

# Event Horizon

October 1999

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## Mars Climate Orbiter Team Finds Likely Cause of Loss

A failure to recognize and correct an error in a transfer of information between the Mars Climate Orbiter spacecraft team in Colorado and the mission navigation team in California led to the loss of the spacecraft last week, preliminary findings by NASA's Jet Propulsion Laboratory internal peer review

indicate.

"People sometimes make errors," said Dr. Edward Weiler, NASA's Associate Administrator for Space Science. "The problem here was not the error, it was the failure of NASA's systems engineering, and the checks and balances in our processes to

detect the error. That's why we lost the spacecraft."

The peer review preliminary findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for a key spacecraft operation. This information was critical to the maneuvers required to place the spacecraft in the proper Mars orbit.

"Our inability to recognize and correct this simple error has had major implications," said Dr. Edward Stone, director of the Jet Propulsion Laboratory. "We have underway a thorough investigation to understand this issue."

Two separate review committees have already been formed to investigate the loss of Mars Climate Orbiter: an internal JPL peer group and a special review board of JPL and outside experts. An independent NASA failure review board will be formed shortly.

"Our clear short-term goal is to maximize the likelihood of a successful landing of the Mars Polar Lander on December 3," said

## Rob'serving Report

**U**pcoming Binbrook observing nights are scheduled for Oct. 8, 9 and Nov. 5, 6, 12, 13. Bret says that he will open up the Conservation area after the monthly meeting if skies are clear. Call Rob Roy (692-3245), Bret Culver (575-9492) at 7pm for local weather conditions and to confirm. The gate will be opened at about 8 pm.

There is very good news about the BCA site. We have been given permission to use the building just north of our parking lot for the winter months. There is no electricity, so we are planning on getting a small propane heater and a kerosene lamp. Maybe one of you has a spare heater, 20lb tank or a lamp? We can borrow one or

more of their small picnic tables to use for seating and a workspace for looking at charts, etc. It will make an incredible difference to our comfort and warmth in the coming months. No excuses that it is too cold, anymore!

It is that time of year when we send a small donation to the Niagara Conservation Authority in appreciation for the use of their facility. If you would like to make a contribution to this donation or to the purchase of the heater & lamp, please see the secretary, Barb Wight at one of the meetings. You may prefer to mail your donation to The Hamilton Amateur Astronomers, Box 65578, Dundas Postal Outlet, Dundas, ON. L9H 6Y6

*Rob Roy,*



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## Chair's Report

October brings us to the end of yet another membership year for the HAA. This means that next month you will see a new council. I have been the Chair of the HAA for two years now. I have had a good time in this position and I haven't regretted being Chair for one minute. I'll tell you a secret; the Chair doesn't run the club. The Chair is only the person that is most visible at the meetings. The entire council runs the club and I would like to thank all of them for their efforts over this past year.

We already have lots of speakers lined up to give talks for the new season. So far we have Peter Forint from Sienna Software giving a presentation on their Starry Night series of software in November. We will hold a raffle for a copy of their new Starry Night Pro! In the same month, John Ne my and Carol Legate will make a presentation on the August solar eclipse. Jeff Collinson will be giving us a talk about William Herschel in December. We will let you know as soon as the details are finalized for the other speakers so that you can mark your calendars.

If you are one of our "armchair astronomers" and thinking of buying a scope for yourself or someone else for Christmas and don't know what to buy then make a point of coming to the November or December meetings. There are lots of people in the club who would be happy to give you some valuable advice.

There are three sites that I am recommending a visit to this month. Since the main talk at our October meeting is by the Mars Society I have chosen their web site at <http://www.marssociety.org/> as one that you should visit. To quote from their web pages;

*The purpose of the Mars Society is to further the goal of the exploration and settlement of the Red Planet.*

*This will be done by:*

*1. Broad public outreach to instill the vision of pioneering Mars.*

*2. Support of ever more aggressive government funded Mars exploration programs around the world.*

*3. Conducting Mars exploration on a private basis.*

The next two sites are related to last month's meeting topic about Aurora. The website at <http://www.triax.com/vlfradio/natradio.htm> will introduce you to the sounds of Earth's fascinating, naturally-occurring radio signals between 300 Hz and 10 kHz. Many of the sounds that can be listened to are associated with Aurora. The site <http://mailman.McMaster.CA/mailman/listinfo/magnetometry-l> will get you connected to a listserver on the topic of magnetometry. Doug Welch is running this list for discussion and distribution of observations of geomagnetic phenomena. Specifically, its members are usually amateur observers of geomagnetism who have constructed (or are considering constructing) magnetometers to monitor geomagnetic activity.

