Nova Notes

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

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In This Issue...

Letter from the Editor

Well here is issue number 2, and no one has sent me any negative comments about the new format yet, but many people had some nice things to say. Thanks to everyone who dropped me a kind note.

I'd also like to thank all the members who took the time to prepare something for this issue — once again we have a 12 page newsletter! By including items from the email list, *eyesUp!*, and regular articles, we have participation from 14 different members. This was one of the goals behind some of the new things we are trying, to hear from more of the members — so keep those submissions coming.

Thanks also to Dave Chapman, Paul Evans, and Dave Lane for their continued help with Nova Notes. ✯

Astrophoto of the Month *Blair MacDonald*

Here is a CCD image of M51 taken at St. Croix. It is a 5 minute exposure with a Meade 416 XT CCD camera at f4.

As heard on hfxrasc@rasc.ca...

If you're a member with email, why not become part of the Centre's email list? The list is a great resource for people looking for other members to observe with, for reminders of upcoming astronomical events, or for sharing information. Members who observe at St. Croix usually post a notice to say if they'll be out that night. Log on to our website (www.halifax.rasc.ca) to get signed up and you too could participate in lively intellectual discussions, or at least read them!

Most of the traffic on the list in February related to observations of the International Space Station and the Space Shuttle, later in March observers were saying goodbye to the evening star...

Subject: Halifax RASCals: Venus in the evening! Venus in the morning!

"The Evening Star" becoming "The Morning Star"

Current Venus Evening Observation:

March 24, 2001, with the unaided eye, I located Venus about 6:40-45 P.M., just above a band of low cloud. When first spotted, Venus was about 8 to 10 degrees above the western horizon. In my 10X50 binoculars the thin crescent was easily resolved and was even clearer once I mounted the binoculars on a tripod. This was a very pleasing sight. According to the RASC Observers' Handbook Venus is near enough to be about a minute of arc in diameter, so most binoculars will resolve this when focused and held steady enough.

With Venus moving between Earth and Sun over the next few days (inferior conjunction, March 29th), very little of its brilliant daylight side is exposed in our direction (presently only about 2 percent). This makes for a very thin crescent and it's getting thinner. At the time of conjunction one may see an edge of light all the way around the dark disk of the planet caused by light diffused in the surrounding fringe of Venus's dense atmosphere (in binoculars???, perhaps, I'll know after the 30th, but I would hope to at least see this in the telescope, it all depends on weather, optics and the skill and determination of the observer).

Meanwhile... back to the current observation...

Venus played tag with the clouds over the next half hour or so and as it got nearer to the horizon its light got brightly reddish-orange and the crescent outline was no longer resolvable because of atmospheric distortion. I last saw it about 7:31 P.M. when it was less than 1 degree above the NW horizon. This is when I decided that if the sky would permit, I would attempt to pick it up again before the sunrise.

Current Venus Morning Observation:

March 25th, 5:58 A.M., in my 10X50 binoculars, I spotted Venus just above the line of a narrow band of low cloud that hung about a degree or so above the eastern horizon. At this point Venus would have been between 2 and 3 degrees above the true horizon, just a bit north of east, almost ENE. The sky was already quite bright (salmon-pink) from the approaching sunrise. I trimmed up my binocular focus, and mounted them on the tripod; the thin crescent of Venus was quite obvious. Over the next few minutes I attempted, without success, to pick up Venus with the unaided eye. If the weather co-operates, this should become possible in the next morning or two. During the observing time, honking Canada Geese, early morning crows and seagulls flew through the view.

By 6:15 A.M. the rising Sun had just cleared the eastern hilltops, and was a dazzling inferno of red as it moved up through the narrow band of cloud. Cloud edges were fringes of glowing golden light. While the Sun moved to gain position above the cloud, Venus was still visible in binoculars, a tiny crescent, bowed south-eastward toward its light source about 10 degrees away.

- Sherman Williams
(sherm@glinx.com)

Subject: Halifax RASCals: Venus in the evening! Venus in the morning!

I just had a great view of Venus with my 7x35 binos and was able to resolve the cresent quite nicely. Since I was sitting in my nice warm vehicle, looking through the windshield, my wife even had a look (a rare event!). It would be nice if the clouds hold off for an attempt in the morning.

- Johnny McPherson
(johnny_peter@hotmail.com)

Subject: Halifax RASCals: Venus in the evening! Venus in the morning!

I just followed Venus with my telescope for about 40 minutes as it disappeared into the trees. It was quite striking with what I estimate to be about 190 - 200° of edge illumination. Starry night tells me that 1% of the disk is illuminated. It seems to pick up a lot of color as it gets closer to the horizon. My deck is on the west side of the building, so I won't have any morning opportunities with the telescope.

- Gary Weber
(gweber@hfx.eastlink.ca)

Subject: Halifax RASCals: Venus in the evening! Venus in the morning!

There was a low bank of cloud extending to a couple of degrees above the horizon and some higher salmon-coloured cloud, but I was able to easily locate Venus. She has taken on a new personality with the cresent now on the other side.

- Johnny McPherson
(johnny_peter@hotmail.com)

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Articles on any aspect of Astronomy will be considered for publication.

Nova Notes is published bi-monthly in February, April, June, August, October and December. The opinions expressed herein are not necessarily those of the Halifax Centre.

"Letters to the Editor" or letters to our resident expert "Gazer" are also most welcome.

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Nova Notes is also available as a PDF file on our centre's website at **www.halifax.rasc.ca**

Material for the next issue should reach the editor by May 21

eyes Up!

eyes Up! is a forum for observing news from Centre members. This is where you can see what your fellow members have been looking at for the last two months and share your own latest discoveries.

