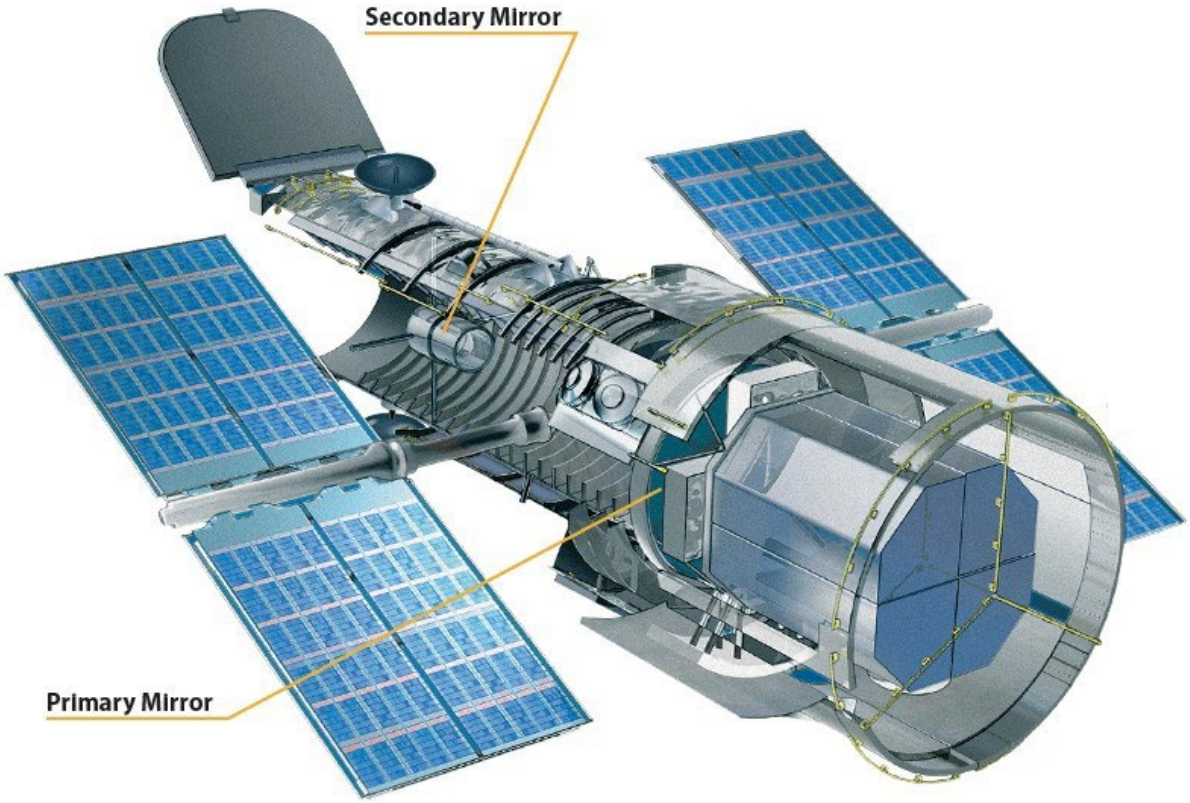
Hubble Space Telescope

Night Sky Challenge

February 2025

Participant Packet



Welcome to the Nurture Nature Center

At the NNC, science, art, and community involvement converge to make incredible things happen!

Founded in 2007 as a center for flood education and community outreach, the NNC has grown since then. Today, we provide a wide range of community programs including many with a focus on science and art. Please refer to our website for more and current information and news about what we offer:
www.nurturenaturecenter.org

One of the many unique opportunities available at NNC is the Science on a Sphere (SOS), a large, suspended globe that displays a variety of earth and space visualizations. We use the SOS to educate about our solar system and the field of astronomy, along with regular 'star parties' in the Easton community where we provide telescopes and staff to guide visitors in viewing the night sky. NNC is excited to expand its education and outreach programming through the 2025 Hubble Space Telescope Observation Challenge: a year-long effort to connect people to space, exploration, and wonder.

NASA launched the Hubble Space Telescope in 1990, thirty-five years ago. Although it wasn't the first space telescope, it continues to be one of the most consequential thanks to all the amazing discoveries it has provided about our universe. Many notable facts of its mission and contributions will be shared during the upcoming celebration at NNC.

Join us on the first Saturday each month at NNC from 4 to 5 pm. We invite fellow sky-gazers (*of all levels and ages*) as we delve into the scientific discoveries of some of the universe's most beautiful views. Participants will be equipped with knowledge, tools, and strategies required to participate in the Hubble Space Telescope Night Sky Challenge.

Each time we meet, a new list of monthly targets will be provided. These objects are selected through a partnership between NASA and the Astronomical League. The NNC will provide information and instruction to make your participation in the challenge both enjoyable and rewarding. Those participating will be eligible for recognition and awards.

