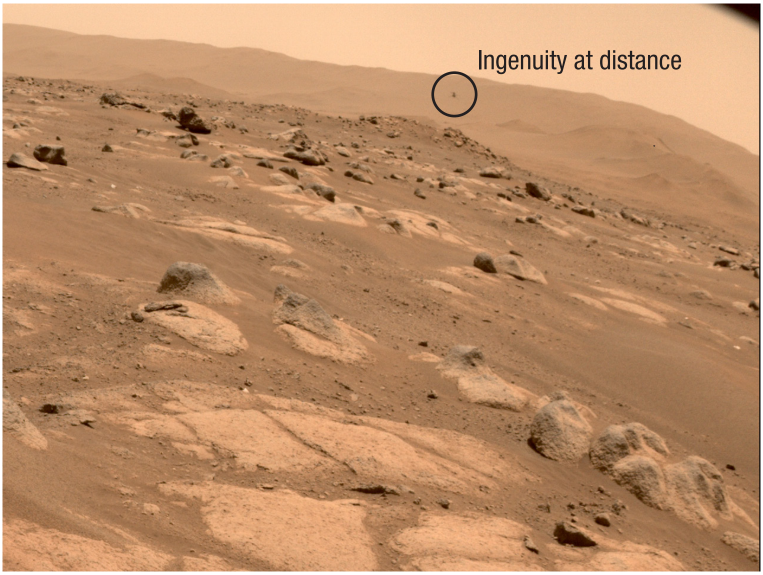
NOVA
NEWSLETTER OF THE VANCOUVER CENTRE RASC
VOLUME 2021 ISSUE 3 MAY JUNE 2021

In Thin Air

by J. Karl Miller

In my previous article, I alluded to the immense engineering resources needed for the very demanding, highly successful landing of a very complex rover vehicle (named Perseverance) on Mars.

The Perseverance rover on Mars had, as part of the payload, a small, specially-designed helicopter to test the possibility of flying in the very thin Martian atmosphere. *Ingenuity*, the name of this helicopter, has now flown several times on Mars and met and exceeded all goals set for it, including flying far enough to be almost out of sight of the cameras on Perseverance. By necessity, both Perseverance and Ingenuity have to be autonomous; at this time, any control signal from Earth would take about 16 and a half minutes to reach both Ingenuity and Perseverance. Information from NASA/JPL regarding Ingenuity says that this little helicopter exceeded the test performance well beyond expectations.



Ingenuity flying in the distance, imaged from the Perseverance rover

Image credit: NASA/JPL

NASA News indicates an expanded demonstration phase is going to start a couple of weeks from the time of writing (April 30). Ingenuity has proven that its communications, navigation, imaging and other functions are working well, and expanded operations will be initiated. In future, other Mars helicopters will play an ever-expanding role in getting to know

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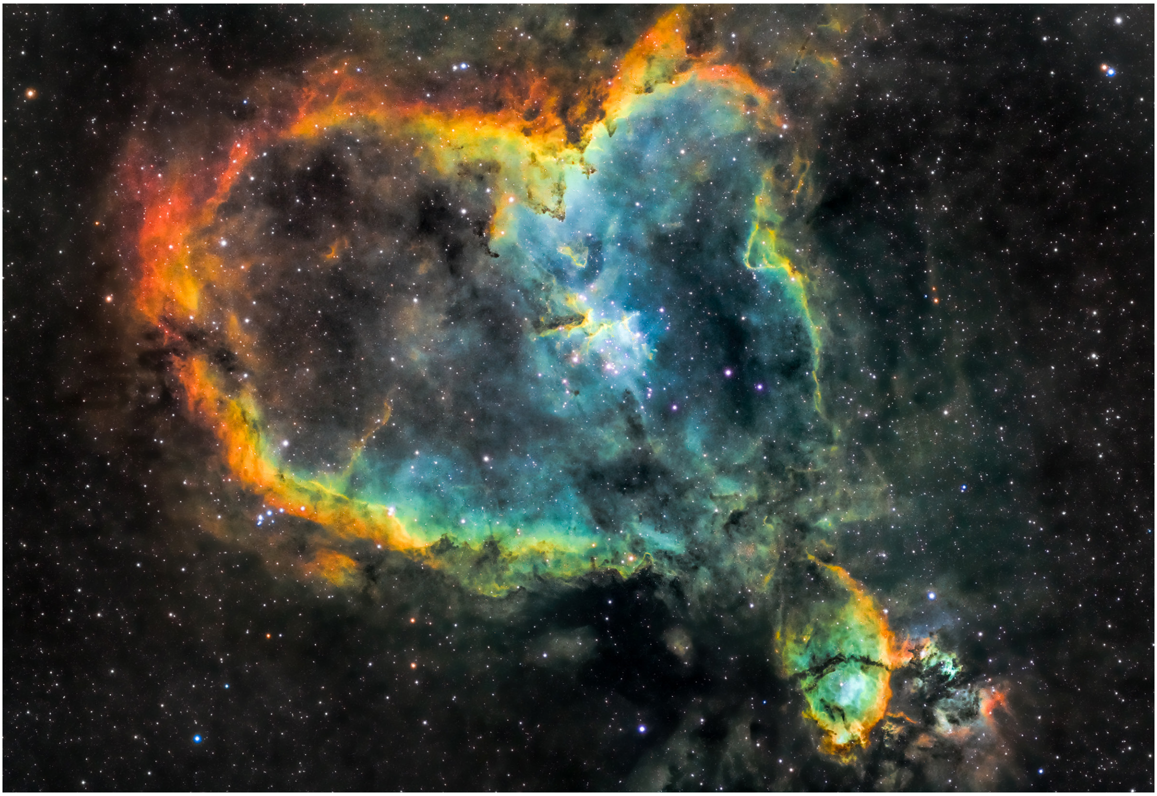
MAY 13 ZOOM	JUNE 10 ZOOM	JULY 8 ZOOM
Peter Clark, Professor Emeritus in Chemistry from U of Calgary: From Stars to Planets: What is Needed to Make Life Possible. Details on Meetup.	Ian Doktor from the University of Alberta. See Meetup for topic and further details closer to the date.	Michael Borghese, NASA/JPL Solar System Ambassador. See Meetup for topic and further details closer to the date.

