Event Horizon

Volume 23, Number 3
January 2016

From The Editor

Happy New Year, everyone!

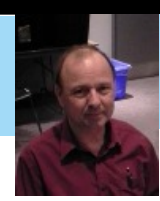
As another year starts, what better way to kick it off than to enjoy another edition of the Event Horizon!

And how appropriate that the latest NASA Space Place article talks about event horizons of black holes!

Happy Reading…

Bob Christmas, Editor

editor 'AT' amateurastronomy.org



Chair's Report by Bernie Venasse

Welcome 2016 !!! Leap Year An extra night for viewing???

New Year, New Goals, New Resolutions

One of the changes that you will see is that we will begin to supply a suggestion box at each meeting. There will likely be a pad of paper supplied that you can write your suggestions or comments upon. Adding your contact info is optional but including your name and number will let us contact you so that we can discuss your ideas further.

Volunteer Corner

The Christmas Coffee and treats event was a huge success. A tip of the dew shield to our volunteers who helped organize and gather and bake. We need people for meet and greet opportunities at our meetings. We have other events and projects coming which will require the help of many *(Continued on page 2)*

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Chair's Report (continued)

more members, such as Binbrook events, Astronomy Day events. Volunteers are our backbone. We need people for meet and greet opportunities at our meetings. The more people available for these events, the easier it is to do and the more fun we can have! There are 6 outreach events booked for January. I am sure that a few volunteers would be welcome to assist in that program.

Bits and Pieces from around the club…
Last council meeting was complemented by our (unofficial) annual dinner. This year it was Chinese food paid for by yours truly as my gift to each of them. From all accounts this was well received by all in attendance.
The Event Horizon is looking for contributors. Articles, notes, drawings, comments, suggestions. Remember that the EH is *your* forum. Make it your resolution to contribute to the E.H. this year.
Calendar sales… We have a few calendars remaining and are very close to having a sell-out again this year. Get one of those last few out there and **Thank You** for supporting this effort.
The McMaster Observatory Outreach at Night (MOON) club is planning a skating night on Jan. 7 at Pier 8 and is inviting us to join them for a collaborative public event. I think it is a wonderful opportunity to meet members of another group.
We have had some good press coverage in the last while. Hamilton Mountain News featured an article about our calendars and Mario Carr contributed to the Hamilton Naturalists' Club's, "Wood Duck" periodical.

Food bank donations
We have had tremendous response to our food bank donation program. But we can always do more…Here is a list of items that are needed on a regular basis:
Veggies and Fruit: Unsweetened applesauce, pasta sauce, canned fruit (pears, fruit cocktail, mandarin oranges) packed in juice or water, canned vegetables (peas, mushrooms, corn, green beans, tomatoes), Juice boxes (100% fruit), potatoes, carrots, raisin boxes.
Grains: Brown rice, whole wheat pasta, whole grain-low sodium crackers, granola bars, hot cereals (oatmeal, cream of wheat), cold cereals (bran, shredded wheat, raisin bran, cheerios), INFANT CEREAL.
Milks: Canned evaporated milk, soy or almond or rice beverage, powdered milk.
Meats: Canned fish (salmon, light tuna), canned meat (ham, turkey, chicken), chili, peanut butter, canned or dried beans (kidney, black, baked, chick peas, black-eyed peas, lentils), raw or unsalted mixed nuts, almonds.
Oils and fats & other edibles: Vegetable oil, salad dressing, baking mixes that require only water (muffin, biscuits), tea, coffee, low sodium canned soup, spices (cinnamon, salt, pepper, oregano, basil), chocolate… everyone deserves a bit of a treat.
Non-food items: Shampoo, soap, toothpaste, DIAPERS, baby supplies, toothbrushes, toilet paper, dish soap, laundry detergent, feminine hygiene products, disposable razors, carrying bags.

WHAT I DIDN'T REALIZE ABOUT FOOD BANKS

- A lot of people have diabetes in this group. Consider low-sugar dietary restrictions.
- Cans and boxes are sturdier than bags. By the time families are receiving the food, it's been handled A LOT and packaging needs to be strong enough to hold up. One food bank said never bring anything in glass, ever.
- Pop-top cans are ideal; particularly for those living on the streets.
- Think about weekends and school breaks. Kids who qualify for free lunches typically receive breakfast at school too and when schools are out for holidays or summer, these families need more support.

(Continued on page 3)

Masthead Photo: *The Andromeda Galaxy & its Companions (M31, M32 & M110), by Peter Wolsley.*

Taken through his 80mm refractor with a focal reducer/flattener; ISO 1600; 11 images stacked. Exposures: 11 x 2 minutes; 22 minutes total.

Chair's Report (continued)

- Many families are in crisis at this time in their lives and food banks often work in tandem with churches or other non-profit programs to get them back on their feet. The Salvation Army in Durham, for example, coordinates with First Baptist Church's "Jobs for Life" program. Recipients get interview training and in some cases, a ride to the mall where they're coached on asking for job applications.

Volunteers are needed to assist in kitchens and with food distribution. Please give a bit of your time…

Upcoming events

Our scheduled speaker for January is Karen Cumming. She is one of only 100 people left from an initial list of more than 200,000 applicants for the one-way trip via Mars One.
Matthew Mannering will be giving us some insight into Carbon Stars, and Kevin Salwach will be at the podium with his newest segment of "This Day in Astronomical History".

Jan 9	Binbrook park planned opening
Jan 15	General meeting in the Spectator auditorium. NOTE that this is the 3rd Friday of the month.
Jan 19	Council meeting at Jim`s
Jan 29-30	Binbrook park planned opening
Feb 5-6	Binbrook park planned opening
Feb 12	General meeting in the Spectator auditorium.

Hamilton Amateur Astronomers 2016 Celestial Events Calendar

There are still a few 2016 HAA calendars for sale. If you don't have your copy yet, get one before they're gone!

This beautiful calendar features images exclusively by your fellow HAA members. It makes a wonderful gift and look great when displayed at home or office.
The price is $15 each or two for $25.

Any revenue generated from sales goes back into the club to help support club activities.

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.

