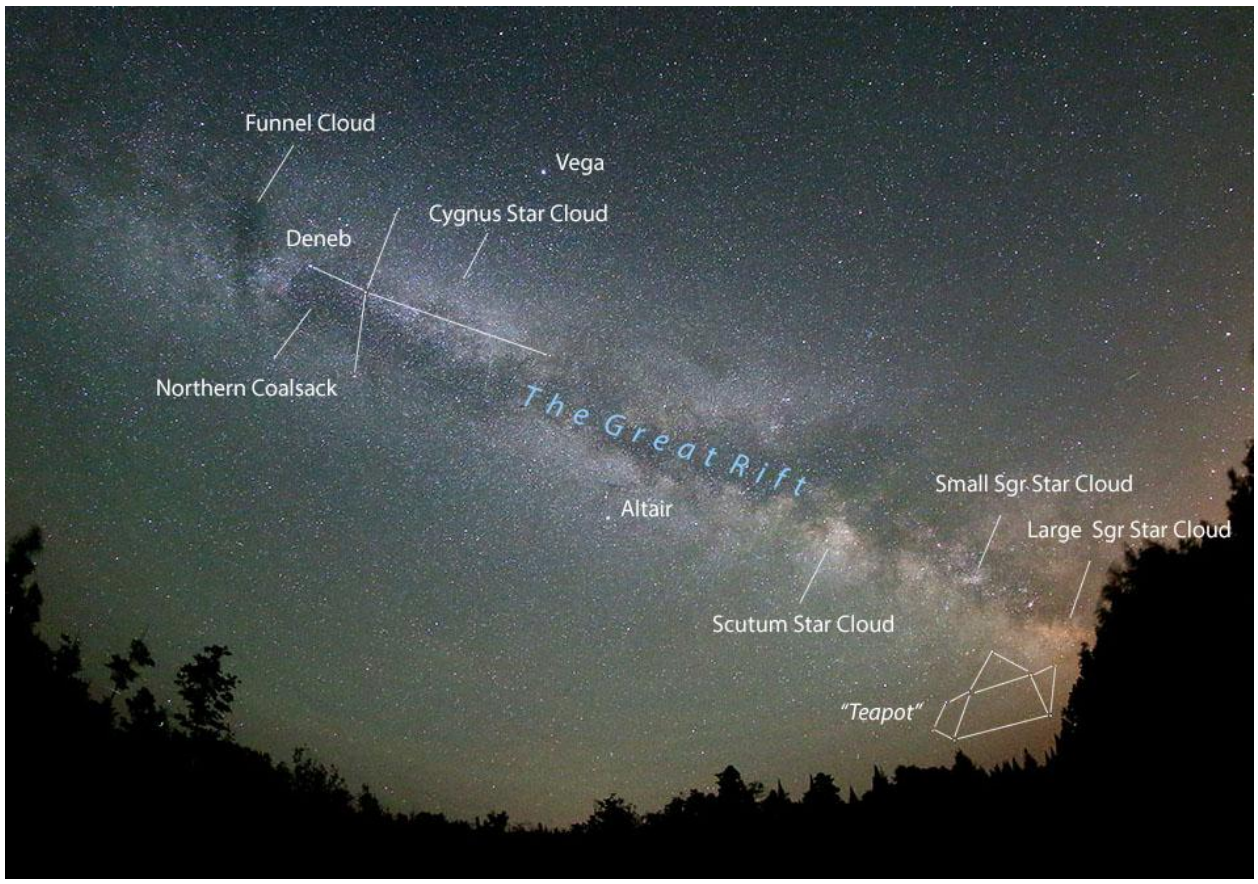
Telescopic program

After the constellation tour, it will be dark enough to go to the telescopes. But be sure to take in the Milky Way while standing in line between views. Even a few generations back, the Milky Way was a familiar sight for our ancestors. For most in the modern world today, it has vanished from our daily lives due to light pollution and lifestyle changes.

In taking in our galaxy, note its milky texture (the cumulative effect of billions of stars) and the brighter spots with a grainy texture (dense clouds of stars close enough that a grainy texture is apparent). Finally, note the dark lanes, which are areas where the interstellar gas and dust are so dense that the stars beyond cannot be seen.



Until the 1920's many Astronomers believed that the Milky Way was the entire universe. It was a discovery by Henrietta Swan Leavitt, a Harvard University observatory "computer" that first allowed the galaxy to be measured, approximately 125,000 light-years across. Later, the same method measured the distance to other "nearby" galaxies, revealing they were not part of the Milky Way but separate galaxies. You will see a couple of these galaxies and will understand why they were not appreciated for what they were until their distance could be measured.

