

Volume 23, Number 4 February 2016

From The Editor

February is here, and winter 2016 has so far been not too bad, all in all. The temperatures have been all over the map, but the night skies have been consistent. Consistently cloudy that is! You can thank, or curse, El Niño for this...

Here's to February being at least a little bit clearer than January.

If not, relax in your armchair with your laptop, tablet or printed copy, and enjoy reading the Event Horizon!

Bob Christmas, Editor

editor 'AT' amateurastronomy.org

Chair's Report by Bernie Venasse

A short message for a short month ...

Welcome to the February issue of the Event Horizon. February is, amongst other things: Heart month, Cherry month, Bird-feeding month, Hot breakfast month, and Library Lovers month. It contains more than the following: the 2nd is Groundhog day, 5th is Doodle day, 7th Ballet day, 9th Extraterrestrial Culture day (really), 11th White shirt day, 14th Valentine's day, 25th Chili day, 29th Leap Year day. But the date I want to focus on is the 15th, Family Day.

My invitation to you is ... Expand this family. Introduce a family member, colleague, friend, classmate, or neighbour to your personal avenue of this hobby. With so many variations in this hobby it is likely that even if they are already participating in astronomy you will be able to show them something new... and they to you as well. You might begin a new adventure... astrophotography or solar or lunar or spectroscopy or become better acquainted with the stars or constellations. The point I am making is this: There are so many areas of this discipline that there is always something new... or old... to learn. Create a newbie... become a newbie. .. again! (Continued on page 2)

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Chair's Report (continued)

By the way ... Extraterrestrial Culture Day is an officially acknowledged day in Roswell, New Mexico which celebrates extraterrestrial cultures, and our past, present and future relationships with extraterrestrial visitors.

Get the kettle on and set the table for a guest, ET might just be popping round!

Hamilton Amateur Astronomers 2016 Celestial Events Calendar



Thank you, to everyone who purchased a 2016 HAA calendar!

Once again this year, our Celestial Events Calendar is a smash hit!



HAA Helps Hamilton

To support our community, we will be collecting non-perishable food items and cash for local food banks at our general meetings. Please bring a non-perishable food item to the meeting or a donation of cash and help us help others.

Our donations go to Hamilton Food Share, which delivers them to various food banks around the Hamilton area.

If you would like to help or have any questions about this initiative, please contact the H.A.A.

Masthead Photo: Binbrook Conservation Area & Lake Niapenco from the air, by Kevin Salwach.

Kevin took this image while flying in a Cessna 172 just after Christmas 2015.

The Sky This Month for February 2016 by Matthew Mannering

If you received astronomy equipment for Christmas, I would be willing to bet that some of you are still waiting to try it. January gave us only two or three clear evenings, one of which was the full Moon. I was lucky to find a 130mm Newtonian tube for a really good price in early January so the evening of full Moon saw me outside in -15C taking some pictures. Working a camera with exposed fingers isn't fun at that temperature so after about 30 minutes I gave up and went inside.

I've taken a lot of full Moon pictures with my camera, but none through a telescope before. In doing so, I found out the Moon is so bright that even with perfect focus the image is soft. The cause, I believe, is due to the lack of contrast between dark and light features. Contrast is required to provide good edges even on large features like the Mare or craters like Tycho. Interestingly, the net result is an image that reminds me of film photos taken in the 50's and 60's.

This is one of my images taken one hour after Moon rise. The 2nd image is a crop of the first showing Mares Marginis and Smythii on the eastern limb (top of the image). This was the day before maximum eastern libration for the month.

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Taken through his 130mm Newtonian reflector.

Image below is a crop of image at left.

The first half of February is your last chance to see all five naked eye planets at the same time. You will need to be at a location with a clear eastern horizon so that Mercury is visible. Make sure you are in place before 6:45am. At that time Mercury will be 5 degrees above the horizon and sunrise will still be half an hour away. Here's how it will look early in the month.



