

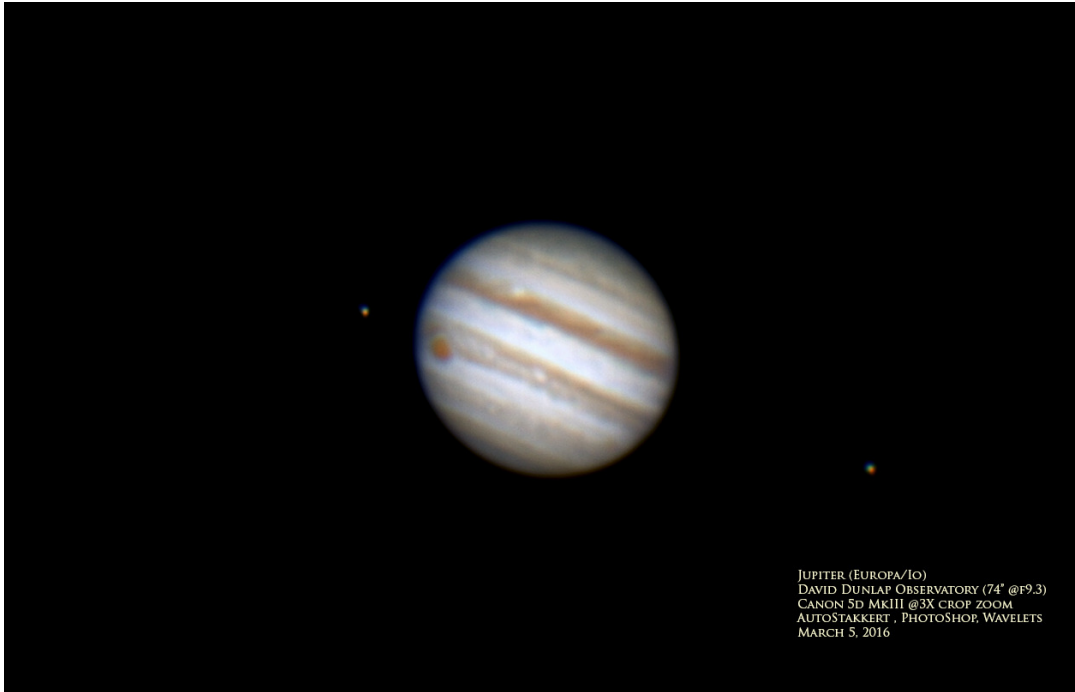


SCOPE

The Newsletter of
The Royal Astronomical Society of Canada, Toronto Centre

What is that which always is,
and has no becoming; and what is that
which is always becoming, and never is?
-Plato

Vol. 55 No. 2
April/May 2016



JUPITER (EUROPA/IO)
DAVID DUNLAP OBSERVATORY (74" @F9.3)
CANON 5D MkIII @3X CROP ZOOM
AUTOSTAKKERT, PHOTOSHOP, WAVELETS
MARCH 5, 2016

COVER PHOTO: Jupiter at DDO by Rick Foster

Inside this issue:

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Next SCOPE Pub. Deadline

May 9th

Editor: Eric Briggs

Copy Editor: Sue Kralik

President's Message

by Paul Mortfield

We just recently had wonderful news that the **Ontario Science Centre (OSC)** wishes to re-establish a partnership with RASC Toronto Centre. While we still need to work out the details, this could include hosting Centre meetings, co-branded outreach and education programs and other special events. The dedication of Shawn Lee and the Saturday solar observing team volunteers who have continued to provide a solar viewing program at OSC has helped to keep us visible and highlight our value to the OSC.

As you'll know, we were extremely disappointed to learn that Richmond Hill town council voted to accept ownership of the **Dunlap Observatory** and Administration Building, disregarding the agreement that had been in place between RASC Toronto Centre and Corsica Development since 2012.

We're doing our best to move on and develop a positive working relationship with the town through a lease agreement. Town staff have made it clear they are looking forward to working with us and want us to continue (and possibly expand) the public outreach and education we've been offering at the DDO for the last seven years.

Early discussions have already taken place. Until a lease agreement is established, it'll be business as usual at the site with our regular outreach and members programs.

May will be a very busy month for us with (hopefully) some appropriate observing weather. Our "**First Light**" program for new members kicks off on May 3. **International Astronomy Day** takes place on May 14 and the Centre will be hosting the **AstroNuts** STEM event during the day at the DDO. It's a great opportunity for kids to get involved with science and will include a live chat with the **International Space Station**. Later that evening, we'll be hosting a public star party at DDO. The **RASC General Assembly** will be hosted by the London Centre over the May 21 long weekend which includes the **AstroCATS** trade show and astrophotography courses. The **Carr Observatory** spring work party will take place the following weekend on May 28. Add to this our various meetings, dark sky and city observing events and you'll find lots of opportunities to participate in great Centre activities.

Equipment Swap Table - April 27

Once again the Toronto Centre will hold an equipment swap table at the April 27 Recreational Astronomy Night meeting. If you have any surplus telescope equipment and accessories that you'd like to sell, please bring them along, and perhaps all of us should bring a little extra cash in case we see a bargain we just can't resist! The swap table will begin after the presentations and is for private sales only. —**Paul Markov**

Welcome to New Members: The Harris-Lowe family, B. Jacobs, J. Kennedy, R. Kesteris, J. Kumar, R. Lash, P. Lu, H. Michael, Y. Pozin, G. Ross-Marquette, C. Salman, P. Sedlacek, C. Sheere, J. Wilson, S. Woolsey, the Yau family, G. Zukovs

Astrophotography Interest Group **By Diana Salerno**

The RASC TC Astrophotography Group and CAO Management Committee are pleased to announce that we will be offering a Beginner's Astro Imaging Workshop Weekend at CAO this summer. This workshop is intended for all participants looking to try astrophotography for the first time at an ideal dark site, or looking to put into practice some of the techniques we've learned in the NOVA program and astrophotography sessions.

