

Saskatoon Skies

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

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To view *Saskatoon Skies* digitally, see our website:

<http://www.usask.ca/rasc/newsletters.html>

In This Issue:	
Membership Information / Officers of the Centre	2
Newsletter Info	3
U of S Observatory / Light Abatement Info	4
Calendar of Events / Notice of Meeting	5
Speakers for Meetings / Clear Sky Chart / Weather Info	6
Visual Observing for February	7-8
February Night Sky Events and Info / Book Drive Info	8-11
Minutes of January Meeting	12-14
Comets of 2019 and 2020 / Wintershines	14-15
Books for Sale / International Day of Women and Girls in Science	16-17
Observing Clubs and Certificates	18-19

MEMBERSHIP? JOIN TODAY!

Regular: \$96.00 /year

Youth: \$52.00 /year

Family: \$90.50 + \$41/additional adult + \$21.10/additional youth

The Saskatoon Centre operates on a one-year revolving membership. You will be a member for the next 12 months no matter when in the year you join. Members are encouraged to renew early to avoid disruption in publications. Renew through the National Office at <http://www.rasc.ca/join>.

Benefits of Membership in the Saskatoon Centre

- knowledgeable & friendly amateur astronomers
- use of the Sleaford Observatory
- use of the U of S Observatory (after training)
- Saskatoon Skies Newsletter
- Observer's Handbook
- Journal of the RASC (electronic format)
- SkyNews Magazine (bimonthly)
- borrow the Centre's projector to give astronomy outreach presentations – contact Les Dickson at astrochem@sasktel.net
- rent the Centre's Telescopes <https://www.usask.ca/rasc/telescopes.html>
- use of the Centre library

SASKATOON CENTRE'S MAIN OFFICERS:

President – Daryl Janzen

Vice-President – Jim Goodridge

Secretary – Rina Rast

Treasurer – Norma Jensen

National Council Rep – Les Dickson

Canadian Tire money - Darrell Chatfield

If you cannot attend a meeting but would like to donate your Canadian Tire money please email Darrell at novachat@sasktel.net.

Speakers are also needed for upcoming meetings. If anyone has a topic they would like to present on, even for a few minutes, please contact Rick Huziak at rickhuziak@shaw.ca.

NEWSLETTER INFO

Newsletter Editors – Colin Chatfield, Grant Ursaki

Copy & Collate – Les & Ellen Dickson

Labels & Temps – Mark de Jong

Web Posting – Gord Sarty

Saskatoon Skies is published monthly by the Saskatoon Centre of the RASC. Distribution is approximately 100 copies per issue. Saskatoon Skies welcomes unsolicited articles, sketches, photographs, cartoons, and other astronomy or space science material. Submissions should be sent by e-mail to the editor at colcha@sasktel.net in MS Word or text format. Images (new or old): any format, less than 30MB, sent by e-mail as attached files. Send any articles of interest to the night sky or astronomy. **Deadline for submission of all articles for an upcoming issue is the first Friday of each month!**

Saskatoon Skies is also posted on our Saskatoon Centre homepage as a .pdf file and can be downloaded free-of-charge. Members may choose to receive the newsletter by regular mail or via the Internet. Articles may be reprinted from Saskatoon Skies without expressed permission (unless otherwise indicated), provided that proper source credit is given. Saskatoon Skies accepts commercial advertising. Please email the editor at colcha@sasktel.net for rates. Members can advertise non-commercial items for free.



M31 taken by Rina Rast and Brennan Rodgers in Jan. 2020 using the 11" Astrograph on the Physics building at the U of S and a ZWO 294 MC Pro Camera

U OF S OBSERVATORY

The U of S Observatory is open to the general public every Saturday of the year. Admission is free. The observatory is located on campus, one block north of the Wiggins Avenue and College Drive entrance. On clear nights, visitors may look through the vintage 6-inch and tour several displays. Current events are recorded on the Astronomy Information Line at 306-966-6429.

