Winnicentrics

The Newsletter of the Winnipeg Centre of the Royal Astronomical Society of Canada

Upcoming Events

Next meetings
September 13, 2019
October 11, 2019

Members' Observing Night
September: TBA
October: TBA
Weather Permitting

September 19	**Oak Hammock Marsh Astronomy Night**
September 23	**Equinox**
September 28	**New moon**
October 9	**Draconids meteor shower**
October 17	**Oak Hammock Marsh Astronomy Night**
October 21	**Orionids meteor shower**
October 27	**New moon**
November 11	**Transit of Mercury**

Deadline for the next issue is October 27, 2019

Regular meetings of the Winnipeg Centre are 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.

One of the summer meetings, usually in June but occasionally July, is not at St. John's College but is instead a barbeque at either a member's house or at Glenlea. Check the RASC Winnipeg website (http://winnipeg.rasc.ca/) in summer months to confirm the dates and locations of meetings and social gatherings.

Meeting dates and places may be adjusted during exam times and during Bombers home games or other stadium events.

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Subscribe To Our YouTube Channel!

RASC Winnipeg meetings from January 2019 to the present are online at:

https://www.youtube.com/channel/UCI-5qhaejiUZHBnQdrbYDAA

If enough viewers subscribe to the channel, a more appropriate address using the RASC name can be obtained.

WHO, WHERE, WHEN?

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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.

If you have comments, questions, or concerns about Winnicentrics, you can contact any of the councillors above.

Notices

New member? We have a mentoring program. Whether your goal is to improve your knowledge of the night sky, set up a new telescope or explore astrophotography, help and advice is available. Contact Darren Hennig for details.

Explore The Universe

Congratulations to Robin Clarke, Corrine Robinson and Kevin Dromereski, who have all completed their Explore the Universe Certificate. They are a great example to us all.

Thanks also goes out to the Centre Volunteers like Darren, Bryan and others who host events where you can go out with members to observe and work on the various Observing Certificates the RASC has to offer.

Watch the email list for the next event, and in no time your name will appear here with Robin, Corrine and Kevin.

Clear Skies,
Dennis Lyons
Explore the Universe Coordinator, Winnipeg Centre

September 2019 Meeting Schedule

7:00 pm Beginner's Session: *My Summer as an Astrophysicist* by Jascha Peterson
7:30 pm Announcements
What's Up? Upcoming events in the sky
What's New? New discoveries in astronomy
8:30 pm Break for Coffee and Refreshments
9:00 pm Featured Presentation: *Building a Backyard Observatory* by Gord Tulloch

October 2019 Meeting Schedule

7:00 pm Beginner's Session
7:30 pm Announcements
What's Up? Upcoming events in the sky
What's New? New discoveries in astronomy
8:30 pm Break for Coffee and Refreshments
9:00 pm Featured Presentation

