NOVA

NEWSLETTER **OF** THE **VANCOUVER** CENTRE **RASC**

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An Old Standby

by J. Karl Miller

In these days of COVID-19, getting together with others to have a look at the night sky is an exercise of don'ts: don't get too close to each other, don't touch or look through the telescope, don't come without a mask, etc. On-line meetings are substituting for the in-person ones. My wife and I are practicing voluntary self-isolation (we are old enough to make this necessary). That means that I'm confined to observing the sky from our home.

We live in a highly light-polluted and horizon-limited area. The smoke from the wildfires in the U.S. has added to the lack of visibility of the stars. There were just a couple of acceptable evenings which led me to look for one of my favourite objects in the sky: The Whirlpool Galaxy not far from the end of the Big Dipper's handle. In a dark sky, M51 can be seen in larger binoculars as a small, diffuse patch of light.

Messier 51. Image taken through the wide-field, 17-inch remote-control Slooh.com telescope located at the Institute of Astrophysics of the Canary Islands.

I used my 15x50 Canon stabilized binoculars to try and see it. I did not detect it at all. The grey sky here made it an impossibility. In earlier years, M51 was easy to see from our house; high-rises, new and under construction, now limit our horizon and add much light pollution.

I decided to get my "M51 fix" by posting an image I took a couple of years ago by connecting my computer to slooh.com to use one of their remotely-accessible telescopes and take a picture; at left is the result.

Some history (from Wikipedia):

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NOTE: Our November lecture will be held on Friday at 7pm

NOVEMBER 13 — SFU	DECEMBER 10 — SFU	JANUARY 14 — SFU
Dr. Tessa Fisher, a gender-neutral astrobiologist from U of Arizona, on using spectral analysis to study the atmospheres of exoplanets. Zoom link on Meetup. SFU	Our AGM followed by a short presentation by our own Hayley Miller at 8pm (Meetup link for her presentation here). SFU	Speaker TBD. See Meetup for updates. SFU

Star Magnitudes

by Robert Conrad and Andrew Krysa

The ancient Greeks took great pleasure in looking at the night sky. One Greek astronomer named Hipparchus around 129 BC came up with a method of measuring the brightness of stars as they appeared to the human eye. He assigned magnitudes to the brightness of the stars and gave the brightest stars a magnitude of one and the faintest stars a magnitude of six. We have kept this scale ever since and a few confusing facts come out of this convention. The first confusing point is that smaller number magnitudes like 1 are actually brighter than larger number magnitudes like 6. This scale was originally defined by Hipparchus' eye and the human eye is a bad brightness detector especially as things get fainter. So, because of this, the second confusing point is that a star that is two numbers brighter than another star is not actually twice as bright as the fainter star but 6 times brighter. Magnitude is actually calculated on a logarithmic scale. This means there is a linear ratio of brightness as we go up or down between magnitudes. The difference in brightness between a 5th magnitude star and a 4th magnitude star is the same ratio as the difference between a third and a second magnitude star. The difference in brightness between one magnitude and the next one is 2.5 times the brightness and a difference of 5 magnitudes is equal to a factor of 100 in brightness. Because we have chosen to keep this antiquated star brightness measuring scale, we have had to adapt it for more modern purposes. There are actually objects and stars much brighter than magnitude one which Hipparchus just lumped into the same basket. So this leads us to a third confusing point about star magnitudes. Objects and stars brighter than magnitude one are actually assigned negative numbers. So the brightest star in the sky Sirius is actually magnitude negative one point five in brightness and Venus, when it is at its greatest western or eastern elongation and at its brightest, is at magnitude minus 4. The full moon is magnitude minus 12 in brightness and the sun is almost minus 27 magnitude brightness. Using the logarithmic scale, the sun appears to be an astonishing 13 billion times brighter in the sky to us than Sirius. Going the other way, a good amateur 8-inch telescope can see stars and objects to about magnitude 12 in brightness and the dimmest galaxy yet observed is magnitude 29.

