Hamilton Amateur Astronomers

Event Horizon

May 2002 Volume 9 Issue 7

Saving Private SID *by Doug Welch*

Don't ever believe it when someone tells you that a project is easy to build - requiring only an afternoon and a few chips (the semiconductor kind)! Still, I have always wanted to build a monitor for solar activity and a receiver for Sudden Ionispheric Disturbances (SID's) seemed like just the thing. Casper Hossfield of the American Association of Variable Star Observers (AAVSO) published a circuit which contains one op-amp chip, a few resistors and capacitors, a wire loop and some batteries. It looked simple enough that even I might be able to build it!

The Beginning stage

First, lets step back and describe a little bit of how this all works. For instance, what is "ionization"? That is pretty easy to explain - when an atom or molecule receives enough energy in a collision or from high-energy light (like ultraviolet), an electron can no longer stay bound to the system. A spark is ionized air molecules. A lightning bolt is ionized air molecules. Near the earth's surface, the air stays mostly neutral. However, if you go up many kilometres into the atmosphere, it becomes more and more ionized. This is partly due to cosmic rays - high-energy particles from violent places in the universe - but, during the daytime, it is also due to ultraviolet light breaking apart molecules and freeing electrons.

The Form

That is the status quo. What is the "disturbance" part and why is it "sudden"? It turns out that when there is a flare on the surface of the sun visible to the earth, it suddenly changes the level of ionization in the ionisphere - which affects radio wave propogation at low frequencies. Throw in a distance, constant source of radio frequency power at low frequencies, and then your receiver can monitor the state of the ionisphere by watching how the *received power* changes with time.

cont'd on page 6 ...

Chair's Report

There must be an alignment of the planets or something - it has been clear two months in a row now on our Binbrook observing session nights! This could end up being a great season!

Summer is fast approaching - although perhaps not fast enough - and that means STAR PARTIES. Practically every new moon weekend has a star party within reasonable driving distance. The "biggie" is still StarFest which will be August 8-11 this year. The HAA always shows up in force for that. The NYAA, who run StarFest, seem to have some sort of deal with the weather gods - it is almost always clear and very nearly bug-free. (I expect that you don't want to know the details of that deal - it probably involves sacrificing refractors or something.) For more information on StarFest, see: `http://www.nyaa-starfest.com/starfest/2000s/2002/`

SkyNews has a website listing of Canadian star parties for the summer of 2002. "Gateway to the Universe" is on July 12-14 up near North Bay. The "Great Manitou Star Party" - which has perhaps the darkest skies of the bunch - follows immediately after StarFest. It runs from August 12-18. Finally, the "Huronia Star Party" is September 5-8 near Alliston, Ontario. More info on all of these, and others, can be found at:
`http://www.skynewsmagazine.com/pages/starpy.html`

Star parties are a great chance to relax with other kindred spirits. It is also nice to get a chance to look through a wide variety of telescopes - some of them very large - without having to buy them! If you are in the buying mood, many vendors have booths at these events and frequently the items are somewhat discounted.

I look forward to seeing you all out under some clear, moonless sky this summer. And, of course, we will be looking for opportunities to do other interesting things as a club this summer, too.

by Doug Welch

Doug Welch is the current chair of the HAA and also a founding member. You can find out more about Doug at:
`http://www.physics.mcmaster.ca/people/faculty/Welch_DL_h.html`

HAMILTON AMATEUR ASTRONOMERS

Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA).

The HAA is an amateur astronomy club dedicated to the promotion and enjoyment of astronomy for people of all ages and experience levels.

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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Ask the Experts

If you have any questions about astronomy we have experts in the following fields that are ready to answer your questions; galactic astronomy, astrophysics, stellar physics and variables, astrophotography using emulsion/print film, polar-aligning an equatorial mount, scanning photos and image processing.

