Keene Amateur Astronomers

The Newsletter for Keene Amateur Astronomers

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James Webb Space Telescope, NGC 602

NGC 602, a young star cluster in the Small Magellanic Cloud (one of our satellite galaxies), where astronomers using @NASAWebb have found candidates for the first brown dwarfs outside of our galaxy. Image Credit: ESA/Webb, NASA & CSA, P. Zeidler, E. Sabbi, A. Nota, M. Zamani (ESA/Webb)

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Editor's Message

The nights are finally turning chilly. December ushers in the winter stars and the planets will continue to dazzle this month.

Venus is spectacular in the Southwest sky. Jupiter and Mars will be increasing in brightness as they both reach their opposition this month.

I highly recommend taking sometime when you are curled up nice and warm in your home to browse the newly revamped Night Sky Network website. There are some wonderful resources available. There are links to NASA resources including several podcasts, blogs, and newsletters. A variety of articles which change on a monthly basis are also available to read. I highly recommend the article on Night Lights: Aurora, Noctilucent Clouds, and the Zodiacal Light. It is a nice read on these phenomena that light up our night sky. I had the good fortune to see Noctilucent Clouds on my second SOFIA flight.

If you are a club member, you can sign up for a Night Sky Network account. As a member, you can receive a discount on subscriptions to the magazines Astronomy, Sky & Telescope, and Stardate.

I hope you have a wonderful holiday and have an opportunity to enjoy this month's night sky.