It is our hope that this opportunity will provide you with a greater appreciation for our Earth as we stargaze each month. The following pages contain many helpful resources to help us on our journey together. Instructions and additional resources will be provided during each monthly program. No matter your age or ability level, we will navigate the night sky together. We will learn together. We will discover new things together. And together we will grow as a community, using Hubble to help guide us along the way!

This packet contains information from NASA, the Astronomical League, and other resources online.

Helpful Links to Explore:

- *Nurture Nature Center (NNC) Hubble Challenge (Packets, Videos, and Resources):* *https://www.nurturenaturecenter.org/hubbles-night-sky-observing-challenge-with-nnc/*

- *NASA "What's Up"*: https://science.nasa.gov/skywatching/whats-up/

- *NASA Hubble Challenge February Objects Image Link*: https://science.nasa.gov/mission/hubble/science/explore-the-night-sky/hubbles-night-sky-challenge-february/

- *NNC Participant Packet*: Hubble's Night Sky Challenge with NNC.pdf

- *Sky and Telescope Star Chart*: https://skyandtelescope.org/interactive-sky-chart/

- *Dark Sky Map*: https://www.darkskymap.com/nightSkyBrightness

- *Dark Skies Link*: https://www.go-astronomy.com/dark-sky-parks-stargazing-state.php?State=PA

- ***FUN*** *NASA Online Hubble Activities*: https://science.nasa.gov/mission/hubble/multimedia/online-activities/

- Astronomical League List of Other Observation Challenges: https://www.astroleague.org/alphabeticobserving/

Useful Resources in this Packet:

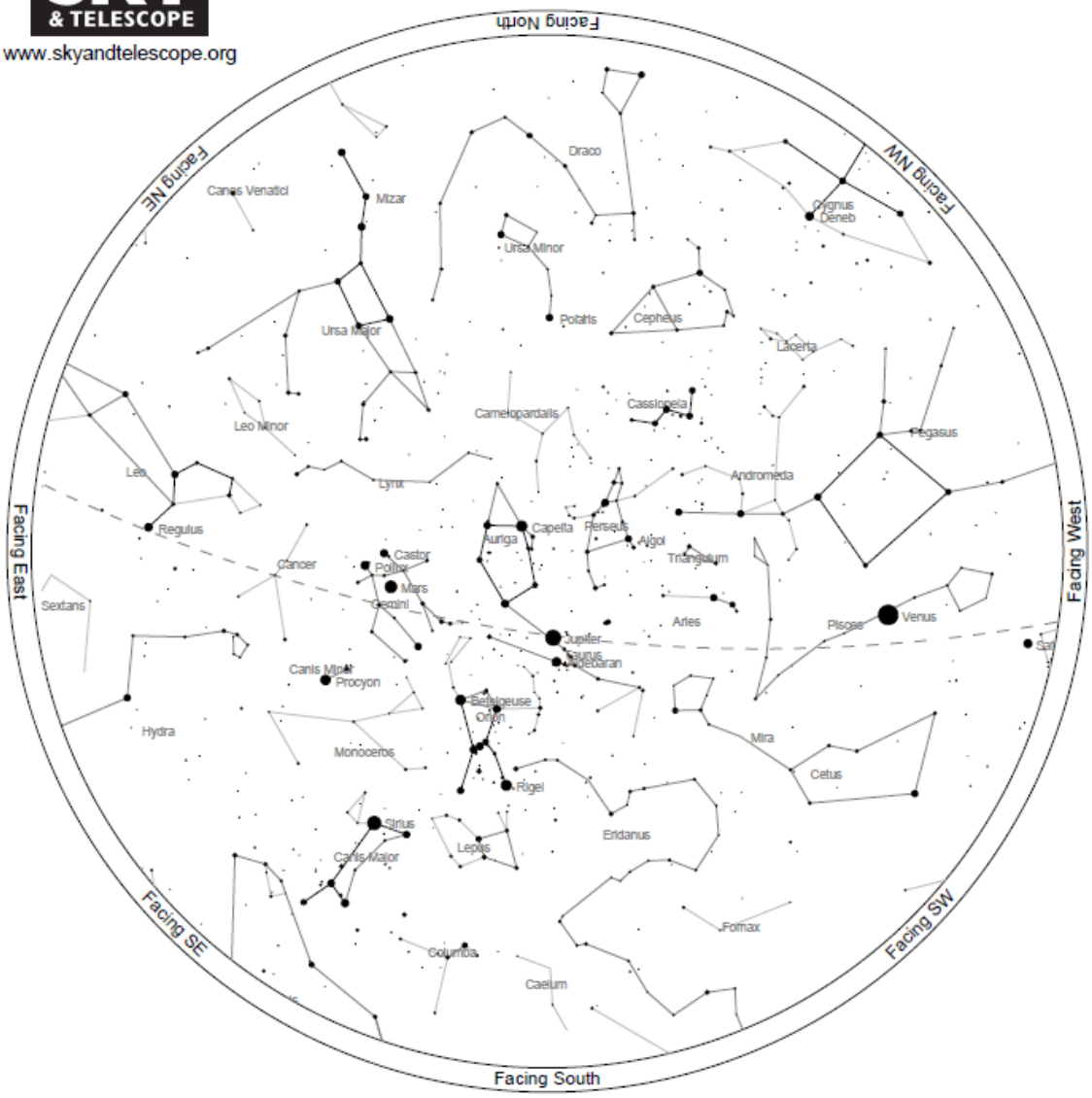
- Sky Charts for February (general and detailed)
- February Hubble Objects (*descriptions and sky maps from NASA*)
- Journal Observation Form (*optional for recognition*)

Additional information and instruction will be provided during the monthly program on the 1st Saturday of each month at NNC from 4 to 5pm.