The Heart of the City

by Robert G. Lyons



I live right in the middle of Vancouver, just one minute from the downtown core in a Bortle 8-9 white zone, so I use all the usual tools for imaging such as narrowband filters, fast aperture scopes, and a dedicated monochrome camera. However, there is something I use while imaging that cannot be found on the shelves of your local astronomy store… patience. It is this virtue that has allowed me to capture majestic deep sky images from home. I started off by imaging a different target each evening, and as miraculous as it was to be pulling these amazing sights from the night sky, they weren't stacking up against what I was seeing online. The big difference between a dark sky site and the city is signal to noise ratio. While we can never match an image made at a dark sky site from the city, we can close the gap by imaging over multiple nights to build up our signal to noise ratio. For this image of the Heart Nebula, I shot a total of seven nights, one being a complete waste due to an incorrect camera setting — ouch! The six successful nights totalled over 23 hours of exposure. I have found the sweet spot to be between 18 and 25 hours. Under 18 hours makes the image hard to edit without noise and colour artifacts, and over 25 hours results in diminishing returns. With nebula season beginning, it is the perfect time to pick your favourite target, approach it with patience, and watch your signal grow stronger every night. I found that slowing down and approaching each image as a larger project translated into other parts of my life as well, inspiring my art and improving my mindset. The delayed gratification of astrophotography is the perfect antidote for the modern frenzied pace of life and of social media. Clear skies.

Target: Heart Nebula in Cassiopeia
Telescope: William Optics Redcat 51
Camera: ZWO ASI183mm Pro
ZWO EFW Mini with New ZWO Ha, SII and OIII 1.25" filters

Mount: Skywatcher Star Adventurer
Guiding: ZWO ASI120 Mini/ASI 30F4
Control: ASIAIR Pro
Exposure: 280 x 300 seconds

President's Message

by Gordon Farrell

It's May, again, and with that comes International Astronomy Day. We typically celebrate the date a week early at SFU's Science Rendezvous and while that event was cancelled last year, it went ahead this past weekend, albeit as a virtual event.

Vancouver Centre's contribution came in the form of a series of presentations on Saturday, kicking off with JPL Solar System Ambassador, Matthew Borghese giving a talk about the Voyager I and II missions. Next up was yours truly with the intention of doing some live solar observing from my roof deck, weather permitting. Well, in a surprise to no one, the weather did not permit and I had to improvise a short presentation about what one might have seen one a clearer day. Fortunately, I had done a practice run a couple of weekends earlier and had managed to record a couple of minutes of shaky video of the Sun through my hydrogen-α telescope mounted on a simple camera tripod. This at least simulated what

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About RASC

The RASC Vancouver Centre meets at 7:30 PM on the second Thursday of every month at SFU's Burnaby campus (see map on page 4). Guests are always welcome. In addition, the Centre has an observing site where star parties are regularly scheduled.

Membership is currently $89.00 per year ($52.00 for persons under 21 years of age; family memberships also available) and can be obtained online, at a meeting, or by writing to the Treasurer at the address below. Annual membership includes the invaluable Observer's Handbook, six issues of the RASC Journal, and, of course, access to all of the club events and projects.

For more information regarding the Centre and its activities, please contact our P.R. Director.

