

Nova Notes

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



Volume 37 | Number 4/5 | Aug/Oct 2006

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Astro photo of the Month *Blair MacDonald – NGC 7000 The North America Nebula*

The CCD image is a mosaic of 41 frames, each one a median combine of three, one minute exposures. The data was acquired under dark skies in Cape Breton. The telescope was controlled by APT and the camera by Maxim DL. The individual CCD mosaic frames were processed and assembled using Maxim DL and the final image was given a log stretch. ★

Nova East 2006 Report

by The Nova East Committee

Attendees at this year's Nova East 2006 at Smiley's Park were treated to: great talks on telescope designs; a brilliantly long -3 fireball; our first Family Camping Program; Naturalist workshops; bannock; Roy Bishop; 2 clear nights to observe; ISS passes; door prizes; & the wonderful fellowship of fellow astronomers from Nova Scotia, New Brunswick, Prince Edward Island, Ontario, the U.S.A., England, and Norway. Where else can you get all that for \$15 bucks?

Thanks to fellow members of the Nova East 2006 Committee, RLB, all the terrific presenters who gave their time & expertise, our Nova East fieldhands, the Smiley's Park staff, Kendrick Astro Instruments, and all who took the time to attend this great annual event. We wish to invite everyone to do it again August 17, 18, 19th in 2007.

Best regards, the Nova East 2007 Committee.

John Jarvo, Chris Beckett, Irene Moore, Ron Mills, Dave Parsons, Daryl Dewolfe ★

See pics on page 6!

Image Processing 101

Blair MacDonald

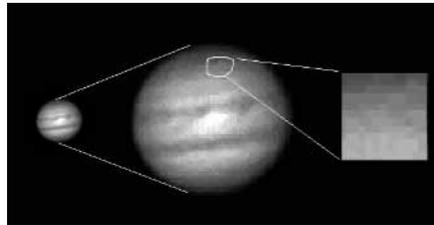
This article is the first in a series of articles following my talks on image processing. The first several columns will be slightly updated reprints of a series of articles I did for Nova Notes a few years ago. As they form the basis for the start of the image processing talks, and since I'm basically lazy, I have combined several of these short articles into this one to catch up. Hopefully by the next issue of Nova Notes I will cover the information presented in more recent meeting talks.

Several members had asked for more information after a few club talks on image processing so I told Michael that I would start a somewhat regular column on the topic. This first installment is meant to describe what an image is in terms of image processing. That is the representation a computer uses for processing purposes. The first few columns will be fairly simple, covering the basics of image representation and noise, but I'm afraid some math will creep in here and there. I will try to include as many answers to questions from readers as possible (meaning those questions I know how to answer) so feel free to contact me by email at b.macdonald@ns.sympatico.ca.

We have all seen the pretty pictures floating around the net and those in the astronomy magazines. These pictures, and even those on photographic film are nothing more than a series of dots of varying intensity. The major difference between photographic pictures and their electronic cousins are that the film grains are not regular and rely on having lots of them to fill in the picture. The

digital images and those in magazines have a regularly spaced grid of dots called pixels.

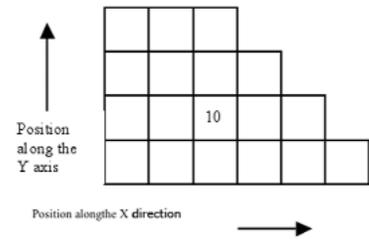
A pixel is the smallest element of the picture. It contains the information about all the light that fell on it during an exposure as well as any noise that may be present. When the picture is displayed, at normal resolutions, the individual pixels blend into a continuous and smooth picture, as the human eye cannot resolve the individual elements. This can be seen in the picture of Jupiter below:



The image on the far left is a picture of Jupiter taken from my backyard in suburban Halifax. The center image is a magnified view and the pixels are becoming visible. The image on the right is an area shown on the center image, greatly enlarged, the pixels are immediately visible.