Send in your questions to editor@amateurastronomy.org

Q. Astronomers have recently been discovering many planets orbiting distant stars, why have no new planets been discovered beyond Pluto in our own solar system? Also, I've heard that Pluto is not really a planet, what does that mean?
Questions by Derek Kostelnik

A. The answer used to be that we could not quite be sure that there were not any other planets beyond Pluto because we did not have sky surveys that went deep (faint) enough to pick up such an object. But because there are no unexplained perturbations (anomalous motions) in the orbits of Pluto and Neptune (at least, none that you could not attribute to errors in measurement), it was known that such an object would either have to be very far away or else very small. Modern, deep, sky surveys confirm this. And our current understanding of how planets are formed suggest that building a planet, via accretion, at such a large distance would be difficult to accomplish (partly because this process is inefficient at that distance and partly because there probably was not enough material to accrete at that distance in the proto-solar gas cloud). But this leaves us with the possibility that there is either a large, far away planet or smaller, closer ones. Let's examine these two possibilities.

If a large planet were to orbit at a relatively great distance from the Sun, it would therefore, gravitationally, be only loosely bound to the Sun. Over the lifetime of our solar system, such a planet could easily have been "lost" due to the gravitational influence of a passing star. Or, if the orbit had been the least bit unstable, it would have been flung out. It is therefore not surprising such a planet does not exist. (Or, it's so far away that it has not been found yet.)

At the other end of the size scale, it turns out we do have lots of smaller objects orbiting around the Sun beyond Pluto. One such class of objects has been known for some time: comets. It is thought that millions of such comets orbit well beyond Pluto in the "Oort cloud" (named after the astronomer who proposed its existence). On occasion one of these comets will head in towards the Sun near our part of the solar system, where we get to see it for perhaps a few weeks after it floated around in the Oort cloud for billions of years. Depending on the inbound path, any such comet will either follow a hyperbolic path (which means it will come toward the Sun once and then leave our solar system) or fall into a highly elliptical orbit and thus have a very long period (measured in thousands of years). But these aren't very planet-like.

More recently (since 1992) we've also become aware of another class of objects in the so-called "Kuiper belt" (also named after the astronomer who proposed its existence). These minor planets, or asteroids, can be quite large - a very recently discovered one is thought to be about half as large as Pluto. It would seem to me that it is just a matter of time before we find one that is in fact bigger than Pluto. We have not yet found a large number of them (500 to-date) and so we do not completely know how to characterize them, but their orbits and other characteristics are such that Pluto is starting to look simply like the largest (for now) and closest such Kuiper belt object (KBO). As a consequence, the more common term for these objects is now Trans-Neptunian Object (TNO).

Thus the debate has recently become: is Pluto really a planet? I do not know nor do I think it's really that important. But here are some things to ponder. All the outer planets (Jupiter and beyond) are gas giants, except Pluto and it is a solid object like the other TNOs. Pluto has a very low density compared to the other inner solid planets (e.g., Earth and Mars), but a density similar to other TNOs. Pluto's orbit is very odd in comparison to the other planets, perhaps because it was "captured" from the Kuiper belt. That is, its orbit is much more elliptical than those of other planets and, in fact, it's orbit crosses Neptune's - thus it isn't even always the planet furthest from the Sun! Pluto does have a moon, Charon, like the inner planets, but it's huge in comparison to Pluto (approximately 50% it's size) - almost like a double planet. (It's discovery allowed us to establish Pluto's low density - before that it had been thought to have a much higher density.) We are increasingly discovering that minor planets are double - that is, being double (or having a moon - depending on how you see it) does not mean it's a planet.

So, to summarize and answer your question: we have in fact found large numbers of planets beyond Pluto - minor planets, that is. *Answers by Tom Steckner*

Q1. How were the rings of the planet Saturn formed?

Q2. Why is there more than one ring?

Q3. Also, I have heard that one or more of the rings is 'braided.' Why is this?

Q4. I heard Ivan Semeniuk say that the rings will not be there forever what will happen to them?