Observatory Hours:

January – February	7:00 – 9:30 pm
March	8:00 – 10:30 pm
April – August	9:15 – 11:45 pm
September	8:30 – 11:00 pm
October – December	7:00 – 9:30 pm

U of S Observatory website -

<https://artsandscience.usask.ca/physics/facilities/observatory.php>



Saskatchewan Light Abatement Committee -

<http://myotherlife.net/slpac/>



www.darksky.org

RASC CALENDAR OF EVENTS

February 22	Observer's Group (weather permitting)	Larry Scott
February 24	RASC General Meeting - 8:00pm (info below)	Daryl Janzen
February 24	Visual Observing for Beginners - U of S Observatory	Jim Goodridge

For a complete list of club events, please visit: <http://www.usask.ca/rasc/activities.html>

February RASC General Meeting

for all members and guests

Join us on February 24, 2020 at 8:00PM

Room 175, Physics Building
University of Saskatchewan

7:00pm - **RASC Executive Meeting** (Members may attend the executive meeting as observers if they wish)

8:00pm - **Meet & Greet Social**

8:15pm - **Warm-up Program**

8:30pm - **Main Program**

Speakers include:

- **Jim Goodridge** - "What's Up in the Sky This Month"

- **Rick Huziak** - "So What's Betelgeuse Doing Now?" In January, Rick described the historic fading episode that Betelgeuse had begun. What's it doing now? Only more observations (and this talk) will tell!

- **Mike Dolan** - "DigiCamControl: Freeware for Your DSLR" Mike will demonstrate this downloadable software. Control your camera settings remotely from your Windows PC via USB. Trigger image capture via release button on the camera or remotely from your computer. Handhold the camera, shoot, and have the resulting images displayed on the computer monitor. You can remotely auto-focus or manually adjust the focus, and lots more. It's free, and it works!

9:45pm - **Visual Observing for Beginners** at the U of S Observatory. Jim Goodridge will be leading beginning observing sessions at the observatory for new members and beginning observers. Easy projects for eyes, binoculars & telescopes. No charge.

9:45pm - After Meeting Meeting Social at Alexander's restaurant (Cumberland Ave) for those interested

SPEAKERS FOR MEETINGS

Rick Huziak

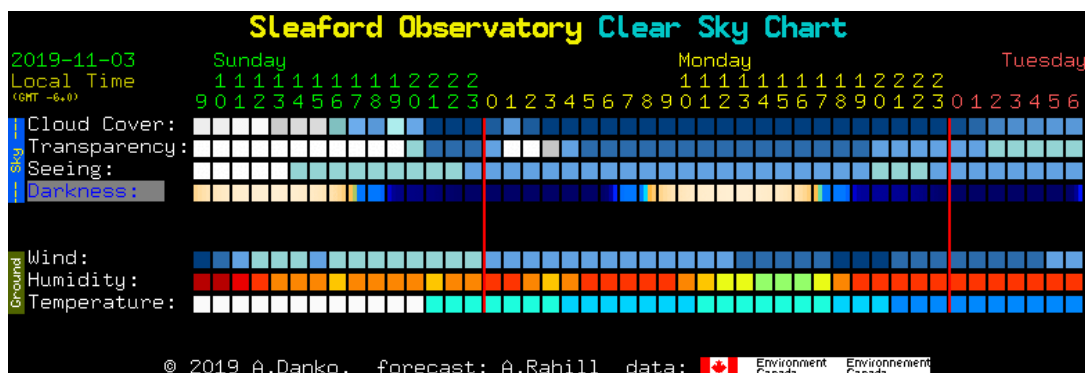
Getting speakers for each general meeting is harder than pulling teeth - plain and simple. Luckily, just before this newsletter went to press, we filled the slate of speakers for February, but going forward, we have only three speakers lined up until the end of the season. In March, Les Dickson will use an SSSP 2019 slide show to announce SSSP 2020. Daryl Janzen will talk about U of S telescopes, and then later in the spring, Gord Sarty will talk about his Space MRI. But with three other main talks and three minor talks to fill the agenda with, it is highly likely that you will be listening to talks about my favourite variable stars or the latest light pollution crisis ... again. So, please volunteer to give a talk about your favourite astronomy topic or experience. It doesn't have to be long and everyone has some sort of interest in the sky. As a matter of fact, there is an entire universe out there to talk about! So, be it 5 minutes or 55 minutes. I'd love to hear from you ... before the March newsletter deadline!

CLEAR SKY AND WEATHER INFO

To find clear skies, visit the Clear Dark Sky website -

<https://www.cleardarksky.com/csk/>

Once there, one can enter your location to find clear skies. The chart will appear as follows:



Environment Canada provides weather information for astronomy -

www.weather.gc.ca/astro

VISUAL OBSERVING FOR FEBRUARY

Jim Goodridge

(Carried over from January)

This month the focus is on six constellations: Auriga, Gemini, Orion, Eridanus, Lepus, and Taurus. In those six constellations our targets include: 10 Messier objects; 11 Finest NGC objects; 16 double stars and 5 variable stars. All of the variable stars can be observed with binoculars and most of the double stars can be split in 10X50 binoculars. The double stars will benefit from increased magnification though, so it is best to use a telescope.