NOVA, the newsletter of the Vancouver Centre, RASC, is published on odd-numbered months. Opinions expressed herein are not necessarily those of the Vancouver Centre.

Material on any aspect of astronomy should be e-mailed to the editor or mailed to the address below.

Remember, you are always welcome to attend meetings of Council, held on the first Thursday of every month at 7:30pm in the Trottier Studio in the Chemistry wing of the Shrum Science Centre at SFU. Please contact a council member for directions.

2021 Vancouver Centre Officers

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Honourary President J. Karl Miller

Library

The centre has a large library of books, magazines and old NOVAs for your enjoyment. Please take advantage of this club service and visit often to check out the new purchases. Suggestions for future library acquisitions are appreciated.

On the Internet

rasc-vancouver.com
astronomy.meetup.com/131/
www.facebook.com/RASC.Van
www.instagram.com/rascvancouver/
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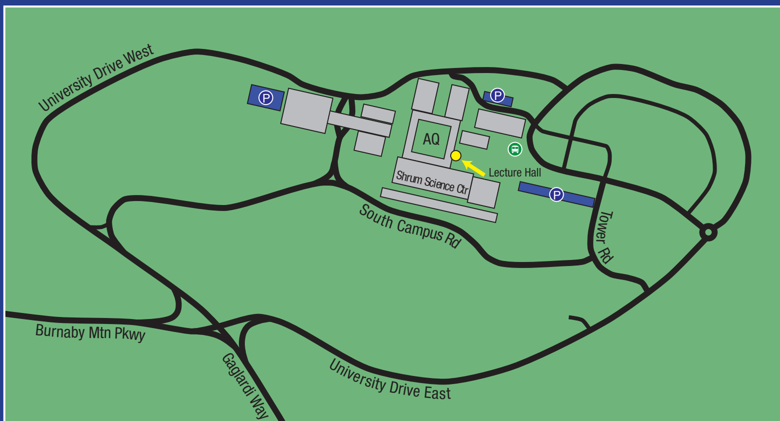
Map to Meeting Site



IMPORTANT NOTICE:

Our lectures have moved online until further notice due to COVID-19 and SFU having shut down most on-campus activities.

We will resume our physical lectures at SFU once is it deemed safe to do so.

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a live session might have looked like. I guess the talk was successful since one of our members later confessed to me that he purchased his own hydrogen-α telescope online later that day. My sincerest apologies to his credit card.

After lunch we had Ted Stroman with one of his always-popular talks about the Moon. And we finished up with Suzanna offering a virtual tour through our Jim Bernath Meteorite Collection with the aid of a handheld magnifying camera. She showed off stony, iron, and mixed meteorites dating from the 1800s all the way up to a chunk of the famous Chelyabinsk meteorite that streaked across Russian skies in 2013. The Widmanstätten texture found in the iron meteorite was particularly fascinating (if difficult to pronounce).

On page 5 of this issue you'll find an article by Alan Jones with an update about a new dome for the Antony Overton Memorial Observatory (AOMO). One of the big motivating factors behind upgrading the dome is a generous donation by past-president Howard Trottier and his wife Loula: a new telescope for the observatory! Once the pandemic allows travel to the Okanagan, we will be taking possession of a Planewave CDK17 telescope (*f*/6.8 with a 17" aperture) on a Paramount ME mount, an Apogee U16M monochrome camera with filter wheel (including Astrodon LRGB and 3nm narrowband filters) and a ZWO camera for guiding (with an off-axis Astrodon guide unit). This is a truly impressive set of equipment and we are so grateful to Howard and Loula for their amazing gift to Vancouver Centre! Stay tuned for further updates and calls for volunteers to help replace the dome and re-configure the observatory to accommodate the new telescope.

I also want to say a special "thank you" to our newest group of council members who answered our appeal for help back in March. Among the new faces on council are Nolan Smith as National Rep., Andrew Ferreira as Public Relations and Speakers, Marla Daskis as Membership, and in at-large positions, Arnie Gauthier, Rob Lyons, Douglas Filipenko,

Shay Pomeroy, and Michael Levy. We're happy to see you all in our Zoom meetings and look forward to the day we can all meet together in person at SFU once the pandemic is behind us! ✸

For Sale

FREE TELESCOPE MAKING MATERIALS

I have some telescope making materials that he is interested in gifting to another enthusiast. There are things like mirror blanks, grinding abrasives, a home-made mirror grinding machine, and so on. These items are available for pick-up in Ladner.

Interested parties can contact Scott Richardson at hughesdepayens@yahoo.ca

AOMO Update

by Alan Jones

RASC Vancouver Centre Observatory gets its first ever brand-new dome!