The practical side of the magnitude scale as it applies to the observational astronomer is knowing what the naked eye limit is and being able to look at any given star or object in the sky and being able to know what magnitude it is. To some extent this magnitude limit is impacted by the amount of light pollution in the sky. Generally speaking, the naked-eye limit in a dark sky location away from city lights is between 6 and 7 depending on how dark the location is, how good one's eyes are and how well their eyes are adjusted to the darkness, which can take up to an hour. If the moon is full there will be little chance to identify a six or seven magnitude star especially if the stars which you are trying to identify are in the vicinity of the full moon. This is why it is critical to protect your night vision at all costs. Using a dim red or green LED light when reading star charts out in the field is one good way to retain your adapted night vision. All good star charts will have a legend showing the star magnitudes usually from negative 1.5 to 13 represented by black circles. The bigger the circle, the brighter the star. After much practice of observing and comparing what is seen in a star atlas, a good amateur astronomer should be able to look at a star and be able to come up with a fairly good approximation of the star's visual magnitude.

If you look in your telescope instruction manual, there should be a section outlining its specifications. One of those specifications is the visual/apparent magnitude limit of your telescope. This value assumes the darkest location and a very clean mirror. I find this value to be overly optimistic by about one magnitude. That's why it is imperative to ensure that you clean your optics regularly and observe in the darkest location feasible to get the most of your experience. Even with just a good pair of binoculars you can increase the number of stars in the sky from a visible naked eye limit of 2000 in your hemisphere to over 100,000. With a telescope, that number increases to a few million stars.

To see a magnitude naked eye limit of 7 you will most likely need to use what's known as averted vision. This means looking not directly at the magnitude seven star but looking slightly away from it so that it comes into view in your eye. Pilots who fly at night are very experienced at using averted vision. Averted vision is approximately 15° off centre vision or straight-ahead vision and the sweet spot is a little different for everybody. The human retina is covered with rods and cones which

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President's Message

by Gordon Farrell

Well, that was different.

With 2020 wrapping up, so too marks the end of my first year as President of the Vancouver Centre, and an unusual year it certainly was. When I stepped into this position last December, the coming year was expected to be fairly typical, with our annual Astronomy Day festivities at SFU in May, expectations for public observing events around the close approach of Mars in the fall (which would likely have been the same multi-week spectacle that attracted crowds in the thousands as it did back in 2003) and regular Starry Nights events at SFU on clear Friday nights, among other public, in-person events. The only extraordinary event was to be hosting the 2020 General Assembly in June, itself a major undertaking.

Instead, things took an abrupt turn in April as the coronavirus began to dominate the news and force everyone to re-evaluate how public gatherings would happen—or not happen as the case may be. With SFU locked up tight, we only

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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.

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Past President Leigh Cummings

At Large Howard Trottier, Bill Burnyeat

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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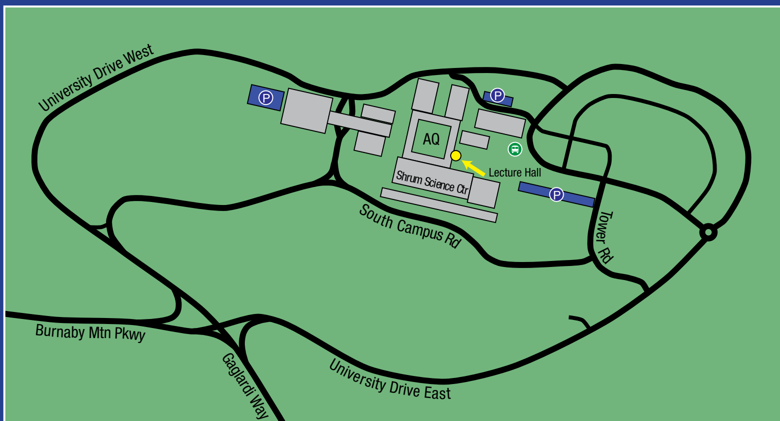
Map to Meeting Site



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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had two public lectures on campus before, like everyone else, we had to move everything online. New words entered the vernacular: Zoom, cohorts, bubbles, PPE and so on. Things changed so quickly that I still have a bag of March NOVA newsletters in a bag in my closet, waiting vainly to be distributed (ironically, our March meeting was cancelled due to the illness of our speaker).