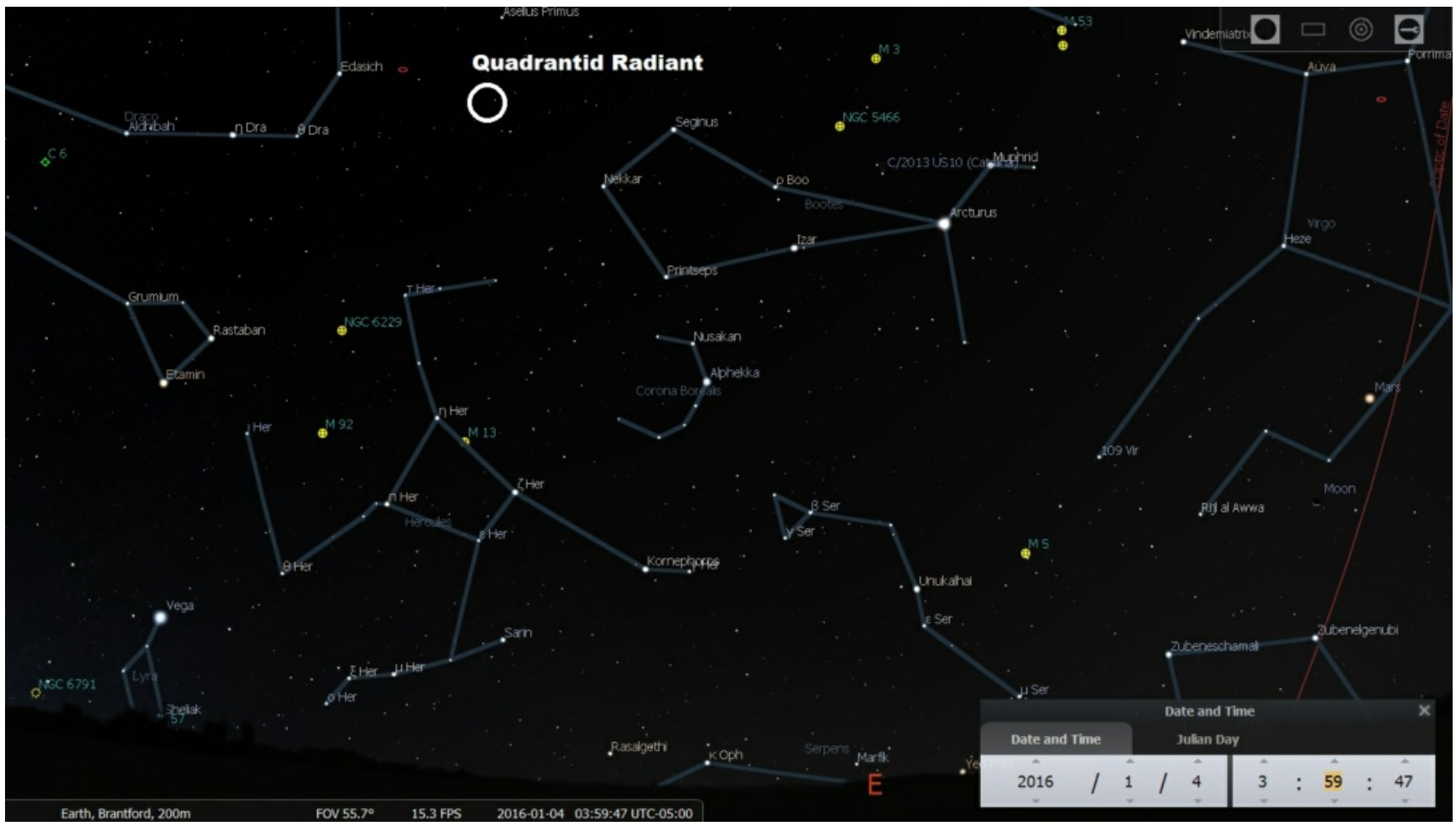
If you would like to help or have any questions about this initiative, please contact the H.A.A.

The Sky This Month for January 2016 by Matthew Mannering

Let me start off by saying that I hope all of you had a safe and happy holiday over Christmas and the New Year. I'm sure that many of you received astro toys for Christmas. The only question I have is "Did you wait for Christmas day to play with them?". I ordered the Sky Atlas 2000.0 deluxe laminated map set on Black Friday in November. I'm pretty sure there was some sort of Cosmic plot to prevent me from using the atlas before Christmas as it didn't arrive in the mail until 2pm Christmas Eve.

The atlas is beautiful and extremely large. This is not an atlas for beginners. For one thing there aren't any lines to connect the stars in a constellation. For another, the atlas goes down to magnitude 8.5 which means that it shows many times the number of stars you can see from a city or town. This could be very confusing for beginners but for me it is very useful for star hopping to a target with an 8x50 finder scope. If you are just starting out and trying to learn the constellations, then an atlas or planisphere that goes down to magnitude 6.0 or 6.5 is better. It will map the sky as it appears to the naked eye in the country on a dark Moonless night.

The **Quadrantid meteor shower** is back this month peaking around 3am on January 4th. Unfortunately, the brighter meteors are expected after the peak so it may be better to get up early that morning and spend an hour looking at them before astronomical twilight ends at 6:45 am. The radiant (common point of origin) is to the east of the constellation Bootes and directly below the bowl of the Big Dipper.