In terms of image processing, these pixels are merely numbers representing the brightness at any given location in the image. You will notice the wording here – any given location. This means that somehow the computer must also store information about the location of the pixel as well as its brightness. This is done by storing the brightness value in an array. An array is just a rectangular table of numbers with the position of the element in the table corresponding to the position of the pixel in the picture. So if the third pixel from the left and

two pixels up from the bottom of the image has the value 10 then the pixel is represented as follows in the array:



Now the nice thing about representing an image as an array is that there is a whole host of mathematical manipulations that apply to arrays which can be used to change and improve the image. Over the course of the next several columns I will try to show how to resize, flip, mirror, filter and deconvolve images, all based on array manipulations. Indeed the modern computer is well suited to this type of processing. All this means that what used to take hours in the darkroom can now be done in a few minutes on a typical PC.

The value of any given pixel depends on two factors: the amount of light collected during the exposure and noise. Noise is something we have all seen; snow on a TV picture is a good example, and it sets the limits on what can be achieved with image processing. Even a badly focused image can be corrected digitally, after all that is what was done with many of the Hubble Space Telescope images until the corrective optics were installed. The problem is that almost all forms of sharpening an image make the noise worse, sometimes to the point where the original blurry image is more appealing to the eye! For now think of noise as the random variation in pixel values over and above the value due to

HALIFAX CENTRE

Nova Notes

The Newsletter of the
Halifax Centre of the RASC

PO Box 31011 Halifax, Nova Scotia B3K 5T9
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.

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

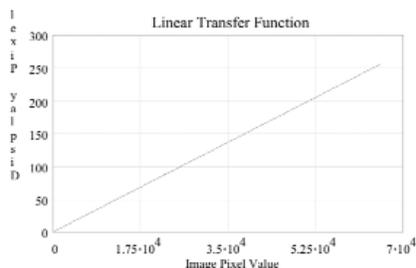
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Material for the next
issue should reach the
editor by Nov. 20-06

the recorded photons. In terms of the processing, it really does not matter how the noise got there, the trick is to minimize the effect on the image. For now just keep in mind that images are represented as arrays of numbers and that the value of any pixel in the image depends only on the light recorded during the exposure and random pixel to pixel variations called noise. In a following column we will examine noise in more detail and show some methods to reduce its effects.

An image, as it is displayed, cannot show all the detail stored in the image array. The reason for this is the limited range of brightness values displayed by computer monitors. Older monitors could display 64 shades of gray while newer ones can get to 256 if you are lucky. For this reason the image values must be mapped or scaled to the display. This can be done by using a display transfer function. Think of this as the plot of a line with the image pixel values on one axis and the display pixel values on the other. This line shows how the pixel values will be mapped to the display and by changing the shape

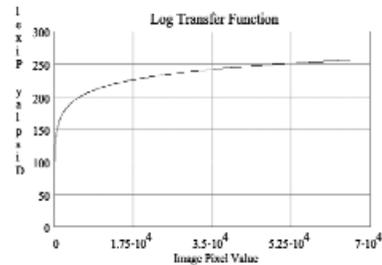
of this line the image can be brightened or the contrast enhanced. In addition, the line does not have to be linear; this is the basis of a log stretch. Both types of transfer functions can be seen below, simply select a pixel value on the X axis and read the corresponding display value from the Y axis.



The expression for the above line is

$$Y = \frac{256}{2^{16}} * X$$

where 256 is the maximum screen pixel value and 2¹⁶ is the maximum image pixel value.

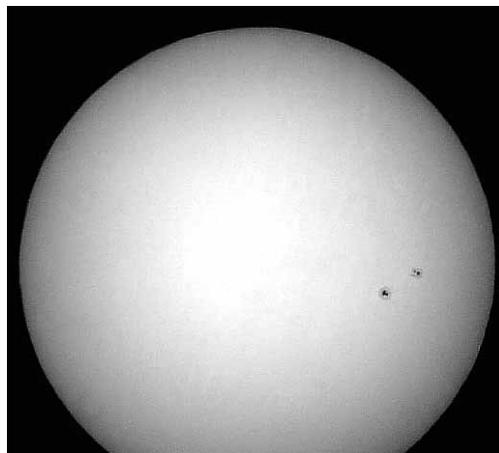


The expression for the log transfer function is

$$Y = \frac{256}{\log(2^{16})} * \log(X)$$

with 256 being the maximum screen value and 2¹⁶ is the maximum image pixel value.