But as the world adapted, so did we. The GA went online and was quite successful (again, a big thanks to Hayley Miller and the rest of the GA committee for pulling it off on such short notice). We moved our monthly lectures to Zoom and even SFU found a way to stream Starry Nights on YouTube, where RASC members can still help out as moderators rather than with our telescopes. And I've become the first NOVA editor to publish online-only versions of the newsletter.

And while 2020 continues to work hard to be synonymous with disaster, loss, and disappointment (the latest—and uniquely Canadian—casualties being the loss of Alex Trebek and Howie Meeker this weekend) there have still been some highlights for us astronomers and space enthusiasts: Rumours of Betelgeuse's death were highly exaggerated. SpaceX launched astronauts to the ISS from US soil for the first time in nine years. Comet C/2019 Y4 ATLAS may have been a dud in April but C/2020 F3 (NEOWISE) more than made up for it when it graced our skies in July. Scientists may (or may not) have detected phosphine, a biomarker gas in the clouds of Venus. Water was found in the crater Clavius on the Moon (with a tip of the hat to fans of *2001: A Space Odyssey*). Mars made its aforementioned closest approach in October. OSIRIS-REX sampled the "rubble pile" asteroid Bennu. BC's own CHIME radio telescope helped identify magnetars as a source of fast radio bursts (FRBs). And there's the conjunction of Jupiter and Saturn coming on December 21st (weather permitting, of course).

And yes, there were 2020-esque astronomical events, too. The Arecibo Observatory was damaged by a hurricane. Starlink satellite constellations continue to worry professional and amateur astronomers alike. The media repeatedly worked itself into a tizzy about harmless asteroids whizzing past the Earth. And we lost our own Barry Shanko.

But 2021 is a new year. There's the promise of vaccines coming so perhaps we can return to some semblance of normalcy in the latter part of next year. And whatever 2021 brings us, the night sky will remain, enticing us with its splendours. So even if you have to do it in solitude, with a small group of immediate family, or with friends spaced safely apart, go out and look up and put our earthly troubles out of mind for just a little while. ✸

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are sensitive to light. Cones are more effective during daytime vision and rods are more efficient during dimmer times and nighttime. Cones are more concentrated in the centre of your retina and rods are more prevalent further out from the centre of your retina, hence the reason for being able to see fainter, darker objects better when not looking directly at them but a little off centre. Rods are also less sensitive to colour which is why things look more black and white at night and why we can't distinguish star colours in the sky so well. Were our rods more sensitive to colour we would see a myriad of different colours in the stars we see at night.

Star limit magnitudes are critical when choosing a starting star during star hopping. The more stars you can identify in the sky and view, perhaps even using averted vision, will reduce the distance that you need to star hop. In other words you want to find the closest star to your destination object.

Experienced astronomers often create custom star charts. The reason we do this is because often, in the case of an asteroid, there will be many stars in the same field of view with a very similar magnitude to the asteroid. Creating a custom chart will help distinguish between the asteroid and the other stars. For comets, which tend to move relatively quickly through a field of view (especially when near perihelion) it helps us ensure we are looking in the exact location at the proper time to be able to identify the comet in the field of view. When generating the custom chart, it allows you to select the limiting magnitude and will then only plot the stars up to that magnitude. What is important here is for you to know what the limiting magnitude of your telescope is but also what the limiting magnitude of what is visible based on environmental conditions where you are observing, such as light pollution, moon, atmospheric transparency, etc. To some extent, even the altitude