Don't forget about the upcoming meteor showers for October and November. The Orionids peak on the 22<sup>nd</sup> of October and the Leonids peak on the 17<sup>th</sup> of November.

*Stewart Attlesey  
attlesey@interlog.com*



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

### HAA Council

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### Web Site

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



# Constellation of the Month - Cassiopeia

*Margaret Walton*

**C**assiopeia's midnight culmination is in early October, however, it is visible to us all year. It is probably the most distinctive arrangement of stars in the sky after the Big Dipper. The stars are bright and form the shape of a 'W'. The Milky Way passes through Cassiopeia.

Queen Cassiopeia was the wife of King Cepheus of Joppa (now known as Jaffa, in Israel) and the mother of Andromeda. She was beautiful, but also very vain. She claimed that she was more beautiful than the sea nymphs. Poseidon, the nymphs' protector, became very angry and sent a sea monster (Cetus) to terrify the

kingdom. In order to satisfy his anger and save her people, Cassiopeia had to sacrifice her daughter Andromeda to the sea monster.

As Andromeda was chained to the rocks and the sea monster was approaching, Perseus came upon the sea. He pledged to save Andromeda in return for her hand in marriage. Although Cassiopeia and Cepheus agreed to the match, Cassiopeia changed her mind and arranged for a former suitor of Cassiopeia's, Phineas, to attack. Perseus defeated Phineas and turned everyone to stone with the head of Medusa.

The entire family group can be seen in the same area of the sky – Cassiopeia, Cepheus,

Andromeda and Perseus.

## Objects to See Stars

**Eta Cas.** – This is a binary star system with contrasting stars of yellow and red.

## Deep Sky Objects

**IC289.** This is a planetary nebula with ring structure and a smooth disk. It is bright and large. Mag is 13.2.

**IC1747.** This is a faint small planetary located in a 'C' formation of stars. The planetary is the second 'star' from the top of the 'C'. Magnitude is 12.0.

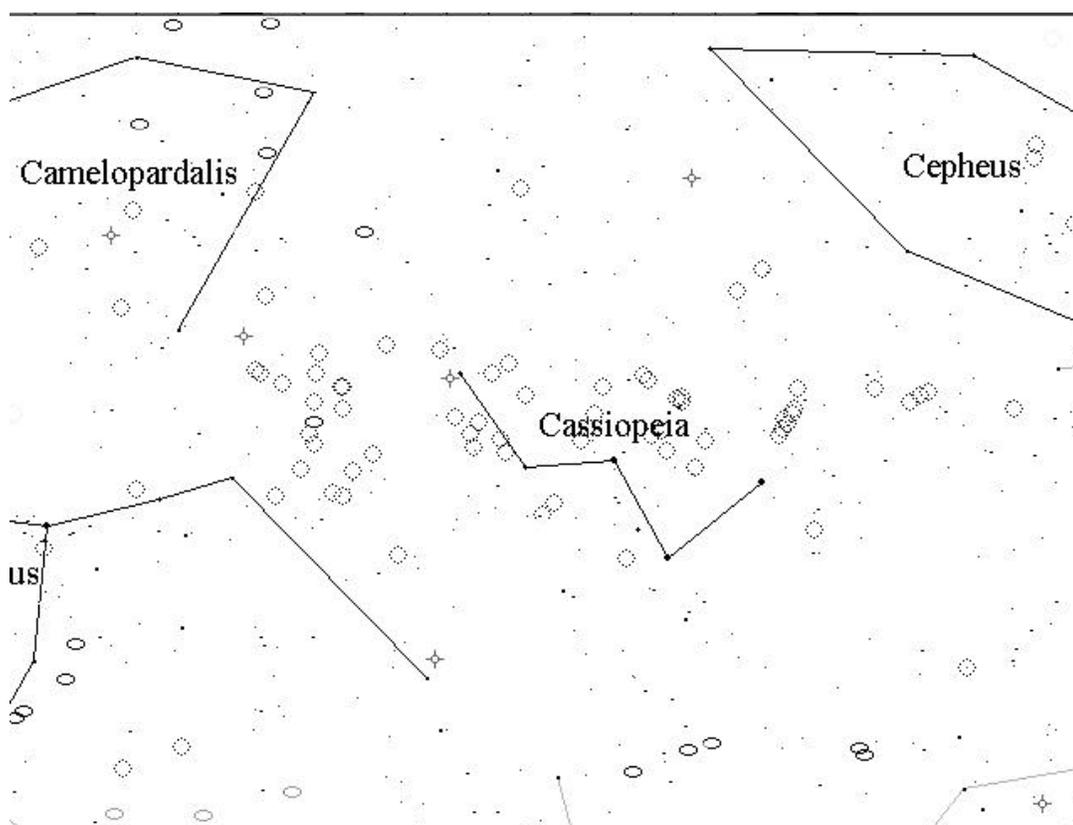
**M52.** This is a large, rich open cluster of about 100 stars. Magnitude is 6.9.