General Sky Chart for February

SKY & TELESCOPE
www.skyandtelescope.org

Sky Chart



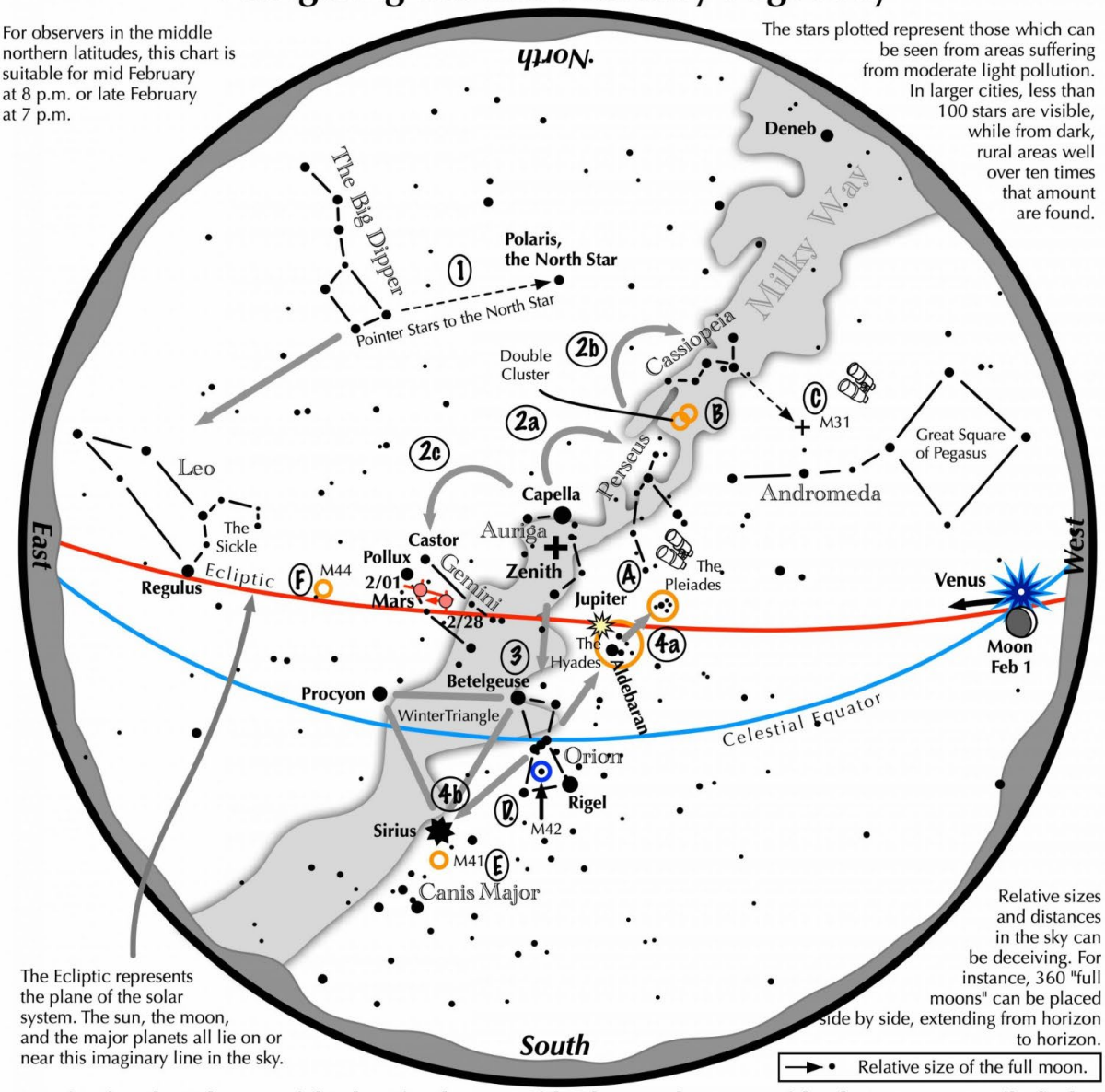
Location: Easton, PA 18042
Latitude: 40° 41' N, longitude: 75° 13' W
Time: 2025 February 15, 19:00 (UTC -05:00)

Powered by: Heavens-Above.com

Navigating the mid February Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid February at 8 p.m. or late February at 7 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

→• Relative size of the full moon.

Navigating the February night sky: Simply start with what you know or with what you can easily find.

1. Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star.
2. Face south. Overhead twinkles the bright star Capella in Auriga. Jump northwestward along the Milky Way first to Perseus, then to the "W" of Cassiopeia. Next jump southeastward from Capella to the twin stars of Castor and Pollux in Gemini.
3. Directly south of Capella stands the constellation of Orion with its three Belt stars, its bright red star Betelgeuse, and its bright blue-white star Rigel.
4. Use Orion's three Belt stars to point northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius, a member of the Winter Triangle.

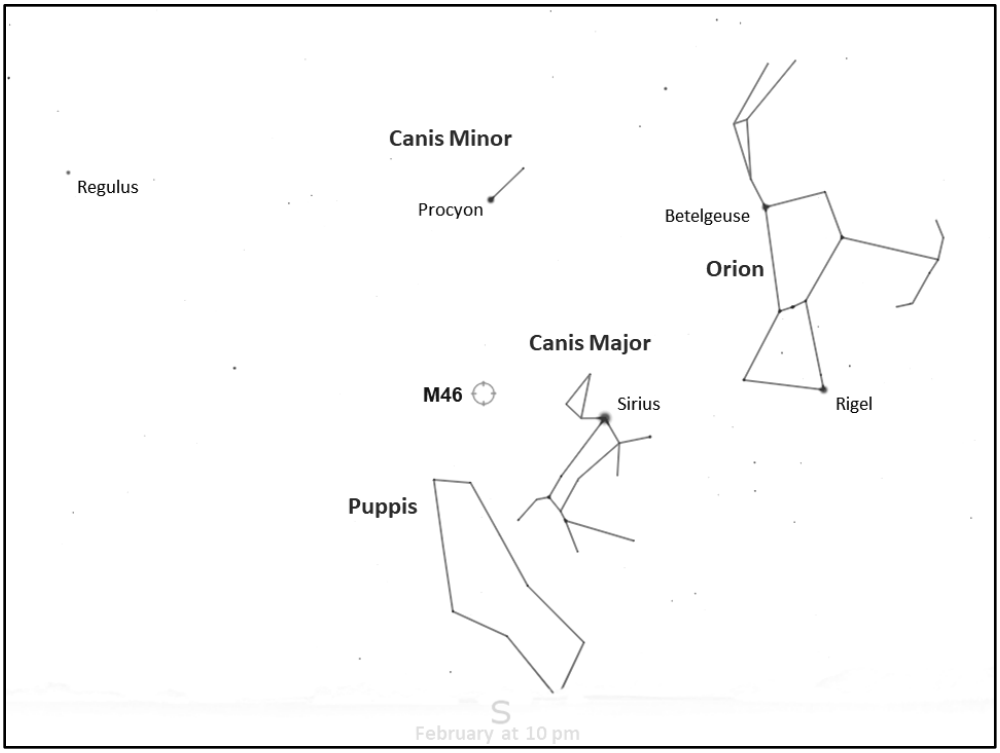
Binocular Highlights

A: Examine the stars of two naked eye star clusters, the Pleiades and the Hyades.
B: Between the "W" of Cassiopeia and Perseus lies the Double Cluster.
C: The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
D: M42 in Orion is a star forming nebula. **E:** Look south of Sirius for the star cluster M41. **F:** M44, a star cluster barely visible to the naked eye, lies southeast of Pollux.

M46

Object Type: Open Cluster

Difficulty: 2



M46 is a relatively easy cluster to find in the constellation Puppis. Use the bright star Sirius in the constellation Canis Major as a starting point. M46 is about 14 degrees to the east and ever so slightly north of Sirius. Once you've found M46, look for the planetary nebula on the northern edge of the cluster. A telescope fitted with a light-pollution filter will increase the contrast between the 10th magnitude diffuse nebula and the background sky. For those with dark skies, the binocular view of star cluster M46 and nearby clusters M47 and NGC 2423 all in the same field of view forms a spectacular group.

The late 18th century astronomer, William Herschel, first spotted NGC 2438. His son, astronomer John Herschel, described it in 1827 as "exactly round … but a little velvety at the edges…"