The Messier objects are all available in small telescopes and most are visible in binoculars but all of them benefit from increased aperture. Alan Dyer compiled the Finest NGC list using a Celestron C8 but most will be good in a six inch, but again, aperture is king.

Everything on the list is in Sky and Telescopes "Pocket Sky Atlas" and by the time our meeting comes about I will have binocular charts for the Variable Stars from the AAVSO available.

In choosing the objects I use the Messier list and Finest NGC list in the RASC Observers Handbook, the AAVSO Binocular Variable Star List and the Double Star Observing lists (binocular and telescope) from the Astronomical League as well as "Double Stars for Small Telescopes" by Sissy Haas. I then cross reference to other books including but not limited to "Celestial Harvest"; "Celestial Sampler"; "Turn Left at Orion"; "Deep Sky Wonders"; "Binocular Astronomy". And then everything is checked against the "Pocket Sky Atlas".

I will go over the object locations during the "What's Up This Month" presentation at the January RASC Saskatoon Centre meeting. Also I hope we can observe some of the objects using the T Cook and Sons refractor at the U of S Observatory after the meeting.

Don't forget to look at the constellations listed as well and note the brightest stars in each.

Auriga: Messier M36, M37, M38; Finest NGC: NGC1931; Double Stars Theta; Variable Stars UU Aur.

Gemini: Messier M35; Finest NGC: NGC2371/2, NGC 2392; Double Stars Alpha, Delta, 20; Variable Stars BU Gem.

Orion: Messier M42, M43, M78; Finest NGC: NGC1788, NGC1973, NGC2022, NGC2024, NGC2194; Double Stars Delta, Theta1, Theta2, Beta, Lambda, Iota, Sigma, Zeta; Variable Stars W Ori, Alpha Ori.

Eridanus; Finest NGC: NGC1232, NGC1535; Double Stars 32.

Lepus: Messier M79; Double Stars Gamma; Variable Stars R Lep.

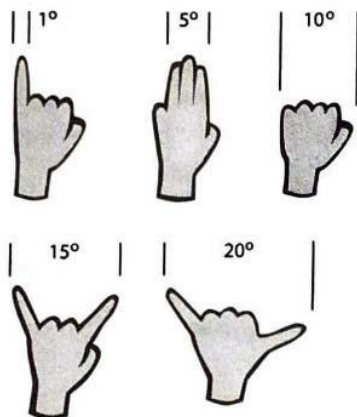
Taurus: Messier M1, M45; Finest NGC: NGC1514; Double Stars Theta1, Theta2.

FEBRUARY NIGHT SKY EVENTS AND INFO

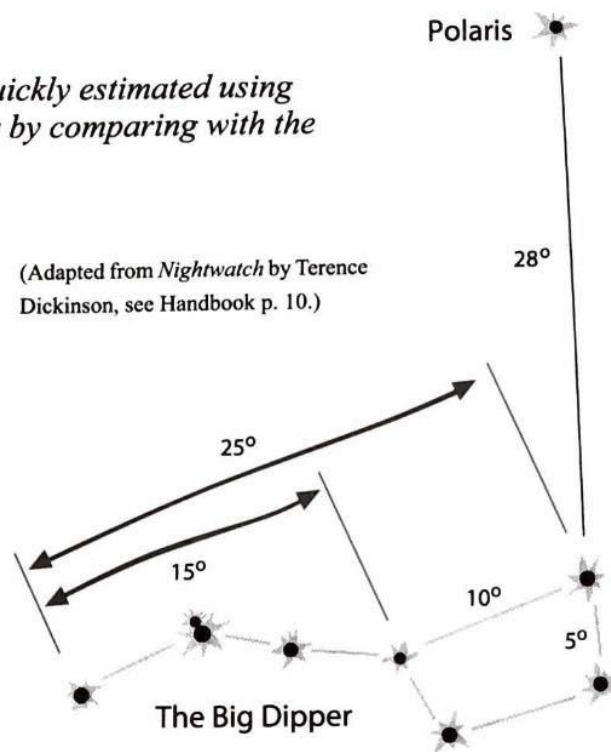
Images on the next few pages taken with permission from the 2020 Observer's Handbook. It can be obtained by joining the RASC here <http://rasc.ca/join> or ordered from <https://secure.rasc.ca/Portal/Shop/RASC/Store/StoreMain.aspx?Category=CURRPUB>

HANDY SKY MEASURES

Angular measure in the sky can be quickly estimated using the fingers of an outstretched arm, or by comparing with the star separations in the Big Dipper.



