

Nova Notes



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

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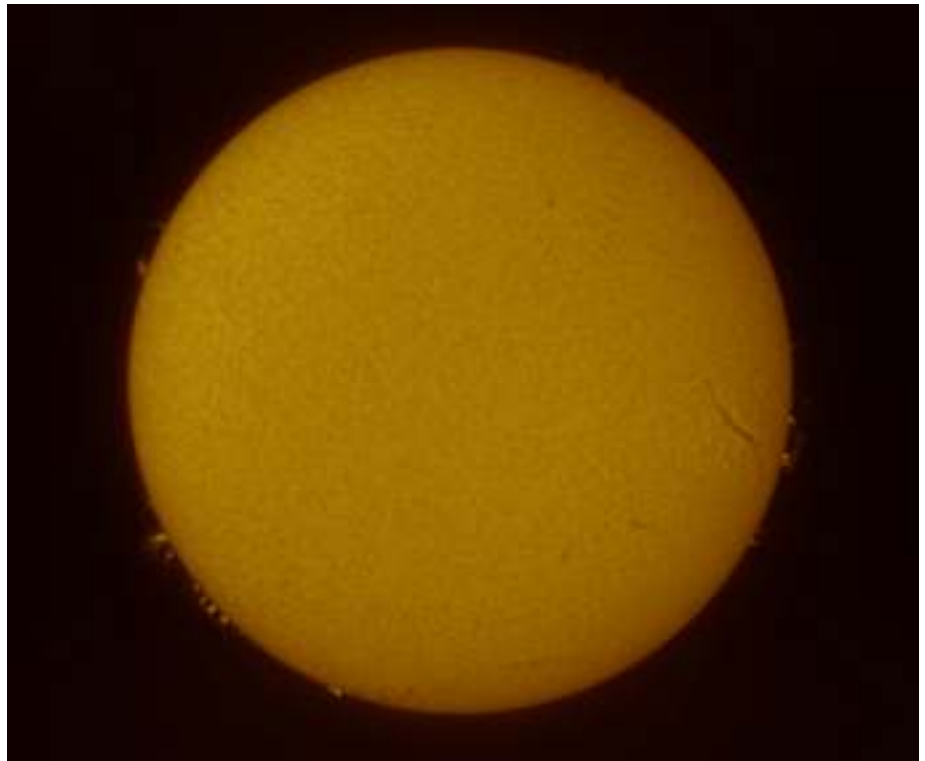
Volume 41 Number 3 July 2010

E mail: novanoteseditor@rasc.ca

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Front Page Photo: Karl Penney
Solar Prominence, 10:45 a.m. on Tuesday,
May 18th. 2010 Details page 3



THIS IS YOUR LAST PRINTED COPY OF NOVA NOTES!

From the editor

Quinn Smith

As I hope you have noticed, this is the last printed copy of Nova Notes! If you would like to continue to receive a printed and mailed version of the newsletter please see the information on page 3. Of course Nova Notes will still be available in glorious colour from the Halifax Centre web site at <http://www.halifax.rasc.ca>. Click on "Publications" then click on "Current Issue" under the Nova Notes column. (go to "archives" for editions on Nova Notes back to 1995!) There - wasn't that easy!

Congratulations to Karl Penney who had his "Front Page Photo" (above) featured in the SkyNews as Editors' Choice - photo of the Week # 432 (<http://www.skynews.ca/pages/POW.html>)

This Labour Day Weekend (September 3rd to 6th) is our annual Nova East Star Party. All the information you need is in the enclosed Nova East program included with this issue. We have had rain, thunder and lightning and even hurricanes over the last few years. This year it will be beautiful. Guaranteed! (*please read the disclaimer on page 99*)

St Croix Observatory

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. Observing nights (Fridays close to the New Moon) are open to members and guests.

If you are not a key holder, or need more information please contact the Observing Chairman, John Liddard (see below).

Upcoming Observing Nights:

July	9th,	2010
August	13th	2010
September	10th	2010
October	8th	2010

Meetings begin at 8:00 p.m. at Saint Mary's University in room Sobey SB 260
(There are no meetings in July and August)

September 3rd - 6th 2010 - NOVA EAST

September 17th 2010 - Speakers night
"Mun and the 7 Bird Hunters" - an introduction into Mi'kmaq astronomy lore with guest speaker.

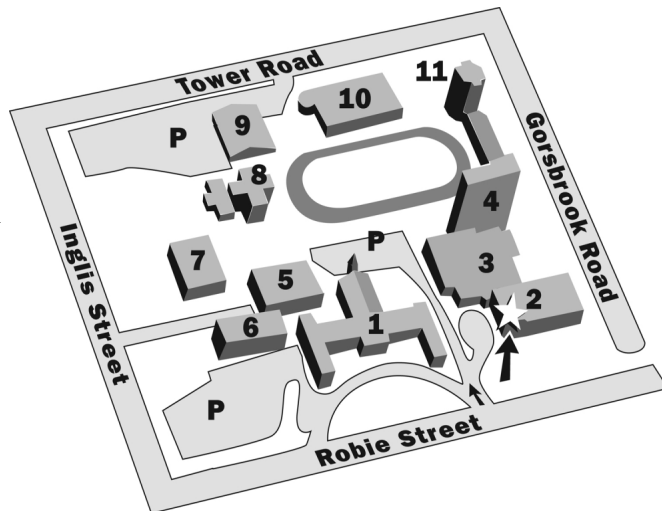
October 15th 2010 - Speakers night
Dr Roy Bishop will discuss Subrahmanyan Chandrasekhar. And Stellar Evolution

November 19th 2010 - Speakers night
Dave Chapman will describe his astronomy adventures in Cuba.

[The content of all meetings is subject to change]

Meeting Location: 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



Meetings are usually held on the third Friday of the month, except for the months of July and August, when there are no meetings.

Executive meetings begin at 7:00 p.m., (usually in room SB152), and all members are welcome to attend.

Halifax RASC Executive, 2010:

Honorary President	Dr. Roy Bishop	902 542 3992	roy@xcountry.tv
President	Richard Vanderberg	902 403 7553	
1st Vice President	Wes Howie	902 252 9453	wesley.howie@nssc.ca
2nd Vice-President	Jim Dorey		jimdorey@gmail.com
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National Rep.	Pat Kelly	902 472-2322	patrick.kelly@dal.ca
Councilor	Paul Heath	902 457 0610	pheath@eastlink.ca
Councilor	Sean Dzafovic	902 430 9062	sdzafovic@gmail.com

Changes to Nova Notes

Quinn Smith

We are phasing out the printed version of Nova Notes in favor of the on-line version found on the Halifax Centre website.