- Susan Rolke

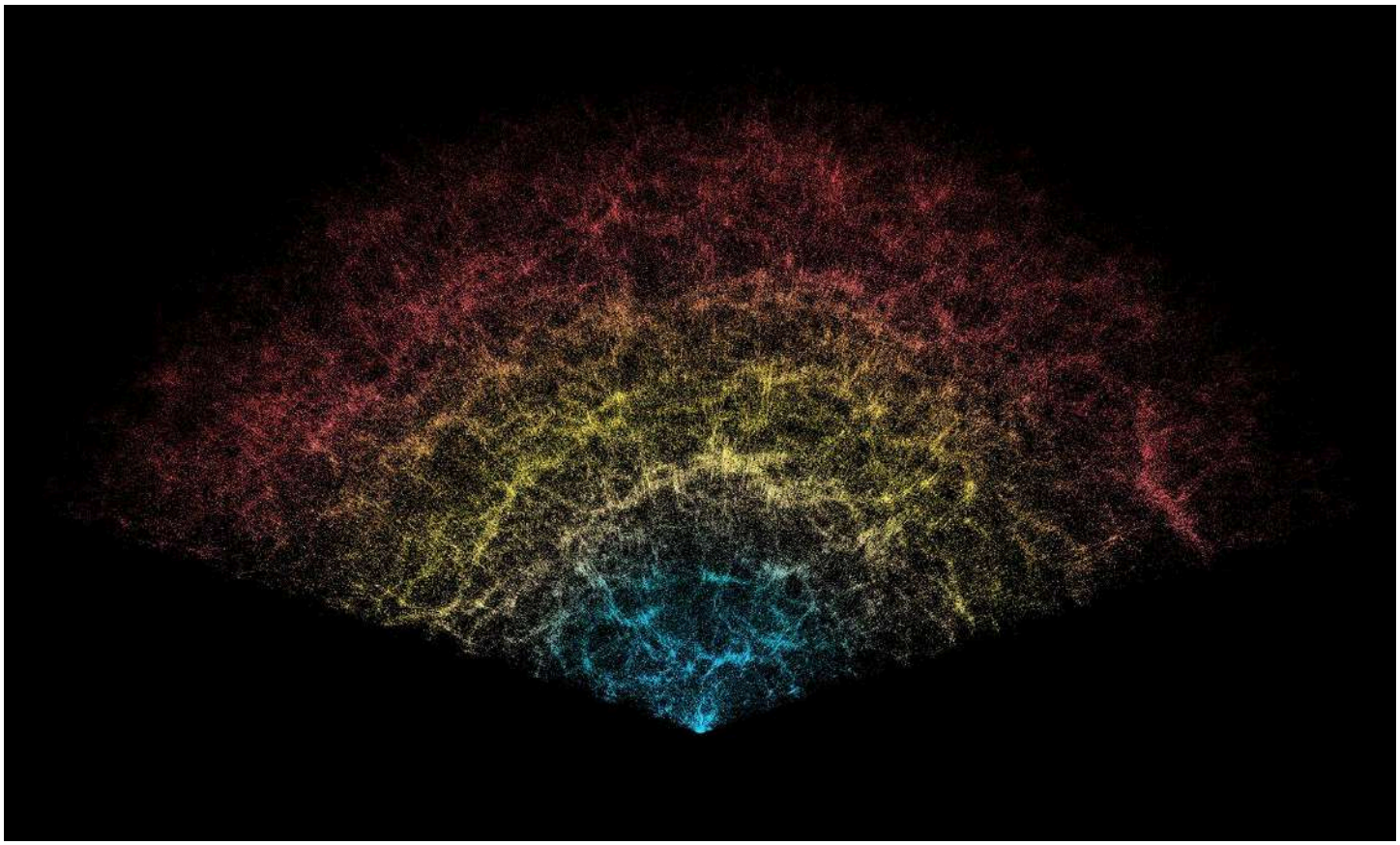
Monthly Business Meeting

Our next meeting will be held on December 6th at Bruce Norlund's at 7 pm. Please see the October Minutes for more details.

DESI Survey and Dark Energy

By Susan Rolke

This year, the largest ever 3D map of the Universe was released. The map was created by DESI, the Dark Energy Spectroscopic Instrument in order to track the expansion of the universe to provide researchers with a better understanding of dark energy. DESI is an international collaboration of more than 900 researchers from over 70 institutions. The project is overseen by Lawrence Berkeley National Laboratory. DESI is designed to determine the properties of dark energy that cause cosmic acceleration and how galaxies are moving apart.



This image shows a slice of the 3D map of galaxies collected in the first year of the Dark Energy Spectroscopic Instrument (DESI) Survey. Earth is at the tip, with the furthest galaxies plotted at distances of 11 billion light-years. Each point represents one galaxy. This version of the DESI map includes 600,000 galaxies — less than 0.1% of the survey's full volume. Image Credit: DESI Collaboration/NOIRLab/NSF/AURA/R. Proctor

The DESI instrument is mounted on the Mayall 4 m telescope at Kitt Peak National Observatory in Arizona. The survey collects information on the position and velocity of galaxies and quasars. It uses 5,000 tiny robots, each attached to an optic cable the width of a human hair, to look at 5,000 locations simultaneously. The light is routed through a grism, a fancy prism, to spread out the light to make a spectrograph. This allows researchers to pinpoint the location and velocity of a million galaxies and quasars a month with extremely high precision.

The Dark Energy Spectroscopic Instrument (DESI) is installed on the Nicholas U. Mayall 4-meter Telescope at Kitt Peak National Observatory near Tucson, Arizona. **Credit:** KPNO/NOIRLab/NSF/AURA/P. Marenfeld

Preliminary data released by DESI is consistent with Einstein's Theory of General Relativity. However, there are subtle differences in the current location of galaxies and that which is predicted by our current understanding of dark energy.

The standard model of cosmology tells us the universe is expanding and that the expansion is accelerating. Dark energy is the cause of this expansion, beating out gravity, and pushing galaxies apart. Astronomers don't know what dark energy is. It is a placeholder to explain the cosmic repulsion that is observed. Researchers don't know if it is a force, a property of space or something else, although it is often referred to as energy. Twenty six years after its proposal, dark energy remains a puzzle. What we do know is that it is causing our universe to expand.

When dark energy was discovered in 1998, it was linked to the cosmological constant. A keystone to our model of cosmology is that dark energy exerts a constant repulsion. The initial data released by DESI suggests that dark energy is weakening. The basis for this claim is that the galaxies are not spread out as far as they should be if dark energy is constant. In order to determine where galaxies should be located, DESI used the Baryon Acoustic Oscillations (BAO), an imprint left on our early universe approximately 400,000 years after the Big Bang. The BAO is a density pattern created by acoustic waves and is used as a standard ruler to measure cosmic expansion.

If dark energy is weakening, a reexamination of the standard model will be necessary. Currently the model predicts everything will continue to spread apart, faster and faster. The possibility that dark energy is weakening means there is a possibility that gravity could take over and slow down expansion or possibly pull everything back together.

Based on these findings, several cosmologists are putting forward alternative theories. However, most scientists remain cautious and stress the need for more data and refining our current theories to model the universe's expansion. While the data is hinting that our long held assumptions regarding dark energy need to be modified, we must remember the sage words of Carl Sagan, "Extraordinary claims require extraordinary evidence."

