Bob McDonald a Hit at HAA's April Meeting! By Heather Neprozel

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Bob McDonald of Quirks and Quarks catches up on astronomy news by reading the HAA's **Event Horizon** at the April meeting!

> Story by Heather Neprozel

Photo by Tim Philp

Event Horizon

Despite cold and rainy conditions the April General meeting of the HAA was well attended. Chairman Steve Germann welcomed the crowd, made a few announcements (Steve mentioned the Binbrook Conservation Area Work Day volunteers sign-up sheet at the door) and then introduced John Gauvreau and his talk on the Sky this Month. John talked about how the sun is going through the deepest solar minimum in several years (sunspot activity very low); that spring time is "galaxy season" so get out there and "go deep" while all those galaxies are so well placed for viewing; and not to miss a grazing occultation of the moon and Venus on the morning of April 22.

From The Editor's Desk



You know, life is just not fair. We have suffered through a long winter where it has been too cold and miserable to go outside to observe very often. Those long winter nights were, however, filled with wonderful objects to see, if you could work your scope through your gloves. Now, we have warmer temperatures and still have lots to see... too bad the sun stays in the sky for hours longer limiting our observing time to just a couple of hours. The only thing left to look at is the sun... and it has not been worth looking at lately. Life is just not fair!

Tim Philp, Editor

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Binbrook Cleanup

Saturday May 9th

08:30—15:00hrs Meet at the work shed just inside and to the left of the main gate BBQ Lunch! Show your support for Binbrook! Bob McDonald a Hit! (continued)

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After the conclusion of John's talk Ann Tekatch pointed out that Canada Post has issued 2 stamps in recognition of IYA (International Year of Astronomy): one stamp showing the Dominion Observatory in British Columbia against the backdrop of the Horsehead Nebula and one with the Canada-France-Hawaii Telescope set against a background of the Eagle Nebula (a Hubble image). Nice looking stamps from Canada Post.

After the break Steve introduced our much-anticipated speaker of the evening, Bob McDonald of CBC's "Quirks and Quarks" radio show.

Just let me say that your humble author is quite envious of Bob McDonald. Why? Over the years I have been fascinated by the space probes such as Viking, Voyager and more recently Galileo and Cassini, to name a few. The Jet Propulsion Laboratory in Pasadena California has managed many of these probes for NASA. Well Bob McDonald visited JPL in the 1970's during the landing of the twin Viking spacecraft on Mars. Bob has witnessed space exploration first-hand. And speaking of space exploration and explorers, McDonald has met Apollo astronaut Buzz Aldrin, the second man to walk on the surface of the moon, and taken Aldrin for a ride around Toronto harbour on his sailboat. Aldrin recollected to McDonald that when he was climbing down the ladder of the lunar module the last rung was still quite a few feet above the surface and Aldrin more or less fell down as much as stepped onto the lunar surface.

McDonald has traveled a lot and is a bit of an adventurer, and one of the interesting things he has done is taken a ride on "G-Force One", otherwise known as the "vomit comet". A ticket on this flight lets you experience the simulated gravity of Mars, the moon or even zero gravity. Bob showed a funny video of his experience where he is "flying" around the cabin and even doing backwards somersaults in zero G. The aircraft takes a parabolic flight to simulate zero G. Looks like a lot of fun.

And that was one of the major themes of McDonald's presentation – when will space become available to anyone who would like to go there, not just highly trained astronauts? Bob showed a charming illustration by famous space artist Chesley Bonestell showing a giant space station in earth orbit where people are frolicking about in a circular swimming pool. Are space hotels coming soon? And will a form of "warp drive" be devised that can get us to the planets and stars? Bob McDonald, the avid traveler, would surely like to go.

At the conclusion of Bob's talk several of us relocated to Kelsey's for some food and more astro-conversation. Thank you Bob for a delightful evening!

Treasurer's Report

By Don Pullen

	(Unaudited)		
Cash opening Bala	ance (1 Apr 2009)	\$40	018.34
Expenses		\$	0.00
Revenue		\$	92.00
Closing Balance	(30 Apr 2009)	\$ 4	110.34

Notes:

- Major revenue sources included: Memberships (\$50), 50/50 (\$42).
- No expenses incurred during month of April.



From the Chair

by Steve Germann

The summer star party season is beginning. Last month we published a list of all the upcoming events we knew of. Star parties combine the best of both of the words in their description.

Star means that you can set up your telescope at a dark sky site, and use it as long as you want for each night you are there. Controlled access at the gate usually means your telescope will be safe from pilfering while you are sleeping.

Of course, you need to keep your eyepieces and valuable small parts locked away when you are not using them.

Last year, at Starfest, for instance, i was able to use my telescope each night, although on 2 nights only for a few hours, before or after the clouds. Having the darkest skies means it's now or never for finding the faint fuzzies you might not have tried for back home.

Being at a star party means there are measures to eliminate the night-vision hampering use of campfires, white lights, green lasers, and cars; Your night vision will be at its peak.