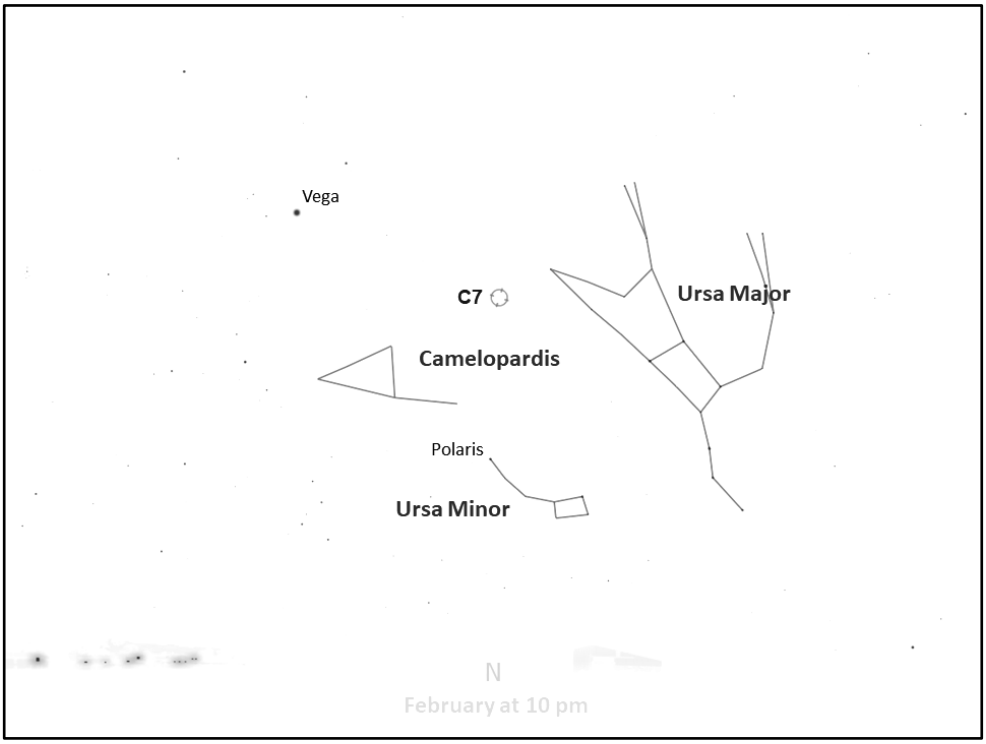
NGC 2438 formed during the death of a Sun-like star. As the star began to die, running out of nuclear fuel, it expelled its outer layers of gas into space and created the spherical glowing nebula we see in this Hubble image. The bright point of light at the center of the nebula is a white dwarf, the evolutionary end product of what was once that Sun-like star.

The visible light image was created using Hubble's Wide Field and Planetary Camera 2. The blue color that fills the center of the nebula represents oxygen [O III] and indicates a photoionized state. Green is hydrogen [H-α], orange is nitrogen [N II], and red is sulfur [S II].

C7

Object Type: Spiral Galaxy

Difficulty: 2



This hazy, steely blue spiral galaxy mottled with pink, flower-like gaseous regions and granular filaments of dark dust is Caldwell 7 (also called NGC 2403). The galaxy's pinkish, glowing clouds are the energetic birthplaces of stars known as H II regions. In these vast, hot areas of ionized hydrogen, the charged gas can form thousands of stars over a couple million years, with each hot newborn star emitting ultraviolet light, further ionizing the surrounding hydrogen.

Roughly 80,000 light-years across, this galaxy became well known amongst supernova hunters in 2004 after Caldwell 7 produced the brightest supernova seen in over a decade (and one of the brightest ever recorded). Supernova 2004dj had a magnitude of 11.2 at peak brightness, and appears as the bright star-like object in the upper right corner of this Hubble image.

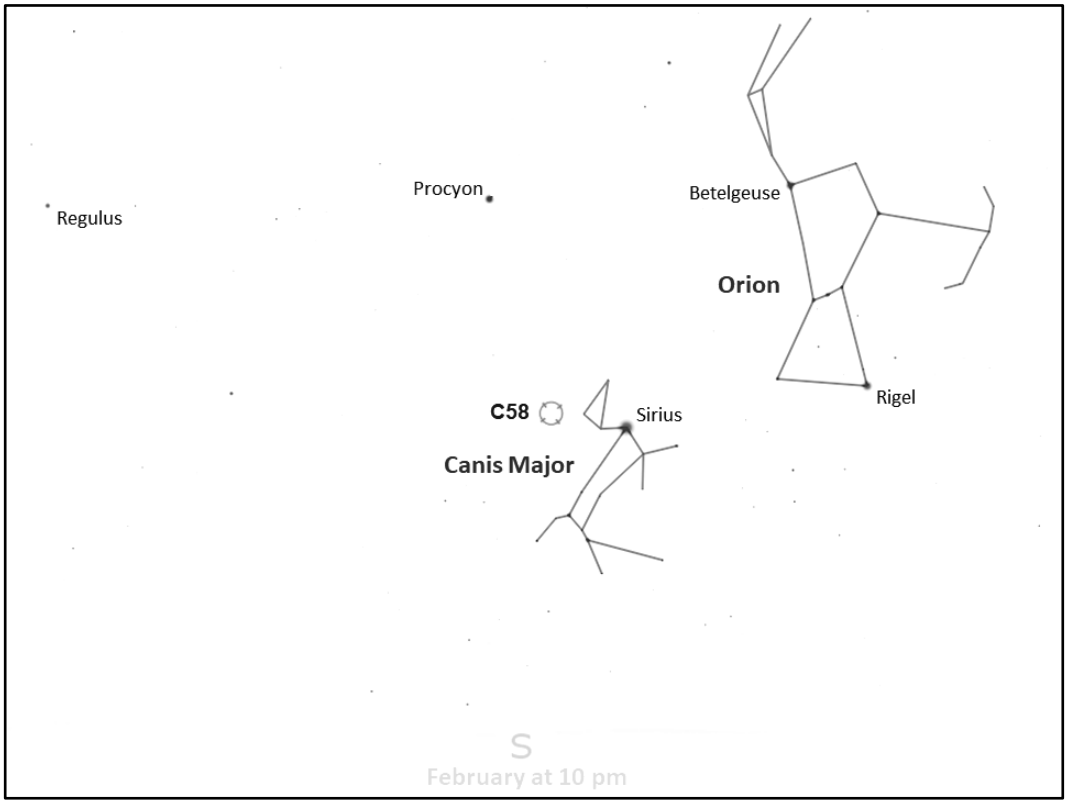
Two bright stars hovering near the top of this view could be confused with supernovae, but they are actually local Milky Way stars, far closer to us than Caldwell 7 is. The galaxy is over 12 million light-years away from Earth and can best be seen in the Northern Hemisphere during the winter months. Southern Hemisphere observers will need to be near the equator to see it and should look for it in the summer. The galaxy can be found with binoculars or a telescope, appearing as an elongated fuzzy patch within the bounds of the constellation Camelopardalis, and is relatively bright at magnitude 8.9.

