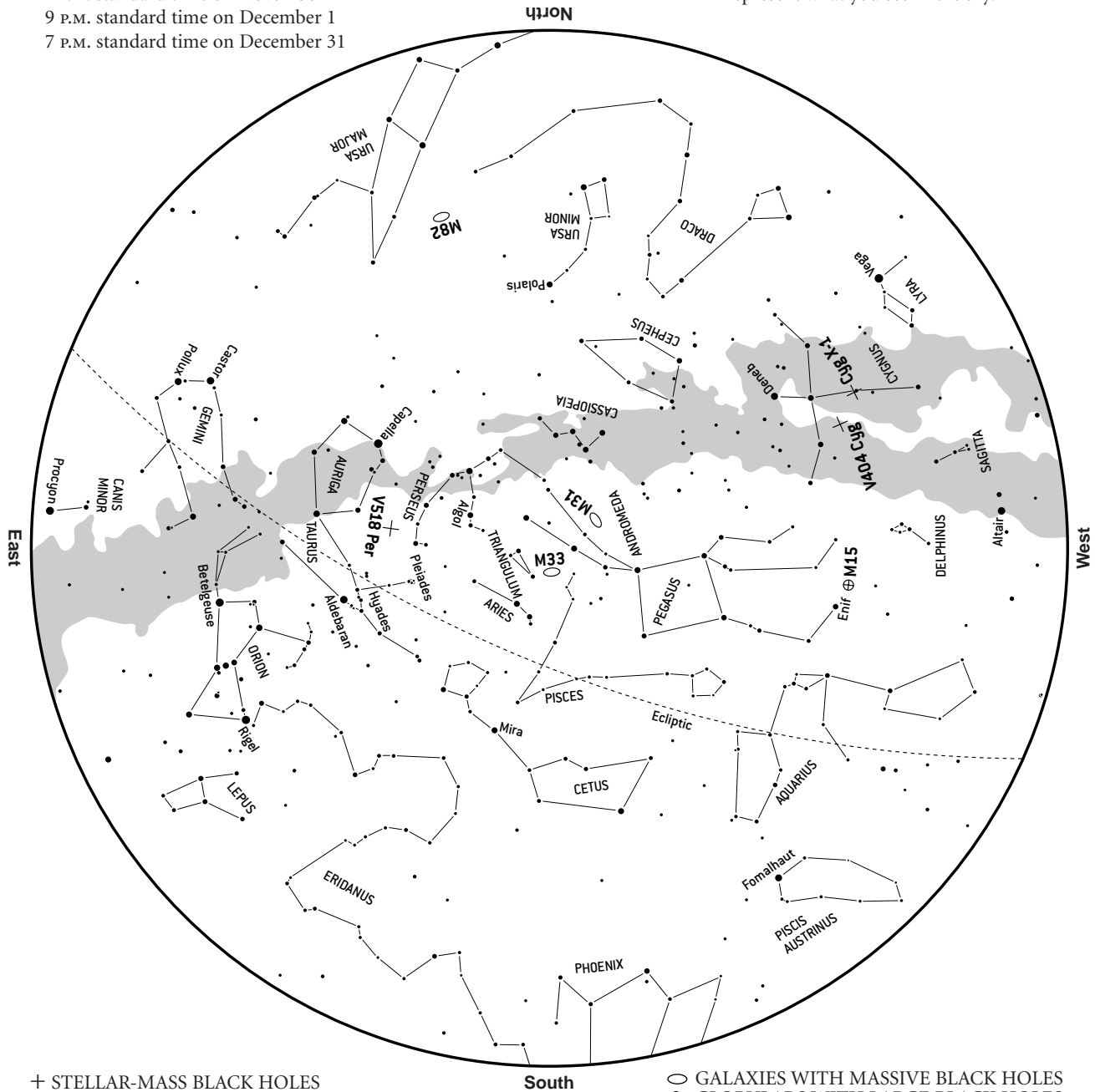
Where Are the Black Holes?

November/December

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

- 11 P.M. standard time on November 1
- 9 P.M. standard time on December 1
- 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.



