The Sky This Month for February 2021

On-line Resources:

- Astronomers' birthdays: https://www.bornglorious.com/world/birthday/?pf=11063&pd=02
- Astronomical Events (extensive listing): https://astronomy.activeboard.com/f613775/historical-calendar/
- 'Leviathan of Parsonstown' drawing: Working Men's Educational Union: http://collections.rmg.co.uk/collections/objects/459517
- www.DateandTime.com
- https://www.spaceweatherlive.com
- https://in-the-sky.org
- https://marysastronomyblogs.blogspot.com/2021/01/lunar-x-and-v-times-for-2021.html
- Lunar S - https://www.universetoday.com/129279/looking-lunar-letters/
- https://www.aavso.org/
- Asteroid Occultations: Global Asteroid Events at http://www.poyntsource.com/New/Global.htm

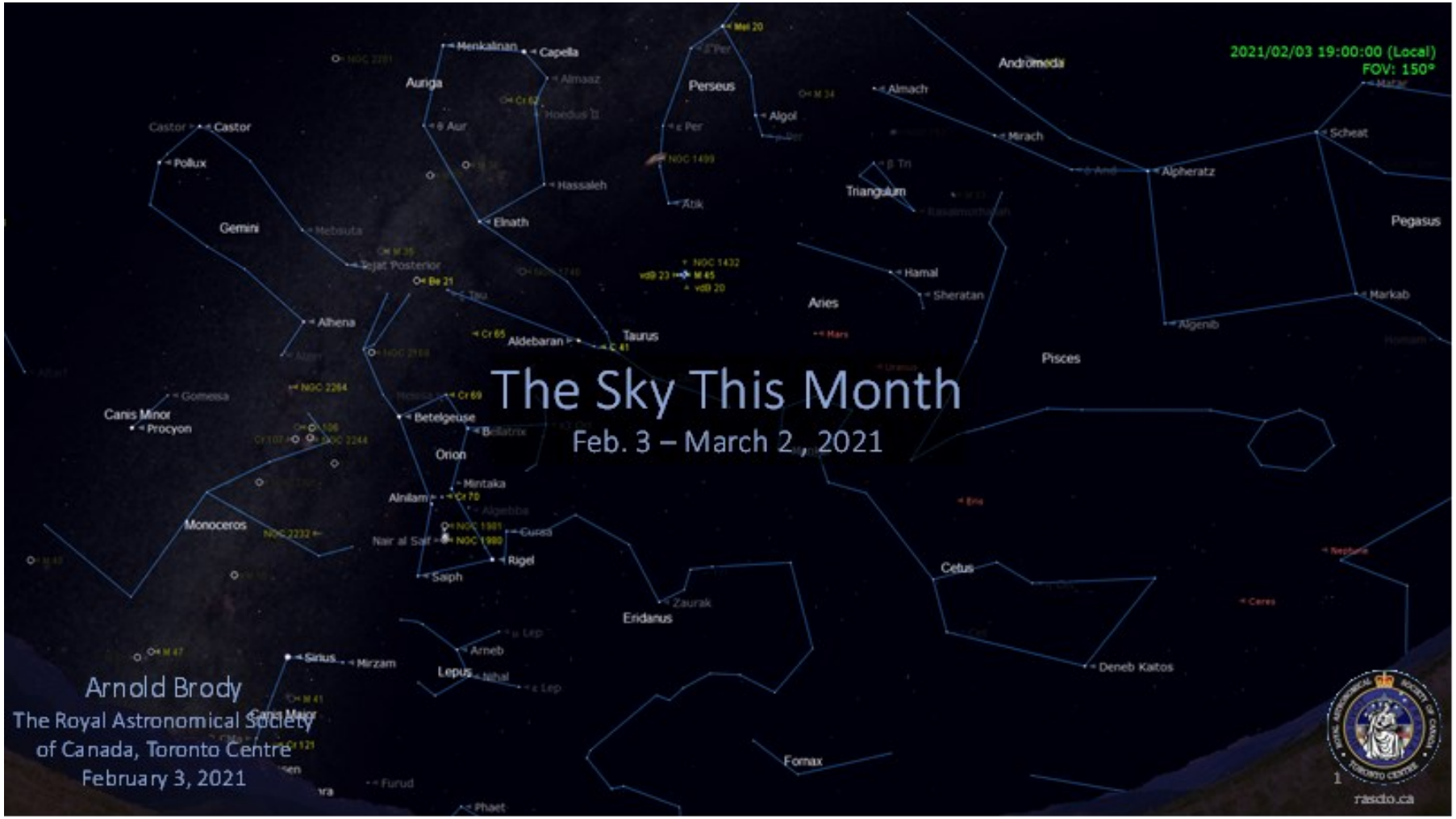
Planetarium software:

- Starry Night Pro
- Stellarium
- Space Engine

Astro-images:

- Adrian Aberdeen, RASC, Toronto Centre
- Jeff Booth, RASC, Toronto Centre
- Ole Nielsen, CC BY-SA 4.0, via Wikimedia Commons
- Göran Nilsson & The Liverpool Telescope, CC BY-SA 4.0, via Wikimedia Commons

Slide 1


2021/02/03 19:00:00 (Local)
FOV: 150°
The Sky This Month
Feb. 3 – March 2 , 2021
Arnold Brody
The Royal Astronomical Society of Canada, Toronto Centre
February 3, 2021
Menkalinan
Capella
Auriga
Perseus
Andromeda
Almach
Algol
Mirach
Scheat
Alpheratz
Pegasus
Castor
Pollux
Gemini
Hassaleh
Elnath
Triangulum
Hamal
Sheratan
Aries
Markab
Algenib
Pisces
Alhena
Aldebaran
Taurus
Betelgeuse
Canis Minor
Procyon
Orion
Mintaka
Alnilam
Monoceros
Rigel
Saiph
Cetus
Deneb Kaitos
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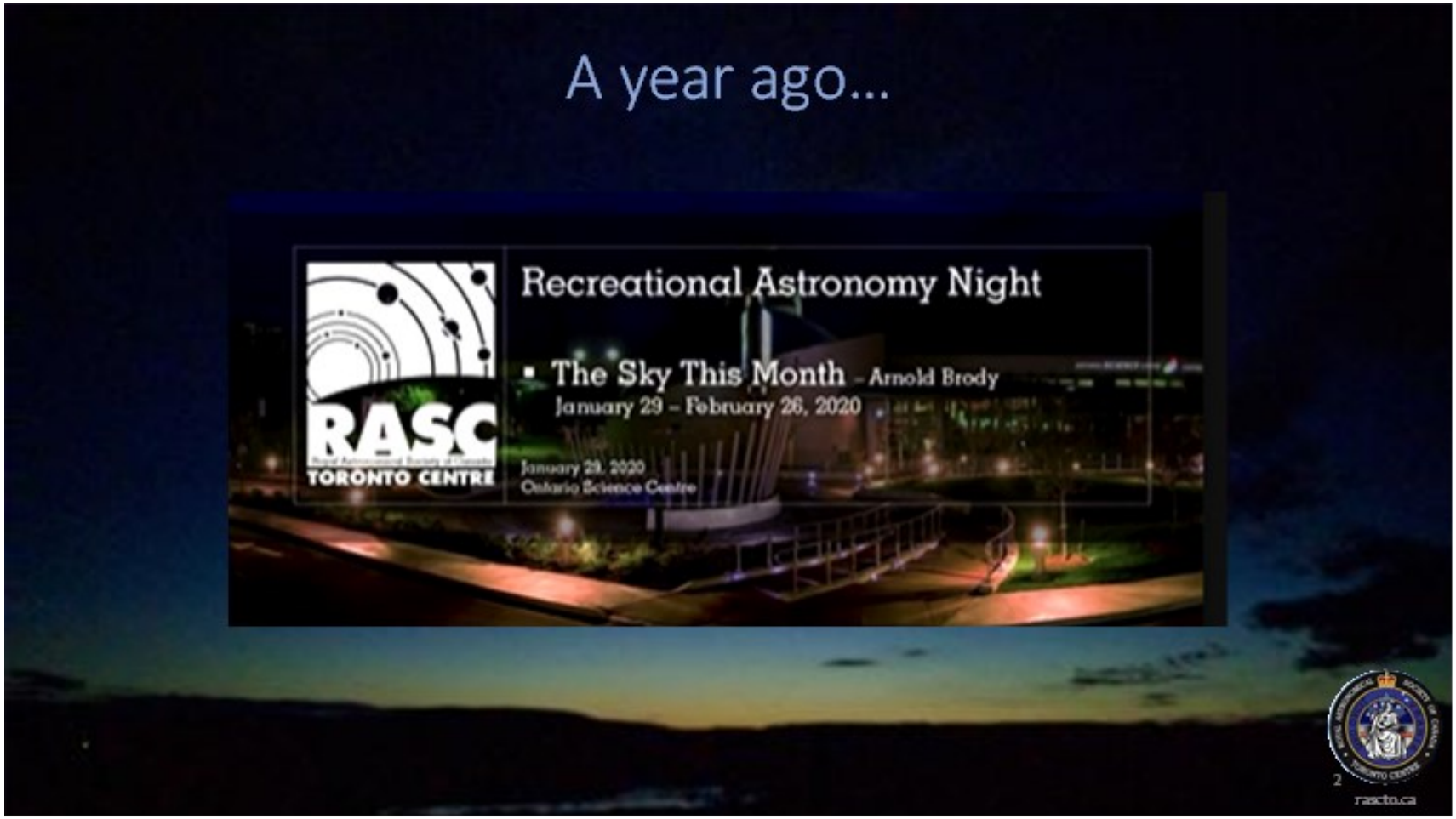
Slide 2



I also did The Sky This Month for February, last year at the Ontario Science Centre. Then the pandemic hit and we've not been back. Fortunately, our meetings have continued uninterrupted thanks to the AV committee and volunteers streaming our meetings online.

A shout-out to Andrew and Betty Reid, Ward LeGrow, Ennio Celluci and Blake Nancarrow for keeping us connected.

Slide 3

Tonight, we'll take a look at some astronomical anniversaries, a quick review of space missions, then jump into February observing.

Slide 4

There are hundreds of astronomers whose birthdays are in February according to the BornGlorious website. For brevity, I've picked two giants who opened the door to modern astronomy.

First, Copernicus, born this month in 1473. He disliked the Earth-centered universe of Aristotle-Ptolemy with planets riding on epicycles, so he put the planets in orbit around the Sun and the epicycles were gone! Simple. He published his theory in *De Revolutionibus Orbium Coelestium* - On the Revolutions of the Heavenly spheres. Knowing the danger his book would put him, he waited until his last days to publish.

Copernicus was followed a century later by Galileo, born in February 1564. Galileo turned his handmade 37mm telescope to the Sun, Moon, planets and stars in the early 1600s and, in 1610, reported his findings in *Sidereus Nuncius*, the Starry Messenger, which challenged conventional wisdom and drew the ire of the Church. He was familiar with Copernicus's Sun-centered model and promoted it in "Dialogue Concerning the Two Chief World Systems" which led to his conviction and house arrest. Galileo's is known as the father of modern science through the use of experimental evidence to test theories.

Slide 5

Of the many astronomical events with anniversaries this month, here are three.

In February 1845, the Leviathan of Parsonstown saw first light, and became the world's largest telescope for 72 years.

In February 1930, Clyde Tombaugh found Pluto with a comparator machine that showed a dot moving between photographic plates he exposed through a 330mm telescope at the Lowell Observatory.

And in February 1974, Mariner 10 became the first spacecraft to use a planet, in this case Venus, for a gravity assist on its way to Mercury.

Slide 6

Mission Updates…

On January 14, Blue Origins successfully tested their sub-orbital space-tourism system with the New Sheppard booster, reaching the planned apogee and successfully recovering both booster and capsule.

Revenue from tourists taking the 11-minute trip above the Karman Line, starting later this year, will help fund missions under development, such as Blue Moon crew and cargo trips to the Moon.

Slide 7

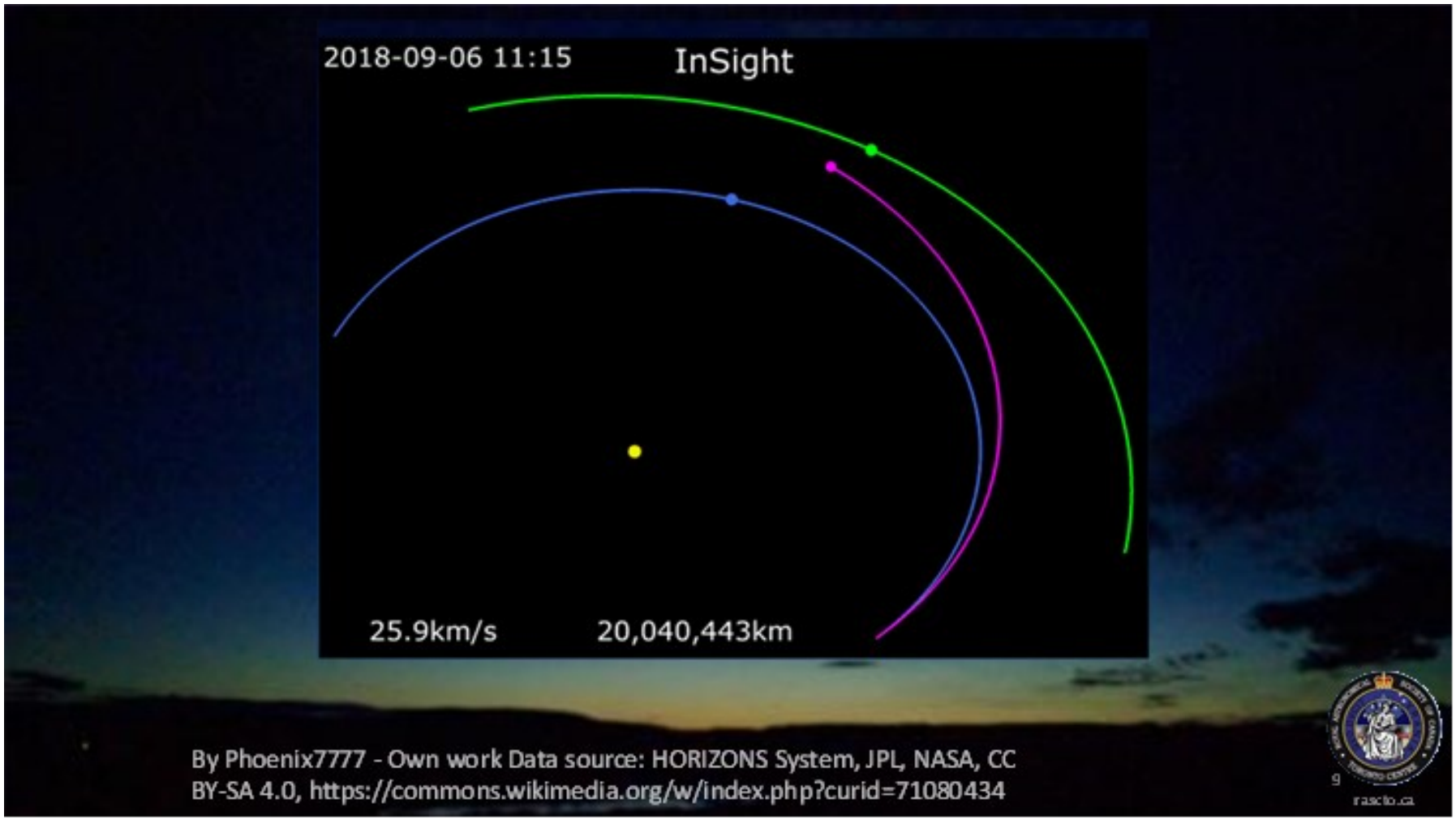
On January 17, Richard Branson's Virgin Orbit had a successful second demonstration of their liquid-fueled Launcher-One rocket that was air-launched from under the wing of Cosmic Girl, a modified Boeing 747-400. They deployed 10 CubeSats for NASA in the demo.

LauncherOne demos are complete, and VO has bookings with the U.S. Space Force, U.K.'s Royal Air Force, Swarm Technologies, and others.

Slide 8

Elon Musk's SpaceX ran a second Starship bellyflop landing attempt yesterday, and like Serial Number 8, SN9 failed to stick the landing due to a Raptor engine not re-igniting. Meanwhile, SN10 stands on an adjacent launch platform waiting its turn to try, later this week or next. Hopefully it was paying attention.

Slide 9



Every 26 months, as Earth approaches Mars, a 2 to 3 week launch window opens for efficient trips to the planet. This graphic shows the InSight mission using the 2018 window. This past year, a Mars window opened in July and missions from three national space agencies jumped through it.

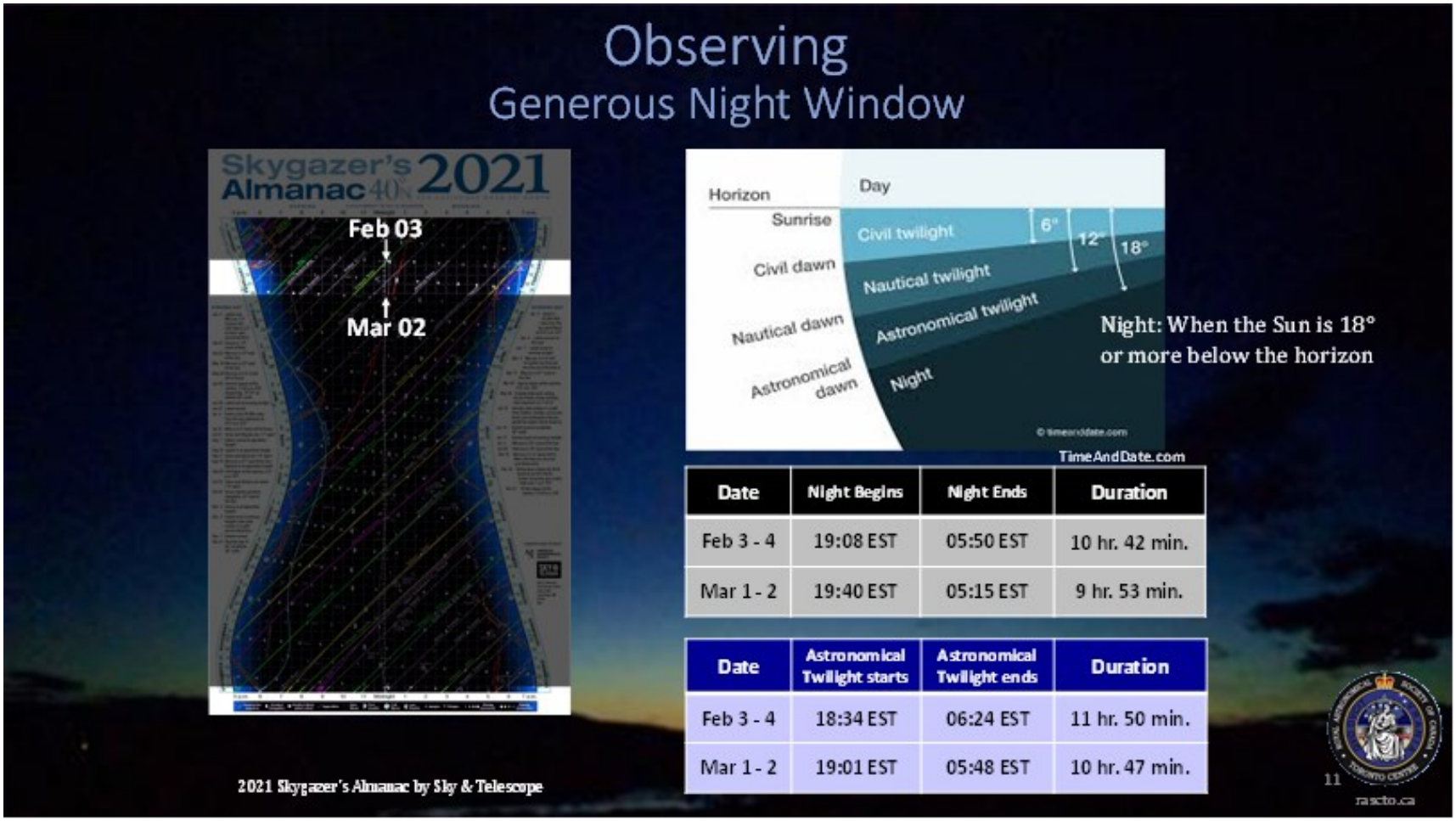
Slide 10

The Emirates Mars Mission "HOPE" will enter into Mars orbit on February 9 and become Mars's first weather satellite as it studies the atmosphere and watches wind storms.