Though Caldwell 7 is comparable to many galaxies in Charles Messier's famed catalog of celestial objects, the French astronomer missed it when compiling his list. The galaxy was instead discovered by German-British astronomer William Herschel in 1788.

C58

Object Type: Open Cluster

Difficulty: 2



Caldwell 58 is an open cluster — a group of stars loosely bound together by gravity. It is located in the constellation Canis Major, roughly 3,700 light-years from Earth. The cluster has an apparent magnitude of 7.2 and can be spotted with a pair of binoculars in dark, moonless skies. Caldwell 58 is most easily observed during the Northern Hemisphere's winter and the Southern Hemisphere's summer.

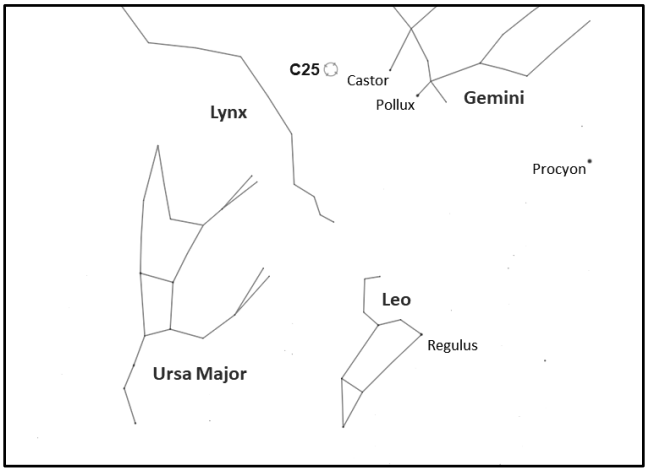
Astronomers used Hubble to study white dwarfs in Caldwell 58 and better understand the age of our galaxy. After a Sun-like star has exhausted its supply of nuclear fuel and ejected its outer layers of gas, what is left behind is the hot core of the star — a white dwarf. These objects cool over a period of billions of years and are some of the oldest stars in our galaxy. Some white dwarfs pulse regularly as they cool.

The time between these pulsations changes over the white dwarf's lifetime, so the time between pulses can be used to estimate how quickly the white dwarf is cooling, and thus how long it has been cooling. This information is useful to astronomers because it means pulsating white dwarfs can be used as chronometers, or "clocks," that constrain the age of our galaxy. The observations of Caldwell 58 were made with Hubble's Advanced Camera for Surveys to help astronomers calibrate white-dwarf chronometers.

C25

Object Type: Globular Cluster

Difficulty: 3



There are about 150 globular star clusters that roam the Milky Way's halo, which encases the galaxy like a giant, diffuse eggshell. But among them, Caldwell 25 is unusual. Unlike most globular clusters, which are huge, spherical clouds of old stars believed to be among the oldest in the galaxy, Caldwell 25 may not be from our galaxy at all. Located about 300,000 light-years from Earth, this cluster is sometimes called "the Intergalactic Wanderer" because it is so far away — even farther than the Milky Way's largest satellite galaxies, the Small and Large Magellanic clouds, which are about 160,000 light-years away. Scientists have surmised that the cluster may be part of the remains of a small galaxy that was captured and disrupted by the Milky Way.

Caldwell 25 seems to be fairly similar to other large globular clusters, though its extreme distance makes it difficult to study and compare its properties with other globular clusters in the Milky Way. Usually all the stars in a globular cluster are very similar to one another in composition, since they typically form in the same general area from the same materials. However, Hubble's observations of Caldwell 25 hint that it has a different story.