The proposed date for the Workshop has been scheduled for Friday June 24 – Saturday June 25 (3rd quarter moon), with a rain date scheduled for July 8 – 9, 2016 (new moon).

Suggested exercises for that workshop include:

- Astrophotography without a telescope
- DSLR with lens on tripod for time lapse, star trails etc.
- DSLR with lens on tripod for single shot (20 - 30 seconds) Milky Way wide field (non-tracking mount)
- DSLR with lens on portable tracking mount (Star Adventurer, SkyTracker etc.) – longer FL lens for deep sky or wide field, or
- Anything you want to try!

The CAO Committee has graciously offered to provide their

venue and support as necessary free of charge for all participants (\$20/night for in-house and \$10/night overnight camping fees are waived). Participants will have to supply their own food/drink, and bedding/personal toiletries, but the CAO has advised that the camaraderie and good times there are free.

Please note that this is a Members Only event as an RASC TO membership is required to register. Please visit the CAO Web Page and be sure to state that you are registering as a participant for this workshop in order to avoid fees. <http://rascto.ca/content/ec-carr-astronomical-observatory-cao>

We are also looking for 1 or 2 additional volunteers to mentor over the course of the weekend to assist with questions and help with day time processing (if interested). Mentors will be provided full use of the CAO facilities without fees. Please contact me off-line if you would like to volunteer as a mentor.

Hope to see you there!

PS - Based on the interest and success of the first workshop, we have also tentatively scheduled a follow up session #2 to cover more advanced techniques using a telescope, tracking equipment and software, etc. Stay tuned.

As a member, you are invited to show your slides, drawings, or discuss your observing program. Please contact the chairman, **Paul Markov**, at 905-470-6642 or membersnights@rascto.ca well before the meeting date to discuss your presentation. Updated listings are at: www.rascto.ca

Upcoming Meeting and Event Schedule

DUNLAP OBSERVATORY MEMBERS' NIGHT

April 23rd: What's Up, Look What I Made/Bought/Found

LECTURE NIGHT Wednesday, April 13th: 7:30 PM

Location: North York Memorial Community Hall, 5110 Yonge Street, Burgundy Room A

Speaker: Dr. Christina Smith, York University

Subject: *The Life and Death of (Relatively) Small Stars*

Small stars, those with masses less than 8 times that of our Sun, evolve very differently from their much larger counterparts. These relatively small stars are never able to create high enough temperatures and pressures in their cores to burn carbon and oxygen. Instead, they pass through a series of complex phases of evolution during which these stars expand, pulse and eventually shed their outer layers in a dramatic fashion, ultimately enriching the Milky Way. In this lecture, Dr. Smith will talk through the evolution and eventual demise of these stars, discussing how we study them and highlighting some interesting findings along the way.



RECREATIONAL ASTRONOMY NIGHT Wednesday, April 27th: 7:30 PM

Location: North York Memorial Community Hall, 5110 Yonge Street, Burgundy Room A

Blake Nancarrow: The Sky This Month

TBA: The Carr Astronomical Observatory, Yours to Discover

Razvan Peteanu: Visiting the South Arizona Observatories

SPECIAL EVENT: Annual Toronto Centre equipment swap table (after the presentations)

Science Rendezvous: Saturday, May 7th

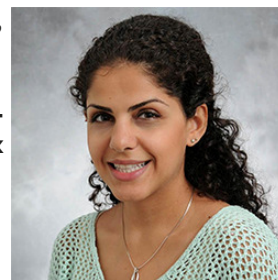
Transit of Mercury: Monday, May 9th, 7 AM to 3 PM (P.8)

LECTURE NIGHT Wednesday, May 11th: 7:30 PM

Location: TBA

Speaker: Sara Mazrouei, PhD Candidate in Planetary Geology, York University

Subject: TBA



University Observatory Public Tours

U of T holds public lectures and tours on the first Thursday of each month, including planetarium shows and views through the 200mm Goto refractor and 40cm Boller & Chivens reflector.

<http://www.astro.utoronto.ca/astrotours>

York University holds online public viewing on Monday nights between 9 and 11 PM on their website, <http://astronomy.blog.yorku.ca>

Also on Monday evenings between 9 and 10, they broadcast an online radio show from <http://www.astronomy.fm>. The York observatory and its 40cm LX200 are open to the public on Wednesday evenings.

Take a Tour!



Upcoming Meetings Cont'd

INTERNATIONAL ASTRONOMY DAY Saturday, May 14th

RASC GENERAL ASSEMBLY May 19th-22nd

RECREATIONAL ASTRONOMY NIGHT Wednesday, May 25th: 7:30 PM

Location: TBA

Speakers: TBA

ANNUAL AWARDS PICNIC Saturday, June 11th

SkyNews Photos

Stuart Heggie's photo of Messier 33, the Triangulum Galaxy, was featured in the March-April 2016 *SkyNews* Magazine. In the same issue, **Malcolm Park** showcased his long-exposure photo of the 2015 Geminid Meteor Shower, and **Lynn Hilborn's** photos of the California Nebula and the Heart and Soul Nebula were also included.

