Newsletter April 2021

Next Meeting: **ZOOM Meeting - Monday 26 April 8pm**

Topic: AAS April Meeting - Variable Stars by Roger Pickard

Join Zoom Meeting:
https://us02web.zoom.us/j/85186562441?pwd=dW14dW13eHJ3eTgxdUQ0OEFvYlcvZz09
Meeting ID: 851 8656 2441 Passcode: Stellar

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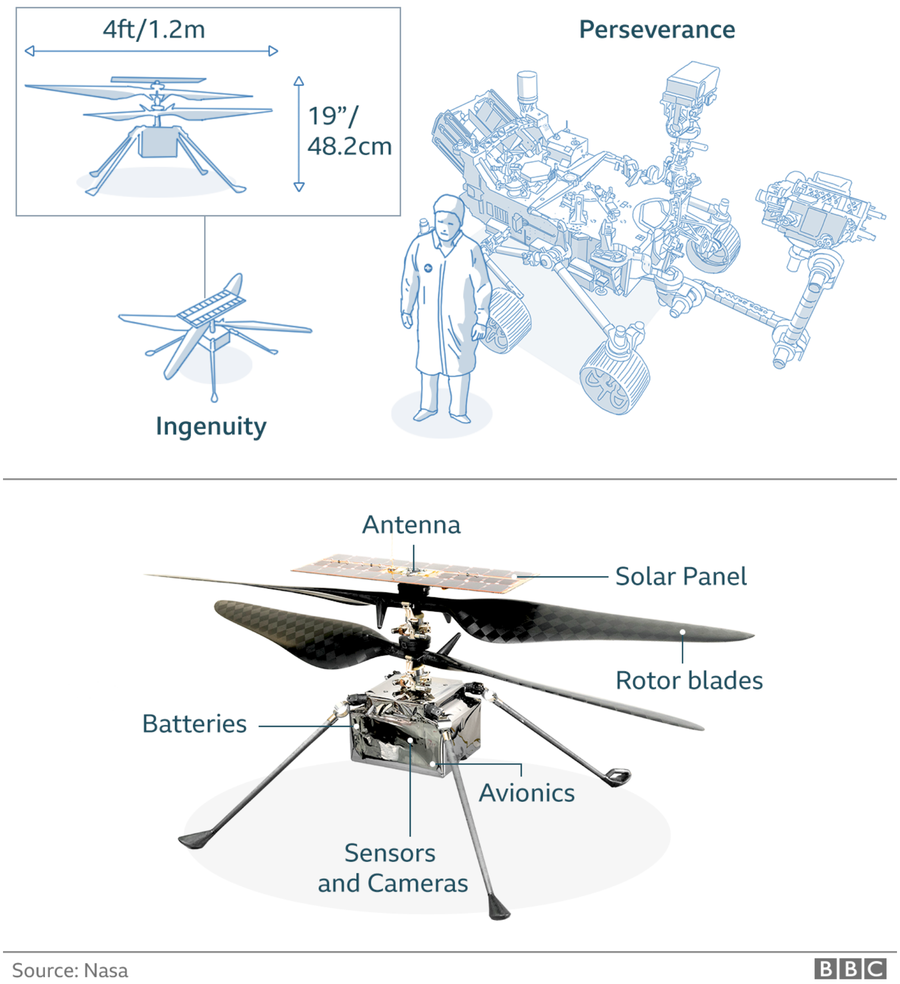
President's Word

I hope you have all had a very happy and enjoyable Easter, and didn't 'expand' too much with the consumption of the usual seasonal fayre! I'm a great fan of Simnel Cake so had plenty of that, and though I do like chocolate, I managed to keep my egg count fairly low.

As restrictions are beginning to open up, there has been more action on the practical astronomy front evident with more and more people looking to the skies. I had been on the lookout for an Adventurer Pro mount but these appear to have been snapped up, with all outlets being left out of stock, so it looks like I will be using my savings for more mundane items like a towbar for the car - At least my rotten shed will finally make it to the tip sometime soon!

Well, big news from Mars, with the North American Space Agency successfully flying a small helicopter drone in the rarified atmosphere.
The drone was airborne for only a short time (less than a minute) but it is the first powered, controlled flight by an aircraft on another planet. Plans are to take more adventurous flights in the days ahead, with testing of the technology to ascertain just how high and far the drone can travel. Very exciting times ahead!



In other 'news'….