The China National Space Administration sent Tianwen-1 on its way to Mars on July 23. It is an orbiter with a lander and rover. Orbital insertion will occur on February 10, with the lander and rover landing in May.

NASA's MARS 2020 mission launched on July 30. It consists of the Perseverance Rover and the Ingenuity helicopter, and, on February 18, Perseverance will use the sky-crane to land in Jezero Crater.

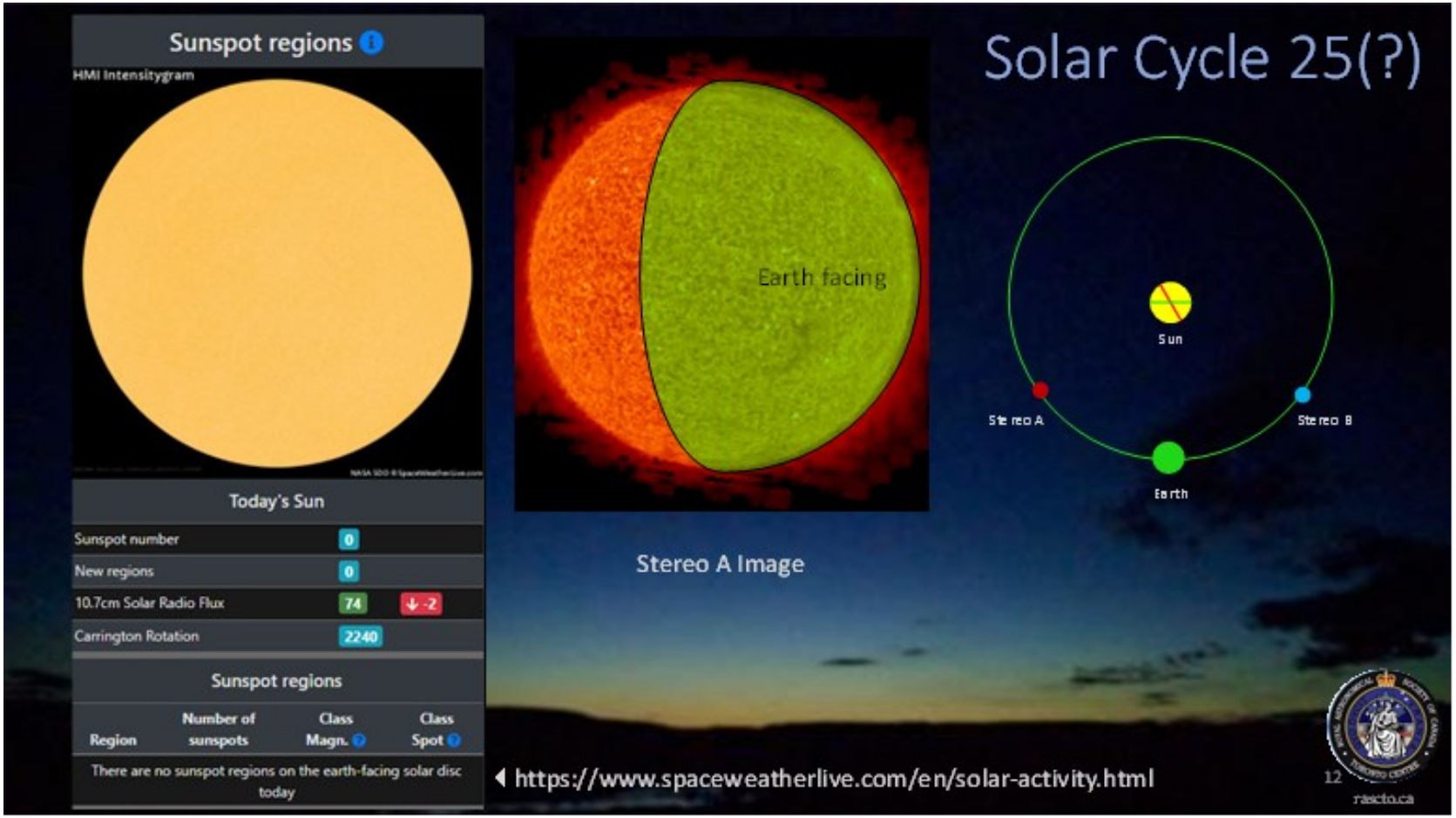
Slide 11



On to observing…

For astrophotographers, the sky is as dark as possible, with the Sun at least 18° below the horizon, for about 10 and 3/4 hours tonight – down by 49 minutes a month from now.
Visual astronomers can enjoy observing an extra hour by including Astronomical Twilight.

Slide 12

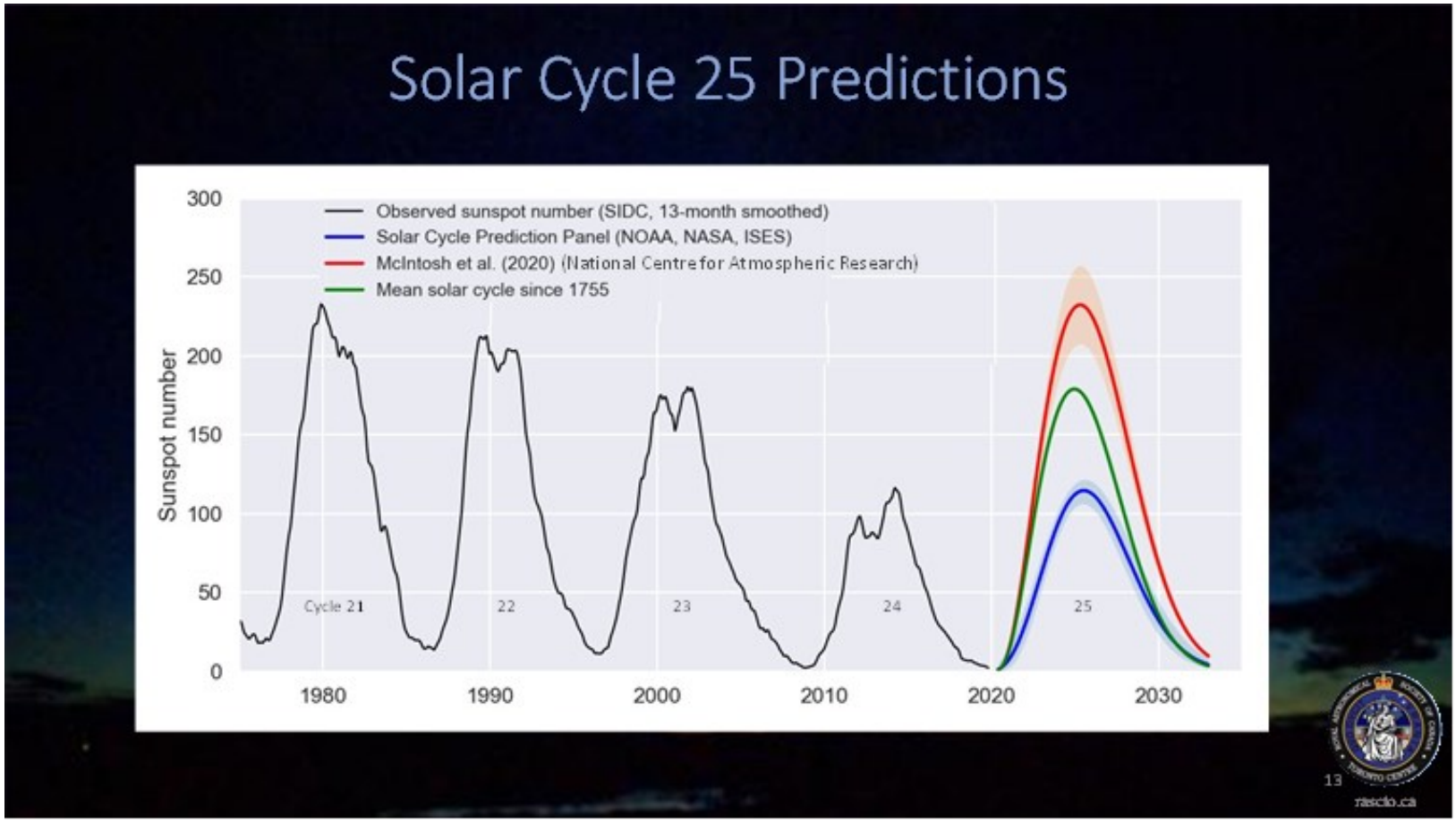


An outburst of activity in the Sun's southern hemisphere back in November signaled the onset of Solar Cycle 25, but activity has taken a pause since. On the left is an image of the Sun taken January 30 showing a spotless complexion. 0 sunspots. 0 new regions.

The view from Stereo A does not promise any activity that will rotate into view.

Stereo A trails Earth on our solar orbit by 60°, so our views overlap. Stereo B is 60° ahead of Earth, but failed 5 years ago.

Slide 13



A team led by Scott McIntosh has made a bold prediction for Solar Cycle 25, shown here in red. They say cycle 25 will be augmented by a secondary cycle and could reach maximum in just two years - with an awesome sunspot count as high as 250, more than double the 120 max for cycle 24, and more than any previously recorded. That's enormous, and a stark contrast to the steady decline we've seen in sunspot maximums over the last four cycles.

NOAA, NASA and the International Solar Energy Society say 25 will be like 24, the blue line. Green is the historical average. How cycle 25 plays out will help space weather forecasters perfect their models needed for planning extended crewed missions to the Moon and Mars.

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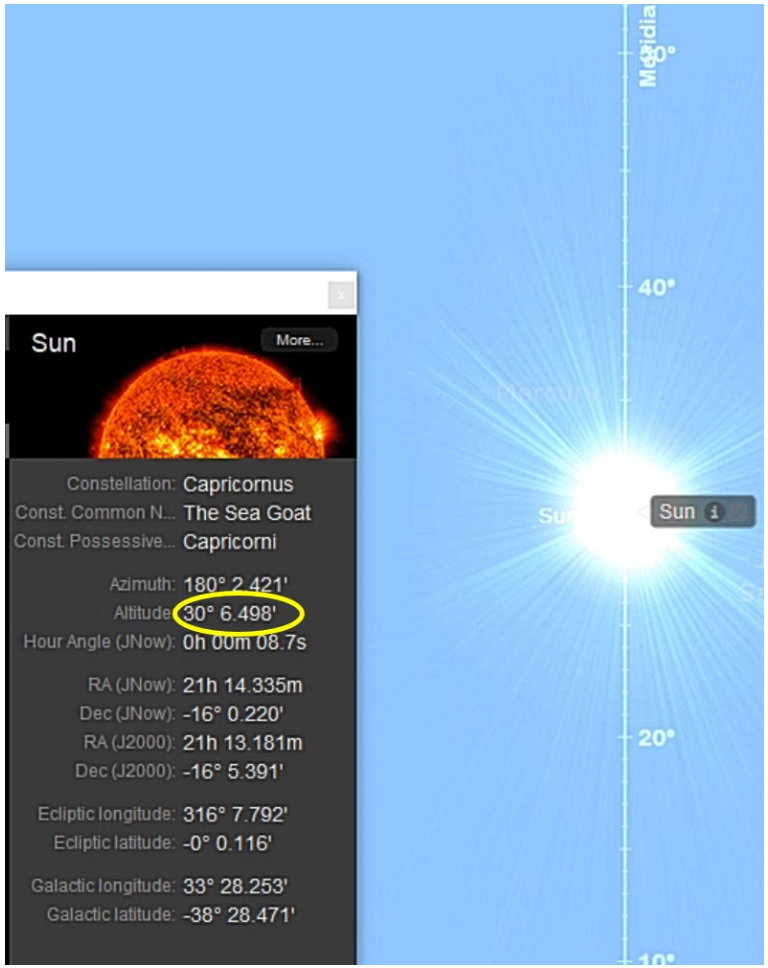
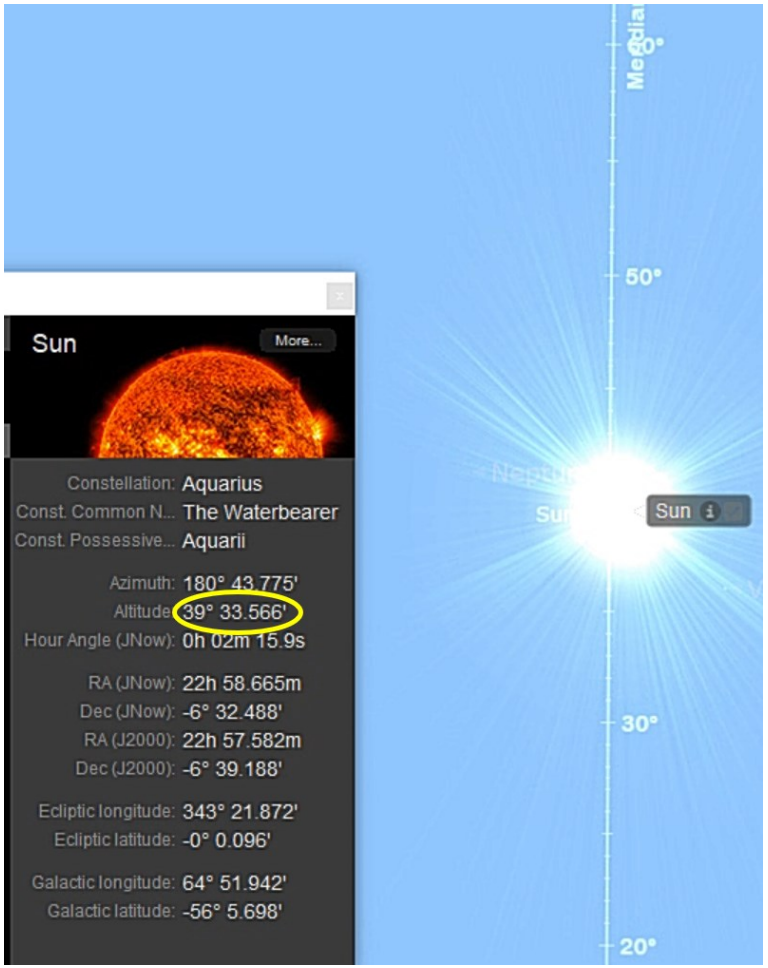
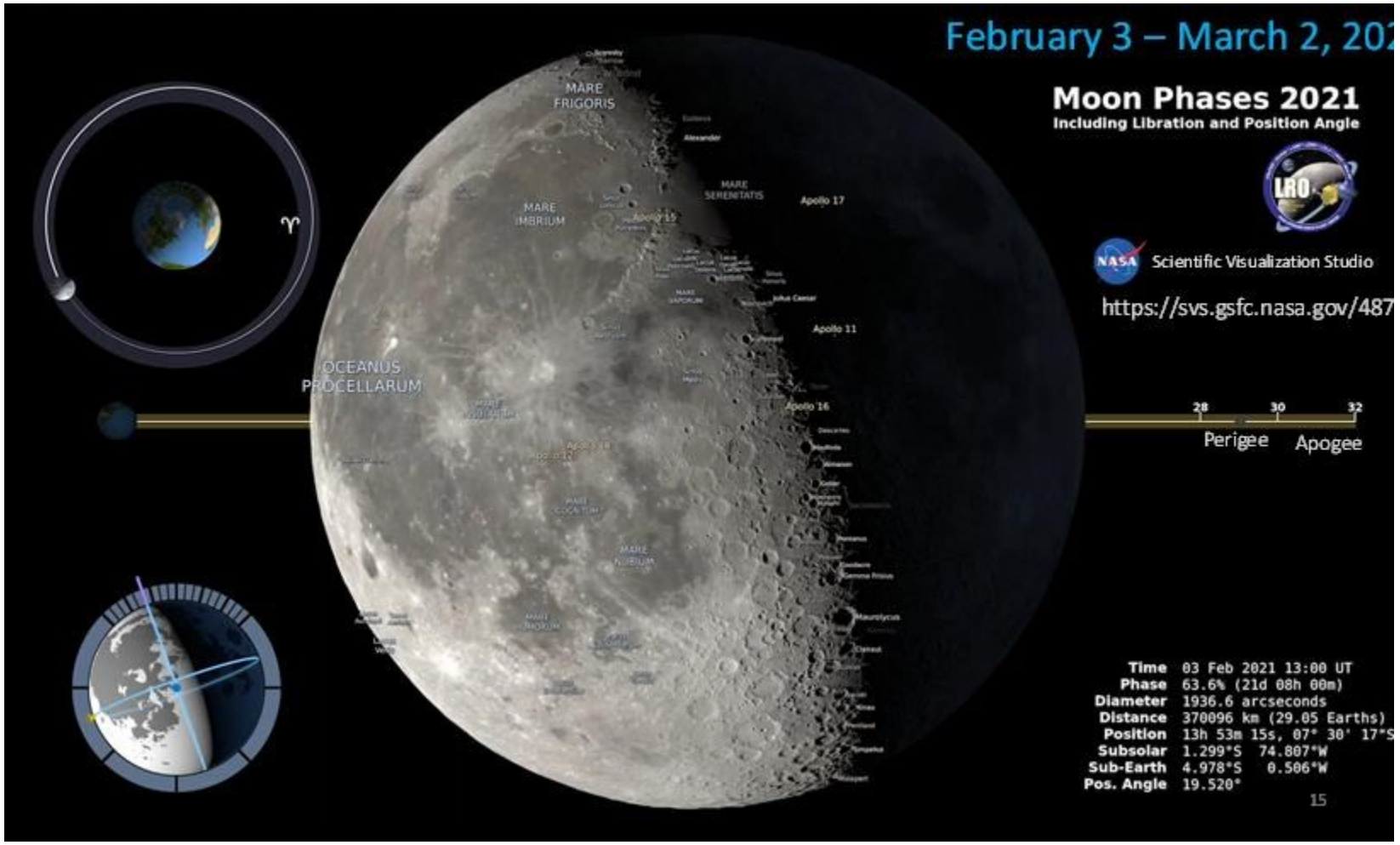




As for the Sun in our sky, it climbs 9-1/2 degrees, from 30° tomorrow local noon to 39 and 1/2 by March 3, squeezing the night window as a result.

If searching for any cycle 25 activity, you're looking through 2 atmospheres at local noon at the start of February, on its way to a minimum of 1.1 on the Summer Solstice, so resolution will improve over the next 4 months.

