

# Event Horizon

November 1997

Volume 5 Issue 1

## Seventeen and Counting: Two New Uranian Moons Discovered!

It's been almost fifty years since the last ground-based discovery of a moon around Uranus in 1948. Now, during a single observing run astronomers have discovered two new moons around the giant planet!! The group of astronomers, including McMaster's own J.J. Kavelaars (January's HAA speaker) have reported the discovery of two new, irregular Uranian moons using the Hale 5-metre telescope at Palomar. Previously, fifteen Uranian moons had been identified, five observed from the ground and ten more by the Voyager space-craft in 1986.

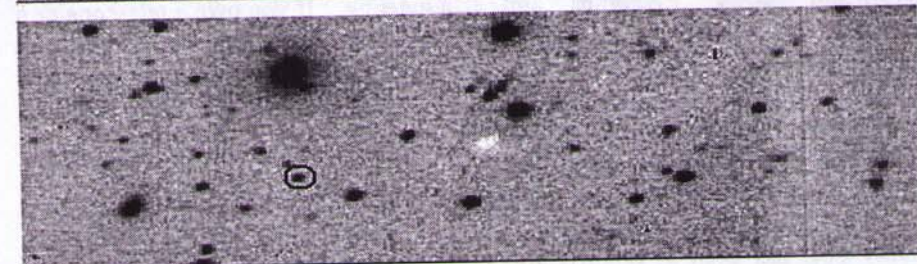
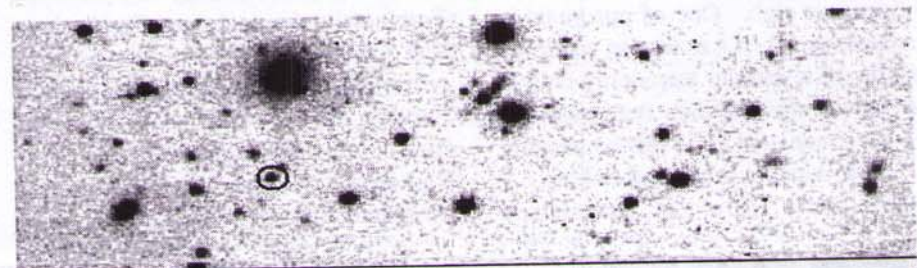
The moons have been classified as irregular satellites due to their highly inclined and eccentric orbits about the planet. The orbits of the other fifteen Uranian moons, like our own, are equatorial and lie within twenty-three Uranian radii of the planet. In contrast, the new moons lie at 200 and 300 Uranian radii. The discovery of irregular satellites is not new to solar system astronomy; the eight outer moons of Jupiter and one moon of both Saturn and Neptune are irregular. However, these are the first to be found around Uranus.

By assuming the satellites reflect 7% of the incident sunlight (the so-called *albedo*) astronomers have

estimated the size of the moons to be approximately 160 km and 80 km. They are, presently, the faintest moons that have been observed from the ground. Their strange orbits, coupled with their small size, has lead the group to suggest that they are asteroids, captured by

Uranus early in the Solar System's life. The larger of the two appears red in colour, suggesting it is made of hydrocarbons (organic molecules).

Possibly the most exciting aspect of  
(Continued on page 3)



The discovery images of the brighter of the two moons (circled) taken at the Hale 5-metre at Palomar.

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# Editorial

It's a new year with lots of familiar faces and some new ones too. This is my first issue of the *Event Horizon* as the new editor. Stewart has done a superb job over the past two years and deserves a break, but he'll be tough act to follow.

Of course, it was impossible not to include an article on the fantastic discover of the two new moons around Uranus especially since the team included astronomers from Canadian Universities. In fact, J.J. Kavelaars (one of the discoverers) is the latest edition to the McMaster astronomy group right hear in the Steel City, and will be our speaker in January.

You will also find the financial

statements for the past year included in this issue, assembled by our Treasurer Barb Wight. It's obvious that you don't need high membership fees to keep an astronomy club running (and running well), just some imagination!

I will try to keep the *Ask the Expert* column going but to do that I need questions! If you're wondering about something, chances are other people are wondering too so don't hesitate to ask.

I'd like to thank all the authors for sending in a great bunch of articles. I'm looking forward to a year of issues packed with great astronomy!