In these days of astrophotography, the telescope's light gathering power is augmented by the time exposure method. As a result, astro-photos can detect and image things you cannot see without a camera. Imagine if you will, the pioneers of visual astronomy, in the days before photography. They tried and often succeeded in sketching details of galaxies which we now take for granted. They had the advantage of very dark skies, and probably were also talented people with extra sensitive eyes. You can try your eye on some

faint fuzzies and see how well you would have done 200 years ago.

There are several kinds of cameras, and several kinds of telescopes to attach them to. The simplest viewing aid is the electronic evepiece. Better than a simple webcam, its analog signal can be fed to a TV monitor, and the background glow can be dialed down, so as to see faint objects with the background subtracted. You can also magnify the contrast to get a better view of a faint fuzzy. Using an electronic eyepiece can give you a near-real-time view of the sky with much improved visibility of faint objects. The added bonus is that several people can observe at once.

Another method to improve your view is to 'sharpen your eye'. Sketching celestial objects helps you to appreciate what can be seen compared to what's imagined. By sketching the nearby stars as well, you learn how to estimate angles and relative distances. Also, you can practice the coordination of looking from scope to paper and back.

Of course, no star party would be complete without the astrophotographers, who have come to take advantage of the dark skies for a few frames with high contrast to add to their 'stack'.

Star Party means you will have a chance to look through your friends telescopes, and in general they will be delighted to share the view with you. Most HAA members are 'Owls' who enjoy being up late at night. Here's the perfect place to be up late and not have to justify your schedule.

Party reminds you of all the time when it's cloudy, or there's only one star visible, when you have a

chance to spend time with your friends and acquaintances. In general we share the tasks of preparing food, cleanup, and setup of the dining area, and of course, there are many interesting talks arranged by the party organizers.

This year, Starfest is from August 20-23, but many HAA members choose to go and set up earlier, to benefit from the dark skies and chance to get together. That way we also get our choice of campsites. Last year we had the good fortune to meet Sue French, and Atilla Danko who came to starfest, camped nearby, and shared their stories and advice.

The invited speakers who come to star parties are a real plus, especially if it's raining. Starfest has a big tent for just such an occasion, and one year, they called it 'tarp fest' because of all the rain. Well, that does not happen every year, and chances are that you will be well rewarded by the 2 hour drive to Starfest this summer.

Our club also participates in a few impromptu mini star parties, taking advantage of the new moon to go to places like Cherry Springs State Park. We will be doing the same this May, and those who would like details may contact me. It's a 4 hour drive, but if you stay a few days, it is very rewarding. I would not be surprised if a few of the distinguished speakers invited to other star parties will be there in cognito, but always willing to share stories with their friends.

Gordon's Park on Manitoulin Island also has dark skies and although a bit further, a wide view and friendly staff. Consider attending a star party this year, and see what all the fuss is about.

Astronomy Day by Don Pullen with photos from Ann Tekatch & Don Pullen

The HAA just has completed another very successful International Astronomy Day on Saturday May2, 2009. Despite some clouds. we had pretty 0 0 d g weather for both the afternoon solar observing session, and for the evening Lunar/Saturn public events.

We started the day with an afternoon ses-

sion at the Lakeland Community Centre at the northern end of Confederation Park. We had 5 telescopes set up, ranging from a 40mm Coronado PST, several smallish refractors and reflectors, and an 8" Schmidt-Cassegrain. These gave people a chance to see the Sun in different colours and various features. There had been a small sunspot earlier in the week which had formed, but it had passed around the edge on Friday and was no longer



visible. So for the first hour or so, all we could see was a blank ball. But later a couple of small flares appeared which made things a little more interesting. Steve, Jim, Brenda, Joe and myself enjoyed showing off the sun and explaining what the heck we were doing there near the beach on a nice spring day.

small sunspot earlier in the Somewhere between 30 and 40 week which had formed, but it people strolled or roller-bladed had passed around the edge their way into our viewing area to on Friday and was no longer take a look and see what was go-

ing on. It was a breezy afternoon with lots of clouds, but enough frequent breaks that the wait wasn't too bad and most everyone who stopped got to see the Sun. As much as we regretted the clouds interfering, we were quite happy it wasn't raining. We could see across the lake to Oakville and saw they were getting lots of rain during the afternoon.

I had fired off a last minute email on Friday to some of the media and it resulted in a videographer from CH News coming out and doing a small segment on us. Fortunately it was a quiet news day so apparently we got about a minute of good coverage on the 6pm news.

The evening session at Bayfront Park was even more rewarding. We had about a dozen and a half scopes set up and when you add in the various binos, we had more

than 2 dozen optical instruments thrilling the audience with views of the Moon and Saturn. About 20 members of the HAA were on hand to share their love of astronomy with the public. The variety of tools on display really gave people a chance to see what was available and ask some good questions about the advantages of each. We were able to steer people away from the "bad"

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Astronomy Day (Continued)

(Continued from page 4)

scopes and suggest local places like Camtech or some of the Toronto and Kitchener stores as good places to go to find something affordable with the quality that will allow them

to enjoy the hobby for many years. I thank every one of our members who were there for doing such a good job with the public and representing the club so well. There were a lot of smiling faces Saturday night and an impressive number with a look of amazement.