On the 26th, there will be a **double shadow transit on Jupiter**. Unfortunately it starts at 4:38am! Here is a brief rundown of event times beginning when the second shadow appears on the limb of Jupiter:

- 4:38am Io's shadow moves onto the disk. Europa and its shadow are already more than half way across the disk.
- 4:53am lo moves onto the disk.
- 5:01am Europa's shadow leaves the disk.
- 5:31am Europa leaves the disk.
- 6:52am Io's shadow leaves the disk.
- 7:08am Io leaves the disk.

As you can see, the double shadow portion of the event is only 23 minutes long. The hard part, other than being awake at 4:30am, being outside in the freezing temperature and avoiding clouds, is trying to see the actual moons against the disk of Jupiter. That requires lots of magnification, good optics and excellent seeing.

Targets for February

Let's start with a carbon star. **Hind's Crimson Star** is located in the constellation *Lepus* which is found directly beneath *Orion*. The best time to look is 8pm when it's at its highest and due south. Carbon stars are very red and should stand out from any other stars in your field of view. On page 5 is a chart and photo to help you identify Hind's Crimson Star.

Next let's look at a bright, easy to find galaxy in *Leo*. In fact **NGC 2903** is brighter than any of Messier's galaxies other than M66. You'll find it under Leo's nose. The chart at the top of page 6 shows it just below two side-by-side 7th magnitude stars. These will show up in your finder scope, so all you have to do is nudge the scope down and to the right about one third of a degree.

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Finder Chart for Galaxy NGC 2903 in Leo

Lastly, take a look at the constellation *Cancer*. This is a very faint constellation between Gemini and Leo and you'll probably need binoculars just to find it. Draw an imaginary line between Pollux in Gemini and Regulus in Leo. Your first target is about half way along that line where you should easily pick out the **Beehive Cluster (M44)**. Next look for **M67**, a nice cluster of stars about a full binocular field to the right of the star Acubens. Finally try to find a couple of Carbon stars, **X Cancri** and **T Cancri**.

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The Moon

Libration this month is as follows: The Northern limb will be most exposed on the 17th, while the Southern limb will be most exposed on the 4th. The Eastern limb will be most exposed on the 19th, and the Western limb on the 5th.

The Planets

(Rise and set times are given for when the planet reaches 5 degrees above the horizon)

- *Mercury* will be at its best for the first half of the month. It will appear low in the east at 6:45am. This is your last chance to see all five naked eye planets at once. They won't all be visible at the same time again until mid August of this year.
- Venus will be low in the east at 6:35am all month.
- *Mars* rises at 1:55am in Libra at the beginning of the month. By months end it will rise at about 1:15am.
- Jupiter rises at about 9:20pm at the beginning of the month and at 7:10pm by month's end.
- Saturn rises at 4:30am at the beginning of the month and 2:40am by month's end.
- **Uranus** is 45 degrees above the horizon in the south-west at 6:30pm at the beginning of the month and sets at about 10:30pm. This is your last chance to see Uranus as by month's end it will be low in the west.
- *Neptune* is disappearing into the evening twilight.

Other Events

-February 6th:	 Venus 5 degrees south of the Moon at 6:45am. 	The Moon 2 degrees above Mercury.
-		

- -February 7th: Mercury at greatest elongation west.
- -February 8th: New Moon.
- -February 15th: First Quarter Moon.
- -February 22nd: Full Moon.
- -February 23rd: Jupiter 2 degrees north of the Moon at 11pm.
- -February 24th: Zodiacal light visible in the west after evening twilight for the next 2 weeks.
- -February 26th: Double shadow transit on Jupiter at 4:38am.

Chaos & The Cosmos by Bruce Pawlett

Although my current interest in Astronomy is relatively recent, I have been interested in cosmology for quite some time. The big questions of how the Universe came about, how it works, how did life start, the process of evolution and finally consciousness have fascinated me for many years. Although I have some science/engineering background I definitely classify myself as a layman and I am not ashamed in the least to admit that especially in such a wide area of interest I often reach my threshold of being able to understand.

It is not hard to perceive the general concept that the emergent organization of the universe into galaxies, stars, planets and life is the result of reductionist principles with respect to the physical laws of nature along with constants. However, I am sure I am not alone in my perpetual awe of the enormity of what has been accomplished in the 13.82 billion year life of our Universe.