(Adapted from *Nightwatch* by Terence Dickinson, see Handbook p. 10.)



RASC OBSERVER'S HANDBOOK 2020

THE SKY FOR FEBRUARY

		Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune	Sun
RA	1	21h 54m	23h 31m	17h 13m	18h 58m	19h 47m	2h 02m	23h 13m	20h 55m
	11	22h 43m	0h 13m	17h 42m	19h 07m	19h 52m	2h 03m	23h 14m	21h 35m
	21	22h 46m	0h 55m	18h 12m	19h 16m	19h 56m	2h 04m	23h 16m	22h 14m
Dec	1	-14° 05'	-4° 07'	-22° 59'	-22° 43'	-21° 09'	+11° 55'	-6° 09'	-17° 23'
	11	-7° 11'	+1° 06'	-23° 30'	-22° 31'	-20° 58'	+12° 00'	-6° 01'	-14° 21'
	21	-4° 17'	+6° 17'	-23° 41'	-22° 17'	-20° 46'	+12° 06'	-5° 52'	-10° 56'
Dist	1	1.19	1.09	1.95	6.07	10.97	19.94	30.73	0.985
	11	0.94	1.02	1.87	5.98	10.91	20.11	30.82	0.987
	21	0.69	0.95	1.79	5.87	10.83	20.26	30.88	0.989
Mag	1	-1.0	-4.1	1.4	-1.9	0.6	5.8	7.9	
	11	-0.6	-4.2	1.3	-1.9	0.6	5.8	8.0	
	21	2.6	-4.2	1.2	-1.9	0.6	5.8	8.0	
Size	1	5.6"	15.3"	4.8"	32.5"	15.2"	3.5"	2.2"	32' 28"
	11	7.2"	16.3"	5.0"	33.0"	15.2"	3.5"	2.2"	32' 25"
	21	9.7"	17.5"	5.2"	33.5"	15.4"	3.5"	2.2"	32' 21"

Moon: On February 0 at 0h UT*, Sun's selenographic longitude is 340.20° and increases 12.2° each day thereafter.

Greatest N declination on the 7th (+23.2°)

Greatest S declination on the 19th (-23.2°)

Libration in longitude: E limb most exposed on the 17th (+6.6°)

W limb most exposed on the 5th (-7.0°)

Libration in latitude: N limb most exposed on the 26th (+6.6°)

S limb most exposed on the 12th (-6.6°)

Mercury: Achieves maximum eastern elongation (GEE) on the 10th, just two days before the perihelion of its orbit and 18° from the Sun. This is nonetheless a decent, though brief, evening apparition for Northern Hemisphere observers as the planet shines brighter than mag. 0.0 through the 14th, fading sharply thereafter as it zooms toward inferior conjunction on the 26th.

Venus: Continues its rise to prominence in the evening sky. It soars some 15° in declination during the month, crossing the celestial equator on the 9th. The Moon makes another wide pass 6° to the S of the brilliant planet on the 26–27.

Mars: Very low in morning twilight among the stars of Sagittarius. It has a close encounter with the waning crescent Moon on the morning of the 18th, with an occultation visible from eastern North America.

Jupiter: Visible in morning twilight, gradually gaining separation from the Sun. In the second half of the month it is the bright centerpiece of a trio of outer planets including Mars and Saturn, all of them situated among the stars of Sagittarius. The waning crescent Moon joins the scene on the 18–20, passing 1° south of Jupiter on the 19th.

Saturn: Emerges in the dawn sky early in the month, about 10° closer to the Sun than is Jupiter. The two giant planets will remain neighbours throughout the year, gradually drawing closer as they build toward a Dec. 21 conjunction. The waning crescent Moon passes 2° to the south on the 20th.

Uranus: In the evening sky among the stars of southwestern Aries, setting around midnight local standard time.