We "guess-timated" we had about 130-150 people come by to enjoy the show. Some came from as far as Oakville. the Peninsula Niagara area and Waterford (south of Brantford). Many had seen one

of our promotions, but a fair number were just passing through and stopped by to see what was going on. We're not sure on the actual count of people who had a look through a scope or a pair of binoculars. Fortunately we were so busy with the people there, that we didn't often take the time to look

think everyone who had a scope copies of SkyNews which were or bino set up had some crowd at all very much appreciated by one time or another. People were the information hungry crowd. really interested in the different Our thanks to SkyNews for views each of the instruments producing a quality Canadian would provide.

astronomy magazine and supporting the community so well.

As part of the International Year



of Astronomy, SkyNews maga- Towards the end of the night, I zine has been printing extra cop- noticed standing quietly off to ies of each edition and were the side was Steve Ruddick making them available to guali- from CH News with his son. fied groups for free. I had con- Steve had called me earlier in tacted them a couple of weeks the day and had expressed a ago and we were able to get a personal curiosity about asbox in time for Astronomy Day. tronomy and made a point of So in addition to our HAA bro- stopping by. We had a nice chures and Event Horizon newsup and do an accurate count. I letters, were able to give out free

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Astro-Events for 2009

by Don Pullen

For the International Year of Astronomy, the HAA has put together a list of events that either we are sponsoring, or may be participating in over the next 6 months or so. For some of these events, a few HAA members may be participating on their own, or may be going to represent the HAA, such as some of the star parties. And while most of these events are "public" in nature meaning that both public and members are welcome to the activity, some are reserved strictly (indicated) for HAA members only (part of the privileges of membership).

Please note that this list does not include any smaller events that a single individual (or maybe 2) might be undertaking such as camping trips or sidewalk astronomy plans. Please refer to our website for postings of these types of events or changes to any others. *NOTE, Items in italics are for members only!*

Sat May 9 - Binbrook Clean-up Day

May 21-24 - Cherry Springs camping/ observing, PA

Friday May 29th North Shore Erie Amateur Astronomers Star Party Wind-del Community Park

Sat May 30 - Binbrook 50th Anniversary Day, Binbrook

Fri June 5 - Imaging Clinic with Kerry - at Jim's

Fri Jun 12 - HAA June General Meeting **June 18-21** - Cherry Springs Star Party, Cherry Springs, PA

Jul 17-21 - Star-Gazing Manitoulin Tue Aug 11 - Perseids Public Night, Binbrook

Wed Aug 12 -Perseids Members Night, Binbrook

Aug 14-18 - Manitoulin Star Party Aug 20-23 - StarFest - River Place Park, Mount Forest, ON

Fri Sep 11 - HAA Sept General Meeting

Sep 17-20 - Huronia Star Party - Duntroon, near Collingwood **Sep 18-20** - Black Forest Star Party -Cherry Springs PA

Sat Sep 26 - Binbrook/Camtech Star Party, Binbrook

Sat Oct 3 (4) - Burlington Public Night, Burloak Waterfront Park, Lakeshore Dr, Burlington

Fri Oct 9 - HAA Oct General Meeting (Thanksgiving weekend)

Oct 24 - Brantford Public Night, Tourism Centre, Brantford

Astronomy Day (continued)

(Continued from page 5)

chat and I was quite pleased with his interest.

Even though we had planned on staying to 11pm, by 10:30 things were starting to get quiet so we gradually packed up and 6 or 7 of us reconvened at a near-by Tim's to

relax and reflect on a successful day and night. Other members made the long treks home after a great night.

We'd like to extend our thanks to everyone who came out and made this a very worthwhile event. It was great to share



with the Hamilton area once again. I think we did a lot to help promote astronomy and our club to the community. Be sure to keep checking our website for our next public event.

And speaking of "community",

ľm going to use this article selfishly to plug the Binbrook Clean-up Day. On Saturday May 9, we are looking volunfor teers (we have about 10 so far) to come out in the

morning to help with light trail grooming and litter pickup. We are fortunate to have a good relationship with Binbrook Conservation Area and because of this, they allow us to use the park for our club

observing sessions. This is a privilege we have with the park and it's important that we make an effort to help maintain this relationship. They don't have to allow us to use it and we would have to travel much further to find a replacement. So when an opportunity comes along to help a group who helps us, it's important that we make an effort to support them. So I hope some of you will volunteer at the HAA meeting on May 8 to come out and lend a hand. We meet at the park main entrance at about 8:30am and aet started around 9. We'll only need to be there for about 3 or 4 hours, and then we'll stop for a BBQ lunch they'll provide to the volunteers. It should be fun and a rewarding way to help the park which generously supports us.