**M103. (NGC581)** This is a bright, large open cluster with a bright gold star in the centre. Mag is 7.4.

**NGC185.** This is a bright, large irregular elliptical galaxy of magnitude 9.2. It has a fainter companion galaxy NGC147.

**NGC436.** This is a small, rich open cluster of mag 8.8.

**NGC457.** Owl Cluster. This is a large, bright, rich open cluster of mag 6.4. It resembles an owl's face with 2 bright eyes.



*(Continued on page 4)*

# Cosmology Discussion Group

Mike Jefferson will present "Powers of Ten - The Cosmology of Ray and Charles Eames." Animating the presentation will be the National Film Board vignette, "Cosmic Zoom." Following the film will be an illustrated presentation of the Eames view of the cosmological realm, from the ultra-macro to the ultra micro. Plenty of room for questions, comments and discussion as our topic unfolds.

Saturday, November 27th, 1999.  
8pm. McMaster's Burke Science Building room B148

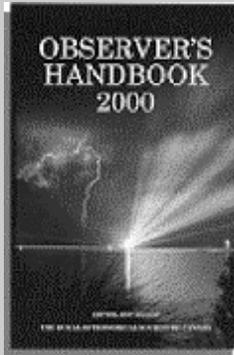
Free Coffee, Ginger Ale, and Timbits.

Informal discussion, everyone welcome.

For further information call Larry at 529-1037.



## Observer's Handbook 2000



It is time to order your Observer's Handbook once again. This year, all orders will be taken in advance, so if you want one, be sure to get your order in before November 13. Cost is \$14.00. Email [margw@icom.ca](mailto:margw@icom.ca) or sign up at the club meetings in October or November.

## Observer's Calendar 2000



Observer's calendars have been ordered and will be here shortly. Cost is \$9.00. Reserve yours by signing up at the meetings or email [margw@icom.ca](mailto:margw@icom.ca). First come, first served. Only 20 available.

## Constellation of the Month - Cassiopeia

*(Continued from page 3)*

**NGC654.** This is a bright, rich open cluster of mag 6.5.

**NGC663.** This is a large, bright, rich open cluster of mag 7.1. It can be seen in the same view (in low powered eyepiece) as NGC559, a smaller bright, rich cluster of mag 9.5.

**NGC7789.** Magnificent Cluster. This is a very beautiful open cluster containing 300 – 1000 stars. It is very large and

surrounded by a rich star field so is best viewed through a low power eyepiece. Magnitude is 6.7.