Neptune: Disappearing into bright evening twilight as it approaches its Mar. 8 conjunction with the Sun. Makes a very close pass of the star Phi Aquarii (mag. 4.2) on the 10th when both are just 26° from the Sun, but the favourable angle of the evening ecliptic in North America might make telescopic observation possible in the early evening.

*See p. 94, the bold-faced sentences of the first paragraph.

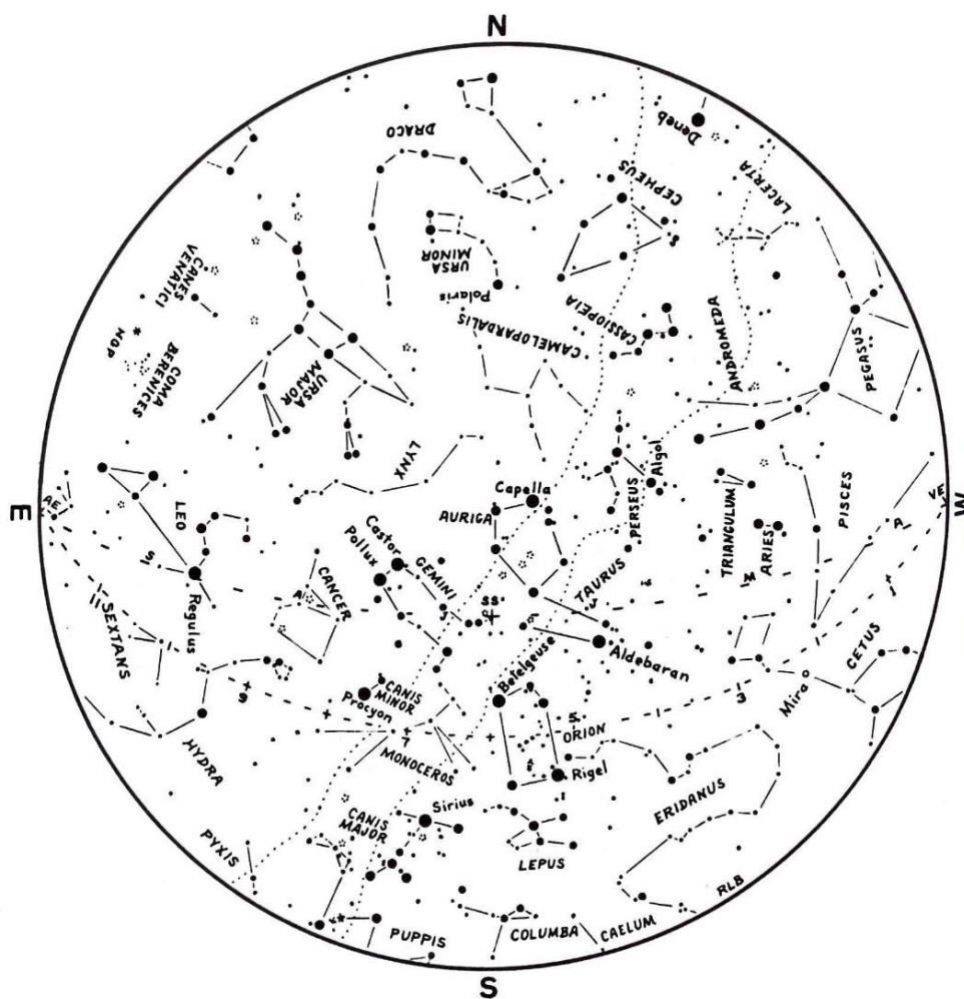
Time (UT)			FEBRUARY EVENTS		Jupiter's Satellites	
	d	h m			West	East
Sat.	1		Mars at descending node			
Sun.	2	1 42	First quarter		1.0	
		9	Vesta 0.5° S of Moon, occultation†		2.0	III
Mon.	3	9 26	Algol at minimum		3.0	II
Tue.	4				4.0	IV
Wed.	5	23	Moon 1.4° S of M35		5.0	
Thu.	6	6 15	Algol at minimum		6.0	I
Fri.	7		Mercury at ascending node		7.0	
Sat.	8	11	Moon 1.0° N of Beehive (M44)		8.0	
Sun.	9	3 04	Algol at minimum		9.0	
		7 33	Full Moon		10.0	
Mon.	10	14	Mercury greatest elongation E (18°)		11.0	
		20	Moon at perigee (360 461 km)		12.0	
Tue.	11		Zodiacal Light vis. in N lat. in W after evening twilight for next two weeks		13.0	
		23 53	Algol at minimum		14.0	
Wed.	12		Mercury at perihelion		15.0	
Thu.	13		Saturn at descending node		16.0	
		7	Juno stationary		17.0	
		10	Juno 0.6° S of Moon, occultation‡		18.0	
Fri.	14	20 42	Algol at minimum		19.0	
Sat.	15		Venus at ascending node		20.0	
		22 17	Last quarter		21.0	
Sun.	16	10	Mercury stationary		22.0	
Mon.	17	17 31	Algol at minimum		23.0	
Tue.	18	13	Mars 0.8° S of Moon, occultation††		24.0	
Wed.	19	20	Jupiter 0.9° N of Moon, occultation‡‡		25.0	
Thu.	20	8	Pluto 0.7° N of Moon, occultation†††		26.0	
		14	Saturn 1.7° N of Moon		27.0	
		14 20	Algol at minimum		28.0	
Fri.	21				29.0	
Sat.	22		Mercury at greatest heliocentric lat. N		30.0	
Sun.	23	11 09	Algol at minimum		31.0	
		15 32	New Moon (lunation 1202)			
Mon.	24					
Tue.	25					
Wed.	26		Jupiter at descending node			
		2	Mercury in inferior conjunction			
		7 58	Algol at minimum			
		12	Moon at apogee (406 278 km)			
Thu.	27	12	Venus 6° N of Moon			
Fri.	28	12	Uranus 4° N of Moon			
Sat.	29	4 47	Algol at minimum			