You will remember some time ago (April 2019) that the Event Horizon Radio Telescope (EHT) team announced that it had successfully imaged the shadow of a supermassive black hole in a neighbouring galaxy by combining observations from eight separate radio telescopes across the Earth.

This technique called interferometry gave the EHT a resolution effectively equal to an Earth sized telescope. At present, the light from optical telescopes can only be combined from telescopes a few hundred metres apart at most (ESO)and while the interferometry does increase the resolution considerably, it falls far short of the resolution available in the radio spectrum.

That may be set to change as astronomers turn to quantum physicists for help, to start connecting optical telescopes that are tens, even hundreds, of kilometers away from one another.

Such optical interferometers would rely on advances being made in the field of quantum communications—particularly the development of devices that store the delicate quantum states of photons collected at each telescope. Called quantum hard drives (QHDs), these devices would be physically transported to a centralized location where the data from each telescope would be retrieved and combined with the others to collectively reveal details about some distant celestial object.

This technique is reminiscent of the iconic double-slit experiment, first performed by physicist Thomas Young in 1801, in which light falls on an opaque barrier that has two slits through which it can pass. The light recombines on the other side of the barrier, creating an interference pattern of bright and dark stripes, also known as an interferogram. This works even if individual photons trickle through the slits one by one: over time, the interference pattern will still emerge.

“If we have two telescopes that can be made to behave like Young’s slits, and we are able to get an interferogram on a source of light, like a star on the sky, the interferogram tells you a lot of things about the source,” says astronomer Jonathan Bland-Hawthorn of the University of Sydney, whose team is proposing the use of quantum hard drives to build optical interferometers. Such instruments could one day help astronomers measure the sizes and intrinsic motions of stars and galaxies with greater precision, a crucial ingredient in our understanding of the evolution of the cosmos.

The reason that interferometers are much used in the radio spectrum is that interferometry is easier to achieve in radio than optical frequencies in three important ways: Firstly, radio antennas are cheaper to build than optical telescopes, so one can construct large numbers of them (to increase the signal collecting area and hence sensitivity) and spread them apart (to increase resolution). Second, astronomical objects emit powerful radio waves, making it simpler to record these signals at individual antennas for subsequent correlation. Optical sources, however, are usually much, much fainter—so faint, in fact, that telescopes often must accumulate a celestial target’s light literally one photon at a time, turning interference into a quantum-mechanical phenomenon. Third, Earth’s atmosphere distorts optical light, leaving telescopes little time in which to collect the photons before the overlying layers of turbulent air disrupt their phase or coherence.

Now Bland-Hawthorn has teamed up with quantum technologist John Bartholomew of the University of Sydney and Matthew Sellars of the Australian National University in Canberra to design optical interferometers that avoid the use of entangled photons and quantum repeaters. The basic idea is simple: Consider two eight-meter telescopes separated by tens of kilometers. The quantum states of the photons collected by each telescope—meaning the amplitude and phase of light as a function of time—are stored in quantum hard drives. Astronomers would physically transport these QHDs—by road, rail or air—to one location, where the quantum states would be read out and made to interfere, generating an interferogram.

Bartholomew and his colleagues have been working together on QHDs that could one day be used to build such an interferometer. In 2015 the group argued that photonic states could be stored in the nuclear spin states of certain ions in a crystal of europium-doped yttrium orthosilicate (or, more simply, Eu:YSO). In theory, in a crystal kept at a frosty temperature of two kelvins, the spin states should remain coherent for up to a month and a half, Bartholomew says. In a lab-based demonstration, his team managed a more modest but still impressive result, showing it could keep the spin states coherent for six hours. “We used to joke about putting the memory system in the back of a Toyota Corolla and driving down the highway,” he says. “You'd be able to go quite a distance.”

If all goes well, Bland-Hawthorn says that a whole new era of optical astronomy will open up, particularly with interferometers using 30-meter and 39-meter telescopes that are being built in Hawaii and Chile, respectively.

Bland-Hawthorn also envisages being able to resolve white dwarfs such as Sirius B and binary systems into their component stars, measure stars’ size and their intrinsic speed across the sky (also called proper motion) with greater precision and resolve, in finer detail, the stars moving around the black hole at our galactic center. “Tracking the stars around the black hole will allow us to probe the general theory of relativity in new way,” Bland-Hawthorn says.

