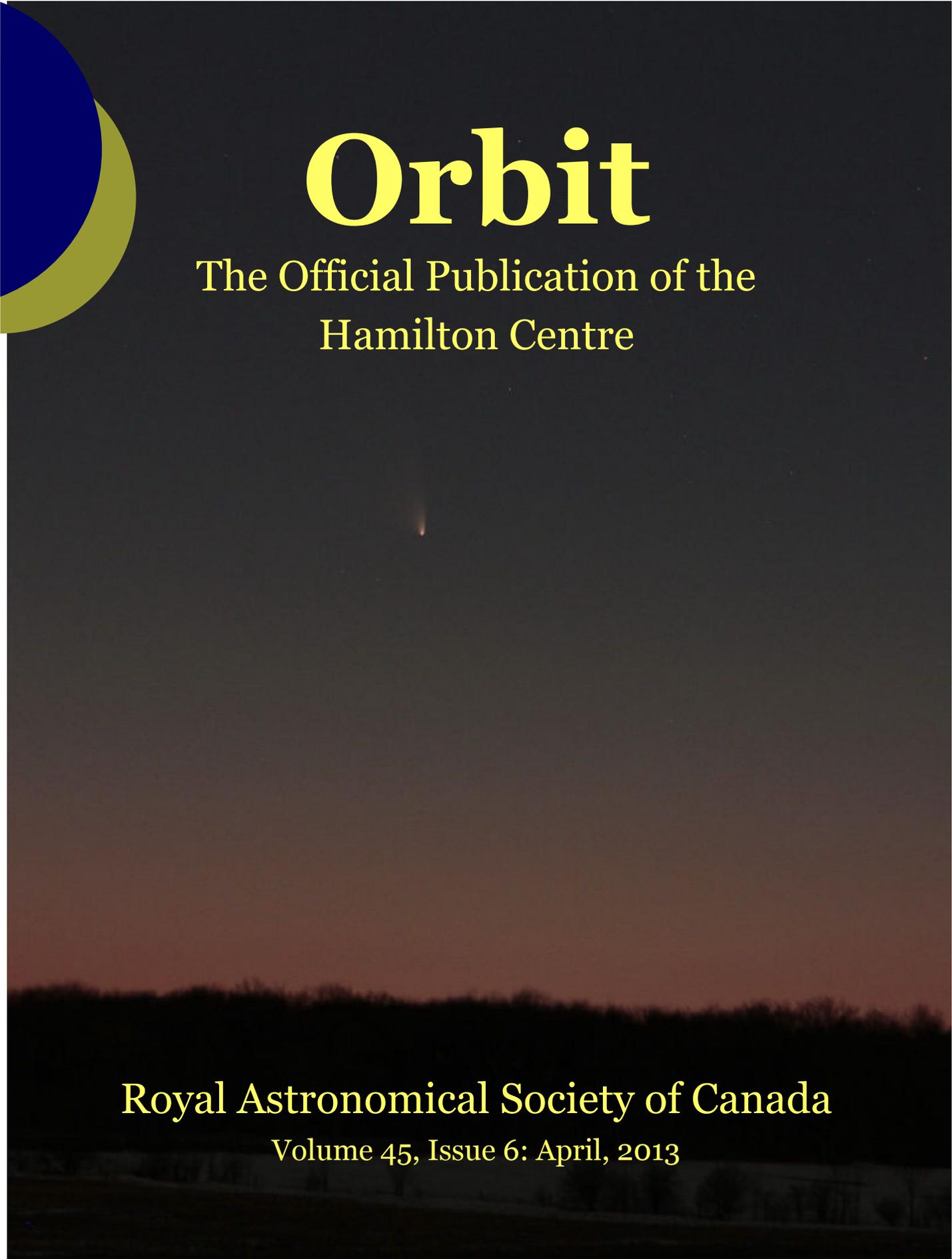




Orbit

The Official Publication of the
Hamilton Centre



Royal Astronomical Society of Canada

Volume 45, Issue 6: April, 2013

Issue Number 6, April, 2013

Roger Hill, Editor

For the last few years I've been fortunate to have been able to travel down south into the Caribbean. Last year, for instance, my wife and I took our kids on a cruise of the Caribbean. We arrived in San Juan, Puerto Rico a day early and then left on a cruise that took us to St. Thomas, Tortola, Antigua, Dominica and Barbados. It was, we figured, the final time the four of us would take a family vacation together, and it was a spectacular time. We also went to St. Thomas with a couple that we love to travel with and stayed there for 10 days...it just may have been the best vacation we ever took. Well, we weren't going to go this winter/spring, but something came up and we're headed down to the Caribbean again in April.

What does this have to do with Astronomy? Well, there is a website out there called Cruise critic that has a forum where you can "meet" up with other people who will be on the same cruise as you. When I posted a question asking if there was a dark place on board to see the stars from, one of our fellow cruisers said that there was. I replied that I wanted to see a few things in the southern sky, and well, one thing led to another as they so often do.

The point is that I will now be doing a guided tour of the night sky on April 15th for about 20 of my fellow passengers. We will be getting together earlier in the day for another reason and will then determine if it will be clear enough. I've told everyone to bring binoculars along if they have them.

I found a web site where you can create custom planispheres for a number of different latitudes: (http://www.geocities.jp/toshimi_taki/planisphere/planisphere.htm). I'll be taking a couple of dozen for Latitude 15N with me. I'm not sure if I'll do them on card stock, or just paper. Anyway, if you're travelling significantly north or south and want to get an idea of what's in the sky, this is a great site to go to.