I recently watched the BBC documentary "The Secret Life of Chaos" narrated by Professor Jim Al-Khalili (Theoretical and Nuclear Physicist - University of Surrey). Although I have been exposed to many of the concepts separately, the clear interrelationship expressed in the documentary not only helped to clarify my understanding but to also realize the enormity of their impact.

The documentary began with the mathematics of Alan Turing. With the relatively recent release of the movie "The Imitation Game" I am sure most are aware that Turing is credited with being the father of computer technology and that he was a major contributor to the team that broke the WWII German military encryption code. With the sudden death of a friend, Turing became interested in human consciousness and what happens to it in death.

Being a brilliant mathematician his attempt at understanding was of course mathematical and his work inspired a new mathematical approach to biology. In 1952 Turing published a paper "The Chemical Basis of Morphogenesis" the worlds first mathematical explanation for embryology (the even now not so well understood process on how identical embryonic cells divide and differentiate to the various specialized cells of our bodies).

Prior to this publication, this process was unknown. The calculations Turing used were similar to that used in Astronomy and Atomic Physics but to describe how a biological system could self organize. The paper included explanation on how his equations could spontaneously create characteristic markings on the skins of animals. Unfortunately, in spite of Turing's significant contribution to the allied war effort (that undoubtedly saved countless lives), unnecessary state induced tragic events ensued that resulted in Turing's premature death in 1954 at the age of 41. We will never know what further signifi-



cant contributions Turing with his brilliant mind could have contributed to scientific understanding.

The documentary then described the work of Russian scientist Boris Belousov who was studying the absorption of glucose in the body. During experimentation Belousov discovered a mixture of chemicals that resulted in an oscillating chemical reaction (solution became coloured, clear, coloured etc.). His paper was unfairly rejected by the editor of the Russian Scientific Journal due to unfounded disbelief of the "impossible" results. Dejected, Belousov soon gave up science.

Later, other scientists found that if Belousov's chemicals where placed in petri dishes unstirred that the chemicals in what is now known as the Belousov - Zhabotinsky reaction would self organize into complex shapes and pat-

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Chaos & The Cosmos (continued)

terns. A fascinating associated fact is that the formation of these patterns exactly parallels how our heart cells move when it beats. The development of these patterns was predicted by Turing's equations in his Morphogenesis paper.

The documentary then discussed how the scientists of that era believed in a "mechanical clockwork universe" that was predictable by simple equations. If something contradicted the predictions it was due to some random outside influence. Thus, the findings of Turing and Belousov were not easily accepted.

Finally, in the 1960's, a scientific concept of "chaos" was introduced. In scientific terms chaos is when "a system that is completely described by mathematical equations is more than capable of being unpredictable without any outside interference whatsoever". Meteorologist Edward Lorenz became frustrated that his equations for predicting air currents failed in producing any useful predictions. Lorenz captured the essence of chaos theory in a talk he called "Does the Flap of a Butterfly's Wings in Brazil Set up a Tornado in Texas?" The amplification of small internal variations resulting in dramatically unpredictable results became known as the "Butterfly Effect". In the early 1970's scientist Robert May ran into similar issues when trying to use equations to predict how animal populations changed over time.



He discovered immeasurable changes in birthrates caused radical and unpredictable fluctuations in population without any apparent external cause. It was soon accepted that unpredictability is everywhere, chaos "is woven into the basic laws of physics".

Al-Khalili indicated "scientists realized something truly astonishing, that there was a very deep and unexpected link, a truly cosmic connection between nature's strange powers to self organize and the chaotic consequences of the butterfly effect..... The natural world could be deeply, profoundly unpredictable, but the very things that make it unpredictable also allow it to create patterns and structure. Order and chaos, the two are deeply linked, more than we could have ever imagined."

