Hamilton Amateur Astronomers

Event Horizon

December 1997 Volume 5 Issue 2

Meteors, Meteorites and Impacts

A meteor is a bright streak of light in the sky (a "shooting star" or a "falling star") produced by the entry of a small meteoroid into the Earth's atmosphere. If you have a dark clear sky you will probably see a few per hour on an average night; during one of the annual meteor showers you may see as many as 100/hour. Very bright meteors are known as fireballs; if you see one please report it.

Meteorites are bits of the solar system that have fallen to earth. Most come from asteroids including a few that are believed to have come specifically from 4 Vesta; a few probably come from comets. A small number of meteorites have been shown to be of Lunar (15 finds) or Martian (12) origin. One of the Martian meteorites, known as ALH84001 is believed to show evidence of early life on Mars.

Though meteorites may appear to be just boring rocks, they are extremely important in that we can analyze them carefully in our labs. Aside from the few kilos of moon rocks brought back by the Apollo and Luna missions, meteorites are our only material evidence of the universe beyond Earth.

A "fall" means the meteorite was witnessed by someone as it fell from the sky. A "find" means the meteorite was not witnessed and was found after the fact. About 33% of the meteorites are witnessed falls.

A very large number of meteoroids enter the Earth's atmosphere each day amounting to several hundred tons of material. But they are almost all very small, just a few milligrams each. Only the largest ones ever reach the surface to become meteorites. The largest found meteorite (Hoba, in Namibia) weighs 60 tons.

The average meteoroid enters the atmosphere at speeds between 10 and 70 km/sec. All but the very largest are quickly decelerated to a few hundred km/hour by atmo-

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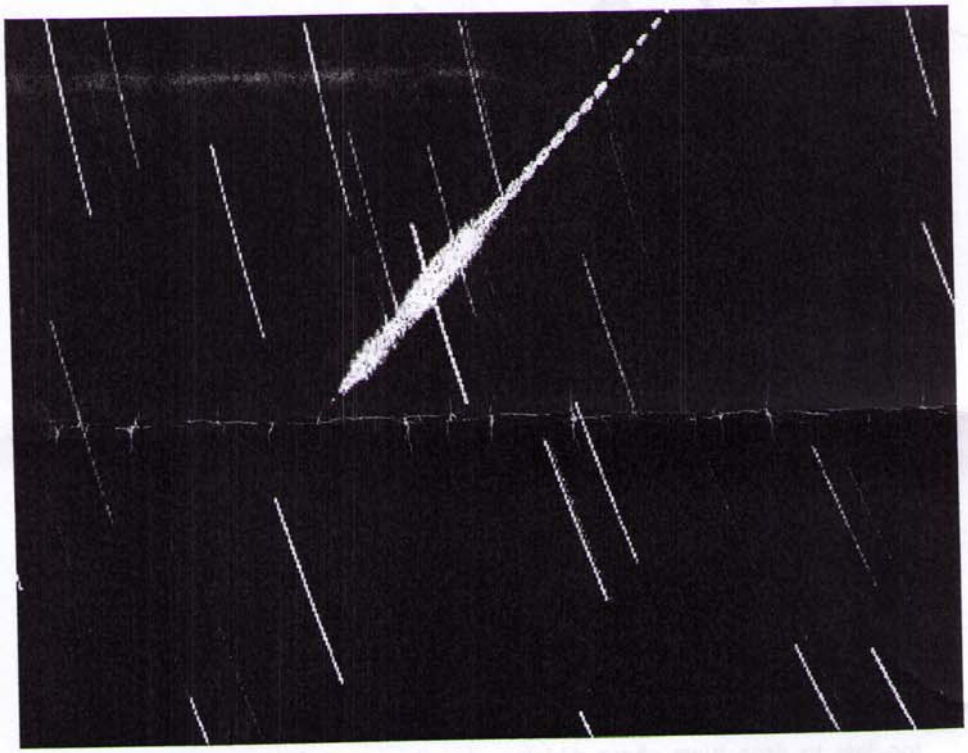

inside...

Editorial

December has *got* to be the most hectic month of the year with shopping, holiday parties and, for us poor students, exams!

Looking over the articles I've recognized a small but nevertheless present solar system theme (two articles and an "ATE"). This was not done on purpose but seems appropriate given our speaker in January (J.J. Kavelaars of McMaster, who will be talking about minor bodies in the solar system). There are some great links on the page that I drew the article on Meteors and the article on the Oort Cloud/Kuiper Belt from and I encourage everyone who has access to the Internet to check them out. We may all be experts by the time J.J. shows up!

Thanks to everyone who sent in articles this month. Remember - you don't need to be a Pulitzer prize winner to make it past *this* editorial board! I would like to to start up an observing/astrophotography tips column, aimed at both the beginner and the expert. As I still qualify as a beginner I need some outside help!