Astronomical Events
September – October 2019

The Planets

Mercury:
- Close to sun
- Transit of Mercury on November 11

Venus:
- Close to sun

Mars:
- Emerging from conjunction with sun, low in morning sky at dawn

Jupiter:
- Visible in evening sky to south-southwest

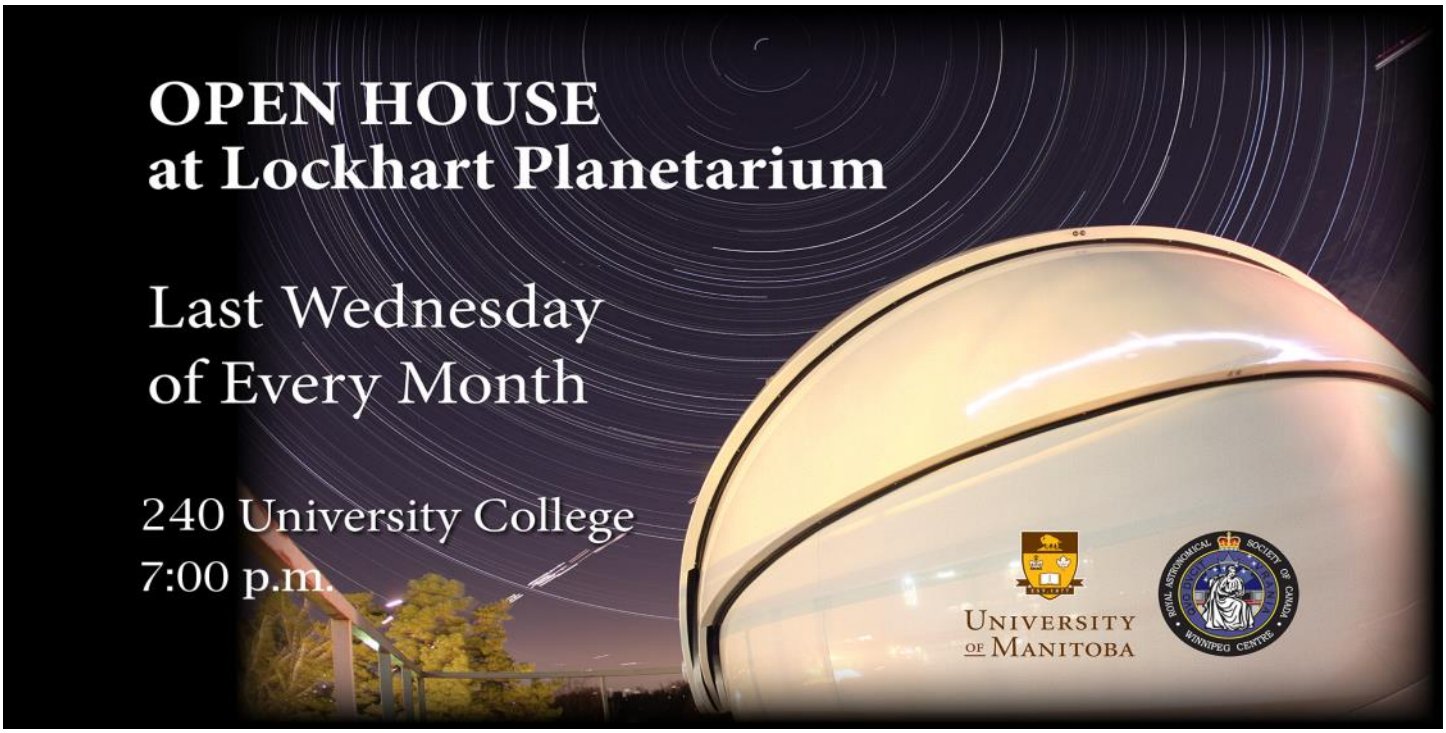
Saturn:
- Visible in south in evening, rings open to 25°

Uranus:
- Retrograde in Aries in late night sky
- October 28: At opposition

Neptune:
- September 10: At opposition near ϕ Aquarii
- Visible in first half of night

The Sky

- Zodiacal light: Visible in pre-dawn sky from approximately September 27 to second week of October
- October 9: Draconids meteor shower



AstroMAKEr: Frankenscope LIVES!

By Gord Tulloch, RASC Winnipeg Centre

Introduction

Through happy circumstances, I was recently reunited with a CG5 mount I used to own, which includes a pier mount for my observatory and a stock Celestron NexStar GOTO system and controller. Alas, the NexStar system has started to act up and occasionally with embark on runaway slews, which are not really conducive to a quiet evening of observing. So, it seems a good opportunity to test out a DIY computer control system. So, I stripped off the NexStar gear and put it up on AstroMart for parts – someone was willing to play $150 to fix his own CG5 so I was funded for my little project!