†S Asia, E Afghanistan, N Philippines, China, Japan, E Russia, Alaska, W Canada

‡N. America (except NE Canada), Central America, Caribbean, N S. America

††N. America (except W Canada & Alaska), most of Central America, Caribbean, N.S. America, S tip of Greenland, Azores

‡‡Antarctica, S S. America †††SE S. America, Antarctica, Kerguelen Is, SW tip of Australia



BOOK DRIVE

Astronomy-related book donations are being accepted to the RASC Saskatoon Centre Library at the U of S Observatory during its regular Saturday evening open house, 7:00-9:30 pm in November to February or 8:00-10:30 pm in March.

MINUTES OF JANUARY MEETING

Rina Rast

Minutes of the Executive Meeting, January 20, 2020

Attendees: Daryl Janzen, Les Dickson, Ellen Dickson, Norma Jensen, Rick Huziak, Donna-Lea May, Darrell Chatfield, Patricia Gakis, Ron Waldron, Rina Rast, Tenho Tuomi

Meeting called to order by Daryl Janzen at 7:07 PM.

Approval of minutes published in December 2019 issue. Motion by Les Dickson, seconded by Patricia Gakis, passed as all were in favour.

Reports:

Discussion of Sleaford updates:

1. Internet installed (weak Wi-Fi)
2. Remote control for roll-off is operational (padlock will soon be installed)
3. Discussion re: making the Meade 16" remotely operational (would need piggyback guider, spare CCD and filter wheel from the Physics building roof). Rick notes that we will need dew-shields that do not have felt, as the roll-off is not mouse-proof. Daryl will look into cost of getting all this done.
4. Discussion regarding getting a protected wall-off area for observing.
5. Discussion regarding query from someone who may be willing to pay rent for setting up a clamshell dome and remote telescope.

Media outreach:

1. Discussion regarding interviews with CKOM for meteorites.
2. Decision that we should put together a list of members interested in talking to media, as well as their interests/expertise.
3. Discussion regarding installing a camera at Sleaford for meteors.

Pale Blue Dot event:

30th anniversary of Voyager's Pale Blue Dot is this February 14th, discussion regarding how to pull an event together as part of a global astronomy initiative (under IAU) during February 13-20th.

Changes to Monthly Center Reports:

Comment on the fact that, due to privacy issues, email addresses belonging to people in our club should not be shared amongst the club; this has been resolved.

SSSP Update:

Finding speakers (perhaps someone exciting coming!). Camping and registration opens up in the middle half of April. Dates for SSSP confirmed for August 19-24th, 2020. Next meeting will occur on February 6.

Telescope rental report:

A few rentals throughout the year, 2 new telescopes were recently donated, Ike recommends perhaps finding a school to donate to. We cannot provide tax receipts for donations. 10" Newtonian (without a mount) is available by donation to the club.