News may include observing reports, observational project status, witnessed daytime or nighttime astronomical phenomena, new equipment reviews, or any other notes of observational interest.

eyes Up! is new to Nova Notes and what it becomes is up to you the membership! All readers are strongly encouraged to contribute regardless of their observing experience. If you've observed something interesting, developed a new interest, or tried something new, let other members know. It's guaranteed that others will share in your enjoyment and benefit from your experiences.

Blair MacDonald—Urban Imaging

Just to show what can be accomplished in a typical light polluted urban setting, the following image was taken next to a street light. Less than 800 meters away was a container pier and a well lit parking lot was less than 50 meters away. Oh and just for good measure there was a first quarter Moon in the sky.

The image, of M1, is the sum of eight exposures of one minute each. The summed image was maximum entropy processed and the result was added back in with the original to reduce the image noise. You can see from the results that you really can get some decent images even from the city.

Paul Evans—Observing With Walter Scott Houston

As a Christmas gift I received a copy of 'Deep-Sky Wonders' — a compilation of writing by Walter Scott Houston. This book was prepared by Stephen James O'Meara who also contributed commentary throughout the book. Each of the 12 chapters cover a month, drawing from Houston's 550 monthly columns published in Sky and Telescope over almost 50 years. O'Meara did not simply republish Houston's columns, but rather compiled his writing into sections covering a variety of topics. Each chapter concludes with a listing of all the objects mentioned including references to the appropriate charts in 3 popular star atlases. I am continuing to enjoy this book immensely and recommend it highly. It is extremely readable and is great for those cloudy nights. Particularly enjoyable for me are the observing tips and techniques throughout the text, for example, the idea of racking an eyepiece out of focus in order to make the plotting the relative position of brighter stars in a sketch easier. 'Deep-Sky Wonders' is published by Sky Publishing Corp ($29.95 USD, 320 pages, 6 x 9 inches, hardcover, ISBN: 0-933346-93-X).

Michael Boschat—More Digital Photography Through the Eyepiece

Hello fellow observers

I borrowed a Canon PowerShot 350 digital camera to see how it would perform on my 10 cm Maksutov telescope. Here are the camera's specs:
CCD: 1/3" VGA Progressive Scan CCD (350,000 pixel)
Optical Resolution: 640x480 pixels
Lens: 6mm F/2.8
Shutter: Electronic (1/4 - 1/2,000)

Well, all I can say is it was frustrating to use. I handheld it over the 25 mm eyepiece (40x) and tried the following objects:

16 or 17 day old Moon – Hard to see sharpness on the LCD screen and only with extreme trial and error at what I considered moments of good seeing took 12 images.
(See page 10)

Sun – Using same setup and a 1000 Oaks full aperture solar filter took a few images.

Venus – Could not get the thin crescent at all only a blob of light!

Jupiter – Being fainter than Venus it was a "white" oval.

When shooting one has to adjust to make sure the flash does not fire off! There are also settings to reduce the brightness, on all of the above I had the setting at a –4! lowest one could go to dim the brightness of bright images. There was no setting to tell you what the exposure was. Also there are 3 different levels of image quality, I had it set to "fine" for better image quality but fewer images could be stored on its 2MB card. If you did not use the camera it would automatically shut off and this was most irritating since the setting needed to be re-done when turned back on!

The process of pulling the images from the camera to the computer was painfully slow and even then after they were viewed most were useless, an example was the Sun, even with Photoshop 5 I had to make the image a greyscale to just see the sunspots!

Personally, I'd rather use my QuickCam at prime focus — at least it works better... on a scale of 1-5 where 5 was excellent, I would give this one a 1 out of 5.

Doug Pitcairn—Sharp Eyes

Hearing about people able to naked-eye spot the Venus crescent brings to mind my dear departed father. He used to enjoy a bit of observing with me, and one night, while looking at Jupiter, I commented that there are some who claim to be able to see the Galilean moons with the naked eye... to which he responded, "Oh yes, I think I can see them." I was skeptical, but over the next few years, on many occasions, I would ask him to step out to be "tested". He could always tell me the moon's orientation, as well as which side of Jupiter they were on (He would sometimes confuse two for three, but he was never more wrong than that). I was certainly impressed as I have my mother's

eyesight, and that is not good.... Dad was in his late 70s at the time.

He would have made a great 15th century astronomer.

Paul Heath—Bright Fireball!!!

At 21:35 March 20th, 2001, four hardy observers (Daryl Dewolfe, Dave Lane, Darren Talbot, and myself) were treated to a spectacular fireball. Streaking out of Leo it crossed the handle of the Big Dipper, flared as it passed through the Little Dipper, brightening to mag –6 and exhibiting yellow and green coloration, then continued and flared again as it vanished in Cassiopeia. It appeared like a solid white line across the sky, punctuated by bright, colourful, flattened teardrops. A very memorable sight!!

To add to the above, two other 1st magnitude meteors were also observed. All three radiated out of Leo. Last evening was listed as maximum for the minor meteor shower Beta Leonids. Also, the Handbook says that any meteor brighter than –4 magnitude is considered a FIREBALL and should be recorded. To this end I will submit a report on the fireball to the Canadian registry. ✯

You may forward your submissions for eyesUp! to Paul Evans by email, mail or phone:

Email	evans@hfx.eastlink.ca
Phone	902.423.4746
Mail	26 Carrington Place, Apt 403 Halifax, Nova Scotia B3S 1J8

Was it Jupiter or Venus?

Mary Lou Whitehorne

Venus strikes again! We have all seen our own Dust Lane confounded by the planet Venus so I suppose it should come as no surprise that the planet has wielded its infernal influence on other observers too. Namely me. On the evening of January 27, 2001, at the St. Croix Observatory, it was the evil planet Venus that was shining so brilliantly that it was casting a noticeable shadow on the snow. At the same time, apparently, it was casting a spell that made us write that the shadows were being cast by Jove. Go figure!

