Winnicentrics

The Royal Astronomical Society of Canada - Winnipeg Centre

Upcoming Events

RASC Winnipeg Centre Monthly Meetings (via Zoom)

November 13, 2020
December 11, 2020
January 8. 2021
February 12, 2021

Members' Observing Nights

TBA

Oak Hammock Marsh Astronomy Night

(upcoming events)

Regular meetings of the Winnipeg Centre are normally held in the Robert B. Schultz Lecture Theatre in St. John's College at the University of Manitoba, 92 Dysart Road. Free parking is available in the lot across the street. The theatre is on the lower (basement) floor of the College. Meetings are usually held on the second Friday of each month from 7 p.m. to 10 p.m. After the meetings, members who wish to do so usually retire for pizza and more conversation about astronomical subjects.

However, due to the current restrictions imposed by Manitoba Health for the COVID-19 Pandemic all meetings are being held via Zoom at 7:30 PM on regular meeting nights as above. Regular meetings will resume once restrictions are eliminated and our members can meet in safety. We miss you!

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YouTube https://bit.ly/2FrcZJZ

https://bit.ly/3iSmFed

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Bill Krosney
Ed Wright

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SWSP Organizer: Silvia Graca

Webmaster: Gord Tulloch

Winnicentrics Editor:
Gord Tulloch

Observatory Director:
Bryan Stach

Winnicentrics is published six times or more each year by the Winnipeg Centre, RASC. Winnicentrics is produced by and for the members of the Winnipeg Centre.
Any opinions expressed are those of the author. Any questions or comments please email:
newsletter@winnipeg.rasc.ca
Or contact one of your Councillors above

Notices:

The Glenlea Observatory LX200 / Dome is CLOSED. Please contact Bryan Stach at bstach@mymts.net or phone 204-295-8506 for current info.

Glenlea Warm Room (1 person limit) and Pad are open to members subject to Social Distancing and Mask requirements.

Members Observing Nights are CANCELLED due to COVID restrictions.

Member Meetings continue to be virtual due to COVID restrictions, please see your email or the RASC Winnipeg Forums for Zoom information.

Boston Pizza after-meeting social events continue to be virtual due to COVID restrictions, please see your email or the RASC Winnipeg Forums for Zoom information.

Visit our web site at:
www.winnipeg.rasc.ca

Editor's Message

By Gord Tulloch, RASC Winnipeg Centre, Acting Newsletter Editor

Hello all! First of all I'd like to thank Kaeren Anderson for her work in getting newsletters out during early 2020 – it's been a tough year! Pressure of work caused Kaeren to step back so I will be filling in for the rest of the year.

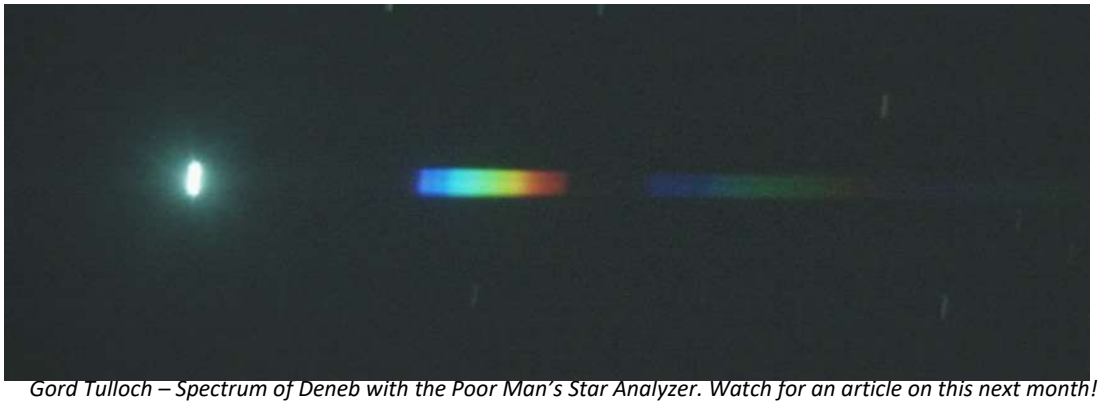
The Winnipeg Centre newsletter, Winnicentrics, has a long and glorious history of keeping our members informed with not only timely astronomy information, but also to keep in touch with other members and their activities. In this unprecedented time we need that more than ever, so I pledge to "up our game" for Winni so we can keep touch with each other, even if we can't all go out and observe together. Cancellation of the Spruce Woods Star Party was an especially disappointing development, although we did get the amazing news at the same time that Spruce Woods is now a Deep Sky Preserve! See the article in this Winni by Silvia Graca for more details, and stay tuned for some new developments to leverage that designation in the future.

It's election time of year again in January, so please consider standing for a position on the Executive or Council, your Centre needs volunteers to continue operating! If you know of someone who might be interested in running, please talk to them and nominate them. See the article below for information on how you can do this. The more our members participate, the more our Centre can do!

Those of you who, like me, remember fondly the excellent newsletters of earlier years will be gratified I hope to see the return of the Abrams Planetarium Sky Calendar and Seasonal Star Chart to these pages! This resource is something you can post on the fridge and use all month to keep tabs on what's going to be happening in the skies tonight, and where they are in the sky! The bad news, I suppose, is because of rampant misuse of the Abrams publications in the past, this free resource is limited to 4 months use, in our case two newsletters. Use in the future comes at a cost, so look for a survey around end of January to gauge our members interest in continuing to receive this part of the newsletter, and costs associated.

Make sure you check out the close conjunction of Jupiter and Saturn near Christmas! It should be glorious, and make for some amazing pictures!

Clear skies to all, stay well, wear a mask, wash your hands, and we'll be back out under the stars together sooner!



Gord Tulloch – Spectrum of Deneb with the Poor Man's Star Analyzer. Watch for an article on this next month!

Notice of Council Elections / Call for Nominations

It's that time of year again, RASC Winnipeg Centre will be holding elections for the following Council positions at the January meeting:

President
Vice-President
Treasurer
Secretary

There are also three of five Councillor positions up for election or re-election. Councillor positions are staggered so as to provide continuity on Council rather than the entire slate being replaced all at once. President and Vice President positions and all Councillor positions have a term of two years and an individual may serve in the same capacity for no more than two consecutive terms for a total of four years in office. They must then sit out a two-year period before running again. However, a Councillor whose four years in office has expired may run for an Executive position, at which time the term limit is reset. The positions of Secretary and Treasurer have no term limits, but must be re-elected every two years.

Currently, the President, Vice-President and those Councillors who have completed one two-year term are all eligible for and required (if they wish to do so) to run for a second term. The positions of Treasurer and Secretary are also open for re-election but the incumbents are not required to follow term limits; new candidates may also put their name forward for these responsibilities. Cliff Levy has indicated that he will not re-run for the position of Secretary.

Please take an opportunity to thank the outgoing President Bryan Stach, VP Dennis Lyons, Treasurer Abdul Al Manni, and Secretary Cliff Levy for their service to the Centre over the last two years. Also please thank Darren Hennig, Ed Wright, and Kaeren Anderson for their service as Councillors. Special thanks to Kaeren for acting as Winnicentrics Editor for 2020-21 and Bryan for his role as Observatory Director.

Positions for National Rep, SWSP Organizer, Webmaster, Winnicentrics Editor, and Observatory Director are appointed – current incumbents may choose to remain in these positions or vacate them by notifying the President.

Deadline for nominations is November 30, 2020 and may be made via email to Stan Runge (stanrunge@hotmail.com) or Jay Anderson (jay.anderson@eclipsophile.com). Anyone may be nominated provided the member is in good standing with the Centre; individual members may place their name for election to an office by contacting either Jay or Stan. If you wish to nominate someone, make sure to obtain their approval first.

If you would like to volunteer for an appointed position please contact an existing Council member to indicate your interest.