+ STELLAR-MASS BLACK HOLES

Object	Distance	Mass
V518 Persei	6,500 light-years	4 Suns
Cygnus X-1	7,000 light-years	10 Suns
V404 Cygni	8,000 light-years	12 Suns

o GALAXIES WITH MASSIVE BLACK HOLES
⊕ GLOBULARS WITH LARGE BLACK HOLES

Object	Distance	Mass
M31	2.5 million light-years	30 million Suns
M33	2.6 million light-years	900,000 Suns
M82	12 million light-years	> 460 Suns
M15	33,000 light-years	2,500 Suns

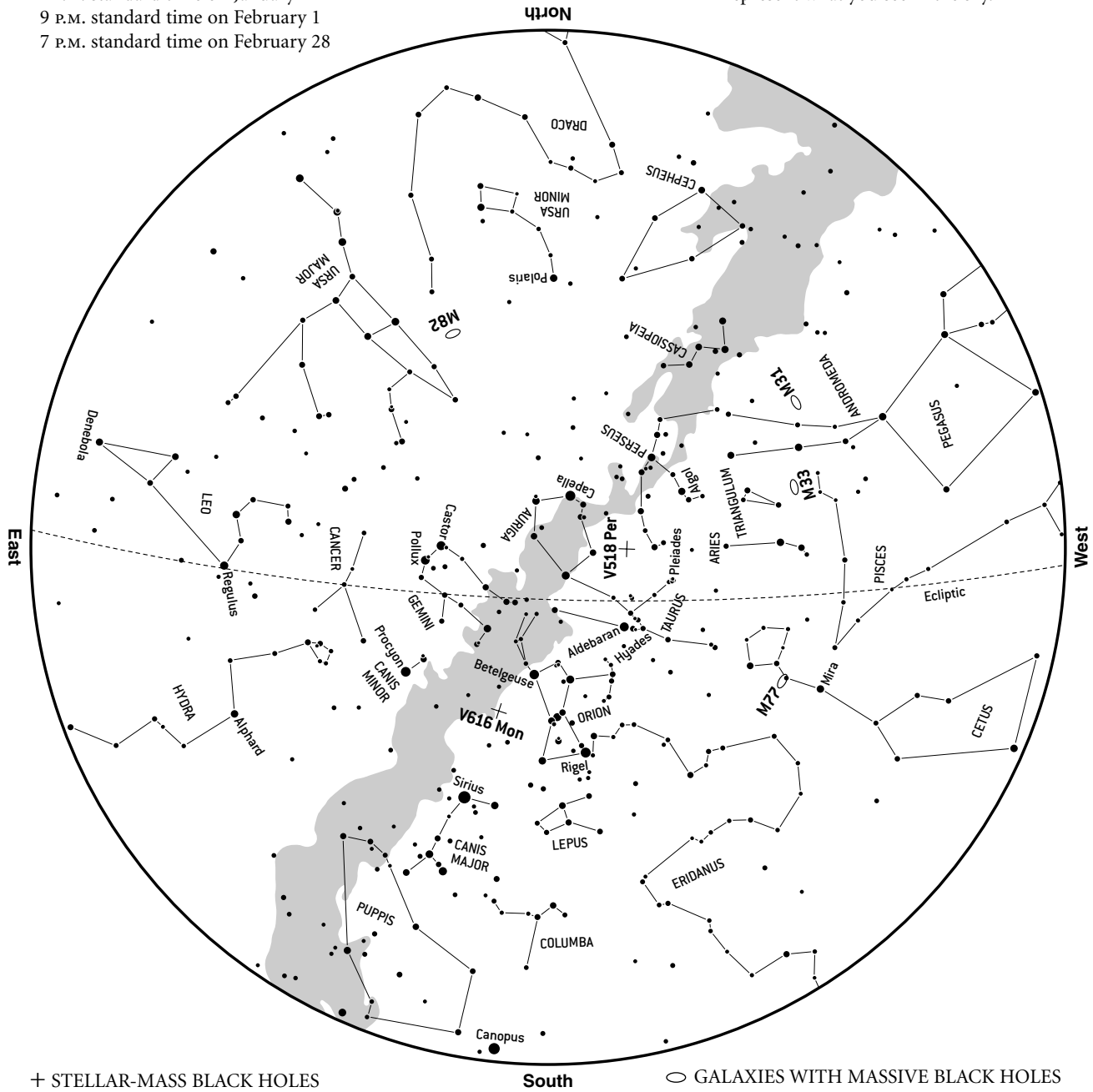
Where Are the Black Holes?

January/February

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

- 11 P.M. standard time on January 1
- 9 P.M. standard time on February 1
- 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.