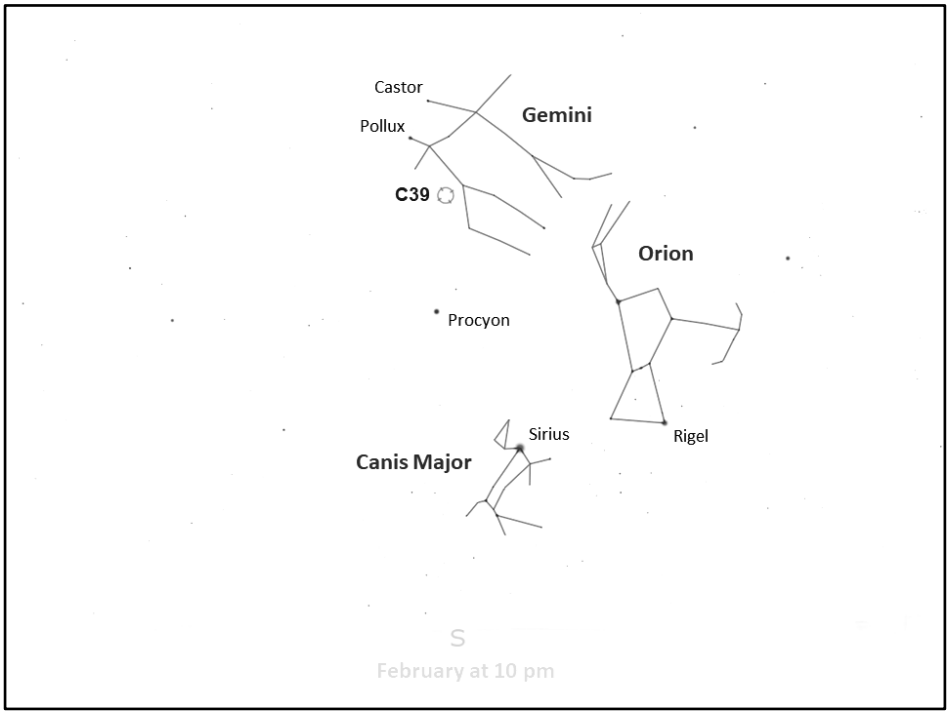
This interesting cluster hosts two distinct sets of red giant stars that have different amounts of certain elements. Red giants are a type of star that results when a medium-mass star expends the fuel that keeps it burning during most of its lifetime. One of Caldwell 25's red-giant subsets, found mainly in the central region of the cluster, has a surprisingly high amount of helium. The differences between the two groups has led scientists to question whether the two stellar populations formed together or started out as individual groups that later merged.

Caldwell 25 was discovered by astronomer William Herschel on New Year's Eve of 1788 and is also cataloged as NGC 2419. The cluster is intrinsically bright, but it appears faint because it is so far away. It has a magnitude of 10.4 and is located in the constellation Lynx. In a typical amateur telescope, Caldwell 25 appears as a soft, hazy, circular glow. Because of the cluster's distance, individual stars are not readily resolved. Observing under clear, winter skies in the Northern Hemisphere will provide the best opportunity to spot Caldwell 25.

C39: Clown Nebula

Object Type: Planetary Nebula

Difficulty: 3



Streams of high-energy ultraviolet radiation cause the expelled material to glow, creating a beautiful planetary nebula — a term chosen for the similarity in appearance to the round disk of a planet when viewed through a small telescope, not because of any actual relation to planets. The nebula's glowing gases produce the colors: nitrogen (red), hydrogen (green), oxygen (blue), and helium (violet).

Caldwell 39's outer disk of material is embellished by a ring of comet-shaped objects with their tails streaming away from the central, dying star. In the central region of the nebula is a bubble of material that is being blown outward by the star's intense "wind" of high-speed material. Hubble's observations provided clues about how the strange structures in the nebula formed and evolve, though scientists are still puzzled about the origin of the comet-shaped features. It seems they may form from a collision of slow- and fast-moving gases. Hubble also helped scientists determine the nebula's distance and the mass of the star that lurks in its center.

Discovered in 1787 by famed astronomer William Herschel, Caldwell 39 (also known as NGC 2392) is about 5,000 light-years away in the Gemini constellation. In the Northern Hemisphere, it is best viewed in the late winter through a large telescope. (In the Southern Hemisphere, look for it in the late summer.) With a magnitude of 9.2, the nebula can be found with a smaller telescope — but you're unlikely to see much of the detail in the center. The nebula exhibits a blinking effect similar to that of Caldwell 15 (the "Blinking Planetary"). When looking directly at the central star, the surrounding nebulosity fades; but as one looks away from the center, the nebula pops back into view.

Hubble Night Sky Challenge

Official Journal Entry Rules

To earn a certificate, you need to meet these requirements:

- ***Complete*** a ***Journal Entry*** including your sketch or image of the Hubble object(s)
- ***Describe*** the parts of your observation that are recognizable in the Hubble image
- ***Submit*** your ***Journal Entry*** before the deadline (to the NNC or Astronomical League)

You can ***submit***, ***in person***, at the ***Nurture Nature Center*** during the monthly Hubble Program **OR *email*** it to Henry Skirbst: henry@nurturenaturecenter.org prior to the deadline.

If you wish, you can also submit your Journal Entry directly to Richard Benson.