During the Festival, we are seeing the last of the Summer Milky Way, while the leading elements of the Winter Milky Way are just rising in the East. Unfortunately, a goodly part of the Summer Milk Way has already set below the SW horizon, including the best of the area's stellar nurseries, while the best such object visible from the northern hemisphere, the Orion nebula, is still below the Eastern horizon during the evening. If you awake before sunrise, you can take it in with a pair of binoculars.

Now a bit of elaboration on some of the objects in our observing list for the night:

Of the gas giant planets, **Saturn and Jupiter,** only Saturn is well placed during the festival. Having reached opposition (closest to the Earth) on September 8th, Saturn should be bright. Unfortunately, the glorious rings will be nearly edge-on. However, that can make its brighter moons more visible. Also, try to focus on the turbulent horizontal bands on the planet itself.

Stars are born in clusters. Globular clusters look like popcorn ball Christmas tree ornaments. They formed early in the galaxy's evolution and lie outside the galactic disc, making them useful in measuring the galaxy's size, as referenced above. **Open clusters** are much younger structures and evolve from the areas where the dust and gas in the body of the galaxy thicken and collapse into star cities. In contrast to the globular clusters, they are a loose scattering of stars, sometimes making shapes from which their popular names are derived. Being young structures, they may still host large stars with short lives. See if you can detect a blue or red tinge in some of the brighter stars.

Individual stars can be quite interesting, coming as they do in varied sizes, colors, and stages of life. In fact, stars have been and remain natural physics laboratories providing a window into physics at the atomic level. Much of the variation in stars is not readily apparent in a telescope's eyepiece, but there are exceptions. We include a couple of **"double stars"** in our observing list. Stars that appear to be single stars are often two or more stars locked into permanent orbits around one another. Sometimes, their proximity allows our mind to tease out their distinct colors. We also include several **"carbon" stars**, which show their distinct nature by sporting a remarkable red hue. **Red giants** are variable stars, meaning their brightness cycles over time. They are in the late stages of life, and their outer layers have cooled as they swelled to enormous size; this cooling contributes to their red hue, just as the embers of a dying fire glow red. In observing these stars, try using averted vision, looking just off to the side, and lingering a moment can cause the star to seem to get brighter.

Planetary Nebula are stars that have reached the end of their main sequence lives. Having exhausted the fuel in their cores, they throw off much of their mass into space, which is then made to glow by the intense energy the collapsed, remnant star emits. Sometimes, the star can be seen in a small telescope, but more often, only the ring of expanding gas is observed.

A note about distances. Planets are part of our solar system and are light minutes away. Individual stars that we view with the naked eye are light-years away. Open star clusters are typically hundreds or thousands of light years distant, while globular clusters are tens of

thousands. Galaxies, even the nearest, are millions of light-years distant. Many distant objects will be faint and show little detail, especially for a first-time observer. But, when gazing upon dim objects, don't look straight at them; look just to one side. This brings the eye's most sensitive vision into play. Beyond that, consider that the photons landing on your retina have traveled for millions of years through space to make you a witness to their existence.

The Star Party Menu

Here is a list and a bit of detail for each of the objects that we hope to make available through the telescopes:

- M25 – At approximately 67.6 million years old, this is a very young open cluster of stars. About 2,000 light-years away, it is a telescopic object. Look for the two bright red giants in the field of view. If you stay up late enough, compare it to M45, which is a much closer naked-eye object discussed below.
- M17, also known as the Omega Nebula and the Swan Nebula, is a so-called HII region, meaning the area is relatively thick with doubly ionized hydrogen gas. Hydrogen is the basic building block of our universe. In HII regions, gravity pulls hydrogen into stars, and the larger of these ionizes the surrounding gas cloud and causes it to glow, similar to how a fluorescent light bulb works, but with a different gas. M42, the Orion Nebula, is a more dramatic object but is located in the winter Milky Way sky. Get up early or stay up late, and you can catch M42 naked-eye as a slightly fuzzy star or view it in some detail with binoculars. It is, of course, a fine telescopic object.
- M16 – a/k/a the Eagle Nebula is also an HII region. The dark structure in the middle has become famous as the Hubble Space Telescope's "pillars of creation" image.
- M13 - The king of globular clusters visible from the northern hemisphere. The cluster comprises several hundred thousand stars, is about 145 light-years across, 22,000 miles distant, and 12 – 13 billion years old.
- M15 – This globular cluster is half again more distant than M13 and yet is almost as rich. M13 is pretty low in the evening sky this time of year. If you miss out on it, M15 will fill in nicely.
- M11 - The Wild Duck Cluster is an open cluster of stars resembling a flock of ducks on the wing, ~ 6,800 miles distant and about 316 million years old.
- M45 – You will have to stay up a while to see this open cluster of stars. Also known as the Pleiades or the Seven Sisters, and sometimes erroneously thought of as the little dipper, M45, at about 450 light-years, is the second closest open cluster to us. It is approaching middle age for an open cluster, about a hundred million years old, as they tend to disperse their stars over a few hundred million years. The stars, of course, are, for the most part, still very young. Our four-and-a-half-billion-year-old star would have been part of a cluster once upon a time. M45 lies in an area of thin gas and dust that reflect the light of its young, hot stars. See if you can catch a glimpse of that wispy feature.
- Double Cluster – These two rich open clusters are far more distant than M45 at about 7,600 light-years and far younger, perhaps only 14 million years. In Greek Mythology, these two clusters form the handle of Perseus's sword.