Figure 1 – The Frankenscope

In the meantime I added a C8 OTA and a bunch of electronics including an Orion Accufocus focuser motor and Shoestring USB controller, a Canon Rebel XTi DSLR as a main imager again with a Shoestring DSUSB controller, and an Orion Off-Axis Guider with an Orion Starshoot guide camera, all controlled via a tiny Raspberry Pi running the StellarMate LINUX operating system from INDI, a LINUX distribution specifically aimed at astronomy users. With all that stuff hanging off the scope, a secondhand CG5 with a secondhand C8 OTA on it, with a repurposed Home Depot surveyor's tripod to boot, the name Frankenscope came pretty easily for this scope!

After poking around the Internet a bit, I observed there are a couple of popular options for motor controller hardware: The AstroEQ (www.astroeq.co.uk) version of the EQMOD electronics, or the OnStep (https://groups.io/g/onstep/wiki) LX200-compatible electronics. OnStep is the brainchild of Howard Dutton (http://www.stellarjourney.com) and seems to have gained quite a following. Obviously LX200 mounts are pretty standard, so not a bad choice either. The OnStep software was quite a bit more capable so I decided to go with that, on a pre-built board so I didn't need to do any soldering. I actually got a couple of AstroEQ boards as well to build for other projects – more on this in another article.

This article looks at the options and how my build went. It also looks at how the CG5 revamp ended up working.

OnStep Electronics

The electronics for OnStep are pretty flexible – basically you can build a basic platform to run the software on solderless breadboards, assemble the circuit on printed circuitboards, or use a pre-assembled electronics platform and just add motors. It is Arduino-based, which is extremely heavily used for DIY electronics projects.

I decided to get a pre-assembled electronics platform instead of soldering something so I could make sure I had something workable by springtime. The easiest option seemed to be the MakeSpace MKS Gen-L v1.0 board. You can get these on Amazon, eBay etc. as they are commonly used as the brains behind DIY 3D printing platforms – cost is about $25, so pretty inexpensive. The beauty of these boards is there's pretty much zero soldering to be done, just plug and play. The downside is the performance of the processor in the board is a lot less than possible if you use a higher end processor but you need to build it yourself. The good news is it supports up to 24v motors so you can run some sizable motors on it. The Gen-L should work well with the CG5 using 12v motors, however.

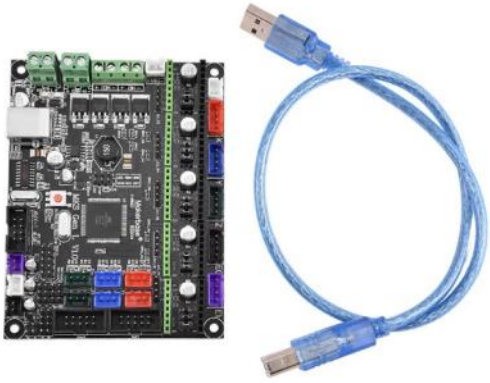


Figure 2 – MKS Gen L V1.0 Board

The board comes as pictured – an unmounted electronics board and a USB cable. To get it fired up, you need to mount it into a case (I used a cheap wooden box from the Dollar Store to prototype things until I knew what the final result would look like, then created a nice case with an aluminum project case for $25), add power and motor drivers, and connect the motors. The DRV8825 drivers actually plug directly into the board, so hookup is essentially plug and play.

OnStep Software

The OnStep software emulators an LX200 mount with a lot of support for other devices such as fans, focus motors, dew heaters, etc. Since the Gen-L board has a lot of ports on it, those things are available to me but for the first go-round, I just wanted to get the RA and Dec motors running.

Installing the software on the Gen-L board involves:

- Downloading the Arduino development environment (https://www.arduino.cc/en/Main/Software)
- Download the OnStep Firmware (on the Wiki above)
- Edit a configuration file to specify the physical characteristics of your mount and motors
- Plug the board into the USB cable provided and into a Windows PC running the Arduino development environment
- Upload the software

Once the software is up and running it now looks like you have an LX200 connected via the USB port of your computer. I tested the software running Starry Nights Pro 8 on my skinny little Surface tablet to ensure it was working properly, then connected the USB to the Raspberry Pi on the mount ,which will talk to the telescope while I operate it from remote via TeamViewer. Once again, an article unto itself!