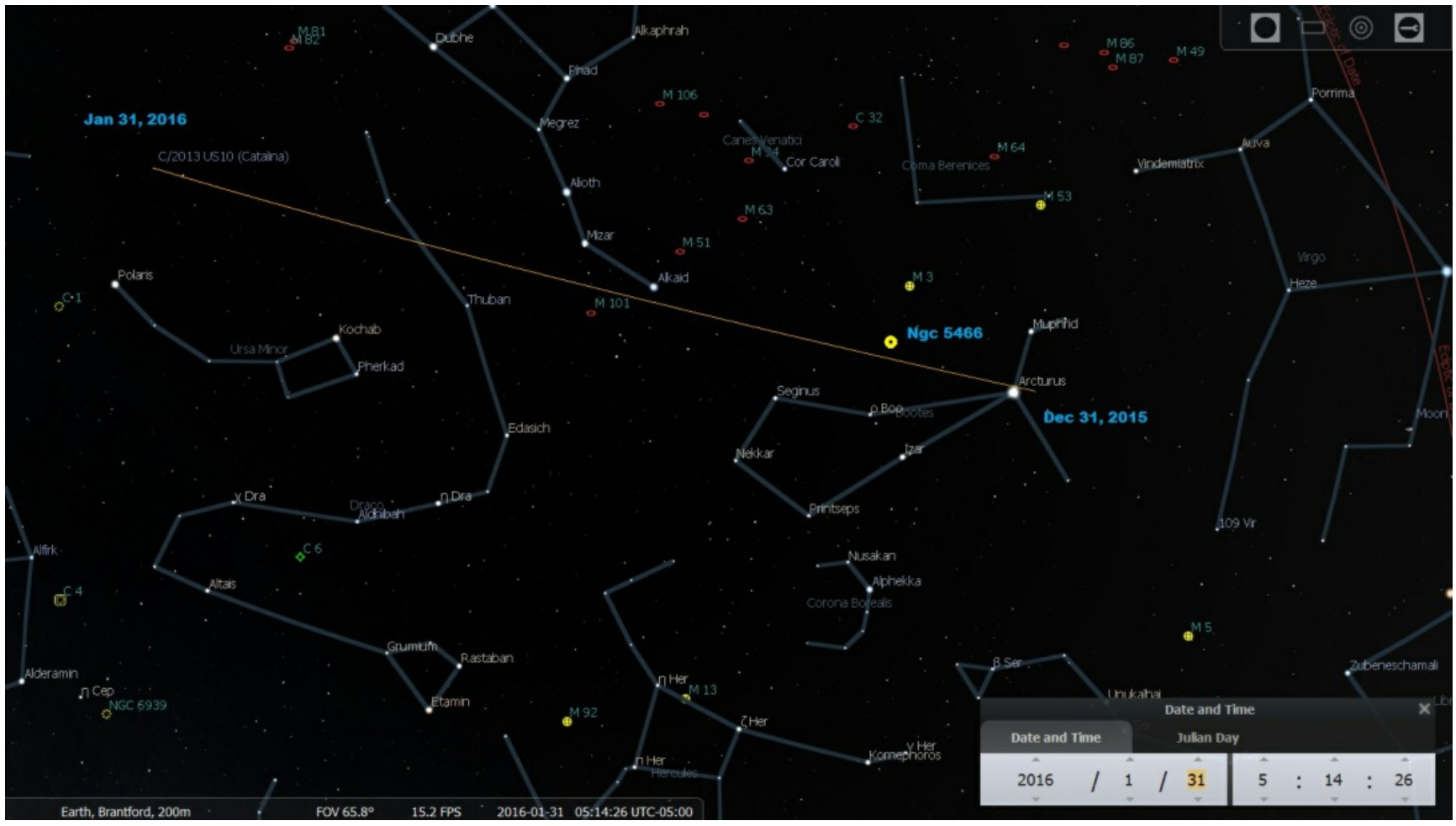
January 2nd brings the Earth to *perihelion*. This is the point in our orbit where the Earth is closest to the Sun at a distance of 147,100,176 km. Personally I think 9 digits of accuracy is a little too exact and hard to remember. If anyone should ask then I think an answer of 147.1 million kilometers is just fine. In case you were wondering, *aphelion* is on July 4th at a distance of 152.1 million kilometers; a difference of 5 million kilometers. This tells us that our orbit is an ellipse not a circle. Although as ellipses go, it's not much of one. Compare that to Mercury's ellipse with a perihelion on January 7th at 46.0 million kilometers and an aphelion on February 20th at 69.8 million kilometers. That's a difference of 23.8 million kilometers.

(Continued on page 5)

The Sky This Month (continued)

Targets for January

For your first target let's spend a few mornings with **comet Catalina**. On January 1st Catalina will be about ¼ degree to the west of Arcturus. On the 6th it will pass east of NGC5466. On the 14th it will pass about 4.5 degrees east of M51 (the Whirlpool galaxy) and finally on the 16th it will pass 2.5 degrees west of M101 (the Pinwheel galaxy) in Ursa Major. The following chart shows the path of the comet for the month of January.



Next on our list is another **occultation of Aldebaran by the Moon** (see chart at top of Page 6). This occurs on the night of the 19th starting at 9:17pm and ending at 10:33pm. The Moon's phase is waxing gibbous so Aldebaran will disappear behind the left limb in darkness and reappear on the fully lit right limb. Make sure you are ready to observe or photograph at least 10 minutes before each event as these times are approximate.

The Moon

Libration this month is as follows: The Northern limb will be most exposed on the 21st while the Southern limb will be most exposed on the 8th. The Eastern limb will be most exposed on the 24th and the Western limb on the 8th. This month try to image the Moon just before and after it is New. All you need is a camera with a zoom lens. At 7am on the 8th the Moon will be 2.8% lit. New Moon is the next day on the 9th and then on the 10th at 5pm it will be 0.9% lit. You may require binoculars to find the Moon as it will be a very thin crescent. Once you know where to point the camera you can take a few shots with an interesting foreground if possible.

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The Sky This Month (continued)