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Galileo Quotes!

Idea by John Gauvreau

- "You cannot teach a man anything; you can only help him discover it in himself."
- "The Sun, with all the planets revolving around it, and depending on it, can still ripen a bunch of grapes as though it had nothing else in the Universe to do."
- "I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use."

Galileo Galilei (15 February • 1564 - 8 January 1642) was an Italian physicist, mathematician, and philosopher who played a maior role in the Scientific Revolution. His achievements include improvements to the telescope and consequent astronomical observations, and support for Copernicanism. Galileo has been called the "father of modern observational astronomy", the "father of modern • physics", the "father of science", and "the Father of Modern Science". Galileo, perhaps more than

ence". Galileo, perhaps more than any other single person, was responsible for the birth of modern science.

Wikipedia

- "I have never met a man so ignorant that I couldn't learn something from him."
- "In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual."
- "Infinities and indivisibles transcend our finite understanding, the former on account of their magnitude, the latter because of their smallness; Imagine what they are when combined."



EVENT HORIZON

The Sky this Month by John Gauvreau

As this column arrives in your hand this month, at the beginning of the second week of May, the **moon** is full, but riding low in the sky. Although this may not be the kind of full **moon** that looks good in romantic movies, it may allow you to observe a little easier even during these **full moon** times. The **Moon** is new on the weekend of the 23rd and 24th, so be sure to take advantage of the warm weather and dark skies to take on the abundance of deep sky objects that spring has to offer.

Prominent at this time of year is the constellation **Boötes**. Following the curve of the **Big Dipper's** handle leads you to **Arcturus** (Arc to **Arcturus**), the brightest star in this constellation, shining at magnitude 0. The distinctive kite shape of **Boötes** is easy to identify and was one of the first constellations that I learned. **Arcturus** sits at the base of the kite, where you would attach the tail. Leading up the left hand side of the kite from **Arcturus** (the eastern side) the next star is a favourite; **Epsilon Boötes**. Also going by the name **Izar**, this is a very tight but beautiful double star. Only 3 arc seconds apart, this pair will challenge a small telescope, but still shows nicely in my 80mm refractor as a 2nd magnitude yellow star and a 5th magnitude companion star, this I think looks blue. How do the colours look to you?

The evening sky also features the vast constellation **Virgo**, with its abundance of **galaxies** and brilliant star **Spica**. After following the curve from the **Big Dipper's** handle to **Arcturus**, keep going in a straight line to complete both the path to the brightest star in **Virgo**, and the memory aid as well; **Arc to Arcturus**, **Spike on to Spica**.

The now familiar **Saturn** continues to dominate the evening sky, riding below Leo and providing a wonderful telescopic distraction for observers. The **rings** have opened to over 4 degrees, and are as good as they will be this year. Don't miss this showpiece of the sky.

Everyone loves a parade! I don't know where that saying originated, but if ever there was a time for astronomers to adopt it, the month of May is it! Early risers are rewarded with a parade of **planets** across the eastern sky, moving slowly westward, one after another.

Leading the parade (and rightly so!) is grand marshal **Jupiter**, which rises by 1:00 in the morning and so is even observable by those staying up very late.

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The Sky this Month (Continued)

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Before the **sun** rises it is high in the south and blazingly bright. **Jupiter** has always been a favourite of mine, with its own mini parade of satellites, constantly changing from night to night, and its wealth of surface detail, visible in even a small scope. **Jupiter** will be particularly fun to watch this year, since it played such an important role in Galileo's observations, and was featured so prominently in his publication of discoveries, the **'Siderius Nuncius'**.

Right behind **Jupiter** is **Neptune.** In fact, they stay so close to each other this month that you can use **Jupiter** to find **Neptune**. On May 25th, **Neptune** will be less that half a degree above **Jupiter**, making it easy to fit on the same telescopic field of view. If you haven't seen the most distant planet in the solar system, here is a great chance to spot this small blue orb.

Next in line is **Neptune's** sister planet, **Uranus.** They are almost exactly the same size, and yet Uranus is significantly closer to us than **Neptune** is. How do they compare in your telescope? Does **Uranus** look bigger? It's certainly brighter, and so should be easy to locate, even without a landmark (or should that be skymark?) like **Jupiter** pointing the way. While you're there, compare the colours of **Uranus** and **Neptune**. Both are blue, but can you really notice a difference in colour and intensity?

Next on the parade route is **Venus**. At magnitude -4.4, it is the brightest thing in the sky and easy to spot even in the morning twilight (keep an eye on it even after the **sun** rises. If you know where to look, **Venus** so bright that it is visible in the daylight!). Having passed though a crescent phase, **Venus** shows half its disc by the end of this month.