So what will I be showing them? Well the note I posted said "We'll have a look at several constellations, a couple of planets, the nearest stars to our solar system, the Milky Way (once your eyes get used to the dark), a nebula or two, and something called Omega Centauri. Hopefully, you'll find it informative and entertaining. It should take about an hour of your time. I'd be happy to try to answer any questions you may have, before, during, and after the session."

This is going to be fun as I will be speaking without benefit of notes, laptop, previously put together PowerPoint deck (the NOVA people are aware of what can happen!) and with a sky above me that I'm not totally familiar with!

The next couple of months will see the Hamilton Centre at it's busiest since we last held an RASC General Assembly. With a banquet coming up, the last few NOVA sessions, the start of the Henry's Astrophotography courses and Astro-CATS, it's going to test our resources to their limits.

With this in mind, I'd like to ask each of you to please donate some of your spare time to help out. I know Spring is a busy time of the year to get gardens and pools ready for the Summer, as well as the start of summer activities, but I'm hoping that many of you will join in. Helping out is the difference between sitting in the back row and watching, versus helping to put on the show. After all, nobody wins an Academy Award for buying a ticket to a movie!

Lastly, comet PANSTARRS is heading back into the dim, dark recesses of the solar system. It wasn't the brightest comet ever seen, but for some, it was their first naked eye comet, or even the very first sighting of one of these "hairy stars". Each one is unique and it's incredibly difficult to tell how each of them will perform. They're like cats that way...very pretty and they do what they darn well please! With that in mind, thanks to Colin Haig for this month's front cover. This picture of PANSTARRS was taken between Milton and Georgetown with Colin's Canon 60Da. The one on Page 11 is mine and was taken from Brampton.

Talk to you next month!

Presidents Report—Andy Blanchard

March was my 1st full month of not travelling south and rightly so, I could not have been busier. Between personal stuff, like buying a new home and club business, as Tom Cruise once said “Going Mach 2 with my hair on fire!”

AstroCATS.

The board had our 1st AstroCATS detailed planning committee meeting in March. Everyone was assigned an area to work on. We meet again on April 3rd at the observatory at 8pm. I encourage and reiterate everyone is welcome to attend and see what all the noise is about. We are less than eight weeks from the official grand opening. Since my last report, we have signed up several more vendors. All we need now is attendees and we will have pulled off a major fundraiser for years to come.

Banquet

Tickets are available on our web site. The date is June 8th and our guest speaker will be David Levy. We now know he will be speaking about his search for comets. Tickets are \$35 per person which includes a full Roast Beef dinner buffet. Come out and share a meal with your fellow astronomers, and of course share in congratulating our Star award winners for 2013.

Henry’s

Our partnership with Henry’s is proceeding very well. My 1st presentation is scheduled for April 27th and the 1st dry run will be this weekend at the Geekend. There are 10 seminars booked from the end of April through to November, located between Hamilton and Ottawa. If you know of anyone who is not a club member but might be interested, tell them that not only do they get the course, and all the material, but included is a full membership to the RASC Hamilton Centre.

April Meeting

Our Guest speaker will be **Kerry-Ann Lecky Hepburn**, who will be discussing her collaboration with Paul Mortfield. Paul images, and Kerry-Ann processes. Together they have achieved some extraordinary results. Not just by our standards either. They have been rewarded with more than one Astronomy Picture of the Day (APOD).
(see article on Page 5 - editor).

New President Candidate

I mentioned in last month’s Orbit and at the March meeting that this would be my last year as your President. Gary Colwell has agreed to run in the election as your President at the October AGM. Gary is a passionate observer, gifted astrophotography buff and an outstanding outreach communicator. I am sure he will add to our club in many interesting ways. Our elections are still a summer away, but I encourage everyone to think about getting more involved. It’s been one of the great joys of my life to be on the board.

See you Thursday at the April Monthly meeting.

Andy Blanchard
President RASC Hamilton

Ps I am attending the RASC General Assembly at the end of June and I have room for 2 in my travel trailer. If you are interested please drop me a note at ablanchard@cogeco.ca
AB

Membership Report—Gary Bennett

Say hello to our new members:

Terry Dawson

Hayd'n Dawson

Neil Easton

We will be formally introducing our new members at the April 4 meeting so please help us in making them feel at home!

A Note of Appreciation—Joseph Pipitone

This is to acknowledge and let our members know that we have received a donation of a number of astronomy magazines from one of our members Dana Barton and her family. The magazines are available for loan at the observatory.
Librarian

A note on how the Hamilton Centre acquires a President—Roger Hill

In Andy's Presidents Report, he states that Gary Colwell will be the next president, but this is not strictly correct. The procedure is as follows: Everyone who desires it can run for the Board, and providing they qualify (must have been a member for a year, is a member in good standing, and can find another regular member to sign his nomination papers) can do so. Depending on the numbers of people who come forth, there may be an election, or the membership will be asked to approve each candidate. Once the Board is assembled from the successful candidates, a president is selected from among their number, with the proviso that the president must have spent at least one year on a prior Hamilton Centre board. The advantage of this system, as opposed to having people run to be President, is that the unsuccessful candidates services are still available to the Centre.

Good governance indicates that there should be at least one person known ahead of time that will be offering their services for each position on the Board, but it is not unknown to have two (or more, but I've never actually seen this happen) people offer their names to be President.