Also in March, **Richard Sowards'** photo of the glittering Pleiades was featured on the *SkyNews* website as photo of the week.

Well done, folks!

2017 Total Eclipse Expedition

Have you made plans for August 21st, 2017 yet? Join other RASC members and view this unforgettable event with the breath-taking **Grand Tetons of Wyoming** in the background. For more information on our Great American Solar Eclipse 2017 Tour see:

<http://www.rasc.ca/news/great-american-total-solar-eclipse-tour-book-now>.

Classifieds

CAO MODL for lease! Enjoy a "My Own Dome Lot" 10-by-10 foot prepared space under the dark skies of Grey Bruce county. Lease a space at Carr Astronomical Observatory for \$55 per month (minimum 1 year commitment).

Install a prefab observatory or build and then set up your rig permanently. Includes electrical power, Internet service, and security monitoring. Contact CAO@rascto.ca for more information.

CAO locker for rent! Store your gear in a 2.5-by-2.5-by-7 foot locker with adjustable upper shelving. Save space in your car! Save space at home! Rental locker fees at Carr Astronomical Observatory are \$15 (winter) or \$25 (summer) per month. Includes security monitoring and includes red lighting which also gently heats locker to avoid moisture. Contact CAO@rascto.ca for more information.

From the Recreational Astronomy

Night Jan. 27, 2016:

Charles Joseph Messier, the Ferret of Comets

By Sue Kralik

Sue introduced the topic by explaining that when she first joined the RASC, she was frequently hearing references to the letter M followed by a number and was curious to find out about Charles Messier, the man behind the letter M. She decided to research the life and discoveries of this French astronomer.

Messier was born in 1730 in Badonviller in what is now Lorraine, France and died in Paris, France in 1817. After his father's death, when Charles was only 11, his older brother took over his education and taught him skills in administrative and methodic work, skills that were very useful in his work as an astronomer. His interest in astronomy was piqued by the appearance of the Great Comet of 1744 with an absolute magnitude that was the 6th highest in recorded history.

Messier was employed by the astronomer of the French Navy, Joseph Nicolas Delisle, and his first documented observation was the Mercury transit of May 5, 1753. As was the case with a number of astronomers, the Comet Halley figured prominently in Messier's professional life. Delisle had assigned him the task of locating the comet which was predicted to return in 1758. However, Messier was given inaccurate information by Delisle and was searching the wrong area of the sky. When he finally located the comet, he was four weeks too late to be the first to observe it. Delisle refused to allow Messier to announce his discovery until Apr. 1, 1759, with predictable results. Sue asked who would believe an announcement made on Apr. 1.

Comet hunting became an obsession for Messier. Between 1758 and 1804, he spent more than 1100 nights on this task and was named the 'ferret of comets' by King Louis XV.

The many awards earned by Messier included being elected to the Royal Society of London in 1764, being made a member of the Berlin Academy of Sciences on Sep. 14, 1769 after he had already been selected as a member of the Royal Academy of Sweden in Stockholm, and being elected into the Paris *Académie des Sciences* in 1770 about 2 weeks after he had discovered another comet.

Personal tragedy involved the death of his wife and infant son in 1772. In addition, he suffered a professional loss. Messier was no mathematician and relied on his aristocratic friend, Bochart de Saron, the President of the French Assembly to compute the orbits of his comets. During the Reign of Terror, 1793-1794, while already in prison and only a few days before he was guillotined, the aristocrat de Saron, as a service to his friend, calculated the orbit of a comet discovered by Messier on Sep. 27, 1793.

During the time that Messier was hunting for comets, he was observing hazy objects that he eventually observed were not moving as related to the background stars. One problem, he found, was that he was often misled by these misty-looking patches in the sky which looked like comets, but turned out to be star-clusters or nebulae. Observing and recording these wasted an incredible amount of time, and finally Messier decided to catalogue them as 'objects to avoid'. He was assisted by his colleague, Pierre Méchain, who was also a successful comet hunter and discovered a number of the objects included in Messier's catalogue. The final edition before Messier's death included 103 objects, amended to 110 in the 20th century.

Sue took the audience on a journey through the catalogue as set out by the RASC Messier certificate.

Sue pointed out the irony in the fact that it is the catalogue of objects to avoid that has made Messier famous and not the 44 comets he observed. His famous list of 110 "not comets" includes some of the most spectacular objects in the Northern Hemisphere.



Deep Sky Observing at the CAO and Some Learnings from the NOVA Course

Artash Nath and Arushi Nath

I have been a member of the Royal Astronomical Society of Canada (RASC) – Toronto since 2014. One of the best things about being a member is that I can visit the Carr Astronomical Observatory (CAO) at Collingwood, Ontario whenever I want. I have already visited it three times. My last visit was from 21 to 23 August 2015 with my Dad and my sister Arushi.

The supervisor at CAO for that weekend was Dietmar Kupke. I thank Dietmar for allowing me to use the telescope to observe Deep Sky Objects (DSO). I am sharing below some of the observations I made.

MOON: First we looked at the moon which was in the first quarter and in the constellation of Libra. We saw several lunar maria (seas). Some of the maria we saw were Mare Crisum, Mare Fecunditatis, Mare Nectaris, Mare Tranquillitatis and Mare Serenitatis.

In the most recent New Observers to Visual Astronomy (NOVA) course run by the RASC at the Fort York Library we learnt that maria were formed when massive meteorites hit the moon. These meteorites caused huge and deep cracks. The cracks were so deep that they reached the lunar core and molten iron flowed out of them. The molten iron spread around and darkened the surrounding surface.