Motion to adjourn by Norma Jenson, seconded by Darrell Chatfield, all in favour.
Meeting adjourned at 7:57 PM.

Minutes of General Meeting, January 20, 2020

Meeting called to order on 8:13 PM by Daryl Janzen.

Motion to adopt meeting minutes by Tim Yaworski, seconded by Ellen Dickson, all in favour.

Recap of discussion regarding collecting volunteers to talk to media. Will send out email to members about this and Patricia will put an article in the upcoming newsletter.

Discussion regarding the possibility of doing a Pale Blue Dot event February 13-20th as outreach (weather permitting).

Update on SSSP by Les Dickson.

Women in Astronomy talk: Usask students giving a public lecture in Health Sciences Building, Room 1130, on February 11th.

Presentations: Rick Huziak: "Will Betelgeuse Explode Next Week?"
Colin Chatfield and Tara Magee: "Saving the Swale"

Announcements:

Speakers needed for upcoming meetings! Contact Rick if you are willing to volunteer.

Deadline for the next newsletter is February 7, 2020.

Next meeting: February 24, 2020.

Visual observing for Beginners has been cancelled for this month.

Call to adjourn by Rick Huziak, seconded by Ellen Dickson, all in favour; meeting adjourned at 9:41 PM.

COMETS OF 2019 AND 2020

Tenho Tuomi

There were many complaints about 2019 being a sparse year for comets. It is true that there were no naked eye comets, but I was still able to photograph 13 comets in 2019, bringing my total of comets seen or photographed to 118. The only two reasonably bright ones to be seen through a telescope were C/2018 Y1 (Iwamoto) in February, and C/2018 W2 (Africano) in September. Others were very faint. Pictures of most of them are at <http://www.lex.sk.ca/astro/350d/comets.htm#2019>.

2020 is not predicted to be much better for comets. Three are predicted to be reasonably bright, C/2017 T2 (PANSTARRS) which will peak at magnitude 8 in May, though some are predicting that it will be naked eye, and two new comets, C/2019 Y1 (ATLAS) which is predicted to peak at magnitude 10 in March, and C/2019 Y4 (ATLAS) which is predicted to peak at magnitude 10 in May. A periodic comet 88P/Howell is predicted to peak at magnitude 10 in September. This might be the comet for the Star Party though it will be very close to the horizon in the evenings. Periodic comet 2P/Enke which has a 3.3 year orbit will be back this year also but it will be seen only from southern latitudes. I photographed this comet in 2003, 2013 and 2017.

There is of course the hope that something bright will come that nobody knows about yet. It has happened before.



Upcoming comet C/2017 T2 (PANSTARRS) taken January 4 by Tenho Tuomi (picture cropped to half size)

WINTERSHINES

Tim Yaworski

Tim Yaworski presented his “Introduction to Astrophotography” workshop in an inflatable “igloo” to a sold out crowd on the evening of January 29. He was invited to present the workshop as part of the Nutrien Wintershines Festival in Saskatoon. The festival highlights all the ways to take advantage of Saskatchewan winters.



BOOKS FOR SALE

All books are in either new, or like new condition. Retail price in brackets. Please email or text me if you want a particular book and I will bring it to the next meeting or arrange to meet you. All books being sold by Darrell Chatfield. Contact him at novachat@sasktel.net or 306-222-0515.

"Deep-Sky Observers Handbook"	Volume 1-5	Enslow-Lutterworth	\$40.00
"International Encyclopedia of Astronomy"	1987	Patrick Moore	Color \$10.00
"Backyard Astronomers Guide"	T. Dickinson & Alan Dyer	2008	Color \$25.00
"Atlas of Deep Sky Splendors"	1978	H. Verhenberg	(50.00) B. & W. \$22.00
"Turn Left at Orion"	2000	Dan Davis	B. & W. (29.99) \$15.00
"Amateur Astronomers Catalog of 500 Deep Sky Objects"	Vol 1	1980	B & W R. Morales \$15.00
"Observing the Constellations"	1989	J. Sanford	Color charts \$10.00

INTERNATIONAL DAY OF WOMEN AND GIRLS IN SCIENCE

Rina Rast

Join us in celebration of International Day of Women and Girls in Science, as USask astronomy students present a public lecture explaining how, throughout history, many women in astronomy have been under-recognized for their contributions. We will also discuss the current conditions in the field.

It will take place in Health Science Room 1130, on February 11th, and will start at 7:30pm. This event is absolutely free of charge and open to the public!