Outside the Milky Way, he thinks 40-meter-class telescopes connected by QHDs will resolve stars in galaxies out to the Virgo cluster and also measure the proper motions of these galaxies. “This last experiment has key implications for the study of how large-scale structure evolves with cosmic time due to the underlying dark matter and the emergence of dark energy,” Bland-Hawthorn says.

telescopes that can Southern Telescope in Paranal, astronomical facility

Composed of four 8.2-meter act as one, the European Observatory’s Very Large Chile is the world’s premier for optical interferometry.

Wishing you all the best of health and clear skies!

Member Articles

Alex's Space

TEMPUS FUGIT

The Universe came into being in a wonderous storm of creation 14 billion yeas ago, 9.5 billion years later the solar system started to take shape, after another billion years life developed in Earth's oceans paving the way for the Dinosaurs to walk the land. Now let's go fast-forward through 500 million years with the evolution of plants, insects, mammals and birds, then through the rise of the Greek, Roman and Maya civilisations until we reach 1995 – The Spice Girls are on top of the charts and Toy Story has arrived in the cinema, but most importantly, the first confirmed planet around another star in the Milky Way was found. This discovery confirmed that our solar system was not just an oddity in the Universe and other stars also had planets orbiting them and maybe, just maybe, those planets might host some form of 'life,' but travelling to another star with a planet which may be suitable for us is unlikely to be an option no matter how much we might end up needing one.

Finally:

A question of time – If only I had the time I would do lots more. I need more hours in the day, more than 24. But time is a precious gift we must use as best we can and in the evening we will see if the day has gone to plan!

Alex Baillie
2021

April / May Observing

General

Galaxy season is well under way, with Leo and Virgo well placed in the sky for observing. Ursa Major is also almost directly overhead placing its many galaxies in good view as well. Unfortunately, or fortunately, depending on your point of view the days are getting longer and longer, meaning we will soon lose astronomical darkness (mid-May to early August), so make the most of what darkness we have while you can. On the upside, apart from late evening strolls, noctilucent clouds may be back and are worth keeping an eye out for.

Planets

Mercury and Venus: Both planets have returned to the evening sky and will be easy to see over this period, with Mercury reaching its greatest elongation on the 17th of May.

Mars: Remains the best of the planets to observe, as it continues to hang around the western sky after sunset, however, it will shrink from an apparent diameter of just under 5 arc seconds now to just a bit more than 4 arc seconds by the end of May. It will also be getting further to the west and will become more difficult to observe. It will be in conjunction with the Moon on the 17th May.

Jupiter and Saturn: They are visible in the morning sky just before sunrise, but are not well placed for observation.

Uranus and Neptune: For most of this period both planets are unobservable, being too close to the sun in the sky.

Three Planet Conjunction: On the 22nd of April Venus and Uranus will be less than 22 arc minutes apart in the early evening with Mercury about two degrees to the right of the pair. On the 23rd Uranus will be right between the two others. Due to the brightness of the sky and how low they are they may be hard to see, but it is worth a go if it is clear. It is a rare chance to see three planets in a wide field telescope!

Vesta: OK, it is not a planet, but at magnitude 6.4 it is currently visiting the body of Leo for this period, and should be visible with binoculars or a modest telescope

Meteor Showers

Apart from the Lyrids (22nd April) just passed there are no other major meteor showers for this period.

Novae and Supernovae

Nova Cassiopeia is visible for anyone with a small telescope, it was discovered on the 18th of March by Japanese observer Yuji Nakamura close to Messier 52 an open cluster. It remains close to its discovery magnitude of 7.8

For keeners there at least two supernovae visible in large telescopes, or photographically in smaller one, 2021hiz in IC 3322A (or UCG 7513) and 2021hpr in NGC 3147, for a full list see https://www.rochesterastronomy.org/snimages/

Comets

There are no easily observable comets visible present during this period.