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Elections will be held electronically (via an online SurveyMonkey form where only Jay Anderson and Stan Runge will have access to the votes) during the period of January 1st through the 6th, with results announced at the Zoom meeting on January 8, 2021 (assuming that we are not meeting in person – if so new instructions will be issued via email.

If there are any questions or comments please feel free to contact any Council member.

Sketchers Corner: Mars at Opposition

By Gerry Smerchanski, RASC Winnipeg

High hazy skies allowed only a dozen stars to poke through, but the air was steady. Off to the south, the dome of Winnipeg illuminated heavier clouds. Dim, hazy Mars was the most prominent light up there. With opposition here, that marks the halfway of this most auspicious Mars apparition. Many veteran observers are saying how they are seeing more this time around than the other recent close approaches of 2003 and 2005. I'm using the same equipment as then (more or less) and I agree that the high altitude of Mars is really beneficial.

Done with colored pencils on white paper using 6 inch Maksutov Newtonian with binoviewers at 180 to 250 ish magnification. Took special care to size the SPC. Seeing wasn't good enough to push for more details and the image was pretty dim through the high haze.

Note: We're hoping now that we have a Astrosketchers Group in the Centre, we can publish a new sketch every month – please send your sketches to newsletter@winnipeg.rasc.ca including a description similar to Gerry's above so our members can enjoy them! – Ed

New Astrosketchers Group

By Silvia Graca, RASC Winnipeg

Silvia Graca - Gerry Smerchanski shares his sketching expertise at Glenlea

Greetings all! The Winnipeg RASC Astrosketchers group has met a couple of times at Glenlea Observatory – it was great fun!

An outdoor PowerPoint presentation was set up before dark where we tried to answer the question; why sketch? Afterwards we all moved to our instruments for guided sketching sessions of Saturn, Jupiter, constellations and the Moon.

As you can see, our sketches below are simple drawings, however they demonstrate some very involved issues, such as Jupiter not being round, noticing rotation, how Saturn's tilt as exemplified in the sketch by the open rings explains why the moons do not neatly cross the planet as they do with Jupiter. There was so much feedback and interchanges during the socially distanced telescopes, it really made for an awesome night of astronomy!

If you would like to join the Winnipeg RASC Astrosketchers let me know to include you in the distribution list. No experience is needed, and artistic ability is definitely not a requirement or even the point of astrosketching… the aim of astrosketching is about accuracy and not about art, although with more practice you might find yourself wanting to put more effort into capturing the beauty of the objects observed.

Astrosketching is a super tool that both helps train the eyes to observe in more detail as well as taking away any preconceived ideas of what you think you are seeing. I am often surprised by the way I see something after I have sketched it!

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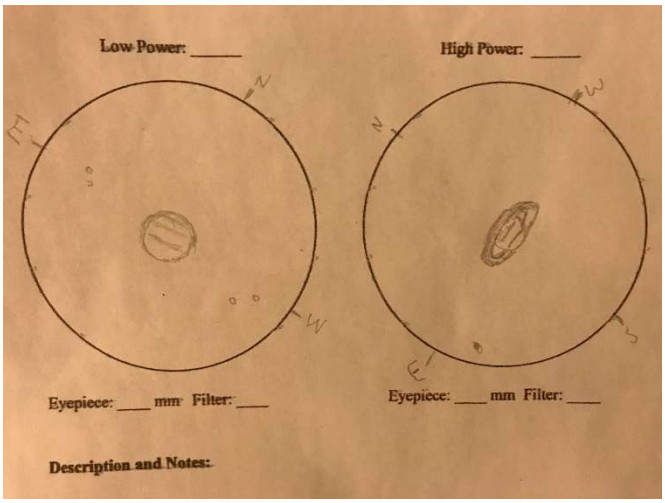
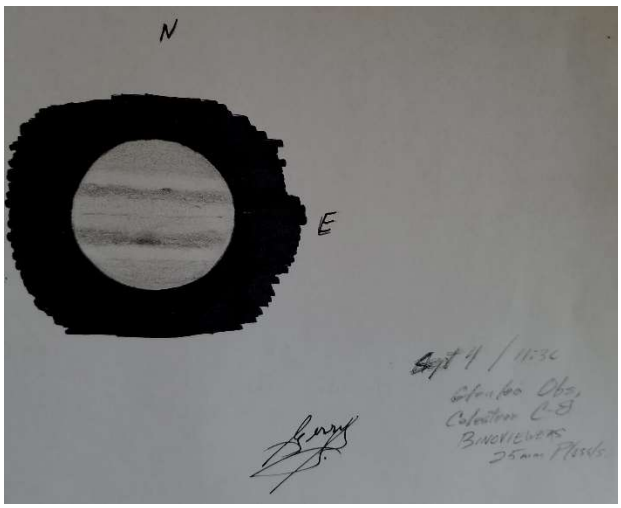
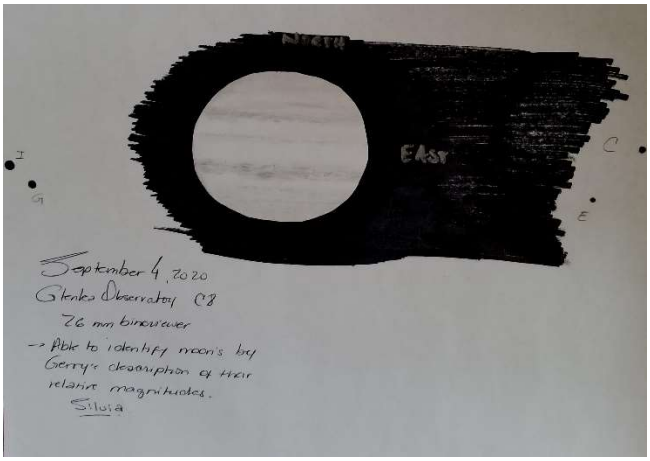
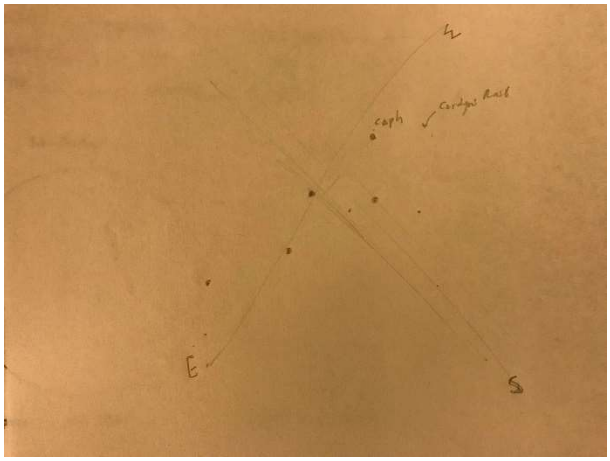
The workshops are guided but you can also just sketch on your own, no obligation to follow along. We will also be conducting the events in the context of COVID-19. Masks are required, social distancing will be in place, disinfecting supplies will be available, and only one person allowed in the warm room at any given time.

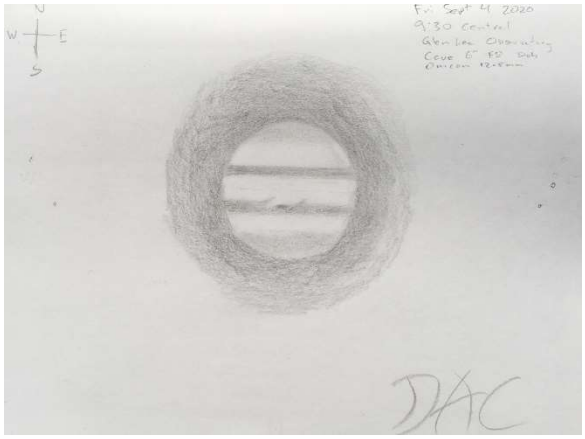
All you need to bring is a comfy chair. Binos or a telescope are not mandatory, but be aware that we can't share equipment due to the pandemic. If you would like to be part of this sketchy group, email me at Arcturus173@hotmail.com with your email address. Thanks to the RASC council for helping make this happen!