It will be interesting to read more about this topic next year when DESI releases more data.

Resources for this article that you might find of interest:

Noirlab, The Making of the Largest 3D Map of the Universe (video)

Mapping the Cosmos: UT Dallas and DESI's Role in Redefining the Universe (video)

New Chapter on Dark Energy Unfolds (video)

DESI 2024 Results: November 19 Guide

DESI 2024 Results: April 4 Guide

Space.com, Largest 3D map of our universe could hint that dark energy evolves with time

Night Sky Network Online Webinar

The Night Sky Network hosts monthly webinars for members to learn more about space and current research. If you are looking to watch a presentation you missed, you can view a recording at Night Sky Network's youtube channel.

Join the Night Sky Network on December 18 at 6:00 PM Pacific (9:00 PM Eastern) for their annual Astronomy Picture of the Day (APOD) with Dr. Robert Nemiroff. The APOD archive contains the largest collection of annotated astronomical images on the internet.

Dr. Robert Nemiroff is a professor of physics at Michigan Tech. He worked at NASA's Goddard Space Flight Center in Maryland before coming to Michigan Tech. He is perhaps best known scientifically for papers predicting, usually among others, several recovered microlensing phenomena, and papers showing, usually among others, that gamma-ray bursts were consistent with occurring at cosmological distances.

To learn more about Dr. Nemiroff and learn about the Astronomy Picture of the Day resource, be sure to watch this webinar on the 18th.

NASA Night Sky Notes, November 2024

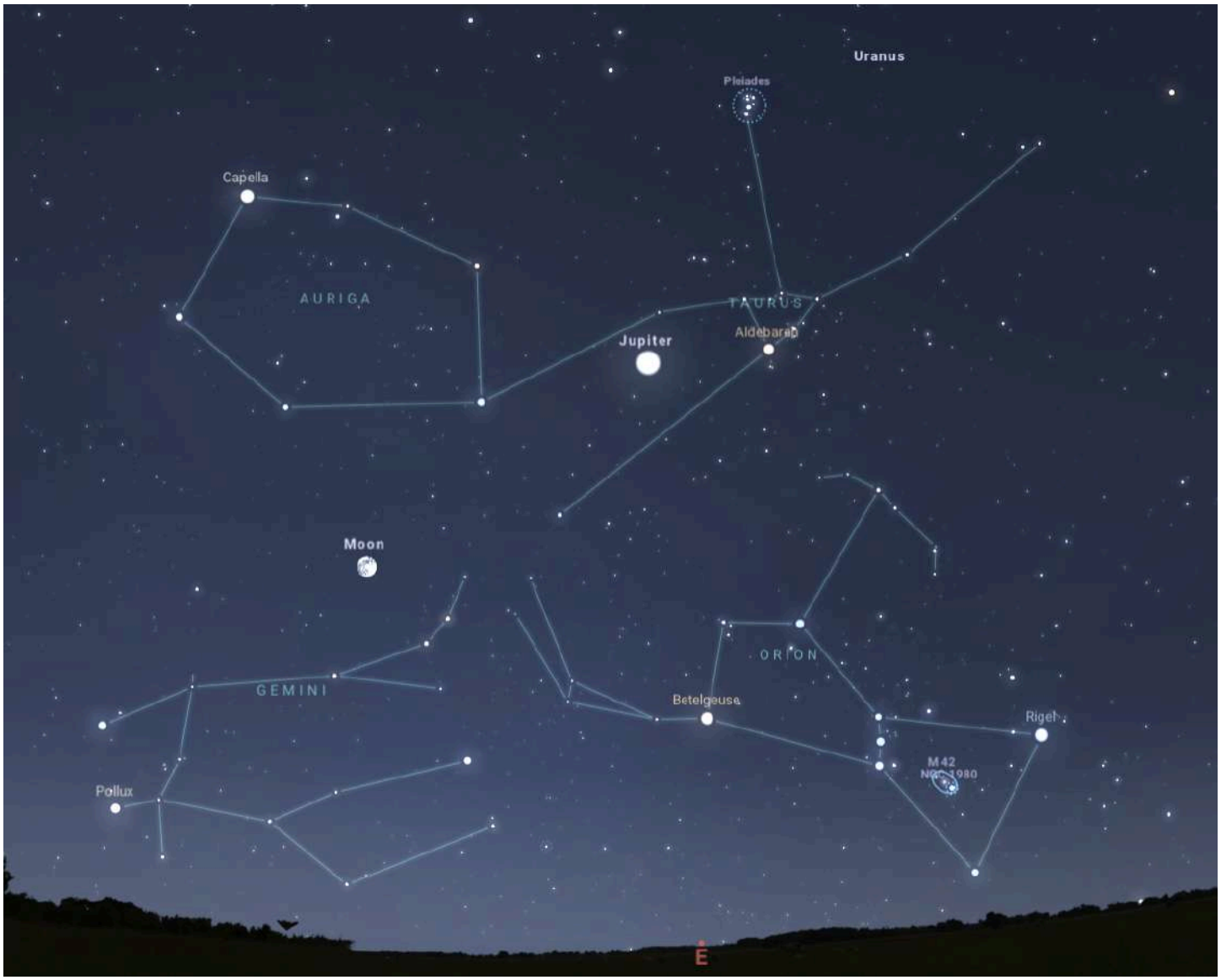
December's Night Sky Notes: Spot the King of Planets