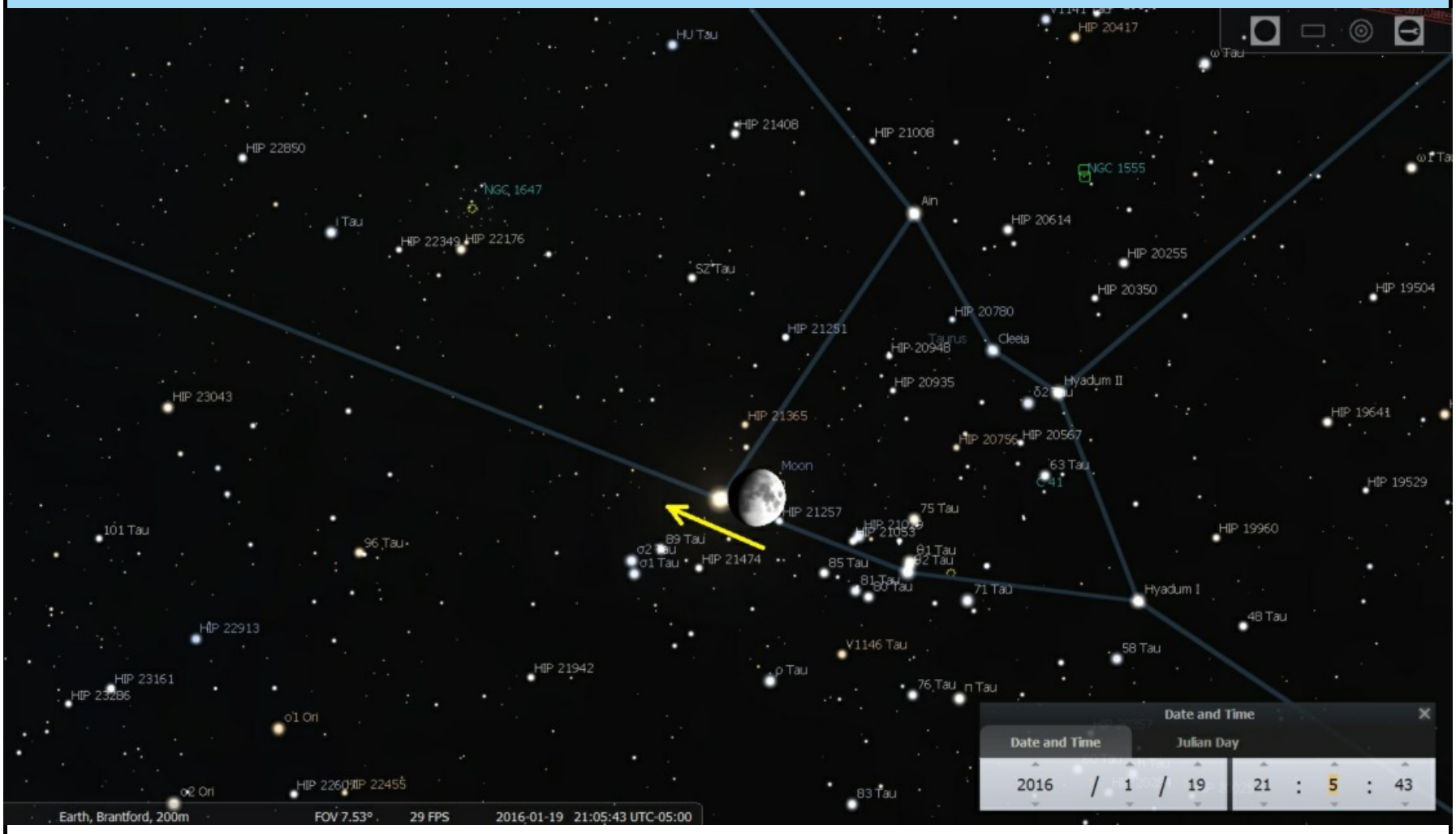


Chart of the Moon's Occultation of Aldebaran January 19, 2015

The Planets

- ***Mercury*** appears low in the west immediately after the sun sets for the first six days of the month. Look for it at 5:15pm about 10 degrees above the horizon in the south west.
- ***Venus*** continues to be visible after 6am in the eastern morning sky. Watch as the days go by for Venus to approach and then pass Saturn on the 9th.
- ***Mars*** appears in the morning sky at 2am in Virgo at the beginning of the month. By months end it will rise at about 1:30am and will have moved into Libra.
- ***Jupiter*** rises at about 11pm at the beginning of the month and at 9pm by months end.
- ***Saturn*** appears low in the east at dawn.
- ***Uranus*** is due south in Pisces at 6pm at the beginning of the month moving to the south west at the same time at months end.
- ***Neptune*** in Aquarius is visible in the evening sky in the south west till 9pm at the beginning of the month and will disappear into the twilight at 7pm by months end.

(Continued on page 7)

The Sky This Month (continued)

Other Events

-January 1st: — Comet Catalina 0.5 degrees from Arcturus.

-January 2nd: — Last quarter Moon.

-January 3rd: — Mars 3.2 degrees south east of the Moon at 6:45am.

-January 4th: — Quadrantid meteor shower peaks at 3am.

-January 6th: — Venus, Saturn and the Moon all in a 8.8 degree span at dawn.
— Comet Catalina passes very close to NGC 5466.

-January 8th: — Venus ¾ degree north west of Saturn at 6:20am.

-January 9th: — New Moon.
— Saturn 1/3 degree east of Venus also at 6:20am.

-January 14th: — Catalina passes M51.

-January 16th: — First Quarter Moon.
— Catalina passes M101.

-January 19th: — The Moon occults Aldebaran at 9:17pm.

-January 23rd: — Full Moon.

-January 27th: — Jupiter 2.3 degrees north of the Moon at 9:45pm low in the east.

-January 31st: — Last Quarter Moon.