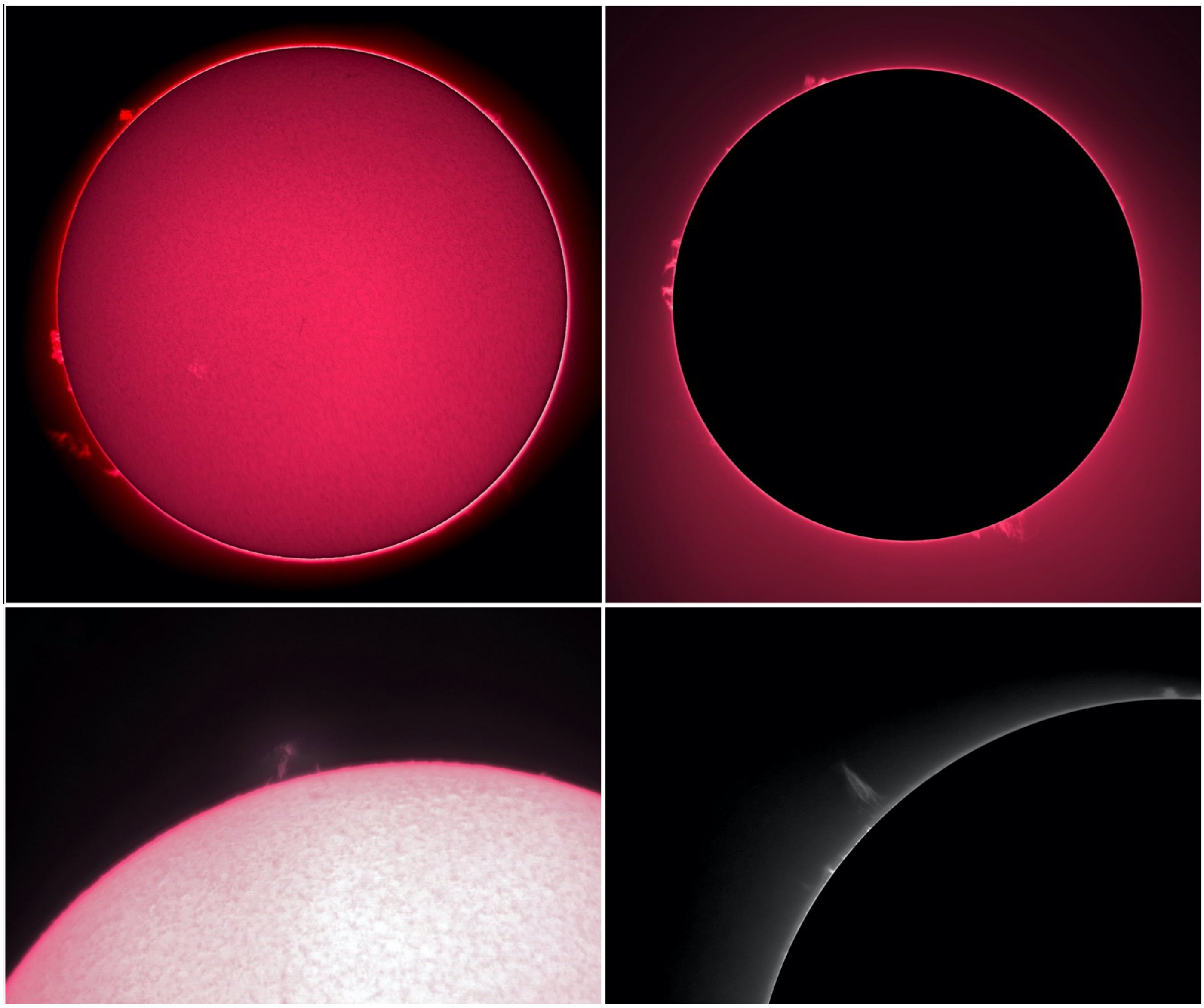
ISS

The ISS is absent but returns in the mornings on the 30th of April shifting to the late evening later in May, until the 29th when we are no longer able to see it. Consult https://www.heavens-above.com for specific times and locations. If you are interested in ISS lunar or solar transits here is another site where you can obtain predictions: https://transit-finder.com/.

