WEST VIRGINIA UNIVERSITY
EBERLY COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF PHYSICS AND ASTRONOMY
WVU PLANETARIUM AND OBSERVATORY

Mountaineer Skies

Volume 16, Issue 1 planetarium.wvu.edu **January – February – March 2015**

Inside This Issue

1. In the Sky this Quarter
2. About: Gravitational Waves
3. Planetarium Show Schedule with Times and Dates
4. Monthly Sky Charts
5. Monthly Sky Charts (cont.)
6. Monthly Sky Charts (cont.)

Constellation Legend

Ari - Aries the Ram
Tau - Taurus the Bull
Gem - Gemini the Twins
Cnc - Cancer the Crab
Leo - Leo the Lion
Vir - Virgo the Maiden
Lib - Libra the Scales
Sco - Scorpio the Scorpion
Oph - Ophiuchus
Sag - Sagittarius the Archer
Cpr - Capricorn the Sea-Goat
Aqr - Aquarius the Water-Bearer
Psc - Pisces the Fish

In The Sky this Quarter

Visible Planets in the Night Sky

January 1st, 2016

	Const.	Rise	Transit	Set	Mag
Sun		07:41	12:23	17:06	-26.8
Mercury	Cpr	08:58	13:44	18:30	-0.3
Venus	Sco	04:46	09:41	14:35	-3.9
Mars	Vir	01:58	07:26	12:53	1.3
Jupiter	Leo	22:58	05:14	11:26	-2.0
Saturn	Oph	05:28	10:16	15:03	1.4

February 1st, 2016

	Const.	Rise	Transit	Set	Mag
Sun		07:28	12:34	17:39	-26.8
Mercury	Sag	06:02	10:48	15:35	0.2
Venus	Sag	05:40	10:21	15:01	-3.8
Mars	Lib	01:19	06:27	11:36	0.8
Jupiter	Leo	20:51	03:09	09:23	-2.2
Saturn	Oph	03:40	O8:26	13:12	1.3

March 1st, 2016

	Const.	Rise	Transit	Set	Mag
Sun		06:52	12:32	18:13	-26.8
Mercury	Cpr	06:20	11:27	16:35	-0.2
Venus	Cpr	05:54	10:57	16:00	-3.7
Mars	Lib	00:30	05:25	10:21	0.3
Jupiter	Leo	18:42	01:04	07:22	-2.3
Saturn	Oph	01:54	06:40	11:25	1.2

Gravitational Waves: The Smallest Measurement Ever Made

Those of you who read our last issue of Mountaineer Skies may remember an opening remark of that article.

Seemingly impossible to observe directly, black holes are alien in nature compared to more prominent members of the night sky.

Seemingly is the key qualifier here, included in that sentence because with modern societies' understanding of Einstein's General Relativity and our recent technological advances we *can* observe black holes. Not individually, or even electromagnetically, but instead by observing the gravitational strain a pair of coalescing black holes impart on spacetime.

When you think of a star, the first thing that may pop into your head are the many points of light you see on the night sky. It turns out that many of those points are not single objects, they are actually two or more stars orbiting each other. Let's imagine a two star (binary) system where each star is much more massive than our Sun. Depending on the exact mass of those objects, they will eventually end their lives with supernovae then, depending on the exact mass of those objects, become white dwarfs, neutron stars, black holes, or some combination of these relativistic objects.