PLANETS: We looked at Saturn and its rings. Saturn was very close to the Earth's moon (like a conjunction). We were able to see four of the Saturn moons, Enceladus, Dione, Tethys and Titan. Enceladus, Dione and Tethys were closely grouped together while Titan was diametrically opposite. We also saw the Cassini Division that separates rings A and B. I learnt from the NOVA lecture on our solar system that the rings are mostly made of water ice and with trace components of rocky material.

Then we looked at Jupiter and saw four of its moons - Europa, Io, Ganymede and Calisto. I also saw the storm that was happening on Jupiter named the Great Red Spot. In fact, the great red spot is shrinking. It is three times smaller than when the storm was first observed.

NEBULAE: A Nebula is a big cloud of gas and dust. Nebulae are formed when stars die and they are also nurseries where new stars form.

M8, the Lagoon Nebula, is an emission nebula in the constellation Sagittarius. An emission nebula is a dying star which lets go of its outer layers which forms a ring of gas around it. It was very beautiful and appeared as a gas cloud. I observed it through the binoculars but it was also very faintly visible with the naked eye.

M17, the Swan Nebula is located in the constellation Sagittarius. It appeared very fuzzy in the centre. It is also an emission nebula.

DOUBLE AND MULTIPLE STARS: These appear as a single star when observed with the naked eye. However, when we look through a telescope or binocular, we find they are actually separate stars.

17 Com is in the Coma Berenices constellation. The stars appeared very well separated and one star was slightly brighter than the other.

32 and 33 Com were also in Coma Berenices constellation. The

stars were much closer than the 17 Com but still easy to resolve. We looked at Epsilon Lyrae in the Lyrae constellation also called the double double because each star is a double star. Without the telescope it just looks like a single star!

Delta 11 and 12 were also in the Lyrae constellation. The 2 stars were so far apart that they barely seemed like a double star.

Albireo (Beta Cygni) was in Cygnus constellation. It is comprised of a brighter star and a fainter star of different color which made it a very beautiful double star. The two stars were closer to each other than all other double stars we saw. Interestingly, Albireo forms a binary system where the two stars revolve around each other.

CLUSTERS are a big group of stars. There can be open clusters or globular clusters. Globular clusters are densely packed as they are tightly bound by gravitational forces. Open clusters are less tightly bound.

M5 is a globular cluster in the constellation Serpens. It appeared like a fuzzy object in the telescope and it was not possible to see any individual stars or star light.

M23 (NGC 6494) is an open cluster in the constellation Sagittarius. It appeared mostly as a hazy smudge but a few stars could be resolved by the telescope.

M11, the Wild Duck Cluster, is an open cluster in the constellation Scutum. There seemed to be lots of bright stars in a close group in the centre. It made the centre of the cluster very bright for an open cluster.

M37 (NGC 2099) is an open cluster near Orion. It has some wide spaces and some bright spots.

M22 is a globular cluster in the constellation Sagittarius. It is one of the brightest globular cluster that is visible in the night sky. It has a bright core with thousands of stars surrounded by fuzziness.

M38 (NGC 1912) is an open cluster in the Auriga constellation. It appeared fuzzy and filled the whole view of the telescope.

Coat Hanger is a group of seven stars. It is an asterism of the constellation Vulpecula. Since the stars are spread out we can only view it in the wider field of a binocular instead of a telescope. It is a very appropriate name as it really looks like a coat hanger.

GALAXIES: M31 is none other than the Andromeda Galaxy – the galaxy closest to our own galaxy. It was also visible to the naked eyes once they got adjusted to the darkness. It appeared as a bright centre with a halo around it. It was also possible to see the companion galaxy M32.

One of the best sites of the night was the M51 or the Whirlpool Galaxy in the constellation Canes Venatici. There were 2 separate galaxies interacting with each other. The other galaxy was far smaller (NGC 5195) than M51. M51 is a spiral galaxy (like our own Milky Way galaxy) and is very close to the handle of the Big Dipper.

Our visits to the CAO are very useful as we see lots of new objects and re-observe some of our favourite objects. We hope to finish the Observe the Universe certificate soon by continuing to observe the night sky. And we are looking forward to going back to our favourite observatory soon.

By Artash Nath (9 years) and Arushi Nath (6 years)

Artash is a Grade 4 student. He loves astronomy because he can stay up late in the night! Arushi is a Grade 1 student. Her favourite constellation is Orion (the Hunter).

February 10th Lecture Night Report **Hunting for and Characterizing** **Extrasolar Planets**

Dr. Nicholas Crouzet, Dunlap Institute

On the evening of February 10th, 2016, after a pleasant round of skating in the Mel Lastman Square, RASC members attended Nicolas Crouzet's lecture on The Hunt for Planets Beyond the Solar System. Nicolas Crouzet is a fellow at the Dunlap Institute, who performs research on exoplanets.



Dr. Crouzet began his speech by discussing the recent prediction of a possible ninth planet in our solar system. Scientists discovered that around Neptune, there are objects with tilted orbits that always extend in the same direction, and when trying to explain this, one of the reasonable possibilities was a ninth planet, causing these strange orbits. Since this planet is well beyond Neptune and very far away, it may take a long time to be able to determine if there is actually a planet or not.