Council approved replacing the dome on our observatory in the Malcolm Knapp UBC Research Forest! This is the first new dome for the observatory, which was built with volunteer labour and donated materials thirty years ago. The current donated dome was a defective cast off when installed and two major attempts over the years to repair the dome have had mixed results. The new dome is a very welcome update that renews, upgrades and extends the life of our facility while preparing it for an exciting future as we recover from the pandemic.

Image credit: Technical Innovations

Observatory domes, even our standard size, are not an "in stock" item. Our new fiberglass dome is currently being fabricated in Florida. It is a superior design to the existing dome, being lighter, having a fully captive mount, a wider slit, and is a well proven dome. It is designed to install on the top of a building with no single piece weighs more than 45 pounds. Shipping logistics require construction of a large, wooden crate to protect the dome which will arrive mid-summer to a shipping terminal in Burnaby. We are currently making arrangements to receive the shipment and transport it to the site and, of course, install it on the building.

Stay tuned for future updates and exciting observatory announcements. Contact AOMO@RASC-Vancouver.com if you are a member and would like to help with maintaining the observatory. When the observatory returns to active, membership will be invited to propose and participate in observatory projects. ✸

Membership has its Privileges!

Are you tired of looking at the same objects again and again (planets, moon, etc.)? Is your telescope collecting dust because it's hard to locate deep sky objects? Would you like to bring your observing to a stellar level? Robert Conrad, our new observing director, revived the Vancouver RASC observing group and invites you to join by sending him an email at observing@rasc-vancouver.com. Some of the benefits of belonging to this group include:

- Hands on training on how to operate the SFU Trottier observatory
- Weekly observing sessions at the observatory or at dark sky locations
- One-one-one coaching on how to locate thousands of objects in the night sky
- Attend small interactive seminars delivered by Robert on a range of topics including failsafe star-hopping, charting challenging objects and understanding the motions of the cosmos
- Learn to make your telescope dance by locating objects such as asteroids, nova, and supernovae
- Spectroscopy and imaging training from Howard Trottier and an opportunity to collaborate on observatory research projects
- Updates on observable sky events happening during the week like asteroid/comet/deep sky conjunctions
- Access to observing guides and lists that Robert created that took hundreds of hours to create and will help with planning observing sessions
- Knowledge and expertise from other observing group members
- Learn how to quickly and efficiently find and star-hop to deep sky objects using a range of binoculars and telescopes

Upcoming Events

August
7 - 15 – Mt. Kobau Star Party

September
4 - 12 – Merritt Star Quest

December
12 – AGM

Light Pollution Abatement

by Leigh Cummings

I'm going to start this article with some very simple definitions:

Light – The part of the electromagnetic radiation to which the organs of sight react from about 400 nanometres to 700 nanometres.

Pollution – the introduction of harmful substances or products into the environment.

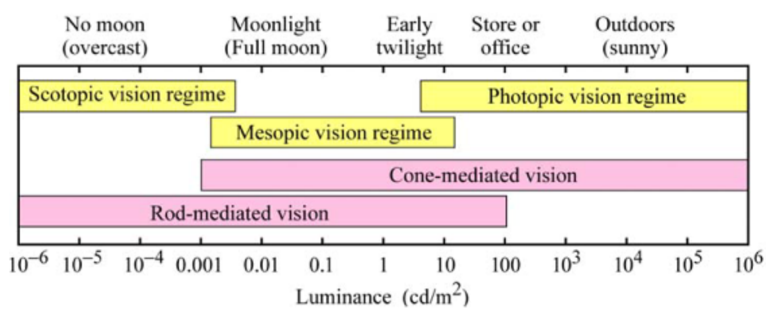
Abatement – the act or state of abating or the state of being abated; reduction; decrease; alleviation; mitigation. It can also mean suppression or termination as in abatement of a nuisance.

I wrote these definitions not so much for our readers, but to bring my goals as LPA chair sharply into focus for me.

One of the reasons that progress on LPA is slow is that it is difficult to convince people that light can be a pollutant. We have after all evolved as daytime creatures. Our eyes have evolved to be very colour-sensitive. We have three sets of cones in the retina of our eyes that are sensitive to the red, green and blue wavelengths of light. The intensity of light within those wavelengths are interpreted by the sight portion of our brain in the same way a painter mixes different tints to come up with all the rich colours of nature. We also have rods in our eyes that only see the whole luminous spectrum. The intensity of light striking them is interpreted from black (no light) to pure white. As there are many more rods in a human retina than cones, our colour vision depends on brighter light for us to discern colours. The first part of our vision we lose as it gets darker is our colour vision. Only the rods in our eyes allow us to see forms and motion after dark. This is why we see very little colour when we look through our telescopes at night.

Almost all life on Earth senses light through some form of light sensing organs. The simplest just respond to any light source, but biologists and botanists are finding that many plants and animals respond to different colours (wavelengths) of light. Nocturnal life does best when light is minimal. They can function in daylight; however, they are usually at a disadvantage when it comes to survival. Diurnal creatures like us still have some ability to function in the nocturnal environment; however, we too are at a disadvantage when it comes to survival. We overcome most of this disadvantage by our use of technology. That technology of course is Artificial Light At Night (ALAN).