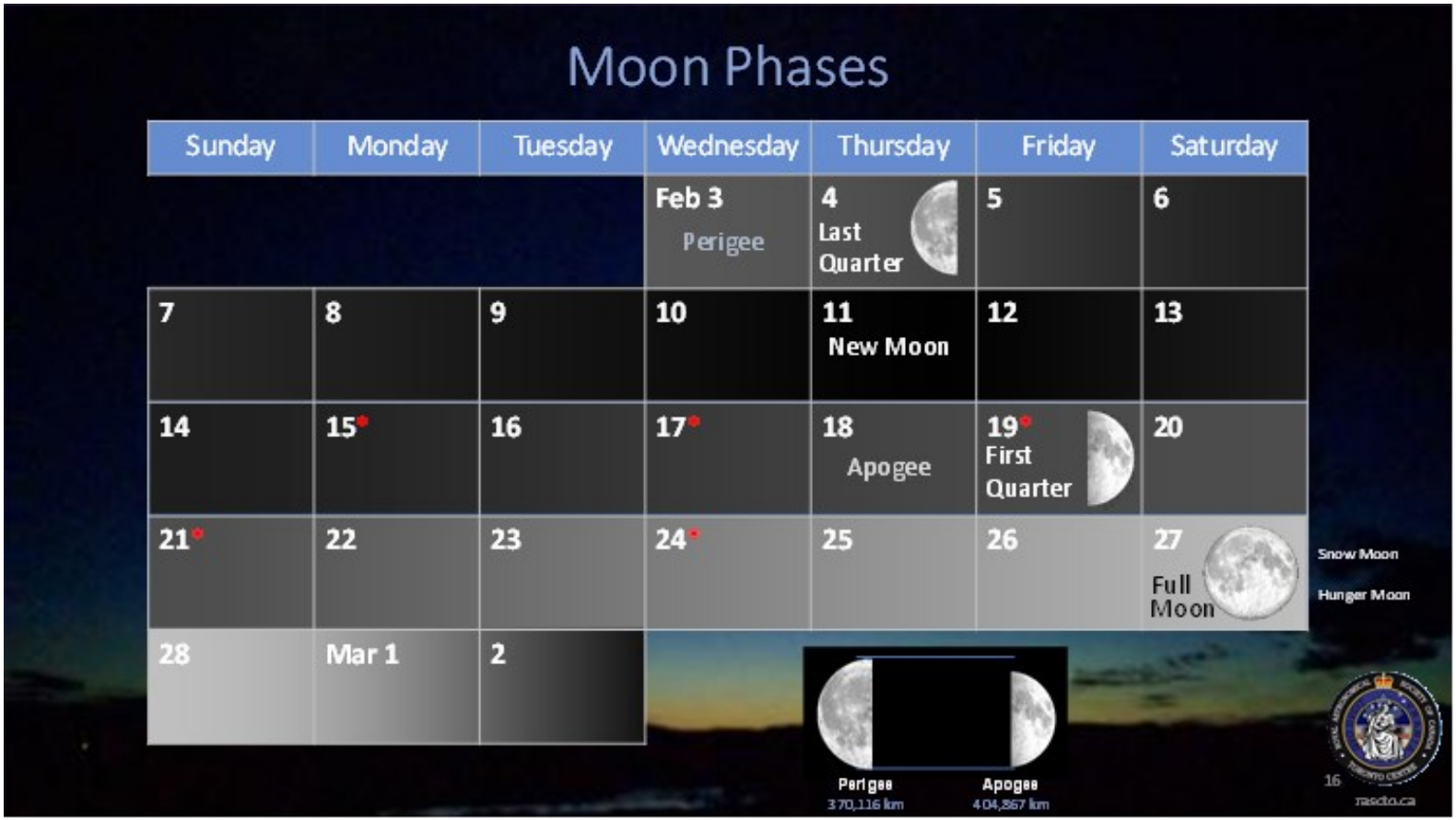
Slide 15



On to the moon…

This animation from NASA's Visualization Studio shows the Moon's phases, libration and distance from Earth this month. You'll notice the Moon at Apogee around first Quarter on February 19, and dropping to another Perigee in early March as the moon ages towards last quarter again. Visit https://svs.gsfc.nasa.gov/4874 to download this animation for all of 2021.

Slide 16



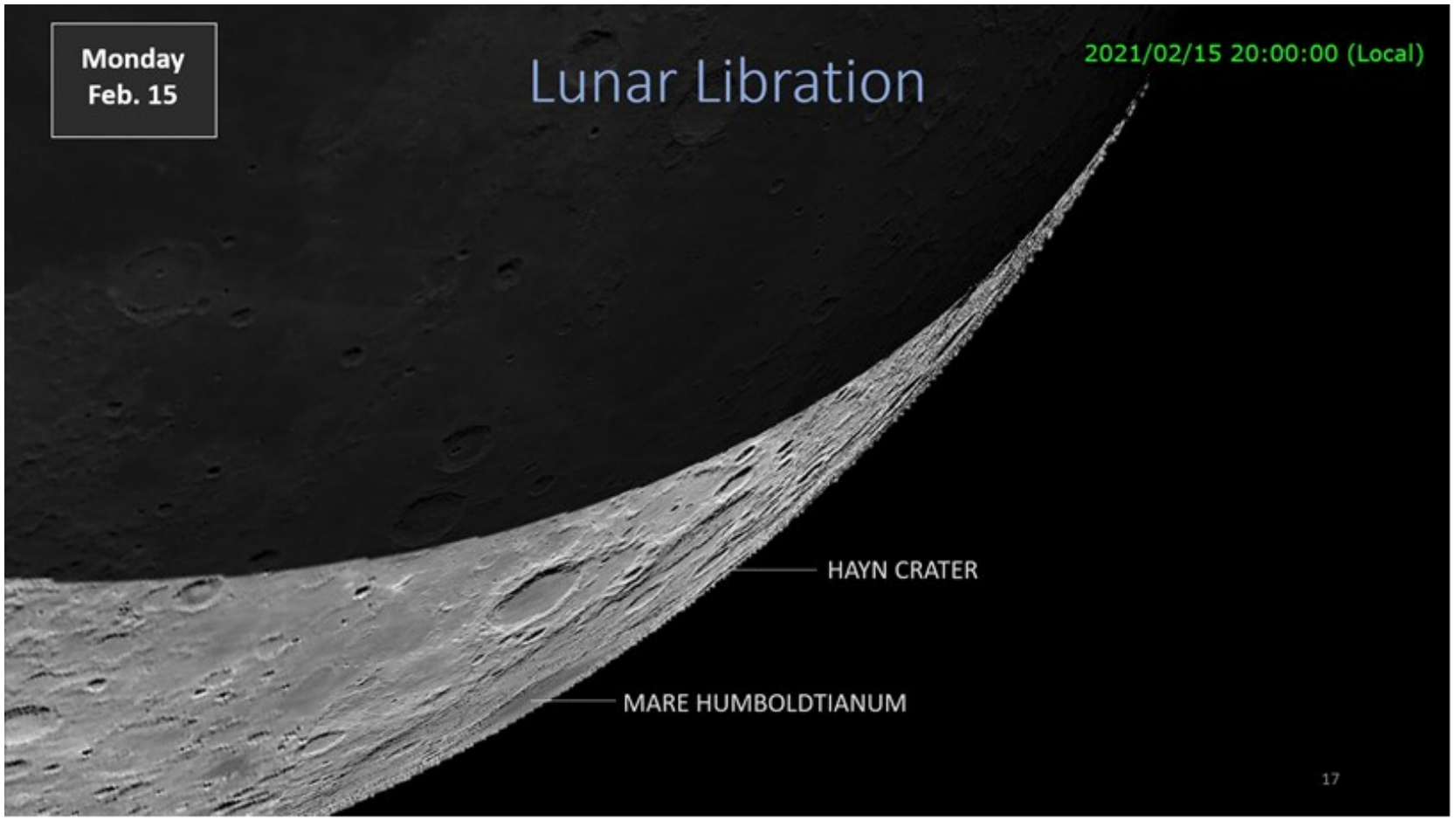
The window for deep sky observing without Moon interference is opening now and runs for the next 10 to 12 days. The Last Quarter moon is tomorrow with New Moon a week later.

Perigee and Apogee occur a day before Last and 1st Quarter Moons respectively.

February's Full Moon, commonly known as the Snow Moon or Hunger Moon, rises on the evening of Saturday the 27th.

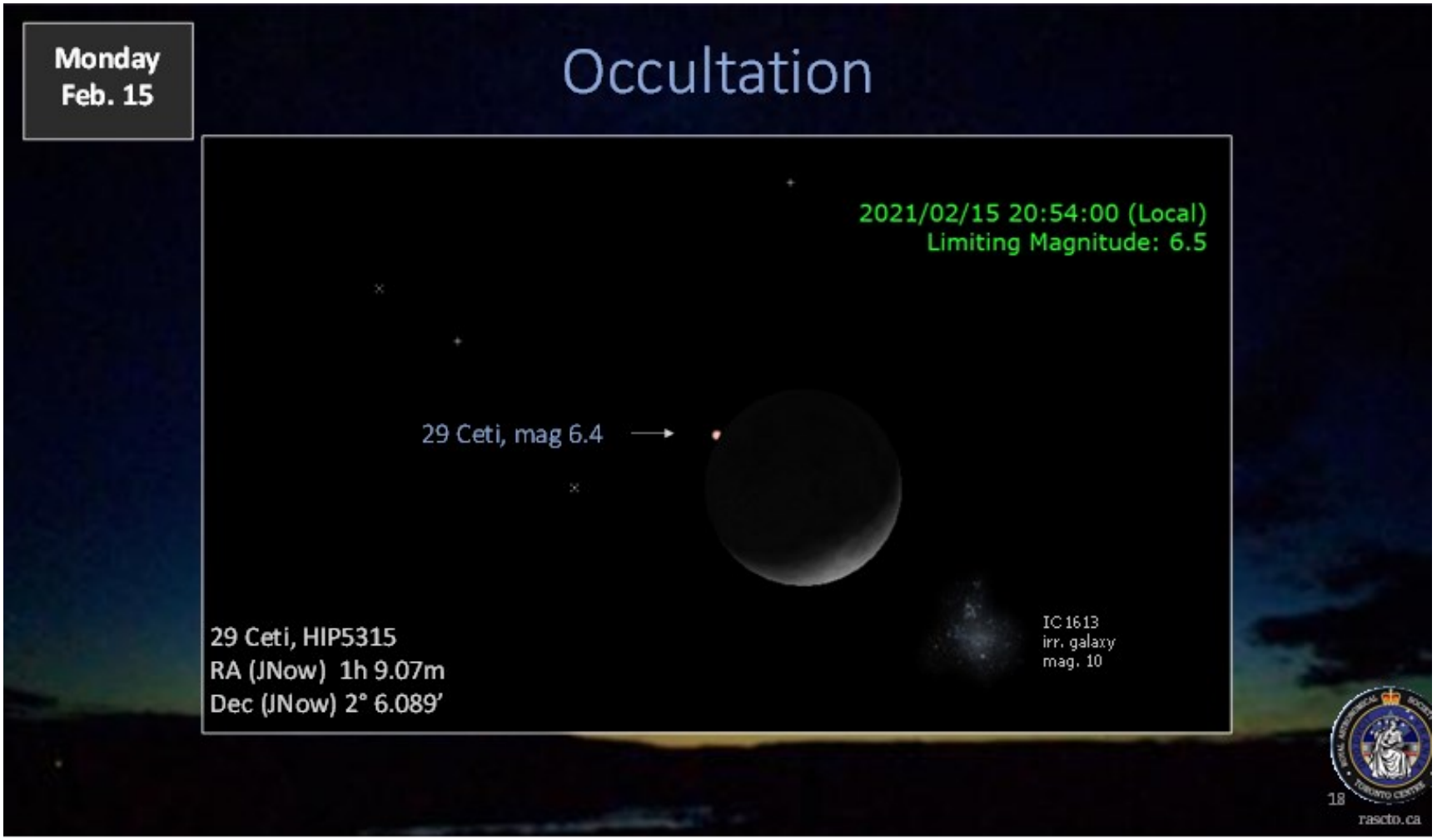
Asterisks identify dates with interesting Moon events. Let's check them out…

Slide 17



On Monday the 15th, lunar libration tips the North East limb of the Moon in our direction, giving us a chance to take a peek at the floor of crater Hayn and study Mare Humboldtianum, one of two lunar mares named after people. Situated next to the unseen side of the Moon, Humboldtianum was named after Alexander von Humboldt, a prominent 18-19-century explorer of unknown lands. BTW, the other mare named after someone is Mare Smythii, named after British admiral and astronomer William Henry Smyth, a contemporary of von Humboldt.

Slide 18



That same night, a few minutes before 9PM, you can watch the dark limb of the young Moon occult 29 Ceti, a mag 6.4 star.

Slide 19

Have you heard of the Lunar S? It was found by Blob Rana several years ago and it's possible to catch it in the Moon's SE quadrant near crater Theophilus on February 17.

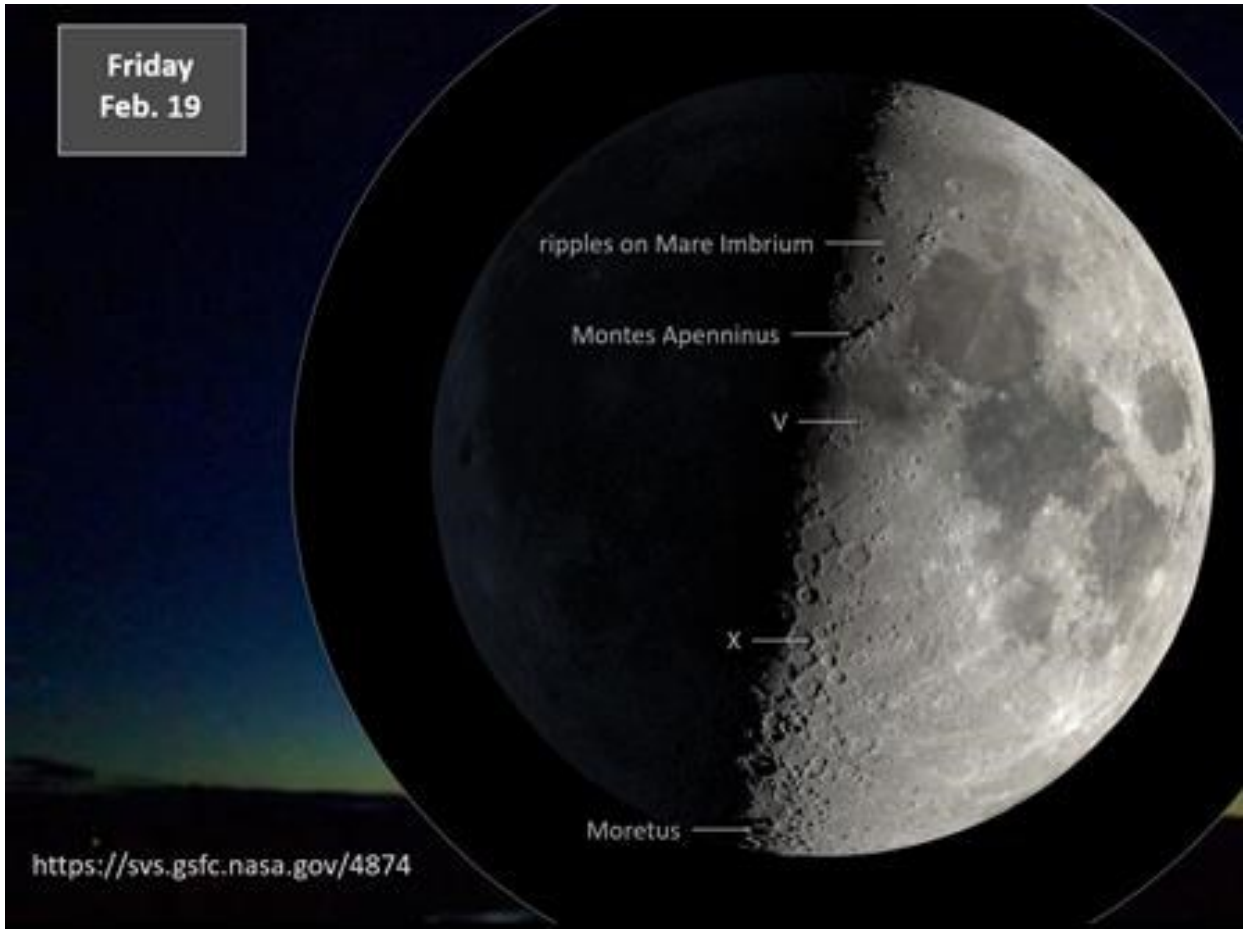
Slide 20

On the 19th, there will be lovely sight high in the south west as the 1st Quarter Moon glides between the Hyades on the left and the bright Pleiades on the right, with the red glow of Mars nearby. The Hyades is very close, only 153 light years away, and dense with hundreds of stars, the brightest forming the V-shape, the face of the bull. BTW, bright red Aldebaran, the eye of the bull, is not a member of the Hyades. It's less than half as far at 65 light years.
Do you see the orange star just east of the Moon? That's 43 Tauri, magnitude 5.5, a K2 red giant, and it's about to be occulted by the dark limb of the Moon.

Slide 21

Here's a simulated mirrored view through a small refractor. We can see a second star to be occulted. It's a tight double. Maybe it will wink out in steps.

Slide 22



After watching the occultation, you can turn your telescope onto the Moon and study a number of features along the terminator.

The uneven surface of Mare Imbrium is highlighted by the shallow angle of sunlight illuminating the eastern side of the Sea of Rains. Mare Imbrium was formed 3.8 billion years ago towards the end of the late bombardment period, from a strike by a proto-planet asteroid estimated to be around 250 km in diameter. The original basin was 100 km deep before the surface rebounded and filled with lava, which you can now study in shallow sunlight.

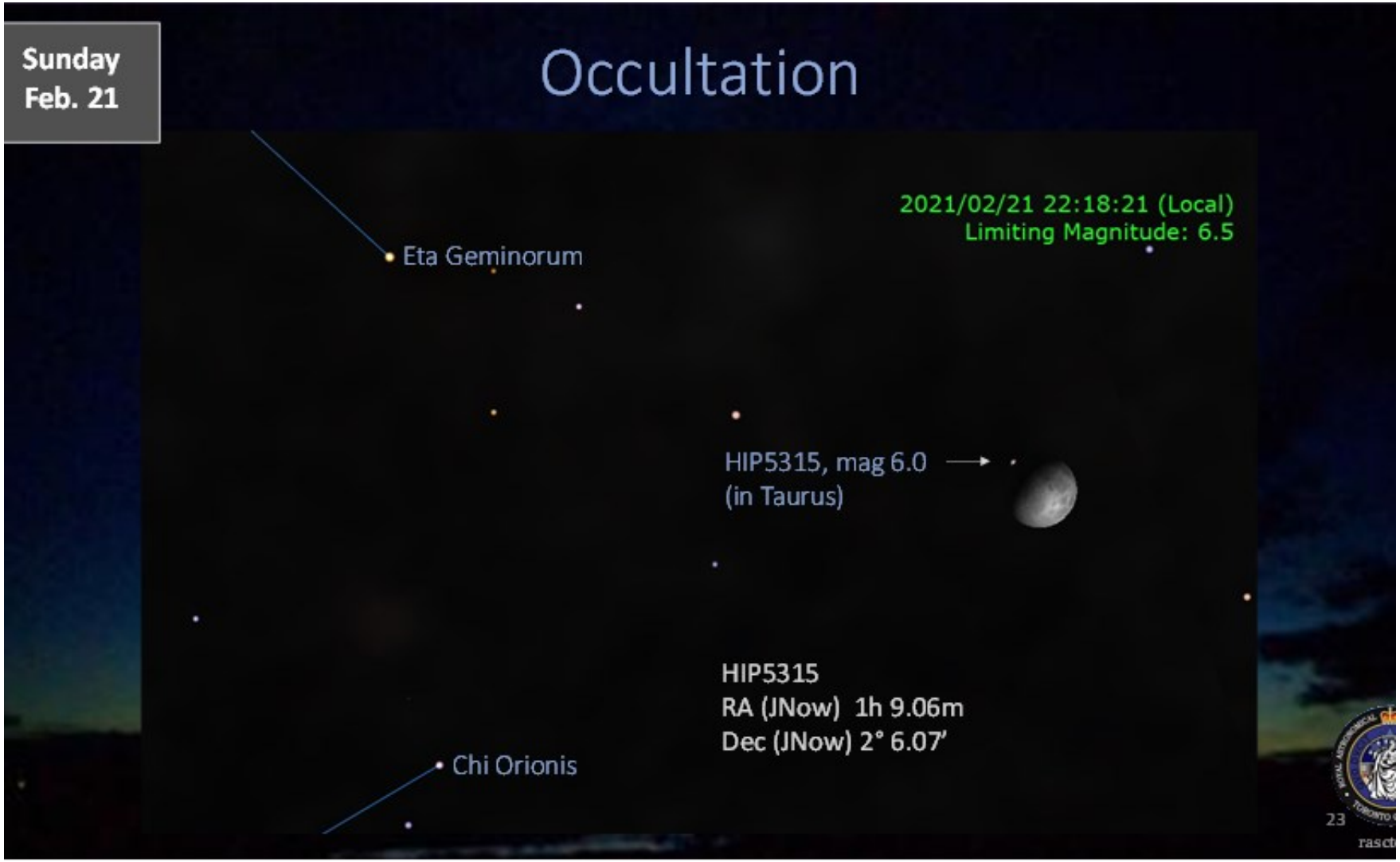
It's a good opportunity to study the tall rugged Montes Apenninus that borders the South East shore of Mare Imbrium. The range is over 5 kilometers high in places and is well defined by its shadows.