Tracy Webb  
webb@physics.mcmaster.ca

## Chair's Report

I find it hard to believe that the HAA is starting its fifth year. It doesn't seem so long ago that a group of us got together in Doug Welch's living room to form our club. One of our goals in establishing the HAA was to offer the benefits of a premier astronomy club at the lowest membership fees possible. We have managed to do this be keeping our costs down and by fund-raising. A steady cash flow is maintained throughout the year by hosting planetarium shows. Another, and perhaps the most important, reason for starting this club was to have fun. Whether it's a club observing night at the Binbrook Conservation Area or a public star party, we always enjoy getting together and sharing the night sky. From our beginning, the HAA's primary goal has been to promote the enjoyment of astronomy. We should all be proud to be a part of the largest independent Canadian astronomy club! If you have any questions, suggestions or even complaints about the club, send any of the councillors e-mail, give us a

call or see any of us after a meeting. The whole idea of an astronomy club is to share ideas and experiences.

Fortunately, the energy and enthusiasm that founded the HAA continues to be renewed as new people join the council. Serving on the council isn't the only means of contributing to our club. Perhaps you have an idea for a newsletter article? We would all enjoy seeing your slides or new equipment at a meeting. If you own a telescope or a pair of binoculars, you could share your observing experiences with us. The more you put into the HAA, the more enjoyment you'll get from it.

Finally, I would like to welcome all the new members of our full and very capable Council. This can be one of the most enjoyable aspects of our club.

Don't forget to renew your Membership!

Stewart Attlesey  
attlesey@interlog.com

# HAMILTON AMATEUR ASTRONOMERS



**E**vent 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 \$15 individual or \$20 family membership fee for the year. Event Horizon is published a minimum of 10 times a year.

### HAA Council

Chair	Stewart Attlesey
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Education Dir.	Grant Dixon
Obs. Dir	Tony Wallace
Editor	Tracy Webb
Membership Dir.	Martha Milkeraitis
HAAJ Coord	Rosa Assalone

### Councillors

Ann Tekatch  
Rob Roy  
Ray Badgerow  
Doug Welch

### Web Site

<http://www.science.mcmaster.ca/HAA/>





## Monitoring Geomagnetic Activity

After October's general meeting, we were treated to a spectacular display of northern lights. This was surprising to me, given that sunspot counts were quite low at the time. I know that sunspots do not cause auroras (aurorae??), but I've always felt that sunspot activity was a good general gauge of solar activity. (i.e. The more sunspots there are, the more active the sun.) And, as we all know, the more active the sun is, the more likely we are to have the necessary charged particles thrown at us that create the aurora borealis.

In the two weeks before our November meeting, I had been reading reports on the internet of magnificent solar events that were guaranteed to cause the most outstanding auroral activity since the late '80's and very early 90's. Each clear night during these two weeks, I've been monitoring the northern sky for the anticipated "display of the decade", only to be greatly disappointed. Despite the furious activity on the sun, we haven't had the expected displays of aurora borealis.

I am annoyed but undaunted. My camera is loaded with the appropriate film and I'm ready to escape to the nearest dark skies at a moments notice. All I need is a decent aurora forecast!

Before the internet became the accessible and vast resource it is today, we monitored solar activity by counting sunspot groups and listening to WWV (Colorado) on the short wave radio. Every hour, at 18 minutes past, the Space Environment Services Center broadcasts a 45 second bulletin called the "Geophysical Alert Broadcast". The bulletin describes conditions for the past 24 hours, the present, and forecasts conditions for the 24 hours using a number of indices. I have found the forecasts near the end of the broadcast to be the most useful for predicting geomagnetic and auroral activity. They describe whether the geomagnetic state will be

quiet (no aurora) to severe storm (duck!!) and they were very reliable in helping me plan when to grab the camera and head for the dark skies during the last solar maximum.

I also recommend the terrific article by David Rosenthal in the February 1990 issue of *Sky & Telescope* that describes what all the Geophysical Alert Broadcast indices mean. Check out the October 1989 issue of *Sky & Telescope* if you want to try and build an "aurora alarm" (magnetometer).