As **Venus** advances higher in the morning sky throughout the month of May, our other neighbour, **Mars** is marching right along with it. Trailing only 5 degrees behind **Venus**, but keeping pace all the month, the **red planet** is only a small disc, 5" across. This means that it is also a lot fainter than **Venus**, struggling through the dawn sky at 1st magnitude. Not to worry though, we take it in this month just to complete our planetary parade. The **red planet** will come in to its glory this winter, when it will dominate the sky and take its role as star of the show.

Finally, the night parade is over, and the lights come on to signal the end of the show, as the **sun** rises and the day begins.

Through the Looking Glass by Greg Emory

With Spring well upon us we are forced, as astronomers, to deal with the increasing hours of sunlight. The shorter nights do have their rewards, how-Several layers less of ever. clothing are required. No drifting or worries about shoveling and accessibility to your favourite site and not the least of

all some amazing skies. The views from the eyepiece can be breathtaking in the spring and summer.

Braving the elements in the winter, or late fall for some viewing has some benefits. The colder weather can make for some excellent skies. On the downside it is cold. In the spring and summer it is common to have hazy skies that offer poor viewing. Some call these skies "soft", not to mention a whole host of other four letter words. These skies tend to be grey instead of black, produce images that are not as sharp and limit the useful magnification that you can reasonably use.

Considering the apparent climate change that we have been experiencing over the last few years, we seem to have what your fellow club member Glenn Muller has previously described as the "Canadian Monsoon Season". Whatever the true underlying cause may be (I still like to blame George Bush the Lesser) we have what for me as the critters moved feels like an increased occur-

rence of storms. I personally take it one step further and say that the number of rain or thunderstorms during or close to the new moon has increased sev-The complete aberal fold. sence of data or evidence of any kind to support my claim is



no deterrent.

So, you find yourself out at the telescope. Apparently your burnt offerings have pleased those in charge of such things and the sky is clear, with little to no humidity. The wind is almost non-existent. Great, can you say black flies? How about mosquitoes? These pesky little critters can cut your time at the eyepiece short if you are not prepared.

There are a few things that work, some better than others. The ultrasonic devices have some success. I was out with a friend of mine who had one of these things. It worked fairly well for him, but wasn't so good away from him and went to the

next warming dish on the buffet...me! The device was not completely ultra sonic and became more aggravating with the growing number of bites.

Skin–So-Soft by Avon, or other natural products containing citronella, lemon balm and the like have mixed reviews from me. They kept the bugs away quite well but could be quite irritating to the skin, or suffered from a rapid drop off in effectiveness. The best, for me, is something loaded with DEET. I can tell you with absolute authority that anytime a Chemist or Chemical Engineer gives something an acronym or a "cutesy-pie" name - it works very well. Think of DDT, TNT, 2,4-D, LSD, Round-Up or Agent Orange. DEET is one of these. Apply it to all exposed skin and your good to go. Be very careful with the stuff. Consider using a latex glove when you go to apply it. This stuff apparently can and will damage optical coatings on your eyepieces.

For those of you that prefer something natural, have concerns about chemical side effects I encourage you to do several things: 1) Stick to your principals, and 2) please observe within 15 to 20 feet of me or someone like me. The best protection from mosquitoes and black flies is to offer them a free meal.

Hmm... almost makes you wish for winter, doesn't it?

E

Astronomy Equipment Through the Ages

More than most hobbies, astronomy is a very equipment intensive hobby. It is somewhat similar to skiing or SCUBA diving in that the you can slide downhill or swim underwater without your gear, but it is a lot more comfortable when the proper equipment is used.

Astronomy too can be done without

equipment. Perhaps the best example of that is observing a meteor shower. All that is required is a comfortable place to sit with a view of the night sky and you can watch meteors to your heart's content.

But to really enjoy the hobby, you need some equipment such as a pair of binoculars or a telescope. However, throughout most of the history of astronomy, optical aids to astronomy were completely unknown.

The history of astronomy optical aids goes back thousands of

years, but it was called astrology before we had any understanding of what we were looking at. People foolishly believed that the stars influenced human affairs here on the Earth. It took a long time before we took a more scientific approach to astronomical observations.

One of the very first tasks that needed to be performed was to map the sky. While many maps had been prepared by astrologers, they were more artistic than accurate. In an effort to create useful maps, you had to have some ability to measure angles in the sky in a way that was repeatable by others.

One of the first instruments to be

used for this purpose is the Quadrant. A quadrant is a quarter of a circle that is attached to two arms. The circle is inscribed with degree marks and you can hold the instrument up to the sky and read off the angular distance between any two points.

By holding it vertical to the horizon,



The astrolabe was a tool used to help map the heavens and for more pedestrian navigation tasks here on the Earth. These simple, yet beautiful instruments are the grandfathers of today's sophisticated optical aids

the sky was divided into 90 degrees. If a star was half way to the zenith, it would be at the 45 degree mark on the circle of the quadrant.

Of course, to be truly useful, the quadrant had to be large because of the limited ability of metalworkers to inscribe small marks on the instrument what would be visible to the naked eye.