CG5 Physical Mounting

The physical mounting of the motors (NEMA 17 describes the size of the mounting for the motor) requires some brackets be fabricated. This can be done in two ways – if you happen to have access to a 3D printer you can download a 3D model of the brackets (https://www.thingiverse.com/thing:1833860) and print them out (figure 3). I decided to go this route and although I don't have a 3D printer, I had the parts printed by 3dhubs.com. This site has a network of folks who will print out and ship items to you at a fairly low cost, in this case $25 + shipping. To use this service just upload the 3D models from thingiverse.com and select a material – I chose ABS as it's more resilient than other materials. Lego blocks are ABS and are indestructible!

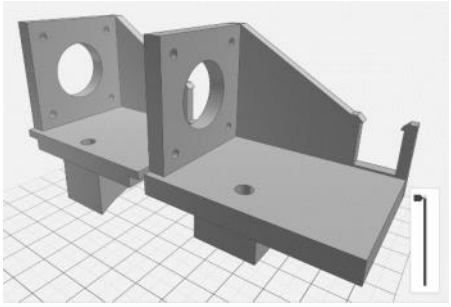


Figure 3 – RA and DEC brackets 3D model

Take a moment to reflect on the fact we can actually download and print out parts for our projects… we live in the freaking future!

Although I opted for 3D printing, fabricating mounts would not be a big chore - a pair of NEMA 17 steel brackets from Amazon.ca go for $10 ea free shipping. They are actually cheaper on eBay, but they come from China so expect a three-month wait! These brackets can be adapted to the CG5 by mounting a 4mm thick 45 by 45mm aluminum block for RA and a 10mm thick 45 by 20mm block for Dec to the slotted leg of the brackets. They have the advantage of the rigidity of welded steel and lateral adjust-ability to accommodate your drive train's setup.

Now the drive train can be made up of pretty much any gear sets, but I prefer a belt-and- pulley system to avoid backlash in the gearing. Over to eBay for a set of pulleys and 6mm belts – the large 80-tooth pulley attaches to the worm for the interior spur gear (1:144 ratio) and the small 20-tooth pulley is mounted on the 5mm motor shaft. I also got a 180mm belt after a few unsuccessful attempts to join the included belt to the right size – not real easy, so easier to buy one!

Figure 4 – Belt and pulleys

The gear ratio is thus increased by 4 (80/20 for the pulleys), resulting in a gear ratio of 1:576. That means the motor has to turn 576 times for one revolution of RA or DEC axis. Since the DRV8825 motor drivers allow 1/32 micro-stepping (micro-stepping makes each increment of the motor 1/12800th of a revolution instead of a full step of 1/400th, which improves the smoothness of the motion). So the maximum slew rate of the completed mount is about 1°/s, which is fast enough, and tracking resolution in arc-secs is 0.176, which results in smooth tracking for astrophotography. As you can see from Figure 8, the 80 tooth pulley was very close to too large for the mount, to the degree that on the Dec axis the 2 pulleys actually touch! But I like the higher gear reduction, so I made it work.