The moon will be below the horizon for us when the Lunar X and V are perfectly illuminated along the terminator, but we can still study them and, the craters whose rims form them, in sunlight on the 19th.

And we can watch sunlight beginning to reach the floors and central peaks in the large craters in the Southern highlands such as Moretus.

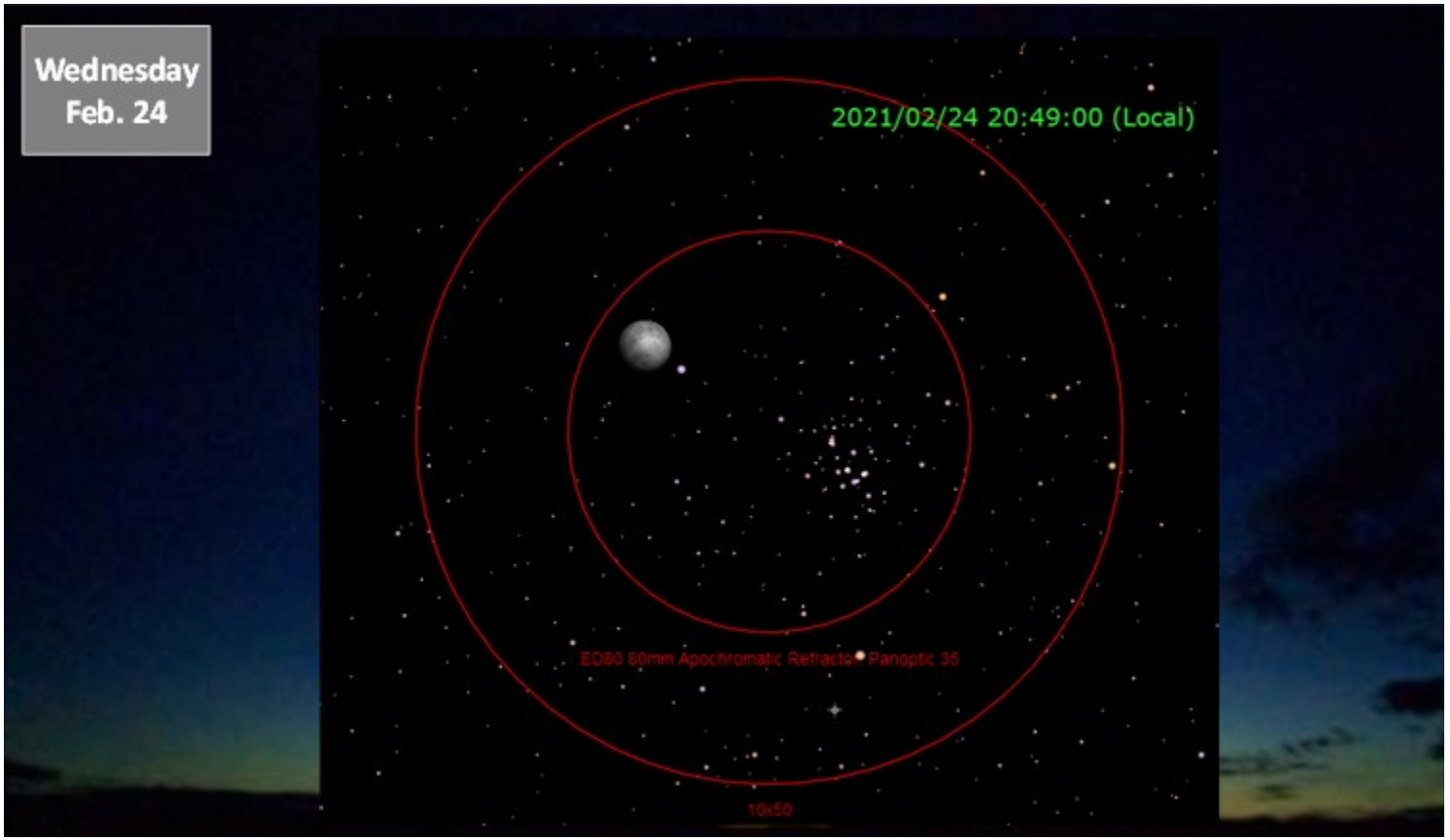
The Moon is at its highest in the winter, so you would be looking through only 1.1 airmasses when studying these features.

Slide 23



There's another opportunity to see the advancing dark limb of the Moon cover a magnitude 6 star on Sunday, February 21, around 10:18 PM.

Slide 24

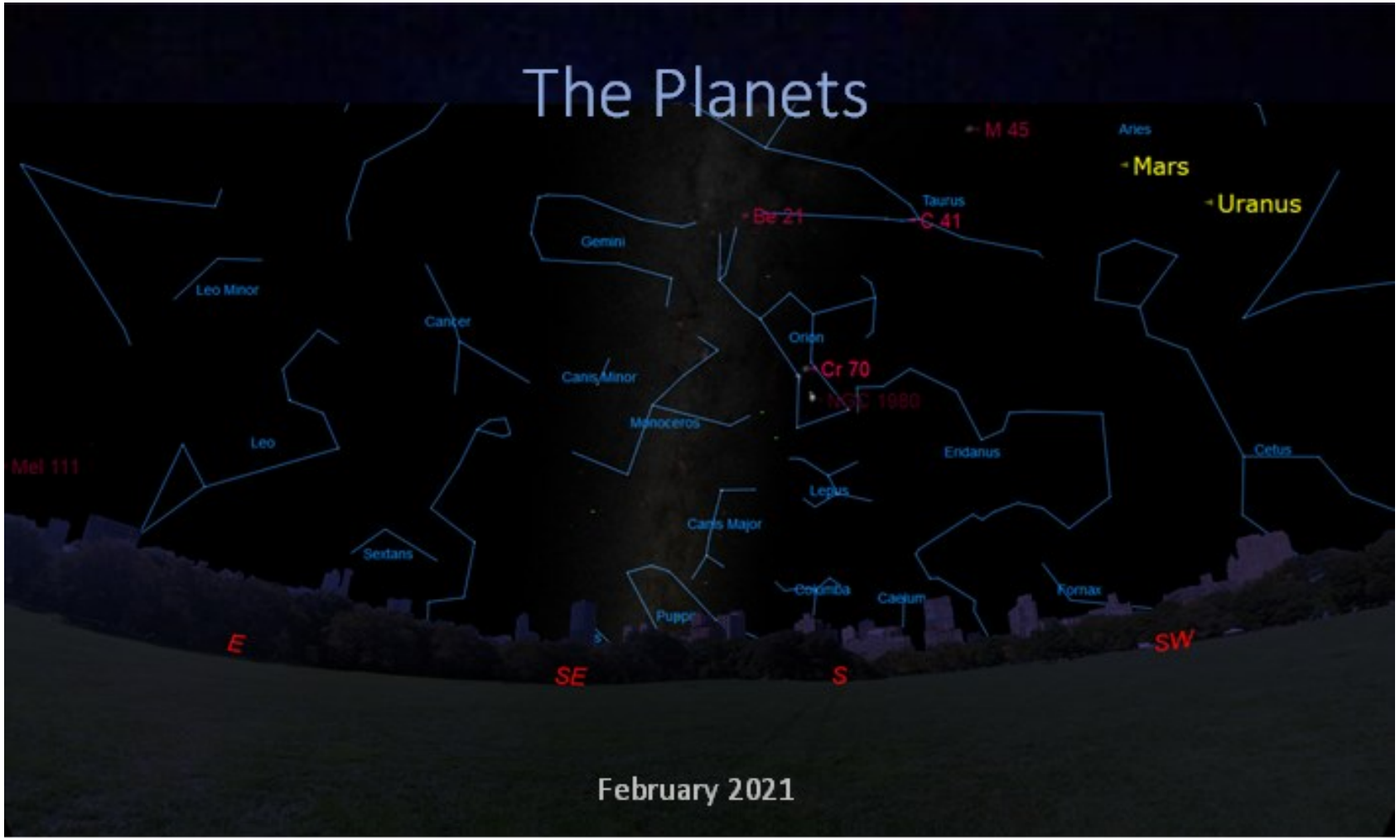


On February 24, the nearly Full Moon passes close to M44, the Beehive Cluster in Cancer.

The inner circle is 4 degrees wide, the view with an 80 mm refractor and a low power eyepiece. Of course, the view inside this circle should be flipped left to right to match.

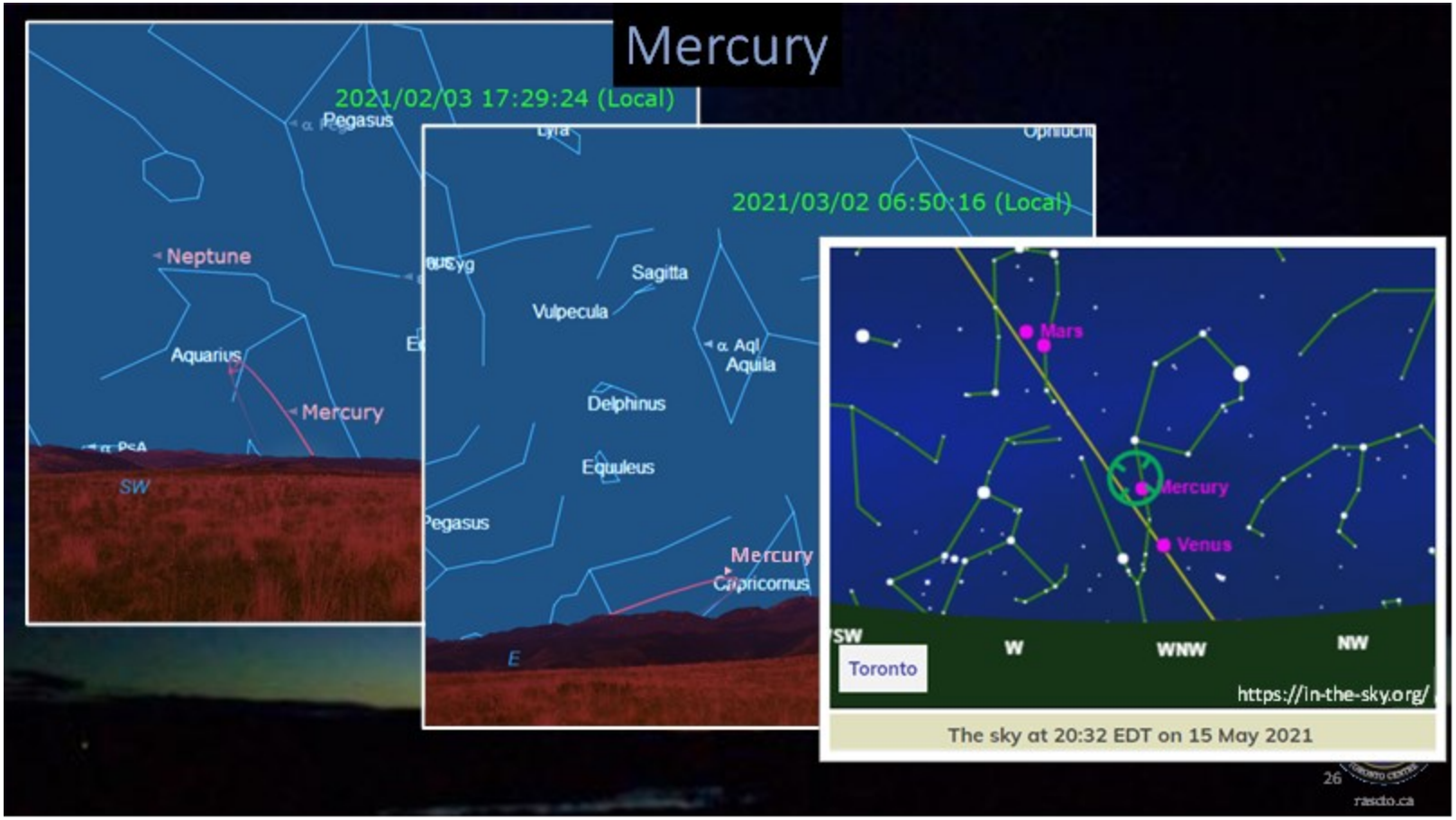
The other circle is a 7-degree field of 10X50 wide-field binoculars. The view might be best in stabilized binoculars.
Here we see the Moon less than 10 arc minutes from 4.6 magnitude Gamma Cancri at 8:49.

Slide 25



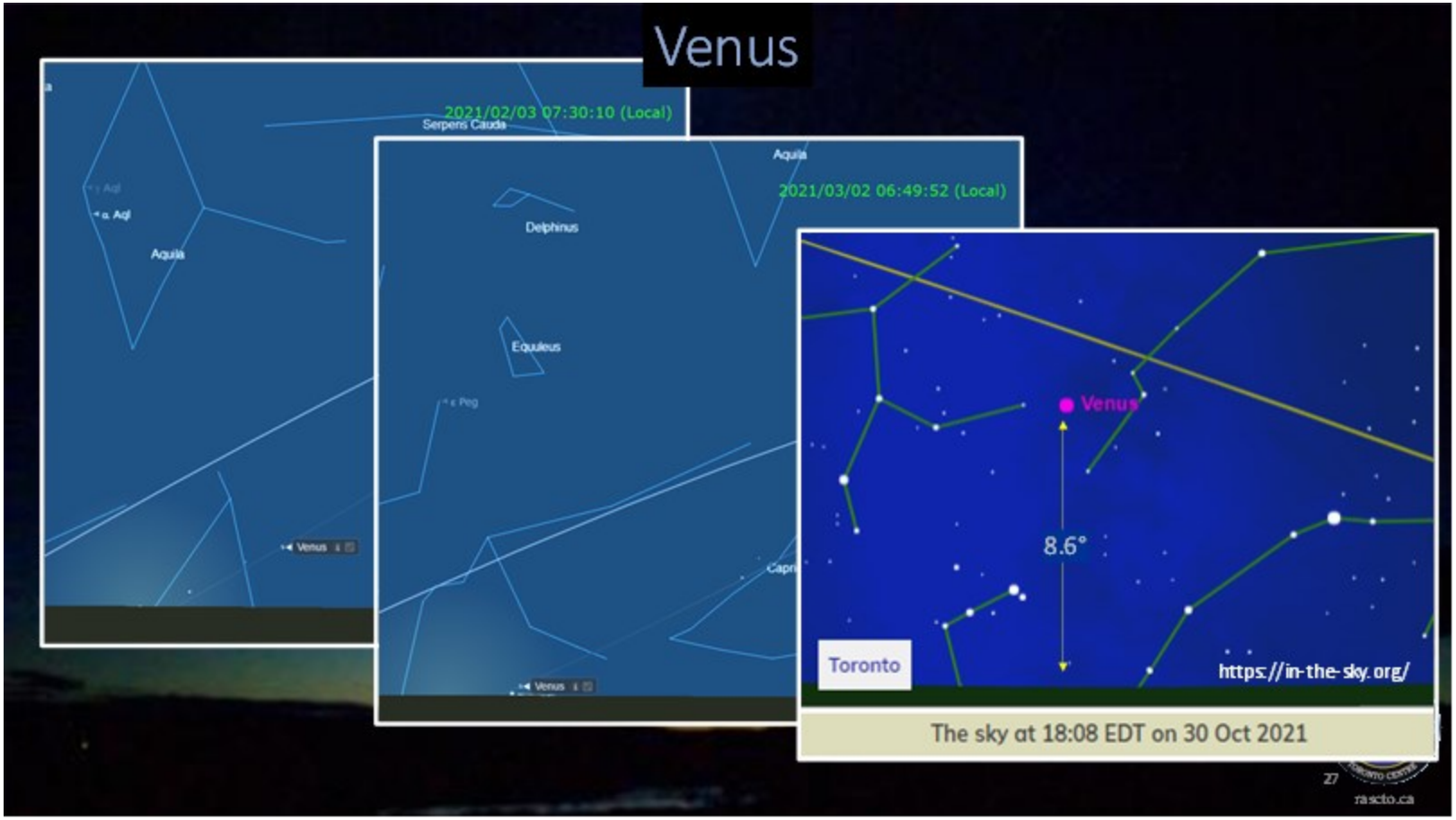
Back in October I talked about a great parade of planets across the sky. Well, the parade has marched down the street and for the most part, has turned the corner and is out of sight. All we have left this month are the fading dots of Mars and Uranus lingering in the West.

Slide 26



Tonight, Mercury sits less than 10° from the Sun and getting closer for the next few days, making it unsafe or impossible to see it. On March 2, Mercury is visible in the East before Sunrise, but very low due to the shallow angle the ecliptic takes at Sunrise as we approach the Spring equinox. There will be more favourable times to catch Mercury, such as May 15 when Mercury will be 19° high in the west at sunset, at a convenient *evening* hour, not pre-dawn. It will be much warmer and the bugs won't be out yet!

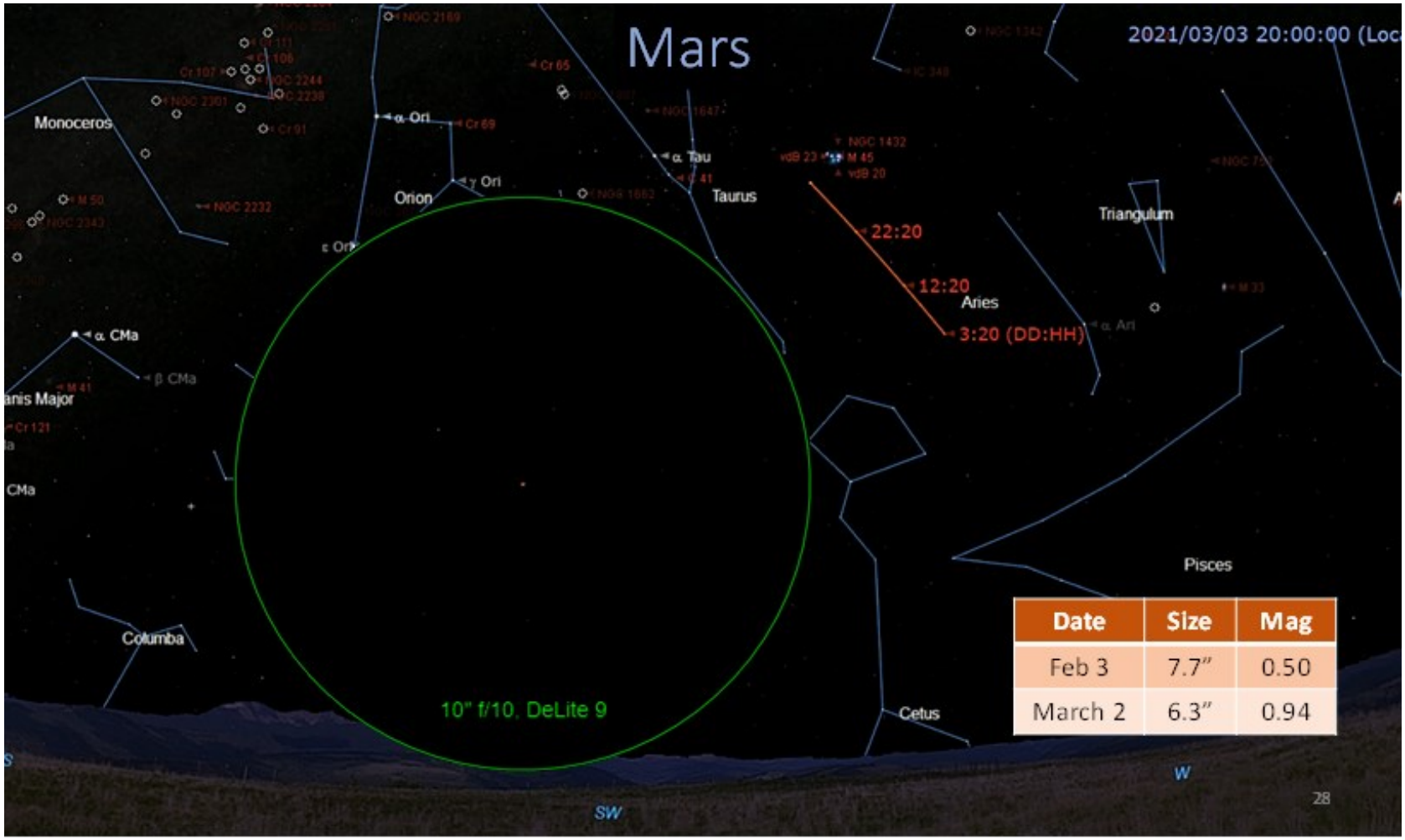
Slide 27



Venus is very low in the east before sunrise at the start of February and even lower as we enter March. With the Sun rising shortly after Venus, now is not a safe time to try to find or observe it.