Happy Holidays and Clear Skies!

Tracy Webb
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Chair's Report

In spite of the bad weather, we had a good turnout for our November meeting. Our new post-meeting gathering place proved to be an excellent choice so it looks as though we are going to make a habit of going to Tony Balony's.

I hope that everyone found enough gaps in the clouds to have a look at the great planet lineup at the beginning of the month. Southern Ontario in the late fall really isn't the best place to do observing. The best part about this time of year is that when it eventually clears up it gets dark nice and early.

It's almost Christmas and nearly too late to drop hints about which astronomical toys you want. Here is a short list of suitable gifts:

-Star charts
-Red flashlight
-Warm clothes
-Battery heated socks and mitts
-Books
-Videos such as Stephen Hawking's Universe or Men in Black :^)
-Full set of Naglars
-Caribbean Solar Eclipse cruise tickets
-Portable heated observatory
-36" Obsession Telescope ...

Sorry, I got a bit carried away there.

Merry Christmas and a Happy New Year,

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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.

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The Sun Stands Still

Christmas really isn't a Christian holiday at all, whisper the gleeful atheists. They just put Christ's birthday near the end of December to replace the Roman festival of Saturnalia.

Well, that's partly true. But it's certainly not the whole story.

Celebrating the winter solstice is something that humans have done for as long as anyone can remember. We've quite naturally come to associate the fewer hours of sunlight with the end of the old year and the birth of the new. Many societies have extended this metaphor to include the death and rebirth of a deity. About seven thousand years ago, the Egyptians began celebrating the demise and subsequent return of Osiris, the celebrated lord of the underworld.

Far more often, it was the sun itself that became a god or, in most cases, a goddess. Sol was the Viking name for this brazen deity. She was Sul or Sulis to the Celts and Sun Sister to the Inuit peoples of northern Canada. In far-off Japan, this goddess was Amaterasu Omikami, one of the two creators of the world. In Korea, she was a little girl who was chased up a tree by a tiger and saved by the Lord of Heaven.

When the hours of daylight are at their fewest, many societies have resorted to lighting bonfires to welcome the returning sun or encourage it to come out of hiding. This was especially popular among the Norse peoples who gave us many of the traditions of Yule, or Midwinter, such as the Yule log, the Christmas tree, and the tradition of wassailing or drinking and making merry.

Another popular myth of the winter solstice is that of a great mother giving birth to a celestial boychild. Again since the time of the Egyptians, humans have set aside the shortest day of the year to celebrate the birth of a lord of light. Among the Egyptians, this was Horus. Next came the Greek Apollo, the Roman Bacchus, and our current favorite: Jesus, who was originally known not as the "son" , but the "sun" of righteousness.

Astronomically, the winter solstice happens the moment the sun reaches it's lowest declination for the year. Our word "solstice" comes from Latin and means "the sun stands still". This refers to the fact that the sun apparently rises and sets at the same times over the course of three days. Right now, the position of the winter solstice is near the galactic center in the constellation of Sagittarius. However, due to the precession of the equinoxes, this place changes over time.

The Mayans discovered precession hundreds of years ago. At that time, the location of the winter solstice was about 30 degrees away from its present position along the ecliptic. The Mayans also noted that the ecliptic - the sun's apparent path among the stars - intersected an interesting part of the Milky Way know as the Dark Rift. Modern astronomers understand this apparent absence of stars not as a whole in the plane of our galaxy, but as a cloud of gas and dust that obscures the stars further in. Yet the Mayans saw this differently. The Dark Rift was also called the Black Road or Xibalba Be, the Road to the Underworld. Some even saw it as the birth canal of the Great Mother.

Since the Mayans were excellent mathematicians, they calculated that the winter solstice would occur at the center of the Dark Rift in a year that corresponds to A.D. 2012 on the Julian calendar. This marks the end of the Mayan Long Count, a cycle of 5125 years which was thought by this ancient civilization to correspond to the end of one of the great ages of humanity and the beginning of another, since at that time, the sun would appear to be rising from the celestial mother's womb. Mayans and latter-day scholars who studied their writings believed that this seminal moment could usher in great catastrophe or great enlightenment — perhaps even both.

Interesting stuff, in any case.

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This is the first in a series of articles about the Great Wheel - the annual parade of celestially auspicious occasions and the ways in which people celebrate them. Stay tuned for more!

Meteors, Meteorites cont ...

spheric friction and hit the Earth's surface with very little fanfare. However, meteoroids larger than a few hundred tons are slowed very little; only these large (and fortunately rare) ones make craters.

A good example of what happens when a small asteroid hits the earth is Barringer Crater (a.k.a Meteor Crater) near Winslow, Arizona. It was formed about 50 000 years ago by an iron meteor about 30-50 meters in diameter. The crater is 1200 meters in diameter and 200 meters deep. About 120 impact craters have been identified on the Earth, so far.