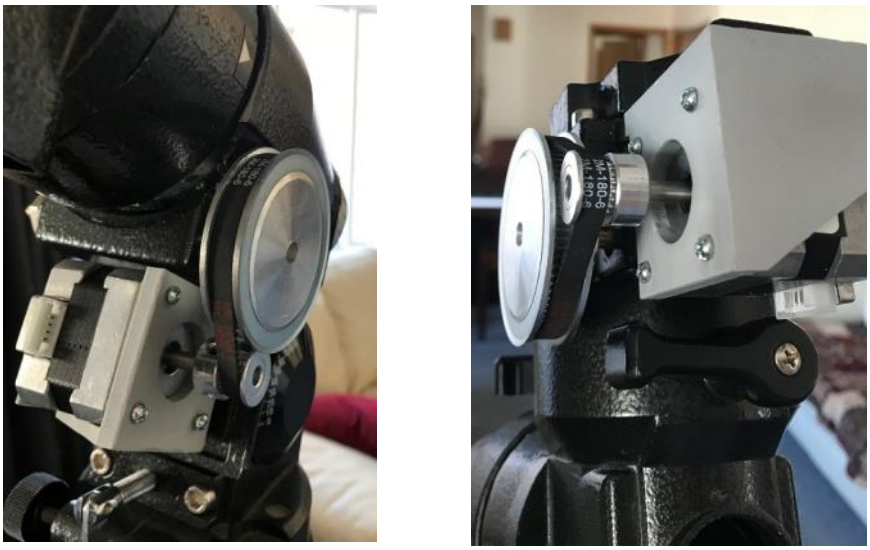


Figure 5 – Final RA / DEC gear configuration

The OnStep was connected to the motors via 6-conductor RJ-12 cables (like an RJ-11 phone cable except with six instead of four conductors) to cable to the motors. They're cheap, and can be cut to length and re-terminated with a cheap RJ11/RJ12 crimping tool. A 12V 5A power supply was procured from (you guessed it!) eBay for $25, which has plenty of current for the system. The OnStep also allows control of other motors such as focusers, so I'm in the process of moving from the Orion AccuFocus to a dedicated 1.8deg/step motor for focusing so I can reuse that system elsewhere.

I'm still getting my observatory ready for the summer now that the snow is gone (and it's not sitting in a foot of water!) but preliminary testing is positive for a smooth and reliable automated mount that I can run autonomously once I roll the roof back on the shed. Once I get the bugs out, time to do some photometry and exoplanet transit observations!

Any questions, feel free to send them to gord.tulloch@gmail.com.

A meteor and the Milky Way, captured by Sheila Wiwchar in late July 2019.

iPhone + Maksutov-Cassegrain picture of waxing crescent moon by Michelle Boyce, July 7, 2019. Image is flipped left/right by the Mak; Mare Crisium is in the upper left corner.

Achromat Testing
By Kevin Galka, RASC Winnipeg Centre

Back in April I purchased a used Celestron C6R, a 150mm achromatic refractor, for under $500. With a focal ratio of F8 it has a focal length of 1200mm. Achromatic scopes get a bad name a lot of the time, mainly due to chromatic aberration (CA), but I often wonder: Are they really so bad? Is the CA manageable in photography via post-processing? If so, how much? How about visual? How does it compare to apochromatic (APO)? These were questions I really wanted to answer.

The first I was able to do on my own. I imaged M81 & M82 on a DSLR, the FOV just right to get the two galaxies in frame. With a little post-processing I was able to control the CA quite well; as a matter of fact, I was surprised with the overall image. The color was quite rich and the stars, while displaying a little of the issues due to CA, were nice and tight. Now, the M81 field doesn't have a lot of bright stars and thus controlling the CA was quite easy, and perhaps, photographically, that's where achromats really have great value.

But what about visual? Having an APO to compare the C6R with would be great, but alas, I don't own one... but that's not how this test of the C6R ends. On the contrary, it turns out that this is something of interest and one nice day, when the stars aligned, I found myself looking through not one APO but three, a Mak, and two other achros! The results I experienced led to the realization that I needed a more controlled version of this test; however, I thought these preliminary findings warrant sharing, with a more systematic, controlled version coming out sometime in the future.

As the test was to see how the different achromats perform, my results will be mainly focused on them, using the APO's and Mak as reference points.