So, while it is good to know that Gary Colwell will be offering to be President next year, it is not cast in stone that he will be.

Frankly, I think he'll do a very good job.

Lastly, when our by-laws change, there will be an opportunity to put in place a chain of succession. The RASC currently has a 2nd Vice President, a 1st Vice President, a President and a Past President, each of which is for a two year term. The 2nd VP is expected to step up to be 1st VP after their term is over, the 1st VP steps up to be President, the President becomes the Past President and the Past President gets to relax! The entire process takes eight years, and ensures a continuity that the Hamilton Centre has not enjoyed. However, also built in is the possibility of someone else offering their services. For instance, about 15 years ago, former Hamilton Centre member Peter Ceravolo was 2nd VP of the RASC. He thought it best, to help bring about a more democratic society, that a second candidate for 1st VP be found. Randy Attwood (then of the Toronto Centre) offered his name and there was an election for 1st VP. Randy won.

Your Daily Dose of Astonishment—By Diane K. Fisher

As a person vitally interested in astronomy, you probably have the Astronomy Picture of the Day website at apod.nasa.gov set as favorite link. APOD has been around since practically the beginning of the web. The first APOD appeared unannounced on June 16, 1995. It got 15 hits. The next picture appeared June 20, 1995, and the site has not taken a day off since. Now daily traffic is more like one million hits.

Obviously, someone is responsible for picking, posting, and writing the detailed descriptions for these images. Is it a whole team of people? No. Surprisingly, it is only two men, the same ones who started it and have been doing it ever since.

Robert Nemiroff and Jerry Bonnell shared an office at NASA's Goddard Space Flight Center in the early-90s, when the term "World Wide Web" was unknown, but a software program called Mosaic could connect to and display specially coded content on other computers. The office mates thought "we should do something with this."

Thus was conceived the Astronomy Picture of the Day. Now, in addition to the wildly popular English version, over 25 mirror websites in other languages are maintained independently by volunteers. (See http://apod.nasa.gov/apod/lib/about_apod.html for links). An archive of every APOD ever published is at <http://apod.nasa.gov/apod/archivepix.html>. Dr. Nemiroff also maintains a discussion website at <http://asterisk.apod.com/>.

But how does it get done? Do these guys even have day jobs?

Dr. Nemiroff has since moved to Michigan Technological University in Houghton, Michigan, where he is professor of astrophysics, both teaching and doing research. Dr. Bonnell is still with NASA, an astrophysicist with the Compton Gamma Ray Observatory Science Support Center at Goddard. APOD is only a very small part of their responsibilities. They do not collaborate, but rather divide up the calendar, and each picks the image, writes the description, and includes the links for the days on his own list. The files are queued up for posting by a "robot" each day.

They use the same tools they used at the beginning: Raw HTML code written using the vi text editor in Linux. This simple format has now become such a part of the brand that they would upset all the people and websites and mobile apps that link to their feed if they were to change anything at this point.

Where do they find the images? Candidates are volunteered from large and small observatories, space telescopes (like the Hubble and Spitzer), and independent astronomers and astro-photographers. The good doctors receive ten images for every one they publish on APOD. But, as Dr. Nemiroff emphasizes, being picked or not picked is no reflection on the value of the image. Some of the selections are picked for their quirkiness. Some are videos instead of images. Some have nothing to do with astronomy at all, like the astonishing August 21, 2012, video of a replicating DNA molecule.

Among the many mobile apps taking advantage of the APOD feed is Space Place Prime, a NASA magazine that updates daily with the best of NASA. It's available free (in iOS only at this time) at the Apple Store.

The January 20, 2013, Astronomy Picture of the Day is one that might fall into the "quirky" category. The object was found at the bottom of the sea aboard a Greek ship that sank in 80 BCE. It is an Antikythera mechanism, a mechanical computer of an accuracy thought impossible for that era. Its wheels and gears create a portable orrery of the sky that predicts star and planet locations as well as lunar and solar eclipses.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



Why citizen scientists take part in crowdsourced science projects

One of the more exciting advances in modern astronomy has been the rise of the citizen scientist and the crowdsourced work these people do. Citizen scientists now routinely study everything from moon craters and Martian weather to the ocean floor and Sun storms.

Perhaps the best known project is called Galaxy Zoo. This is a website that asks volunteers to help classify galaxies that have been photographed as part of the project called the Sloan Digital Sky Survey. The idea is that to understand how galaxies evolved, astronomers need to know what shapes they can form and how common these shapes are. Volunteers visually inspect images of galaxies and classify them accordingly.

Since Galaxy Zoo began in 2007, hundreds of thousands of volunteers have taken part, producing hundreds of millions of classifications. This success is far beyond the wildest dreams of the astronomers who created the project who had imagined that citizen scientists would be few and far between.

So an interesting question is who are these people and what motivates them to take part. Today, we get an answer of sorts thanks to a survey of Galaxy Zoo volunteers carried out by Jordan Raddick at Johns Hopkins University in Baltimore and a few pals.