A more recent impact occurred in 1908 in a remote uninhabited region of western Siberia known as Tunguska. The impactor was about 60 meters in diameter and probably consisted of many loosely bound pieces. In contrast to the Barringer Crater event, the Tunguska object completely disintegrated before hitting the ground and so no crater was formed. Nevertheless, all the trees were flatted in an area of 50 kilometers across. The sound of the explosion was heard half-way around the world in London.

There are probably at least 1000 asteroids larger than 1 km in diameter that cross the orbit of Earth. One of these hits the Earth about once in 300 000 years on average. Larger ones are less numerous and impacts are less frequent, but they do sometimes happen with disastrous consequences.

The impact of a comet or asteroid about the size of Hephaistos or Shoemaker-Levy 9 hitting the Earth was probably responsible for the extinction of the dinosaurs 65 million years ago. It left a 180 km crater now buried below the jungle near Chicxulub in the Yucatan Peninsula.

Calculations based on the observed number of asteroids suggest that we should expect about 3 craters 10 km or more across to be formed on the Earth every million years. This is in good agreement with the geological record. It is more difficult to compute the frequency of larger impacts like Chicxulub but once per 100 million years seems like a reasonable guess.

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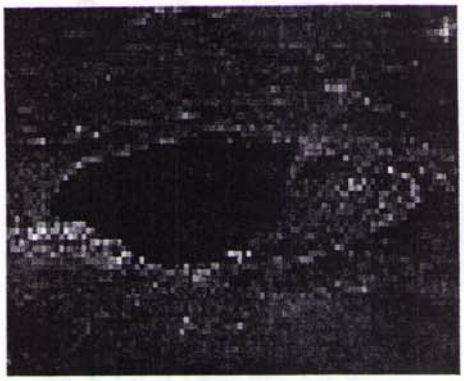
http://www.seds.org/nineplanets/nineplanets/nineplanets.html



The Barringer Crater in Arizona - 1.2 kilometres across and 50 meters deep!

Cosmic Voyage Review

We recently received an invitation for a limited number of people to attend an evening event at the Ontario Science Centre. The purpose was to preview the Ontario release of the Omnimax film *Cosmic Voyage*. The evening included some excellent food and drink before the show and dessert and live entertainment afterwards.

I first saw this movie in May of this year while on a trip to the States. I enjoyed seening it the second time as much as the first. The movie consists of a voyage from the Earth out to the edge of the universe and back and then a journey down to quarks which are currently the smallest known particles. Extensive use was made of computer animation to show that which cannot normally be seen. One especially impressive sequence showed the merging of two galaxies that took 900 hours of computer time to create on a fast Cray supercomputer. I recently saw an old version of this movie, one which used cartoon animation. The journey into the very small stopped at showing a sphere representing the nucleus of an atom. I wish I knew when the first movie was made because the comparisons between the technology used to create the movie and the knowledge of the world around us was fascinating.

I think that eight dollars for a 45 minute movie is a bit steep but I still recommend that you go to see it and roam around the Science Centre afterwards.

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The Kuiper Belt and Oort Cloud

Careful orbital calculations done in 1950 by Jan Oort indicate that a huge spherical "cloud" (now called the **Oort Cloud**) of perhaps a trillion or more comets orbit the Sun far beyond the orbit of Pluto from about 30 000 AU (astronomical units - the distance from the Earth to the Sun) to a light-year or more. This is the source of the long-period comets.

The Oort Cloud may account for a significant fraction of the mass of the solar system, perhaps as much or even more that Jupiter. (This is highly speculative, however; we don't know how many comets are out there nor how big they are).

The **Kuiper Belt** is a disk shaped region past the orbit of Neptune roughly 30 to 100 AU from the sun containing many small icy bodies. It is now considered to be the source of the short-period comets. Occasionally the orbit of a Kuiper Belt object will be disturbed by the interactions of the giant planets in such a way as to cause it to cross the orbit of Neptune. It will then very likely have a close encounter with Neptune sending it out of the solar system or into an orbit crossing those of the other giant planets or even into the inner solar system.

There are presently six known objects orbiting between Jupiter and Neptune (including 2060 Chiron, and 5145 Pholus). The IAU has designated this class of objects as **Centaurs**. These orbits are not stable. These objects are almost certainly "refugees" from the Kuiper Belt. Their future fate is not known.

Curiously, it seems that the Oort Cloud objects were formed closer to the Sun than the Kuiper Belt objects. Small objects formed near the giant planets would have been ejected from the solar system by gravitational encounters. Those that didn't escape entirely formed the distant Oort Cloud. Small objects that formed farther out had no such interactions and remained as the Kuiper Belt.