A list of scopes that were used:

Celestron C6R	150mm f8	- fl 1200mm (achromatic refractor)
Canadian Telescopes CT152	152mm f5.9	- fl 900mm (achromatic refractor)
Intes m500	127mm f10	- fl 1270mm (Mak-Cass)
Tak FS102	102mm f8.1	- fl 820mm (apochromatic refractor)
Celestron Nexstar 102 GT	102mm f9.8	- fl 1000mm (achromatic refractor)
Orion ED80	80mm f7.5	- fl 600mm (apochromatic refractor)
Skywatcher ED100	100mm f/10	- fl 1000mm (apochromatic refractor)

Targets:
Regulus
Messier 13
Vega
Jupiter (Note: Low on the horizon and a lot of turbulence)

Overall sky conditions:
- Seeing 4.5 (little to no turbulence except on the horizon)
- Transparency 4.3 (pollen in the air, low humidity)
- SQM reading 21.2 (SQM is a representation of overall sky conditions/darkness, obtained by a metering device)

The first target of the night was Regulus in Leo: Altitude approximately 26 degrees, west of the meridian.

- The APOs showed pinpoint stars in the FOV (field of view), no CA (though the ED80 had an extremely faint halo), pretty much what you'd expect in them.
- The C6R showed some CA. If the star was lined up straight with my pupil it wasn't bad; however, moving my head even a little caused CA to flare. Stars were pinpoint in the FOV.
- CT152 showed a little CA, less than the C6R. Stars were pinpoint in the FOV.
- 102GT showed almost no CA, least amount of the achros. Stars were pinpoint in the FOV.

The results of Regulus were the least controlled of all the tests. The apparent FOV wasn't approximate between the scopes and I just used whatever eyepiece was in the scope at the time (the C6R had 1.25" eyepiece and diagonal, which was swapped out to a 2" for the M13 test and the rest of the night). Overall, though, the achros performed quite well.

Next was Messier 13, the great globular cluster in Hercules: Altitude approximately 70 degrees, east of the meridian.

- The achros performed very well here as they were nearly, if not on par with, APOs and Mak in terms of pinpoint stars and lack of CA. The big achros really shined with their resolving power and light gathering, being able to resolve many stars in the cluster without losing much contrast when increasing the magnification.
- At this point, however, I was noticing something with the achros that I'd never heard mentioned before: The eyepiece being used seemed to affect the scope quite drastically.

Onto Vega: altitude approximately 63 degrees, east of the meridian.

After noticing the eyepiece variable earlier, I paid more attention to how the achros performed with different eyepieces. I started to try and approximate the FOV between the different scopes by changing out eyepieces (unfortunately I didn't really pay attention to the eyepieces themselves). This had some really interesting results.

- The C6R and CT152 both exhibited CA with higher magnifications, but as the FOV increased (less magnification) the CA started dropping off, and with a large FOV there was almost no CA -- on Vega! This was quite a surprise. The achros began to become more in line with the 80ED, with an extremely dim, largish halo around Vega. The CA did not appear to drop off at the same ratio as the FOV increase but was almost more logarithmic with diminishing returns to the point where CA was nonexistent.
- On the 102GT CA was low to start with, and any increase in FOV pretty much removed it altogether.

And finally, Jupiter: altitude approximately 16 degrees, east of the meridian.

- Though never reaching that high in the sky, most of the scopes made their way to Jupiter to wind down the night. Turbulence was an issue and magnification could not be pushed very high.
- Of the achros, the C6R suffered the greatest amount of CA while the 102GT had next to none. This may have been a direct result of magnification, but being the end of the night, I didn't really check.

Another thing I was looking at was color. While all the scopes showed great color throughout the night, I was curious how Jupiter would fare. The richest color came from the 102GT, with (Gerry's APO) a close second and the big achros relatively

washed out. I hope to try and determine if this was because of aperture or some other factor. Unfortunately, I didn't get a chance to look at Jupiter through the Mak.

With the haphazard testing that was run throughout the night, it really showed that a more controlled approach was needed to explain what was experienced. Was CA, or the lack thereof, strictly a magnification/FOV issue with the achros or was the eyepiece and diagonal also part of the equation? On the drawing board is a test to include all the scopes running at similar or same FOV on each of the targets, ideally with the same brand and model of eyepiece, just different focal lengths. Also, different brands of eyepieces with the same focal length to test how much of a difference the eyepiece itself makes.