Beyond our solar system, are there other planets around other stars? Since we cannot see them, in order to find other extrasolar planets, scientists use techniques to detect them. The first is the transit method – the luminosity of a star is measured over a long period of time, and if there is a periodic drop in the lightcurve graph, it is likely due to a planet transiting the star. This method however, is limited in its use since the planet's orbit must be aligned perfectly in the same plane as earth for us to be able to detect the transit. It can, however, also be used to determine an exoplanet's atmosphere. This is done by measuring the absorption, the size of the transit depth in different colours, and from this we can know which molecules have been absorbing light. This reveals the composition of the atmosphere.

ASTEP, the Antarctic Search for Transiting Exoplanets, is a mission in Antarctica that uses this transit technique to detect exoplanets. Since it is permanently night for six months in Antarctica, scientists there can take measurements of the brightness of stars nonstop for half a year. Our lecturer himself participated in this, setting up near Concordia Station with instruments and telescopes. He would point continuously toward the South celestial pole and take as many images as possible for five to six months, then try to form the lightcurve for many stars in those images. Once a transiting planet is located, scientists use another detection technique called

the Radial Velocity technique, to confirm the existence of the exoplanet detected using the transit method. Since planets have gravitational effects on their stars, the gravity of a planet or planets pulls the star toward them as they orbit around it. Thus, the star appears to wobble about its centre of mass, and from Earth's point of view, the star seems to be periodically coming toward and moving away from us. This results in periodic blueshifts and redshifts, as the star moves toward and away from the Earth. Thus, transiting candidate planets can be confirmed with this method.

Dr. Crouzet is also a member of another exoplanet hunting mission called XO, and it consists of three instruments, one in Utah, and two in Spain. The different locations of the 'scopes allows them to be connected and serve as one big telescope that has a "continuous" night.

Thus far, scientists using various space missions have discovered 1642 confirmed exoplanets. The discoveries started to bloom after the 80s, because prior to that we didn't know there were planets beyond our solar system. Major missions to date have included CoRoT by ESA, and Kepler by NASA. CoRoT-7b is known as the "lava-ocean-planet," and is a very small planet composed mostly of rocks. Kepler has discovered hundreds of planets of all sizes, from much smaller than earth to larger than Jupiter, and from all the data scientists have compiled using Kepler so far, we know that there are many more earth-sized planets than Neptune or Jupiter-sized ones. No matter the size of the planet, it is now known that almost all stars have exoplanets orbiting around them!

-Maggie Fei



The AstroNuts Kids' Space Club Presents
The Fifth Annual
What's Up in Space?
Camp & STEM Contest
It's our annual kids space club fundraiser!

Saturday, May 14th, 2016
11:30am to 4:00pm

DAVID DUNLAP OBSERVATORY
123 Hillview Dr, Richmond Hill, ON
(Free parking, \$5 admission)



STEM Contest
starts at
10:00am sharp!



RASC
Royal Astronomical Society of Canada
TORONTO CENTRE
@ The David Dunlap Observatory

There will be both indoor and outdoor space activities including live telescope demonstrations from the Royal Astronomical Society of Canada (RASC) and much more!



Guests & Events



LIVE ISS chat with Astronaut Tim Peake

Professor Paul Delaney - Kids Astronomy
Brian Ewenson - "Living in space"
Professor Marianne Mader - "Imagination space"
Make and launch a rocket with Logics Academy
Learn about "Soccer & Space"
What happens to your body in space?
...plus lots more to be announced!

Check out our website for more information!
astronutskidsspaceclub.com
Contact: ray@astronutskidsspaceclub.com



CAO opening soon!?

By Blake Nancarrow

While the Carr Astronomical Observatory is open to members all year around, it is certainly more convenient when the access road is open and free of snow and ice. It looks as if the 6th Line may be passable sooner rather than later this year. Yahoo!

Supervised weekends, without a full Moon, are scheduled May through October, weather permitting.

Book your stays now! Book early. Book often.

Seriously, we ask all interested in visiting the CAO, even if just popping in for the day or early evening, to let us know.

See <http://rascto.ca/content/ec-carr-astronomical-observatory-cao> for more information on the CAO, a video tour, and a link to the booking form to share your plans.

The book-early nudge is actually relevant. There's nothing wrong with reserving in advance even if your plans are tentative. You can always send us a cancellation by email if your plans change. We do not charge for cancelled trips.

N.B.: One cannot reserve a particular room or bed; supervisors allocate sleeping arrangements to best maximize use of the facilities.

Day visit rates are very inexpensive. If you expect to use the CAO often, the individual or family annual pass quickly pays for itself. Your user fees help offset our maintenance costs, Internet access fees, and supplies. CAO is self-sufficient, due in part to members! Thank you.

We have many new features in store on the Blue Mountains this year. For example, we'll have our new Star Adventurer imaging platform on a robust tripod, with camera cables, available for members to use. And our lovely Genesis 4-inch refractor, with new 1x finder, will find itself atop a new easy-to-use alt-az mount. And, as you've probably heard, we'll be running an astrophotography workshop or two.

If you've never been to the CAO, you should try it. You don't know what you're missing...

See you at the CAO!

P.S. The spring CAO work party is scheduled for Saturday 28 May. Watch for a future article on the web and post on the listserv.