**PK119-06.1.** This is a small, bright planetary nebula appearing as a smooth disk. Magnitude is 12.3.

**TR-1.** This is a small open cluster of magnitude 8.1. It is quite close to M103 and very easy to find.

# D warfs, D isks, A nd Pale B lue M arbles: The ongoing search for exoplanets at UCL A

**Denise Kaisler**  
kaisler@astro.ucla.edu

**A** Short Time Ago, In A Galaxy Not Far Away. . .

So begins the saga of the search for extrasolar planets-worlds which orbit stars other than our sun. As of this month, we know of 20 such objects, all but three of them around sunlike stars right in our cosmic backyard. Yet new extrasolar planets, or exoplanets, are being discovered so quickly that one or two be added to the list up by the time you read this.

This flood of new discoveries is not due to a sudden interest in worlds beyond our sun. Astronomers have been actively searching for decades and interesting blips have been showing up since the 1940s, however, no detections were confirmed until 1994. Now, a scant five years later, astronomers all over the world are searching for planets using a host of new techniques and technologies. And it is here at UCLA that a number of these innovative searches are taking

place.

## Pioneering Studies

It all began more than twelve years ago, when UCLA astronomers Ben Zuckerman and Eric Becklin began looking for sub-stellar companions around nearby stars. It was not planets that they hoped to detect-those were too small and faint for the instruments available at the time. Instead, they were searching for brown dwarfs: a mysterious class of objects that are too massive to be planets, but not massive enough to be stars

Brown dwarfs form the way stars do. They condense out of clouds of gas in the inky depths of space, getting hotter and more dense as gravity squeezes them. But although the core of a star can get hot enough to fuse hydrogen into helium, a brown dwarf can never reach that point. Instead it gradually radiates away its initial heat and does very little from then on. A brown dwarf is basically a failed star.

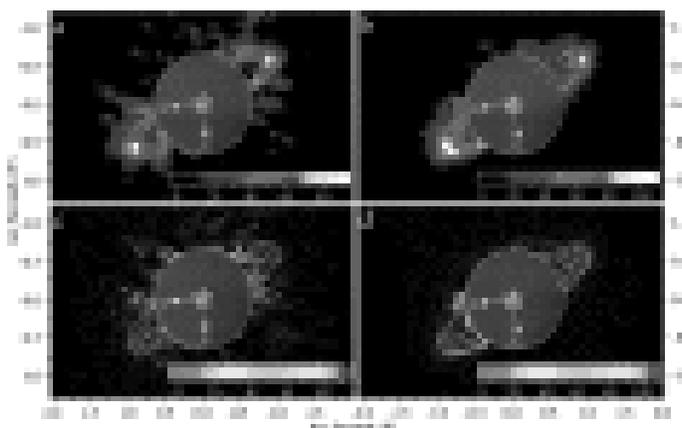
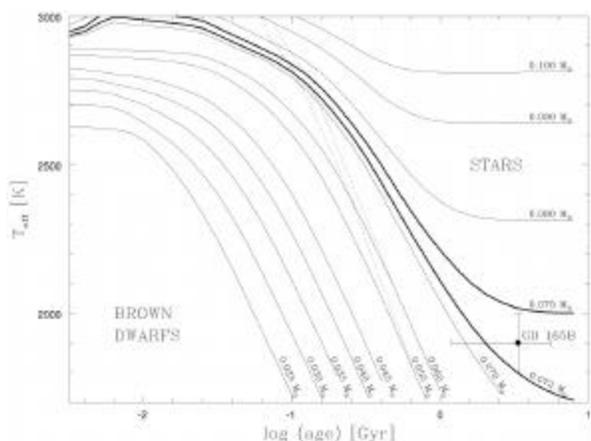
Still, these objects are interesting for a number of reasons, not least of which is that they're a

step away from planets. In their groundbreaking search, Zuckerman and Becklin detected one tantalizing object. It's known as GD 165B.

With a surface temperature near 2000 K, this object is about three times cooler than the sun, yet it lacks the lithium signature that would place it squarely in the brown dwarf regime. Instead, we now believe GD 165B is a transition object right on the boundary between brown dwarfs and stars -- one of only a handful known to us. The diagram of effective temperature vs. time, reproduced here, shows the relationship between GD 165B and other, more familiar objects.