Our use of ALAN has now come to the point that the vast majority of humans rarely get to experience nature's nocturnal environment, nor get to see the universe in all its splendour. We also never really get to experience our night vision to its fullest.



Our vision sensitivity is broken down by how our receptors work. Photonic vision is full daylight; Scotopic is our night vision, while Mesopic is in between. Photonic vision is when our cones are in full use and can see colour easily. As

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far more Mars details. One of the main efforts is to find out whether traces of past or present extraterrestrial life exist now. There are many interesting topological formations on Mars which may be suitable; an area on Mars in which traces of life (as we know it) could possibly be found: under the icecaps. Martian seasons are similar to Earth, but last about twice as long. Mars is farther away from the Sun and takes about twice as much time to complete one orbit.

Below are some of pictures showing the edges of Martian ice caps. The ice caps contain water ice for the most part and are usually covered by CO_2 ice (dry ice) during the Martian "winter." The caps melt and rebuild much like on Earth over the span of the Martian "year." Wikipedia contains details regarding Martian polar ice caps.

It seems that this rough terrain would be problematic for any rover but could much more easily be explored by drone-like "Ingenuity" helicopters.

There is a YouTube video showing ice and dust avalanches at the edge of the north polar ice cap. The images were obtained by NASA's Reconnaissance orbiter's HIRISE camera.

When the Sun shines on the layers of the ice caps edges, the warmth makes the ice unstable. Blocks of rock and ice can break off and fall down the about 500m tall edges to create ice and dust clouds when they hit bottom. The colours vary depending on the proportions of dust and ice mixed in these avalanches.

It always amazes me to see dense clouds of dust in such a thin atmosphere in pictures transmitted from Mars. Well, it made the idea to try flying aircraft on Mars plausible. ✸

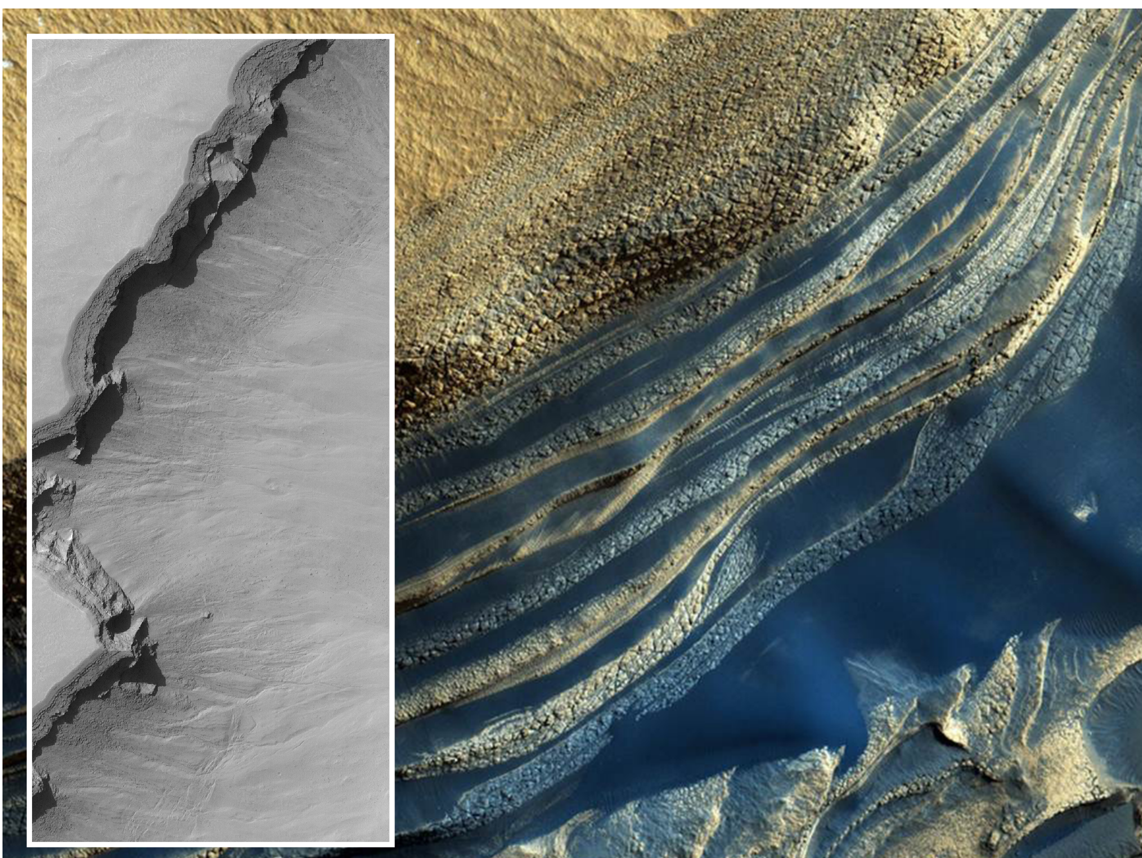

Image credits: NASA/JPL

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the light intensity decreases, our eyes start to depend on the rods more and this is the Mesopic stage of our vision. When the light intensity decreases to the point that only our rods can detect it then we are using our Scotopic vision.