If you would like to become a dedicated aurora hunter, tune your short-wave radio to 2.5, 5, 10, or 20 MHz at 18 minutes past the hour and listen to the alerts. Monitor WWV and keep a very close eye on the northern sky whenever a major or severe storm is forecast. Make sure your camera is loaded with slide film (not print - you'll want to share your photos with all the rest of us at a meeting, of course!). Find a spot that's relatively close to home and that has a clear and acceptably dark northern sky. (You don't want to have to go driving all over the place looking for a suitable site during the aurora!). Be prepared.

I just know that the "display of the decade" is going to happen any minute now ....

"Aurora Annie" Tekatch



## Uranian Moons ...

(Continued from page 1)

this discovery is the expectation of additional moons of this type around Uranus. Only four regions of space surrounding Uranus (North, East, South and West of the planet) were imaged and two moons discovered, implying these objects are much more common than expected!

The satellites are, as yet, unnamed. Planetary satellites are traditionally named after heroines from Shakespeare or Pope. The official suggestion for the faint moon is *Caliban*, a dark and disfigured character from the *Tempest* while the bright moon is presently being referred to as *Squeaker*, the name of one of the team member's cat.

More information and images of the moons can be found at

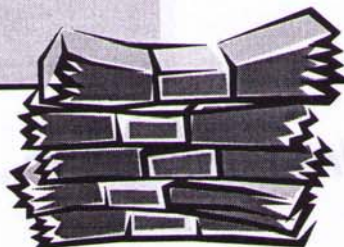
<http://www.physics.mcmaster.ca/Uranus/index.html>

### Discoverers

- Brett J. Gladman, Canadian Institute for Theoretical Astrophysics, University of Toronto
- Philip D. Nicholson, Cornell University
- Joseph A. Burns, Cornell University
- J.J. Kavelaars, McMaster University

- Tracy Webb





# Financial Statement

## BALANCE SHEET AS OF OCTOBER 31, 1997

### ASSETS

	Oct-31 1997	Oct-31 1996
Bank	1641	2019
Investments	4000	2000
Accounts Receivable	0	146
Inventory	288	308
Prepaid Expenses	<u>70</u>	<u>63</u>
<b>Total Assets</b>	<b>5999</b>	<b>4536</b>

### LIABILITIES

Deferred Revenue	525	455
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### EQUITY

Opening Balance	4081	2317
Current Year	<u>1393</u>	<u>1764</u>
Closing Balance	<u>5474</u>	<u>4081</u>
<b>Total Liabilities and Equity</b>	<b>5999</b>	<b>4536</b>

Prepared by Barbara Wight, Treasurer

## INCOME STATEMENT

## Treasurer's Report

It's that time of reconciliation again. With the completion of another year of the existence of the HAA, the books must be closed to prepare for a new year. As you can see from the financial statements I have prepared, we had another good year. The support of the membership and the efforts of the Public Education program under the direction of Grant Dixon are the reasons for our success. The revenue from the planetarium shows has allowed us to invest another \$2,000 into a GIC.

I will be available for any questions regarding the statement at the November meeting, and will request acceptance from the membership.

- Barbara Wight

## The Pacific Observatory

Ken Hewitt-White, writer and cohost of *Discovery Channel's* "Cosmic Highway" will be speaking at Brock University on Saturday, November 22nd at 7:30 p.m. In a presentation featuring original video footage not seen in the television series he will be describing the world of modern astronomy.

Tickets are \$7.50 and can be obtained from the Centre for the Arts box office at Brock University (905-688-5550 ext. 3257) or at the door. Doors open at 7:00 p.m.

Hosted by the Pacific Observatory  
saturn@itcanada.com



**ASK THE EXPERT!****Financial Statement ...****Income Statement  
FOR THE YEAR ENDED OCTOBER 31, 1997**

<b>INCOME</b>	1997	1996
Membership Fees	1635	1845
Donation Income	80	257
Public Education	1434	1826
Sweatshirt/T-shirt Sales	0	569
Observers Handbook/Calendar Sales	395	313
Book Sales	<u>24</u>	<u>264</u>
<b>Total Income</b>	<b>3567</b>	<b>5074</b>
 <b>EXPENSES</b>		
Newsletter Printing	469	459
Newsletter Postage	445	508
HABA	46	37
Speakers	25	258
Public Education	84	74
Promotion	0	179
ATM	0	19
Sweatshirt/T-shirt Cost of Sales	0	589
Observers HB/Calendar Cost of Sales	372	337
Insurance	594	551
General Administration	76	136
Post Office Box Rental	63	63
Donation	<u>0</u>	<u>100</u>
<b>Total Expenses</b>	<b><u>2174</u></b>	<b><u>3310</u></b>
 <b>SURPLUS</b>	<b>1393</b>	<b>1764</b>

