Hamilton Amateur Astronomers

Event Horizon

November 1999 Volume 7 Issue 1

Constellation of the Month - Pegasus

Margaret Walton

Pegasus is the famous flying horse of Greek Mythology. He arose from the body of the Medusa when it was killed by Perseus. The spring of Peirene gushed forth where Pegasus' hoof struck the rocky heights (Mt Helicon) above Corinth.

The hero Bellerophone rode Pegasus using a golden bridle given him by Athena. He unwisely attempted to ride Pegasus to Mount Olympus. Pegasus refused and threw his rider. He was rewarded with a place among the stars.

Objects to See in Pegasus

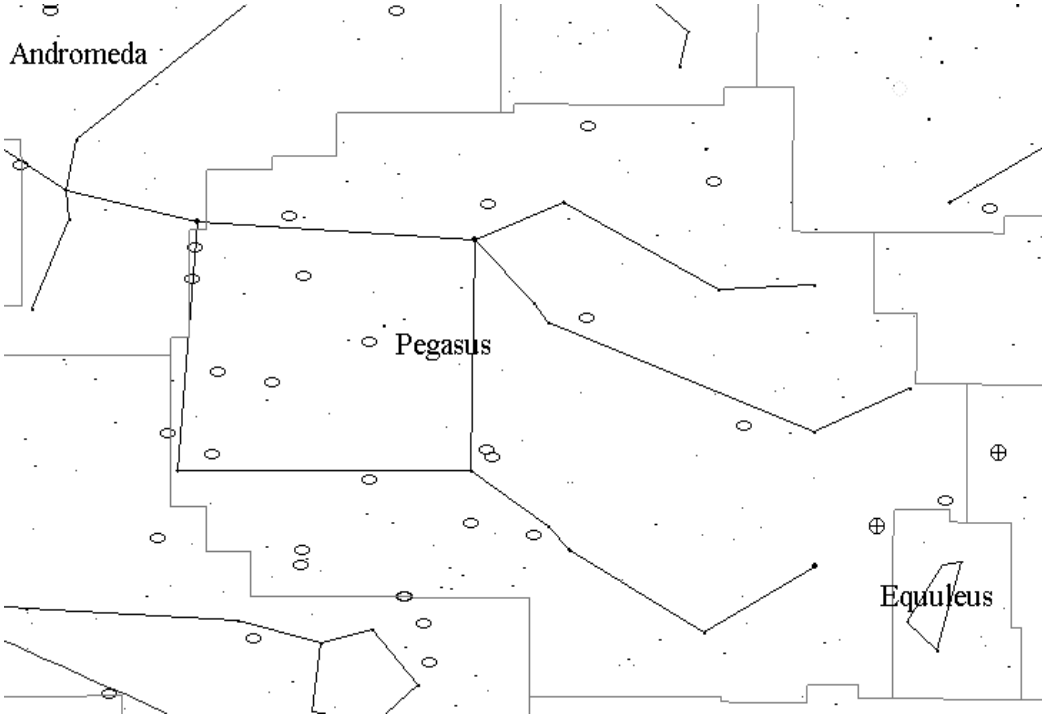
M15 (NGC7078). Globular Cluster. This is one of the richest and most compact globular clusters. It is bright, large irregular and highly condensed. It can be seen through binoculars. Magnitude is 6.4.

NGC7331. Spiral Galaxy. This galaxy is similar in type and size to our own Milky Way. It is a bright, elongated galaxy of magnitude 9.5.

NGC7479. Barred Spiral Galaxy. Bright, large, elongated galaxy of magnitude 11.0.

NGC7814. Galaxy. Large, bright, elongated galaxy with a large, bright centre bulge. Magnitude is 10.5.

Stephan's Quintet. Cluster of 5 faint galaxies ranging in magnitude from 14.0 to 14.8. They can be glimpsed in a 6" telescope as a dim, fuzzy patch.



inside...

The Speed of Light.

John Lawson

During the 1700s and 1800s, in the heyday of the development of mechanics and classical science, it was known that light has a frequency associated with it. The concept of it as a wave superceded Newton's view of it as a stream of corpuscles. To explain the speed at which it travels - it had been measured - scientists envisioned a medium called "the luminiferous aether". This eventually became "the ether." Borrowing from the study of sound waves in fluids, this medium was supposed to have an exceedingly high stiffness, yet have an exceedingly low density and viscosity. It allowed material things, such as planets, to pass through it with no sign of resistance.

Following the development in the mid 1800s of the concept of electromagnetic fields, the mechanical properties of the aether were replaced with electrical field permittivity and magnetic field permeability. The square root of the inverse of their product is the speed of light.