March 9th Lecture Night Report

Two Galaxies to Rule Them All

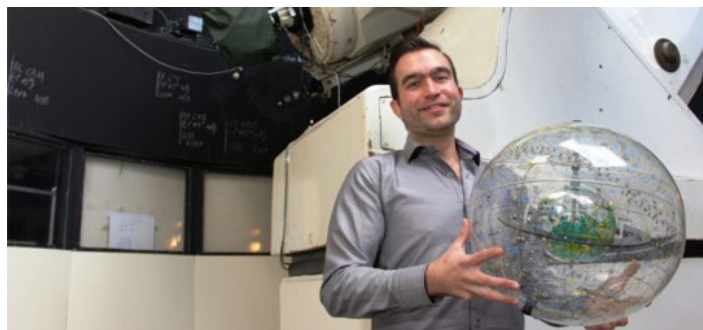
George Conidis, York University

On the evening of March 9th, 2016, RASC members attended a lecture about the two most important galaxies in our lives – Andromeda and the Milky Way. The speaker, George Conidis, is currently a graduate student working to obtain his Ph.D. at York University. He graduated with a Bachelor of Science from U of T, and is now studying sheets of galaxies in our universe.

There are two classifications of galaxies – ellipticals and disks. Scientists measure the luminosity of the galaxies, and red and blue colours generally come up. Red is almost always elliptical, and blue almost always disk. There are two main theories about how galaxies formed, the classical Monolithic Collapse theory and the more modern Hierarchical Clustering theory. Monolithic Collapse, proposed in the 1950s, speculates that if a big gas cloud with no spin were to fall down, an elliptical galaxy would form, but if the gas cloud had a little bit of spin, then the spin would keep building up until eventually a disk galaxy would form. On the other hand, Hierarchical Clustering states that really small blobs of gas kept combining until eventually a huge galaxy was formed, from all these other smaller fragments joined together. In recent years, astronomers have put together the Cosmic Web, which is a diagram of the arrangement of all the galaxies in the universe. Studying the Cosmic Web shows that gravity and the attraction between galaxies provides structure to the placement of galaxies. The Cosmic Web can also be modelled using dark matter, the force that pulls a galaxy, causing it to rotate faster than expected or calculated, and the Dark Cosmic Web comprises about 26.6% of all energies in the universe, while “real” matter makes up only about 4%. Interestingly, scientists at some of the top universities in the world recently realized that the structure of the galaxies in the Cosmic Web look like the structure of neurons and neural pathways in the brain, and when calculated, they were almost indistinguishable, despite the fact that the forces that control the two are completely different.

There are several ways to group galaxies, either by spheres, filaments (cylinder shapes), or sheets, depending on how galaxies are aligned and seem to be aligned relative to each other. Our speaker believes that our galaxy, together with Andromeda, were once “bullies” in our Local Sheet of galaxies, a result of the Milky Way being almost at the very centre of our Local Sheet, and both the Milky Way and Andromeda have asymmetrical mass. Since they're so big and gravitationally attracted, they may have had effects on the galaxies near them in the past, and affected them, causing them to flip a bit, resulting in many galaxies in the Local Sheet not being perfectly aligned. Our lecturer is currently studying this subject area in great depth using the Sloan Digital Sky Survey and an observatory in Mexico, which he frequents, to obtain more substantial data and further back up this idea that our two galaxies were so powerful they flipped other nearby galaxies sometime in the past.

-Maggie Fei



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David Dunlap Observatory (DDO)

Paul Mortfield, DDO@rascto.ca

Telescope Loan Program rascto.ca/content/telescope-loans

George Slavinski, Marc Teitelbaum, Peter Richards

2016 RASC General Assembly/ AstroCATS/Canadian Astro Photography Schools

<http://events.rasc.ca>

The **London Centre** is hosting this year's RASC main event at **Fanshawe College** on the May long weekend, May 19th-23rd. Online registration for the GA is now open. The schedule for the main event has been published:

Thursday, May 19th

10 AM to 5 PM Golfing at a course to be determined later
4 to 7 PM Teachers' Workshop at Fanshawe College, featuring **David Levy**, co-discoverer of 22 comets
8 PM Public Astronomy Talk by **Dr. Robert Jedicke** of the Institute for Astronomy in Hawaii

Poster and Art displays Friday, Saturday and Sunday

Friday, May 20th

10 AM to 12 Noon Paper Spacecraft Building Workshop
10 AM to 4 PM National Council Meeting
1 to 4 PM **Dresden Meteorite** display
1 to 4 PM Aviation Faculty Open House
1 to 5 PM Sketching Workshop with **Erica Rix, Brian McCullough** and **Gary Shelley**
6 to 9 PM Wine and Cheese Reception
8 to 9 PM 5-Minute Presentations and Awards

Saturday, May 21st

9 AM to 5 PM Walking Trail Tour
9:45 to 10:30 AM **Dr. Tina Pollmann**, describing the **Sudbury Neutrino Laboratory**
10:30 to 11:15 AM **Dr. Robert Jedicke**, describing Asteroid Disintegration
11:15 to Noon **David Levy**
10 AM to 4 PM AstroCATS
10 AM to 4 PM **Western University Centre for Planetary Science and Exploration** display
1 to 1:45 PM **Dr. Stan Metchev** of Western University, describing Exoplanets
4 to 5 PM Helen Sawyer Hogg Public Lecture by **Dr. Ann Hirschmeier** from NASA's **Goddard Space Flight Center**
7 to 9 PM BBQ at Fingal Wildlife Management Area, the RASC London Centre Observatory

Sunday, May 22nd

9 AM to 1 PM Annual Meeting and Board/Council Meeting
10 AM to 4 PM AstroCATS
1 to 1:30 PM **Charles Ennis** of RASC Sunshine Coast Centre, Slides on Small Observatories
1:30 to 2 PM **Ron MacNaughton**, How David Thompson Explored Canada's West
2 to 2:30 PM **Randall Rosenfeld**, Music of the Spheres: The Ultimate Observing Music, or the Big Silence?
6 to 8 PM Banquet

Hospitality Suite all evenings, as well as road trips to **Wayne Parker's SkyShed** headquarters in Dublin, ON to view POD observatory sheds.