By Dave Prosper
Updated by Kat Troche

Jupiter is our solar system's undisputed king of the planets! Jupiter is bright and easy to spot from our vantage point on Earth, helped by its massive size and banded, reflective cloud tops. Jupiter even possesses moons the size of planets: Ganymede, its largest, is bigger than the planet Mercury. What's more, you can easily observe Jupiter and its moons with a modest instrument, just like Galileo did over 400 years ago.

NASA's Juno mission captured this look at the southern hemisphere of Jupiter on Feb. 17, 2020, during one of the spacecraft's close approaches to the giant planet. This high-resolution view is a composite of four images captured by the JunoCam imager and assembled by citizen scientist Kevin M. Gill. Credit: NASA, JPL-Caltech, SwRI, MSSS | Image processing by Kevin M. Gill, © CC BY

Jupiter's position as our solar system's largest planet is truly earned; you could fit 11 Earths along Jupiter's diameter, and in case you were looking to fill up Jupiter with some Earth-size marbles, you would need over 1300 Earths to fill it up – and that would still not be quite enough! However, despite its formidable size, Jupiter's true rule over the outer solar system comes from its enormous mass. If you took all of the planets in our solar system and put them together, they would still only be half as massive as Jupiter all by itself. Jupiter's mighty mass has shaped the orbits of countless comets and asteroids. Its gravity can fling these tiny objects towards our inner solar system and also draw them into itself, as famously observed in 1994 when Comet Shoemaker-Levy 9, drawn towards Jupiter in previous orbits, smashed into the gas giant's atmosphere. Its multiple fragments slammed into Jupiter's cloud tops with such violence that the fireballs and dark impact spots were not only seen by NASA's orbiting Galileo probe but also by observers back on Earth!



Look for Jupiter near the Eye of the Bull, Aldebaran, in the Taurus constellation on the evening of December 15, 2024. Binoculars may help you spot Jupiter's moons as small bright star-like objects on either side of the planet. A small telescope will show them easily, along with Jupiter's famed cloud bands. How many can you count? Credit: Stellarium Web

Jupiter is easy to observe at night with our unaided eyes, as well-documented by the ancient astronomers who carefully recorded its slow movements from night to night. It can be one of the brightest objects in our nighttime skies, bested only by the Moon, Venus, and occasionally Mars, when the red planet is at opposition. That's impressive for a planet that, at its closest to Earth, is still over 365 million miles (587 million km) away. It's even more impressive that the giant world remains very bright to Earthbound observers at its furthest distance: 600 million miles (968 million km)! While the King of Planets has a coterie of 95 known moons, only the four large moons that Galileo originally observed in 1610 – Io, Europa, Ganymede, and Calisto – can be easily observed by Earth-based observers with very modest equipment. These are called, appropriately enough, the Galilean moons. Most telescopes will show the moons as faint star-like objects neatly lined up close to bright Jupiter. Most binoculars will show at least one or two moons orbiting the planet. Small telescopes will show all four of the Galilean moons if they are all visible, but sometimes they can pass behind or in front of Jupiter or even each other. Telescopes will also show details like Jupiter's cloud bands and, if powerful enough, large storms like its famous Great Red Spot, and the shadows of the Galilean moons passing between the Sun and Jupiter. Sketching the positions of Jupiter's moons during the course of an evening – and night to night – can be a rewarding project! You can download an activity guide from the Astronomical Society of the Pacific at bit.ly/drawjupitermoons