Spruce Woods Deep Sky Preserve

By Silvia Graca, RASC Winnipeg

Greetings RASC Winnipeg! Here is a quick summary of the recent announcement about Spruce Woods being designated a Dark Sky Preserve.

For those new to astronomy and not familiar with dark sky preserves (DSP), what this means for Spruce Woods Provincial Park is that it is now officially considered an area that is and will be protected from light pollution.

The whole process took Winnipeg RASC volunteers over 12 years, contending with so many challenges such as natural disasters like the floods that hit Spruce Woods, change of management at the Parks, Park budgets played a role as some of the existing lighting had to be either replaced or shielded properly to make sure they were compliant - in other words make sure that the light was not too bright, was pointed towards the ground and not spilling to the sky or to unnecessary areas which of course affects the quality of a dark sky.

So although the Winnipeg RASC has achieved this goal and the designation is in place, the Winnipeg RASC, will have to continue to maintain the relationships that have been built with the park, to make sure we do not lose the designation by failing to use appropriate lighting. This is something that will always have to be monitored.

Achieving this designation means Manitoba has its very first dark sky preserve designation ever!!! This is a major accomplishment!!!

Those RASC volunteers have essentially ensured that:

- The pristine dark skies of Spruce Woods Provincial Park will be preserved and so it will be a great place for astronomy and science!
- Visitors to the park will be able to experience a dark sky and enjoy it for years to come.
- Living creatures will be protected from light pollution.
- There is also the elimination of excess lighting that will save electricity and money that can now be channeled to more important things, like more astronomy things!

Now you must be wondering who are these heroes from the Winnipeg RASC that donated so much of their time and energy to this project?

First and foremost is the leader of this team - Tim Kennedy. He asked me not to single him out and he feels that credit goes to all the Winnipeg Rascals that gave their time and effort over the last 12 years, but Tim was certainly the moving force behind this.

Continued next page…

His leadership and ability to engage and energize volunteers and other stakeholders definitely played a major role.

I am just a messenger here but off the top of my head, when I think of Tim's DSP team, the following people come to mind, Sandy Schrewchuk, Gail Wise, Marnie Dangerfield, Ron Berard, Sheila Wiwchar, our current president Bryan Stach, Gord Tulloch, Scott Young, Gerry Smerchanski, Mike Karakas, Cliff Levi and the late Lindsay Price, and so many others that I might be forgetting that volunteered in council throughout the years! Tim will make sure to mention everyone that was involved when he gives us his presentation on this in the near future.

Please give these people a shout-out on this major accomplishment by your very own **Winnipeg RASC volunteers**! You guys rock!

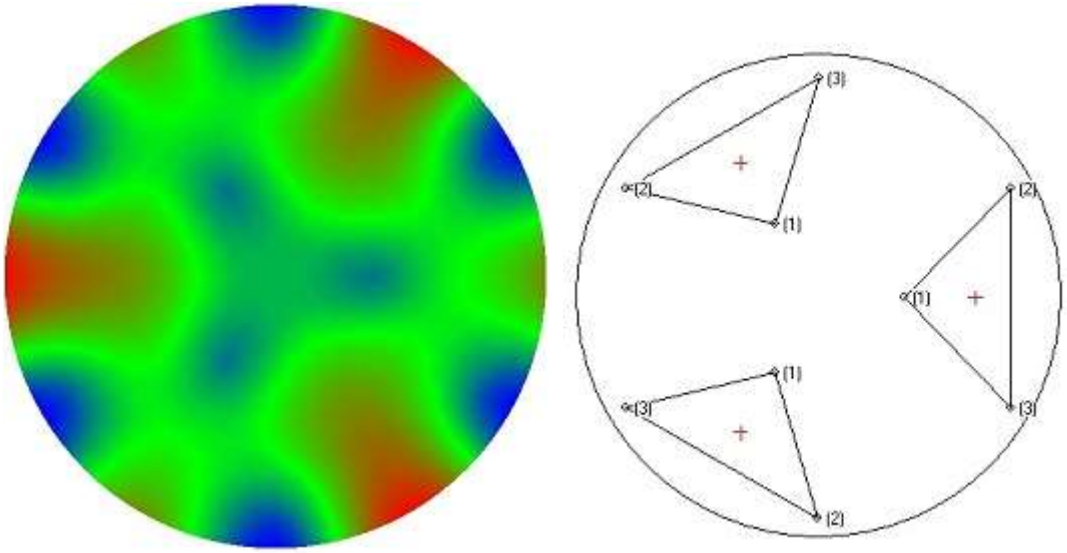
Scott Young October 13 2020 – "Probably my last look at Jupiter and Saturn for the season - they're getting so low in the sky that the turbulence is wiping out a lot of detail."

Building The NTT16 Part 2 – Mirror cell and Lower Tube Assembly

By Gord Tulloch, RASC Winnipeg Centre

Last time we looked at some design considerations for my New Technology Telescope 16" F4.5 telescope. The first step for building a telescope is a mirror cell that will properly support the mirror so it doesn't flex and change the figure of the mirror. Glass is actually fairly flexible, in the scales we're dealing with for optical surfaces. Not only can they flex and bend out of shape due to gravity, even uneven cooling can cause your optical figure to go out of whack so one part of the mirror focuses in a different place than other parts. This means blurry images, which definitely won't do.

To avoid flexing of my mirror, using the program PLOP (https://www.davidlewistoronto.com/plop/) I've decided to go with a 9 point mirror cell, with three triangles. The plot of the mirror and the cell triangle layout looks like this in PLOP – the red areas indicate where there are possible areas of flexure, but in this case the bulk of the mirror will be fine.



With this in mind it was time to turn the design into reality. Taking my cue from the classic telescope making handbook *"The Dobsonian Telescope: A Practical Manual for Building Large Aperture Telescopes"* by David Kriege and Richard Berry I decided to build a square mirror box with a steel frame rather than a round one with a triangle I took the day off to get a jump on some ATM projects, including the mirror cell for my 16".

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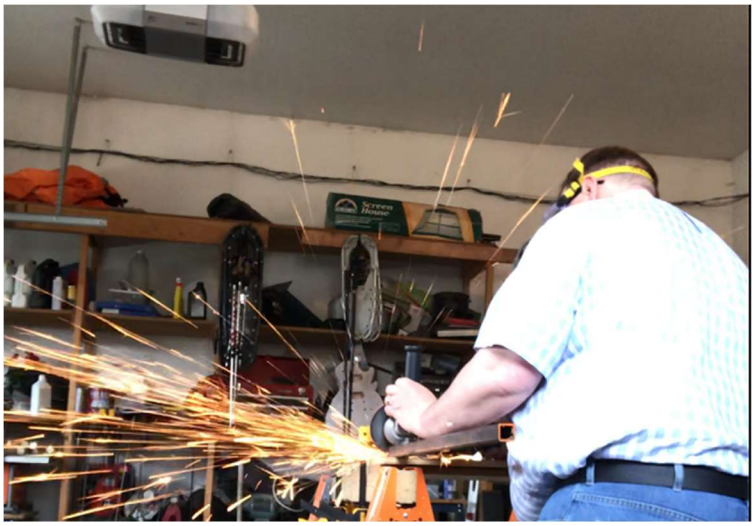
I had great fun cutting steel with an angle cutter, something I've never done before. Lots of sparks!



Once I had the parts cut out, I assembled them on a piece of plywood marked out with the mirror diameter and laid out with where everything would go, so I could see how things looked before welding. I used wood braces to line everything up – below is an image of the cell before I drilled holes for the triangles and attachment to the mirror box, as well as for the truss attachment points for my three pairs of truss poles.