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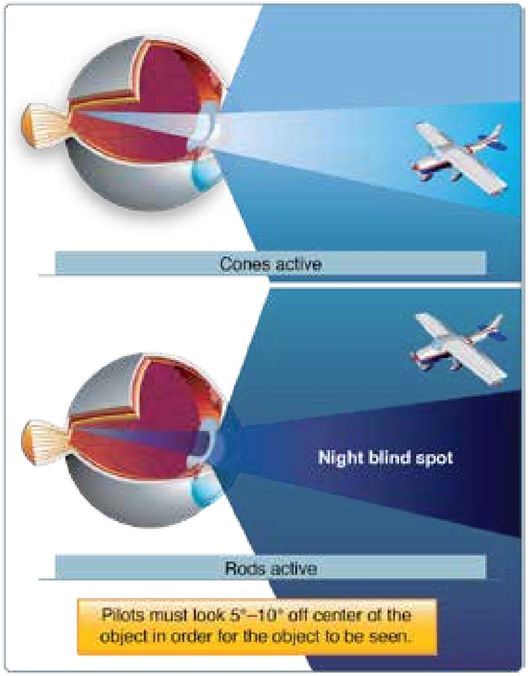

Image credit: FAA

Upcoming Events

December

10 – AGM

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What later became known as the Whirlpool Galaxy was discovered on October 13, 1773, by Charles Messier while hunting for objects that could confuse comet hunters, and was designated in Messier's catalogue as M51. Its companion galaxy, NGC 5195, was discovered in 1781 by Pierre Méchain, although it was not known whether it was interacting or merely another galaxy passing at a distance. In 1845, William Parsons, 3rd Earl of Rosse, employing a 72-inch (1.8 m) reflecting telescope at Birr Castle, Ireland, found that the Whirlpool possessed a spiral structure, the first "nebula" to be known to have one. These "spiral nebulae" were not recognized as galaxies until Edwin Hubble was able to observe Cepheid variables in some of these spiral nebulae, which provided evidence that they were so far away that they must be entirely separate galaxies even though they are seen close together. The advent of radio astronomy and subsequent radio images of M51 unequivocally demonstrated that the Whirlpool and its companion galaxy are indeed interacting.

There are still some uncertainties regarding M51. For instance, the distance of it is variously quoted as 31 million light years (NASA), Wikipedia says about 23 million, universetoday.com states 19 to 27 million light years. A location chart is shown above. A dark sky will allow for M51 to be seen in 10x50 binoculars as a faint patch of light. An 8" (200mm) telescope will begin to show its spiral structure.

Messier 51 is circumpolar, so it is accessible for most of the year. At this time of year, the Big Dipper skirts the northern horizon through the night. M51 therefore moves along above the northern horizon as well. Give it a try under a dark sky anyway. Its position will improve as we progress through winter and into next year. ✸

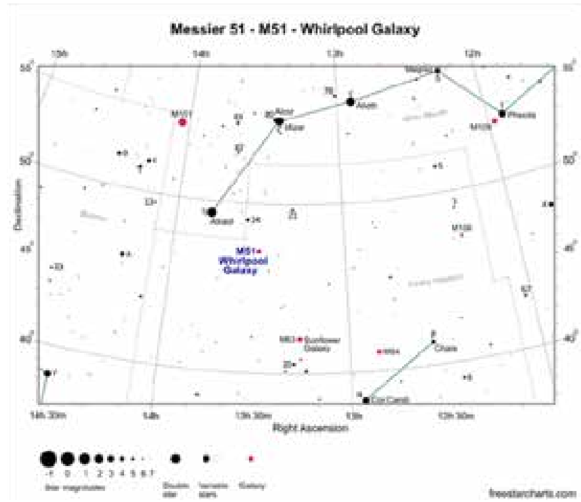

Image credit: freestarcharts

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at which you are viewing can affect the magnitude limit. For example, if you are viewing right at or near the horizon, don't expect to see the upper limit of the limiting magnitude of your telescope.