Treasurer's Report by Steve Germann

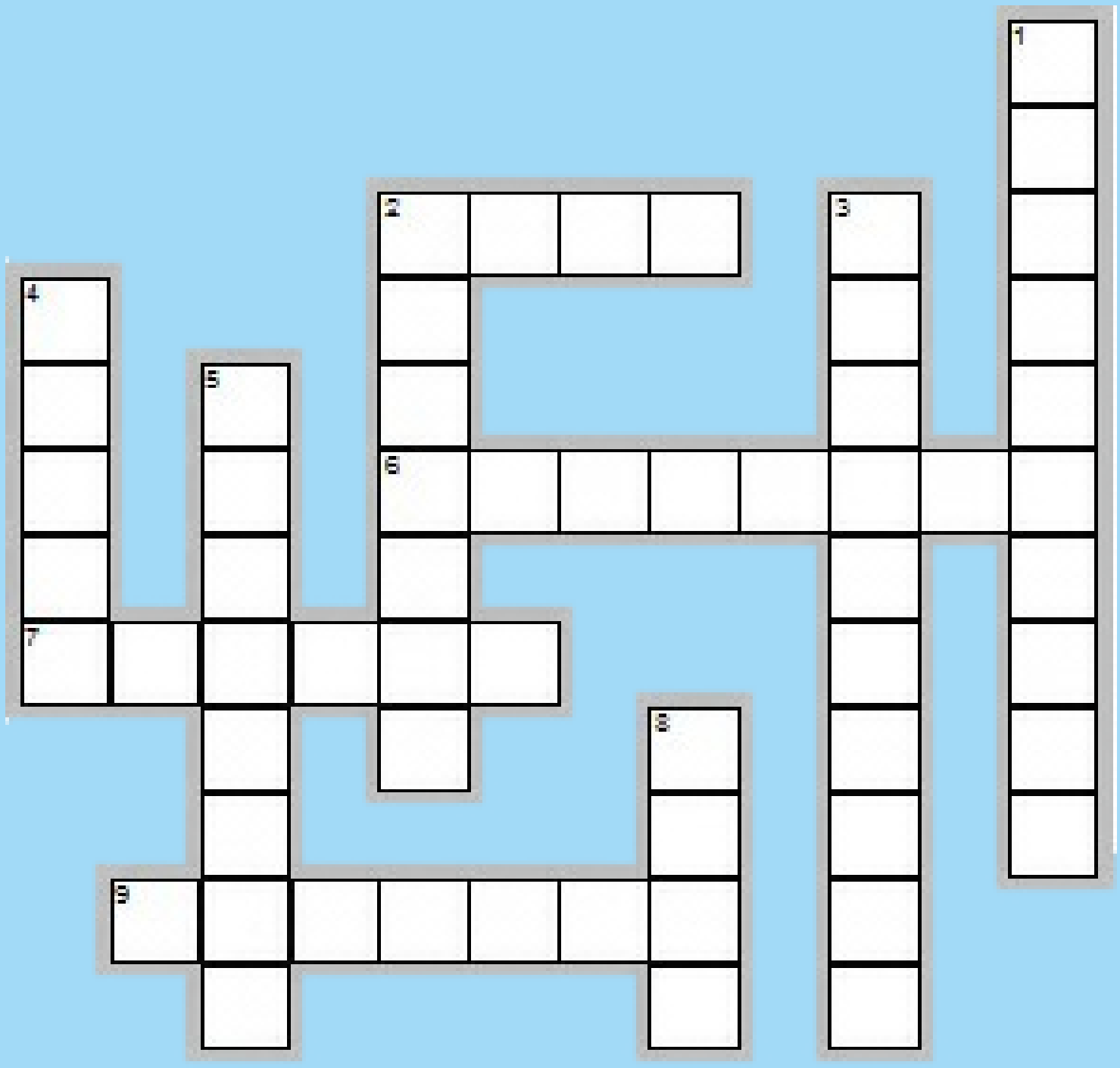
Treasurer's Report for December 2015 (unaudited)

Opening balance:	$7,093.27
Revenue:	$1,289.00
Expenses:	$53.43
Closing Balance:	$8,328.84

Major Revenue included 50/50 $64, Memberships $260, and calendar sales $965.

Expenses included supplies for the December meeting, $53.43.

Astronomy Crossword by Mario Carr



Across

2. On January 6, Venus is close to this object in the eastern morning sky.
6. Usher in the New Year with this comet
7. On January 9, Venus and this planet are extremely close in the eastern morning sky.
9. On January 27, this object is close to the Moon in the evening sky.

Down

1. On January 3, this meteor shower peaks.
2. This planet can be seen in the evening western twilight sky January 1-9.
3. On January 2 Earth is at?
4. This planet is bright in the eastern morning sky.
5. On January 1 a comet was close to this star just before dawn in the south eastern morning sky.
8. On January 3, this planet is close to the Moon in the evening sky.

Answers can be found on page 14. (No peeking!)

Cosmic Bubbles by Bruce Pawlett

I have often heard that Astronomy is a great lifetime passion since there is no end to the information that can be known. Not only is that true but it is amazing how often one serendipitously stumbles upon associations with astronomy while pursuing more earthly activities.

I was recently satisfying my penchant for watching scientific documentaries by viewing BBC's "Pop the Science of Bubbles" (Physicist/Oceanographer Dr. Helen Czerski). For such a seemingly simple phenomenon I was surprised that there are scientists that spend much of their careers studying bubbles. I was fascinated to learn the many practical applications of the science of bubbles.

In nature, bubbles are implicit in the oceans' breathing through their creation in crashing waves. The ocean bubbles also attract tiny particles and carry them to the surface with their upward motion. The smaller of these particles are further carried higher in the atmosphere where they serve the necessary purpose of acting as a cloud condensation nucleus or cloud seed. Without a non-gaseous surface, water vapour cannot condense to a liquid. Thus, bubbles are very much integral to our atmosphere and climate.

Emperor Penguins are able to trap air within their feathers to help provide increased insulation as do many birds but they also take advantage of the bubbles' ability to reduce the friction of water. While underwater, timed releases of the air from their feathers enable the penguins to double or even triple their speed to jump onto the arctic ice pack or escape a predator. This has practical applications for the shipping industry in the development of air (bubble) lubrication systems for super tankers to reduce friction and thus fuel consumption.

Bubble science has practical medical applications. The injection of bubbles into patients greatly improves the resolution of ultrasound imaging. Currently, there is experimentation to utilize the ability of bubbles to attract small particles to precisely target delivery of anti-cancer medication to affected areas. Here, the use of fine iron particles along with medication allows the bubbles to be directed with magnets. The progression of the medication-laced bubbles is tracked with ultrasound and when the destination is reached a sonic shock results in the release of the medication.