It is important to note the similarities between Belousov's pattern producing chemicals and Lorenz's weather predictions. Both behave in complicated ways but are based on simple mathematical rules but the rules involve feedback. I am sure most are familiar with the unpredictability of amplification effects of feedback loops. The documentary used a video feedback scenario (movements of a picture within picture at infinitum) to demonstrate that slight tweaking of such a feedback system can result in ordered patterns. The same mathematics generate both chaotic and patterned behaviour. As per Al-Khalili "ultimately pattern formation is woven very deeply into the fabric of the universe and it takes very simple processes like diffusion, rates of chemical reactions and the interplay between them naturally gives rise to patterns. Patterns are everywhere, just waiting to happen."

Next the documentary discussed brilliant mathematician Benoit Mandelbrot and his discovery of Fractal Geometry. If you are not familiar with Mandelbrot's work I highly recommend watching PBS Nova: "Fractals Hunting the Hidden Dimension" which can be found on YouTube. Prior to Mandelbrot, most mathematics described orderly structures but nature generally appears disordered. Mandelbrot saw rules and patterns where others saw anarchy. "Mandelbrot's quest was to find a simple mathematical basis for the rough and irregular shapes of the real world. "..... "Underlying nearly all the shapes in

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Chaos & The Cosmos (continued)

the natural world is a mathematical principle known as self-similarity. This describes anything in which the same shape is repeated over and over again at smaller and smaller scales" (e.g. the branches of trees, structure of our lungs, distribution of our blood vessels).



Using a very simple equation and feeding the output back into the input (the **Mandelbrot Set**) a now infamous beautiful mathematical pattern of infinite complexity emerged. To fully understand the true beauty of the math and image it needs to be explored in an online video. As a side note, the application of Mandelbrot's fractal geometry to CGI has dramatically enhanced the imagery in the film and video gaming industries. Use of nature's self-similarity principle enabled unprecedented computer generated realism.

"The really fascinating thing is that the Mandelbrot set isn't just a bizarre mathematical quirk, its fractal property of being similar at all scales mirrors the fundamental ordering principle in nature. Turing's patterns, Belousov's reaction and Mandelbrot's fractals are all signposts pointing to a deep underlying natural principle..... What the mathematics in this area is telling us is that very simple rules naturally gives rise to very complex objects."

The next obvious question asked, "Can nature's ability to turn simplicity into complexity in this mysterious and unpredictable way explain why life exists, can it explain how a universe full of simple dust can turn into human beings, how inanimate matter can spawn intelligence"?

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Chaos & The Cosmos (continued)

Evolution is discussed as the process that enables nature to experiment with what works and what doesn't. "Evolution refines and enriches complex systems.... Evolution's mindless yet creative power to develop and shape complex systems is indeed incredible, but it operates on a cosmic timescale." Next, the use of computer technology to model evolution at an accelerated rate was demonstrated. It was very interesting to see just how few generations were required to evolve the computer animations' ability to successfully navigate their digital environment.

The Secret Life of Chaos was a phenomenal learning experience that certainly enhanced my understanding of how the Universe works by reinforcing the similarities and interrelationships of the natural processes, biological processes, feedback loops, fractal geometry along with the necessity of the unpredictable contributions of chaos. I especially like the way the documentary provided at least some brief background information of the contributing scientists to illustrate what led them to their discoveries. It is truly remarkable how totally independent scientists from different geographic locations, eras and with different interests and motivations contributed to interlinked merging pieces of the puzzle.

From the nothingness prior to the Big Bang to intelligent thought in 13.82 billion years. Although now much wiser to the processes involved, especially with respect to the accelerant nature of chaos in its contributions to the formation of complex order in the evolution of our Universe, the perpetuity of my awe is not diminished in the least.

May a little healthy chaos be with you!

Chaos & The Cosmos

NASA's Space Place



The Loneliest Galaxy In The Universe

By Ethan Siegel

Our greatest, largest-scale surveys of the universe have given us an unprecedented view of cosmic structure extending for tens of billions of light years. With the combined effects of normal matter, dark matter, dark energy, neutrinos and radiation all affecting how matter clumps, collapses and separates over time, the great cosmic web we see is in tremendous agreement with our best theories: the Big Bang and General Relativity. Yet this understanding was only possible because of the pioneering work of Edwin Hubble, who identified a large number of galaxies outside of our own, correctly measured their distance (following the work of Vesto Slipher's work measuring their redshifts), and discovered the expanding universe.