Prepared by Barbara Wight, Treasurer

**QUESTION**

*Why are meteors/meteor showers always more numerous after midnight?*

**ANSWER**

There appears to be more after midnight due to the way the Earth travels around the Sun. If you could position yourself above the Solar System so that you are looking down on the North Pole you would see that the earth rotates counter-clockwise and orbits the sun in a counter-clockwise direction. This is called prograde motion. It then becomes apparent that after midnight and before noon we are on the side of the earth that is facing the way we are going around the Sun.

An analogy can be made with a car travelling down the road in the summer. Imagine that the Earth is the car and that the meteors are represented by insects. As you know, you get a windshield full of them and nothing elsewhere. This analogy is rather extreme since meteors travel much faster than the earth unlike the reverse situation between the insects and the car. The effect though, is that meteors impact with a higher velocity on the leading face of the Earth with more being visible due to their increased brightness.

There is one more effect that occurs in the late spring and early summer. The darkest part of the night is after midnight which allows you to see fainter and therefore more meteors.

**QUESTION**

*I have been reading about the Voyager expeditions and the moons of Jupiter and Saturn. I have been wondering about why the moons of Jupiter and Saturn exhibit so much diversity and*

*(Continued on page 7)*



# Daytime Sky Shows (Winter Edition)

Ever Wonder why you seldom see rainbows in winter?

Think about it for a minute.

The answer is that once the temperature drops below freezing, the water droplets necessary to produce a rainbow change to ice, which has different optical properties. However, right when we lose the chance to see rainbows we get the chance to spot a series of halos, pillars, arcs and other fragmented images of the sun.

These displays are quite common on winter days that aren't overcast. Yet many people just don't see them because they don't know what to look for. Here is a quick rundown of the startling effects produced by ice crystals in the atmosphere. Any of these phenomena can be seen independently of all the others. Sometimes, you'll see many at a time.

**The 22 Degree Halo** - a ring of white light with the sun at its centre. This is caused by refraction of light through the ice crystals.

**The 46 Degree Halo** - same as its smaller cousin, but fainter. It's rare to see a complete 46 degree halo. In-

stead, people often see incomplete arcs.

**Parhelia** - the popular name for these is "sun dogs". They're found on either side of the sun, just outside the 22 degree circle and consist of a more bulbous end pointing towards the Sun and sometimes a slimmer "tail", which points away. Usually, sun dogs are white or yellow, but at times they exhibit rainbow hues.

**Upper Tangent Arcs** - occasionally, the 22 degree halo will be brightened at the top (the side furthest from the nearest horizon). At times, you might even see a separate arc that's tangent to the halo. It's also possible to see the arc, but not the halo. If you're looking at the sun from an elevated position, like a plane or mountain top, lower tangent arcs could be visible instead.

**Parry Arcs** - these are different from tangent arcs in that they're more pointy. If you catch sight of a white, arrow-shape pointing at the Sun, you've seen a parry arc.

**Sun Pillars** - unlike all the other phenomena described so far, sun pillars are caused by reflection instead

of refraction. These aren't visible unless the sun is within a few degrees of the horizon. Look for vertical beams of light that reach towards the horizon and the zenith. You can still see a sun pillar for a few minutes after the sun has set. At night, it's possible to see moon pillars or even artificial light pillars.

There are many more rare and beautiful effects that can arise from the interplay of ice and sunlight. If you're interested, pick up a copy of Robert Greer's *Rainbows, Halos and Glories* or Bill Livingston and J. Lynch's *Color and Light in Nature*. Both are fascinating books with lots of cool photos.

But don't just read about it! The next time you're out on a cold, sunny day, see if you can tear your eyes away from that snow shovel for a few minutes. The patterns of the daytime sky show are not only interesting in their own right. Looking at them might even help you determine if tonight's a good night to break out the telescope and its number-one winter accessory: long underwear.