Another search for brown dwarfs and planets was done with the Hubble Space Telescope's NICMOS camera. Zuckerman and Becklin were part of this team, as were graduate students Patrick Lowrance, Chris McCarthy, and Richard Webb, as well as postdoctoral researcher Alycia Weinberger. Just this year, the NICMOS search team uncovered TWA 5 : another brown dwarf candidate on the rear edge of the Hyades

(Continued on page 7)



## Canadian Solar Eclipses: 1000 BC to 3000 AD

Ray Badgerow

This article deals with the occurrence of solar eclipses throughout Canada during a period of 40 centuries. The calculations done were carried out using the software Guide 6/7 and EclipseLive 1.1 for local circumstances. My work will show not only how many eclipses occurred at a given location, but also will compare the rate of recurrence between 2 adjacent cities. For my purposes, I chose to explore the occurrence of solar eclipses at the provincial/territorial capitals and the RASC centers as well. This set of articles was somewhat from the original target date in the spring for a number of reasons such as the work load involved, and the fact that I went to see the August eclipse in Turkey. These articles could eventually become the basis for a web site, if you agree.

**Table 1: Summary of Eclipses**

Type	Number
Annular	379
Total	347
Annular-Total	36
Non-Central Annular	17
Non-Central Total	6
Partial	1113
Total	1898

Here is the summary per century:

**Table 2: Canadian Solar Eclipses Per Century**

Time Span	Annular	Total	Ann/Tot	An/+	Tn/+	Partial	Sum/Century
-999 to -900	8	11	0	1	1	30	43
-899 to -800	11	8	0	1	0	23	43
-799 to -700	13	4	1	0	0	24	42
-699 to -600	11	10	0	1	0	30	52
-599 to -500	13	6	0	0	0	23	42
-499 to -400	10	6	4	2	0	32	54
-399 to -300	7	11	0	0	0	34	52
-299 to -200	7	12	1	1	1	29	51
-199 to -100	7	9	3	0	0	31	50
-99 to 000	11	9	2	0	0	28	50
001 to 100	9	9	3	0	0	33	54
101 to 200	3	12	2	1	0	27	45
201 to 300	8	11	0	0	1	30	50
301 to 400	7	13	1	0	0	21	52
401 to 500	7	10	0	0	0	28	45
501 to 600	13	9	0	0	0	32	54
601 to 700	10	12	1	0	0	32	55
701 to 800	11	6	0	0	0	27	44
801 to 900	6	12	0	2	0	33	53
901 to 1000	11	8	0	0	0	29	48
1001 to 1100	17	5	1	0	0	30	53
1101 to 1200	9	10	0	0	0	34	53
1201 to 1300	14	8	1	0	0	28	51
1301 to 1400	11	7	2	0	0	24	44
1401 to 1500	8	9	0	1	1	28	47
1501 to 1600	10	8	1	1	1	22	43
1601 to 1700	6	10	3	0	0	25	44
1701 to 1800	11	5	2	0	0	24	42
1801 to 1900	11	7	0	1	0	27	46
1901 to 2000	3	11	2	0	0	23	39
2001 to 2100	7	7	0	0	1	21	36
2101 to 2200	7	8	1	1	0	25	42
2201 to 2300	10	8	1	0	0	27	46
2301 to 2400	14	9	0	0	0	25	48
2401 to 2500	10	9	1	1	0	24	45
2501 to 2600	8	6	1	0	0	28	43
2601 to 2700	10	8	0	1	0	31	50
2701 to 2800	14	5	0	1	0	27	47
2801 to 2900	12	6	2	0	0	27	47
2901 to 3000	12	13	0	1	0	27	53
Sum	379	347	36	17	6	1113	
Average/Century	9.67	8.67	0.9	0.425	0.15	27.8	

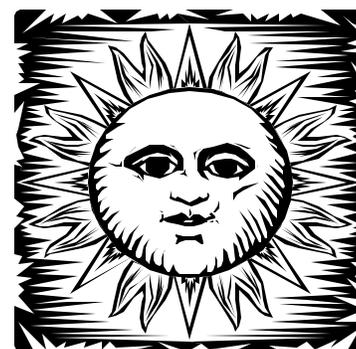
Key: An/+,Tn/  
+ : non-central annular  
and total eclipses with no  
northern limit,

axial(n) and non-axial(+).