This made for a very cumbersome way to measure the sky. As well, it was sometimes difficult to manufacture them so that they had consistent measurements from one instrument to the next. The quadrant was improved by making it smaller as technology advanced and they took

the form of a quarter of a disk with markings and a pointer to sight along.

Another important instrument, developed in 160 BCE by the ancient Greeks, was the astrolabe. The astrolabe was a disk with a pointer affixed to the centre of the disk. The disk had 360 degree

markings around its circumference and the pointer could be moved to point anywhere in the circle.

By holding the astrolabe vertical the pointer could be used to sight objects in the sky. The position could then be read from the dial around the edge of the astrolabe.

The primary use for the astrolabe was in navigation. All of the major explorers - Columbus, Magellan, and Drake all used the astrolabe to guide them on their voyages.

The astrolabe and the quadrant morphed into today's modern sextant used by all mariners before the advent of electronic navigation aids and the skill is still a requirement for advanced sailors. A great deal was accomplished by early astrologers and astronomers as they struggled to make sense of the sky and to map it. Of course it is far easier to do today with all of the modern optical aids that we have today. It is useful, however, to look to the past to appreciate just how far we have come in our quest to understand the stars.



Hubble Constant Value Refined

Whatever dark energy is, explanations for it have less wiggle room following a Hubble Space Telescope observation that has refined the measurement of the universe's present expansion rate to a precision where the error is smaller than five percent. The new value for the expansion rate, known as the Hubble constant, or H₀ (after Edwin Hubble who first measured the expansion of the universe nearly a century ago), is 74.2 kilometers per second per megaparsec (error margin of \pm 3.6). The results agree closely with an earlier measurement gleaned from Hubble of 72 ± 8 km/sec/megaparsec, but are now more than twice as precise.

The Hubble measurement, conducted by the SHOES (Supernova H₀ for the Equation of State) Team and led by Adam Riess, of the Space Telescope Science Institute and the Johns Hopkins University, uses a number of refinements to streamline and strengthen the construction of a cosmic "distance ladder," a billion lightvears in length, that astronomers use to determine the universe's expansion rate.

Hubble observations of pulsating stars called Cepheid variables in a nearby cosmic mile marker, the galaxy NGC 4258, and in the host galaxies of recent supernovae, directly link these distance indicators. The use of Hubble to bridge these rungs in the ladder eliminated the systematic errors that are almost unavoidably introduced by comparing measurements from different telescopes.

Riess explains the new technique: "It's like measuring a building with a long tape measure instead of moving a yard stick end over end. You avoid compounding the little errors you make every time you move the yardstick. The higher the building, the greater the error."

Lucas Macri, professor of physics and astronomy at Texas A&M, and a sig-



NASA, ESA, and A. Riess (STScl/JHU)

nificant contributor to the results, said, "Cepheids are the backbone of the distance ladder because their pulsation periods, which are easily observed, correlate directly with their luminosities. Another refinement of our ladder is the fact that we have observed the Cepheids in the nearinfrared parts of the electromagnetic spectrum where these variable stars are better distance indicators than at optical wavelengths."

This new, more precise value of the Hubble constant was used to test and

constrain the properties of dark energy, the form of energy that produces a repulsive force in space, which is causing the expansion rate of the universe to accelerate.

By bracketing the expansion history of the universe between today and when the universe was only approximately 380,000 years old, the astronomers were able to place limits on the nature of the dark energy that is causing the expansion to speed up. (The measurement for the far, early universe is derived from fluctuations in the cosmic (Continued on page 16)

Hubble Constant Value Refined

(Continued)



(Continued from page 15)

microwave background, as resolved by NASA's Wilkinson Microwave Anisotropy Probe, WMAP, in 2003.)

Their result is consistent with the simplest interpretation of dark energy: that it is mathematically equivalent to Albert Einstein's hypothesized cosmological constant, introduced a century ago to push on the fabric of space and prevent the universe from collapsing under the pull of gravity. (Einstein, however, removed the constant once the expansion of the universe was discovered by Edwin Hubble.)

"If you put in a box all the ways that dark energy might differ from the cosmological constant, that box would now be three times smaller," says Riess. "That's progress, but we still have a long way to go to pin down the nature of dark energy."

was conceived of long ago, observational evidence for dark energy didn't come along until 11 years ago, when two studies, one led by Riess and Brian Schmidt of Mount Stromlo Ob-

servatory, and the other by Saul Perlmutter of Lawrence Berkelev National Laboratory, discovered dark energy independently, in part with Hubble observations. Since then astronomers have been pursuing observations to better characterize dark energy.

Riess's approach to narrowing alternative explanations for dark energywhether it is a static cosmological constant or a dynamical field (like the repulsive force that drove inflation after the big bang)-is to further refine measurements of the universe's expansion historv.

Before Hubble was launched in 1990, the estimates of the Hubble constant varied by a factor of two. In the late 1990s the Hubble Space Telescope Key Project on the Extragalactic Distance Scale refined the value of the Hubble constant to an error of only about ten percent. This was accomplished by observing Cepheid variables at optical wavelengths out to greater distances Though the cosmological constant than obtained previously and comparing those to similar measurements from ground-based telescopes.