With the able assistance of my live-in machinist (my eldest son Liam – he works for beers!) I welded the parts together along with three 6"x1.5" steel pieces angled along the 120deg lines to allow me to put a piece of threaded rod through the steel with nuts on either side to center it. I will then attach Heim bolts (bolts with swivels in them) to that rod for the base of the trusses. The top attach point will also have a

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swivel safety clip for the top of the mirror to prevent tipping forward. I also drilled some holes in the middle rail to hold bolts to attach a wire sling for the mirror, using 3/16" aviation cable.

Once the mirror cell frame was welded, I punched holes on the top of three acorn nuts and threaded them onto threaded rod as pivots on which the triangles for the 9 point support system can rest. I then cut some lock nuts in half so their profile was less than the teflon sliders that will actually contact the mirror.

Next the mirror triangles were cut from some 2mm aluminum I recovered from an old computer case. The triangles rest on the acorn nuts and can adjust their angle to ensure that the mirror isn't being distorted by the cell. I later cut a ring of Kydex to join the apexes of the triangles together so they don't rotate out of position.

Finally, the wire sling that will support the bottom of the mirror was fitted to bolts in the frame. A piece of aircraft cable will support the bottom of the mirror along it's entire lower perimeter to ensure the mirror isn't distorted as it might be with more traditional mirror clips.

Next time, we'll look at the Upper Tube Assembly / Secondary Cage and truss structure.

Abdul Al Manni – Moon and Mars from my home - 250 pictures 1 min apart, 10 second exposure, iso 400, stacked with startrails software

GLP-TRAINED USERS AND SPOTTERS
RASC WINNIPEG CENTRE

The following Members have received training in the proper use of Green Laser Pointers and may apply to receive a permit to conduct an astronomy outreach session in accordance with applicable law and RASC policies respecting green laser pointers.

9 August 2019 (Expires 8 August 2022)

Abdul Al Manni	Patrick Curry	Kaeren Anderson	Kevin Davis
SHR Bannister	Michael Fry	Michelle Boyce	Darren Hennig
Sean Ceaser	LLoyel Hull	Ralph A. Croning	Paul Karlowsky
Clifford Levi	Dennis Lyons	Alan Macklem	Jim Mcdowal
Krzysztof Keller	Daemon Nightshade	Gail Wise	Brian Renaud
Stan Runge	Bryan Stach	Gordon Snarr	

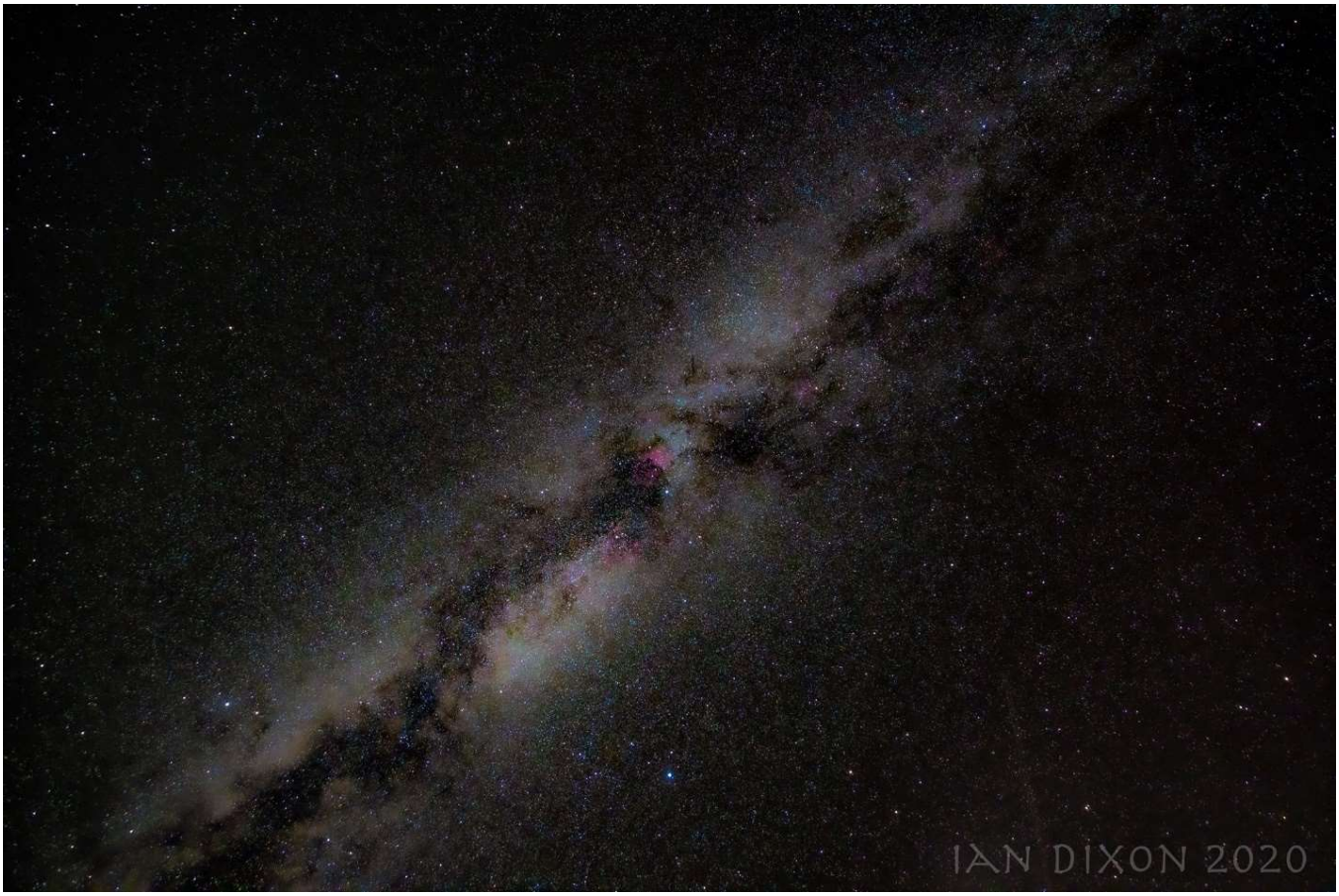
11 August 2019 (Expires 10 August 2022)

Jay Anderson	Judy Anderson

13 December 2019 (Expires 12 December 2022)

Trevor Bryant	Stephen Altstadt	Ed Johnson	Robin Clarke
Adelle Kennedy	Lucille Eustache	Timothy Kennedy	William McDonald
Kevin McGregor	Michelle Paquette		

Members Image Gallery



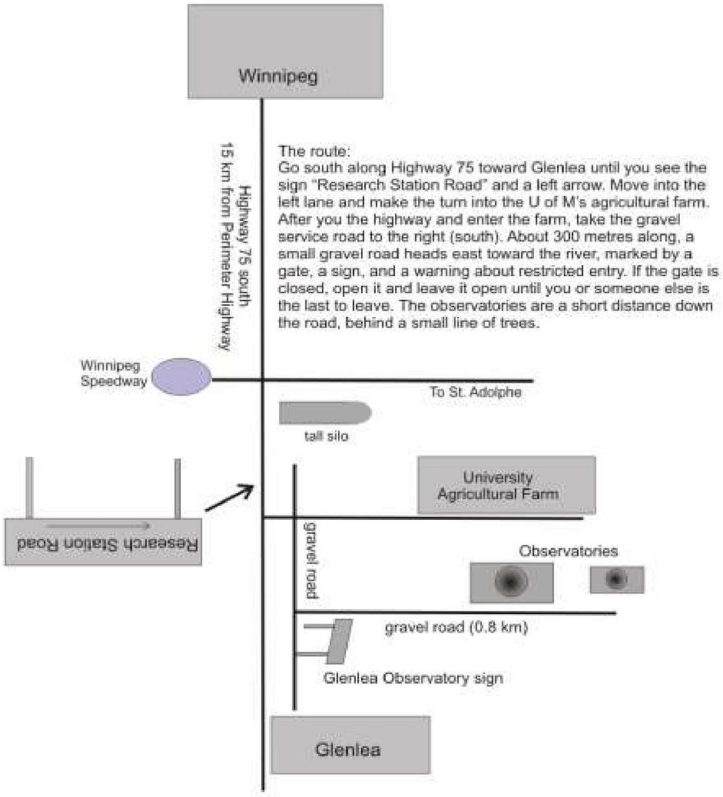
Ian Dixon - September 26, 2020. Milky way in wide field - region of Cygnus. I took a break from hunting aurora, and went after some deep sky, albeit with the same lens (10mm Rokinon f2.8). Canon 60D modified, 180 s x 1, ISO 800, Ioptron skyguider mount, processed with Pixinsight

Gord Tulloch – An image of Jupiter accompanied by Europa (top left) and Io (best 200 frames of 5000) Aug 31 2020

Kevin Galka – "Made it to Sandilands [in September]. After about 5 hours of trying to get things working I finally had some decent guiding. Turned the scope to the horsehead and finished the night off on it. Combined with 15 minutes from a few weeks back it brought the total time up to 115 minutes."