Denise Kaisler  
kaisler@soback.kornet.nm.kr

## Adventures in Québec

I'd like to tell about a great discovery my wife and I made in Québec this fall on our way to Nova Scotia. On highway #185 just east of Rivière de Loup we came across an observatory called *Aster*. We went up a side road for a few kilometres and found their parking-lot. They have an information centre so we went in to see if we could have a look around the inside of the observatory but they told us it was closed

(Continued on page 7)



Come and spend an evening that's out of this world! The next meeting of the Hamilton Amateur Junior Astronomers will be on Monday, November 17th. We will continue to discuss the solar system and if the weather cooperates we will bring the telescope outside and view selected objects!

During the last meeting the children coloured pictures of the planets in

our solar system and began assembling a solar system cube puzzle.

The activity night for children aged 12 and under is regularly held on the third Monday of each month at 7:00 - 8:00 p.m. in Room 148, Burke Science Building, McMaster University (the room beside the W. J. McCallion Planetarium).

Member and non-members are welcome.

For more information, contact Rosa Assalone at 540-8793 or by e-mail at assalor@mcmaster.ca.



## Ask the Expert ...

(continued from page 5)

variety in character and nature. One would think that, with all of the moons orbiting the same planet at similar distances from the sun, they would be fairly similar. Why the startling differences?

### ANSWER

The answer lies in the fact that although in the case of Jupiter and Saturn we have many satellites orbiting the same planet at similar distances from the sun, they have very different formation histories. These formation histories can be divided into two distinct groups: captured satellites and those which formed with the planet. The main tip-off that a satellite did not form with a planet but was captured at a later time is if it follows a retrograde orbit, that is, it orbits in a direction opposite to the rotation of the planet and usually out of the plane of the planet's equator. These captured objects are typically small and dark, made out of material such as carbon. It is believed that they are former asteroids whose orbits around the sun brought them dangerously close to a planet. Examples of these types of moons include Jupiter's satellites J6 through J13 and Saturn's Phoebe.

Another possible formation mechanism for these rebel moons is the collision of a satellite with another body. This could have thrown debris in all directions and created a new satellite with an unusual orbit.

The larger, regularly-spaced and prograde satellites (moving in the same direction as the planet rotates) likely had a calmer birth. It is believed that these systems formed in a similar manner as our solar system with the planet forming at the centre of a great disk of material which then condensed to form the satellites. Just as the planets decrease in

density as one moves outward through the Solar System (rocky planets close to the sun and the gas planets further out), the moons of Jupiter and Saturn follow a similar pattern. This is because the formation of the giant gas planet at the centre of the disk maintained temperatures so high that only rock-like material was able to exist, forming rocky moons such as Jupiter's Io and Europa. Further away from the planet temperatures were lower and ice moons such as Ganymede and Callisto could form.

## Adventures in Québec ...

(continued from page 6)  
for the season.

I happened to mention I was from Hamilton and that I belonged to the HAA and showed them my card and from that we got our own guided tour.

They have a 14 inch Celestron in the observatory that is on a pier, the dome is made from a silo that has an electronically operated door for the 'scope. The building is about 20 years old but in very good shape. They also have lots of display rooms and give talks about the different displays. They have an electric wind-mill for back-up power if needed because they are out in the sticks. The view they have of the south sky was just beautiful with low rolling hills, the whole site was really well cared for.

If anyone is heading east and wants to see a nice observatory, this is it. Their summer operation is from the end of June to the first of September. Well worth the time to see it!

-Allan Shinn

## The Moon's "Straight Wall"

My favorite lunar feature is a fault scarp called **Rupes Recta** or, more commonly, the **Straight Wall**.

The Straight Wall is not a "wall", but actually a moderate slope with a 7 degree gradient. It is 100 kilometres long and 240-300 metres high. It formed as the lunar plain in Mare Nubium subsided along a fault line.

The Straight Wall's slope faces west on the moon. Near first quarter, the sun shines on the slope from the east, throwing the slope into shadow. At this time, the Straight Wall appears as a thin, straight back line. At last quarter, when the sun shines from the west, the slope is illuminated directly and appears as a thin bright line to us. The line formed at either first or last quarter so is unnaturally straight and well defined that it appears like a wall. In the nineteenth century, this lunar feature was often referred to as "the railway".