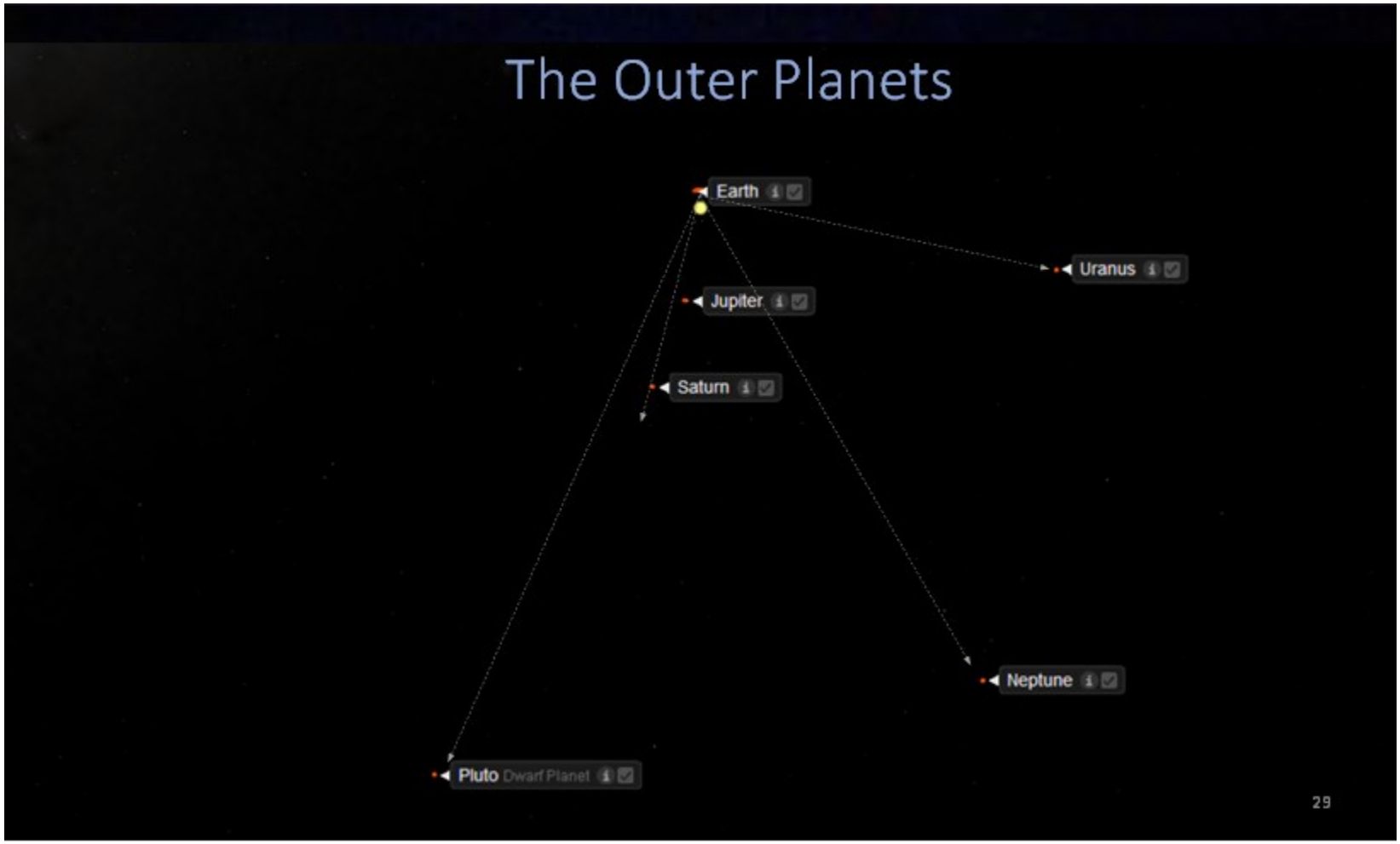
Venus becomes the Evening Star after sunset as it climbs into the western sky this spring, summer and fall. On October 30, Venus is easily seen 8 degrees above the SW horizon at the start of Astronomical twilight. On this night, Venus is as far as it can get from the Sun, so viewing is safe.

Slide 28



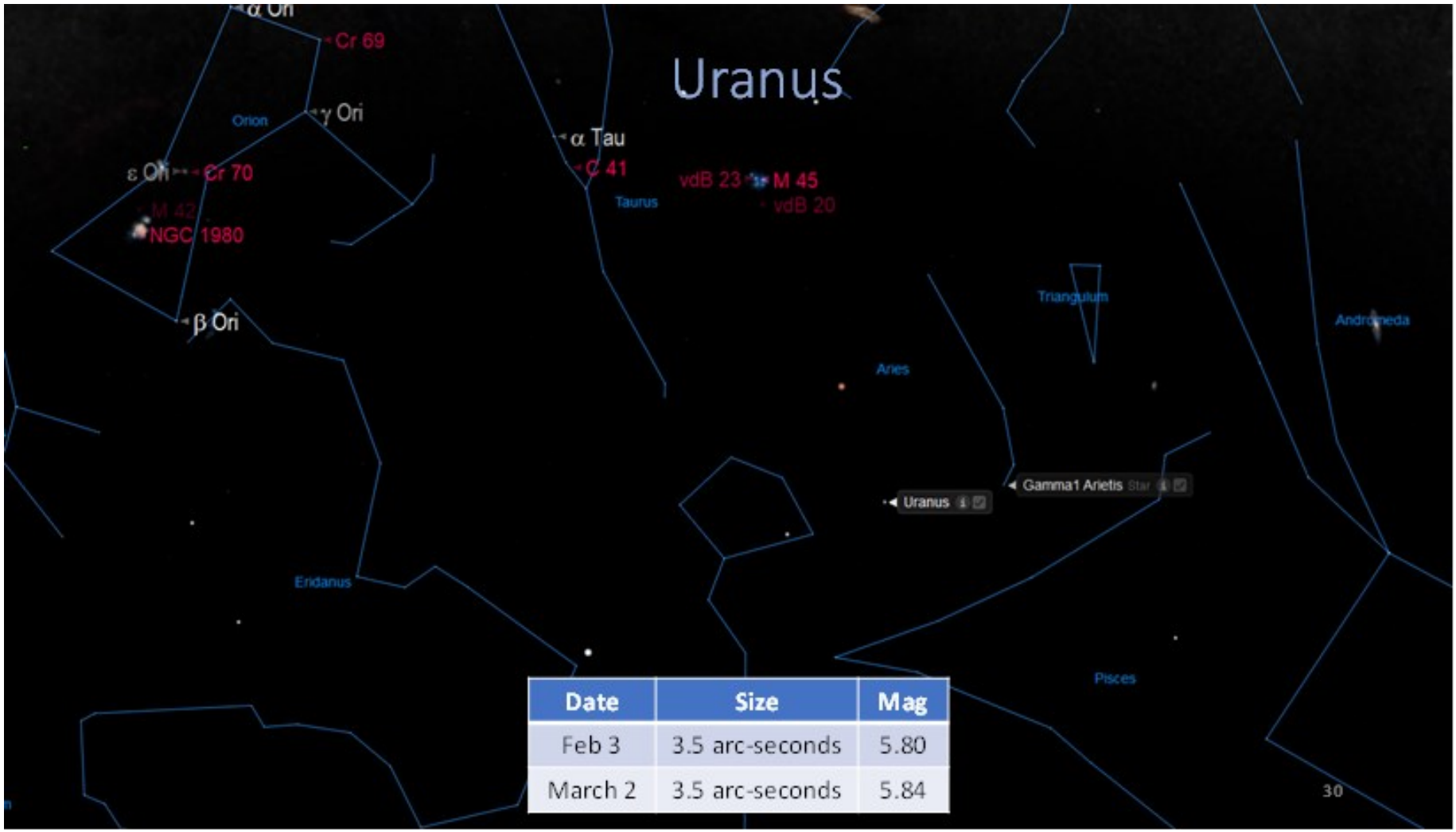
Mars is a fading red dot in the west, climbing higher throughout the month.
We're orbiting directly away from Mars, so it shrinks and fades significantly. You may not see any features on the tiny disk, but you might want to give it a look anyway knowing the amount of attention Mars will be getting with three missions arriving there this month.

Slide 29



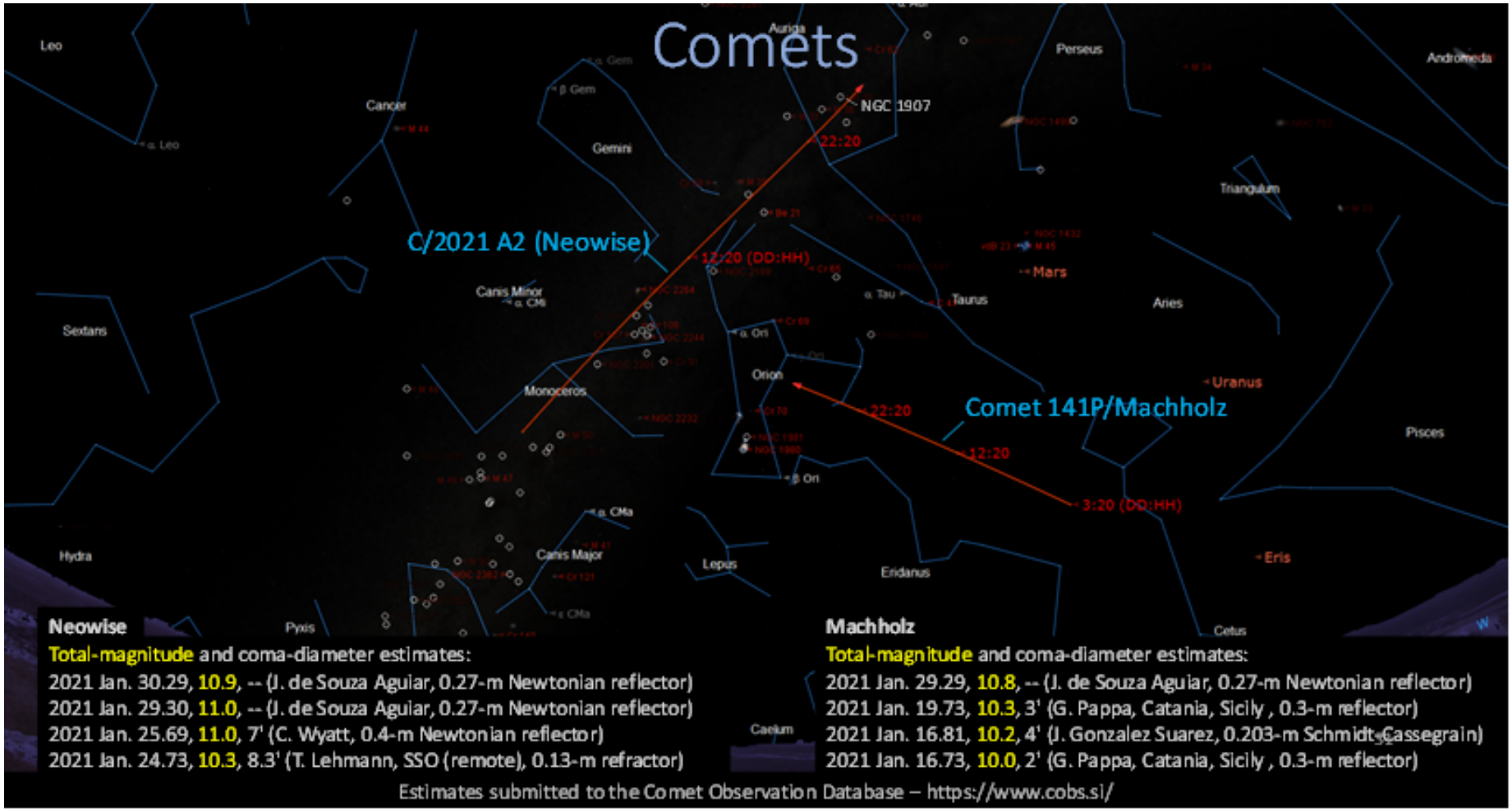
We don’t fare much better with the outer gas and ice giants. Our sight-lines towards Jupiter, Saturn, Neptune and Pluto all pass close to the Sun, making them unobservable. Jupiter and Saturn have recently passed Superior Conjunction and will gradually return to the pre-dawn sky as Earth races around the Sun to move it out of the way, but we’ll need to wait until Spring to start observing them. Uranus lingers in the west, like Mars, with Earth pulling away.

Slide 30



Uranus is a very small blue-green disk at 3.5 arc-seconds, found 8 and 1/2 degrees east of Gamma Arietis.
And that’s about it for planets. Not much for now I'm afraid.

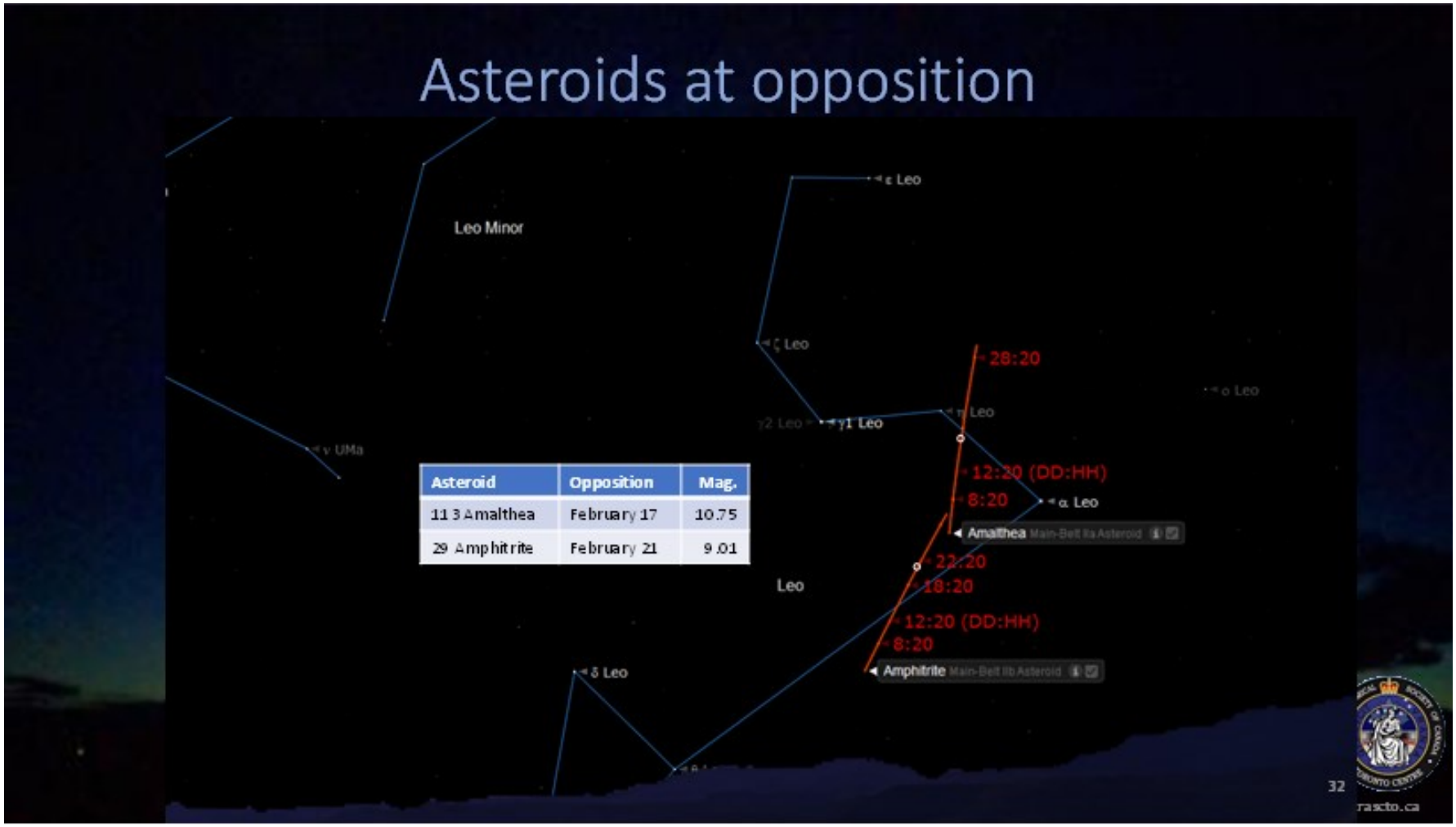
Slide 31



There are two comets crossing the southern sky this month. Comet Neowise will pass thru Monoceros, under the feet of the Gemini Twins and past a few open clusters in Auriga – coming within 35-arc-minutes of NGC 1907. Meanwhile Machholz travels eastward from Cetus to Orion. Below each are magnitude estimates over the last week or two by observers using 8-to-12-inch telescopes.

Visit www.cobs.si to see recent estimates on all comets.