Q5. Also, why are the recently discovered rings of the other planets so much less prominent than those of Saturn? *Questions by Brian Chire*

A. First, let's start with some basic information about Saturn's rings. We know that Saturn's rings are made up mostly of water ice particles ranging in size from dust sized to tens of meters in diameter with most being about the size of snowballs. The particles are kept in line around Saturn's equator by its gravitational field. The rings are only about 1 kilometer thick but hundreds of thousands of kilometers wide.

There are three theories to explain how the rings formed:

1. The rings consist of material leftover after the planet formed.

2. A nearby moon was smashed to bits by an incoming comet or another moon or it strayed too close to Saturn and was torn to bits by tidal forces.

3. A comet strayed too close to Saturn and was torn apart by tidal forces.

The first theory has largely been abandoned because the rings would have vanished in the time since the solar system formed. Collisions among the particles rob them of energy and they gradually fall into the planet.

The "smashed moon or comet" theories seem the most promising, but no one yet knows exactly what formed the rings.

Saturn has many rings. Two gaps are visible from earth: the Cassini Division and the Encke Division. The Cassini Division is caused by a resonance with Saturn's moon, Mimas. Particles at the distance of the Cassini Division travel once around Saturn for every two times that Mimas orbits the planet. This means that Mimas' gravity tugs on these particles at exactly the same point in their orbit every other time Mimas orbits Saturn. The effect of these cumulative tugs is to clear the Cassini Division of most ring particles.

The Encke Division is caused by the presence of a moonlet embedded in the gap. The moonlet is thought to be 5 kms. 10 kms. in diameter and it sweeps up any particles in its orbit. (Moonlets are small enough that they can withstand the tidal forces that would rip apart larger objects at this distance from Saturn.)

The narrow and "braided" F ring is formed by two shepherding satellites (very small moonlets) orbiting Saturn on either side of the F ring. Their gravitational influence prevents this band from spreading out. The kinky, braided appearance of the F ring may be due to the fact that the two shepherding satellites have different and eccentric orbits.

These three mechanisms are repeated to various degrees throughout the ring system, resulting in many smaller rings and ringlets.

As I mentioned earlier, Saturn's rings are not forever. As the particles within the rings collide with one another, they lose energy and slowly sink closer to the planet until they fall into it. If new material is not available to replenish the rings, they will eventually disappear.

Saturn's rings are impressive because they are very bright and large. The other planet ring systems contain less and darker material than Saturn's rings, so they're not as prominent. *Answers by Ann Tekatch*

If you have the answers to the following questions then please send them into `editor@amateurastronomy.org`

I have heard that the "black holes" found in the universe are supposed to be the densest possible concentration of matter - so dense that they are said to "suck in" all matter that comes into their gravitational force. In popular thinking one hears that these black holes could theoretically "pull" something/someone (like a space ship) into a different part of the universe. What is the thinking behind that kind of speculation? *Question by Tom Chire*

I have heard the term 'antimatter' used a lot lately. Please explain what this is. Where is it found and how was it discovered? Can we see it? What does it behave like? What is its significance? *Question by Tom and Brian Chire*

AstroBargoon for HAA Members!

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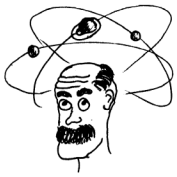
If more people sign up for enewsletters, we may save enough to allow us to cut membership fees!!!
To add your name to the growing enewsletter list, please email me: tekatch@sympatico.ca
Ann Tekatch

Planetary Mnemonics



Everyone seems to have their own way to remember the names of the planets in order from the Sun to the edge of the known solar system. Here are a few from the April meeting and it's concluding beer fest:

- My Very Educated Mother Just Served Up Nine Perogies
- Mary's Violet Eyes Make John Sit Up Nights Proposing
- Man Very Early Made Jars Stand Up Nearly Perpendicular
- And for the visual learners; ☿(Mercury), ♀(Venus), ⊕ (Earth), ♂(Mars), ♃(Jupiter), ♄(Saturn), ♅(Uranus), ♆(Neptune), ♇(Pluto)

Do you have a special way to remember the names of the planets? send them in and I'll put up a list of them in next months edition.
You can find many more mnemonics on the web at:

- http://www.frii.com/~geomanda/mnemonics/astronomy.html
- http://www.cmnh.org/education/teacher-guides/solarsystem.html

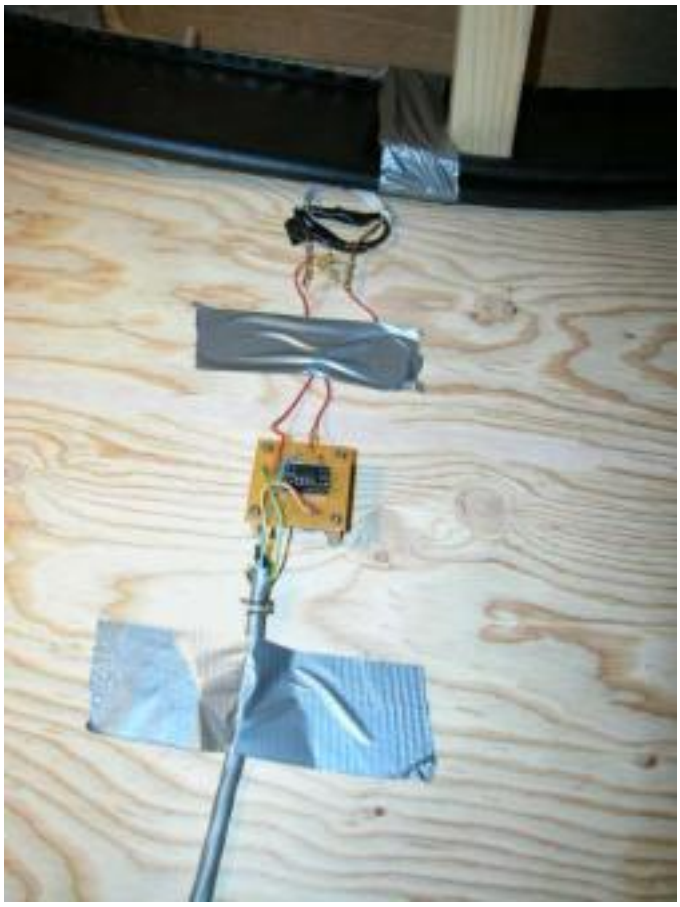
... cont'd from page 1

The Coil

The distant, constant source of power is interesting all by itself. The main reason such transmission facilities exist is to communicate with nuclear submarines at great depths under water! Regular (higher frequency, shorter wavelength) radio waves will not penetrate the salt water surface for any significant distance. However, in the VLF (Very Low Frequency) and ELF (Extremely Low Frequency) parts of the radio spectrum, it is possible for submarines to receive at all ocean depths.

The Serial circuit

The mother-of-all VLF stations is NAA, operating at 24.0 kHz from Cutler, Maine. From Hamilton, it is about 1000 km away at an azimuth of 77 degrees east of north. It radiates 1 million Watts at this frequency! The wavelength of a 24.0 kHz radio wave is 12.5 kilometres!!



The Preamp

To receive the signal, the important issue is the antenna. I am using a 1.5m loop of 24 turns of 14-gauge wire (shown in the picture). The wire I am using is used for circuits inside houses and so it is quite cheap! I started by buying three 2x1's and cutting them to size (1.5m = 59.0 inches). I then drilled holes in their centers and attached them together with a carriage bolt and nut. After splaying out the 2x1's so that the ends were 60 degrees from each other, I wrapped a piece of plastic lawn edging around them and fastened it with screws to the ends of the 2x1's. Next, I took the 2-conductor-plus-ground wire and wrapped 8 turns around the lawn edging. Once I had completed eight turns, I brought the cut ends back together and stripped off the insulation for two or three inches. I then spliced the ground wire of one to the white wire of the other end, then took the other end of the white wire and spliced it to the end of the black wire. Once done, I had effectively one wire making 24 turns!