Anyone wishing to continue to receive a printed version of the newsletter may still have a copy mailed to them, however there will be a \$12 per year fee for the printed/mailed version.

We are expecting that this will reduce the environmental and financial cost associated with the newsletter, while minimizing the inconvenience to members.

How it will work:

- The first three editions of Nova Notes in 2010 (February, April, and July) will be delivered by mail in the normal way .

- The last two issues (October and December) will only be mailed to members who have specifically “opted-in” to the newsletter.

- All members who “opt-in” to the newsletter will continue to receive a newsletter until they renew their membership, even if that renewal does not occur until the first half of 2011.

- A member may “opt in” to the newsletter by e-mailing, or writing to the newsletter editor any-time between now and September 15th 2010 at:
novanoteseditor@rasc.ca
or mail
Nova Notes Editor
PO Box 31011,
Halifax, NS, B3K 5T9

- There is no fee to “opt-in” to the newsletter, the print fee being paid at the next membership renewal.

- All members “opting in” to the newsletter will receive confirmation of their “opt in”.

After June 30th 2010 as a member renews their membership (at the National level), they will have a renewal option to receive the printed version of Nova Notes by paying a publication fee of \$12.00 (as an addition to the regular membership fee).

By June 30th 2011 all members should have renewed and all members wishing to receive the printed version of Nova Notes will have indicated such on their membership renewal.

Life members may continue to receive a printed version by paying \$12.00 through the renewal process at National (as is currently done with the Journal).

Front Page Photo: Karl Penney

The image is a combination of 1ms exposures for the surface detail and 5millisecond (ms) exposures for the prominences. Taken from my garage doorway at about 10:45a.m. on Tuesday, May 18th 2010.

“I just hooked up a QHY5 camera to my LS60THa solar telescope.”

(easy for Karl to say! Ed.)

The logo for the Halifax Centre, featuring the word "HALIFAX" in a large, serif font above the word "CENTRE" in a smaller, serif font, with a horizontal line separating the two words.

Nova Notes: The Newsletter of the Halifax Centre of the RASC

PO Box 31011, Halifax, Nova Scotia, B3K 5T9

E mail: novanoteseditor@rasc.ca Newsletter editor: Quinn Smith

Nova Notes is published 5 times a year, in February, April, July, October and December.

The deadline for the next edition is September 20th 2010

The opinions expressed herein are not necessarily those of the Halifax Centre.

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

Astronomy Outreach in Cuba

Dave Chapman

This story begins in 2009 when I was enjoying a pint at Stayner's (a local jazz bar) with my friend Phil Theriault. Phil is a retired teacher who I met through the Atlantic Jazz Festival (now called the Halifax Jazz Festival).

Phil was the Volunteer Coordinator in charge of recruiting and assigning the 450+ volunteers (including me) needed to run the 9-day festival every July. Over his pint, Phil was describing another volunteer opportunity in which he leads a group to Havana University every spring to assist Cuban students in mastering the English language. (Not teaching, but language enrichment.) He was trying to get me to join, but I was reluctant. "If I could teach astronomy in English, then I could get interested," I said.

So I went home and came up with a proposal to present some introductory practical astronomy talks (like our NOVA program) and I added the possibility of a workshop with Galileoscopes, the special teaching kit developed for International Year of Astronomy 2009.

To cut a long story short, we had a devil of a time getting anyone seriously interested in this, as Phil only

had contacts at the Foreign Language School, and I had zero contacts! So my Plan B (astronomy lectures) was not looking promising and I was going to have to resort to Plan A (English enrichment), as by this time I had committed to go.

However, since Saint Mary's University Department of Astronomy & Physics had pledged a number of Galileoscopes to support the project, I continued spinning Plan B for anyone who would listen. As you will see, what I ended up with was Plan C, which was better than Plans A and B combined!

When I actually accepted the 12 Galileoscopes from SMU (with a letter of introduction) I resumed searching for contacts. Perhaps the fact that I was committed to coming and that I actually had the 'scopes (along with an official letter) made the difference, as this time I got an enthusiastic reply from Dr. Oscar Alvarez of the Cuban Ministry of Science, Technology, and Environment.

Oscar was also the Cuban National Point of Contact for IYA 2009 and was instrumental in setting up a new planetarium in Havana that had just



Cuban IYA 2009 Point of Contact, and Dave

opened in January 2010. Oscar put me in touch with Alejandro Jimenez, who is very much involved in astronomy outreach and amateur astronomers in Cuba, along with Oscar. Plans developed rapidly in the last few weeks before departure but it turned out that nothing was ever certain until almost the minute one started! (Apparently this is typical of Cuba.)

The journey down was more eventful than we wanted, with us arriving a day late on 2010 March 5. It turned out that I had not done my homework, as despite all the great documentation I had regarding my project, the Cuban Customs would not let me pass through with my two large cardboard boxes of Galileoscopes. They held on to them and gave me an official-looking receipt. Honestly, I thought they were very nice about the whole



One of the 12 Galileoscopes taken to Havana



Dave and Alejandro Jimenez with a Galileoscope



A typical workshop



Reading the upside-down book titles!

business. They understood what I was doing and approved, but could not let the telescopes go!

Several days later, Oscar and I returned to the airport and visited several offices, but no one would authorize their release. In the end I formally signed them over to the Ministry and they took care of the importation, which did not take place until I was back in Canada! At the time I write this, I am happy to report that Oscar finally has the Galileoscopes.

When I finally met Alejandro, I discovered a tall, thin, energetic man who is dedicated to astronomy and who never seems to sleep. We became instant pals. His enthusiasm was infectious and I found myself swept up into his world for about a week. The idea of teaching a NOVA-like course was

immediately tossed out the window and we started on Plan C: teaching the teachers.

I had the foresight to assemble a Galileoscope and place it in my suitcase. No one even looked in my suitcase, but my position would have been that it was my "personal" telescope, like my tripod, binoculars, camera, and computer I had with me. Alejandro and I built a presentation around that one Galileoscope and my Power Point presentation on the Galilean vs. Keplerian telescope designs.

That week, I presented 3 Galileoscope workshops to about 125 people at the National Museum of Natural History in Plaza des Armes in Havana. My Galileoscope was put together and disassembled multiple times over that time! The first group included instructors, teachers, and planetarium volunteers, plus schoolchildren and some "explorer pioneers", which are the Cuban equivalent of scouts and girl guides.

The second and third group was mostly senior elementary schoolchildren, but there were always adult amateur astronomers, observatory directors, science popularizers, and others in the mix.