But, Jupiter has been observed to cast faintly visible shadows under just the right conditions. For all you Doubting Thomases *(Are you paying attention, Dave Tindall?)* just ask Roy Bishop; he has also observed this phenomenon. When I turn to my observing log, I see an entry from January 10, 1988, where myself and Pat Kelly observed Jupiter to be casting a faint shadow on the snow at our old observing site in Beaverbank. Jupiter was in the western sky, about twenty degrees above the horizon, 99% illuminated and shining at magnitude – 2.28. It was 10:30pm, we had been on site getting dark adapted for two and one half hours, and my notes rate the sky as a 9 out of 10 with a minimum visual magnitude of 6. Joe Yurchesyn was also there — he did actually go observing thirteen years ago! — but I can't recall in what direction he might have had his scope pointed.

On that same evening we also observed the asteroid Vesta, two comets (Bradfield and Borelly), M67, M35, the Beehive and Pleiades clusters, M31, M33, M42, M43, NGC2244, the Rosette Nebula, galaxy NGC6946 and open cluster NGC6939 in Cepheus. It was a fairly typical observing session except for the business of Jupiter casting shadows.

The moral of this story is "Keep good observing records." You never know when you're going to need supporting evidence to defend yourself against eagle-eyed Centre Presidents and the like. ✯

ERRATUM - February 2001, Nova Notes

Bump in the Night, Page 5, first column, second paragraph, line one: where it says "Jupiter's shadow," it should read VENUS' shadow. Also the second-last sentence of the same paragraph should also be Venus' shadow.

Eyes Up!, page 3, second column, paragraph two, line one: where it reads "Jupiter's shadow," it should read "Venus' shadow."

President's Report

President's Report to the 2001-01-19 RASC Council Meeting

Most members of Council met at an extraordinary meeting on Wednesday 2001-01-10, to plan for the Centre in the New Millennium. We are very grateful to Mary Lou Whitehorne for offering her home and refreshments.

This was a free-wheeling session that lasted about three hours in which a variety of topics were discussed. The focus was on attracting members of the public who attend meetings to become members, and to retain the members that we currently have.

The following were the main conclusions:

Survey: Paul Evans agreed to draft a survey to gauge members opinions on various topics.

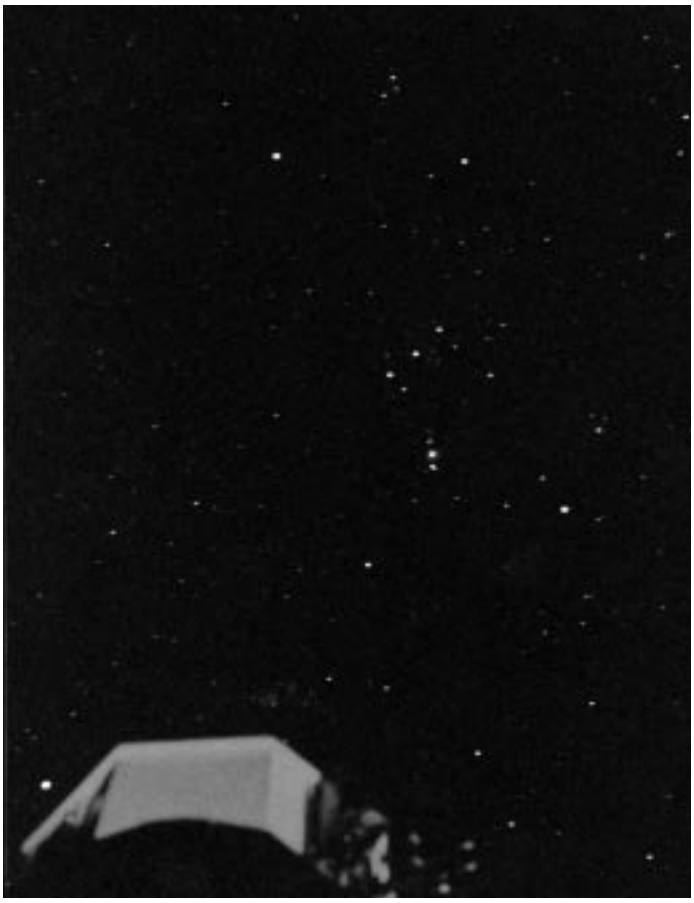
Greeters: David Chapman and Mary Lou Whitehorne agreed to be "greeters" — to welcome people attending the main meeting... find out how we could serve them better and generally offer a warm and welcoming environment. This will also fit well with Michael Falk's suggestion that he leave the Council meetings early in order to tend our library.

Handbook Talks: There was a general feeling that these should be re-instated and Dave Lane offered to do the first one — for which, as was the previous tradition, he gets to pick the person who will do the next.

Talks for beginners: There was some suggestion that we should have one of these after the main meeting... but nothing firm was concluded.

Refreshments: We agreed that refreshments should be re-instated and Pat Kelly offered to pick up Timbits, pop and juice. We decided to try having a 10 min. refreshment break after the main talk.

Centre telescopes: We should take stock of our holdings, many of which were thought to be in a poor state of repair. Dave Lane offered to do this, in conjunction with Paul Evans. Steve Tancock offered to help with repairs. ✯



St. Croix vs Halifax A night sky comparison

Paul Heath

On the right is a photo taken at a dark site in Halifax, the top of Main Avenue just beyond the radio tower in Fairview. The photo on the left was taken at our observatory at St. Croix. Both pictures are unguided 25-second shots on Kodak Gold 1000 ASA film.

Although both pictures show the same number of stars, most evident in the photo on the right is the sky glow from the Halifax core below Orion. The left photo shows sharper star images and more definition in the Orion nebula.

Photo comparisons such as this one readily show the effects of light pollution on our night skies. To further demonstrate the loss of a dark night sky in Halifax, a collage of photos taken throughout the HRM and overlaid on a city map would be a worthwhile resource for a public viewing session or public talk by RASC members.