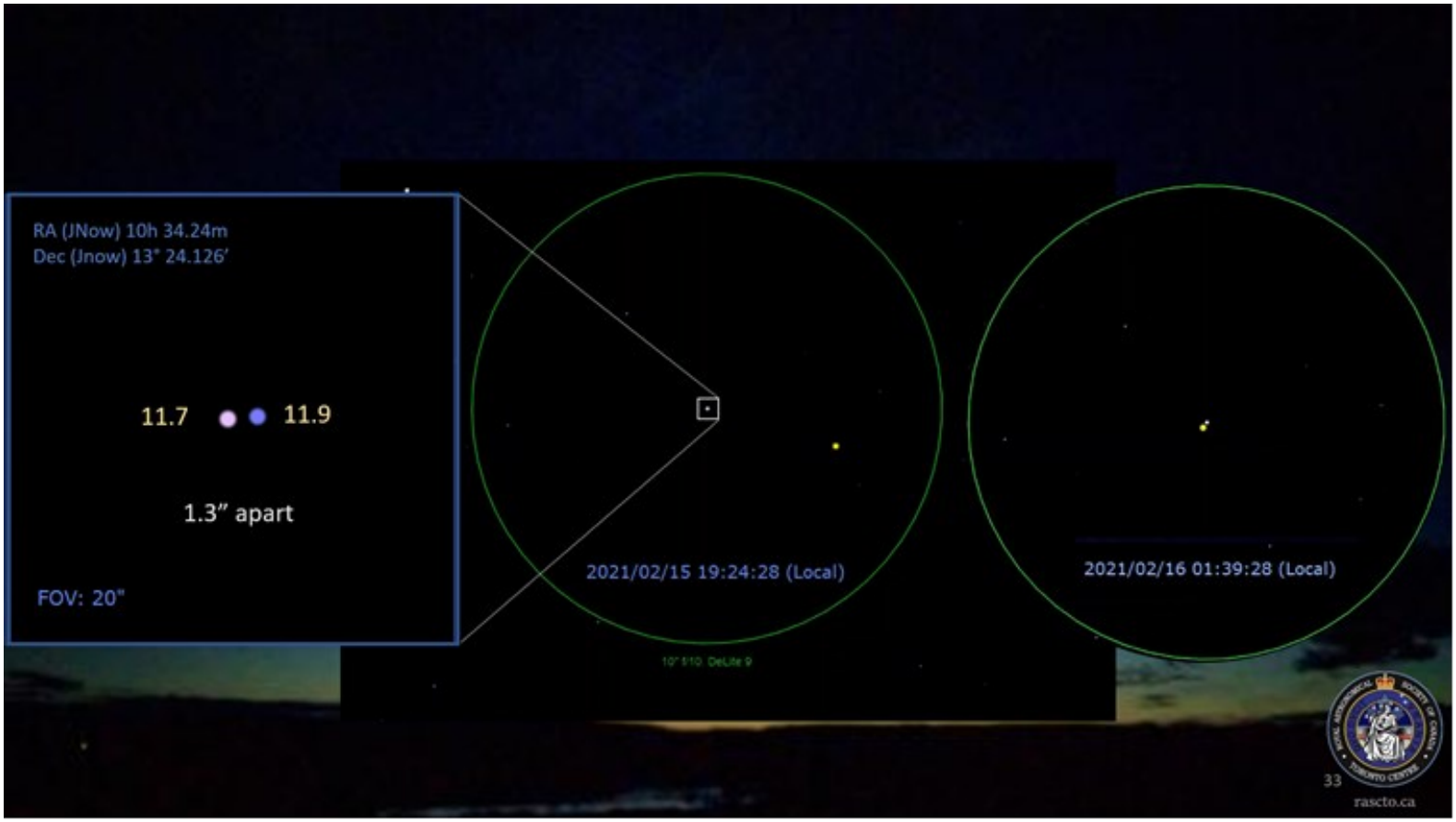
Slide 32



Two asteroids pass through opposition this month, 113 Amalthea and 29 Amphitrite.

Asteroids travel at their quickest in our sky at opposition.

Slide 33

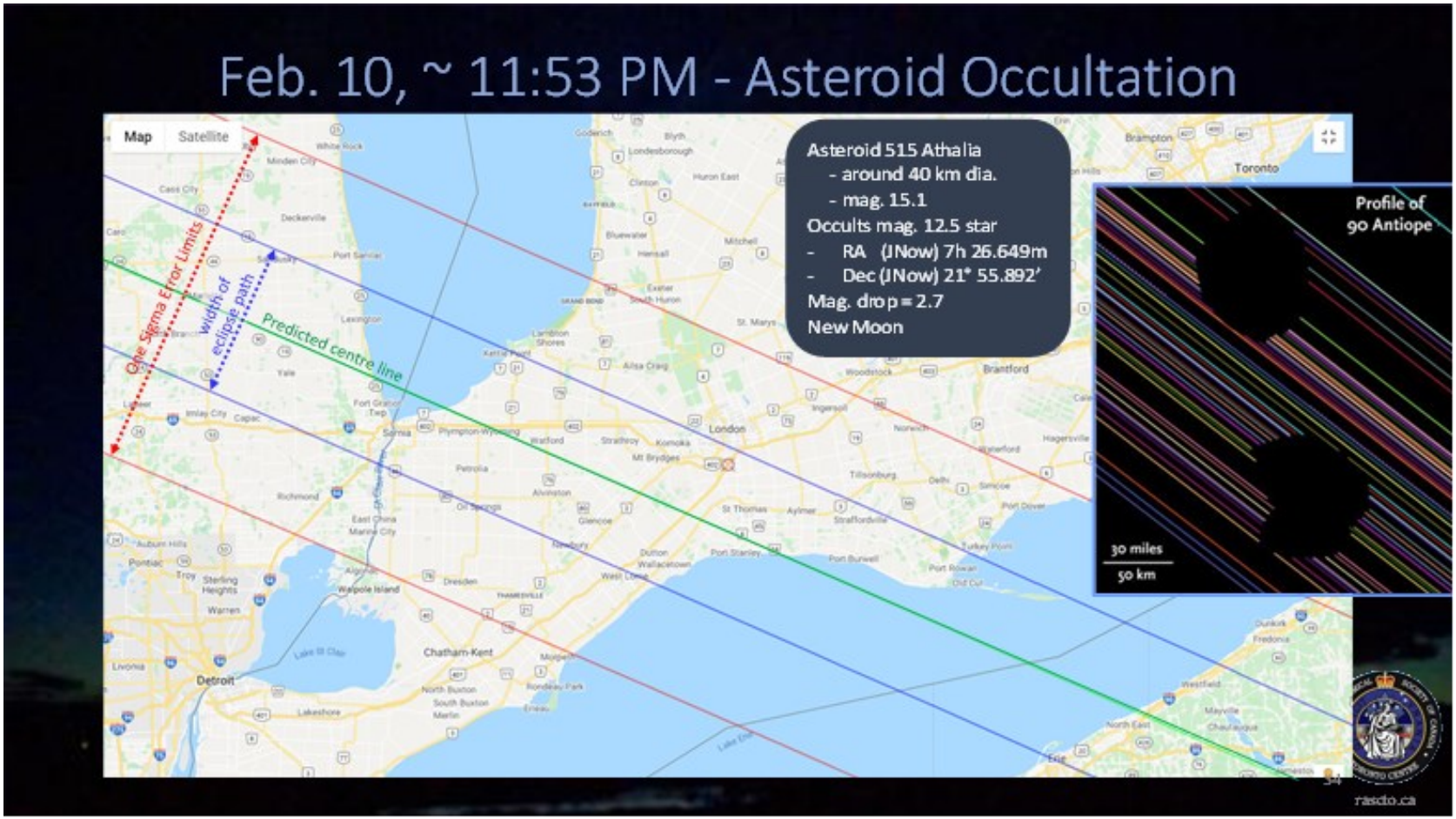


If you would like to visualize an asteroid's orbital motion in real time, or record it, you can watch Amphitrite cruise within 10 arc-seconds of a pair of closely spaced stars on Monday the 15. Closest approach is around 1:30 Tuesday morning.

Here (centre) we have a simulated mirror-image view through an equatorial 10-inch SCT and 9mm eyepiece. We're at the end of twilight, around 7:30.

In 4 hours (right), Amphitrite makes its closest approach.

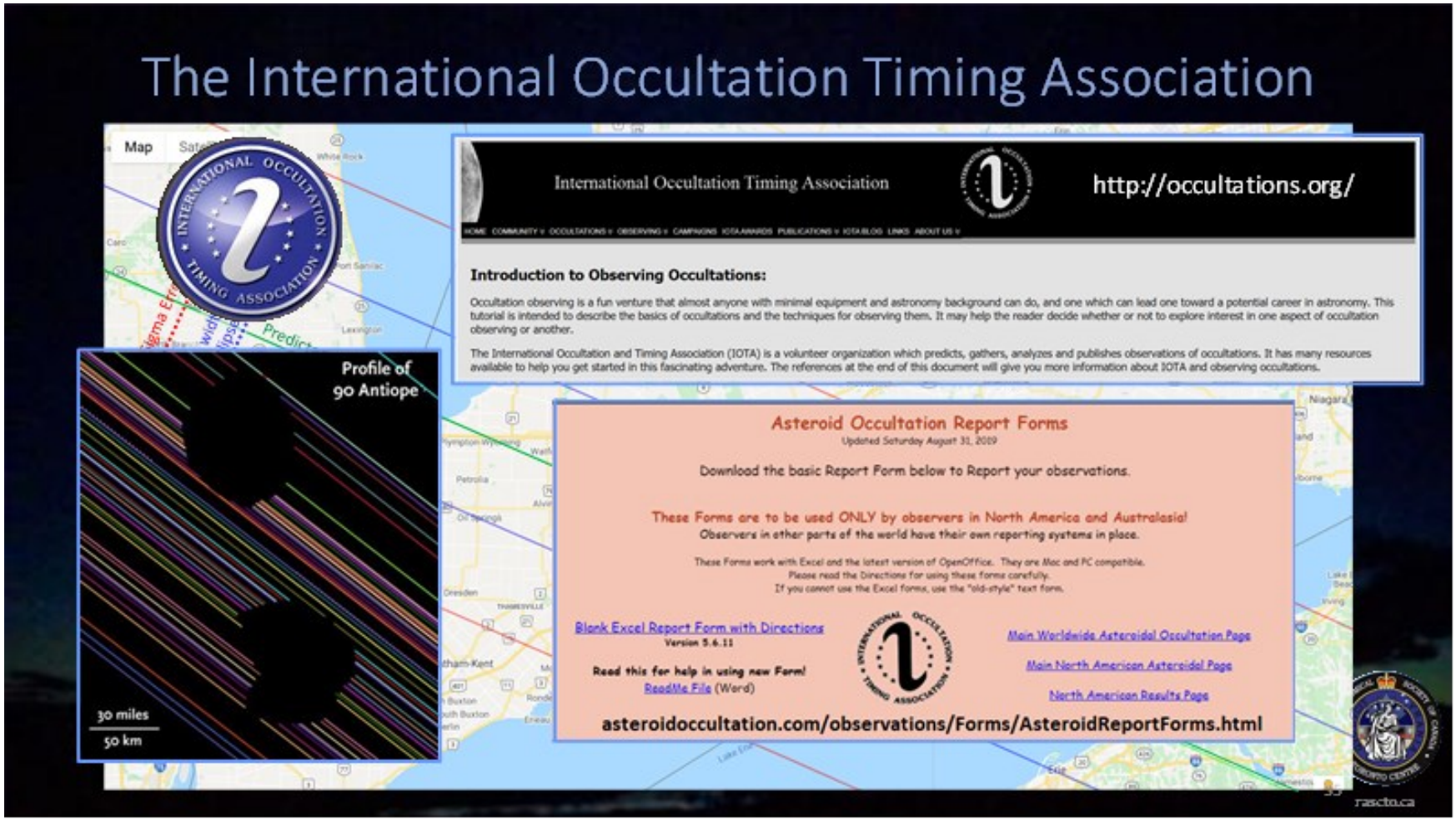
Slide 34



On the New-Moon night of February 10, a 40-km-wide asteroid, 515 Athalia, occults a magnitude 12.5 star in the constellation Gemini around 23:53 in Southwestern Ontario. The occultation is expected to last up to 5.9 minutes on the centre line, although there is a lot to be learned about an asteroid's shape with occultation timings taken throughout the width of the eclipse path.

On the right is an example of the profiles of the twin bodies of asteroid 90 Antiope based on timings submitted by 37 observers spread out across the eclipse path.

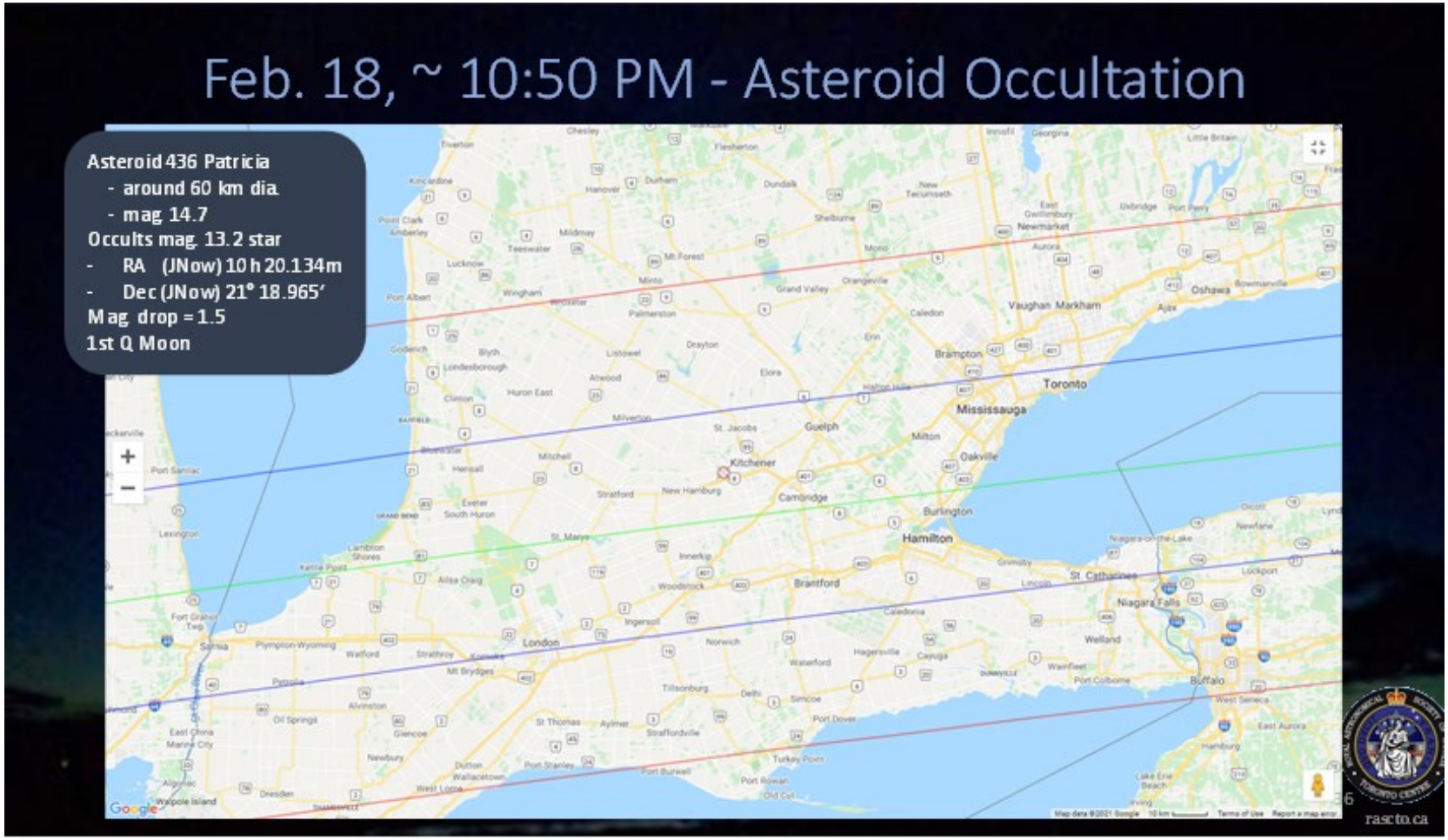
Slide 35



If you are interested in learning more about timing occultations and making submissions, you can visit IOTA, the International Occultation Timing Association at these two websites…

- www.occultations.org (info, training)
- www.asteroidoccultation.com/observations/Forms/AsteroidReportForms.html (submit timings)

Slide 36

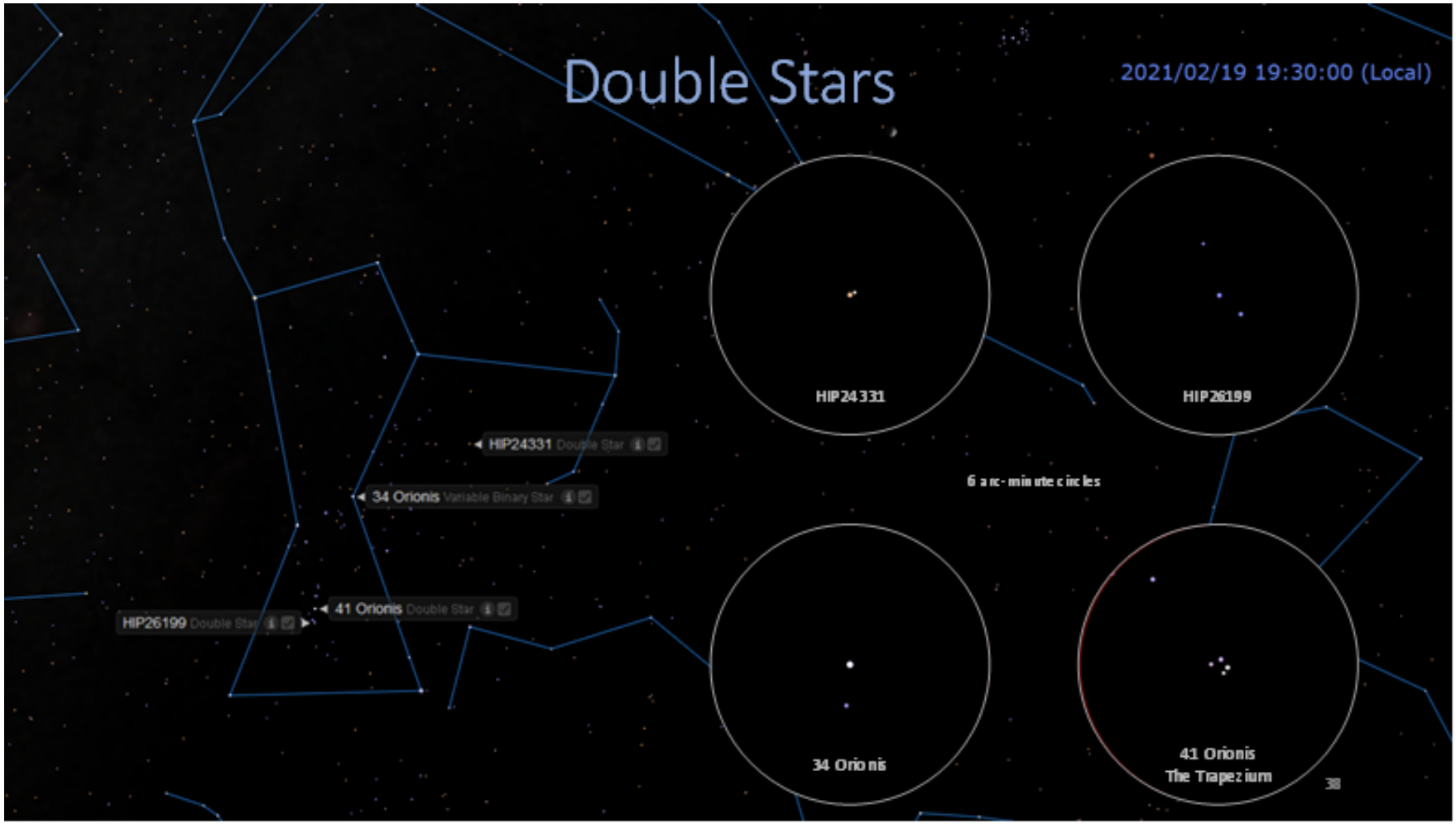


A week later, on the 18th, there is another occultation that passes across Southern Ontario, including Mississauga, Etobicoke and downtown Toronto south of Eglington-St. Clair. The magnitude drop is not as great, but enough to detect with an astro-camera tracking the star. So, if this sounds like something you are interested in trying, and have the needed gear, you have two of asteroid-occultations, 8-days apart, to try your skills on. Good luck!