Mike Karakas and Silvia Graca provide two perspectives on Mars on the same evening. Mike used a Intes-Micro M809 F10 maksutov cassegrain, operating at F25 with an ASI224 captured with Sharpcap and processed with Autostakkart! and Registax while Silvia was using an 8"SCT with binoviewers and 25mm eyepieces

Finding the Observatory



The Winnipeg Centre maintains a working observatory and warm room at the University of Manitoba's Research Farm. The observatory contains a 30 cm Meade telescope on a fork mounting. Members of the Centre may sign out the use of this telescope provided they have first taken a short instruction course on its use.

The Meade provides outstanding views of the night sky. Its large aperture collects more than 1800 times as much light as the human eye. It is capable of magnifying more than 500 times under favourable conditions.

The warm room provides a convenient place for members to take refuge from winter temperatures and summer mosquitoes, or to wait out a passing cloud. The building also provides desk space and lighting for planning a night's observing session. A concrete pad in front of the warm room and observatory provides a convenient space to place members' telescopes while conducting personal observing programs.

Etiquette requires that you approach the observing site with your headlights off if that's possible on your model of car. Headlights should remain off, but you can still use your parking lights to drive. Proceed slowly, and be careful about parked cars along the road, or people walking. If you cannot turn off your headlights, make a cardboard or garbage bag mask to dim the lights. You might wish to turn around at the end of the road so that you are facing the direction back toward the highway at the end of the evening.

Remember to close the gate if you are the last one to leave.

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SKY CALENDAR NOVEMBER 2020

An aid to enjoying the changing sky

Planetarium business office:
(517) 355-4676
http://twitter.com/AbramsSkyNotes
http://abramsplanetarium.org/

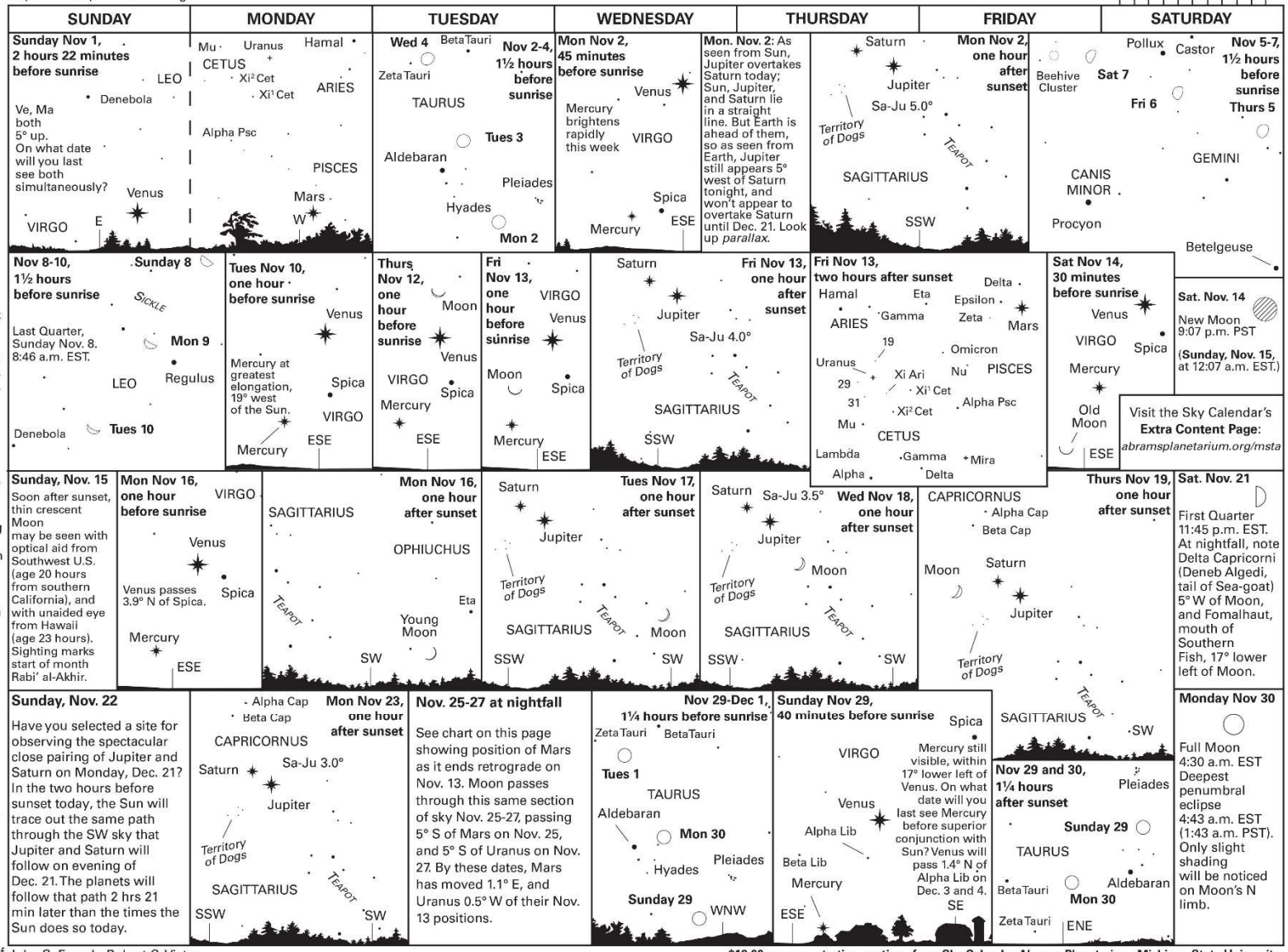
Use this scale to measure angular distances between objects on diagrams below.

Evenings: In mid-November, Spaceship Earth is flying directly away from the 3rd-mag. star Delta Capricorni, or Deneb Algedi, tail of Capricornus, the Sea-goat, in south as twilight ends. During last four months, our fast-moving planet overtook all five outer planets, **Jupiter and Saturn** in July, **Neptune** in September, **Mars and Uranus** in October, each in turn appearing at *opposition* as we passed between Sun and planet. Now in November 2020, we are looking behind our planet at an impressive lineup of all the outer planets across the evening sky.

Let's consider the bright planets in order from west to east. In Sagittarius, east of the Teapot, **Jupiter**, at mag. –2.2 to –2.0, is now the brightest "star" in the evening sky. Look for it in SSW to SW an hour after sunset, lower as month progresses. Just 5.2° to 2.3° to its upper left is **Saturn**, at mag. +0.6 about one-tenth as bright. Illustrations for Nov. 2, 13, 23, Dec. 3, 12, 21 show Jupiter creeping about 1° closer to Saturn each ten days. **A spectacular close conjunction will occur on December 21.** These largest planets – Jupiter with cloud belts and four bright satellites, and Saturn with rings, are always pleasing for telescopic viewing.