To this end, I am encouraging any members who have Orion photos, especially unguided shots, taken within the HRM to bring them to an upcoming Halifax Centre meeting so that a collage of shots can be assembled. These would then be available to any Halifax Centre members giving public talks on Astronomy. ✯

The 2001 Messier Marathon Athena Community Astronomy Club

Bill Thurlow
Summerside P.E.I.

On the night of Sunday into Monday morning, March 25-26, 2001, a few members of the Athena Community Astronomy Club (ACAC) participated in a Messier Marathon at Jerry Arsenault's place near Abram Village, Prince County, Prince Edward Island. Using his trailer-mounted 17.5 inch f4.5 Dobsonian mounted telescope and binoculars (10x50 and 20x60), Bill Thurlow clearly identified 105 of the 110 objects in the Royal Astronomical Society of Canada's Messier Catalog. ACAC Secretary, Marietta Hughes, now expanding her astronomical interests, stayed the entire night, looked at everything demonstrated in the telescope and found and viewed dozens of Messier objects herself with binoculars. Mike Nesbitt and Trevor Delaney joined after the usual monthly ACAC meeting in Summerside was finished and also viewed many objects.

M77 and M74 were picked up first after viewing a setting Venus and setting up the telescope. M31,32,110, 33 and 79 were next. Then the rest of the fall and winter
(continued on following page)

Image Processing 101

Blair MacDonald

Image Spectrum

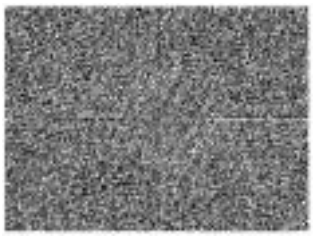
Normally we think of an image as made up of pixels of a certain brightness at a certain location. Another way to present an image is through its spectrum. A spectrum is a map of how fast details change in an image. If, for example, the brightness of some detail changes over 20 pixels then this would represent low frequency information in the image. Now if instead, the detail changed in brightness over two pixels then this would represent high frequency (or fast changing) information in the image. It is important to note that for the low frequency example, the detail must change smoothly over the 20 pixels. If the detail were to change abruptly then this would be high frequency content again.

The idea of a spectrum lets us look at the frequency content in an image. This can allow us to correct for several defects by applying filters to remove or enhance various parts of the image spectrum (more on that later). The way we get the spectrum of an image is to use a two-dimensional Fast Fourier Transform or FFT. For those determined to actually write an FFT, I would refer you to two excellent books covering the subject, Numerical Recipes in C and CCD Astronomy. Both give C and BASIC source code for a FFT and other image processing algorithms as well. For those determined to see the math, a FFT is an algorithm used to solve the discrete Fourier Transform, which is

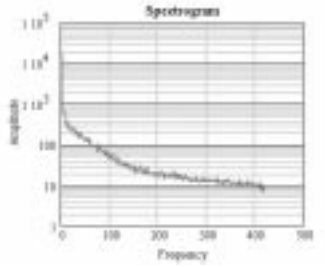
$$F(u,v) = \frac{1}{n^2} \cdot \sum_{x=0}^{n-1} \sum_{y=0}^{n-1} f(x,y) \cdot e^{-2 \cdot \pi \cdot i \cdot \frac{x \cdot u + y \cdot v}{n}}$$

Sorry, I've always wanted to use that in a sentence. Most people use a pre-programmed FFT or a mathematical processing package to obtain the image spectrum. Once you have the spectrum, you can begin to make decisions about which frequencies to filter to improve your image. Removing low frequencies will improve image sharpness at the cost of making noise more pronounced, while removing high frequencies can make a noisy image better at the cost of some image sharpness.

The FFT produces an output with DC or zero change at the four corners. This is then usually transformed around so that DC is in the center of the spectrogram and the frequency climbs as the distance from the center increases. I typically like to look at the spectrograph as a one dimensional plot of the maximum value at any given frequency, verses frequency. The image if M33 and its two dimensional spectrogram are shown below, the spectrogram has been rearranged to have DC at its center.



The spectrogram shows a denser area near the center. This area contains most of the information while the higher frequencies, farther from the center, contain mostly noise. When the maximum value along any line, radiating from the center, is plotted against its distance (frequency) from the center a one dimensional spectrogram is obtained that is quite a bit easier to interpret.



As can be seen from the plot there is not much information after 100 on the X axis and a low pass filter at this location would remove the noise without distorting the image.

Confused yet? Don't worry it will get a little clearer in the next installment when we take a look at using the spectrogram to see what happens to an image when you apply filtering to it. ✯

The 2001 Messier Marathon

Athena Community Astronomy Club

(continued from previous page)

objects were seen, followed by the 5 Leo galaxies, Ursa Major's 7 items, M102 (NGC 5866), M3, M53, all the galaxies from M51 to M104. After Jerry's indoor warmth and tea break, we started with M13 and went through everything from the M92-M39 line to the M68-M83-M4-M62 line and to M11 and M26. After a little wait for the lower Milky Way to rise a bit, we saw the rest except for 5 that were beyond our reach.

Not seen were M70, M55, M72, M73, and M30. M70 was behind an evergreen tree when M54 and M69 could be seen; however, they then all disappeared behind some more tree tops. M55, M72, and M73 were also in the trees until it became too light. M15 and M2 were unmistakably seen but were fuzzy blobs in the increasing twilight. We did not wait for Zeta Cap to rise above the low tree line.

We thank Jerry Arsenault for his invitation and hospitality. Minimum Visual Magnitude was 6.0. No clouds all night. Only a very little haze for a little bit of time. Temperature -5C, wind varied from 20 km/hr to occasional gusts. On the drive home afterward, just enough low eastern haze developed to make it impossible for us to see the morning Venus. ✯

Editor's Note

Watch next issue for another report from Paul Gray in Maryland and his very successful Messier Marathon attempt.