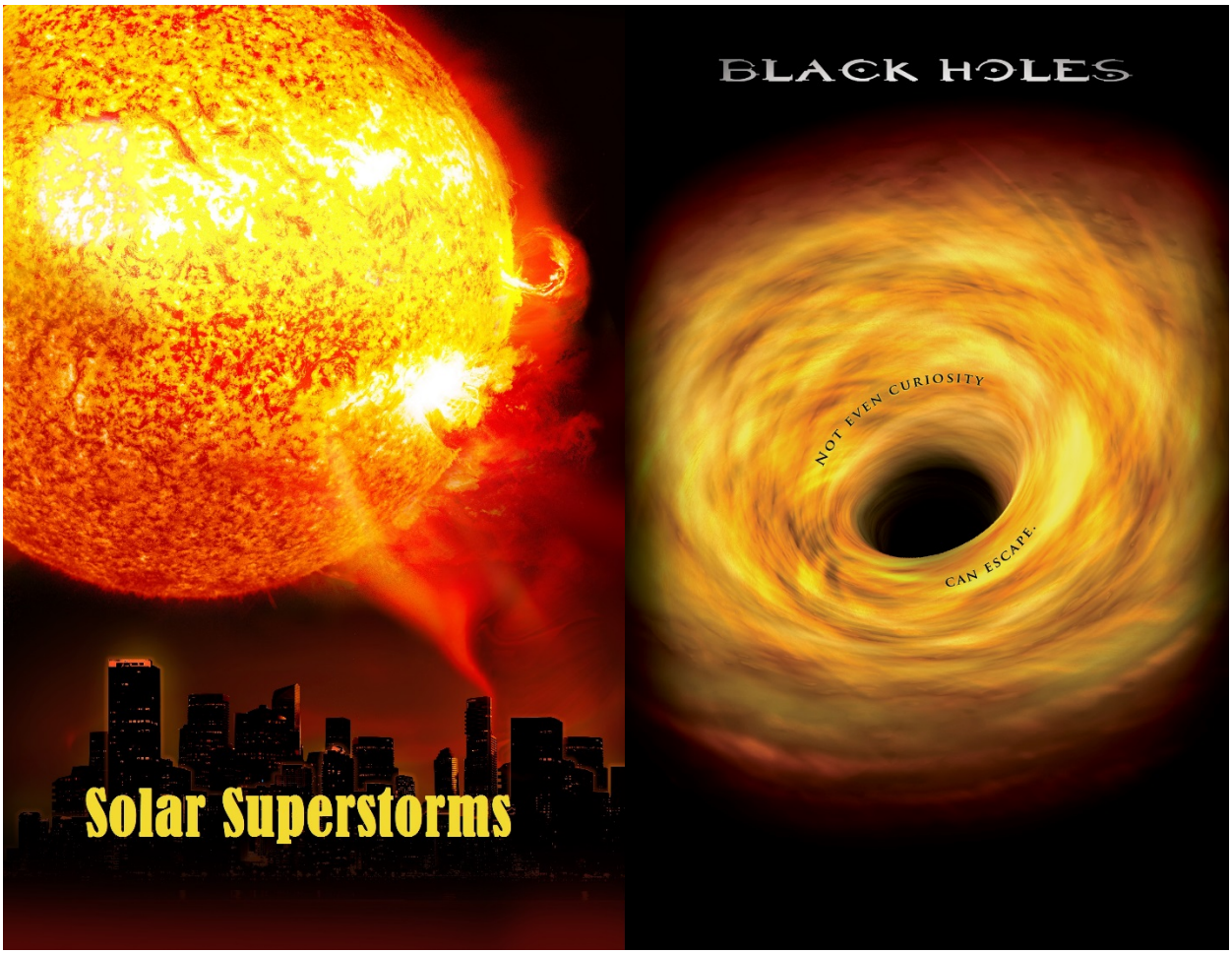
As these relativistic objects orbit each other after the death of their progenitors, they will slowly lose their orbital angular momentum and spiral in toward each other. The brief moment before the objects combine is when gravitational waves will propagate away from the source. This scenario actually happened, about one billion years ago, literally in a galaxy far, far away. Two black hole coalesced and the resulting gravitational waves began to move through space.