Each workshop began with a brief introduction by me, followed by a step-by-step assembly of the Galileoscope. I spoke slowly in English and Alejandro translated. We brought the audience up in groups to examine the telescope parts on the table, then we chose 4 young volunteers to perform the assembly steps. At the end, we set the telescope on a tripod at the window and everyone got to look through it.

Across the Plaza, there were outdoor book stalls and the children amused themselves by reading the upside-down book titles in the inverted-image astronomical telescope. In the second workshop we covered an advanced topic by explaining the difference between Kepler's astronomical telescope and Galileo's terrestrial telescope. To my amazement, Alejandro converted my English PowerPoint presentation into a Spanish one overnight!

I presented my personal Galileoscope to a lady living in Havana who was very helpful to my project in a number of ways. I loaned Alejandro my tripod for a year, as photo tripods seem scarce. I also left behind two copies of the RASC Observer's Handbook (thanks Chris Young!) and a used copy of Nightwatch. These materials are deeply appreciated by the Cuban amateur astronomers.

Stay tuned for Part 2 in the next Nova Notes: Dave on Cuban TV and a visit to the Planetarium.



Assembling the Galileoscope



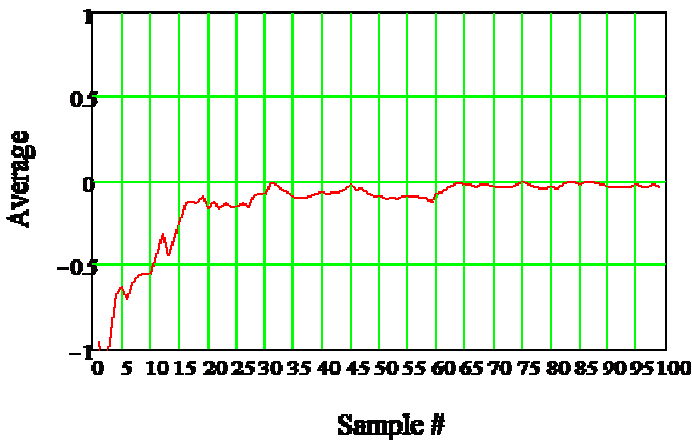
Blair MacDonald

This edition's question was sent in by John Nangreaves as one of several readers curious about how many exposures to stack.

"How many frames do I expose, given that I have somehow managed to figure out how to get a "proper" exposure? I have assumed from some study "the more the better"; however, realizing that this is much along the lines of improving SNR by over-sampling, there must be some "point of diminishing returns" after which you're basically wasting time."

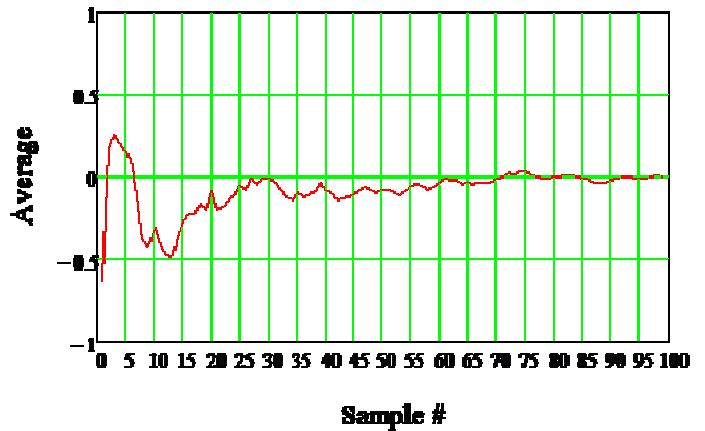
Well the simple answer is as John surmised the more images stacked the better. Of course there is a limit to such nonsense and we will have to take a look at what is really going on to see just where the limit is.

First, let's assume, as John states in his question, that each individual frame in the stack is exposed properly. By this I mean that the shutter has been left open long enough so that the sky's photon noise is the dominant noise source in the image. This means that the camera noise can now be ignored. Under these conditions the data, as sampled at each pixel, can be thought of as the sum of the actual signal plus a zero mean noise signal or $data = signal + noise$. Zero mean random noise is simply a noise that has an average value of zero.



Now there is a branch of statistics that deals with how long it takes a random sequence to settle to its mean value. It turns out that a random process settles to within ten percent of its mean in about 30 to 35 samples. This is shown in the plot (lower left) which shows the average, of a number of samples, generated by a pseudorandom number generator with a mean of zero and a standard deviation of one.

As you can see the curve flattens out at about sample 15 and is within ten percent of the mean shortly after that. There is some variability on this as it is random data and the next run looks different as shown below.



Again, although different, the curve has flattened out by sample number 30 and is a reasonable approximation of the mean by sample 20.

What these plots show is that if you take 20 to 30 exposures that are photon noise limited then you have a reasonable average value for each pixel. The short answer is to take as many exposures as you can, but after 20 to 30 you will see very little improvement in SNR so you would be wasting your time. Generally I shoot between 10 and 30 exposures, ten for very bright objects and 30 or more for dim Ha nebula.

These numbers are from a dark sky site, if you shoot in the city or with the Moon up, then you should shoot closer to 30 exposures to reduce the photon noise to acceptable levels. Also keep in mind that my camera is an unmodified DSLR and is rather insensitive to Ha emissions, those with a CCD or a modified DSLR may get away with fewer exposures on Ha targets.

Remember, this column will be based on your questions so keep them coming. You can send them to the list at hfxrasc@lists.rasc.ca or you can send them directly to me at b.macdonald@ns.sympatico.ca. Please put "IC" as the first two letters in the topic so my email filters will sort the questions.



**Nova
East** ★
★ ★ **2010**

Atlantic Canada's longest running Star Party

September 3 – September 6

Smileys Provincial Park, Hants County, NS

Guest Speaker: Charles O'Reilly

Nova East 2010 Program of Events

The keynote speaker and special guest at Nova East 2010 will be Charles O'Reilly. O'Reilly's current position is Chief of Tidal Analysis and Prediction, Canadian Hydrographic Service(CHS)/Atlantic Region, and has served as Acting/National CHS Tidal Projects Coordinator. He has been very active in researching the impacts of rising sea levels, storm surges and tsunamis. His talk, entitled "The Saxby Gale", discusses the tropical cyclone which struck eastern Canada's Bay of Fundy region on the night of October 4-October 5, 1869.

Nova East registrants have access to all events, including O'Reilly's talk, the nine presentations scheduled for Saturday and Sunday, three nights of observing (weather permitting!), two astronomers' breakfasts, the door prize draw, and a tour of the St. Croix Observatory. Nova East Registrants have on site parking (if Camping) or adjacent site parking (if non-Camper).