The Straight Wall is located at 22 degrees south latitude, 7 degrees west longitude in Mare Nubium. It is very easy to find. Draw an imaginary line through the centre of the moon from north to south. Approximately one third of the way up from the south and just west of your line, you'll find the Straight Wall. It is quite spectacular in a small telescope at low to moderate power just after first quarter moon.

I especially enjoy showing the Straight Wall at public star parties. Most people are familiar with the sight of craters on the moon, but few expect to see a "wall" on it!

-Ann Tekatch



# Announcements

## "OUT of SIGHT"



When we gaze at the beauty and wonder of the night sky, we take our sight for granted.. We give little thought to those who cannot see - never have, or never will again. It is difficult to imagine what it would be like to live in a world without sight.

Recently, I had the pleasure of being part of a very special project. "OUT of SIGHT" is a compilation album of visually impaired and blind artists "SEEING through SOUND". The artists range in age from twelve years old to very mature. The music ranges from folk to rock, from country to classical. My partner and HAA member, Brian, is the producer and also performs one of his songs. All of the artists contributed their time and talent to this project. The proceeds go to the

CNIB *Capital Campaign* fundraising for an improved facility.

If you wish to share in this unique experience, CD's are \$20.00, and tapes are \$15.00. They can be purchased from me at the November meeting, or directly from the CNIB.

- Barbara Wight

## IT'S A GIRL!

On Monday, October 13 th Jeff Secker ( former HAA member) and his wife Julie became the proud parents of Michèle Aline Lefebvre, 6 lb 7 oz and 19.5 inches long. Both mother and daughter are doing well in Washington where Jeff and Julie hold a post-doctoral fellowships.



## POST MEETING SOCIAL GATHERING

The HAA Social Hour is once again on the move. Due to difficulties at our most recent location, we have decided to try another place. After our monthly meetings, we will be going to **Tony Balony's** on Main St. West, across from the CNIB. To get there, turn left from the main Spectator parking lot, follow that road to the end, turn left again to the stop sign on Dundurn St. Turn right onto Dundurn St. and go to Aberdeen Ave. Turn right on Aberdeen and follow it to Longwood Rd. Turn right on Longwood and follow it until you see the CNIB on your right and a plaza on your left. Turn left into the plaza. Tony Balony's is a separate building at the far end of the plaza. If you hit the turn off for Highway #2 to Ancaster, or start going down the hill into Dundas, you have gone too far.

Please join us after the meeting and enjoy some conversation and refreshment with your fellow astronomers!

## CALENDAR OF EVENTS

- ◆ Friday, November 21st, 7:00 PM
- ◆ November 28,29 , 8:00 PM
- ◆ Friday, December 12th, 7:30 PM
- ◆ Friday, January 9th, 7:30 PM
- ◆ Monday, December 15th, 7:00PM

**COUNCIL MEETING** - At the home of Rob Roy. Call Doug at 525-9140 Extension 23186 if you are interested in attending.

**BINBROOK OBSERVING SESSIONS** - Proposed observing nights. For confirmation or directions call Rob Roy (692-3245) or Ann Tekatch (575-5433)

**HAA GENERAL MEETING** - At the Spectator Building auditorium. The speaker will be Lesley Buckley of the International Space University.

**HAA GENERAL MEETING** - At the Spectator Building auditorium. The speaker will be JJ Kavelaars of McMaster University who will be talking about *Darkness on the Edge of Town - Major Search for Minor Planets.*

**HAJA MEETING** - McMaster Burke Science Building, room B148. Topic TBA. For more information contact Rosa Assalone at 540-8793.



### CALENDAR

1998

#### January

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

#### February

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

#### March

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

#### April

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

#### May

S	M	T	W	T	F	S
				1	2	
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

#### June

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

#### July

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

#### August

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

#### September

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

#### October

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

#### November

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

#### December

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

● New Moon

② HAA meeting- 7:30 pm Spectator Auditorium, 44 Frid St.

③ Council Meeting (proposed)

④ Binbrook observing- see map for directions

call: Ann 575-5433, Tony 526-6154, Rob 692-3245

#### BINBROOK OBSERVING SITES