The Whole system

The next trick is to pick a set of capacitors to cause the loop to resonate at 24.0 kHz. I'll talk about how I did that next time. If you want to read ahead and check out some background and what other people have done, here are two good links:

`http://www.aavso.org/committees/solar/sid.stm`
`http://moondog.astro.louisville.edu/info.html`

by Doug Welch

Doug Welch is the current chair of the HAA and also a founding member. You can find out more about Doug at: `http://www.physics.mcmaster.ca/people/faculty/Welch_DL_h.html`

Books

amazon.com

The web site has a new section for member recommended books.

- 15% of the cost of the books featured here will be given to the Hamilton Amateur Astronomy club (only if "Add to Cart" is clicked as soon as you get to the Amazon site)
- Also, 5% from **anything** ordered from Amazon when you "click through" to a purchase using the banner at the bottom will be given to the club to help keep membership fees low.

Here are some books recently recommended by fellow HAA members.

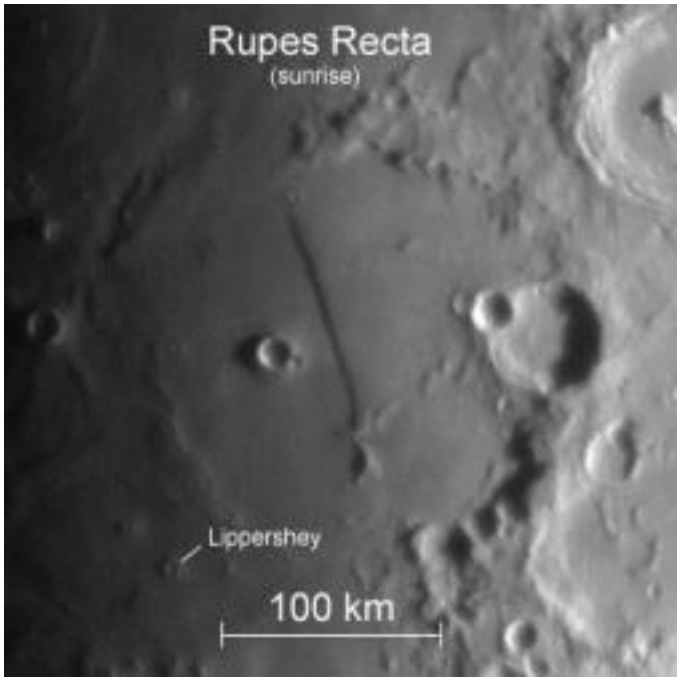
- The Great Atlas of the Stars by Serge Brunier
- Find the Constellations By H.A. Rey
- Nightwatch : A Practical Guide to Viewing the Universe By Terence Dickinson

Please send your recommendations along to `webmaster@amateurastronomy.org`
Visit `http://amaetuerastronomy.org/books`

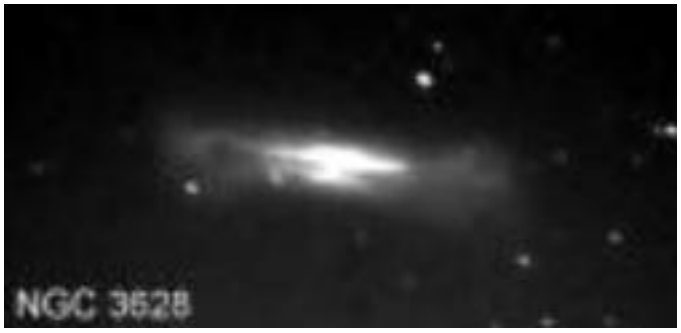
WebWatch

Contributed by Ann Tekatch
Here are a couple of excellent links:
AAVSO (American Association of Variable Star Observers) `www.aavso.org`
ALPO(Association of Lunar and Planetary Observers) `www.lpl.arizona.edu/alpo`

Photos by Bob Botts



Here's an image of Rupes Recta (the straight wall) taken at sunrise (sunrise for Rupes Recta is at first quarter). The small crater 'Lippershey' is named after Jan Lippershey, who is credited with the invention of the telescope.