NASA Observing Challenge and Special Award Coordinator:
Richard Benson (*of the Astronomical League*)
3105 Lykes Dr. NE
Albuquerque, NM 87110
E-mail: rlbenson6691@comcast.net

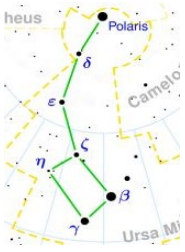
Recognition certificates will be emailed to you from Richard Benson within a month.

Use the information below to help you complete your Journal Entry:

Seeing: ***How stable is the sky?***
E *(excellent)* – The *brighter stars* are *not twinkling* at all.
VG *(very good)* – The *stars* are *twinkling slightly*, but the brighter *planets* are *not twinkling*.
G *(good)* – The *brighter planets* are *twinkling slightly*.
F *(fair)* – The *brighter planets* are *obviously twinkling*.
P *(poor)* – The atmosphere is *turbulent*. *All objects are twinkling* to the points where observation is not practical.

Transparency: ***How clear is the sky?***
Transparency is a measure of what you can see in the nighttime sky in spite of dust, smoke, haze, humidity, or light pollution. An easy way to measure this is to use the magnitude of the faintest star you can see. In the northern hemisphere, to make life simpler, you can use the *Little Dipper (Ursa Minor*) if you can see it. Here is the scale (*based on the visible stars*):

No stars visible		Magnitude **1**
Only Polaris is visible	α	Magnitude **2**
… ***plus*** Kochab ***or*** Pherkad	β, γ	Magnitude **3**
… ***plus any stars in the tail***	δ (Yildun), ε	Magnitude **4**
… ***plus another bowl star***	ζ	Magnitude **5**
All 7 stars are visible	η	Magnitude **6**
More than 7 stars visible		Magnitude **7**



What makes a good ***Description*** when you are filling in an ***Observation Log*** for an Astronomical League Observing Program? These are some suggestions and guidelines to help you. The reason for the object description requirement is to help the observer to become a more detail-oriented observer; to "observe" the object and not just "see" it, and in the end, to become a better observer. You cannot learn to "observe" from a book. It can only be mastered with an eyeball to the eyepiece. The intent of requiring object descriptions is to have you pick out details to the best of your ability. These details are what make the object unique.

The description should describe what makes that object different from all the rest. This is possible with any size optical instrument. You can't say that M70 looks like M13 even though both are globular clusters. You wouldn't describe the Great Orion Nebula (M42) the same as the Crab Nebula (M1), even if they both are nebulae and appear as fuzzy clouds in the eyepiece. M31 looks nothing like M65 even though both are spiral galaxies seen at a fairly similar angle.

Things like:

Is the object *round*, *oval*, or *irregularly* shaped?

If the object is oval shaped, *how stretched out*, or oval, is it; i.e. 2 times longer than wide, 4 times longer than wide, even more? Is it basically just a little streak?

Does the galaxy or nebula have *sharp edges*, or does it *fade gradually* away to nothing? If it fades away to nothing, does *averted vision* (*not looking directly at it*) seem to increase its size?

Does the *galaxy* have a *brighter core area*, or is it an *even brightness* across the entire surface? Is the brighter core a *large area*, or does it come to a *stellar point*?

For *globular clusters*, is the central area *large and full*, or *very pointed* and stellar-like?

For *open clusters*, are all the stars the *same magnitude?* Can you guess the *number of stars*?

Does the open cluster *stand out well* against the starry background, or does it *blend in* making it difficult to determine the edges?

For *nebulae*, are there any *denser* or *lighter* areas? Are there any stars involved in the nebula?

What else is in the field of view that is *interesting*? Other deep sky objects? A nice double star? Any colorful stars? Is the field of view densely packed with stars? Did a satellite just pass? etc.

And of course, any other thoughts you have while viewing the object that might *make it personal* to this observation. After all, this is YOUR observing log.

Yes, it may at times seem like a lot of work, but after a dozen or so observations, it will become second nature to ask yourself these things. The result is that you end up training your eyes to see detail in the objects you observe. And after doing this, each object becomes unique.

Thanks to Observing Program Coordinator, Scott Kranz, for developing this instructional aid.

Hubble Night Sky Challenge

Official Observation Journal Entry Form

Please complete as neatly as possible.

Group Affiliation:	*The Nurture Nature Center, 518 Northampton St., Easton, PA 18042*				
Your Full Name:					
Mailing Address:					
Phone Number:					
E-mail Address:					
Tools Used:	Eyes (**E**), Binoculars (**B**), Telescope (**T**)				
Location Method:	Manual (**M**), Device Aided (**DA**)				
Observation:	Visual (**V**), Imaging (**I**)				
Location:					
Date:		Time:			
Object Name:					
Catalogue ID:		Host Galaxy:			
Object Type:		Constellation:			
Magnitude:		Seeing:		Transparency:	
Instrument Used:				Magnification:	
Sketch / Image & Comparison	*https://science.nasa.gov/mission/hubble/science/explore-the-night-sky/hubbles-night-sky-challenge/*				