AstroCATS will conduct their Canadian Astro Photography Schools event on May 19th and 20th at Fanshawe College, parallel to the opening of the General Assembly. The CAPS instructors will be:

- **Richard Wright** (Introduction to Astrophotography)
- **Doug George** (MaxIm DL)
- **Ken Crawford** (Photoshop)
- **Ron Brecher** and **Warren Keller** (PixInsight)
- **Chris Go** (Planetary Imaging)
- **Wally Pacholka** (keynote speaker)

The fee for CAPS will be \$350, and registration is now online!

As for registration for the main AstroCATS and RASC events, the daily rate will be \$20, or \$100 for five days, with accommodations available both on and off campus.

Certificate Corner

SCOPE tracks the progress of Toronto Centre members towards the Observing Certificates.

- Eric Briggs, Messier, 65/110
- Kersti Meema, Messier, 38/110
- Jack Pennings, Messier, 98/110
- Nick Pierre, Messier, 84/110
- Allard Schipper, Explore the Universe, 21/55

To register for Certificate Corner, e-mail to:

SCOPEditor@rascto.ca.

More about working towards an RASC Observing Certificate:

- Send an e-mail with your inquiry to observing@rascto.ca
- See the National web site Certificate Page at

<http://www.rasc.ca/observing/certificate-programs>

To apply for a certificate and pin, send your observation information by e-mail to: observing@rascto.ca

Arizona Astronomy Tour in September

After a successful trip to astronomy and space exploration sites in southern California last November, the National RASC are planning a five-day trip to Arizona in September to visit the following amazing astronomy sites:

- **Kitt Peak National Observatory**
- **Mount Lemmon SkyCenter**
- **Lowell Observatory**
- **Arizona Meteor Crater**
- with sightseeing in **Sedona** and **Canyon de Chelly**.

The tentative dates are from September 27th to October 2nd, 2016. This is a preliminary schedule – dates are subject to change. If you are interested and want more information, please contact Executive Director Randy Attwood at the National Office (416-924-7973) or execdir@rasc.ca

Transit of Mercury

By Eric Briggs

Transits of Mercury appear at first to be common enough. I recall observing the one at dawn on May 7th 2003, when a bunch of us gathered at Cathedral Bluffs Park to watch it come up. The event on May 9 of this year (see P.2) should be much more favourable

than that one. In fact, although there have been 16 Transits of Mercury in the past century, many of them have been glancing or partial transits, or have been in November when the Sun was usually not above the horizon from our location. This one will be central at 15h UT, and in May... perfect. If the weather holds, this may be the most favourable Transit of Mercury seen from Canada since May 6, 1878. Although there is a nice one coming up again on May 7th, 2049 at 14h.

95th Anniversary of Dr. Chant's 1st Meeting with David Dunlap

We understand that David Dunlap attended a meeting of the RASC in the Spring of 1921 at which the passage of Comet Pons-Winnecke was discussed by Dr. Chant, and that Mr. Dunlap approached Dr. Chant after Chant said a few words about his long-held desire that Toronto should have a large observatory. Here are the minutes of that meeting, as published in the *Journal of the RASC* in August of that year.

Meetings of the Society

April 26.-The Society met in the Physics' Buildings of the University at 8 p.m., the Vice-President in the chair.

Mr. H.R. Bristow, 871 Third St., Medicine Hat, Alberta, was elected a Member.

Prof. C.A. Chant exhibited a model of the orbits of the earth and Winnecke's Comet which is due to arrive at perihelion on or about June 15th of this year. He explained the importance attached to this return of the comet, and showed a slide which he had received only that morning from Prof. Barnard of the Yerkes' Observatory, and which was made from the original negative taken by Prof. Barnard on April 10th. It showed the comet, a faint hazy spot, of magnitude twelve.

Mr. John A. Paterson, K.C., who was to have given the paper of the evening on "Percival Lowell, his life and work," through illness was unable to be present. In his place Prof. S. Beatty of the Department of Mathematics of the University, gave a lecture upon "The Notion of Infinity in Mathematics."

Because in the natural world we have to deal with finite quantities, one might think that the idea of infinity is quite beyond our reach. We seldom use numbers descriptive of anything, having more than 8 or 9, or at the most 12, figures in them. Although we can create large numbers by writing down a series of figures we are able to understand their significance. It would be a very large number, but there would only a finite number of drops of water in the ocean.

We conceive the notion of infinity when we begin to think of numbers, not as denoting things in the physical world, but as existing in the world of thought. The first type of infinity is found in the conception of "successor". Suppose you think of the series of numbers 1, 2, 3, 4, 5, etc., and leave orders that each number is to have a successor; you are forced to conclude that there is no end to the series, that is - the series is infinite. Another notion of infinity is that involved in the consideration of all the proper fractions from 0 to 1. The lecturer also showed that there is an infinite number of incommensurable numbers. He next discussed some properties of finite and infinite sets, and concluded with an explanation of the Petersburg Game.