Now in its eighth year, NASA's Juno mission is one of just nine spacecraft to have visited this impressive world. Juno entered Jupiter's orbit in 2016 to begin its initial mission to study this giant world's mysterious interior. The years have proven Juno's mission a success, with data from the probe revolutionizing our understanding of this gassy world's guts. Juno's mission has since been extended to include the study of its large moons, and since 2021 the plucky probe, increasingly battered by Jupiter's powerful radiation belts, has made close flybys of the icy moons Ganymede and Europa, along with volcanic Io. What else will we potentially learn in 2030 with the Europa Clipper mission?

Find the latest discoveries from Juno and NASA's missions to Jupiter at science.nasa.gov/jupiter/

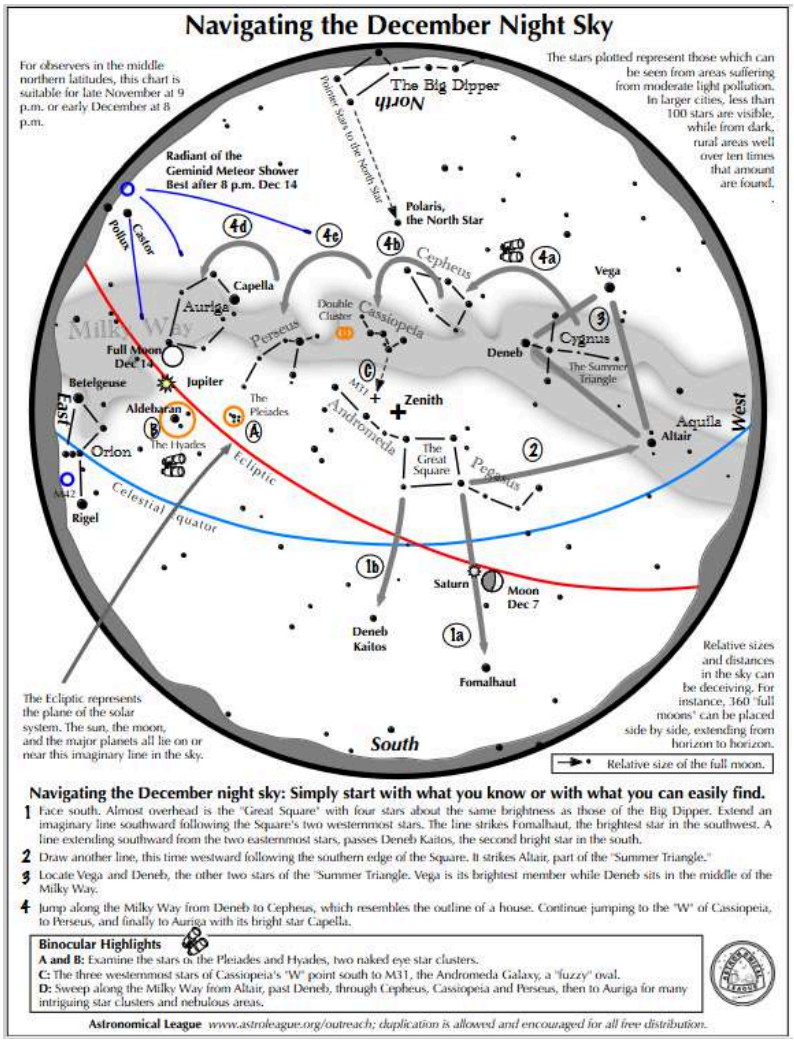
Originally posted by Dave Prosper: February 2023

Last Updated by Kat Troche: November 2024

Observing

To find out skywatching tips for this month, click on the following links (in blue and underlined) to learn more.

Video: What's Up December 2024 Sky Watching Tips from NASA



Click here for a larger image December 2024

You may find past issues of the Astronomical League charts **here.**

Astronomical League Observing this Month

This is a slight change from prior newsletter's due to the inability to locate this information on the NSN website this month. Instead, I urge you to go to the Astronomical League's website and view their monthly resources.

This month they have two observing projects, both of which focus on Mars.

Try This Challenge in Early December

Observing Project: Retrograde Motion of Mars