February 2001 Meeting Report

Pat Kelly

As with most meetings, things were kicked off by president David Tindall welcoming everyone to the meeting. I counted at least 32 people in attendance, so we do not seem to have suffered any problem in that area as a result of our move to Saint Mary's. His welcome was followed by the usual announcements, plus an additional item that may be of interest to some readers.

The publishers of *Looking Up, a history of the RASC* that was written by Peter Broughton had accidentally remaindered the leftover stock of these books. "Remaindering" is the jargon used in the publishing business to get rid of excess inventory by selling it to discount book stores. The National Office accidentally came across 57 copies, and was able to obtain all of them. They are for sale, from the National Office, for $43.00, while supplies last.

David then introduced the main speaker for the evening, Dr. Francine Marleau. She joined the Department of Astronomy and Physics last fall and this was the first presentation that she has made to the centre. The topic of her lecture was "Galaxy Formation and the Origin of the Hubble Sequence". She had selected this subject as, over the last ten years, there have been great gains in understanding the formation of galaxies as a result of data obtained by the Hubble Space Telescope.

She began by giving a brief history of the discovery of galaxies. Starting from their original classification as nebulas, she proceeded to the Curtis-Shapley debate where arguments were made to try and determine if these objects were gas clouds in our own galaxy, or if they were galaxies in their own right. The discussion then led to Hubble's early work, which settled the argument in favor of galaxies as being large objects external to the Milky Way. Hubble had also taken enough pictures of these objects to begin to attempt to classify them. He based his classification system on their physical appearance. Dr. Marleau noted that such types of classification had lead to many important scientific breakthroughs, such as the periodic table and the Hertzsprung-Russell diagram.

The Hubble sequence forms the shape of a tuning fork, with elliptical galaxies along the main branch, which then splits into the two tines of the fork, one for spiral galaxies, and one for barred spiral galaxies. Dr. Marleau showed slides of various galaxies to illustrate the various Hubble classes. *(In order to get the lights off rapidly, David Tindall scooted across the front of the room; I haven't seen him move that quickly in a long time!)* She reminded everyone that while the Hubble sequence looks like a diagram that was designed to explain the evolution of galaxies from one form into another, that is not the case.

What is not commonly explained in the description of the Hubble sequence, is that Hubble was only able to get good images of galaxies that had a high surface brightness. He missed most of the dwarf galaxies, as they have extremely low surface brightnesses, with a mass/light ratio that is about 10 times that of the so-called "normal" elliptical and spiral galaxies.

At this point, Dr. Marleau pointed out some work that had been done in the 1970s by Beatrice Tinsley. She had noted that spiral galaxies are referred to as "blue" because they are still producing new, bright, hot, blue stars. In the past they would also have been blue. On the other hand, elliptical galaxies are now "red" because they consist mostly of older, redder stars. In the past, though, when these stars were being formed, their host galaxies should have been quite blue, despite being ellipticals. Keep this idea in the back of your mind, as it will show up again.

One of the biggest unsolved mysteries of galaxies is how they form and why there are two main types, ellipticals and spirals. One approach that has been used to attempt to solve this mystery, is to determine if the nature/nurture argument can be used: are they different because of the initial conditions when they formed, or are they different because of the environment in which they evolved.

The classical view had been that the initial conditions under which a galaxy formed determined its Hubble type. The two main players in this scenario are angular momentum and the ratio of the rate of star formation to the free fall time for the gas to fall into the galaxy. If the galaxy rotates rapidly it takes a long time for all of the material to infall and the result is a disk (spiral) galaxy. If the initial rotation is slow, the material can fall in much quicker and you get an initial burst of star formation, which uses up most of the gas and dust, resulting in an elliptical galaxy.

The newer hierarchical view is much different. It postulates that all galaxies start off as disk galaxies and mergers of these galaxies form ellipticals. Minor mergers give rise to the large nuclear bulges seen in "earlier" spiral Hubble types Sa and SBa. Mathematical models have been used to simulate galactic formation using this approach. When gas physics and gravitational dynamics are taken into account, the merged galaxies should display gas shells, bulges, ripples, and other visible features.

The Hubble Space Telescope has been able to obtain images with sufficient clarity to show galaxies with many of these characteristics. Dr. Marleau showed a series of images to illustrate the point. Centaurus A is an example of a merger. She showed new images of that object, which show shells of gas and stars. Many of you are probably familiar with the Hubble image of the so-called Antenna Galaxies. It shows the burst of star formation produced by the collision. We got to see many Hubble images showing spirals in the process of turning into ellipticals.

Another feature of elliptical galaxies is also predicted by the disk merger theory. If you plot the brightness of an elliptical galaxy starting at the centre and moving

straight out towards the outer regions you get a curve called a brightness profile. The profile of elliptical galaxies show a strong central peak, with the brightness falling off with a characteristic shape. The peak and distinctive curve match those predicted by the disk-merger hypothesis.

Before Hubble it was very hard to see any detail in distant galaxies. Using that amazing instrument it is now possible to see detail in objects going back to 60-70% of the age of the universe. Probably the most famous of these are the Hubble Deep Fields. These images were taken by using the telescope to look at the same small area of the sky repeatedly and then adding the images together to give a very long exposure of that small piece of sky. When you look at it, the elliptical galaxies appear to be bright red, just like we would expect them to be.

Even after repeatedly seeing these images, I did not make the correct mental shift to see the image as it "really" is. These galaxies are so distant that when you correct for the amount of red shift, the red ellipticals are actually blue — we are seeing them when they were in the process of forming most of their stars, which would have been young, hot, and blue! Now you can see where Beatrice Tinsley's work comes into the picture. The problem is that in order to color-correct the galaxy, you have to know its distance, but due to these objects' great distance, you cannot get a spectrum to measure the red shift distance. Instead you have to rely on the color, which puts you into a quandary because that was the property that you were trying to correct in the first place.