One important thing that we need to discuss is that the magnitude limit referred to in astronomy literature is in reference to a single point of light. Another concept that you will need to become familiar with is something called surface brightness. This is a term often used to describe the brightness of not stars but diffuse objects such as galaxies and nebulae. Light from these objects appears to come from an extended surface rather than just from a point, so they are called extended objects. Since the light from these objects is spread out over a small area of the sky, astronomers measure their surface brightness. The surface brightness is a measure of *brightness per area* on the sky. You may be able to see a 13-magnitude star without any difficulty in your telescope however trying to view a 13-magnitude galaxy is a completely different challenge. The same can be said for comets that are often described by their surface brightness since comets, compared to stars and asteroids, tend to be more diffuse. The reason I mention this is because often when a comet is worthy of media news, a false picture is usually painted with a magnitude brightness

Mars: Three Weeks after Opposition

by Phil Lobo

After a historically good opposition, Mars is slowly receding but is still a great target. This image of Mars was taken November 1, 2020 in the early evening. Mars was at opposition on October 13, and at that time closest to earth and largest in apparent size. By November 1, Mars was slightly more distant but still a respectable 20 arc-seconds in apparent angular size (which, for comparison, is roughly as large as Saturn's disk gets). Compared to Jupiter and Saturn, Mars appears quite small most of the time and details can be difficult to see, and so oppositions are important (see "The 5 W's for Mars at Opposition" in the September/October 2020 issue of Nova).

A few features can be identified in the image. The south polar cap is visible at the bottom. Mars is inclined as seen from the Earth so that the south pole faces us, and the larger north polar cap is not visible. The polar cap shrinks during summer in the southern hemisphere as the frozen carbon dioxide turns to gas. The large, dark area on the right side consists mainly of Mare Erythraeum, which means the 'Erythraean Sea' and is named after a part of the Indian Ocean. As with the Moon, early visual observers assumed that dark areas were seas of water. The dark areas are actually regions that have been swept clear of the fine red dust by wind to expose the darker rocks below. The brighter areas, by contrast, are areas in which dust has been deposited by winds. The extents of the dark areas can change slightly as dust is moved around.

Some major features of Mars can be seen visually through a modest-sized telescope (though not always to the detail in the photo). With a 150mm Newtonian reflector, and waiting for a night when the atmosphere was steady, it was possible to see the polar cap. The very general shapes of the dark areas could also be seen. On another night, Syrtis Major, a large triangular-shaped dark area on the other side of the planet, was visible due to the planet's rotation. The dark areas were noticed to be mainly in the southern hemisphere. There are a few resources for checking what features are visible on Mars at various times, including most planetarium software (e.g. the free Stellarium program), or *Sky and Telescope*'s "Mars Profiler."

(The photo was taken through a 200mm telescope with a Canon 1000D using eyepiece projection. Note that the blue halo is due to chromatic aberration. BackyardEOS was used to capture the images, and Registax was used to process them.) ✸

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that doesn't take into account its surface brightness and so the comet does not appear as spectacular as touted. The Triangulum galaxy M33, at magnitude 5.7, is the fifth brightest galaxy in the night sky in terms of visual magnitude after the Milky Way, the large and small Magellanic Clouds and Andromeda. However, it is referred to as a faint galaxy because its brightness is spread over a huge area, nearly a square degree.

Earlier we mentioned that you can see many more stars through a pair of binoculars and many more still through a telescope, up to magnitude 13 or 14 depending on the size of your telescope. However, when doing astrophotography and taking long exposures of the night sky, you can see stars near 20 magnitude. This is why it can be difficult at times to compare a visual star chart to an astrophotograph of the same area of the sky.

In summary, as an amateur astronomer, you will want to hone your star magnitude identification skills. A good place to start is to pick an easily recognizable constellation, for example Cepheus, write down the star magnitudes for each of the stars connected by the constellation lines and observe each star. Once you gain more experience, you can choose a variable star and guess the star magnitude. You can easily find the magnitude range of many variable stars online. ✸

Perseid meteor by Randall Peterman

Taken on August 10th, just at the start of the Perseid meteor shower from Burnaby Mountain Park with the Japanese totems in the foreground. The image comes from an exposure that lasted 1 hour and 4 minutes using the “Live Composite” feature on my Olympus E-M1 camera.