Bringing the stars to the public is a legacy of every Nova East Star Party. To that end, Nova East 2010 offers night sky observing sessions on Saturday/Sunday which are open to the general public, and Smileys Park users.

Friday, Sept. 3rd

1:00 p.m. – 7:00 p.m.

Registration

At the Information/Registration Tent
(if arriving later just find the registrar
at campsite 3 – Blair MacDonald)

7:45 p.m.

Welcome and Announcements

Host: Ron Mills
Event Tent

8:00 p.m.

Nova East 2010 Special Guest

Speaker: Charles O'Reilly

Topic: Saxby Gale

Introduction: Ron Mills
Event Tent

9:30 p.m.

Nova East Registrant Observing

Observing Field
(Astronomical twilight ends
at 9:34 p.m.)

Saturday, Sept. 4th

9:30 a.m.

Astronomer's Breakfast

Hosts: Ron Mills & Smileys Park
Event Tent
Baked goods and coffee will be
available.

10:45 a.m.

Nova East 2010 Group Photo

Observing Field

11:00 a.m.

Presentation 1 "How High is the Sky?"

Speaker: Quinn Smith
Event Tent

12:00 p.m. – 1:30 p.m.

Lunch Break

1:30 p.m.

Presentation 2

The Abby Ridge Observatory

Speaker: Dave Lane
Event Tent

2:30 p.m.

Solar Observing and Telescope tours

Hosts: Nova East Astronomers
Observing Field

3:30 p.m.

Presentation 3 "A Nature Walk through Smileys Park"

Host: Sherman Williams
Event Tent

4:30 p.m.

Presentation 4 "Tour of St. Croix Observatory"

Host: John Liddard
Event Tent

5:00 p.m. – 6:45 p.m.

Supper Break

7:00 p.m.

Door Prize Draw

Host: Pat d'Entremont
Event Tent

8:00 p.m.

Presentation 5 "The Rainbow – Starlight and Hydrogen Oxide Spheres of the Third Planet"

Speaker: Roy Bishop
Event Tent

9:00 p.m.

Sky Tour

Host: Paul Heath
Event Tent

9:30 p.m. – 12:00 a.m.

The Universe, Yours to Discover

The Nova East Astronomers
invite Smileys Park Campers & the
general Public to view the stars &
other celestial objects in the night
sky through telescopes of all sizes
and shapes.

Hosts: Nova East Astronomers
Observing Field

(Astronomical twilight ends
at 9:32 p.m.)

Remember to visit <http://halifax.rasc.ca/ne/> for more information.

Sunday, Sept. 5th

4:45 a.m.

Zodiacal Light Patrol

9:30 a.m.

Astronomer's Breakfast

Hosts: Ron Mills & Smileys
Park Event Tent

Baked goods and coffee
will be available.

10:30 a.m. – 11:30 a.m.

Workshop 1

"Astrophoto Processing"

Bring your laptop and those
difficult to process photos for
some processing tips

Host: Blair MacDonald
Event Tent

10:30 a.m. – 11:30 a.m.

Workshop 2

"How to Observe the Sun"

Host: Karl Penny
Observing Field

10:30 a.m. – 11:30 a.m.

Workshop 3

"How to Set Up and Align an Equatorial Telescope"

Host: Tony McGrath
Observing Field

11:30 a.m. – 1:30 p.m.

Lunch Break

1:30 p.m. – 3:30 p.m.

Solar Observing and Telescope tours

Hosts: Nova East Astronomers
Observing Field

9:00 p.m.

Sky Tour

Host: TBD
Event Tent

9:30 p.m. – 12:00 a.m.

The Universe, Yours to Discover

The Nova East Astronomers invite
Smileys Park Campers & the gener-
al Public to view the stars & other
celestial objects in the night sky
through telescopes of all sizes and
shapes.

Hosts: Nova East Astronomers
Observing Field

*(Astronomical twilight ends
at 9:30 p.m.)*

Monday, September 6th

4:45 a.m.

Zodiacal Light Patrol

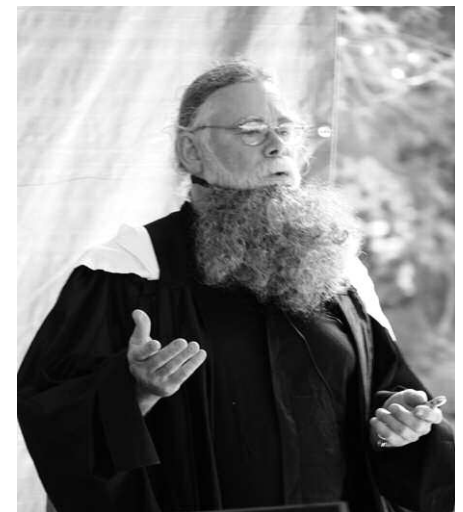
10:00 a.m. – 12:00 p.m.

Farewells & Packing Up

No other formal events are planned
for Monday, September 6. Relax,
be social and help out cleaning
up and packing up the gear from
the weekend.

Please note that all times are
approximate and somewhat
flexible. Impromptu events may
be scheduled. Please check at the
Information/Registration Tent, or at
the Bulletin Board by the Event Tent.

*Nova East is presented by
The Halifax Centre of the Royal
Astronomical Society of Canada
and The Minas Astronomy Group.*



Registration

You are urged to register by mail before **June 30, 2010**. Please complete and return the included registration form, with payment, to the indicated address. We will confirm your registration by post or e-mail if your payment is received by June 30, 2010. Registration allows Nova East day-users vehicle parking adjacent to the Nova East observing site for easy access and equipment unloading, as opposed to parking at the Park entrance. It also guarantees Nova East campers a campsite adjacent to the observing area. (see "Campsite Reservation Information") It also ensures your name is included in our door prize draws. Registration is extremely helpful for Nova East organizers and the Park staff, to ensure adequate on-site facilities such as picnic tables, garbage cans, etc. and to estimate potential numbers attending Nova East programs.

Campsite Reservation Information

This is a camping week-end so we encourage everyone to bring their tent or trailer. This year, we have camp sites available adjacent to the observing site. To guarantee one of these sites it would be best to register early. All Nova East campers pay for and register their campsite with us - do not register at the Park entrance. Specific campsites will be assigned upon checking in at the Nova East Information Tent at the Nova East site in the Park. One vehicle per site. Non-camping vehicles are not permitted in the Nova East campers area. Nearby vehicle parking is available.