There are other physiological factors that increase our night adaption even further. The three physiologic processes contributing to the increased light sensitivity of the retina in darkness are dilatation of the pupil, synaptic adaptation of retinal neurons, and increase in the concentration of rhodopsin available in the outer segments. (Slatters, 2008) Rhodopsin is the hormone that we astronomers are addicted to. It is the chemical that increases our night vision dramatically. Our body produces it through a series of biochemical reactions involving carotene and vitamin A that is too complex for this article. The process is steady, but because the rhodopsin is "bleached" by light, it only builds up on the rods as the light intensity decreases. The bleaching process happens fastest with white light. This biological process is common in most animals with complex eyes.

We do not think of daylight as a pollutant, nor the Moonlight of a full Moon (unless, of course, you are an astronomer). The pollutant is ALAN. Unlike air pollution, water pollution and waste pollution, the effects of which have a more immediate and noticeably harmful affect on us humans, light pollution has crept upon us slowly and as most humans tend to sleep during the night, it tends not to be as noticeable. In the past it has only come to the public's attention when it is disturbing someone's place of sleep or their enjoyment of their property.

With the advent of LED lighting, scientists are becoming more aware of the effect light has on our health. The blue part of the spectrum bleaches rhodopsin faster that the other portions of the spectrum. This is a safety factor when driving at night, as it prolongs the recovery of our Mesopic vision. It also has a greater effect on the ganglions in our eyes. These sensors control our circadian rhythm. This exacerbates sleep disorders but also has many other far-ranging effects on our health. LED lighting also opens up new ways of limiting light pollution if used correctly. New LED lights can be dimmed. They can now be designed to operate at different colour temperatures. Because they do not require a warm-up like high pressure sodium (HPS) lighting that is being replaced for street lighting, the opportunity is opening up to use "Smart Lighting" to lower the overall light and power wasted when the lights can be turned right off.

One of the challenges facing me as LPA chair is to alert people to the fact that ALAN is as harmful a pollutant as air and water pollution. As we as a society accept that humans will always create air and water pollution, we have become keenly aware that we have to mitigate the pollution of our environment for the good of us all. I want to bring light pollution to the same level of public awareness so that we can convince our governments to act more responsibly to mitigate the damage it does to our nocturnal environment. It is also important to note that light that is serving no useful purpose is just energy, and hence money wasted. I do not expect us to be able to rid the world of ALAN; however, I do hope we can change lighting policies in order reduce the waste, bring back our night sky and to fight the further spread of this pollutant.

One of the ways I hope we can do this is by encouraging city dwellers to find dark locations to view the night sky in all its splendour, the way all humans had until the recent invention of electric lighting. For this reason, our Vancouver Centre is promoting the City of Vancouver's application to have the Beaver Lake area of Stanley Park designated an Urban Star Park. We have a way to go in the process; however we have a great group of people working on the application process led by Michael Levy, councillor at large. We believe that although no site within a large city is perfect for star gazing, an Urban Star Park can be a great way to introduce people to a nocturnal ecosystem along with a better view of the night sky. We hope this will build up a public appetite for Dark Sky Preserves around the province of BC to help to preserve the dark experience for generations to come. ✸

Spacesuits: The Past, Present and Future

by Hayley Miller & Gordon Farrell

Spacesuits are cool and they're only getting cooler. Not only are they the most technically advanced garments ever made, they are essentially personal spaceships, providing all the necessities of life for the astronauts that wear them.

The first spacesuit dates back earlier than you may think. Made in 1935 by Emilio Herrera from Guadalajara, Spain, his "stratonautical" spacesuit was a pressurized suit designed for a stratospheric open balloon flight the following year, a flight that was cancelled due to the start of the Spanish Civil War. The suit was made of vulcanized silk, incorporated an articulated metal frame, offered mobility that was described as "satisfactory" and was supplied with pure oxygen. Herrera also included a heater but tests showed it was unnecessary since the suit remained very warm due to the near-vacuum which made it difficult to dissipate the heat produced by the wearer's own body.