(Continued on page 10)

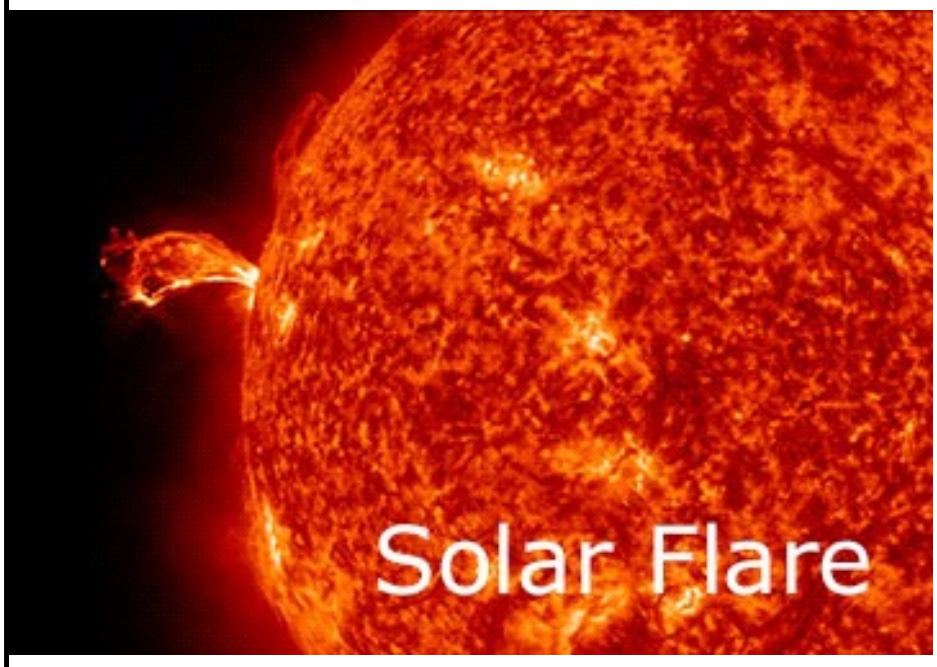
Cosmic Bubbles (continued)

I digress, what has any of this have to do with astronomy? Where is the cosmos in "Cosmic Bubbles"? I have to admit that I cheated and introduced topics perhaps not worthy for an Astronomy Newsletter. I am banking on others similarly having diverse interests and I am not quite done.

My previous understanding of singularities was in the astronomical sense as in black holes or the beginning of our universe. However, "in mathematical terms, a singularity is the point at which any given object – such as when an equation or surface breaks down and explodes". Since these are non-linear they are hard to describe or understand mathematically.

Professor Raymond Goldstein a researcher at Cambridge University is using suitably shaped wires to achieve complex soap film/bubble structures that become unstable by deforming the wire shape. Professor Goldstein indicated "…structures come off the sun… they form these beautiful arching filaments and give rise to huge ejections from the sun. So at every life scale you can imagine physicists and mathematicians are interested in understanding the mathematical singularity, the moment the re-arrangement happens… We hope to see a pattern emerging that will lead to something deep about these transitions."

It is much easier to study such phenomena in the laboratory through precise control of parameters such as viscosity, surface tension, size of the wire along with high-speed video analysis. I am sure you will agree the photos below illustrate Professor Goldstein's skill in achieving a soap bubble singularity that at least visually approaches a mini solar flare.



In research for this article I discovered an abstract entitled "Experimental Studies of a Strongly Shocked Gas Bubble" by Devesh Ranjan et al. Here the researchers use shock waves to disrupt 5 cm free falling spherical nitrogen filled soap bubbles in a square vertical shock tube. Laser imaging is used to trace the flow and evolution of the shocked bubble geometry. The resulting observed jets are compared to mathematical computer simulations with the hope of helping to explain the jetting observed following the core-collapse in supernovae.

Putting the cosmos into bubbles!

NASA's Space Place

Note: This month's article describes a project that is not related to NASA and does not suggest any relationship or endorsement. Its coverage is for general interest and educational purposes.

How will we finally image the event horizon of a black hole?

By Ethan Siegel

One hundred years ago, Albert Einstein first put forth his theory of General Relativity, which laid out the relationship between spacetime and the matter and energy present within it. While it successfully recovered Newtonian gravity and predicted the additional precession of Mercury's orbit, the only exact solution that Einstein himself discovered was the trivial one: that for completely empty space. Less than two months after releasing his theory, however, the German scientist Karl Schwarzschild provided a true exact solution, that of a massive, infinitely dense object, *a black hole*.

One of the curious things that popped out of Schwarzschild's solution was the existence of an event horizon, or a region of space that was so severely curved that nothing, not even light, could escape from it. The size of this event horizon would be directly proportional to the mass of the black hole. A black hole the mass of Earth would have an event horizon less than a centimeter in radius; a black hole the mass of the sun would have an event horizon just a few kilometers in radius; and a supermassive black hole would have an event horizon the size of a planetary orbit.

Our galaxy has since been discovered to house a black hole about four million solar masses in size, with an event horizon about 23.6 million kilometers across, or about 40 percent the size of Mercury's orbit around the sun. At a distance of 26,000 light years, it's the largest event horizon in angular size visible from Earth, but at just 19 micro-arc-seconds, it would take a telescope the size of Earth to resolve it – a practical impossibility.

But all hope isn't lost! If instead of a single telescope, we built an *array* of telescopes located all over Earth, we could simultaneously image the galactic center, and use the technique of VLBI (very long-baseline interferometry) to resolve the black hole's event horizon. The array would only have the light-gathering power of the individual telescopes, meaning the black hole (in the radio) will appear very faint, but they can obtain the resolution of a telescope that's the distance between the farthest telescopes in the array! The planned Event Horizon Telescope, spanning four different continents (including Antarctica), should be able

(Continued on page 12)

to resolve under 10 micro-arc-seconds, imaging a black hole directly for the first time and answering the question of whether or not they truly contain an event horizon. What began as a mere mathematical solution is now just a few years away from being observed and known for certain!