Slide 37

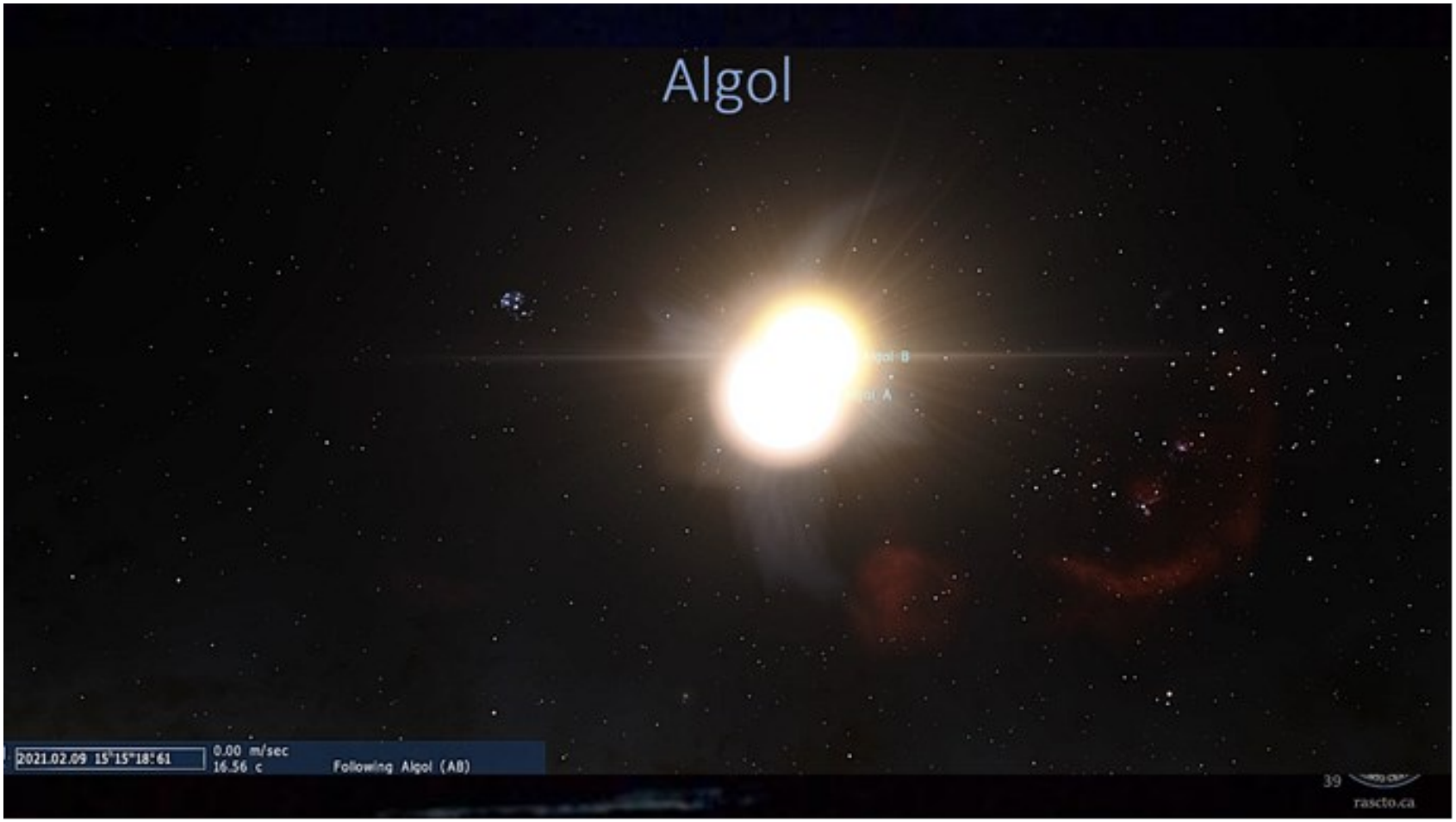

Meteor Showers
My deepest regrets but there are no meter showers in February.
The next two are:
April 22 Lyrid (ZHR 10-20)
May 5 Eta Aquarid (20-60)
37
rascto.ca

Slide 38



If you're out for that occultation of 43 Tauri by the 1st quarter Moon on February 19, chances are you'll also explore the sights in Orion. While there, here are 4 double stars from the Double Star Observing Certificate in the constellation. Here's how they look in simulated 6 arc-minute circles, inverted as through a Newtonian or reflector telescope. 41 Orionis, or the Trapezium won't be sitting in a dark field suggested here. It's in the middle of the Orion Nebula so there will be glowing gas and dust in the view.

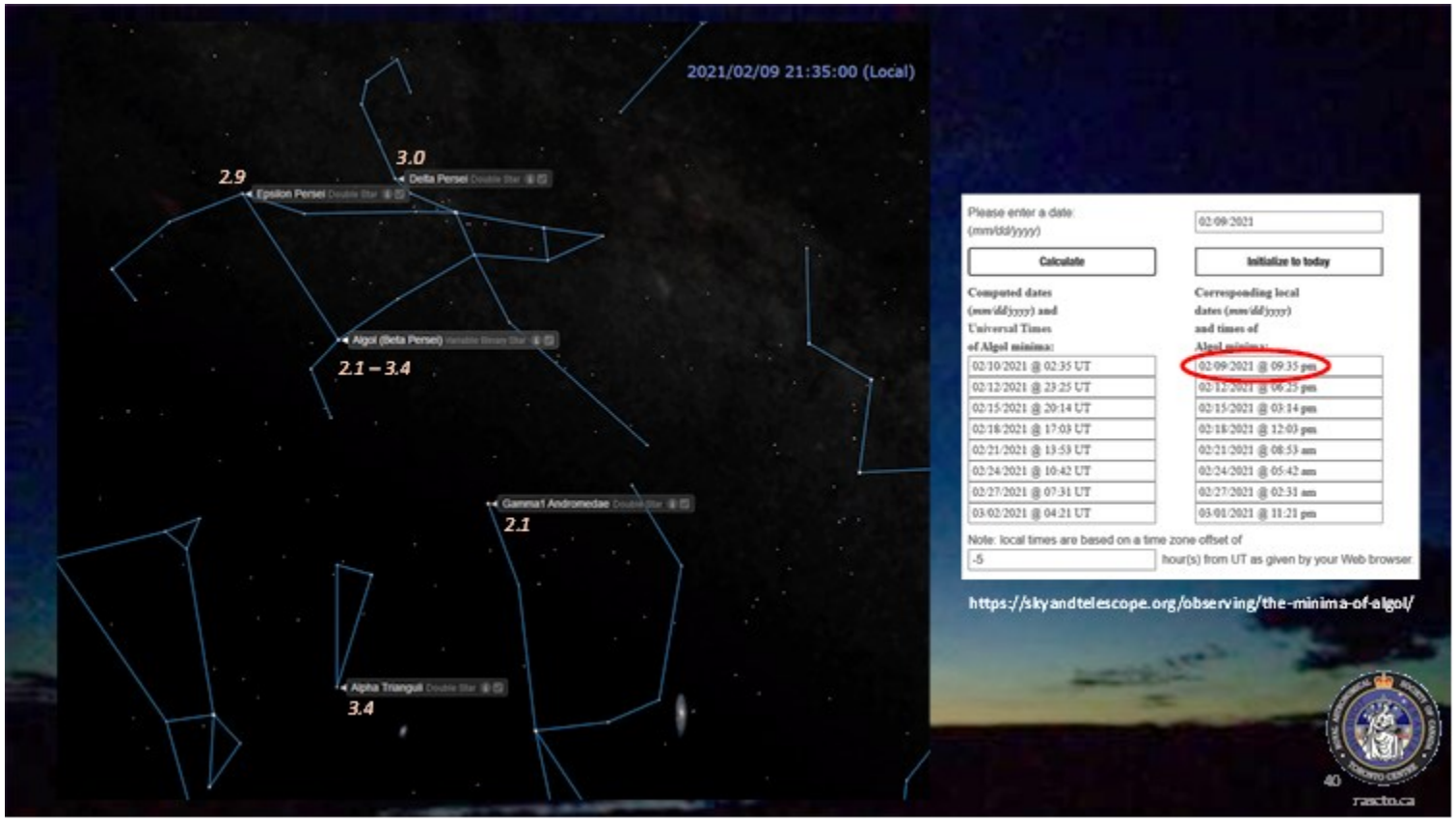
Slide 39



On the 9th, Demon star Algol drops in magnitude by 75% when bigger and dimmer Algol B passes in front of brighter Algol A. The two stars are so close together, it takes just over 2 and ½ days for the pair to complete one orbit around their barycentre. When the dimmer B slips behind A, the drop in magnitude can only be measured with equipment.

Algol is bright at magnitude 2.1 at max, and you can monitor the entire eclipse with your eyes alone.

Slide 40

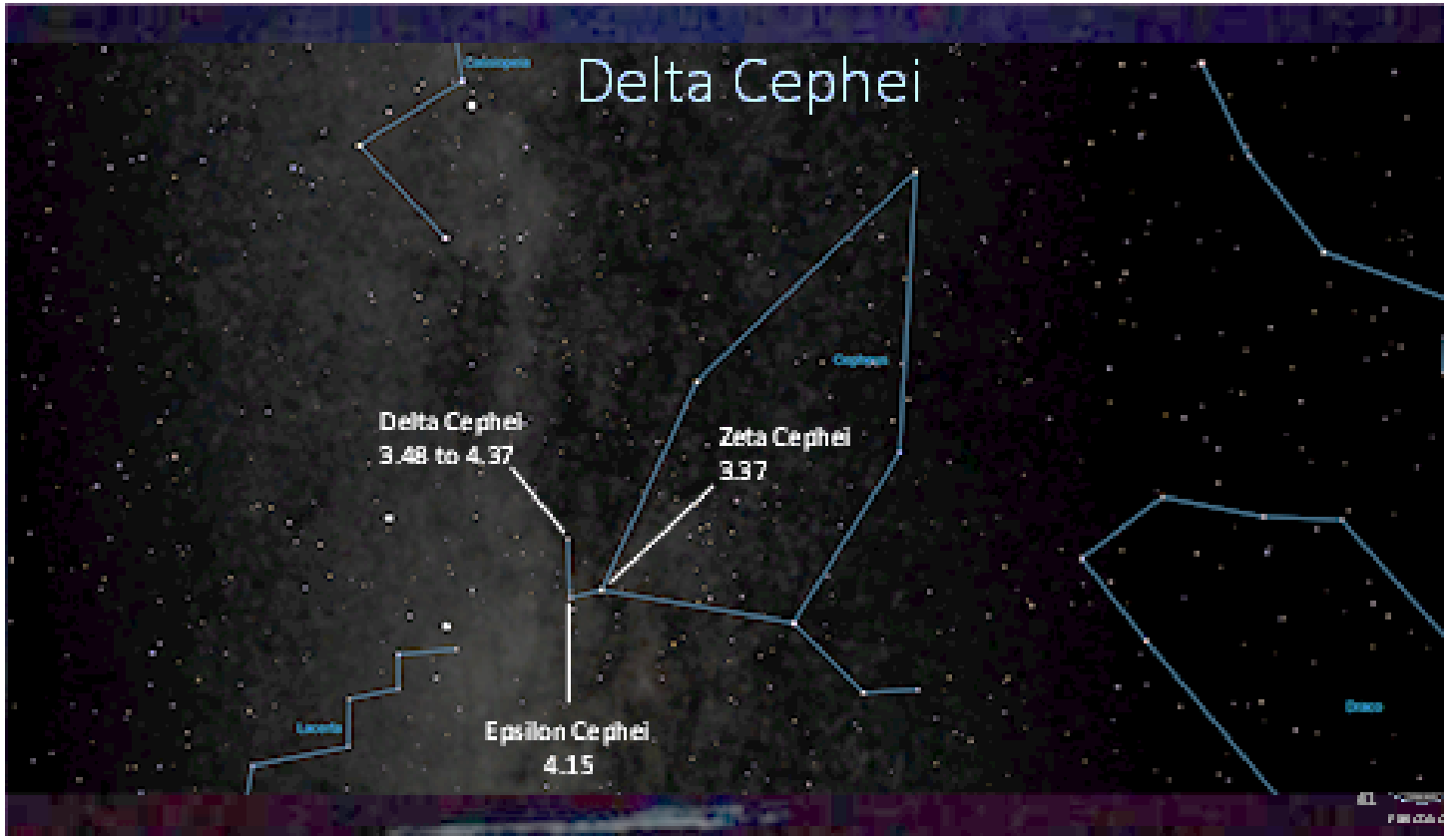


You can watch an Algol eclipse - already underway at nightfall - on the 9th. Algol will already be dimmer than Almach or Gamma Andromedae. But how dim? Like 2.9 Epsilon Persei? Or 3.0 Delta Persei? (Which, by the way, is a good test of discerning a .1 difference in magnitude.)

By 8:35, Algol will be at minimum, as dim as magnitude 3.4 Alpha Trianguli, and stay there for two hours. 9:35 is the midpoint of the 2-hour minimum. Alpha Trianguli will probably look dimmer due to atmospheric extinction being 20 degrees closer to the horizon.

If you're stargazing past 10:35, Algol will begin to re-brighten. Take a look every 15 minutes and compare it to its neighbors as it re-brightens. Visit www.skyandtelescope.org/observing/the-minima-of-algol to get predictions.

Slide 41



Another variable you can watch dim and re-brighten with your eyes alone is Delta Cephei, after which the Cepheid class of variables is named.

This star is pulsating as it has not reached equilibrium between the atmosphere wanting to collapse and the release of fusion energy in the core pushing back. This results in the star heating up and cooling off causing a fluctuation in brightness between 3.48 and 4.37 with a 5.4 day-period.

At its brightest, it's nearly the same as Zeta Cephei, and slightly dimmer than Epsilon when at minimum. You can compare Delta with its neighbors on any clear night since Cepheus is circumpolar.

The period of the fluctuations tells us the *absolute* brightness of a Cepheid-type star. The star's *apparent* brightness depends on its distance, so by comparing a Cepheid's actual vs apparent brightness, we can tell us how far away it is, or how far away a galaxy is with a Cepheid in its arms. That's how Edwin Hubble determined the Andromeda "nebula" was actually a galaxy far outside our own, by discovering a Cepheid in Andromeda in his photographic plates in 1924.

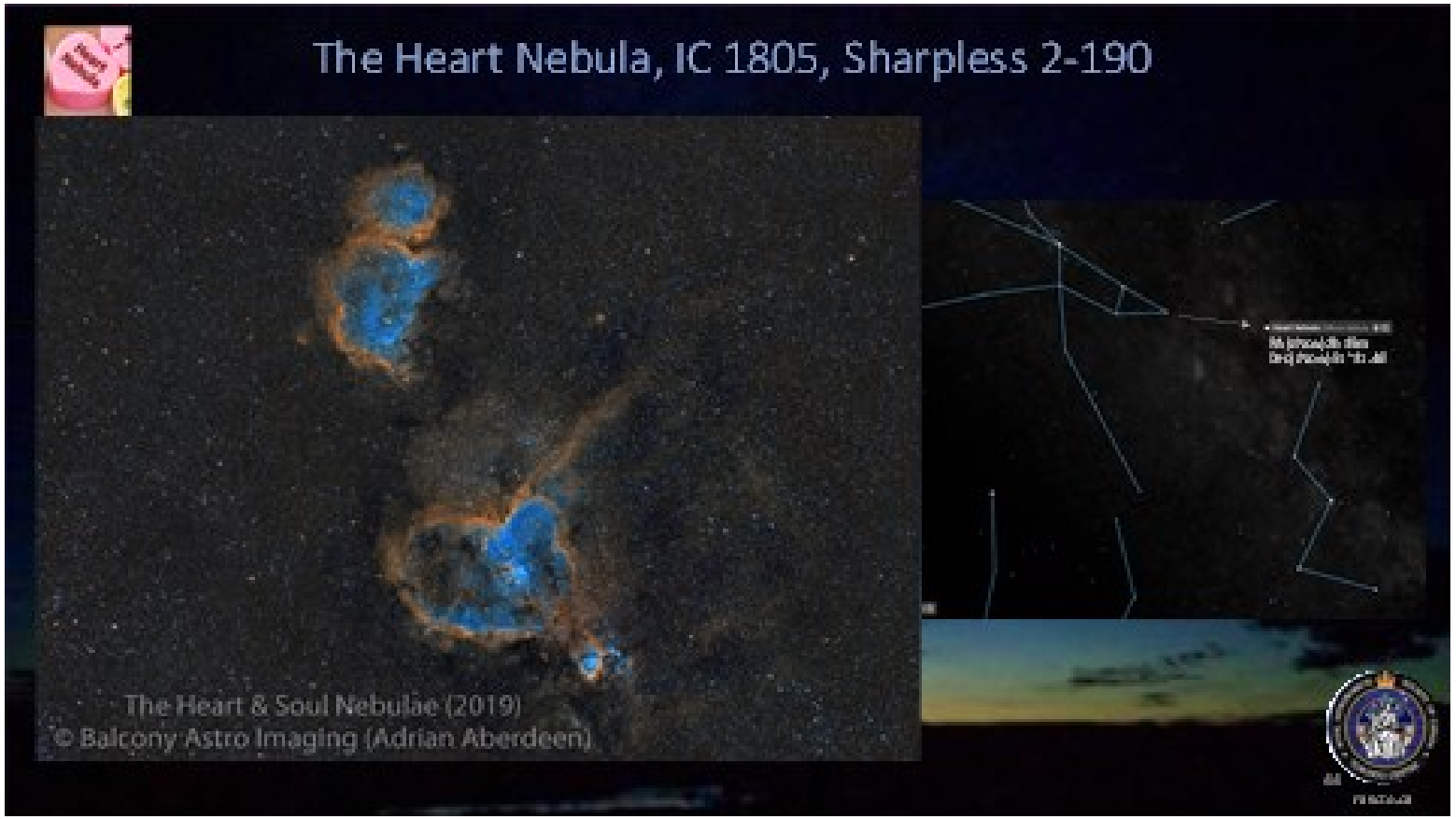
Slide 42

If you would like to learn more about observing variable stars and submitting magnitude estimates, visit AAVSO at www.aavso.org.

Slide 43

With Valentines day on February 14, I would like to suggest a few deep space targets along that theme. Some of you may remember these targets from when I did The Sky This Month last February.

Slide 44

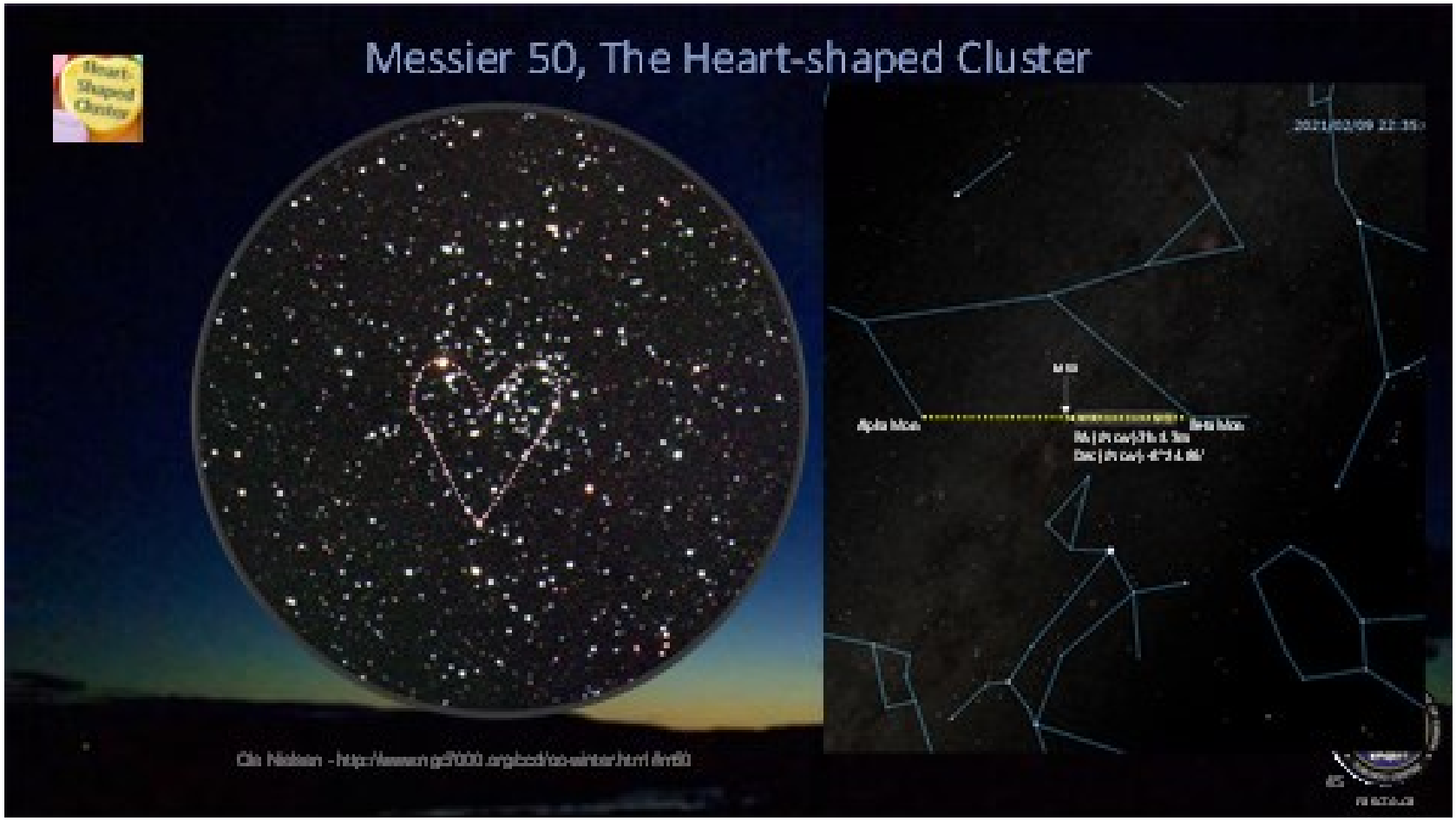


First on our list is the Heart Nebula. We get a bonus with the Heart's soul-mate, the Soul Nebula, only 2° away.