Skip to September 14, 2015. The state of the art detectors of LIGO (Laser Interferometer Gravitational-Wave Observatory) record a signal. Both detectors, in Louisiana and Washington, observe the gravitational wave from one billion years ago "stretch" the very space they occupy. This is a bizarre thing to think about, but maybe not as much when you realize the scales at which LIGO is working. The amplitude (size) of the gravitational waves they observed was millions of time smaller than a proton, itself nearly unimaginably small. This signal was the smallest thing humans have ever measured!

Corresponding to the billion year travel time mentioned earlier, the source for these gravitational waves was about one billion light years away. That's to say, gravitational waves travel at the speed of light, just as electromagnetic radiation does. The position of the source isn't well constrained at this point because only LIGO's two detectors are operational. After similar gravitational wave observatories in India and Japan go online, scientists should be able to better locate the source of each signal.

It is an exciting time to be an astronomer. Scientist have now measured a new phenomenon of the universe, not unlike the first people to observe the sky with an optical telescope. Upgrades to LIGO and completion of new facilities should yield even more detections in the coming years, so be sure to keep an eye (or interferometer) on the sky.

Planetarium Shows



January 15th, 22nd, 29th	**February 12th, 19th, 26th**	**March 11th, 18th**
7:00 P.M. ***Solar Superstorms***	**7:00 P.M.** ***Solar Superstorms***	**7:00 P.M.** ***Solar Superstorms***
8:00 P.M. ***Supervolcanoes***	**8:00 P.M.** ***Black Holes***	**8:00 P.M.** ***Oasis in Space***

For those who are interested in bringing a group, such as schools or scouts, during the day, please call Logan Hough at (304) 293-4961 or email at: lhough3@mail.wvu.edu

Selected Sunrise/Sunset and Moon Rise/Moon Set Times

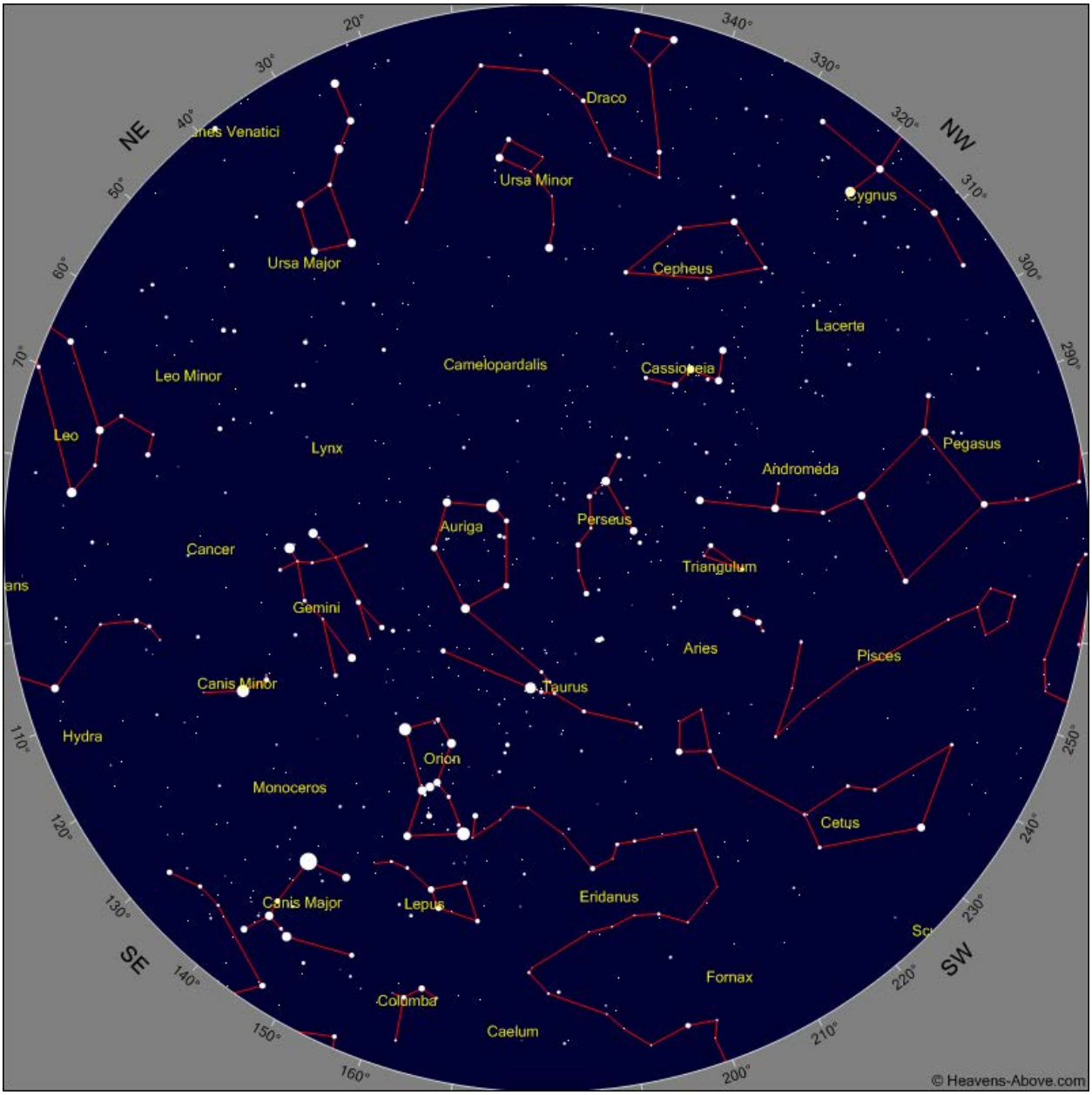
Date	Sunrise	Sunset	Moon Rise	Moon Set	Moon Phase
Jan. 15	07:39	17:20	11:07	23:53	First Quarter
Jan. 29	07:31	17:36	23:13	10:23	Last Quarter
Feb. 12	07:16	17:52	09:44	22:51	First Quarter
Feb. 26	06:58	18:08	21:59	08:54	Last Quarter
Mar. 11	06:37	18:23	08:19	21:43	First Quarter
Mar. 18	07:26	19:30	15:11	04:35	Last Quarter