Journal of the RASC Note

The cover feature of the April *JRASC* is 'The David Dunlap Observatory at 80' by **Lee Robbins** and **Randall Rosenfeld**, describing the anniversary celebrations of June of last year, including detailed abstracts of the papers presented by **John Percy**, **Brian Gaensler**, **Randall Rosenfeld**, **Mike Reid**, **Christine Clement**, **Ernie Seaquist** and **Paul Mortfield**. These writings encapsulate the past, present and future of the DDO.

Blake Nancarrow's column 'Binary Universe' features the astronomical software product **ISS Detector**, which makes predictions of when the Space Station will be visible from your location.

John Percy's *JRASC* column is 'Beta Cephei Stars—the Brightest Class of Stars that You Have Probably Never Heard Of'.

Jim Chung's recent astronomy book published by Springer, **Astro-Imaging Projects for Amateur Astronomers: A Maker's Guide** is reviewed by **Rick Saunders** from the RASC's London Centre.

For *JRASC* current PDF issues, just login to the National site using your personal username and password, then click the link at www.rasc.ca/jrasc/recent to get the issue of your choice. If you haven't logged in and are unsure of the procedure, or if you are having difficulty with your login, please go to the Login Assistance page at www.rasc.ca/login-assistance or drop by the RASC office at **4920 Dundas St. W. at Burnhamthorpe** for support. The office phone number is **416-924-7973**.



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Observing Nights

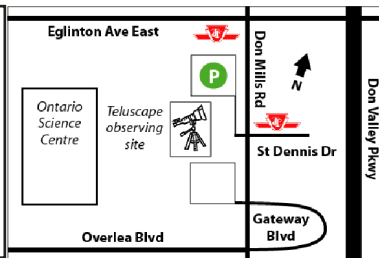
Join your friends from the Toronto Centre for Observing Sessions and Public Star Nights.

Observing takes place on the first clear night listed. Go on-line at www.rascto.ca or check the e-mail list, or our [FaceBook group](#) and Twitter feeds, www.twitter.com/RASCTC for confirmation after 6:30 PM if conditions are questionable.



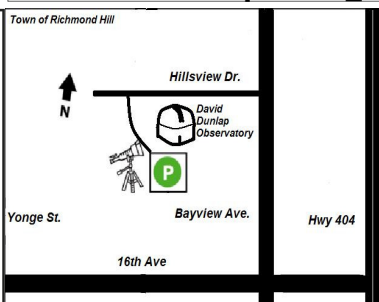
Solar Observing

Ontario Science Centre Teluscape
10:00 AM - May 7th
(April 9th, May 14th weather dates)
Contact: Shawn Lee
416-759-0650



David Dunlap Observatory

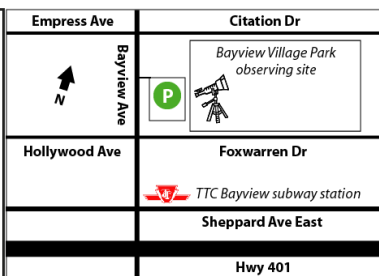
Please stay tuned to our **Yahoo! Groups** and other electronic media for updates on members-only DDO opportunities this winter, such as Tailgate Astronomy.



City Observing

Bayview Village Park

April 11th, 12th or 14th
May 16th, 17th, 18th or 19th
(first clear night)

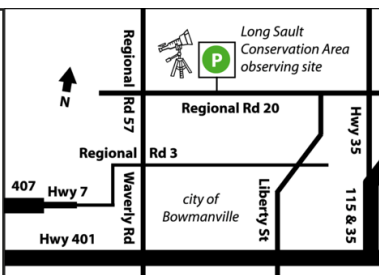


Dark Sky Observing

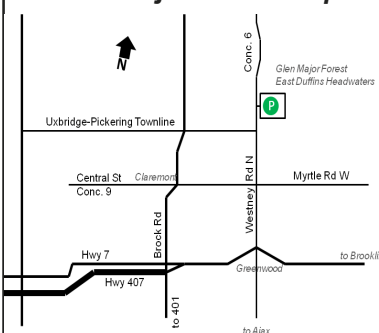
Long Sault Conservation Area
April 4th, 5th, 6th or 7th
May 2nd, 3rd, 4th or 5th
Contact: Stuart McNair
416-725-6840 C

Please dress according to the weather conditions. Winter outdoor events may be cancelled due to extreme cold weather, although the sky is clear.

See right for the new map to the **Glen Major Forest (East Duffins Headwaters)** observing site, which will be used for Dark Sky Observing under special circumstances. The entrance to the site is on the east side of Uxbridge Concession 6, and 850 metres north of the Pickering-Uxbridge town line.



Glen Major Forest Map



The Toronto Centre of the Royal Astronomical Society of Canada is one of the 28 Centres of the Society across Canada formed to promote the advancement of astronomy and allied sciences.

Membership Fees are:

Regular \$ 85.00 per year
Family \$ 80.00 primary + \$11 per person
Youth (under 21) \$ 45.00 per year
Affiliate (from other RASC centres) \$ 33.00 per year
Carr Observatory Annual Pass: \$85pp/\$140fam

Benefits of Membership:

- SCOPE Newsletter
- SkyNews Magazine
- The Journal and Bulletin
- Observer's Handbook
- Telescope loan program
- First Light Program for new astronomers
- Optional use of the Carr Astronomical Observatory
- Use of the David Dunlap Observatory
- RASC Insurance

Address Correspondence to:

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c/o David Dunlap
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123 Hillsview Drive
Richmond Hill, ON
L4C 1T3

Websites

www.rascto.ca
www.theddo.ca

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Join our electronic community! The Toronto Centre hosts an active Yahoo Groups! site for members.

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