Mars drops in brilliance from mag. –2.1 to –1.1 this month as we race away. An hour after sunset, the red planet climbs higher in ESE as month progresses, but remains near Delta and Epsilon in Pisces, a pair of matched 4th-mag stars 3.5° apart. Ending retrograde on the 13th, Mars doesn't wander far in Nov. **Using binoculars and finder chart for Nov. 13,** start at head of Cetus, then star-hop using fainter stars of Aries as stepping-stones to 5.7-mag. **Uranus**.

In morning sky, Regulus, heart of Leo, lies dead ahead of Spaceship Earth on Nov. 21. This month, we're seeing the swift inner planets, **Mercury and Venus**, racing ahead of us. In a favorable apparition lasting nearly all month, Mercury stays 13° lower left of Venus Nov. 10-18. Mercury approaches within 4° E of Spica in a *quasi-conjunction* on Nov. 2. Venus passes 4° N of the same star on Nov. 16.



John S. French, Robert C. Victor
ISSN 0733-6314

Holiday Gift Idea: Subscription: $12.00 per year, starting anytime, from Sky Calendar, Abrams Planetarium, Michigan State University, 755 Science Rd, East Lansing, MI 48824 or online at abramsplanetarium.org/skycalendar/

November Evening Skies

This chart is drawn for latitude 40° north, but should be useful to stargazers throughout the continental United States. It represents the sky at the following local standard times:

Late October	10 p.m.
Early November	9 p.m.
Late November	8 p.m.
Early December	7 p.m.
Late December	6 p.m.

This map is applicable one hour either side of the above times.

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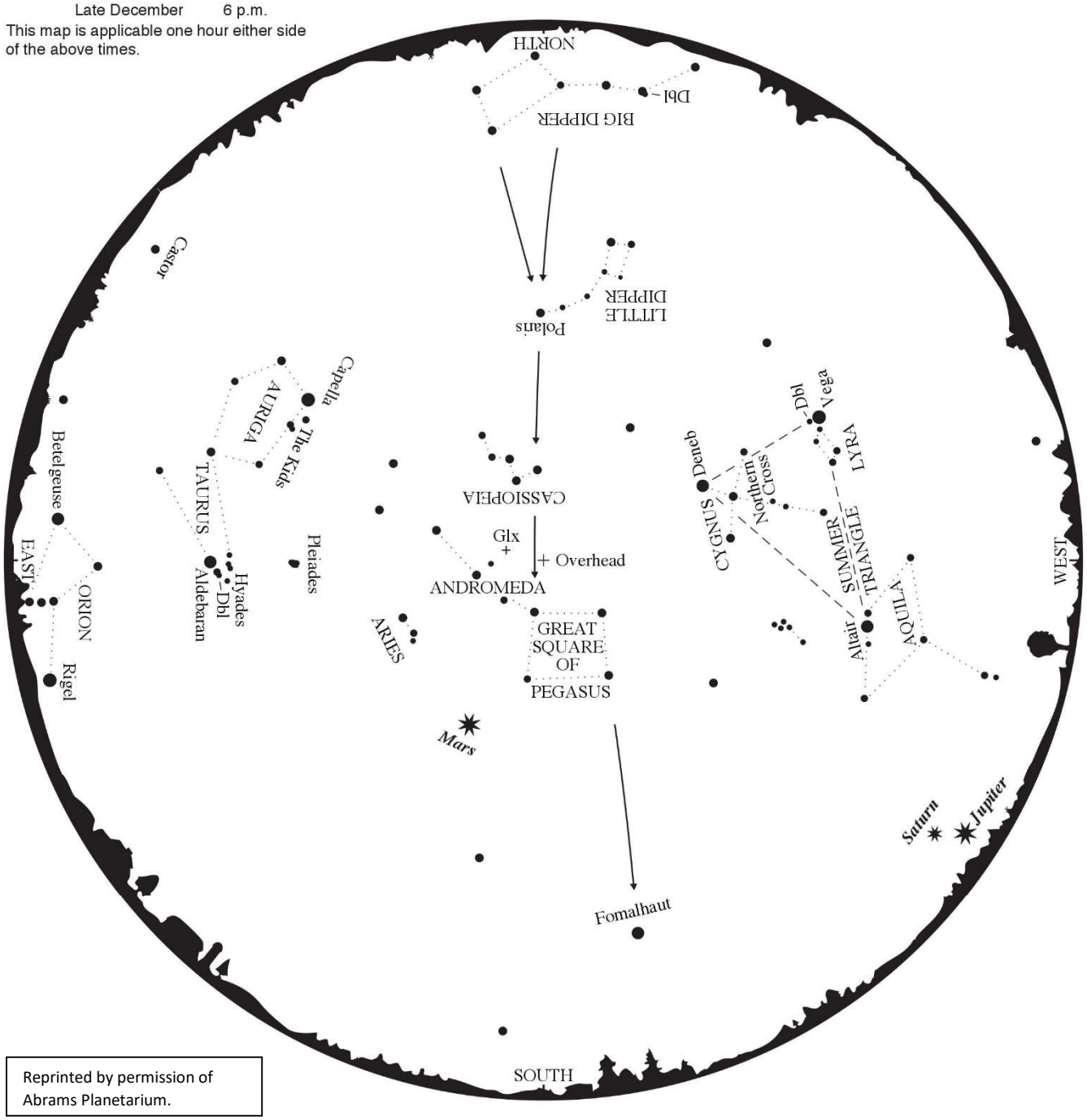

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The planets Mars, Jupiter, and Saturn are plotted for mid-November 2020. At chart time eleven objects of first magnitude or brighter are visible. In order of brightness they are:Jupiter, Mars, Vega, Capella, Rigel, Saturn, Betelgeuse, Altair, Aldebaran, Fomalhaut, and Deneb. In addition to stars, other objects that should be visible to the unaided eye are labeled on the map. The double star (Dbl) at the bend of the handle of the Big Dipper is detectable low in the north. Another is close to Aldebaran in the "face" of Taurus. More closely spaced is the double star near Vega in Lyra. The position of an external star system, called the Andromeda Galaxy after the constellation in which it appears, is also indicated (Glx). Try to observe these objects with unaided eye and binoculars.

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SKY CALENDAR DECEMBER 2020

An aid to enjoying the changing sky

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http://twitter.com/AbramsSkyNotes
http://abramsplanetarium.org/

Use this scale to measure angular distances between objects on diagrams below.

0° 10° 20°

Evenings: Jupiter and Saturn form a striking, close pair in SW sky at dusk, within 2.2° apart on Dec. 1, closing to just over 6 arcminutes (0.1°) apart on Monday, Dec. 21, and reopening to nearly 1.2° apart on Dec. 31. During Dec. 12-29, the two giant planets appear within 1°, easily fitting within a low-power telescope field. Evenings around Dec. 21, try higher magnifications for closer views of Jupiter's cloud belts, system of four Galilean satellites, and Saturn with rings 21° from edge-on, all within one field!

The pairing of Jupiter-Saturn in Capricornus on Dec. 21, 2020 is their closest since a conjunction in Cancer in 1623, and until another in Capricornus in 2080. Jupiter-Saturn pairings occur at intervals of about 20 years, just over two-thirds of the way eastward (or nearly one-third of the way westward) around the zodiac on each successive occasion. At their next two pairings, in Virgo on the morning of Oct. 31, 2040, and in Taurus within 5° S of the Pleiades on the evening of April 7, 2060, they'll appear 1.1° apart. This month, Jupiter at mag. –2.0 is the brightest evening "star," following Sun over WSW horizon by 3.3 hours on Dec. 1, by 2.3 hours on Dec. 21, and 1.7 hours on Dec. 31 (from lat. 40° N). Saturn at mag. +0.6 is about one-tenth as bright.