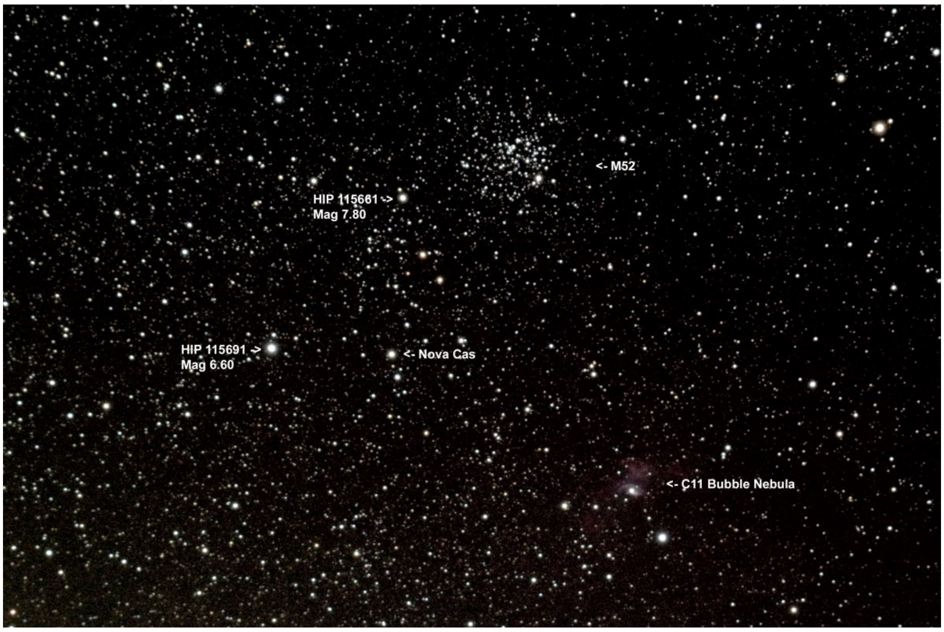
Member Images

Marc Charron

I have been able to shoot a bit of deep sky as well as some solar from a borrowed PST (courtesy of the SDSO) which I am giving a spin.



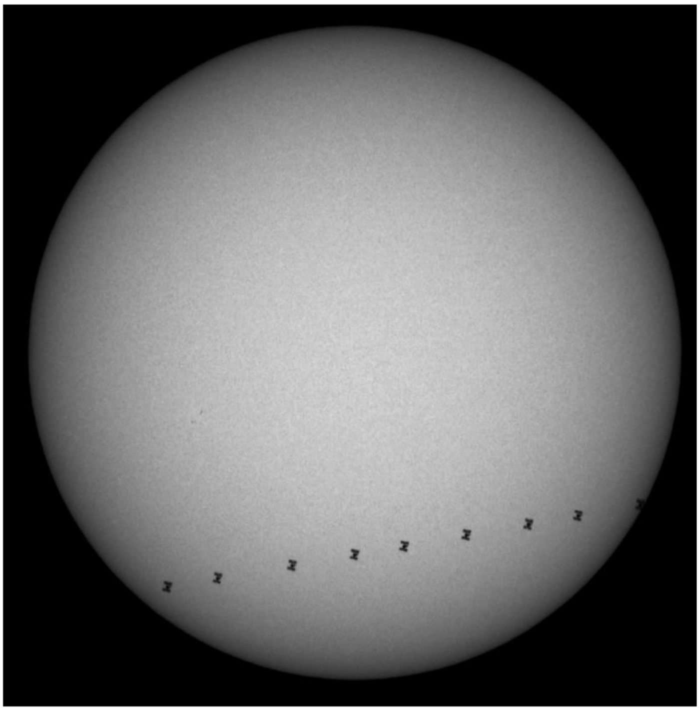
Nova Cassiopeia

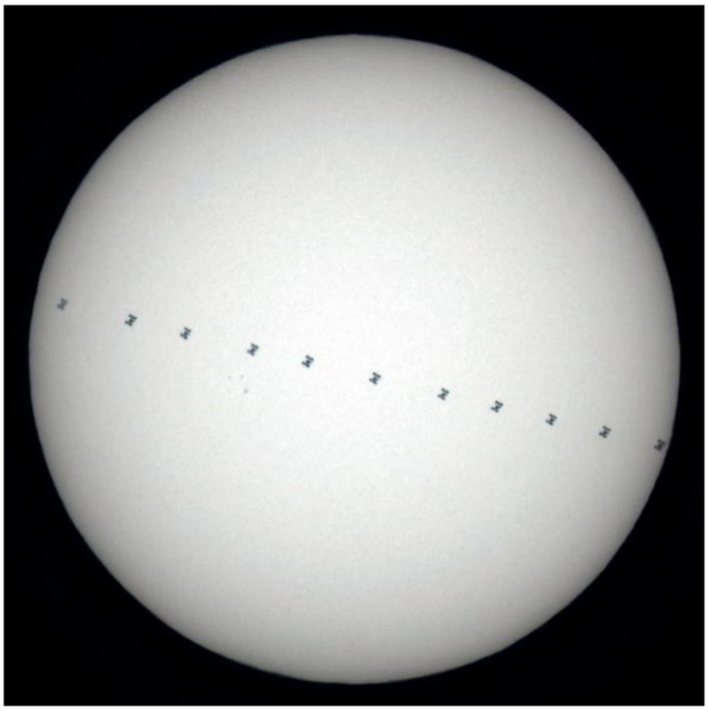


SN 2021hiz in IC 3322A and SN2021hpr in NGC 3147, shot with 70mm f6 triplet with 1x flattener.