One test that I didn't do, and wished I had, was to push each of the scopes to their respective maximum magnification. Do the achro optics begin to "break down" at some point, do they continue to be near APO performance on certain targets? Certainly, with bright(er) stars the CA becomes extremely noticeable at higher magnification, and the APOs outperform the achros easily, but with M13 CA was near-nonexistent. This scenario could lead to issues if trying to split bright doubles where an increase in the magnification could cause CA to blind out the companion -- certainly something an APO doesn't have to worry about.

Overall, however, it was a very interesting and informative night that also introduced questions I never thought to ask. The achros all performed surprisingly well, with the 102GT appearing to lead the pack in terms of color and lack of CA. The APOs and Mak were, as expected, great scopes and looking through the eyepiece was a pleasure each and every time.

Birds Hill Park Members' Nights Continue

As an alternative to the Glenlea Observatory, the east side of Birds Hill Park is proving to be a popular place for RASC Winnipeg Centre. Both new members in the Mentoring Program and more experienced observers have met at the site numerous times this summer, including back-to-back sessions on July 20 and 27.

Take Highway #59 north from Winnipeg, turn east onto Garvin Road (PR #213) and then north at PR #206 until you see the Birds Hill Park sign. (If accessing the park via the main entrance on #59, take either North or South Drive and then go east on Festival Drive.) The observing site is on the south side of Festival Drive just inside the east gate, accessible via a short dirt road.

A Manitoba parks pass, available at liquor stores and hunting/ fishing outlets, is recommended.

Events are announced through the RASC Winnipeg mailing list a few days in advance, along with weather updates and cancellation notices.

(Photo credit: Bryan Stach)

Some late-breaking news in astronomy

Weather on Venus affected by dark patches in atmosphere

The cloud cover surrounding Venus features dark patches currently labelled "unknown absorbers." By absorbing solar radiation, these areas increase atmospheric temperature and affect wind patterns over the planet.

The composition of the unknown absorbers is currently unknown, but possibilities include sulfur, ferric chloride , or microorganisms. Ongoing monitoring of weather patterns, and sampling of the cloud layer, may one day shed light on the mystery.

http://www.astronomy.com/news/2019/08/mysterious-dark-patches-in-venus-clouds-are-affecting-the-weather-there

A glimpse across the Milky Way

The far side of the Milky Way galaxy is known as the *Zona Galactica Incognita* because of the difficulty in viewing it through stars and clouds of dust. A study, soon to be published in the Astrophysical Journal, describes the results of analyzing five years of observations from the Vía Líactea ESO Public survey. The longer wavelength of near-infrared is able to penetrate the dust, and has revealed over 1100 new stars, all Cepheids. These variable stars, with the younger ones closer to the galactic centre, may provide insights into the shape of the Milky Way.

http://www.astronomy.com/news/2019/08/new-images-illuminate-milky-ways-mysterious-far-side

First pair-instability supernova found?

The normal outcome for a large star at the end of its lifecycle is to explode in a supernova and then collapse into either a neutron star or a black hole. A particularly massive star, however, can theoretically experience an explosion that results in its destruction: The high mass in the core triggers runaway fusion that blows the star apart before it can collapse into a black hole. This is a *pair-instability supernova*, named for the electron-positron pairs that form at the core.

SN 2016iet is a potential example of this class of supernova. This isolated star, 54,000 light years from the closest galaxy and almost a billion light-years from Earth, was estimated to have had between 55-120 solar masses before it exploded. It was also in an area of low metallicity, with primarily hydrogen and helium and little in the way of heavier elements -- similar to conditions in the early universe.

https://www.skyandtelescope.com/astronomy-news/supernova-that-destroyed-its-star/

Space telescope one step closer to first light

NASA's James Webb Space Telescope, an infrared observatory designed in conjunction with the Canadian Space Agency, European Space Agency and other partners, has been successfully assembled for the first time. The device, which combines instrumentation, mirrors, multi-layered sun screen and spacecraft, will undergo further testing before deployment in 2021.

https://www.nasa.gov/feature/goddard/2019/nasa-s-james-webb-space-telescope-has-been-assembled-for-the-first-time

Spruce Woods 2019

The Spruce Woods Star Party was attended by 60 participants this year!