Note: The total sums of  
both annular and total  
eclipses includes the non-  
central eclipses as well.

This article was also  
based upon a previous  
Orbit article in May 1992  
that dealt with solar  
eclipses as seen from  
Hamilton over a smaller  
time interval. The first  
central eclipse that  
occurred in Canada was  
an Annular on July  
21,997 BC, and the last  
one will be a total eclipse  
on May 6,2999.

Next month: Victoria and  
Vancouver.



## Dwarfs, Disks, And Pale Blue Marbles: Continued...

(Continued from page 5)

star cluster. But again, only one companion was found out of a survey list of over forty. This rarity of brown dwarfs, a condition that also extends to planets, is puzzling to a good many astronomers.

### *Solar Systems In The Works*

What astronomers at UCLA are finding, is a number of dusty disks. These pancakes of rocky particles surround many young stars, resembling what many believe our own solar system looked like billions of years ago. The NICMOS team recently imaged a remarkable disk encircling the star HR 4796. In the near-infrared image shown here, the star at the center has been blocked out to enhance the disk's visibility.

HR 4796 was originally identified as interesting by Dr. Michael Jura, another UCLA astronomer. In 1991, he noticed an excess of infrared radiation coming from HR 4796 and rightly concluded that there must be an envelope of dust around this young, blue star. Later this month, he and graduate student Christine Chen will travel to Hawai'i where they will use the world's largest telescope to extend that research by looking for protoplanetary disks around other young stars.

Disks are also the concern of Dr. Andrea Ghez and her research group, as are multiple stellar systems. Most of the stars in the universe exist in binary or triple systems, making the lone sun something of an oddity. Thus the question of whether planets can form in a binary system naturally arises. By studying the disks

around multiple stars, Ghez and graduate student Jennifer Patience have come to the conclusion that multiplicity is a factor. They have found that the disks around binary stars are smaller than those around single stars, leaving less material for planet formation. Graduate student Russell White has taken this one step further. His research shows that if a planet does form around either member of a binary pair, it's most likely to form around the primary (brighter) star.

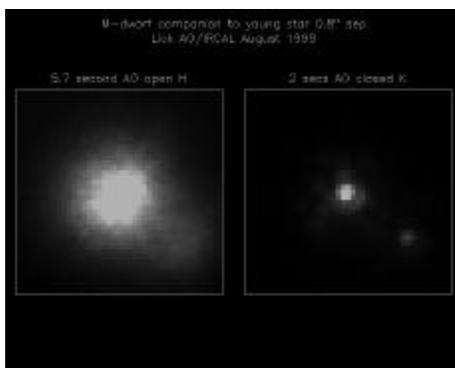
Ghez and team are also active in the field of direct imaging. Last year, a collaboration which also included Russel White and Greg Schultz, used one of the 10 meter Keck Telescopes to observe a quadruple system in the constellation Taurus. The smallest, coolest member of this four-star set is yet another brown dwarf candidate. Like TWA 5, this cool, faint object hasn't yet been analyzed spectroscopically to see if it bears the telltale lithium signature. but the mass and luminosity of this object make it a good bet as any to be a brown dwarf.

### *But Where Are The Planets?*

Well, we've never stopped searching. As our knowledge

base grows and technologies mature, new, deeper searches become possible. One of these was begun just last month by Zuckerman, UCLA graduate Bruce Macintosh, and grad student Denise Kaisler. They are using a new technique known as adaptive optics (AO) to search nearby stars for evidence of sub-stellar companions. The big advantage of AO is that it allows astronomers to overcome the limitations of peering through the Earth's atmosphere. Normally, the image of a star is spread out due to pockets of turbulence in the air above. But an AO system includes a wavefront sensor to detect deviations in the incoming starlight plus a palm-sized deformable mirror to correct things. The resulting image has much higher resolution, which means that objects at a great distance may be distinguished from one another.