M81 and M82 through TMB 130 with 0.6x focal reducer and M3 at prime focus

Two ISS transits the first on the 11th and the second on the 12th of April. Given we are fairly far north, good transits are not all that common, but what I have noticed is that they tend to come in clusters a few times a year. Both taken with 70mm f6 triplet at prime focus using AA Herschel wedge and AA178C camera.





And to finish a couple of unusual lunar images, the first a 1.6 day old moon, which can be hard to capture, the second, a day later, the moon with ω-Tau, a 4.90 magnitude star. Both taken with 70mm f6 refractor.

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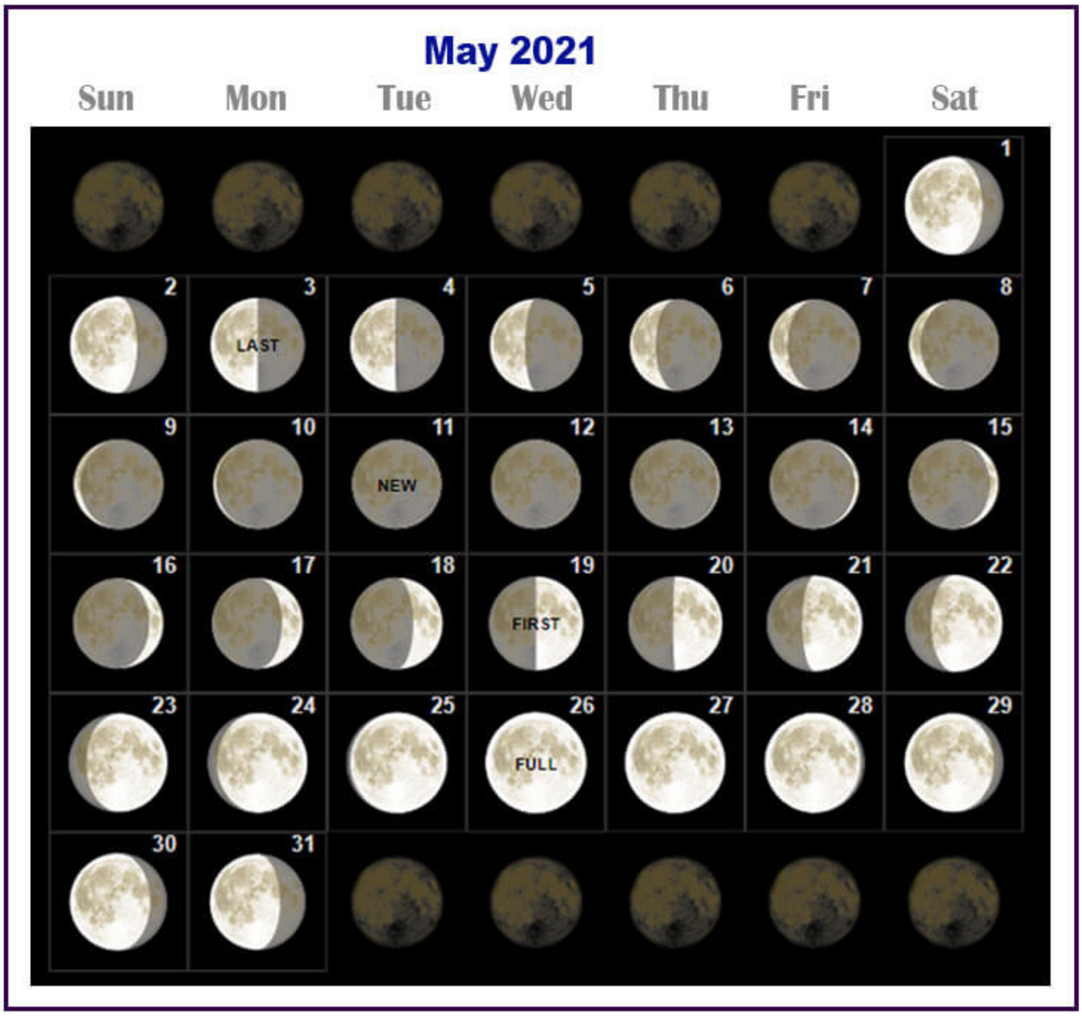
Moon Phases