January 2016 Sky Chart* for:

10:00 P.M. at the beginning of the month

9:00 P.M. in the middle of the month

8:00 P.M. at the end of the month



***Sky Chart used with the kind permission of Heavens-Above at http://www.heavens-above.com/**

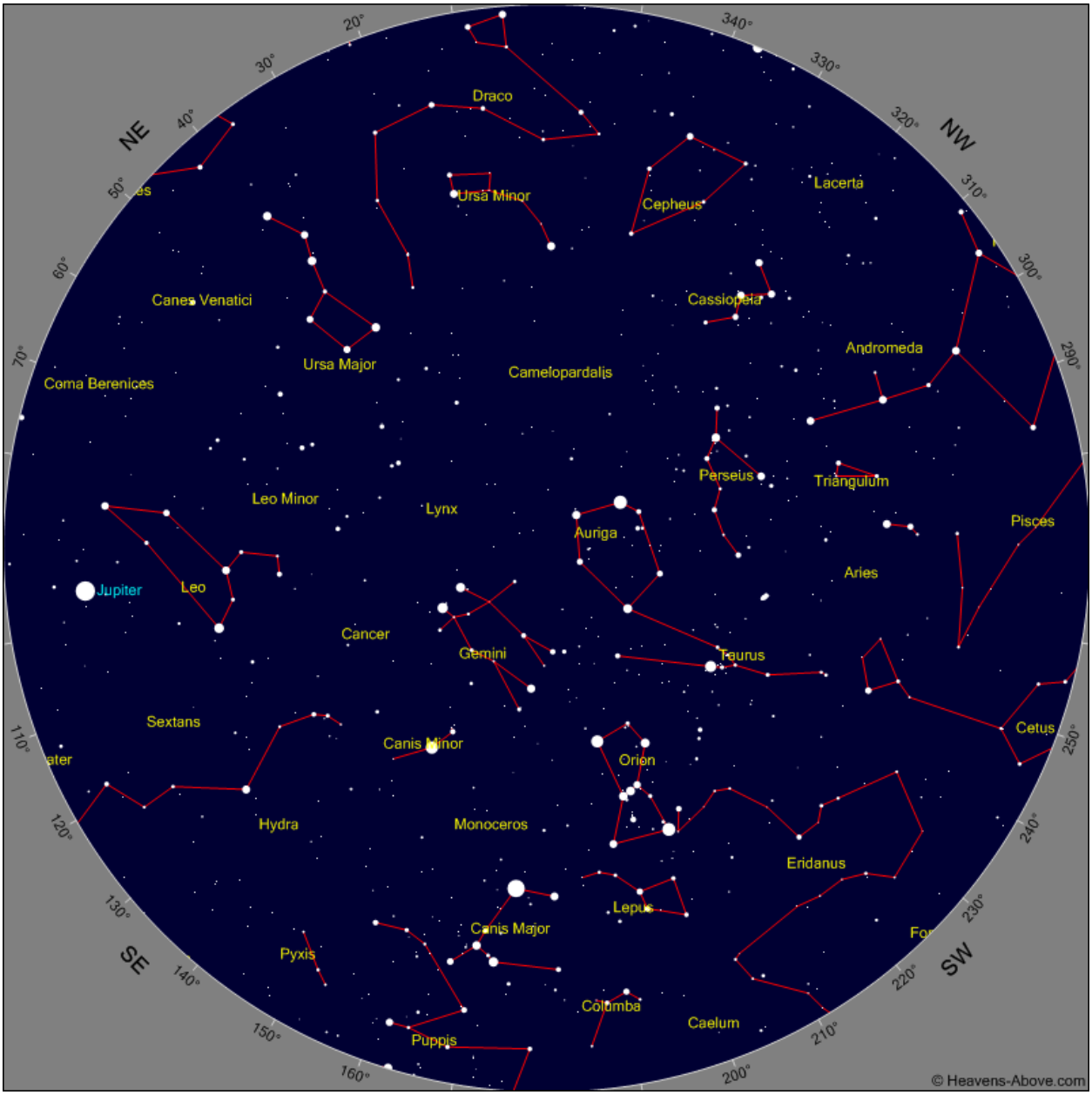
The WVU PLANETARIUM is for the educational benefit of WVU students, staff, and faculty members, as well as the local community. Should you wish to make a contribution to the planetarium, it can be made through the WVU Planetarium Project at the WVU Foundation, Inc., phone (304) 284-4000. Thank You.

February 2016 Sky Chart* for:

10:00 P.M. at the beginning of the month

9:00 P.M. in the middle of the month

8:00 P.M. at the end of the month



***Sky Chart used with the kind permission of Heavens-Above at http://www.heavens-above.com/**

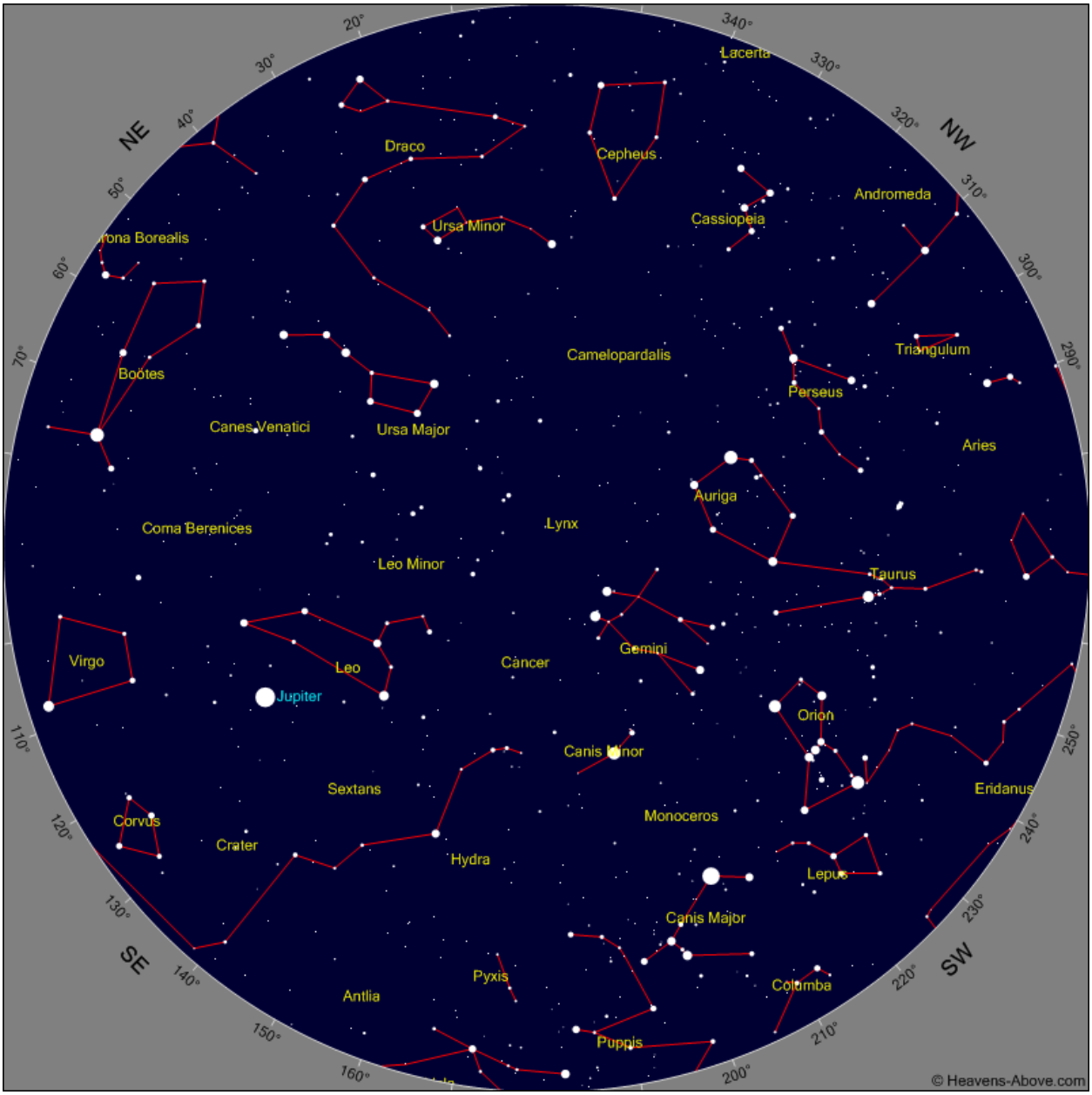
March 2016 Sky Chart* for:

The WVU PLANETARIUM is for the educational benefit of WVU students, staff, and faculty members, as well as the local community. Should you wish to make a contribution to the planetarium, it can be made through the WVU Planetarium Project at the WVU Foundation, Inc., phone (304) 284-4000. Thank You.

10:00 P.M. at the beginning of the month

9:00 P.M. in the middle of the month

8:00 P.M. at the end of the month



***Sky Chart used with the kind permission of Heavens-Above at http://www.heavens-above.com/**

The WVU PLANETARIUM is for the educational benefit of WVU students, staff, and faculty members, as well as the local community. Should you wish to make a contribution to the planetarium, it can be made through the WVU Planetarium Project at the WVU Foundation, Inc., phone (304) 284-4000. Thank You.

Edited by Logan Hough
(304) 293-4961
Lhough3@mail.wvu.edu