Join us after the talk at the University of Saskatchewan Observatory for refreshments and night sky viewings."

ILLUMINATING THE STARS:
SHINING LIGHT ON
FORGOTTEN WOMEN
IN ASTRONOMY

Tuesday, Feb. 11 | 7:30 pm

1130 Health Sciences Building, 107 Wiggins Rd.

FREE AND OPEN TO THE PUBLIC



In celebration of International Day of Women and Girls in Science, USask astronomy students will present a public lecture on how women have changed our understanding of the universe.



For more information contact:
daryl.janzen@usask.ca | 306-966-6411



UNIVERSITY OF SASKATCHEWAN
College of Arts and Science
ARTSANDSCIENCE.USASK.CA

OBSERVING CERTIFICATES AND CLUBS

RASC OBSERVING PROGRAMS AND CERTIFICATES

The RASC offers four observing certificates for **members** who observe all objects in each of the following observing lists in this chapter:

- THE MESSIER CATALOGUE (p. 314)
- THE FINEST NGC OBJECTS (p. 318),
- THE DEEP-SKY CHALLENGE OBJECTS (p. 322),
- DEEP-SKY GEMS (p. 324).

See www.rasc.ca/certificate-programs for details and contact the RASC Observing Committee Chair at rasc.ca/contact/observing for further information.



The RASC also offers the **Explore the Universe Certificate** for novice observers (who do not have to be RASC members), the **Explore the Moon Certificate** for beginning members, and the **Isabel Williamson Lunar Observing Certificate** for intermediate to advanced members. In addition, **Astroimaging certificates** are available for those members with a photographic bent. See www.rasc.ca/astro-imaging-certificate

RASC OBSERVER'S HANDBOOK 2020

Join the Club! Observe all 110 Messier, 110 Finest NGC, 400 Herschel I or II, 140 Lunar, 154 Sky Gems or 35 Binocular objects, or Explore the Universe and earn great OBSERVING CERTIFICATES!

MESSIER CLUB

Certified at 110 Objects:

R. Huziak, G. Sarty, S. Alexander, S. Ferguson, D. Chatfield, T. Tuomi, L. Scott, G. Charpentier, B. Johnson, L. Dickson, B. Burlingham, Norma Jensen

Ron Waldron	108
Marcel Müller-Goldkuhle	94
Wade Selvig	75
Wayne Schlapkohl	43
Ellen Dickson	34
Graham Hartridge	9

FINEST NGC CLUB

Certified at 110 Objects:

R. Huziak, G. Sarty, D. Chatfield, T. Tuomi

Larry Scott	110
Scott Alexander	97
Norma Jensen	83
Sandy Ferguson	23
George Charpentier	13

HERSCHEL 400 CLUB

Certified at 400 Objects:

R. Huziak, D. Chatfield, T. Tuomi

Gordon Sarty	251
Scott Alexander	117
Larry Scott	45
Sandy Ferguson	18

HERSCHEL 400-II CLUB

Darrell Chatfield	400
Tenho Tuomi	378
Rick Huziak	246

EXPLORE the UNIVERSE

Certified at 55 to 110

Objects: *T. Tuomi,*

Wayne Schlapkohl	55
Jim Goodridge	35

Chatfield BINOCULAR CERTIFICATE

Certified at 35 to 40 Objects:

T. Tuomi, R. Huziak

Jim Goodridge	12
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Isabel Williamson Lunar Observing Certificate

Certified at 140 Objects:

T. Tuomi, N. Jensen

LEVY DEEP-SKY GEMS

Certified at 154 Objects:

Tenho Tuomi	150
Darrell Chatfield	70

The Messier, Finest NGC and David Levy's Deep-Sky Gems lists can be found in the *Observer's Handbook*.

The Explore the Universe list is available here <http://www.rasc.ca/explore-universe>

On-line Messier and Finest NGC lists, charts and logbooks:

<http://www.rasc.ca/observing>

On-line Herschel 400 List:

<http://www.astroleague.org/al/obsclubs/herschel/hers400.html>

Binocular List is at: https://www.usask.ca/rasc/Chatfield_Binocular_List.pdf

"Isabel Williamson Lunar Observing Program Guide:

<http://www.rasc.ca/sites/default/files/IWLOP2015.pdf>

Program details can be found at: <http://www.rasc.ca/williamson/index.shtm>