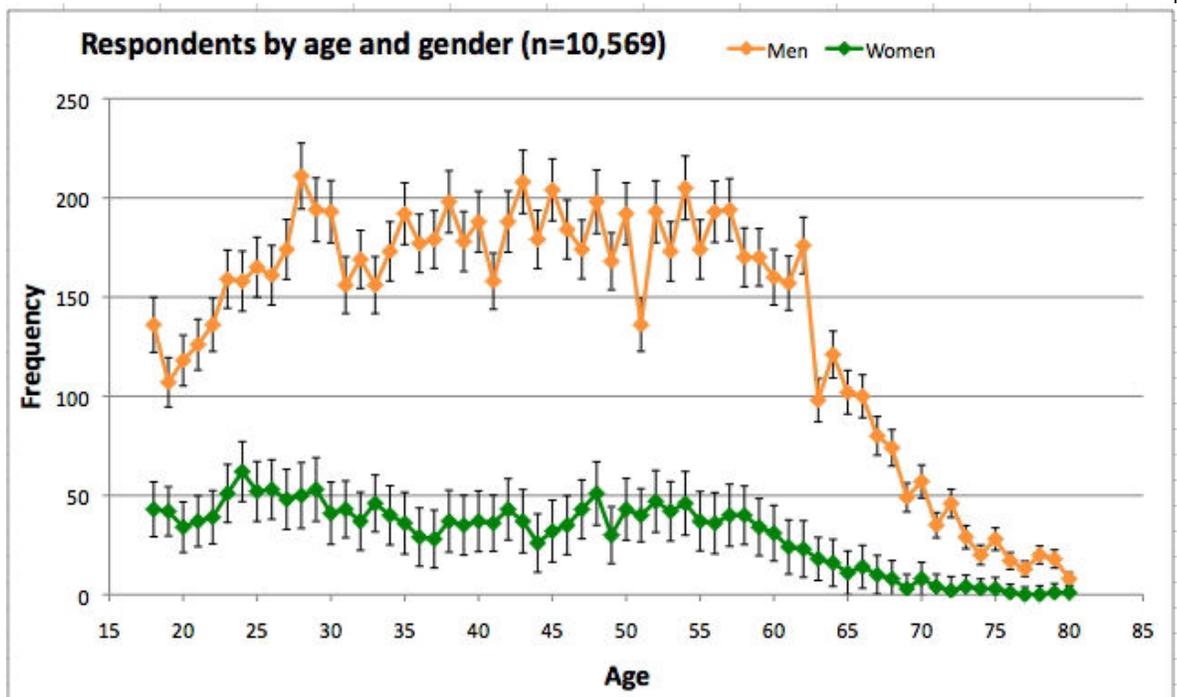
These guys asked about 11,000 Galaxy Zoo volunteers to fill in a quick online survey that asked them about their age, sex, location and what motivated them to take part, giving them 12 options to choose from.

The results are curious. Unsurprisingly, Galaxy Zoo volunteers are overwhelmingly male with 82.1 per cent being men. There is also a particular over-abundance in the 50-60 age group. Overall, the volunteers have an average age of 43 and over 60 per cent come from the US and UK.

What is mildly surprising is their motivation for taking part. The survey asked volunteers to give their primary reason and this turned out not to be things like enjoying looking at pretty pictures of galaxies or the fun of it all. Instead, more than 40 per cent of volunteers say that the desire to contribute to science is their primary motivation.

Raddick and co are clearly pleased with this result. "The fact that most Galaxy Zoo users are motivated by a desire to contribute to science

is encouraging for the future of citizen science," they conclude. That gives them access to a huge, highly motivated workforce prepared to work long hours for free. That's even cheaper than employing students. What's not to like?



Collimating with a DSLR —Rick Saunders London Centre

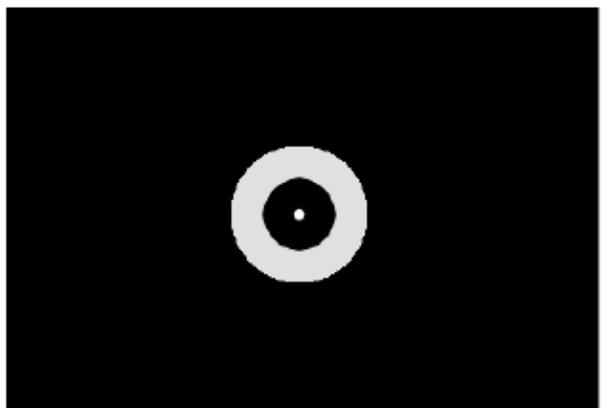
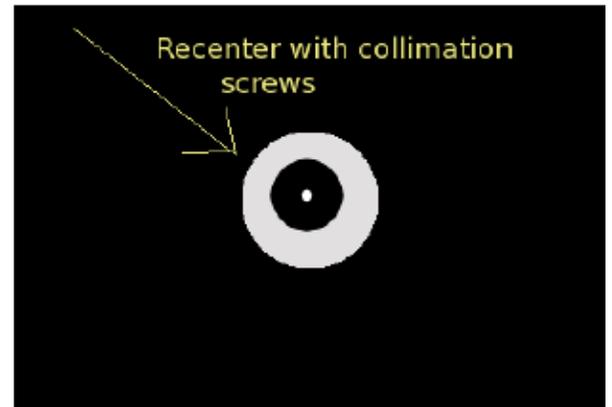
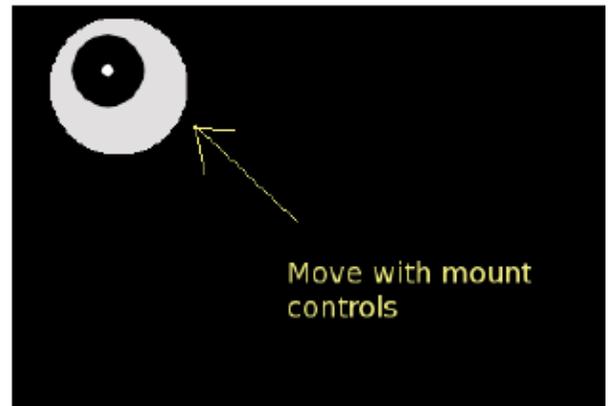
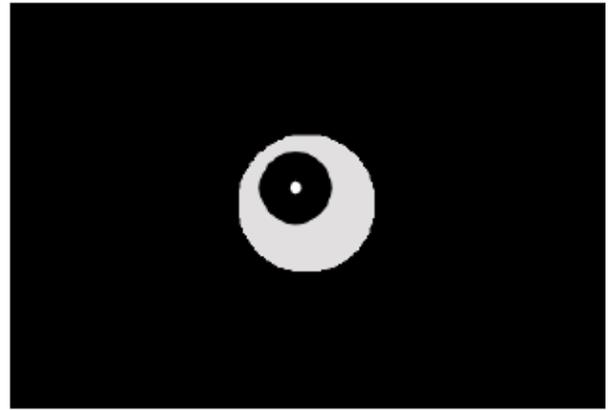
When I arrived in Indiana on my last trip down there I found that I had left my Hotech SCA collimating laser at home. As Doug didn't have a functioning laser on hand I had to improvise. I normally align my mount with my DSLR in place and aligned parallel to the tube so I decided that I would use the camera to aid in collimation. After aligning the mount I slewed to Altair and turned on LiveView. After defocusing I had the beautiful out-of-focus image of a 'doughnut' that showed that the shadow of the secondary was quite off-centre. The mount was tweaked to place the image of Altair in the centre of the sensor.