At this point, I had some trouble trying to see where I was writing as the slides that were shown were mostly black. I'll have to bring a book light with me next time! I was not able to concentrate fully on what Dr. Marleau was saying, but I got the distinct impression that there was a very elegant solution to the problem.

Further study of this problem will require the type of spectroscopy that will be possible with the new generation of instruments such as the Gemini Telescopes. This looks to be an area that will be generating a lot of good science. Hopefully Dr. Marleau will be able to keep give us an update in a few years.

The Handbook talk was delivered by Paul Heath. He chose the section on the phenomenon of the Galilean satellites because he did not want to do a portion that had been written by Roy, but that excluded almost all of the handbook! We had an interesting presentation of the geometry that produces these events.

The last item for the evening was the What's Up talk. Normally this segment would be presented by Paul Evans, but he was going to be moving the next day, so he had Dave Lane pinch-hitting for him. Dave started out with a review of the status of Venus. I think he was making up for the time, many years ago, when he was observing chairman and Venus was in about the same point in its orbit. For not one, but two consecutive meetings he totally forgot to mention Venus. While this is well known to long-standing members of the centre, it is worth repeating for the benefit of newer ones… thus are legends passed on from generation to generation. Dave filled us in on Venus's upcoming transition from the evening sky to the morning sky, including the fact that it may be possible, at inferior conjunction, to see it in the evening as well as the following morning, due to Venus passing high above the Sun. Dave also told us to keep our eyes open for the zodiacal light as it is that time of the year when it is best seen, and an upcoming gathering of Jupiter, Saturn, the Moon, and the Pleiades when all of these will be within a 9° field. ✯

March 2001 Meeting Report

Pat Kelly

Once again, a crowd that numbered in the mid-thirties turned out for the monthly meeting. David Tindall has spent some time sprucing up his presentation on the benefits of RASC membership—we had a color overhead which documented the separate costs of various rewards of membership. Not only that, it was done in the style of the recent Mastercard ads: RASC Journal $80, SkyNews $24, Observer's Handbook $22, Nova Notes "priceless"!

He quickly proceeded to introduce the main speaker for the evening, Aidan Keane of the Department of Mathematics and Statistics at Dalhousie University. While I was trying to obtain some biographical information on the speaker, to include in the meeting announcements, I tried the departmental web site only to find him listed as a "PDF". I was quite sure that he was not an Adobe Acrobat file, but I actually had to call the department to find out that PDF stood for Post-Doctoral Fellow. *Doh!*

Before he began his presentation on relativity and black holes, Dr. Keane apologized for his Scottish accent, in the event that people were not able to understand him. Fortunately, I do not believe it posed a problem for anyone, and I actually enjoyed it, not having heard one in some time.

While most people think of black holes as a modern idea, they were first postulated, two centuries ago, by Laplace. He only did a simple treatment of the problem, using Newton's laws to determine the density of an object which would have an escape velocity equal to the speed of light. Under the concept of space and time that were passed on from Euclid to Galileo's era, time and space were thought to be independent of each other. In this view, there is no restriction on the speed of an object. That view had to change once the Michaelson-Morley experiment showed that the speed of light was the same in all directions, and that light did not propagate through the ether, a mysterious medium that was thought to "carry" light waves in the same manner that water carries ocean waves. One of the main developments of modern physics is that space and time cannot be treated separately, but must be dealt with together as something called space-time. (Just think of how often in

Star Trek, they invoke the phrase "space-time continuum".)

Dr. Keane then described some of the differences between Euclidian geometry and Minkowski space-time. One of the biggest differences between the two systems is that in the latter, time becomes a coordinate for measuring distance. In Euclidian space, the distance from the origin (0,0,0) to a point at coordinates (x,y,z) is given by $d^2 = x^2+y^2+z^2$. In Minkowski space-time $d^2 = t^2-(x/c)^2-(y/c)^2-(z/c)^2$, where c is the speed of light. This implies that the distance measured along a light cone is zero and that particles cannot move faster than light.

In 1905, Albert Einstein published his special theory of relativity based on Minkowski geometry. Two of the theory's postulates are 1) the speed of light is a constant in all reference frames; 2) the equivalence of all inertial frames, which is a fancy way of saying that everyone, regardless of relative motions, will observe the same results from all physical experiments. Some of the consequences of relativity are: a) time dilation (time slows as you near the speed of light), b) Lorentz contraction (objects travelling near the speed of light are shortened in their direction of motion), c) increase in rest mass (mass increases as you near the speed of light), and d) matter and energy are equivalent (the famous equation $E=mc^2$).

It should be noted that special relativity only applies in the absence of a gravitational field. Einstein added that condition to special relativity to produce the general theory of relativity in 1915. The general theory adds two more postulates: a) the equivalence principle which equates gravity with acceleration, and b) the covariance principle which states that experiments are the same in all coordinate systems. One implication of general relativity is that gravity is not really a force, but is caused by the curving of the geometry of space-time in the area around a mass. He (Dr. Keane, not Einstein) showed a slide which demonstrates the principle quite nicely. Imagine a large sphere, with two masses located on the sphere's equator and near each other. Now, move both masses to the sphere's north pole, travelling along the shortest route. Both masses will start moving in parallel, but as they progress, it will appear as though they are being attracted by a gravitational force when, in fact, they are coming together because of the geometry of the surface on which they are moving.

Solutions to the equations of general relativity result in ways by which we can describe space-time. A partial list of solutions is given below.