Mars is high in SW sky at dusk. Fading from mag. –1.1 to –0.2 this month as Earth pulls away, the red planet ranks next in brightness after Jupiter among early evening's "stars"; claims first place when Jupiter sets; and then drops back to second when Sirius appears in ESE. During Dec. 1-31, Mars goes 10° east against the faint constellation Pisces. Binoculars help you enjoy these passages: Mars 1.0° S of 4.3-mag. Epsilon Psc on Dec. 4; within 6° N of gibbous Moon on Dec. 23; 4.5° S of 3.6-mag. Eta Psc on Dec. 31; 2.5° N of 4.3-mag. Omicron Psc on Jan. 1, 2021; and 1.6° N of 5.7-mag. Uranus on Jan. 20.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Dec 6-8, one hour before sunrise	**Mon Dec 7** Last Quarter Moon 7:37 p.m. EST **Mon Dec 14** New Moon 11:17 a.m. EST	**Tues Dec 1, one hour after sunset**	**Dec 2-4, one hour before sunrise** **Fri 4**	**Thurs Dec 3, one hour after sunset**	**Dec 10-12, one hour before sunrise** **Thurs 10**	**Sat Dec 5, one hour after sunset**
Sunday Dec 13, 40 minutes before sunrise	**Total solar eclipse** Chile and Argentina.	**Mon Dec 14, two hours after sunset**	**Tues Dec 15, 40 minutes after sunset**	**Wed Dec 16, one hour after sunset**	**Dec. 12, 16: Planets near old, young crescent Moon. On Sat. Dec. 12 at dawn, don't miss** 7-percent waning crescent **Moon 4° upper right of Venus.**	**Sat Dec 12, one hour after sunset**
Peak of Geminid meteors night of Dec. 13-14.		Solstice Dec. 21, 5:02 a.m. EST. Winter begins in N hemisphere			**On Wed. Dec. 16 at dusk, catch** 2.3-day, 7-percent waxing crescent **Moon 5° below Jupiter and Saturn. Only five days before the planets' Dec. 21 closest pairing, Ju-Sa will appear 32 arcminutes or one Moon-diameter apart!**	
Sunday Dec 20, one hour after sunset	**Sunday Dec 20, one hour after sunset (telescopic view)**	**Mon Dec 21, one hour after sunset**	**Mon Dec 21, one hour after sunset (telescopic view)**	**Tues Dec 22, one hour after sunset**	**Tues Dec 22, one hour after sunset (telescopic view)**	**Sat Dec 19, one hour after sunset**
						Jupiter-Saturn separations for central U.S.
Dec 26-29, 40 minutes after sunset	**Mon Dec 21** First Quarter Moon 6:41 p.m. EST **Tues Dec. 22, predawn hours** Peak of Ursid meteors **Tues Dec 29** Full Moon 10:28 p.m. EST **Tues Dec 29, 40 minutes before sunrise**	**Wed Dec 23, 40 min before sunrise** **Wed Dec 30, one hour after sunset**	**Wed Dec 23, two hours after sunset**	**Uranus**, mag. 5.7, is W of line from 2.0-mag. Hamal (Alpha Ari) to 4.3-mag. Mu and 2.5-mag. Alpha in Cetus. (See Nov. 13, Dec. 14, 23.) Using binoculars, start at 4.3-mag. Mu Ceti or 4.3-mag. Xi-2 Ceti, and star-hop to Uranus, noting position relative to 5.7-mag. stars 31 and 19 Ari, 6.0-mag. 29 Ari, and 5.5-mag. Xi Ari. **Neptune**, of mag. 7.9, is ¾° to 1° ENE of 4.2-mag. Phi Aquarii.	**Sat Dec 26, one hour after sunset** **Dec 29-31, one hour before sunrise** **Thurs 31**

John S. French, Shannon E. Schmoll, Robert C. Victor
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Holiday Gift Idea: Subscription: $12.00 per year, starting anytime, from Sky Calendar, Abrams Planetarium, Michigan State University, 755 Science Rd, East Lansing, MI 48824 or online at abramsplanetarium.org/skycalendar/

December Evening Skies

This chart is drawn for latitude 40° north, but should be useful to stargazers throughout the continental United States. It represents the sky at the following local standard times:

Late November	10 p.m.
Early December	9 p.m.
Late December	8 p.m.
Early January	7 p.m.
Late January	6 p.m.

This map is applicable one hour either side of the above times.

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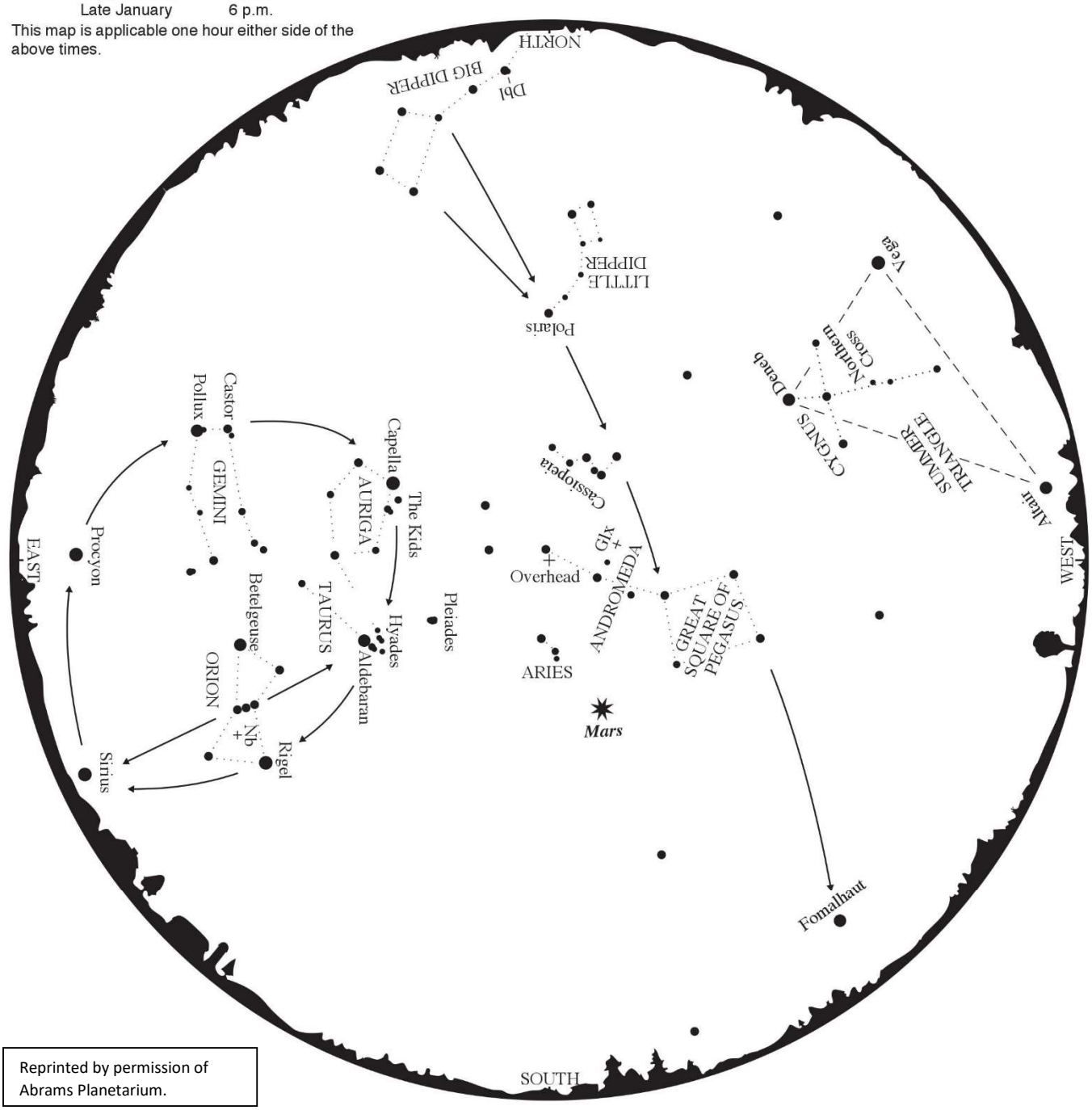

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Mars is plotted for mid-December 2020. At chart time 12 objects of first magnitude or brighter are visible. In order of brightness they are: Sirius, Mars, Vega, Capella, Rigel, Procyon, Betelgeuse, Altair, Aldebaran, Pollux, Fomalhaut, and Deneb. In addition to stars, other objects that should be visible to the unaided eye are labeled on the map. The double star (Dbl) at the bend of the handle of the Big Dipper should be detectable above the tree tops in the north. The famous Orion Nebula, a cloud of gas and dust out of which stars are forming, is marked (Nb) in that constellation. The position of an external star system, called the Andromeda Galaxy after the constellation in which it appears, is also indicated (Glx). Try to observe these objects with unaided eye and binoculars.