So far we have seen that an image is represented as an array of pixel values for the purposes of image processing and that each pixel contains both the desired image value plus some unwanted noise. The basics of display stretching has also been shown and it should be kept in mind that this technique forms the basis of image histogram stretching to be shown in a later installment of Image Processing 101. ★



Astro Images

- M31—Blair MacDonald, this image is the sum of 4, 5-minute shots taken on a Canon digital Rebel XT at ISO 800. Scope used is an 8 inch Schmidt Newtonian at f/4.
- Sun — Michael Boschat, August 13, 2006, 1130 UT, scope Runibar 10cm, f/10, Maksutov @ 40x with Centrios 3.0MP Digital Camera mounted over eyepiece.
- Moon occults Pleiades — Michael Boschat, Date: July 20, 2006, 0720 UT, Olympus C-750 camera Exposure: 1.6 seconds at f/8 ISO 400.
- Moon — Michael Boschat, Date: July 3/4, 2006 0000-0005 UT, Runibar 10cm, f/10, Maksutov @ 40x with Centrios 3.0MP Digital Camera

My Summer Reading

by John Vandermeulen

Earlier on this summer, and still in the guise of a beginner, I began the self-appointed task of reading a series of books by the new crop of science writers, and a few not so new. The first 'must read' on the list is of course Stephen Hawking's "A Brief History of Time". First published in 1988, and reprinted several times since, it remains on the bookstore shelves, although there is an updated retitled version which I haven't seen yet. (I do most of my book-buying at used-book web sites, like strandbooks.com and amazon.ca, usually three or four at a time to lower the shipping costs a little.)

Anyway, apart from the little Penguin pocketbooks and the like of the 50s and 60s, I had not really read anything more astro-modern until Hawking's book. And I must admit that my first encounter with Hawking was a tough one. Over the previous years I had drifted away from physics and math stuff, and rambled instead in things biological. Hence my first reading was a tough go, what with fuzzy (to me) concepts like scientific determinism, or the unification of gravity with quantum mechanics, and then something called string theory, and much more of the same. I have since learned that this reaction to his book was not just me, but that many others shared my cluelessness. However, a physicist friend of mine, now sadly deceased, shamed me into trying it again, and eventually Hawking's perspective on our universe did sink in, although with many pot

holes still to be overcome.

In his Acknowledgements Hawking promised to avoid math, keeping only $E=mc^2$. After about the third or fourth read, I am not so sure that this approach is really useful, as there are many equations that are equally simple and that do demonstrate some points probably better than a lengthy wordy paragraph. For example the Lorentz contractions (these having to do with speed and relativity etc.) are actually very clear in their statement. And they look good. There are several other places where a single equation would help out.

Overall, however, this book is astonishingly straight forward. Hawking takes the classic tour - beginning in chapter 1 with Ptolemy, then Aristotle, Copernicus and on to Galileo and Newton. All this in chapter 1! He then doesn't waste any time and in chapter 2 rolls right away into the beginnings of the special theory of relativity. It's good stuff, although I must admit to even now barely understanding his light cone-based diagrams. I just can't seem to be able to twist my head around to visualize these, while everything else is pretty easy going. I guess we all have our little puzzlements. For me it is his light cones.

On we go. Assuming that at the end of chapter 1 the reader is now familiar with relativity, Hawking goes straight ahead into the expanding universe, the uncertainty principle, elementary particles and forces, and on into black holes. Admittedly a hand full, it all seems to hang together, but what I especially like about his approach is that it is a bit like a classical duet.