+ STELLAR-MASS BLACK HOLES

o GALAXIES WITH MASSIVE BLACK HOLES

Object	Distance	Mass
V518 Persei	6,500 light-years	4 Suns
V616 Monocerotis	2,700 light-years	11 Suns

Object	Distance	Mass
M31	2.5 million light-years	30 million Suns
M33	2.6 million light-years	900,000 Suns
M77	49 million light-years	15 million Suns
M82	12 million light-years	> 460 Suns

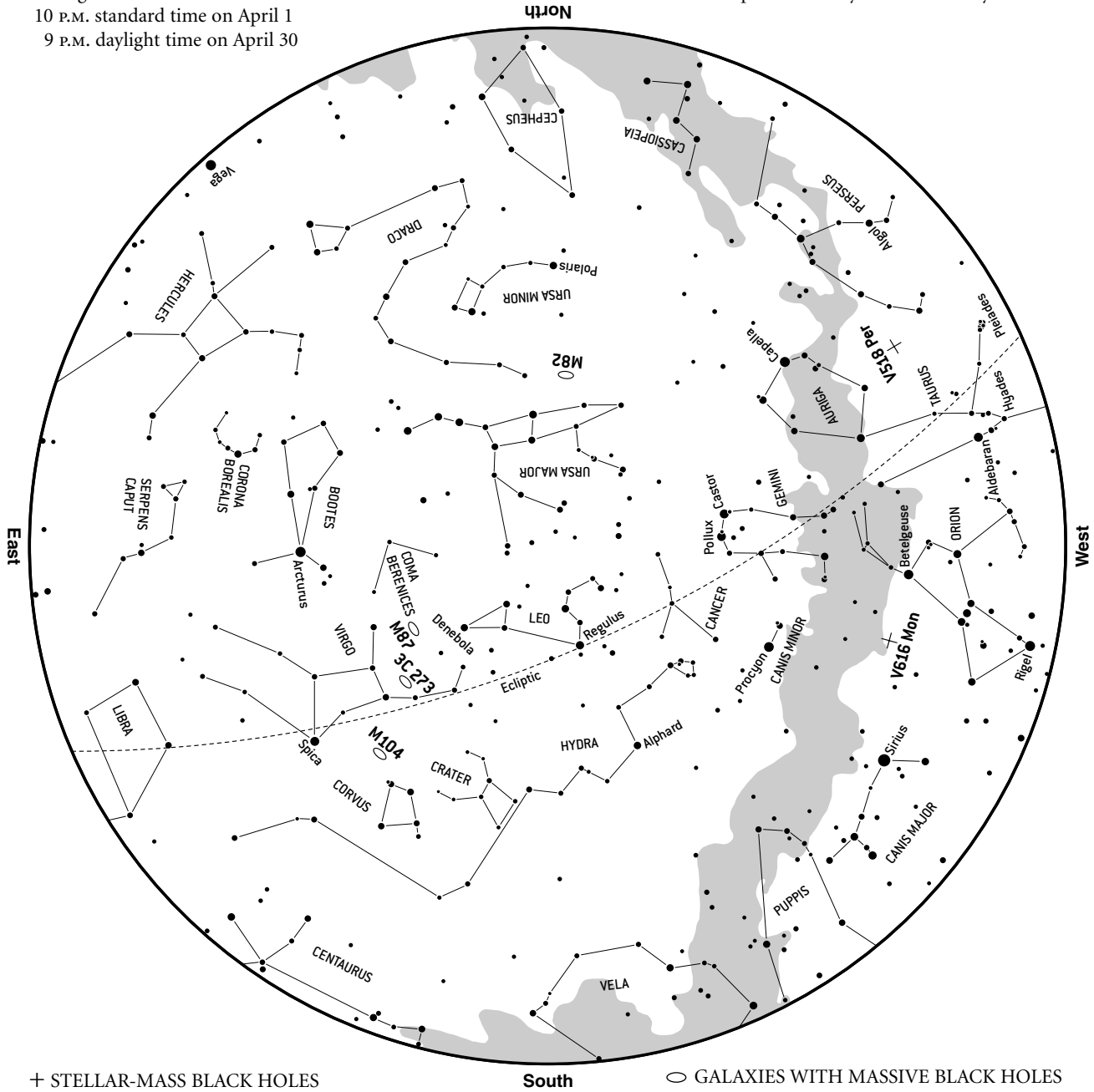
Where Are the Black Holes?

March/April

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

- midnight standard time on March 1
- 10 P.M. standard time on April 1
- 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.



+ STELLAR-MASS BLACK HOLES

O GALAXIES WITH MASSIVE BLACK HOLES

Object	Distance	Mass
V518 Persei	6,500 light-years	4 Suns
V616 Monocerotis	2,700 light-years	11 Suns

Object	Distance	Mass
M82	12 million light-years	> 460 Suns
M87	52 million light-years	3 billion Suns
M104	30 million light-years	500 million Suns
3C 273	2 billion light-years	1 billion Suns