I knew that my newtonian rarely needed the secondary collimation tweaked which was good as it meant that I only needed to work with the primary mirror adjustments. I could reach these easily while viewing the LCD screen of my DSLR. This wasn't an issue anyway as if the adjustment screws were too far from the focuser to reach I would have connected the DSLR to my netbook. The image could then be viewed from just about anywhere.

With the image on screen I moved Altair up and to the left using the movement buttons on the mount's hand controller as shown in the second graphic. The direction I moved it was in the direction of the thin part of the 'doughnut'. I took Altair as far as I could in the needed direction while keeping it on the sensor.

Once that was done I turned my attention to the collimating knobs on the rear cell of my telescope and, adjusting them as needed, moved the image of Altair back to the centre of the DSLR's LCD screen. This showed the image a bit better collimated, but still needing adjustment as shown in the third graphic. I repeated this sequence four or five times until the shadow of the secondary was perfectly centered in the spread out image of Altair and Altair was in the centre of the LCD. I didn't bother checking with an eyepiece as the image scale on the LCD seemed perfect for the job at hand.

This method would work perfectly well with any two mirror telescope such as an SCT very simple. With one of the new Ritchey Chretien scopes with a centre spotted secondary or a newtonian, checking the secondary first with a Cheshire would allow for an extremely accurate collimation to be performed; even with a coma corrector or flattener/reducer in place.



Imagers Corner, by Blair MacDonald—Halifax Centre

This edition's question centers on how much processing is applied to astrophotos and is it based in science or art. Where do you guys come up with these? (Keep them coming!) The answer the first part of the question is simple – lots! There is much more time spent at the computer than there is at the guiding eyepiece (anyone remember what one of those looks like?). Once you figure out the quirks of your imaging system and master polar alignment, setup takes about half an hour and alignment about another 20 or 30 minutes. Focusing takes about five minutes and you're in business.

If you are guiding then setting that up can take another 20 minutes, but it is well worth it. From there on in the equipment does the work and you can enjoy the view of a star filled sky through other telescopes, binoculars or even with the unaided eye.

The processing is another story altogether. The usual calibrating, stacking and producing the image ready for post processing is pretty standard stuff and there are several packages that automate the whole process. If you stop there the results are rather disappointing. Here is a stacked and calibrated 30 minute image of NGC 7000 (the North American Nebula) as an example.

It rather boring and the nebula is just barely there! After about two hours of setup and exposure the result leaves you a little flat. But this is where the fun starts. After many hours (about 10 in all) of trying different techniques to squeeze out as much detail as I could, I ended up with what I consider an acceptable image.