—D. David Batch

I I : Tra start: 1 Nov 2020 0:02
I : Sha start: 1 Nov 2020 1:16
I : Tra end : 1 Nov 2020 2:18
I : Sha end : 1 Nov 2020 3:33
III: Tra start: 1 Nov 2020 17:34
III: Tra end : 1 Nov 2020 20:59
I : Occ start: 1 Nov 2020 21:10
III: Sha start: 1 Nov 2020 22:35
I : Ecl end : 2 Nov 2020 0:42
III: Sha end : 2 Nov 2020 2:07
II : Occ start: 2 Nov 2020 10:24
II : Ecl end : 2 Nov 2020 15:43
I : Tra start: 2 Nov 2020 18:31
I : Sha start: 2 Nov 2020 19:45
I : Tra end : 2 Nov 2020 20:48
I : Sha end : 2 Nov 2020 22:02
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IV : Sha start: 3 Nov 2020 13:21
I : Occ start: 3 Nov 2020 15:40
IV : Sha end : 3 Nov 2020 17:58
I : Ecl end : 3 Nov 2020 19:11
II : Tra start: 4 Nov 2020 4:36
II : Sha start: 4 Nov 2020 7:05
II : Tra end : 4 Nov 2020 7:27
II : Sha end : 4 Nov 2020 9:57
I : Tra start: 4 Nov 2020 13:01
I : Sha start: 4 Nov 2020 14:14
I : Tra end : 4 Nov 2020 15:17
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III: Occ start: 5 Nov 2020 7:46
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Jupiter's Moons Events in November 2020

Here are times for the shadow, transit, occultation, and eclipse events for Jupiter's four major satellites over the above time period.

I = Io = innermost satellite
II = Europa
III = Ganymede
IV = Callisto = outermost satellite

All times are in Universal Time (UT). To convert to Central Time subtract 5 hours if CDT, 6 if CST.

Data courtesy of www.projectpluto.com

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1 Nov 2020 18:12	17 Nov 2020 1:37	2 Dec 2020 9:04	17 Dec 2020 16:30
2 Nov 2020 4:07	17 Nov 2020 11:33	2 Dec 2020 19:00	18 Dec 2020 2:26
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2 Nov 2020 23:59	18 Nov 2020 7:25	3 Dec 2020 14:51	18 Dec 2020 22:18
3 Nov 2020 9:55	18 Nov 2020 17:21	4 Dec 2020 0:47	19 Dec 2020 8:14
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10 Nov 2020 0:48	25 Nov 2020 8:14	10 Dec 2020 15:41	25 Dec 2020 23:07
10 Nov 2020 10:44	25 Nov 2020 18:10	11 Dec 2020 1:37	26 Dec 2020 9:03
10 Nov 2020 20:40	26 Nov 2020 4:06	11 Dec 2020 11:33	26 Dec 2020 18:59
11 Nov 2020 6:36	26 Nov 2020 14:02	11 Dec 2020 21:28	27 Dec 2020 4:55
11 Nov 2020 16:32	26 Nov 2020 23:58	12 Dec 2020 7:24	27 Dec 2020 14:51
12 Nov 2020 2:27	27 Nov 2020 9:54	12 Dec 2020 17:20	28 Dec 2020 0:47
12 Nov 2020 12:23	27 Nov 2020 19:49	13 Dec 2020 3:16	28 Dec 2020 10:43
12 Nov 2020 22:19	28 Nov 2020 5:45	13 Dec 2020 13:12	28 Dec 2020 20:38
13 Nov 2020 8:15	28 Nov 2020 15:41	13 Dec 2020 23:08	29 Dec 2020 6:34
13 Nov 2020 18:11	29 Nov 2020 1:37	14 Dec 2020 9:03	29 Dec 2020 16:30
14 Nov 2020 4:07	29 Nov 2020 11:33	14 Dec 2020 18:59	30 Dec 2020 2:26
14 Nov 2020 14:02	29 Nov 2020 21:29	15 Dec 2020 4:55	30 Dec 2020 12:22
14 Nov 2020 23:58	30 Nov 2020 7:25	15 Dec 2020 14:51	30 Dec 2020 22:18
15 Nov 2020 9:54	30 Nov 2020 17:20	16 Dec 2020 0:47	31 Dec 2020 8:13
15 Nov 2020 19:50	1 Dec 2020 3:16	16 Dec 2020 10:43	31 Dec 2020 18:09
16 Nov 2020 5:46	1 Dec 2020 13:12	16 Dec 2020 20:39	

Great Red Spot

Transits in Nov/Dec 2020

Here are times for the transit of the Great Red Spot over the above time period. A transit is when the middle of the Spot passes through the middle latitude of the planet.

All times are in Universal Time (UT). To convert to Central Time subtract 5 hours if CDT, 6 if CST.

Data courtesy of www.projectpluto.com

Comets in November and December

This section lists all of the comets that are prominent in the sky, the visual magnitude and the declination of the comet. Brighter comets (lower magnitude) at higher declinations (higher h) are the best candidates to observe.

Month	*Evening*			*Midnight*			*Morning*		
	Comet	**Mag**	**h**	**Comet**	**Mag**	**h**	**Comet**	**Mag**	**h**
2020 Nov	C/2020 M3 (ATLAS)	8	8	**C/2020 M3 (ATLAS)**	**7**	**79**	**C/2020 S3 (Erasmus)**	**7**	**30**
	88P/Howell	**9**	**24**	**156P/Russell- LINEAR**	**12**	**24**	**C/2020 M3 (ATLAS)**	**7**	**56**
	156P/Russell- LINEAR	**12**	**63**	**P/2020 P2 (Boattini)**	**12**	**44**	C/2020 P1 (NEOWISE)	11	10
	141P/Machholz 2	**13**	**29**	**29P/Schwassmann-Wachmann 1**	**13**	**82**	C/2019 N1 (ATLAS)	12	10
	29P/Schwassmann-Wachmann 1	**13**	**81**				**P/2020 P2 (Boattini)**	**12**	**21**
							29P/Schwassmann-Wachmann 1	**13**	**24**
2020 Dec	**C/2020 M3 (ATLAS)**	**8**	**42**	**C/2020 M3 (ATLAS)**	**8**	**89**	C/2020 S3 (Erasmus)	7	2
	88P/Howell	**10**	**26**	**P/2020 P2 (Boattini)**	**12**	**54**	**C/2020 M3 (ATLAS)**	**8**	**30**
	141P/Machholz 2	**11**	**34**	**156P/Russell- LINEAR**	**12**	**22**	C/2019 N1 (ATLAS)	12	11
	P/2020 P2 (Boattini)	**12**	**27**	**29P/Schwassmann-Wachmann 1**	**13**	**57**	C/2020 F3 (NEOWISE)	13	1
	156P/Russell- LINEAR	**12**	**76**						
	29P/Schwassmann-Wachmann 1	**13**	**81**						

Data courtesy of Seiichi Yoshida (http://www.aerith.net/comet/future-n.html