Promotional Items

A limited supply of Nova East T-shirts will be available at the star party. To avoid disappointment, it would be best to pre-order your Nova East 2010 T-shirt with your registration. Your T-shirt will be then be waiting for you upon arrival at the Nova East Information Tent.

No T-shirt orders will be accepted after June 30th.

Smileys Park Facilities

In the Park, over 100 campsites are available to the general public. Hot showers and flush toilets are at the main comfort station. Water, fire grills, picnic tables, a trailer dump station, and facilities for the disabled are also available. Firewood can also be purchased.

Local Services

Gas stations, Camping Supplies, Confectionary goods, and Hardware supplies are 5 min from Smileys Park in the village of Brooklyn. Extensive services such as Malls, Restaurants, Banking, and 24 h services are in the town of Windsor, 15 min from the Park. The closest motels are near Windsor, the DownEast Motel (902-798-8374) and the Super 8 Motel (902-792-8888), each about a 15 min drive from Nova East.



To contact Nova East 2010

Visit our Website:

<http://halifax.rasc.ca/ne/>

E-mail: novaeast2010@rasc.ca

Please return this form to this address by **June 30, 2010**, to ensure timely delivery of T-shirts. Cheque payable to RASC, Halifax Centre.

Nova East 2010 c/o Blair MacDonald 106 Spruce View Drive
Bedford NS B4A 3Y3

Registration Form

Name: _____

Street or P.O. Box #: _____

City: _____

Province: _____

Postal Code: _____

Telephone #: _____

E-mail Address: _____

Nova East Family Camping (change from last year)

Attendees who prefer to have campfires and white lights after dark are encouraged to reserve their campsites through the new Park reservation system by calling 1-888-544-3434. Specify your location near the showers/washroom building. **For these campers your Nova East 2010 registration form should include only the weekend registration fee of \$25 plus T-shirts (if desired) with no entry for camping.**

Fees

Attendance

\$25.00 for Weekend
(Single or Family attending)

weekend pass/passes X \$25.00 =

Camping

\$23.00/night
One vehicle and one tent/
trailer permitted per site

night/s X \$23.00 =

T-Shirts

All T-Shirts are \$20.00.
Please indicate
the number of each
size you will need.

XL LG MD SM

Total number of shirts X \$20.00 =

Total Payment =

Please return this form to the address above by **June 30, 2010**

Another Sketch

Mike Gatto

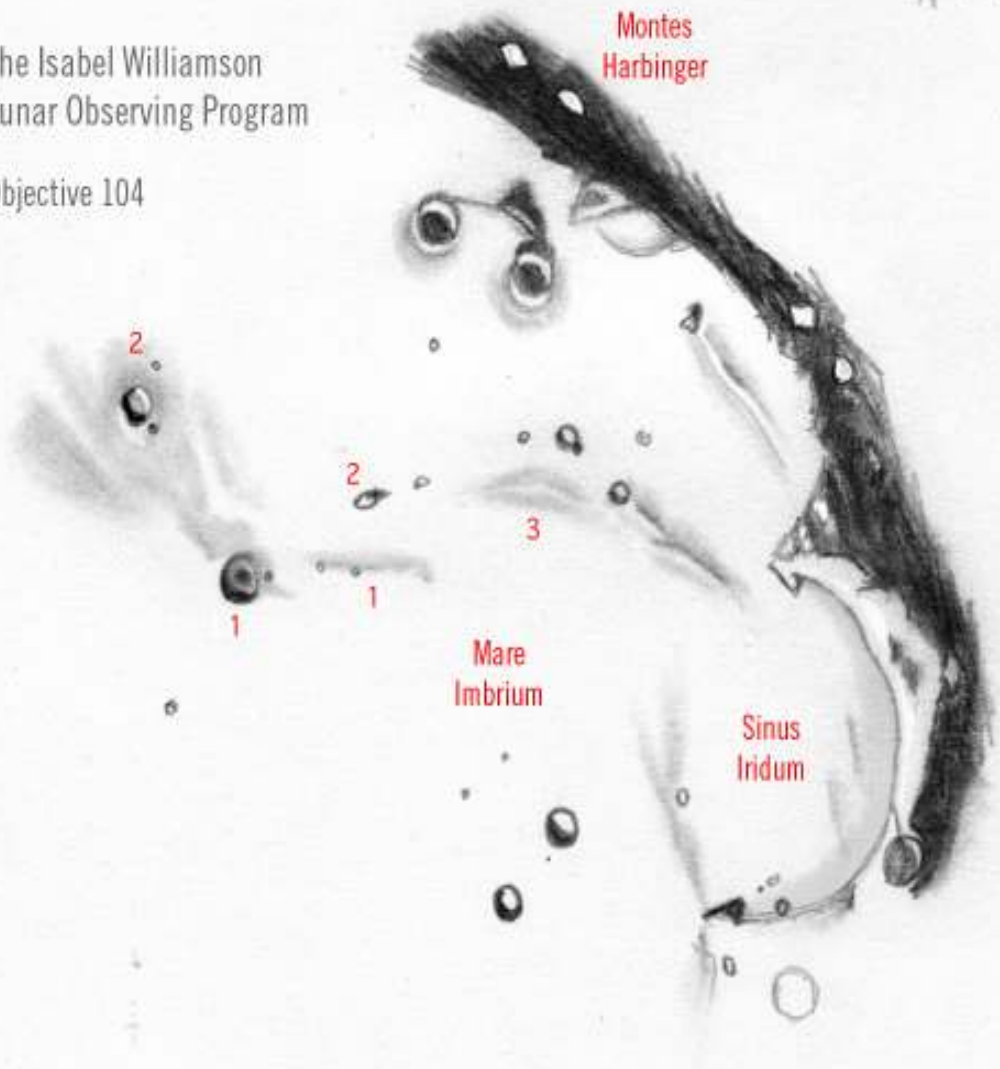
All this lunar talk has gotten me interested in maybe completing the Isabel Williamson Lunar Observing Program. Last night I set up to go outside at 9:30, but as Dave mentioned the seeing was terrible

I went back out at 10:45 and it was better, but not great. I was out for an hour, and worked on Objective 104. This was about an hour's worth of observing with minimal clean up after scanning. There is so much detail that literally you could spend hours on an area this large. These are meant to be "quick and dirty" so to speak. The five required objects are noted, and I labelled the peaks of Montes Harbinger that were lit but in the terminator. The seeing was not good enough to grab the challenge objects.

I was lucky to have picked up one of the Rukl's *Atlas of the Moon* 2004 reprints, I think it would be hard to do it without one.