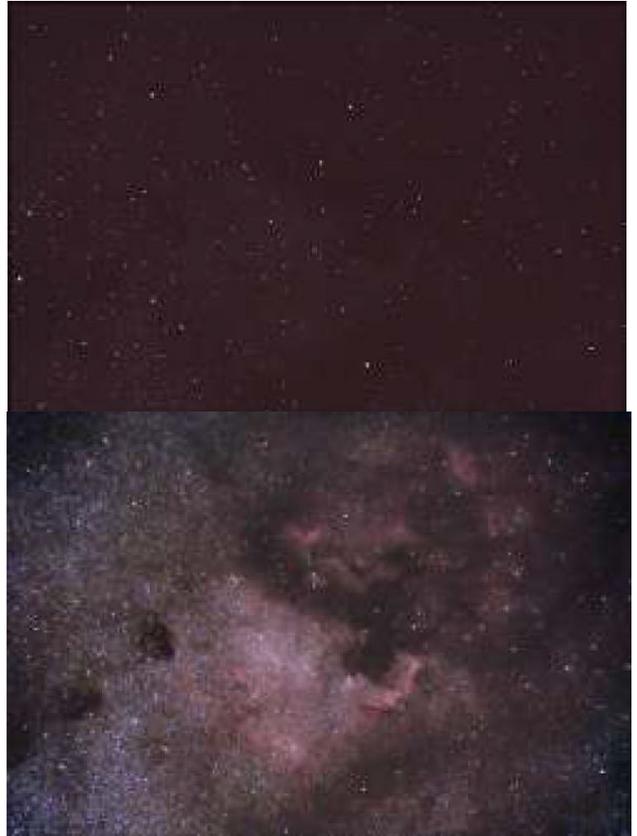
So if you have just taken your first astro-image and are disappointed with the result, have some patience and some coffee, roll up your sleeves and start processing! Plan on spending three to five times the time spent acquiring the image in the processing. There will be lots of false starts, but after a while you will develop a workflow and use many of the same processes over and over again. At that point the processing will get shorter, but still take longer than acquiring the data in the first place.

Now for the second part of the question, is it science or art? The answer here is a bit of both. The foundations of image processing and astrophoto processing in particular are rooted in signal processing. All the same processes that I use in my day job to design software radios and tracking systems are generalized to two dimensions and used in image processing. Those nifty kernel filters that are available in almost every image processor are just 2D implementations of a FIR (finite impulse response) filter common in all signal processing. Much of the image calibration and stacking relies on well developed signal processing techniques and engineering knowledge of the sensors used.

Many amateurs do solid scientific work and limit their processing to that which preserves the integrity of the data for things like photometry. Personally I capture and process images with the end goal of making a pretty picture. That means that I will take liberties with the data to get the final effect that I want. If there is noise in one area then I'll use a layer mask and turn up the filtering on just that area. Or if something I want in the image is dim, I'll stretch the brightness more in that area than others. Take the following Horse Head shot as an example.

If I had simply applied linear processing, the bright stars would so overwhelm the image that it would be a very boring shot. Instead, several stretches were used with mask layers to block out the brighter areas. Is it what it looks like in reality – absolutely not, but this is one area where reality should imitate art!

The real view makes for a terrible shot that I would not even put in my digital picture frame let alone on my wall. Colourless, dim nebulae and overly bright stars are not what I was after in the processing so that is where the art comes in, bringing out the parts that you want to see and suppressing sections of the image that are not so interesting.



RASC Book Review by Joseph Pipitone

Imaging the Southern Sky: An Amateur Astronomer's Guide

Stephen Chadwick, Ian Cooper. Springer Press, N.Y. 2012

Due to Patrick Moore's recent death this is probably the last of his popular practical astronomy series. The book was intended as a guide for all levels of amateur astronomers primarily wishing to image the sky south of the celestial equator and some objects that are visible from the northern sky.

As such, the authors who live in New Zealand took all the images and included a wide range of common and rarely imaged objects including nebulae, galaxies, planetary and supernova remnants and other wide-field images of large areas of the night sky. The objects were selected specifically for the amateur astronomer in mind.

The book provides guidance for particular equipment setup and recommends suitable sites for that equipment. Each site image referred to comes with the technical information used to take the image so that they can be duplicated or modified depending on available equipment. Each image has important background information of the specific characteristics of the image taken and the type of telescope used, focal length, F ratio, camera type, lengths of exposures and the field size.

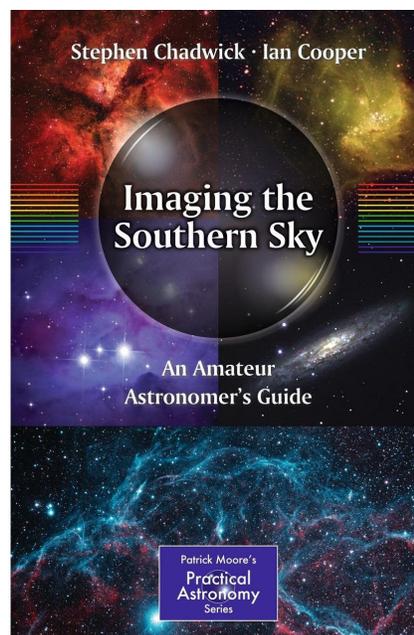
This aspect of the book makes it very useful for new and experienced imagers alike. It is the first book that I have seen that is so comprehensive in terms of the volume of items imaged with the corresponding technical data. In addition, the book has good helpful information on "Introduction to Astrophotography" chapters at the end of the book with photographs of a range of astrophotography equipment, cameras, and software imaging tools used in this field. Although brief, in comparison with the imaging data, the introduction to astrophotography section is useful for orienting those considering getting into this field regardless of where they live.

The only minor fault of this paperback book is the poor quality of the printed pictures. The pictures are on cheap paper similar to trying to print a photograph on paper rather than on photographic paper. Also, some images are too small to appreciate but they do give some idea of the type of images that could be captured. In short, I would buy this book even if I only planned the occasional southern sky imaging trip but I feel content that it now exists in the club library for members to borrow. I hope a similar book about the entire northern sky will come out in the near future.

This book is now in our library.