Nowadays, electromagnetic effects are thought to stem from the exchange of photons. The concept explains a lot of science better than previous ideas. But what physically changes the exchange of photons into forces? In trying to find an answer - which satisfies me at least - I asked - Why is the speed of light special, regardless of its exact value? On what can its exact value be based?

Aether and all such media concepts are out. They do not work. So what is left? If one looks at any established system of units, be it mechanical or electrical, it is found that all units, all physical properties, are ' boiled down' to three quantities, mass, space and time. Mass is a subject on its own. It can be converted into energy therefore, it cannot be fundamental as space and time (or space-time) are. They cannot be analysed into any other simpler, more fundamental quantities.

In Quantum Theory, physical processes are not smooth and continuous at very small scale. They occur in steps or quanta, like digital electronics. There is a

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Bret's Observing Notes

The next observing sessions at Binbrook Conservation Area will be on November 12, 13 and December 3, 4. Call Bret Culver at 575-9492 or Rob Roy at 692-3245 at 7pm for directions and confirmation. The park will be open at 8pm. For observers that are interested I'll be opening the park on November 17-18 at 9pm to observe the Leonids shower. The shower should peak after midnight and there is a possibility of a meteor storm. Don't forget to dress warmly and bring hot refreshments.

HAMILTON AMATEUR ASTRONOMERS

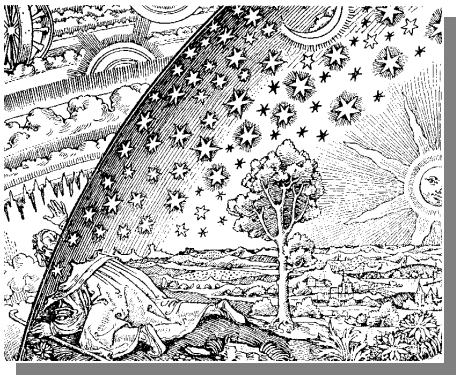
Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA).

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.

Web Site

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



Chair's Report

It is now the beginning of a new HAA year, and with it, a new Council. This is not my first time as Chair, so I am not entering the position with my eyes closed. The position of Chair can be a wonderful job, or it can be stressful, depending on a number of things, some of which are within the control of a Chair, and some which are not. Thankfully, the stress level of the job as Chair of the HAA is very low.

As I see it, the Chair has four main responsibilities.

1. The Chair is the main ambassador for the club, within both the membership and the community. I am very proud of this organization. I take great pride in standing before you at the meeting every month, and in representing you in the community. While I am quite sincere in my belief in the HAA, I must confess that I am a bit of a ham in public performance and find it quite easy to take front row centre on your behalf.

2. The Chair=s responsibility is to recruit the monthly speakers. Now, this should create a lot of pressure, but I have found in the past that the amount of help I get from the membership in the form of suggestions, and the cooperation I get from those who wish to speak, is a joy to behold.

3. The Chair must be Captain of the Ship, or the Simon Legree of the Council. The Chair has to be the glue that holds the Club together and the whip that drives it forward. This has never been an issue. The Council of the HAA has always been, and hopefully always will be, a hard working and amiable group of people. I am very happy with the present and the previous Councils.

4. So, if all is wonderful in the Lotus Land of the HAA, why isn=t everyone beating a path to the Chairship? What=s the catch? Where=s the beef? Well ... to be quite frank, it=s the writing of these reports! I=m not necessarily speaking for everyone, just myself. It is not my favourite pastime and I have to be driven to write them. That being said, there are two that are enjoyable to write: the first and the last. They have a special place in the hearts of Chairs because they are easy to write. The first is a big-warm-fuzzy-feeling one, the one where you tell how happy you are with the new Council and how excited you are in looking forward to the new year. The final one is also a joy because you reflect on how happy you have been with your Council over the past year, and on what a wonderful year it was.

The conclusion of this report is that, while this was a joy to write, watch next month to see me really struggle!

Grant Dixon
Chair
dixon@netaccess.on.ca

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.

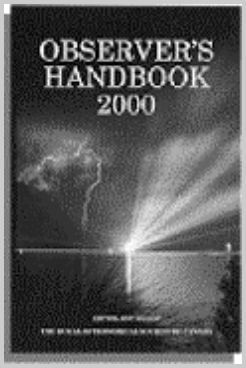
Saturday, November 27th, 1999. 8pm. McMaster's Burke Science Building room B148

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** 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.** First come, first served. Only 20 available.

Treasurer's Report

Barbara Wight

The financial statements for the year ended October 31, 1999 have been published in this issue of the newsletter. There is a small deficit of $364 for the year, which is not significant considering our Public Education program did not bring in any revenue last year. Also, the membership fees have remained constant throughout HAA's existence.

It was necessary to cash in one $1,000 Ontario Savings Bond to finance the purchase of an overhead projector, and to replenish our bank account.