NGC3628 is the third member of the Leo trio, (the others being M65 & M66).
See more at `amateurastronomy.org`

Moon Hoax debunking
Are you still wondering if we landed on the moon? This website is dedicated to dispelling the myths. `http://www.redzero.demon.co.uk/moonhoax/`

Photo by Stewart Attlesey

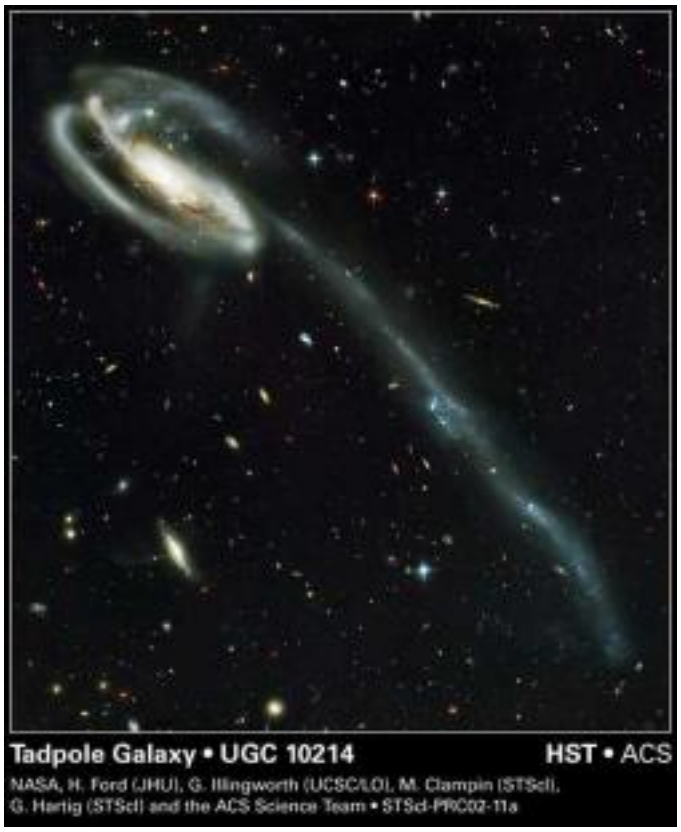
This was taken on May 4, 2002 at the HAA Observatory in the Binbrook Conservation Area park. See more detail at `amateurastronomy.org`

Photo by Bob Christmas

This is Comet Ikeya-Zhang as it appeared on the evening of April 3, 2002, from north of Burlington, Ontario. This is a combination of enlargements of two photos taken with a 50mm lens at f/2.8 on a fixed tripod, one for 10 seconds and the other for 20 seconds. The fuzzy oval just to the right and below the head of the comet is the Andromeda Galaxy. Both were easily visible in binoculars.

Doug Welch's suggestions:

New Hubble Space Telescope images and stories at SPACE.COM. Many of these images are suitable for computer desktop wallpaper



http://www.space.com/scienceastronomy/astronomy/hubble_acs_020430-1.html

June 2002

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 **Observing Night**
2 GRS 2:01am 9:53pm	3	4 GRS 3:40am 11:32pm	5	6	7 GRS 1:11am 9:03pm **Observing Night**	8 **Observing Night**
9 GRS 2:51am 10:42pm	10 Annular solar eclipse, centered on 23:44 UT and visible at sunset just south of Puerto Vallarta, Mexico.	11 GRS 4:30am	12 GRS 12:21am 8:13pm	13	14 GRS 2:01am 9:52pm **Observing Night** **HAA General Meeting**	15 **Observing Night**
16 GRS 3:40am 11:32pm	17	18	19 GRS 1:11am 9:03pm	20	21 GRS 2:50am 10:42pm	22
23 GRS 4:29am	24 GRS 12:21am 8:13pm	25	26 GRS 2:00am 9:52pm	27	28 GRS 3:39am 11:31pm	29
30		GRS: Jupiter's Great Red Spot visible at night. Eastern time is used.	For observing info, call Stewart Attlesey 827-9105, Rob Roy 692-3245, Ann Tekatch 575-5433			

May 2002

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July 2002

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