Emilio Herrera's stratonautical suit from 1935

Jumping ahead to the 1960s, we find the first generation of American spacesuits, which were really upgraded versions of the Navy's Mark IV high-altitude flight suits. These are the iconic silver suits worn by John Glenn and other Mercury-era astronauts, with the aluminized outer layer for thermal control, stiff gloves with curved fingers for gripping controls and a straight middle finger for pushing buttons, and various straps and zippers to ensure a snug fit. Being the first generation of modern spacesuits, there were some complaints from the wearers, the most common being poor temperature control and an inability to turn their head when the suit was pressurized.

The next generation of American spacesuits were the ones for the Gemini program. These were the first American suits designed for extravehicular activity and went on to be the basis of early Apollo suits but met their end with the tragic Apollo I fire. They were succeeded by the Apollo/Skylab suits that became the spacesuit most people think of when picturing an astronaut—bulky, white suits festooned with red and blur connectors and a large backpack filled with oxygen and other life-supporting equipment—and served until the Skylab missions in 1974. The Apollo suits consisted of an inner layer for life support and an outer layer to both protect the inner layer from abrasion and to shield the astronaut from solar radiation and micrometeoroid impacts. Improvements were made for Apollo 15 to allow the astronauts to sit and turn their heads, both of which were required for driving the LRV around on the Moon. The Skylab suits did away with the backpack, replacing it with an umbilical cord to provide oxygen, instead.

During the shuttle era, pressure suits were replaced by simple, blue flight suits with oxygen helmets during launch and re-entry until the Challenger disaster demonstrated there was still a need for greater protection. After that, as-

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tronauts wore the orange "pumpkin suits" during the dangerous stages of the mission. While these suits weren't made for the vacuum

Image credits: NASA, Boeing

Gordon Cooper wearing a Mercury-era spacesuit

of space, they were sufficient to protect the astronauts if they had to bail out in the upper atmosphere—a feature that was never tested in a real-life scenario. Once in orbit with the Shuttle (and to this day at the ISS), the Extravehicular Mobility Unit (EMU) is used for spacewalks, which is the latest version of the classic, white NASA spacesuit (the Russian and Chinese space agencies use their own suits). This is a two-piece, semi-rigid suit whose upper and lower halves come together at the waist. One feature that is common to all of these NASA-commissioned suits is that they emphasize function over form. They get a very challenging job done but government agencies care little about how good they look while doing it.

Enter the private sector. Say what you like about the comedy stylings of Elon Musk but as a savvy business leader he knows how to sell a product, and that includes space travel. The SpaceX suits not only serve a purpose; they make a fashion statement. Hollywood costume designer Jose Fernandez (known for his work on films like *Captain America: Civil War* and *Batman v Superman: Dawn of Justice*) was brought in to work with Musk on these "Starman Suits," nicknamed for the Tesla Roadster-driving mannequin that wore a version of it for the Falcon Heavy test flight in 2018. At 50 lbs, they're half the weight of the

Eugene Cernan wearing an Apollo/Skylab suit in the Taurus-Littrow valley on the Moon

pumpkin suits and are rated for use in a vacuum (though they offer no protection from radiation so are unsuitable for extra-vehicular activity). These suits are a one-piece design and are customized for each astronaut. They are also designed to be a part of the

Two astronauts wearing Shuttle-era "pumpkin" pressure suits

Crew Dragon capsule, with the crew plugging them in to power and oxygen via a single connection when they sit down. The helmets are 3D-printed, the body made of fire-retardant Kevlar and Nomex, and they're what all the best-dressed astronauts are wearing (Musk did want them to look like a tux, after all).

So what does the future hold for spacesuits? With NASA seeking to return to the Moon by