1915: Schwartzchild space-time; describes black holes

1916: Reissner-Nordström space-time; describes charged black holes

1917: Einstein static space-time; describes a static universe

1930s: Freidmann-Robertson-Walker space-time; describes an expanding universe

1963: Kerr space-time; describes rotating black holes

1965: Kerr-Newman space-time; describes charged, rotating black holes

The structure of a static black hole (no rotation, no electric charge) is the same at all times and appears to be the same from all directions. The equations can be used to represent, not only a black hole, but a neutron star, white dwarf, or a regular star. In a black hole, however, the curvature of space-time increases from the event horizon to the central singularity, at which point it becomes infinite. At radius, r=0, we have the singularity, at r=1 we have the event horizon, and at r=1.5 (50% further out from the event horizon) we have the photon sphere, where photons are in circular orbits about the black hole. Should you ever fall into a black hole, be sure to look to to your left or right or you will not see the photon sphere!

One of the more interesting concepts is that inside a singularity the concepts of space and time are "reversed". Dr. Keane showed diagrams of the possible routes that can be taken by a particle falling into a static black hole. One path misses the black hole altogether; another path enters the event horizon and hits the singularity; a third path crosses the event horizon and then meets the event horizon of another static black hole from which it can then emerge into another universe. The only problem is that to follow that path, the particle would have to travel faster than light.

The equations that describe Reissner-Nordström space-time (a charged blackhole) are much more interesting. A charged black hole has two event horizons, an inner one and an outer one. This comes about as a result of a quadratic equation which involves solving for the radius of the event horizon in terms of the mass and charge. (You may recall from solving quadratic equations, that there is a square root involved. If the value in the square root is zero, there is one solution; if it is positive you get two solutions; if it is negative you only get solutions that make sense when using imaginary numbers.) If Q is the black holes charge, and M is its mass, the area under the square root is defined by M^2-Q^2. If $Q^2 < M^2$, M^2-Q^2 is positive are there are two event horizons. As Q increases, the inner event horizon moves outward and the outer one moves inward until, when Q=M (and $M^2-Q^2 =0$) the two event horizons merge into one. If the change increases beyond that point, M^2-Q^2 becomes negative and there is no event horizon at all; you end up with a naked singularity. While there is no mathematical reason prohibiting such a phenomenon from occurring, noted physicist Roger Penrose suspects that nature prevents such things from actually existing. (This would agree with Star Trek, where the energy source that powers Romulan warbirds is a artificially forced quantum singularity.)

With two event horizons, the diagram showing the passage of a particle is complicated as space and time reverse twice. The solution to the equations allow for a particle to enter the outer event horizon and then pass through the event horizon of another black hole and re-emerge in any number of other universes, but it cannot re-emerge in our own universe. It can

accomplish this without exceeding the speed of light. The model also allows for the possibility of particles from other universes emerging into ours, creating a white hole.

Kerr space-time describes a rotating black hole. Its equations are similar to those of the previous case, but Q is replaced with A (angular momentum). In a similar fashion, there are two event horizons for spinning black holes where M^2-A^2 is positive. The area between the two event horizons is called the ergosphere, and it can be used, at least theoretically, as an energy source. If a particle enters the ergosphere and then splits into two equal-sized pieces, it is possible for one of the pieces to fall further into the black hole, while the other leaves the event horizon with more total energy that the original particle. If that is not strange enough, the solution of a rotating black hole that has more spin than mass results not only in a naked singularity, but the singularity forms a ring instead of a point!

We then had our "new format" break for munchies and there was a lot of discussion among the audience about the presentation.

First up after the break was "What's Up" with Paul Evans. He gave us a general overview of the sky for the coming month which can be summarized with: Jupiter and Saturn are out, the Virgo Cluster is in. We also had a preview of pending close encounters between the Moon and Saturn, and the Moon and Mars.

Dave Lane was up next with a report on what had transpired at the RASC National Council meeting, which he had attended the previous weekend. There is another new RASC centre, with the Prince George centre becoming the fourth RASC centre in British Columbia. The other main item that came up was that the finance committee had not felt that a fee increase was needed this year, but that there would likely be need of one next year. Despite that, there was a motion from a member of the council to propose a $4 increase. The council vote was tied, and the president voted in favour of it, so the issue will come up for approval by the membership at the annual meeting. Dave had already briefed the centre executive before the main meeting, and a motion to approve the increase was approved unanimously.

Our last presentation was the Handbook talk. It was given by Johnny McPherson. He chose the section on interplanetary dust, but not because it is the thinnest section! He gave an excellent description of the nature of this material and how it is effected by many forces. He also covered the many ways that it can be observed, everything from meteors to the zodiacal light. He even had once seen the Gegenschein when he was 70 km from the nearest lights on Baffin Island. He was almost as amazed that it was an arctic night with no aurora and no high ice crystals! ✯

Digital Photography

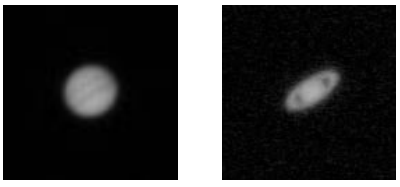
Michael Gatto

While the cost of digital cameras keeps declining, and with cameras getting better all the time, a few of us have wondered, "what would happen if I aimed this through my scope?"

Here are a few tests done by Steve Tancock, Michael Boschat, and myself. These were taken by simply holding the camera in front of the eyepiece and clicking away. Michael Boschat has included his review in *eyesUp!* on pg. 3, and I had explained my experiences in last months *eyesUp!* column. (Which begs the question, 'Steve, where's your *eyesUp!* submission?')

In these shots 3 different cameras were used, Steve was using a Pretec DC-600 digital camera with a max resolution of 640x480 pixels. Michael Boschat was using a Canon Powershot 350 also with a resolution of 640x480 pixels, and I used a Sony DSC-S70 with a max. resolution of 2048x1536 pixels.