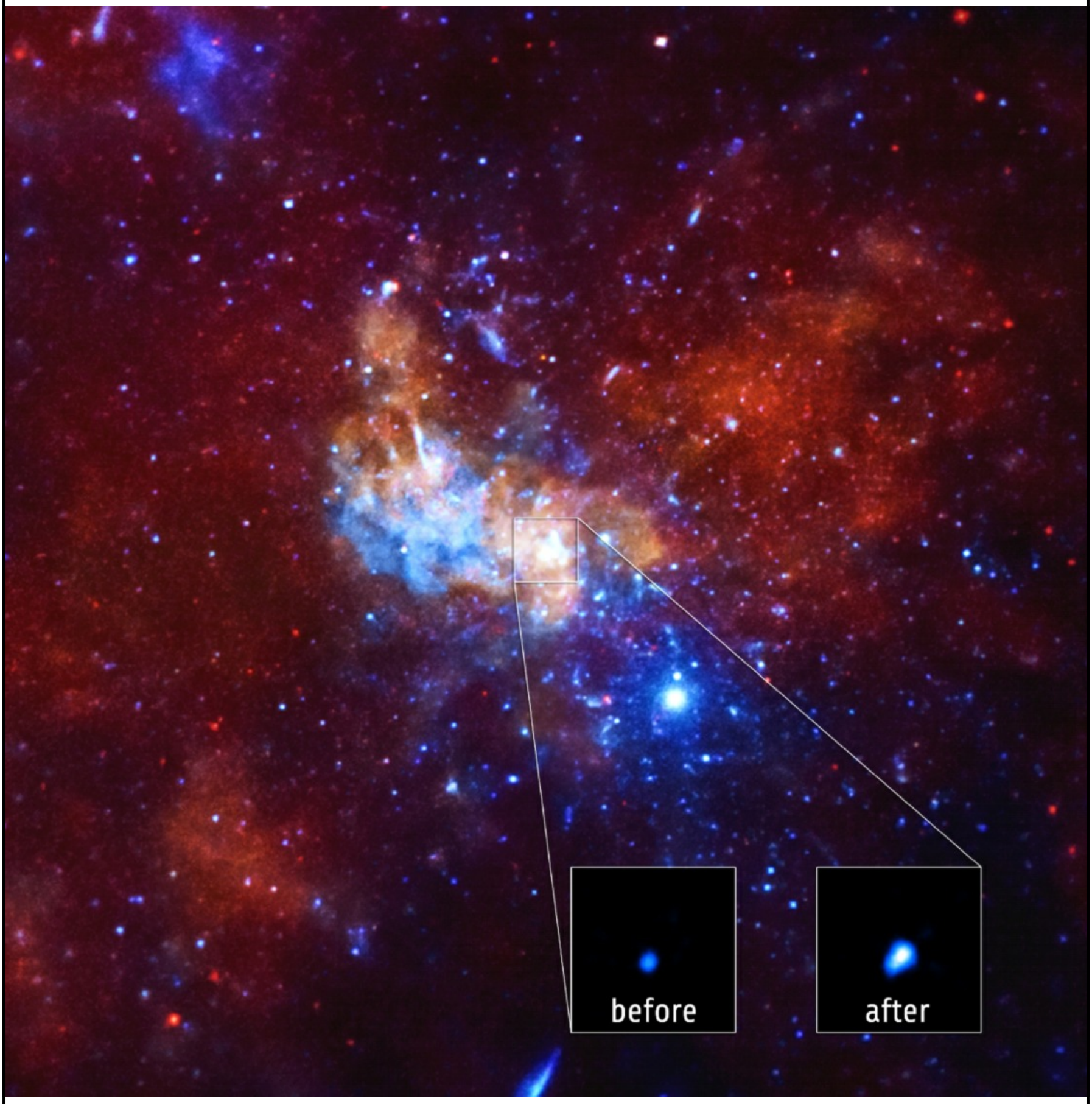
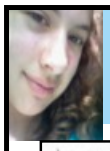
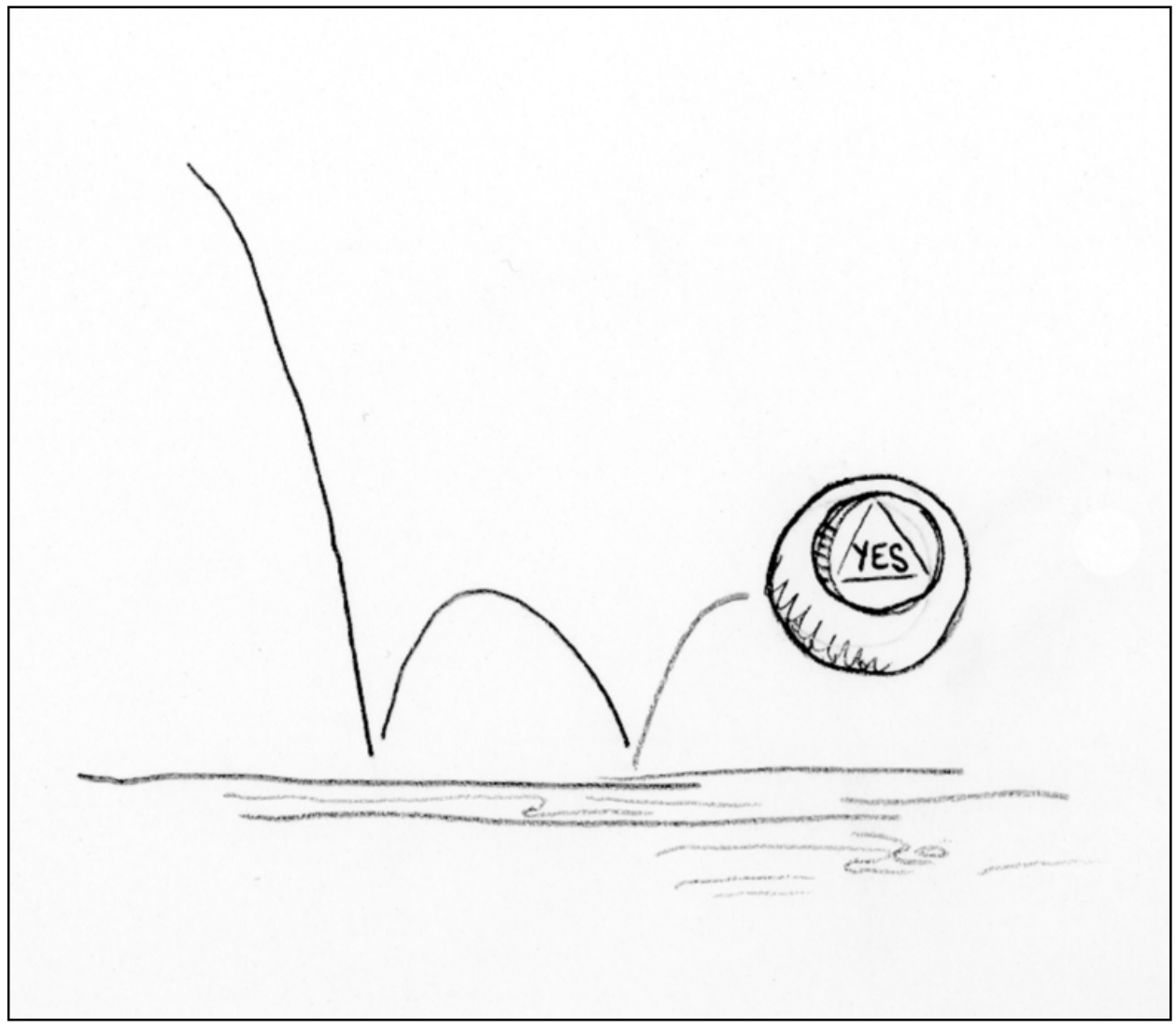