His principal line is to trace the forward evolution of the physics underlying our understanding of the processes of the universe, stepping from idea to idea. But there regularly is a base-line of historical references to an earlier thinker or idea. For example, in his discussion of Steven Weinberg's work on elementary particles in the 70s, Hawking reaches back to the fifties to illustrate symmetry in nuclear forces. This, to me, is a good device as it knits together the very busy business of elementary processes.

Now ... should one buy and read this book. Yes for a couple of reasons. Hawking is probably the most well known physicist/cosmologist today. Also, he writes a fine line. He hits all the high points, and with good explanations. However, this book is a trial for those readers not already familiar with the field. Books like this are often advertised as being suitable for the "educated layman". If that educated layman is a highschool science teacher, than that's fine. If he or she is the lawyer or bank manager next door, then it will take some heavy sighing.

The rest of the story you will have to discover for your self. I don't think that I am giving the whole plot away by saying that Hawking reveals the beginnings of string theory. But he does give short shrift to the scenarios of the early universe. For that one would need many more pages, and we are already on page 180. Plus the title of the book promises a Brief History of Time. Best turn to Weinberg's "The First Three Minutes" for that. It is super, but I can't find my copy. ★

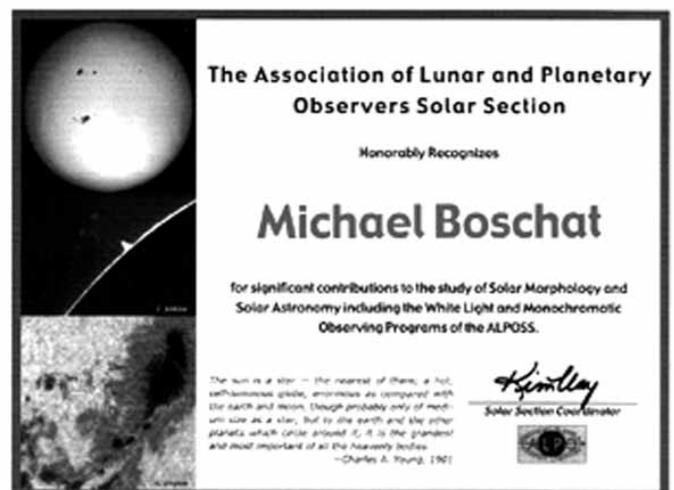
Mike Boschat recognized by the ALPOSS

Mike's work in Solar Astronomy was formally acknowledged this summer when he received this certificate from the The Association of Lunar and Planetary Observers Solar Section. It reads:

The Association of Lunar and Planetary Observers Solar Section

Honourably Recognizes Michael Boschat for significant contributions to the study of Solar Morphology and Solar Astronomy including the White Light and Monochromatic Observing Programs of the ALPOSS.

Congratulations Mike! ★



Meeting Report

June 2006

By Andrea Misner

June's meeting was filled with five mini-talks from RASC members. Present Craig Levine started the meeting with the usual introductions before he introduced the night's first speaker, Pat Kelly, and his talk titled Astronomy on Banknotes. Pat discovered in old Sky and Telescope magazines from the 70's that there was currency from different countries with astronomical themes. The question of whether or not there was a way to get this currency today lingered in Pat's mind until he came up with the answer – eBay! Pat took us through currency from Great Britain, with Sir Issac Newton, Slovenia, Poland, with Copernicus and his idea of the solar system, and finally Romania, with the astronomical event of a total solar ellipse. Thank-you to Pat for giving us a brief and interesting talk!

Next up was John and his wife, Gail, (last name??) with a little chat about

their New York adventure to the Hayden Planetarium. John and Gail were in awe with the massive glass cube that encompassed the floating globe planetarium. They were treated to an IMAX system presentation called, Collisions in the Heavens. John and Gail have nothing but praise for the astrophysics and planetarium director, Dr. Neil Tyson. Thank-you John and Gail for the indulging talk! I wonder if the RASC can take a field trip?