Venus, Jupiter, and Saturn by Steve Tancock



Jupiter, and Saturn by Michael Gatto

Given these are 3 different cameras looking through 3 different scopes, one can start to get a sense of what to expect from these types of cameras. The planets being the smallest objects of course have the least amount of detail, but Jupiter does show cloud belts in both of these images, Saturn shows its rings off well, and Venus is clearly a crescent. The moon images both have a lot of detail and the Sun image does show a group of sunspots just below centre. *(Image quality of originals is better than what appears here in print.)*

If anyone else has experimented with this type of photography please send me your images for a future issue of Nova Notes. ✯

Moon and Sun (top) by Michael Gatto
Moon (bottom) by Michael Boschat

The St. Croix Observatory

The St.Croix observatory. Pictured from left to right, the RASCan, the warm room and the roll-off roof observatory.

The roll-off with the roof partially open.

Part of your membership in the Halifax RASC includes access to our observatory, located in the community of St. Croix, NS. The site has grown over the last few years to include a roll-off roof observatory with electrical outlets, a warm-room and washroom facilities. Enjoy dark pristine skies far away from city lights, and the company of like minded observers searching out those faint fuzzies in the night.

Members' Night

Every Friday night closest to the new Moon is Members' Night at St. Croix. The purpose of members' night is to attract members from the centre to share an evening of observing with other members. It's also a great night for beginners to try out different scopes and see the sky under dark conditions. For more information or transportation arrangements, please contact the Observing Chairman Paul Evans at 423-4746.

Dates for Members' Nights for the following two months are

Fri. April. 27th *(rain date Sat. 28th)*

Fri. May. 25th *(rain date Sat. 26th)*

Observer's Log Classic Entry

"Photos and photons, Hershels and comets (Lee), and Messiers observed by the intrepid "gang of four" tonight. Clouded out here 23:30 hours. (Roy L. Bishop must have turned off the fans in Avonport).

Daryl D., Paul E., Dave L, Darren T. (aka Cloud Bank) *" - (DD) October 11 / 1999*

Become a St. Croix Key Holder

For a modest key fee, members in good standing for more than a year who have been briefed on observatory can gain access to the St.Croix facility. For more information on becoming a key holder, contact the Observing Chairman Paul Evans at 423-4746.

Directions from Halifax

(from Bayers Road Shopping Centre)

1. Take Hwy 102 (the Bi-Hi) to Exit 4 (Sackville).
2. Take Hwy 101 to Exit 4 (St. Croix).
3. At the end of the off ramp, turn left.
4. Drive about 1.5 km until you cross the St. Croix River Bridge. You'll see a power dam on your left.
5. Drive about 0.2 km past the bridge and take the first left (Salmon Hole Dam Road).
6. Drive about 1 km until the pavement ends.
7. Drive another 1 km on the dirt road to the site.
8. You will recognize the site by the 3 small white buildings on the left.

Meeting Announcements

Halifax Centre of the Royal Astronomical Society of Canada

April 20

"Time-Lapse Photography and Animations in Astronomy"

By: Jeff Kowalski and Kevin Casteels, Saint Mary's University

Abstract:
We will be discussing how time-lapse photography can be used to find asteroids and their orbital parameters. In add tion, we'll be discussing how to make time lapse movies, star-trail photography and the practicalities of photography/imaging in astronomy. I will discuss recent research and observations that have produced clues leading to some answers and raised even more questions about the formation process of galaxies.

"Workshop Report"

Dave Lane

Abstract:
Report on my attendance in February at a Mirror Making Workshop put on by the Delmarva Stargazers (Delaware).

May 11

"Interstellar Gas and Galaxy Evolution"

Gary A. Welch

Abstract:
One of the most obvious distinctions among galaxies is that some are making stars today while others are not. Astronomers can explain why some galaxies don't have young stars, but other cases are quite puzzling. This talk will describe some of the things we know, and don't know, about aging processes in gas-poor galaxies.

Meetings begin at **8:00** P.M.

Members of the general public are welcome.

All members—but especially new ones—are invited to come to the meetings 20 - 30 minutes early to participate in our new informal "Meet and Greet". It's a chance to ask questions about astronomy, the RASC, memberships, or to just say hello.

Room 176 Loyola Building
Saint Mary's University *(See Map Below)*

The Halifax RASC Executive meetings begin at 7:00 P.M., and members are welcome to attend.

Halifax Centre Executive 2001

Honorary President	Dr. Roy Bishop	
President	Dr. David Tindall	455-7456
1st vice-president	Pat Kelly	798-3329
2nd vice-president	David Croston	477-5817
Secretary	Steve Tancock	465-4092
Treasurer	David Lane	826-7956
Nova Notes Editor	Michael Gatto	453-5486
National Representative	David Lane	826-7956
Librarian	Dr. Michael Falk	422-5173
Observing Chairman	Paul Evans	423-4746
Councilor	Clint Shannon	889-2426
Councilor	Dave Chapman	463-9103
Councilor	John Jarvo	897-0529

Captain Tindall ?

It appears that one of the problems encountered by new people who attend meetings, is that if they want to speak to someone who is on the centre's executive, the only person that they can identify is David Tindall, who always makes a point of introducing himself at the start of each meeting as the centre's president. A proposal has been made which will a) make centre council members easier to spot at meeting and events, b) relieve David Tindall of having to deal with so many people during the refreshment break, and c) make use of the centre's large inventory of RASC lapel pins.

Council members will now wear the lapel pins on their collars, in a similar fashion to the rank insignia worn on Star Trek. The president will have four pins, vice-presidents will get three, officers will receive two, and councillors will get one. :) ✯

— Pat Kelly

Meeting Location

Meetings are held every third Friday of the month, except for the months of July and August. Meetings take place in room 176 of the Loyola Building at Saint Mary's University.