This AO image, taken last month at Lick Observatory near San Diego, shows a cool, red star 60 light years away. Without adaptive optics, we see a fuzzy halo, but with the system working, a previously undiscovered companion star has been resolved. Although this is probably not one of the brown dwarfs that the team is hoping for, it beautifully demonstrates the capabilities of AO. Macintosh and team plan to look for brown dwarfs at Lick and then move on to the Keck observatory next year. The higher sensitivity of that telescope should allow the team to directly image extrasolar planets, something which has not yet been achieved in modern astronomy.



# Membership Renewal

## November 1, 1999 - October 31, 2000

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Province: \_\_\_\_\_ Postal code: \_\_\_\_\_

Phone number: (\_\_\_\_) \_\_\_\_\_

E-mail: \_\_\_\_\_

Type of membership:	Individual	\$15.00/year
	Family	\$20.00/year

Voluntary Donation: \$ \_\_\_\_\_  
(tax receipts will be issued)

Total: \$ \_\_\_\_\_

Please make your cheque payable to:

Hamilton Amateur Astronomers  
P.O. Box 65578  
Dundas, Ontario

Membership renewals are due November 1, 1999

### CALENDAR OF EVENTS

- October 8, 9  
November 5, 6, 12, 13
- Friday, November 12, 7:30pm
- Saturday, November 27th 8pm
- Friday, December 10, 7:30pm

**BINBROOK OBSERVING NIGHTS** - For confirmation or directions call Rob Roy at 692-3245 or Bret Culver 575-9492

**HAA GENERAL MEETING** - At the Spectator Building auditorium. John Nemy and Carol Legate will speak on the August solar eclipse.

**COSMOLOGY DISCUSSION GROUP** - McMaster Burke Science Building, room B148. For more information contact Larry at 529-1037.

**HAA GENERAL MEETING** - At the Spectator Building auditorium. Jeff Collinson will give a talk about William Herschel .



## Beginning Observational Astronomy Page

This is the start of a series of articles for beginning (and not so beginning) astronomers who wish to learn the art of observing. We will cover many of the basics including: learning the night sky, binocular observing, finding objects, star charts, choosing a telescope, eyepieces, filters and more. If you have a topic you wish covered, just send email to [margw@icom.ca](mailto:margw@icom.ca).

### How to Get Started in Astronomy

This month's article will cover the basic steps to take to start observing. These topics will be covered in more depth in the coming months.

- 1. Join a Club.** The most important thing you can do is to join an astronomy club. Most clubs have members ranging in experience from beginners to experts and those with more experience are usually more than happy to help beginners. By joining in on observing sessions you can learn how and what to observe, and do it through others' scopes before making the decision on the right purchase for you.
- 2. Learn the Night Sky.** In order to find things in the night sky you need to learn the constellations. You don't need a dark site to do this; in fact, it may be easier to pick out the constellations at a brighter site without a background of thousands of stars. All you need is a map showing all the constellations (such as a planisphere), a red flashlight (for reading the map) and your eyes.
- 3. Don't Buy a Telescope – Yet.** Using a telescope can be a frustrating and discouraging exercise until you learn a few basic things. These include: learning the constellations, knowing where some of the basic naked eye objects are, learning to use sky charts, and spending time looking through others' scopes. When the time comes to buy a scope, don't waste money on a cheap 'department store' scope. You are better off waiting until you can afford a decent one. By looking through others' scopes, you will get a better idea of what you would like.
- 4. Do Buy Binoculars.** 7 – 10 power binoculars can be hand-held and are light and portable enough to take anywhere. There are many objects that can be seen with binoculars: planets, moons, star clusters, galaxies and even some nebulae. They are a great way to become familiar with finding your way around the sky without investing in expensive equipment. Binoculars can also be used for other activities such as bird watching, on those mornings you are NOT sleeping in because it was too cloudy the night before to observe!
- 5. Invest in Charts and Guidebooks.** While binoculars can see many things, how are you going to find them? Charts and guidebooks will help you find objects to see, whether using binoculars or a telescope. In addition, it is essential to know how to use star charts before you buy a telescope.  
  
Other great sources of information are astronomy magazines. Two of the most popular are *Sky and Telescope* and *Astronomy*. These have monthly sky charts and articles describing what you can see in the sky each month. You can get a discounted subscription to these magazines through our club.
- 6. Have Fun!**