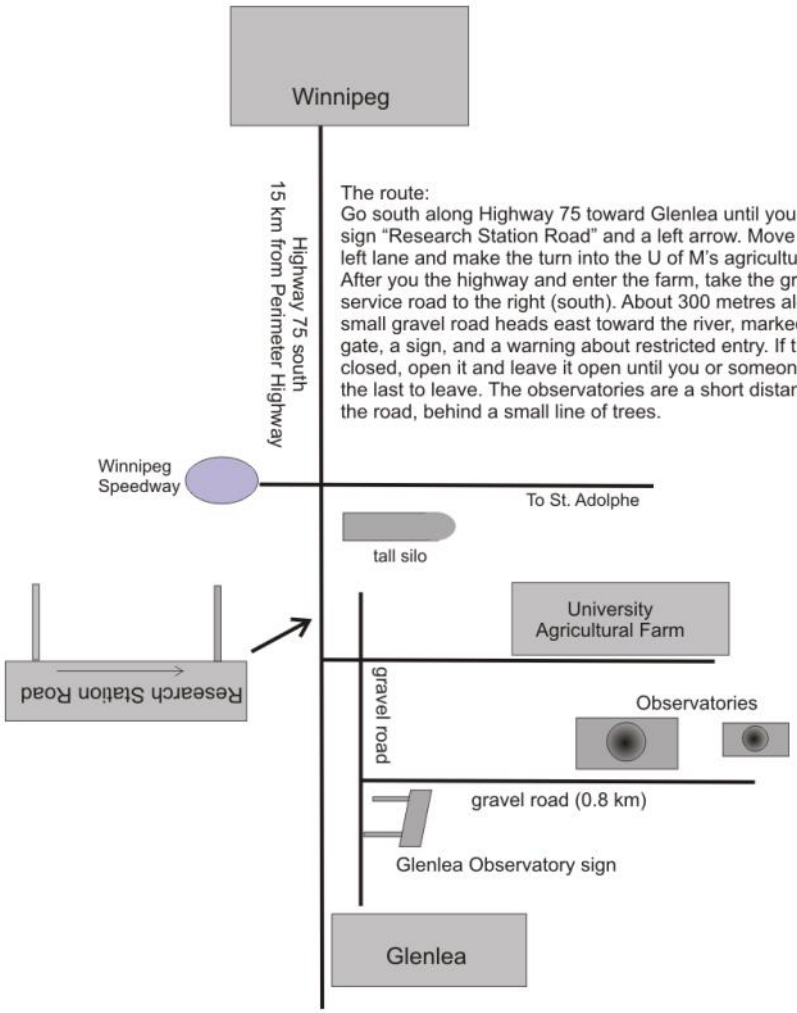
Dedicated volunteers set up an event that included awesome astronomy lectures at the interpretive centre from Gord Tulloch on all issues surrounding telescopes and Dr. Samar Safi Harb presented on neutron stars and explosion remnants that make the heavy elements essential for life.

During a cloudy night everyone gathered at the cabin where Gerry Smerchanski gave a presentation on his binocular tour which was also delivered during his sky tour under starry skies on Sunday night! It was another accomplished SWSP where we explored many different astro-gear setups, held a “walk in” equipment clinic, shared views of pristine dark skies and made many new friendships!

SWSP has proved to be an ideal event for amateur astronomers and your SWSP committee is already busy planning for 2020 – we hope to see many of you there!

SWSP Committee

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 cement 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.