The third speaker of the evening was Chris Pettipas. Chris's talk was on his favorite article, "End of Civilization", from the September 1991 Astronomy magazine. Chris's article talked about the debate between astronomers and paleontologists on whether an asteroid had in fact wiped out the dinosaurs or not. At the time the paleontologist said no, but the astronomers has said yes. Chris reminded us how fragile this world really is and how fast it could be destroyed!

Our resident sage of image processing, Blair McDonald, gave our fourth talk of the evening. Blair's talk focussed on

PSF (point spread function), which describes the light from a single point is spread out as it travels through the optical channel. The channel was the source of the signal, it could be a star for example, and what lies between the star and the detector, or camera. Blair discussed how to find the PSF and use it to cleanup an image and help with tracking errors. Thank-you Blair for the tips on imaging!

The last speaker of the evening was Craig Levine, conversing about his passion for maps, and not just any maps, star charts! Craig remarked that for good observing you first need a plan! After all, half the fun is looking for a certain object and getting frustrated when you can't find it. Craig weighted different observing charts such as: Deep Map 600; Cambridge Star Atlas; Sky Atlas 2000; Uranometria 2000; and Herald-Bobroff AstroAtlas. In conclusion, a variety of good maps is best to cover all of your observing needs!

Thank-you Craig for sharing your observing maps. ★

Meeting Report Sept. 2006

By Paul Heath

Once again I was "volunteered" as scribe' for the Member's presentation night. Craig welcomed all back, and spoke on the benefits of membership. He also notified all members of upcoming elections and open positions available for interested members to join the executive. The following positions will be open for 2007:

- President
- 2nd VP (*chief Ferengi*)
- Secretary
- Nova Notes Editor

First Presenter

Mary Lou Whitehorne – Guess the Constellation

It went something like this - flash of a photo of a constellation, and the first guess received a box of Smarties. List of fun facts on constellations Auriga, Perseus, Orion, Ursa Major, Taurus, Scorpius, Crux, Canis Major and the mysterious "Glow Worm" Constellation.

Second Presenter

Pat Kelly – Useless gadget

A non glow-in-the-dark sky map astronomy clock that was also a plainshere set for a southern location.

Third Presenter

Tony McGrath – Digital setting circles

Tony discussed how he evolved his mount from manual setting circles to digital setting circles on a Losmandy mount. He demonstrated the ease of the Losmandy mount and how the digital setting circles allowed for precise pointing of the scope. An informative discussion flowed from his talk.

Fourth Presenter

Craig Levine – Atlases

Craig showed a brief overview of his favorite hard copy sky atlases and how one could progress from one to another. Petersons, Sky Atlas 2000, Uranometria 2000, Herald-Bobroff AstroAtlas, Millenium Star Atlas, Pocket Sky Atlas. Craig than gave a brief show of online Charts including Mag 7 Star charts, and Taki's Mag 8.5 Atlas.

Craig initiated a fun Pluto debate, then we adjourned for treats and discussions. ★

Web-only Nova Notes?

If you are the type of person who downloads the latest issue of Nova Notes off of the web to print it at home, then you may be interested in taking your name off of the mailing list for the printed version. If so, please email me at agatto@ns.sympatico.ca with the subject line "Remove from mailing list" and I will do just that. If enough people opt out then I will consider sending out the issue to members in a large group email. But for now, **you will be responsible for downloading the issue yourself each month**, and will not be added to the list again unless you email me again to reinclude yourself. ★

Nova East 2006

Picture book

Thanks to Garth Arsenault, Charlottetown RASC, for sending me his images from this year's Nova East!





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.

2006 Observing Chair: Tony McGrath 463-4018

Members' Night

Every weekend closest to the new Moon there is a 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 Chair. *Dates for Members' Nights for the remainder of 2006 are:*

20–October | 24–November | 22–December

These dates are all Fridays, and the alternate date will be the following Saturday.

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.

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 Chair.

RULES FOR THE 17.5" SCOPE (OR ANY RASC SCOPE AT SCO)

On Members' Nights the 17.5" scope must be shared by all members. The 17.5" scope can be used by anyone, but all views have to be shared with anyone interested in taking a look.