The Isabel Williamson Lunar Observing Program

Objective 104



April Meeting Report

Chris Young

The meeting was hosted by Richard Vanderberg who welcomed the members and guests.

Before asking Blair MacDonald to update the members on the upcoming Nova East, Richard announced that he had taken on the role of Centre President (he was previously 1st VP and acting President). Richard welcomed Wes Howie back to the Executive as Wes had agreed to return to his old position of 1st VP (which he held last year). The Executive is now back to full strength.

Blair then outlined the plans for the upcoming Nova East Star Party pointing out that the year's Nova East would be held on the Labour Day long weekend (September 3rd to 6th) at our usual location at Smiley's Provincial Park. See the flyer included with this issue.

Richard then introduced the three speakers for the night.

- Karl Penney spoke about his new computerised mount.
- Blair MacDonald spoke about how to Polar align a telescope.
- Tony McGrath spoke about Setting Circles.

All of the talks were received with

great interest, and it was decided that each of them would make interesting articles for Nova Notes. Rather than try to squeeze them all into a single issue, they will be spread out over the next few issues of Nova Notes. The first of these, Setting Circles by Tony McGrath may be found on page 8 of this issue. Look out for the others in the September and November issues.

The meeting was closed by Richard who thanked the speakers for their excellent talks. Discussion about the talks continued over the usual munchies and pop. The meeting ended about 9:30 p.m.

Setting Circles

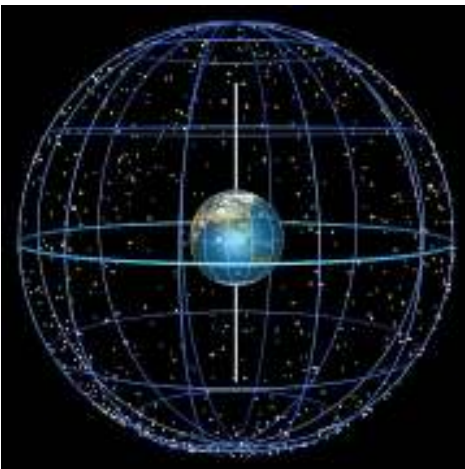
Tony McGrath

For an astronomer, time spent searching for an object is lost observing time. Since the invention of the telescope, knowing where to point it has always been a challenge.

To an observer on the surface of the Earth, the sky above appears as a dome which meets the observer's horizon. Celestial objects appear to be located on this dome. In fact the sky which surrounds the Earth is best represented as a sphere, with the Earth at the centre. Depending on our location on the Earth's surface, we see some section of this celestial sphere every night. To an observer in the northern hemisphere, this sphere appears to rotate about a point in the northern sky known as the north celestial pole. This motion is apparent motion, for in fact it is the Earth which is turning.

To help locate objects on the celestial sphere, a co-ordinate system has been created, such that only two co-ordinates are required to pinpoint an object's position on the sphere. These co-ordinates are Right Ascension (RA) and Declination (DEC).

If you imagine an axis at the centre of the celestial sphere extending from the north celestial pole to the south celestial pole, then motion about this axis is motion in Right Ascension. If you imagine another axis which is at



90 degrees (orthogonal) to the polar axis, it will intersect the celestial sphere at the celestial equator. This axis is called the declination axis, and motion about this axis is motion in declination.

Right ascension is measured in hours, minutes and seconds eastwards from the Vernal Equinox (the point where the Sun crosses the Celestial Equator in Spring).

The celestial sphere rotates once with respect to the stars (not the sun) in 24 sidereal hours. A sidereal hour is about 0.3% shorter than a "clock" or "solar" hour. At any instant, the value of the RA at the meridian is called "sidereal time". Right Ascension on the celestial sphere is analogous to longitude on the earth.

Declination is measured in degrees, arc minutes and arc seconds. The celestial equator is taken as the reference point, and motion in declination north of the celestial equator can vary from 0N to 90N. Declination on the celestial sphere is analogous to latitude on the Earth.

Armed with this information, all we need to locate a celestial object is the RA and DEC co-ordinates of a the object. Over the course of time, much work was done by positional astronomers to precisely determine the co-ordinates of celestial objects. Principal among these astronomers is a Danish astronomer of the 16th century, Tycho Brahe. Tycho plotted the position of celestial objects with great precision. He was followed by a long line of positional astronomers who developed catalogs of stellar positions with every increasing accuracy.

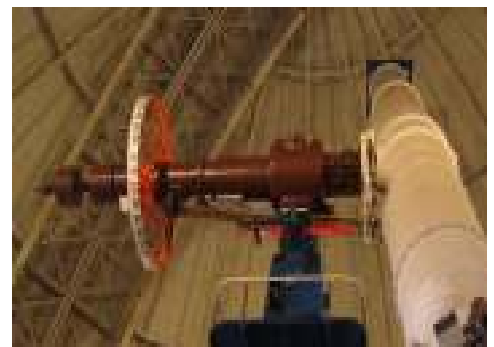
A major innovation that helped observers immensely was the introduction of the equatorial mount by Joseph Fraunhofer. This new form of tele-



The great refractor at Yerkes Observatory in Minnesota

scope mount, known as the German equatorial mount, brought a number of innovations to observers. With this mounting arrangement, large circular wheels were fitted to the ends of the polar axis and the declination axis. On the wheel fitted to the polar axis, the scale was from 0 to 24 hours of RA, and on the circle fitted to the Declination axis, the scale was from -90 degrees to +90 degrees.

Once the telescope mount's polar axis is aligned with the polar axis of the celestial sphere, an observer could find an object by looking up its position (RA & DEC) in an atlas, and then moving the telescope so that these co-ordinates appeared under the index marks on the scale of the RA & DEC setting circles. To improve the accuracy of reading the setting circles, the size of the wheel was increased. In the case of the great Yerkes refractor, the diameter of the setting circles is approximately 2 meters. *(cont. page 9)*



Setting Circles (continued)

With the advent of the microprocessor, setting circles like almost everything else, went digital. Digital Setting Circles (DSC) consist of a number of components;

1. Sensor to measure the motion of the polar axis (RA)
2. Sensor to measure the motion of the declination axis (DEC)
3. Microprocessor which measures the motion of the RA & DEC axis, and also contains a catalog

of positions for celestial objects.

To operate the DSC, the observer first roughly aligns the mount to the polar axis of the celestial sphere (polar alignment). Once this is completed, the DSC requires that the observer point the telescope at one of the stars in its database, and once the telescope is pointed there confirm this by pressing a button on the DSC.