Astronaut Douglas Hurley wearing a SpaceX “Startman” suit

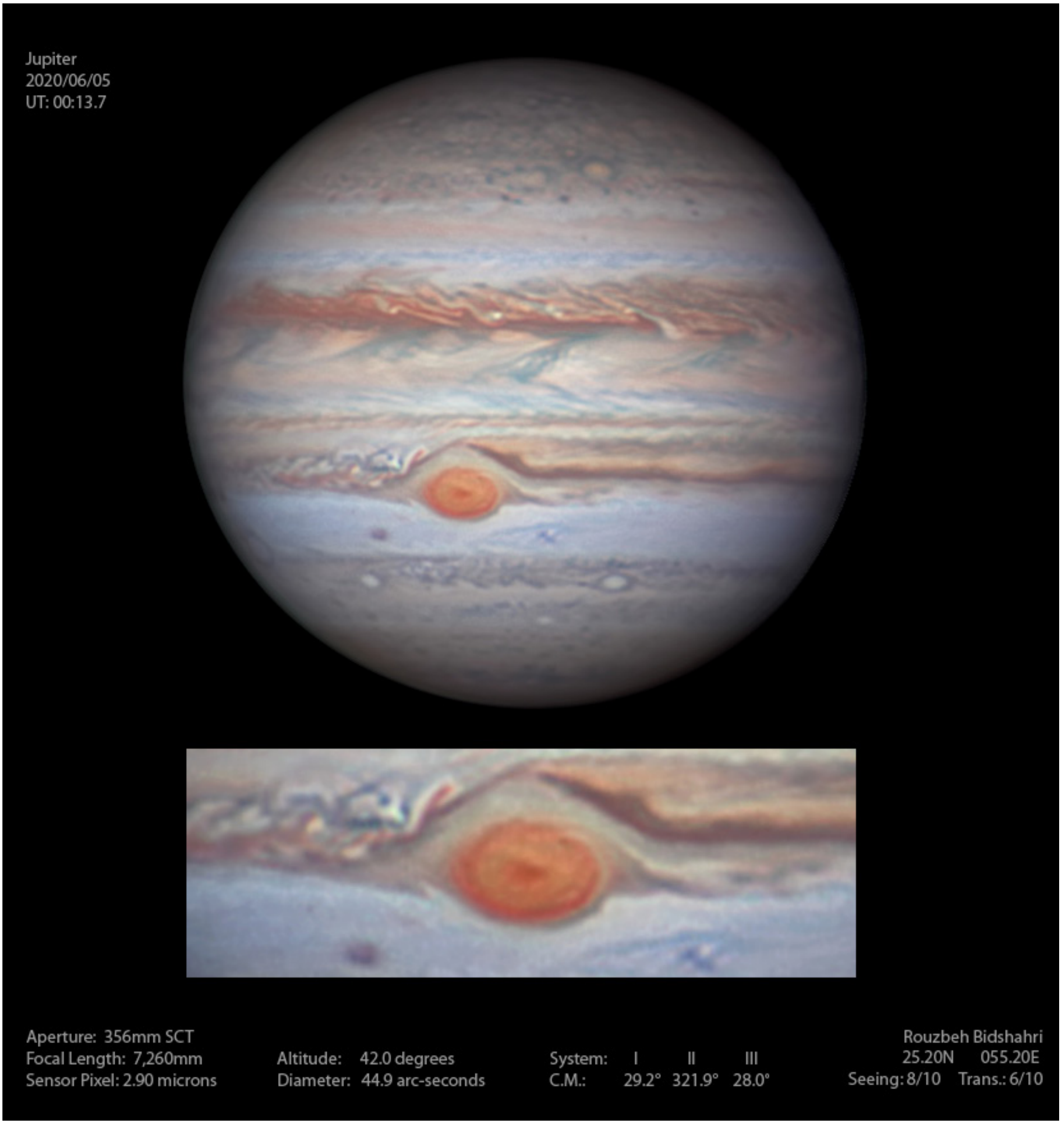
Former astronaut Chris Ferguson wearing the Boeing spacesuit

2024, the Orion spacecraft comes with its own set of suits: the Artemis Generation Space Suits. First, the Orion Crew Survival System suit is the latest generation of the pumpkin, this time with a 3D-printed helmet, improved mobility and touchscreen-sensitive gloves. For walking on the Moon’s surface, the suit of choice is the eXploration Extravehicular Mobility Unit (xEMU). Like the EMU suit, it consists of a top and bottom half but can twist and bend at the waist, allowing the wearer to walk more normally and even kneel, something the Apollo-era suits did not.

There are also the pressure suits Boeing is designing for their CST-100 Starliner spacecraft for ferrying astronauts to the ISS. Sleeker than the NASA suits but not as stylish as the Starman suits, the Boeing suits feature a soft, hood-like helmet with a wide, polycarbonate visor which offers better peripheral vision.

But even these future suits are only a glimpse into the near future of spacewear. Who knows what new materials, environments, and whims of fashion vs. functionality will affect the future of spacesuits, but they undoubtedly be cooler than ever. ✸

NASA spacesuit engineer Kristine Davis (left) wearing a ground prototype of the xEMU suit and Dustin Gohmert (right) wearing an Orion Crew Survival System suit, both part of the Artemis generation of NASA spacesuits



Jupiter and the Great Red Spot by Rouzbeh Bidshahri

The Great Red Spot is a giant storm system several times the size of the Earth that is constantly undergoing changes due to its turbulence nature. On exceptional nights when seeing is calm enough, small ground based telescopes can make out considerable details of the GRS. Seen here is the GRS with its complex structures and the “flaking” or breaking off fragments. Clyde’s spot can also be seen below the spot in this image.

This image was compiled from 194 GB of data with some 372,000 frames captured. Focal Length was 7,150mm with a C14 telescope x 1.86 the Astro-Physics 2” barlow. Camera: ASI290mm. Software used: Firecapture, AS3!, Winjupos, GIMP. Location: Backyard, Dubai, UAE.