Just a reminder that a charitable tax receipt will be issued for membership fees. Thank you for your continued support, and we encourage any contributions you may have to further the enjoyment of our club.

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Ask Stella: Habitable Planets

Hey Stargazers! This month's question comes to us from an astro-enthusiast in far-off Taiwan. Michael Wu, a 7th grader at Taipei American School writes:

I would like to know what planets and moons in our solar system can be habitated by people. I would also like to know what resources these places have.

If people try hard enough and have enough technology, it seems to me that they could live on almost any planet in our solar system. But some places would certainly be easier to colonize than others.

The first thing that you have to understand about our cosmic backyard is that there are two kinds of planets in the solar system: terrestrial or Earthlike planets (Mercury, Venus, Mars, Earth, Pluto) and Jovian or gas giants (Jupiter, Saturn, Uranus, and Neptune). The many moons in are solar system are like terrestrial planets, but smaller still.

Terrestrial planets are made up of rock. You could land a spaceship on one and stand on its surface. Jovian planets weigh tens to hundreds of times as much as the Earth and are made up mostly of gas. You can't stand on them. It would be like trying to stand on top of a cloud. They may have a small, rocky core, but we don't know because we've never sent any space probes down that far.

So the first rule would be that terrestrial planets would be more easy to inhabit than Jovian planets. To live on a Jovian world, you'd have to build some kind of giant flying city.

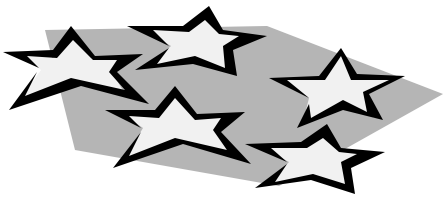
Next you have to consider things like how hot or cold the planet (or moon) is and whether it has an atmosphere. It would be more difficult to live on Mercury or Pluto than it would be to live on Mars, for example. Both Mercury and Pluto have extremely hot and cold temperatures at their surfaces and no atmospheres. Mars, on the other hand, has relatively mild temperatures and a thin atmosphere. You could walk around on Mars with the help of an insulated pressure suit.

The easiest places to inhabit are the ones that are most like Earth. Mars is a favorite because it is nearby, has a thin atmosphere, and has gravity and temperatures similar to the Earth's. Venus is also nearby, but has an a thick, corrosive atmosphere that would bake and crush almost any satellite we sent to its surface. We'd have to be pretty inventive if we wanted to live on Venus.

Another favorite are the moons of Jovian planets. Europa is a moon of Jupiter. It's interesting because it's thought to have a crust made entirely of water ice. Some writers and scientists have envisioned colonists landing on Europa and melting the ice to make water and rocket fuel. Water is critical to Earth-based life, but it's hard to find in its liquid form. Ice is usually the closest we can get.

Saturn's moon Titan has also caught the attention of a great many people. Titan is big enough to have an atmosphere of its own (it's the biggest moon in the solar system, in fact). Some speculate that there may even be liquid water on its surface. But it's difficult to tell because the atmosphere hides the moon's surface. We will have to wait for more space probes or better telescopes to find out more about this little world.

But naturally our own moon would be a great starting point. Even though the Moon has no atmosphere and low gravity, it is very, very close. It takes only a day or so to travel to the moon in a spaceship, instead of years or decades it would take to get to other planets. Also, new data indicate that there is water on the moon, although whether there is enough to be useful to humans is another question. But if we



sent many supplies up from Earth, we could certainly establish a Moon base.

-Stella

Do you have a question that's keeping you up at night? Then email *ask_stella@earthling.net*.

The Speed of Light (continued ...)

(Continued from page 2)

limit to the accuracy with which we can measure physical quantities. Heisenberg's Uncertainty Principal states that momentum and position are connected, as are energy and time, by a quantity known as Planck's Constant.

In equation form, if d- is the limit of accuracy of measuring,
(1) dP*dx is proportional to h
(2) dE*dt is proportional to h
P = momentum
x = position
E = energy
t = time
h = Planck's Constant.

Their connection can be seen by
(3) dP is m*v = m*dx/dt
(4)dE is m*v*v = m*dx*dx/dt*dt
So,
(5) dP*dx is m*dx*dx/dt
(6) dE*dt is m*dx*dx/dt
These equations are similar and both involve dx and dt.
The limit of accuracy, h, is
(7) h = m[e]*c*2*Pi*137.036*Ro
m[e] = electron mass
Ro = classical electron radius
Pi = 3.14159...
c = speed of light
h is not a fundamental quantity but can be broken down into more basic components as shown above.

Physical quantities such as momentum,energy, etc.,are determinate only for integer multiples of h,.....h, 2h, 3h... Between those values, the probability of measuring them is reduced. This also applies to the interval from 0 to h.