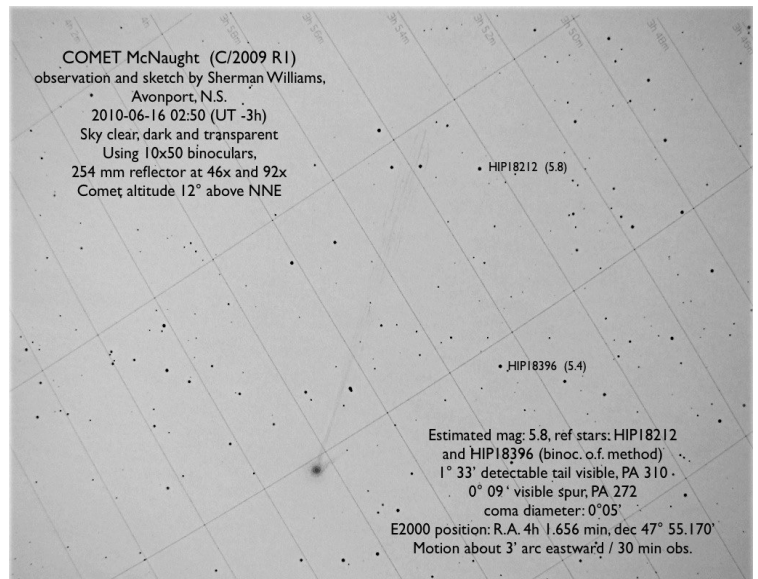
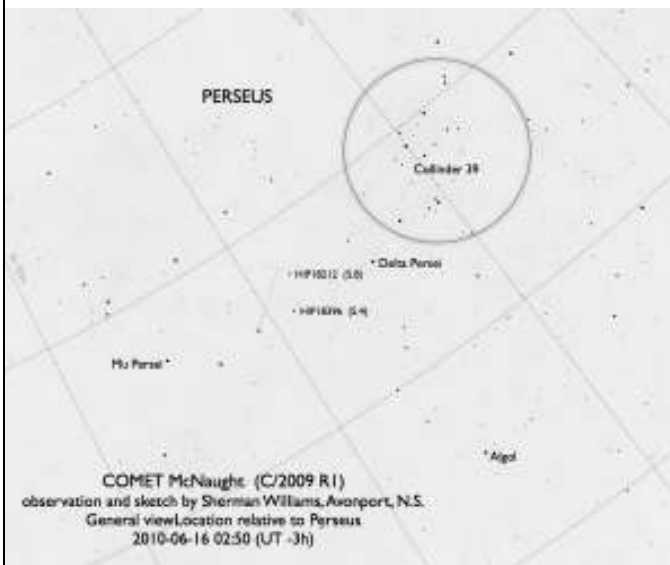
The observer then selects another star for the DSC database, moves the tele-

scope so that it points at this new star, and then once again confirms to the DSC that the telescope is pointed at this second star.

The DSC is now calibrated, and all an observer need do is either pick an object from the DSC database to observe, or set the coordinates of the object to be observed into the DSC, and then move the telescope as indicated on the DSC display to point the telescope at this new object.

Comet McNaught

Sherman Williams



I got up Wednesday morning at 2:30 a.m. and got in a good observation of Comet McNaught (C/2009 R1). The sky was clear and dark. I was able to detect about 1.5 degree tail in both binoculars (10x50s) and my 250 mm reflector. In the latter I got a good fix on its location and a bit of its eastward motion. In addition to the faint tail, I could see a short spur on its southwest side. No greenish colour was obvious with the eye, although a brief exposure (30 sec) with the digital camera records the colour (but not the overall subtle detail that the eye could see).

I compared its brightness using the out-of-focus binocular method and two nearby stars of similar brightness. On Starry Night they are identified as HIP18396 (mag 5.37) and HIP18212 (5.75). The comet's brightness appeared about the same as HIP18212, and HIP18396 was a bit brighter so I gave the comet 5.8, however, I could not detect the comet or either star naked-eye. The altitude was only about 12 to 14 degrees above the NNE.

It was an enjoyable half hour. I recorded my sketch (top right) on a chart plotted by Starry Night, a white on black map of the star field (colours inverted).



May Meeting Report

Chris Young

The President, Richard Vanderberg, opened the meeting and greeted the 34 in attendance including our guest presenter and 3 of his colleagues. Also attending the meeting were two astronomy students from Iraq who studying at Dalhousie University.

Richard introduced the Executive members and invited anyone with questions to speak with any member of the Executive.

Blair provided an update on Nova East and advised there was only 1 space left on the hill ! The deadline for T-shirts is June 30th. The dates for Nova East are September 3rd to 6th.

Richard then introduced the speaker for the evening - Dr. Jack Josefowicz, who is the Chief Technology Officer with LED Roadway Lighting, a local company which does all its R&D and production here in Nova Scotia.

Dr Josefowicz gave a very thorough talk on their LED street lighting. He had 3 of his young but talented professional staff, all local graduates, with him, along with a sample fixture.

Their lighting fixtures are entirely designed and manufactured in Nova Scotia and, according to Dr Josefowicz, out perform the competition in performance areas such as optics, colour, light distribution, energy consumption, light output, life expectancy of all components (20 years), low maintenance, and climate and weather operating conditions.

Dr Josefowicz provided a technical overview of all of the important characteristics of this type of lighting and how it improves on old technology and the current LED competition. He advised that there are 500 million street lights worldwide. LRL's fixtures are Dark Sky certified (Darksky.org) and



A "hands-on" view of the operational LED lighting fixture

do not waste light and energy by sending it towards homes and the night sky.

An observation from RASC member Paul Heath brought out from Dr J. that the fixtures should be angled to stay parallel with the road surface even on inclines, which is not yet the case in the demonstration fixtures installation in Halifax.

The group was advised that a new smaller fixture (half size) for residential areas will be available shortly. An informative overview of the fixtures and the technology is available on www.ledroadwaylighting.com. It is worth the visit !

Richard, on behalf of the Centre, thanked Dr Josefowicz for his talk and the meeting was formally closed. With refreshments and munchies in hand, the conversation continued on the technology of LED lighting as members examined first hand, the operational LED fixture which was provided by Dr Josefowicz



Dr Josefowicz addressing the members at the May meeting.

June Meeting Report

Quinn Smith

The June meeting was opened by our President Richard Vanderberg. Richard welcomed the 43 members and guests, and introduced the members of the Executive.

After outlining the benefits of RASC membership, Richard handed the floor to Blair MacDonald who reminded the members about the upcoming Nova East Star Party, which will be held at Smiley's Provincial Park on the Labour Day weekend (September 3rd to 6th). Blair pointed out that all of the campsites on "the hill" had been taken.