Image credit: NASA/CXC/Amherst College/D.Haggard et al., of the galactic center in X-rays. Sagittarius A is the supermassive black hole at our Milky Way's center, which normally emits X-ray light of a particular brightness. However, 2013 saw a flare increase its luminosity by a factor of many hundreds, as the black hole devoured matter. The event horizon has yet to be revealed.*



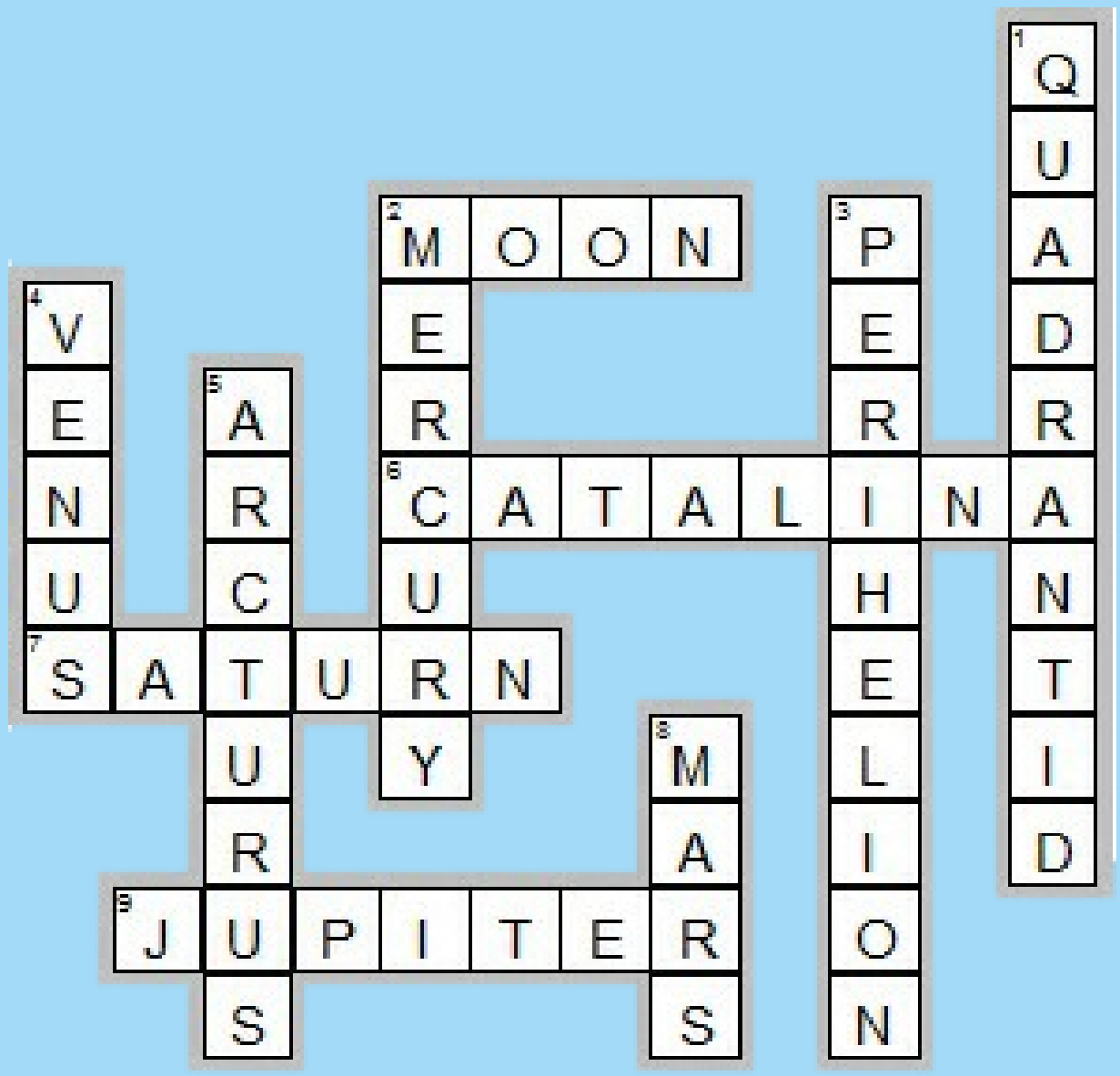
Cartoon Corner by Alexandra Tekatch

"Oh, Magic Cloud Ball, will there be clouds tonight?"



"Awww, rats! Not again!!"

Answers to Astronomy Crossword on Page 8



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:**
  - **Jan 27: Death from the Skies!**
  - **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**
  www.physics.mcmaster.ca/planetarium

UPCOMING EVENTS

January 15, 2016 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium. Our main speaker will be *Karen Cumming*, who will be talking about the Mars One project.
NOTE that this will be the 3rd Friday in January.

February 12, 2016 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium.

2015-2016 Council

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Check out the Hamilton Amateur Astronomers **Website**

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Observing site for the HAA provided with the generous support of the
Binbrook Conservation Area
Come observing with the HAA and see what a great location this is for stargazing, a family day or an out-door function.
Please consider purchasing a season's pass for $79 to help support the park.
http://www.npca.ca/conservation-areas/binbrook/
905-692-3228

HAMILTON AMATEUR ASTRONOMERS