This gorgeous image of the Heart and Soul nebulae was produced by Adrian Aberdeen from his apartment balcony in Toronto and is found in our Forum's Astrophotography Section where you can find Adrian's write-up and imaging details.

Whereas Adrian pushes the blue component a lot (it's his favourite colour), the two nebulae glow predominately in the red of ionized hydrogen. They can be viewed visually with moderate to large amateur telescopes under dark conditions. You can find the heart and soul nebulae 6 degrees NNW of Eta Persei, the star at the tip of the hero's cap.

Slide 45



Do you see a heart-shape pattern in the brighter stars of this open cluster? Maybe this?

The heart-shaped cluster is M50, discovered by Charles Messier in 1772 while observing a comet. It is a rich cluster with 500 stars, and is still quite young at 140 million years old.

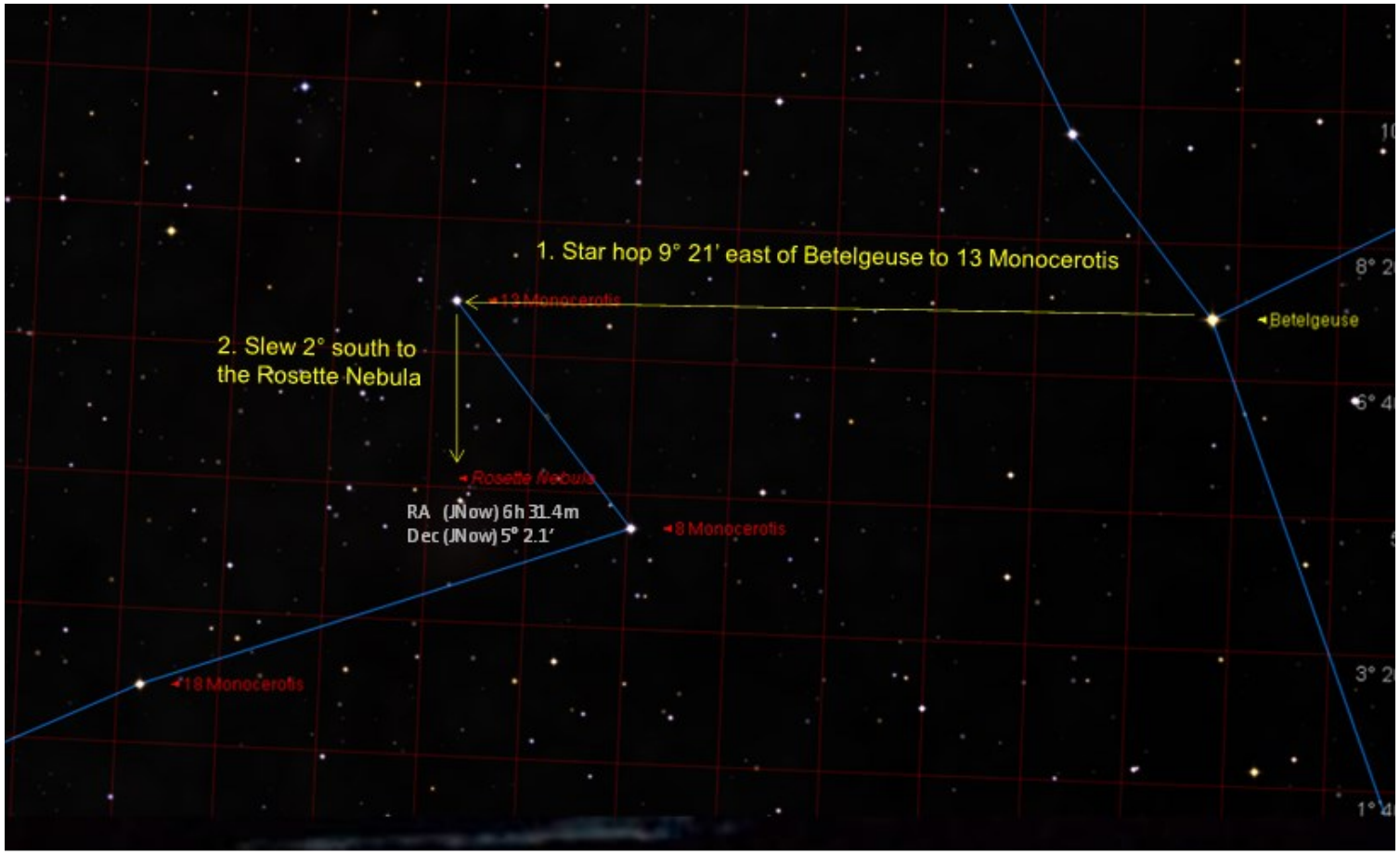
M50 can be found almost half way on a line between Alpha and Beta Monocerotis, slightly closer to Beta. It's easy to find at magnitude 5.9.

Slide 46

Next on our tour is the Rosette Nebula, also known as Caldwell 49, seen in this image by Jeff Booth. It is a large spherical H II region (circular in appearance) located in the Monoceros region of the Milky Way Galaxy. NGC 2244 (Caldwell 50) is the open cluster of stars found in the nebula's centre, having formed from the nebula's matter, and are now exciting the left-over gas to glow red. The nebula and cluster lie some 5000 light years away and has an estimated mass of over 10,000 solar masses.

BTW, to encourage others, Jeff would like you to know that he imaged this nebula from his backyard in "light polluted Oakville".

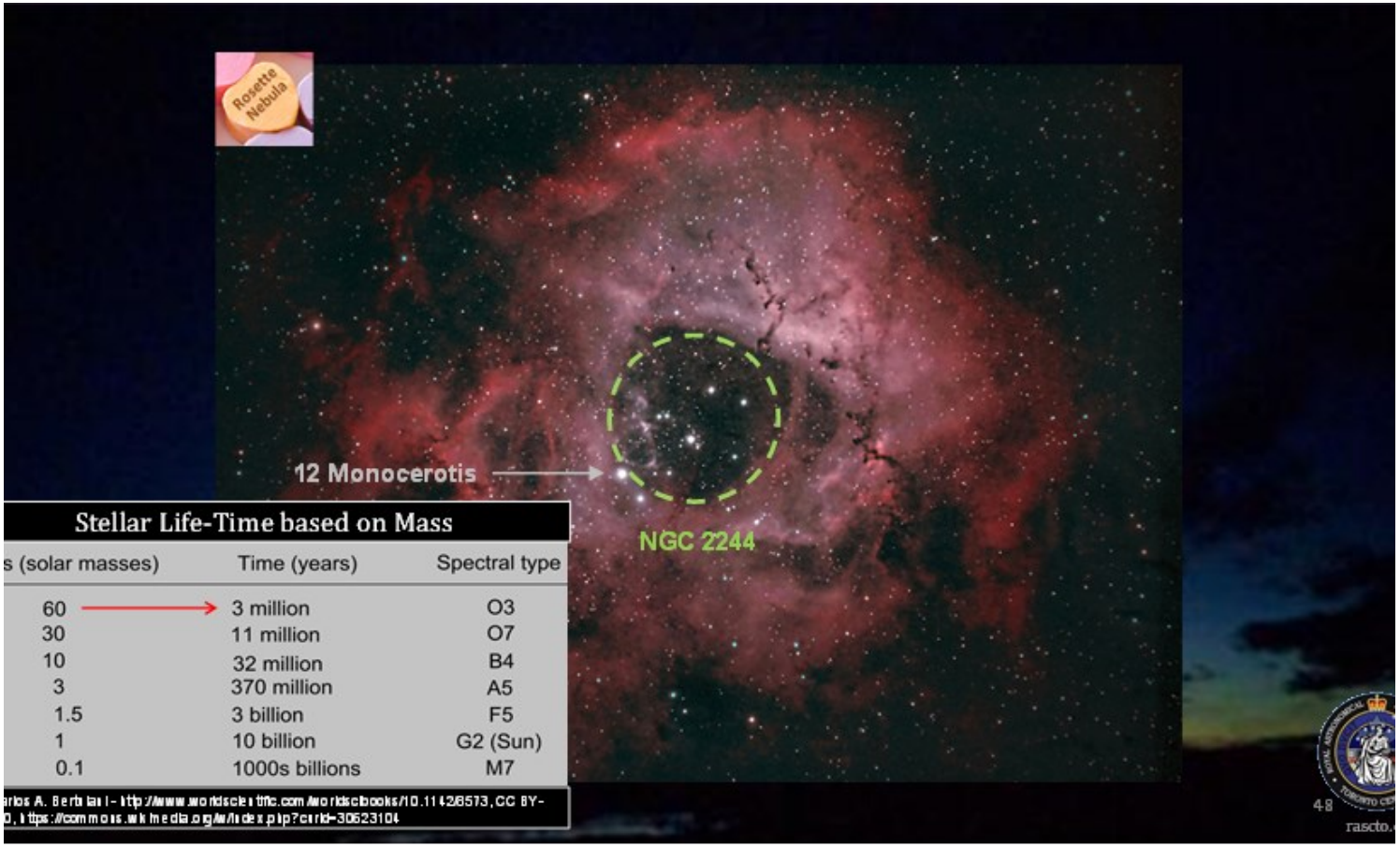
Slide 47



There is an easy two-step star-hop that will take you to the Rosette Nebula.
First, find magnitude 4.5 star 13 Monocerotis 9° 21’ east of Betelgeuse almost one fist to the left of Betelgeuse.
Next, with your telescope aimed at this star, slew south 2 degrees and the open cluster NGC 2244 will enter your eyepiece.

The Rosette has an apparent magnitude of 9.0 and the imbedded open cluster NGC 2244 will be easier to see at magnitude 4.8. To see the nebula surrounding this brilliant cluster you will need dark skies and a narrow band nebula filter.

Slide 48



This cluster is truly amazing. It is ***very*** young at less than 5 million years old. Its brightest two members are fearsome O-class monsters, the most luminous stars on the main sequence. One is **450,000** times brighter and **60** times more massive than our Sun and the another is **400,000** times brighter and **50** times more massive. (By comparison, Sirius is twice our Sun's mas, Betelgeuse 11, Antares 12). Stars this massive exhaust their fuel in only 3 million years, putting an upper limit on the how old this cluster can be.

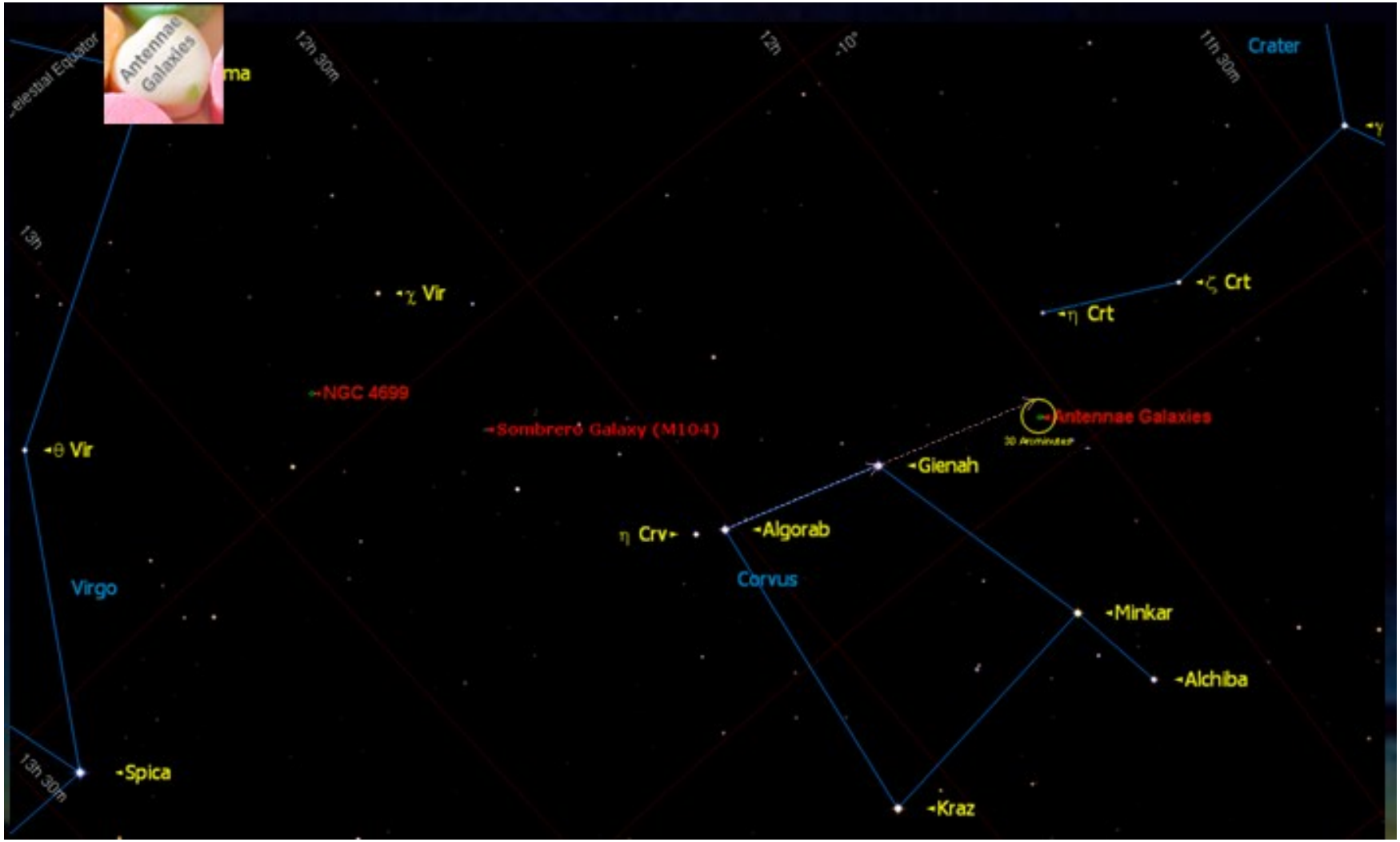
By the way, 12 Monocerotis is not a cluster member. It's around 500 light years away, not 5000 like the cluster.

Slide 49

Our final Valentine's treat is this merging pair of galaxies, NCGs 4038 and 4039, located 45 million light years away in Corvus. Tidal interactions have resulted in two long streamers of stars, dust and gas being ejected in curving arcs, resembling an insect's antennae.

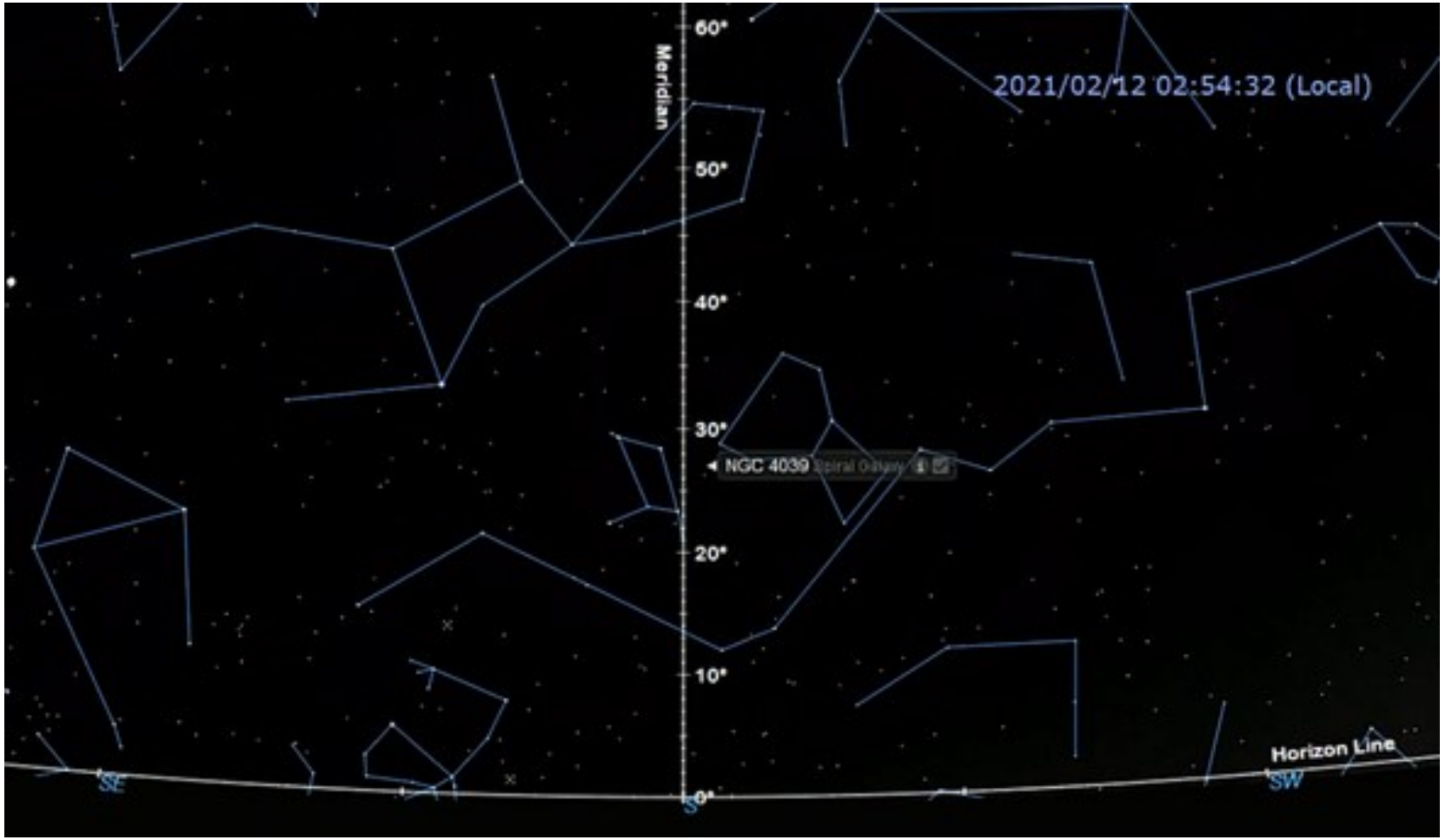
The original spiral structures of the two galaxies have fallen together to become the two lobes of a heart. The collision has triggered starburst, raising the luminosity of each to mag 11, within the reach of visual observing from dark sites with 8" or larger telescopes.

Slide 50



We can use the stars across the top of Corvus to locate the merging galaxies.
Go from Algorab to Gienah, and continue for that same distance and you'll be less than 1/2 degree north of the merging galaxies.

Slide 51



Being in Corvus, the galaxies do not rise very high in the south. On the New Moon night of February 11, they rise at 10 pm and reach the meridian around 3 AM at a height of 27 degrees, about as high as they get in Southern Ontario.