List Price: **CDN\$ 39.69**

Price: **CDN\$ 33.89**



Pocket Sky Atlas Challenges for March—John Kulczycki

April Sky

It's April, and astronomers have visions of galaxy clusters dancing in their heads. Now is the time to get your binocular or telescope rig sorted out for the next few months of viewing. Try to get your eyepieces, battery packs and other as-sorted bits assembled into a unified kit that is ready to go with observing with your telescope at a moment's notice. Nights can still be chilling so pack some spare clothes if you are venturing away from home base.

Don't forget the sky charts and lists you've compiled of objects you want to see. Many months' cold and snow have dulled out enthusiasm for the night sky, but now the excuses don't seem so valid. Warmer spring breezes push us back to places of wonder in the night sky. Prepare your equipment, find your charts and guides, get ready to taste the night sky again.

April is also the biggest outreach month amateur astronomy has during the year. Make sure you share your love of the night sky with others. Sharing and explaining how you do astronomy makes you think about what you are doing; in return, makes you better at what you do.

I've indexed the objects to their respective pages.

April Event

Naked Eye:

- Regulus, Algieba, Adhafera and Rasalas, Page 35
- Nekkar, Edasich and Thuban, Page 42.

Small Scopes and binoculars:

- Tania Australis and Tania Borealis, page 33.
- 14 LMi and 15 LMi, page 33.
- M13 page 52.
- Alphecca page 53.

Larger Scopes:

- NGC 3193 and NGC 3190, Page 35
- NGC 4144 and NGC 4203, Page 43.
- NGC 6207 page 52.
- UGC 10822 page 52.

Bonus objects:

- NGC 3193 and NGC 3190, Page 35
- NGC 4144 and NGC 4203, Page 43.
- NGC 6207 page 52.
- UGC 10822 page 52.

Seeing PANSTARRS by Stuart Atkinson

There you are, peeking out from behind
That curtain of cloud, as if afraid to show your face
On the twilight sky's stage;
Embarrassed by all the attention;
Frightened by the crowds with their clicking cameras
And telescopes, all pointing at you, staring right at you
From the muddy fields, parks and gardens of Earth.
No wonder you just want to hide.

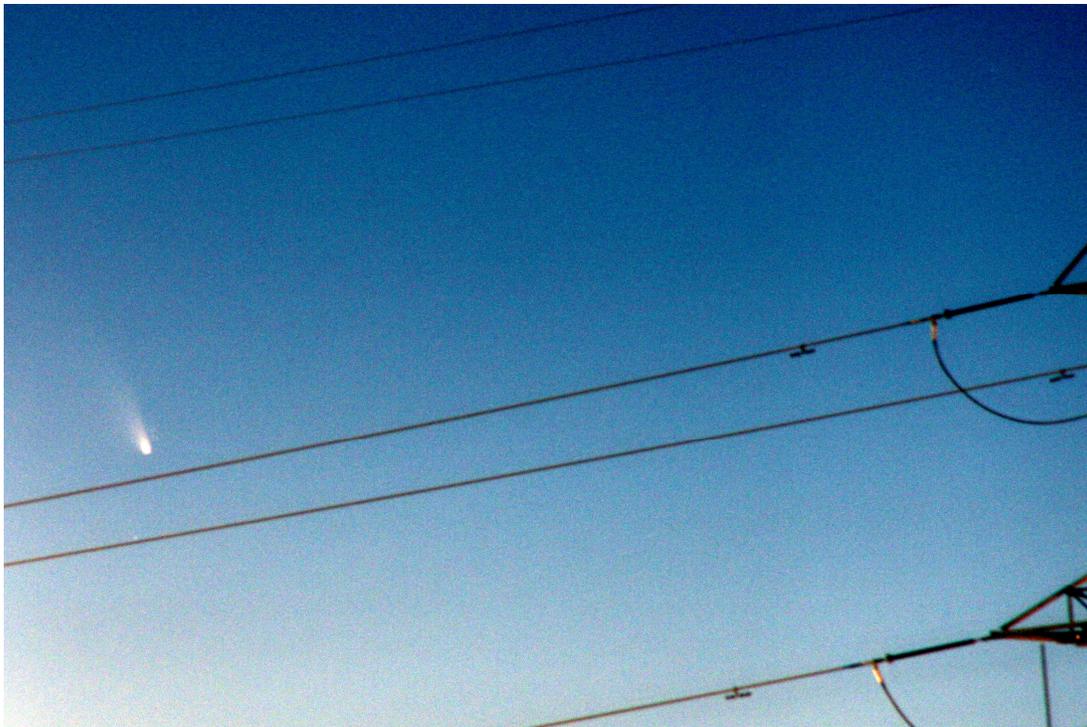
You don't want to be here, do you?
You'd rather be back Out There, in the Oort,
So far from here Sol is just a distant, lonely lantern,
A lighthouse on the horizon with diamond dust
Stars all around. No sound out there;
No-one asking where you are;
No-one sighing "We should be seeing it by now!"
No-one moaning "That's it? That's what all the fuss is about?"