- M57 – About 2,300 Light-Years distant and 1.3 across. This is a poster child planetary nebula. Popularly called the Ring Nebula, its smoke ring-like structure has been expanding for about 7,000 years.
- M27 – The Dumbbell Nebula is another close planetary nebula that is slightly older than M57. It has been expanding for about 10,000 years, and being almost half the distance, it is noticeably larger. See if you can tell why it is called the Dumbbell Nebula.
- Veil Nebula – If the veil were far away, we might say it was a planetary nebula. This supernova remnant is about 50 light-years across and 1,500 distant. As with M31, it is dim enough to need instrumentation to see it but so large it is hard to fit it all in a field of view.
- Saturn – The beautiful ringed planet takes us twice as far out. The rings are dirty ice, the remnants of a failed moon.
- Albireo – The components of this double star in Cygnus are in orbit around each other every 100,000 years or so. At about 430 Light-Years distant from us the pair beautifully demonstrates how a close pair can yield colors to the human eye, in this case, a pale blue and golden tint.
- Polaris – Also known as the pole star because it currently aligns very closely with the earth's northern axis of rotation, making it a unique navigational aid, it is also a double star. Look closely, as its companion is much dimmer than the primary star and thus may be a challenge to pick out.
- The Double Double – Here we have four stars dancing together through time and space only 162 light years away. What first looks like a pair of very distant car headlights coming at you, closer inspection reveals to be four stars, with each of the headlights being itself a very close pair. It will take a minute to "split" them.
- M31 – The Andromeda Galaxy is our nearest large galactic neighbor. Despite being over 2,500,000 Light-Years away, its core is still clearly visible to the naked eye under a dark sky. Being six times wider than the moon in the sky, it is a difficult object to fully appreciate because its outer arms are dim enough to require optical aid but hard to fit in a field of view. It has two much smaller nearby galaxies similar to the Milky Way's Magellanic clouds. See if you can spot them and a dark band in M31's otherwise milky form.
- M33 – Also known as the Triangulum galaxy for the constellation it is in, and the Pinwheel galaxy because its nearly face-on attitude reveals its spiral structure so well. Somewhat more distant than M31, it is still visible to the naked eye under a dark sky.
- Stephan's Quintet – Well, stars have clusters, and so do galaxies. If you think you have exhausted the reach of a backyard telescope with M31 and M33, you are way wrong. This group of five galaxies is part of a much larger group, too large to get into the field of view of a telescope, lying approximately 290 million light-years away – a hundred times farther than our neighboring galaxies. They will be dim and featureless but this is the time to think about how long the light falling on your eyes has been traveling to make you a witness to the Quintet's existence.
- Coat Hanger Asterism – An asterism is any collection of stars that form a recognized pattern in the sky that may have no physical relationship to one another. Constellations are areas in the sky that often contain asterisms by which they are identified. The big

and little dippers are familiar examples of asterisms hosted by a constellation. However, asterisms don't have to be associated with a constellation. The Summer Triangle is a particularly relevant and large example, composed of Deneb, Vega, and Altair. The coat hanger, which lies on one line of the Summer Triangle, running between Vega and Altair, is one of the smallest examples. You'll have no problem seeing where its name comes from.

In addition to the above greatest hits objects, viewable under the sliver of sky that happens to be up during the two hours of our star party through one or more of the telescopes in the field, we have two observers taking a different approach.

Learn to use a Telescope
Try your hand at learning to use a small telescope by visiting the table where library telescopes are available, along with personal guidance on how to.

The EAA Experience
Novice observers don't see as much detail in an object as experienced ones do. This is partly due to learning to observe but also partly to knowing the object to start with. If you know what it is supposed to look like, it is easier to pick up the details. Michael Borrelli will use two telescopes, one with an eyepiece like all the others in this event and another with a camera, which can show the objects in more detail by accumulating light over time. Perhaps you have seen one of the objects he will be focused on elsewhere in the event. After doing that, look at his camera image and then in the eyepiece telescope. Do you see more than you did before?

I hope the above adds interest to your night under the stars.