May 2021
Sun
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Wed
Thu
Fri
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LAST
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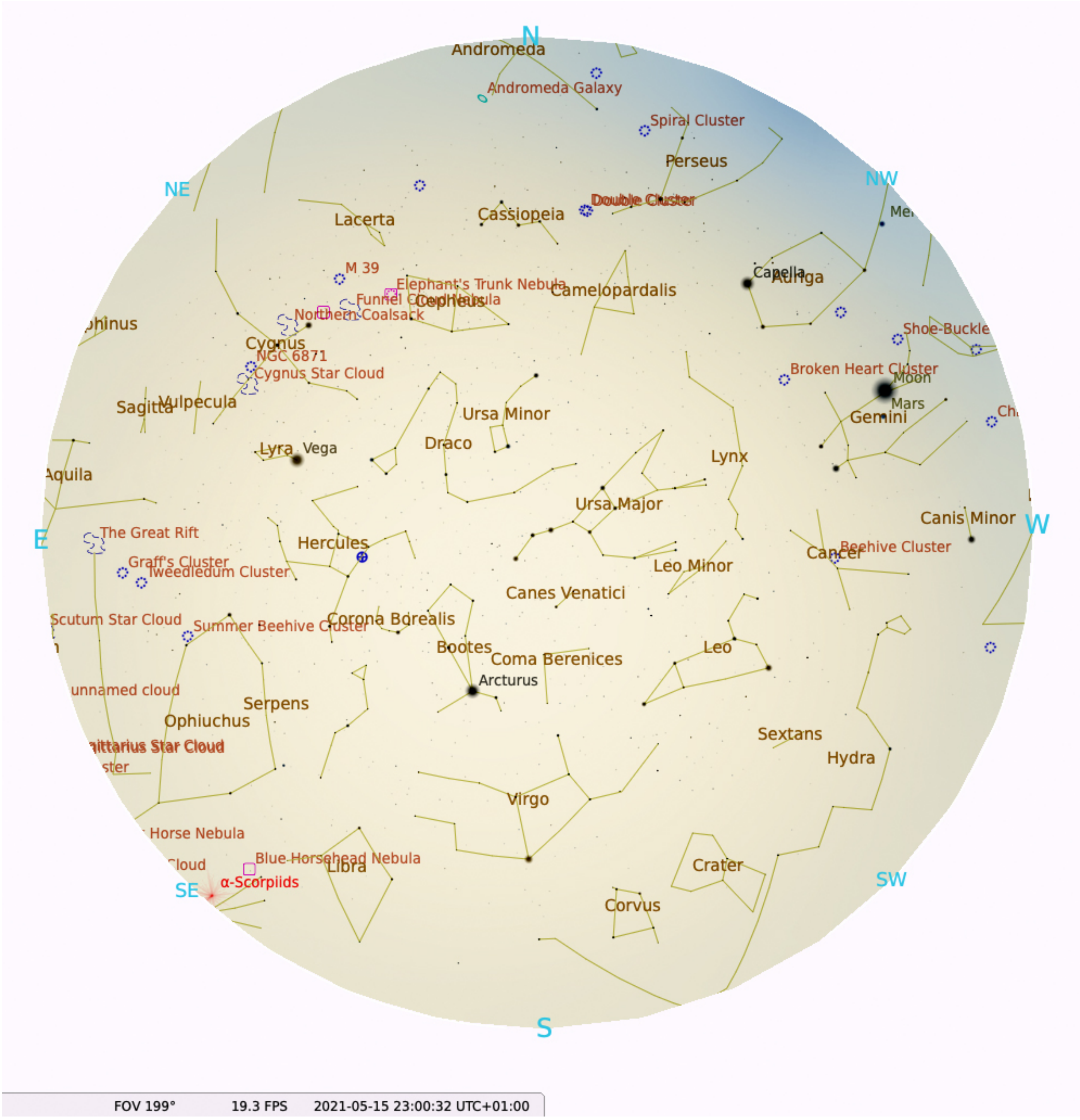
May Sky Chart



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