Quinn Smith briefly mentioned that the Dark Sky Preserve (DSP) application had been submitted by Kejimikujik National Park. If accepted by the RASC National Executive it is still possible that the Park can be declared a DSP on July 17th (Parks Day).

Chris Young (our Secretary) then introduced the speaker for the evening Mr Ken Donovan. Mr Donovan is a Parks Canada historian at the National Historic Site at Fort Louisbourg and also a lecturer at Cape Breton University. Mr Donovan was to speak about the Marquis De Chabert and Canada's first astronomical observatory at Fort Louisbourg, 1750-1751. Mr Donovan had driven all the way from Cape Breton to speak to our group.

The first observatory for viewing the planets and stars in Canada was built at Fort Louisbourg in 1750. The astronomer Marquis de Chabert was commissioned by the French to go to North America to correct the maps of the coasts of Cape Breton, Nova Scotia and Newfoundland.

Chabert's primary objective was to determine the longitude of Louisbourg and other locations in Cape Breton, but he also recorded observations on the stars and the Moon, as well as the tides and the climate.

At the time, navigation required dead reckoning as it was very difficult (if not impossible) to calculate longitude on board a ship. Latitude was fairly easy to establish by measuring the angle of the Sun and stars above the horizon. Longitude however required an accurate clock in order to measure the (Sun) time difference between current position and a known location. On a moving, rolling ship, such an accurate timepiece was unavailable (and would not be available for several decades).

Longitude could be calculated by taking many, very accurate, astronomical observations of lunar and planetary occultations, as well as timing the eclipses of the Jovian moons. Difficult enough on solid ground - nigh on impossible on a moving ship.

Within two years of his return to France, the French Royal Academy published Chabert's book documenting his findings in Cape Breton.

Chabert had led a well-financed and sophisticated scientific delegation to Cape Breton. Besides stellar observations throughout the island, he had constructed a well-built astronomical observatory that had windows, doors, locks and board siding.

His instruments included eight telescopes. Six were refracting telescopes with focal lengths between 3 and 18 feet. There was also a Gregorian reflecting telescope with a focal length of 3 feet as well as a telescope for measuring angles. The observatory also had a seconds clock, terrestrial globes, maps of the stars and an octant.

Ken ended his talk by answering many questions from members about Louisbourg, the observatory, and the Marquis de Chabert. Richard closed the meeting at about 9:15 p.m. and the conversations continued over munchies and pop.

Request for Feedback

The St Croix Observatory

It is always the aim of the Executive of the Halifax Centre to follow the wishes and needs of the membership.

There are many routine day to day matters that are quietly taken care of by the Executive, but there are issues for which we really need to get feedback from the membership. A case in point is ongoing maintenance and upgrades to the St. Croix Observatory.

The Observatory represents the Centre's most significant asset and is one of our largest expenses on an ongoing basis.

There have been no major upgrades, or new equipment purchases for the Observatory for sometime, and the Executive would like to hear from the members as to what additions or improvements they would like to see at the Observatory.

Obviously the cost of any improvements is important, but we would like to hear your suggestions.

Be it new equipment (solar telescope?), improvements to the observing area (observing pads outside on the gravel area?), improvements to the warm room (a bunk?) or any other improvements, we would like to hear from you.

Please contact our Observing Chair, John Liddard at jliddard@gmail.com.

The Centre's money is your money and we want to spend it wisely. Send us your thoughts and suggestions and we will see what is practical, and affordable.

Cosmic Debris

Odds and Sods from the World of Astronomy and Cosmology.

LIGHT ON DARK MATTER

Missing piece found in particle puzzle

Tue Jun 1, 1:41 PM

By Robert Evans

(Editing by Jon Boyle)

GENEVA (Reuters) - Research scientists announced on Monday they had identified the missing piece of a major puzzle involving the make-up of the universe by observing a neutrino particle change from one type to another.

The CERN physics research center near Geneva, relaying the announcement from the Gran Sasso laboratory in central Italy, said the breakthrough was a major boost for its own LHC particle collider program to unveil key secrets of the cosmos.

According to physicists at Gran Sasso, after three years of monitoring multiple billions of muon neutrinos beamed to them through the earth from CERN 730 kms (456 miles) away, they had spotted one that had turned into a tau neutrino.

Behind that scientific terminology lies the long-sought proof that the three varieties of neutrinos -- sub-atomic particles that with others form the universe's basic elements -- can switch appearance, like the chameleon lizard.

The discovery is important, scientists say, because it helps explain why neutrinos arrive at earth from the sun in apparently far smaller numbers than they should under the Standard Model of physics that has held sway for some 80 years.

The fact that neutrinos are now proven to switch identities -- as posited by two Moscow scientists in the late 1960s based on earlier work by a U.S. physicist -- suggests that other types of



A graphic showing a collision at full power is pictured at the Compact Muon Solenoid (CMS) experience control room of the Large Hadron Collider (LHC) at the European Organisation for Nuclear Research (CERN) near Geneva, March 30, 2010. REUTERS/Denis Balibouse

neutrinos could exist but slip detection.

In its turn, specialists say, this could help shed light on what is the dark matter that makes up about a quarter of the universe alongside the some 5 percent that is observable and the remaining 70 percent invisible "dark energy."

"This is really exciting because it shows that there are things beyond the Standard Model," said James Gillies, spokesman for CERN -- the European Organization for Nuclear Research on the border between Switzerland and France.

The search for concrete evidence of dark matter and of what it might be is part of the work of CERN's LHC, or Large Hadron Collider, the world's biggest scientific machine that began operation near full force at the end of March.

But the beaming of muon neutrinos to the Italian center is not part of the LHC experiment. The beam is directed south under the Alps from another,

smaller, CERN particle accelerator.

CERN quoted Lucia Votano, director of the Gran Sasso laboratories near the town of L'Aquila 112 kms south of Rome that was hit by a devastating earthquake in April last year, as saying that its work had achieved its first goal.

Scientists there were confident that the detection in the centre's OPERA experiment of a tau neutrino would be followed by others showing that neutrinos can change, she said.

Work on the behavior of neutrinos has already brought Nobel prizes to late U.S. scientist Ray Davies, who first recorded in the 1960s that fewer were coming from the sun than current theories of the universe predicted.

He shared the prize in 2002, at the age of 87 and 4 years before his death, with fellow U.S. researcher Ricardo Giacconi and Japanese physicist Masatoshi Koshiba for the contribution to astrophysics.