> The SHOES team used Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS) and the Advanced

Camera for Surveys (ACS) to observe 240 Cepheid variable stars across seven galaxies. One of these galaxies was NGC 4258, whose distance was very accurately determined through observations with radio telescopes. The other six galaxies recently hosted Type Ia supernovae that are reliable distance indicators for even farther measurements in the universe. Type la supernovae all explode with nearly the same amount of energy and therefore have almost the same intrinsic brightness.

By observing Cepheids with very similar properties at near-infrared wavelengths in all seven galaxies, and using the same telescope and instrument, the team was able to more precisely calibrate the luminosity of supernovae. With Hubble's powerful capabilities, the team was able to sidestep some of the shakiest rungs along the previous distance ladder involving uncertainties in the behavior of Cepheids.

Riess would eventually like to see the Hubble constant refined to a value with an error of no more than one percent, to put even tighter constraints on solutions to dark energy.



The End of the Universe by Tim Philp

By now, most people will have heard of the big bang as the model for the creation of universe. the Sometime. about 14 billion years ago, the universe came into being in a massive expansion of space and time from microscopic size to grow into what we see today. Religious people might say that this is analogous to "Let there be light" in Genesis, however, I take a more scientific view. Regardless, of



The universe is not unchanging. It will evolve over billions of years as it expands. Determining the actual fate of the universe is the province of cutting-edge physics today.

Should this be the case. the expansion would not only continue. but it would start to tear apart first galaxy clusters, then galaxies themselves. It could even go so far as to tear stars and planets apart in a Big Rip that would eventually destroy the universe.

Of course, this is just speculation at this time.

However, if dark energy does not increase with time, only distance, we can expect the universe to continue to expand

how you feel the universe was created, perhaps more interesting is the question of how it will end.

There were three main theories of the end of the universe. First, was The Big Crunch. In this theory, the universe has expanded since the creation event, dubbed the Big Bang by astronomer Fred Hoyle, but eventually, the gravitational attraction of all this mass will inexorably slow this expansion and reverse it. Sometime in the dim distant future, all this matter will come crashing together in a big crunch that, who knows, might spawn a new big bang event.

This was an interesting theory and one that was held by many astronomers and cosmologists; however, in 1998, it was discovered that the expansion of the universe, far from slowing down, appeared to be accelerating! How could this be? Gravitational force only attracts matter, never repels it. Science fiction notwithstanding, there is no such thing as antigravity.

It is at times like this that science becomes exciting. There is no great joy in phenomena that we understand completely, the really exciting stuff is when something happens that we don't understand. It is the exceptions that make new knowledge, not the well-understood stuff.

To account for this expansion, scientists postulated a new force, called Dark Energy. This dark energy acts in opposition to gravitational forces, but only at very long distances. It has little effect over short distances.

If dark energy exists, there are two possible scenarios. First, that dark energy may increase its effect over time and the acceleration may speed up tremendously. As well, it may start to effect matter on a more short distance. forever at ever increasing rates. Eventually, the universe will be so large and the matter so spread out that very little will be seen. All the matter in the universe will be very cold and dark, just fractions of a degree above absolute zero. It would, in effect, be a Big Chill.

There might still be isolated pockets of matter, small galaxies and individual stars that had long since burned themselves out due to lack of fuel, but most of the universe will be a cold, dark emptiness. Not a very satisfactory end, is it? Unfortunately, this scenario is our current best guess for how the universe will end.

Of course, I would not start thinking about taking out 'End of the Universe' insurance just yet. The events I am talking about will not take place for billions, if not trillions of years from now. Humans will no longer exist... nor will insurance companies. See, some good will come of the end of the universe!



This presentation, the latest offering from the Origins Institute of McMaster University, occurred at 8:00 PM on March 26 in the Michael DeGroote Centre at McMaster University.

Exoplanets of all 'species' are the rage in astronomical research, at present. It was no accident, therefore, that Room 1305-7 was packed to more than 7/8ths full. However, the author notes that only three other HAA members, plus two of John Gauvreau's astronomy course students, besides himself, were token representatives the from all of the amateur contingents in this area, in attendance. This was surprising, given that some of these local amateurs are also supposedly involved in exoplanet studies! Dr. Seager is the "Dr. Harry Lyman Hooker Distinguished Visiting Professor" at McMaster. Her background is "Ellen Swallow Richards Associate Professor of Planetary Sci-

ence" and Associate Professor of Physics at MIT. Before that, she was on the senior research staff at the Carnegie Institution of Washington for four years, preceded by three years at the Institute for Advanced Study in Princeton, New Jersey. She earned her doctoral degree at Harvard and her math and physics BSc at the University of Toronto. In 2007 she won the "Helen B. Warner Prize" from the American Astronomical Society.