But what if the Milky Way weren't located in one of the "strands" of the great cosmic web, where galaxies are plentiful and ubiquitous in many different directions? What if, instead, we were located in one of the great "voids" separating the vast majority of galaxies? It would've taken telescopes and imaging technology far more advanced than Hubble had at his disposal to even detect a single galaxy beyond our own, much less dozens, hundreds or millions, like we have today. While the nearest galaxies to us are only a few million light years distant, there are voids so large that a galaxy located at the center of one might not see another for a hundred times that distance.

While we've readily learned about our place in the universe from observing what's around us, not everyone is as fortunate. In particular, the galaxy MCG+01-02-015 has not a single known galaxy around it for a hundred million light years in all directions. Were you to draw a sphere around the Milky Way with a radius of 100 million light years, we'd find hundreds of thousands of galaxies. But not MCG+01-02-015; it's the loneliest galaxy ever discovered. Our Milky Way, like most galaxies, has been built up by mergers and accretions of many other galaxies over billions of years, having acquired stars and gas from a slew of our former neighbors. But an isolated galaxy like this one has only the matter it was born with to call its own.

Edwin Hubble made his universe-changing discovery using telescope technology from 1917, yet he would have found absolutely zero other galaxies at all were we situated at MCG+01-02-015's location. The first visible galaxy wouldn't have shown up until we had 1960s-level technology, and who knows if we'd have continued looking? If we were such a lonely galaxy, would we have given up the search, and concluded that

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NASA's Space Place (continued)

our galaxy encompassed all of existence? Or would we have continued peering deeper into the void, eventually discovering our unusual location in a vast, expanding universe? For the inhabitants of the loneliest galaxy, we can only hope that they didn't give up the search, and discovered the entire universe.



Image credit: ESA/Hubble & NASA and N. Gorin (STScI); Acknowledgement: Judy Schmidt, of the loneliest void galaxy in the known: MCG+01-02-015.



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Eye Candy



Comet Catalina (C/2013 US10) in Bootes, by Bob Christmas

Taken with Canon 40D through Canon 100mm f/2 lens on fixed tripod from Burlington, ON January 5, 2016 (ISO 3200; 30 x 3.2 seconds; 96 seconds total). Globular cluster NGC 5466 is visible at extreme upper left. Cropped from the original frame. North is towards upper left.



If the groundhog sees his shadow, he runs back into his hole...





Treasurer's Report by Steve Germann

Treasurer's Report for January 2016 (unaudited)

Opening balance:	\$8,328.84
Revenue:	\$1,351.00
Expenses:	\$396.26
Closing Balance:	\$9,283.58

Revenue consisted of Advertising, \$100; Calendar Sales, \$880; 50/50, \$61; and Memberships, \$310.

Expenses consisted of Speaker Allowance, \$12.06; and Planispheres, \$384.20.

We have sold all of the calendars. Thanks to all our support as photographers, promoters, and buyers, editors, and selection committee, as well as the volunteers who helped to sell them at meetings, and carted around the boxes.

The calendar project this year realized a net of \$1092.41 for your club. Special thanks to everyone who contributed in any way.



William J. McCallion Planetarium

McMASTER UNIVERSITY, HAMILTON, ONTARIO

- Public shows every Wednesday (7:00pm)
- Public transit available directly to McMaster campus
- Tickets \$7 per person; private group bookings \$150
- Different shows every week
- Upcoming shows include:
 - Feb 3: Introductory Astronomy for Kids (1st Wed of every month)
 - Feb 10: Robotic Renaissance
 - Feb 17: Celestial Harmonies
 - Feb 24: Carl Sagan's Universe
- For more details, visit <u>www.physics.mcmaster.ca/planetarium</u>

UPCOMING EVENTS

February 12, 2016 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium. Our main speaker will be *Christine Wilson* of McMaster University, whose talk is entitled "New Eyes on the Cold Universe: The Atacama Large Millimeter Array".

March 11, 2016 - 7:30 pm – HAA Meeting at the Hamilton Spectator Auditorium.

2015-2016 Council

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