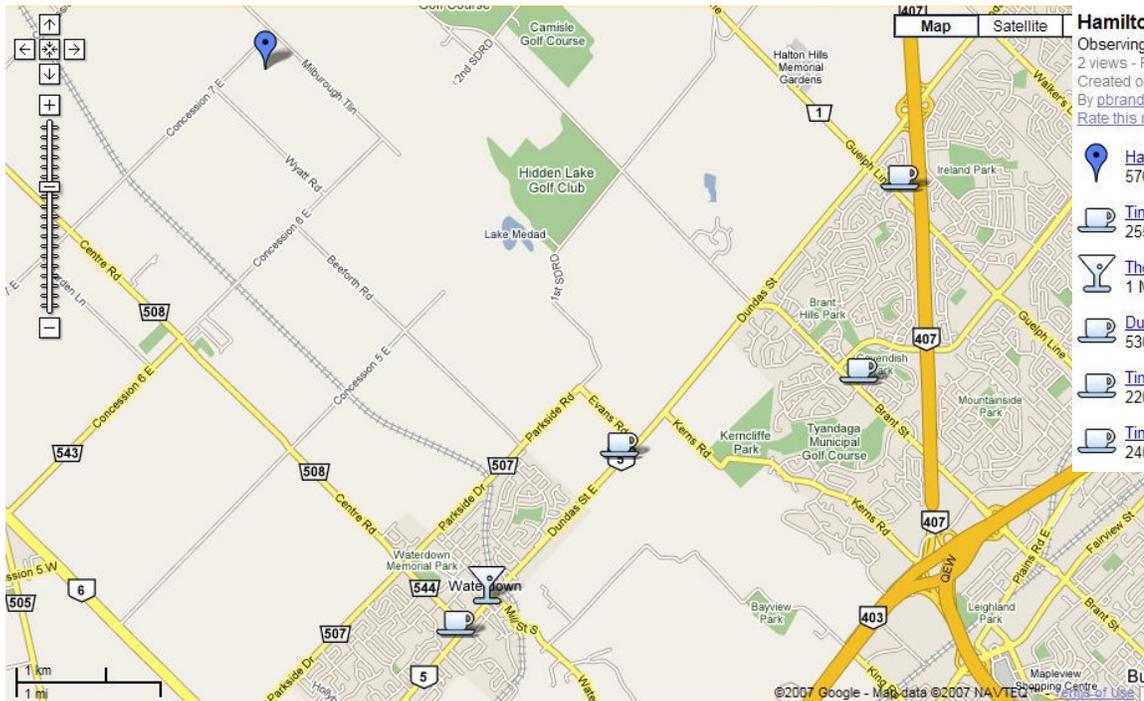
You didn't want to come here, did you?
You'd rather have stayed away,
Far, far away, but something pushed
Or pulled you out of place, sent you tumbling solwards,
Left you falling towards the Sun's foreign fire,
First warming you, then melting you,
Leaving you blushing as you rushed faster and faster
Towards its blinding light. STEREO watched
Your tails unfurl, tattered banners of gas and dust
Each a million miles long.
So beautiful, so beautiful...

But now you hide yourself from our view,
Pulling clouds around your shoulders like a cloak,
Refusing to burst into life as we had hoped.
Instead, a reluctant, shy climb out of the twilight,
In oh-so-slow motion, so dim and pale
Only your most devoted followers have managed
To glimpse your face, leaving the rest to turn away,
Disappointed that you have none of Hale-Bopp's grace;
And your tail: "Pathetic compared to Hyakutake's!"
"McNaught's veil was spread across half the sky!"
They sigh wistfully, "What a waste of time..."

But some of us have seen your beauty,
Traced the elegant curve of your tail -
A golden scimitar blade burning
In the lavender hour between sunset
And the fall of true night;
Hanging above the trees and hills,
Your star-like head a faraway firefly
Struggling to shine through the horizon-hugging
Smoke and haze which rises from our villages and towns
At the end of our busy days.

Sol's soldering iron hot gaze is on your back now;
Your first visit to the light-drenched, sunburnt
Inner Worlds is almost at an end.
Is that your laughter I hear?
Carried to my cold-numbered ears
On the western winds as I watch you glowing,
Golden, through a rapidly-closing gap in the cloud...





- Hamilton Observing Sites**
 Observing site in Hamilton and area.
 2 views - Public
 Created on Oct 18 - Updated Oct 20
 By pbrandon
[Rate this map](#) - [Write a comment](#)
- [Hamilton Centre Observatory](#)
576 Concession 7E, Flamborough, ON
 - [Tim Hortons Waterdown](#)
255 Dundas St E Waterdown, ON L0R, Ca
 - [The Royal Coachman](#)
1 Main St N Waterdown, ON L0R, Canada
 - [Dundas Street Tim Hortons](#)
530 Dundas St E Waterdown, ON L0R, Ca
 - [Tim Hortons Brant Street](#)
2201 Brant St Burlington, ON L7P, Canada
 - [Tim Hortons Guelph Line](#)
2400 Guelph Line Burlington, ON L7P, Car

Website:

<http://hamiltonrasc.ca/>

576 Concession 7 East, Flamborough ON
 N43° 23' 27" W79° 55' 20"

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L6L 1G86L 1G8

Calendar for April, 2013

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
W K 1 4	01 • 8pm» NOVA Program - Lesson 5	02	03 ☾	04 • 8pm» Public Monthly Meeting Kerry-Ann Lecky Hepburn	05	06	07
W K 1 5	08	09	10 ☉ • 7pm» Lecture - Curiosity Rover in Gale Crater Mars • 7:30pm» Star Gazing at the Observatory	11 • 7:30pm» RASC Board Meeting	12	13	14
W K 1 6	15	16	17	18 ☽	19	20	21
W K 1 7	22 • 8pm» NOVA Program - Lesson 6	23	24	25 ☼ • 7:30pm» Free Public Astrophotography Lessons	26	27	28
W K 1 8	29	30					