In equation (7), the factors c, 2Pi, 137.036 are all constants. M [e] is not involved in quantum conditions. That leaves only Ro, a space dimension which is involved. So the quantum condition may be restated as follow.

There is a certain interval of space, l = Ro, which is the smallest interval particles can measure with 100% probability. There is also a certain interval of time, t, which they can measure with 100% probability. These are therefore the fundamental units of measure in the universe. Their ratio is the speed of light.
(8) c = l/t

This does not 'explain' the value of c - that is obviously dependant on the values of l and t. But it does show its uniqueness. If the probability 'psi' of measuring reduces linearly from 100% at intervals l and t to zero at zero interval, then
(9) psi[l] = 100%*x/l
psi[t] = 100%*y/t
x = a length smaller than l
y = a time interval less than t

If it can be shown that psi[l] and psi[t] are always equal (ie, they are dependant quantities) then the probability of measuring at any 'off-quantum'condition is 100%*psi squared. This is in line with equations (3) and (4) wherer dx and dt are both involved. It also means that below l and t, only one velocity c is probable because psi[l] and psi[t] cancel out.

Above l and t, any value of l may be connected with any value of t, so that, for any given value of space or time, an infinity of velocities is possible - if they are less than c. None of them is unique.

Above l and t is 100% probability classical physics. Below l and t is quantum physics of psi squared. l, t and c form the boundary between the two regimes.

This approach ties the speed of light to the Uncertainty Principal and the basic measuring blocks of the universe.

One may ask, "Why are we limited to the sizes of l and t? Why are those particular values the limits of 100% probability?" That is a good question. The corollary of it, "Why can't we measure down to zero interval?" is readily answered. If we could measure down to zero interval, the speed of light would be indeterminate.

c = l/t = 0/0
This would give two values.
(10) c = 0/1 = 0 or,
(11) c = 1/0 = infinity.

Neither of these two universes is practical. In the first, where c = 0, nothing moves, or it takes infinite time to move. In the second, where c = infinity, everything moves at infinite speed. Both regimes have some interesting qualities, which can be explored, but neither leads to a mainstream practical universe in which we could exist. Any practical universe requires that it be determinate, so quantum conditions are a necessity of life.

I hope this article is of interest to members.

John Lawson
jrlawson@cgocable.net.

HAMILTON AMATEUR ASTRONOMERS
BALANCE SHEET
AS AT OCTOBER 31, 1999
(Unaudited)

ASSETS	Oct 31 1999	Oct 31 1998
Bank	532	73
Investments	3000	4000
Inventory	193	392
Prepaid Expenses	77	70
Total Current Assets	3802	4535
Fixed Assets -Equipment	1287	948
Total Assets	5089	5483
LIABILITIES		
Deferred Revenue	480	510
EQUITY		
Opening Balance	4973	5474
Current Year	-364	-501
Closing Balance	4609	4973
Total Liabilities and Equity	5089	5483

Prepared by Barbara Wight, Treasurer

HAMILTON AMATEUR ASTRONOMERS

INCOME STATEMENT
YEAR ENDED OCTOBER 31, 1999
(Unaudited)

INCOME	Oct 31 1999	Oct 31 1998
Donations -Membership Fees	1460	1395
Donations -Other	132	75
Public Education	0	486
Sweatshirt/T-Shirt sales	491	396
Observers Handbook/Calendar sales	366	282
Interest Income	140	0
Total Income	2589	2634
EXPENSES		
Newsletter printing	448	750
Newsletter postage	452	522
HAJA	0	73
Speakers and Meeting Expense	75	70
Public Education	0	52
Promotion	0	194
Sweatshirt/T-Shirt cost of sales	547	392
Observers H/B/Calendar cost of sales	397	288
Insurance	621	621
General Administration	243	3
Post Office Box rental	70	70
Donation Expense	100	100
Total Expenses	2953	3135
SURPLUS/DEFICIT	-364	-501

Prepared by Barbara Wight, Treasurer

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

- Saturday, November 27th 8pm
- November 12, 13 at 8pm
  December 3, 4 at 8pm
- Tuesday, November 16, 7pm
- Friday, December 10, 7:30pm

COSMOLOGY DISCUSSION GROUP - McMaster Burke Science Building, room B148. For more information contact Larry at 529-1037.
BINBROOK OBSERVING NIGHTS - For confirmation or directions call Rob Roy at 692-3245 or Bret Culver 575-9492 at 7pm.
HAJA - We will meet at McMaster University, in the Burke Science Building, room B148. For more information contact Rosa Assalone 540-8793
HAA GENERAL MEETING - At the Spectator Building auditorium. Jeff Collinson will give a talk about William Herschel .