On non Members' Nights the scope can be used by individuals wishing to work on personal observing projects. Members should try to limit their use to under 45 minutes when other members are waiting to use it. Preference will be given to members who send an email to the hfxrasc list, or call the observing chair on the night they want to go out. If no one else wants to use the scope then feel free to use it all night, but it would be considerate every so often to ask members there if anyone has been quietly waiting to use it.

Please contact the Observing Chair for more information.

Meeting Announcements

Halifax Centre of the Royal Astronomical Society of Canada



There are no meetings in the summer months of July/August. See you in September!

Meeting Dates:

October 20, November 17, and December 15.

October Speaker/Topic:

"Ancient and Not-So-Ancient Astronomy in Ireland"
by Patrick Kelly

While on vacation in the Emerald Isle this summer, Patrick visited several locations that have a connection with astronomy. While three of the places visited have an obvious association with astronomy, at others the link is a bit more tenuous.

2007 Executive – Positions need to be filled.



The four highlighted council positions below will be vacant in 2007. If you are interested in giving some of your time to fill these important positions, or have any questions as to exactly what each position entails, please contact Craig Levine at the number below. Being on the executive is a great way to give back to the Society and to help shape the future of the Halifax Centre of the RASC. Plus it's fun!

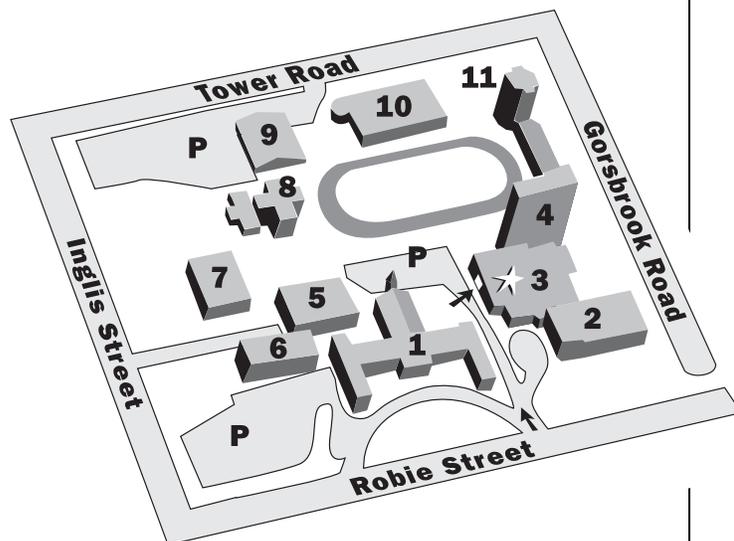
Halifax RASC Executive 2006

<i>Honorary President</i>	<i>Dr. Roy Bishop</i>	
President	Craig Levine	852-1245
<i>1st vice-president</i>	Paul Evans	423-4746
2nd vice-president	Marc Bourque	835-2589
Secretary	Andrea Misner	425-5074
<i>Treasurer</i>	Pat Kelly	798-3329
Nova Notes Editor	Michael Gatto	453-5486
<i>National Rep.</i>	Pat Kelly	798-3329
<i>2nd National Rep.</i>	Mary Lou Whitehorne	865-0235
<i>Librarian</i>	Alex LeCreux	404-5480
<i>Observing Chairman</i>	Tony McGrath	463-4018
<i>Councilor</i>	Jim Dorey	464-8781
<i>Councilor</i>	Wesley Howie	835-3966
<i>Councilor</i>	Gilles Arseneault	

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, Loyola Building (#3 on map) at Saint Mary's University.

1. McNally
 2. Sobey Building
 3. Loyola Academic Complex
 4. Loyola Residence
 5. Patrick Power Library
 6. Science Building
 7. Burke Building
 8. Bookstore
 9. Alumni Arena
 10. The Tower
 11. Rice Residence
- P = Parking



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.