Those of you not in attendance missed a great presentation. She had already given several technical lectures to the McMaster Department of Physics and Astronomy earlier in that week. This one was a general summary of methodology and findings to date, in exoplanetary science.



Her research is in building theoretical models of atmospheres and interiors of all types of exoplanets. She has brought in many new ideas to exoplanet characterization and the detection of their atmospheres. A team, of which she was a member, co-discovered the first findings of light emitted from an exoplanet and a spectral signature of one.

Her talk focused on the difficulties aliens would have locating Earth and determining if it was hospitable to life. This set the framework for the rest of the talk which was how difficult this work is for us and how we go about getting around those difficulties. To date, we have found over 300 'planetary' bodies beyond our solar system. They range in size from greater-than-Jupiter giants to multiples-of-Earth.

They orbit their respective stars anywhere from ellipses of ~4hours to distances beyond Pluto from the sun.

Dr. Seager made the audience very aware of the difficulties of travelling to any 'exoplanet earths', given the vast distances and the 'slowness' of light, even if we could approach that velocity.

Detection focuses on fortuitous transits, light curve variations and the 'wobble' method (where a star and it's planet both orbit a common focus and the star is seen to shift slightly back and forth). Given our present technology, it is likely we will confirm a 'real earth' finding in less than 25 years and probably less than 3!

Dr. R. Pudritz was in charge

of the proceedings and gave those people who wanted to leave right after the lecture a chance to go before he opened up the Q&A period. The audience had obviously been very stimulated by Dr. Seager's talk as evidenced by the number and variety of interesting questions. After this was finished, she entertained more questions from the front of the hall.

It would have been good to have seen more HAA membership present. Hopefully, it will keep itself more aware of future Origins Institute lectures.



Spotting volcanic eruptions, monitoring the health of pinpointing crops, distress signals for search and rescue teams.

It's not what you might expect from a satellite. weather But these are just a few of the abilities of NOAA's newest polar-orbiting weather satellite, launched by NASA on February 6 and turned over to NOAA for full-time operations on February 26.

Formerly called NOAA-N Prime and

last in its line of weather satellites that stretches back almost 50 years to the dawn of the Space Age. Over the decades, the abilities of these Television Infrared Observation Satellites (TIROS) have gradually improved and expanded, starting from the grainy, black-and-white images of Earth's cloud cover taken by TIROS-1 and culminating in NOAA-19's amazing array of capabilities.

"This TIROS series has become quite the Swiss army knife of weather satellites, and NOAA-19 Tom Wrublewski, NOAA-19 Satel-Center in Greenbelt, Maryland.

The evolution of TIROS began in 1998 with NOAA-K. The satellites



The new NOAA-19 is the last and most capable in the long line of Television Infrared Observation Satellites (TIROS).

now renamed NOAA-19, it is the have carried microwave sensors that can measure temperature variations as small as 1 degree Celsius between Earth's surface and an altitude of 40 kilometers-even through clouds. Other missions have added the ability to track large icebergs for cargo ships, monitor sea surface temperatures to aid climate change research, measure the amount of ozone in Earth's protective ozone layer, and even detect hazardous particles from solar flares that can affect communications and endanger satellites, astronauts in orbit, and city power grids.

is the most capable one yet," says NOAA-19 marks the end of the TI-ROS line, and for the next four years lite Acquisition Manager at it will bridge the gap to a new series NASA's Goddard Space Flight of satellites called the National Polar -orbiting Operational Environmental Satellite System. NPOESS will merge civilian and military weather satellites into a single system. Like

N O A A - 1 9 , NPOESS satellites will orbit Earth from pole to pole, cirplanet cling the roughly every 100 minutes and observing every location at least twice each day.

NPOESS will have yet more capabilities drawn from its militarv heritage. Dim-light sensors will improve observations of the Earth at night, and the satellites will better monitor winds over the ocean - important information for ships at sea and for

weather and climate models.

"A lot more capability is going to come out of NPOESS, improving upon the 161 various environmental data products we already produce today," Wrublewski says.

Not even a Swiss army knife can do that many things, he points out.

For more on the NPOESS, check out http://www.npoess.noaa.gov. Kids can find out about another NOAA satellite capabilitytracking endangered migrating species—and play a fun memory a t http:// qame spaceplace.nasa.gov/en/kids/ poes_tracking.

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



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The Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA) The HAA is an amateur astronomy club, for people of all ages and experience levels, dedicated to the promotion and enjoyment of astronomy . The cost of the subscription is included in the \$25 individual or \$30 family membership fee for the year. Event Horizon is published a minimum of 10 times a year.

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Next Meeting

Friday, June 12th, 2009

7:30 PM @ The Spectator

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Binbrook Conservation Area... Come out observing with other members and see what a great location this is for stargazing, a family day or an outdoor function. Please consider purchasing a season's pass for \$70 to help support the park. www.conservation-niagara.on.ca/conservation_areas/ binbrook/binbrook.html (905) 692-3228

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