Several Kuiper Belt objects have been discovered recently including 1992 QB1 and 1993 SC. They appear to be small icy bodies similar to Pluto and Triton (but smaller). As of late 1997 there are several known trans-Neptunian objects (not counting Pluto and Charon). Many orbit in 3:2 resonance with Neptune (as does Pluto). Colour measurements of some of the brightest have shown that they are unusually red.

It is estimated that there are at least 35 000 Kuiper Belt objects greater than 100 km in diameter, which is several hundred times the number (and mass) of similar sized objects in the main asteroid belt.

A team of astronomers led by Anita Cochran report that the Hubble Space Telescope has detected extremely faint Kuiper belt objects. The objects are very small and faint, perhaps only 20 km or so across. There may be as many as 100 million such comets in low-inclination orbits and shining brighter that the HST's magnitude-28 limit. (A follow-up HST observation failed to confirm this observation, however.)

Spectra and photometric data have been obtained for 5145 Pholus. Its albedo (a measure of the amount of sunlight it reflects) is very low (less than 0.1). Its spectra indicates the presence of organic compounds, which are often very dark (e.g. the nucleus of Comet Haley).

Chiron is by far the largest known object of this type. It is about 170 km in diameter, 20 times large than Halley. If it ever is perturbed into an orbit that approaches the sun it will be a truly spectacular comet. Some believe that Triton, Pluto and is moon Charon are merely the largest examples of Kuiper Belt objects.

But these are more than distant curiosities. They are almost certainly pristine remnants of the nebula from which the entire solar system was formed. Their composition and distribution places important constraints on the models of the early evolution of the solar system.

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Did you know that ...

Scarcely a single specimen of a meteorite that predates 1790 is known today. L'Acadamie Fracaise had declared that stones could not fall out of the sky. As a result, museums all over Europe had thrown out their cherished meteorite specimens with the rubbish as humiliating reminders of a superstitious past.

How To Have Warm Buns at a Cold Eyepiece ... Part 1

Winter is one of my favourite seasons. No, I'm not deranged, but, I've learned to harmonize rather than fight with the weather it brings. I've spent many a weekend winter camping and enjoyed it thoroughly, day and night, even in temperatures of -35C.

The learning came at the cost of numbness, shivers, and generally living my mistakes in the early boldness of these ventures. Last winter I was able to confirm that the same techniques that warmed me on trail and camp also keep me cozy at the eyepiece of my telescope.

Here, then, is some of what I now know about dressing for comfort as applied to winter observing.

How warmly should I dress?

Observing consists mostly of sitting or standing around as opposed to walking, chopping wood etc. Add to this the effects of radiating our heat into the inky night sky and you have a recipe for disappointment. The cure is simple. We need, only, to dress somewhat warmer than if we were outside doing some physical activity.

In order to be comfortable we need to *dress for a temperature of about 10 degrees lower than the air temperature*. This, by the way, is good advice for observing at any time of year, but, particularly so in winter.

Know Thy Enemy!

Rather than provide you with a list of solutions, I would like to explain some of the processes at work as we try to keep warm and the basic remedies for these. Once you understand what's happening, you become able to recognize symptoms and devise your own solutions to problems that may arise while you're outside on a winter's night.

The major culprit in making us feel cold is our *perspiration*. We're all familiar with the perspiration of summer, but, what about other times? It may surprise you to know that we perspire continually, all year round, all day long. It seems our skin is very partial to life in a tropical rainforest and tries to create these humid conditions wherever it may be. In fact our comfort demands these conditions. Skin *LOVES* moist air and sets about making this environment by perspiring into the adjacent atmosphere. This emerges from our pores as water vapour. We are generally unaware of this process and only feel a change when this forms on the skin as a film of water and then evaporates directly from the skin's surface. In this case, the perspiration is being used to cool us down rather than just avoiding dryness.

The process of evaporation, you may recall from high school physics, requires an additional bolt of heat (Latent Heat of Evaporation?) to go from a liquid to its gaseous state. It gets that heat from the skin's surface, thus, cooling us down in the bargain. But, we don't *WANT* to cool down on cold winter nights! So we put some clothing next to our skin and feel warmer. OK?... Maybe...

It depends on what that undergarment is made of. The most popular fabric for underclothes is cotton. We like its soft feel, it's inexpensive, and it's durable. Problem is, it's just about the worst thing one could wear next to the skin on a cold night! You see cotton likes water. That is to say, cotton absorbs and retains water, which is why we use it in the best towels. One reason it feels so nice, is that it's much easier to have a rain forest next to our skin when what we're wearing is sopping wet! So, getting back to our skin, cotton soaks up the water and holds it by the jugful. Then, in order to stay warm, we not only have to keep ourselves warm, but, also that wet garment must be kept warm too! What we need is a fabric which abhors and detests water and would rather dump it out than retain it. *Polypropylene* is the best known of these *"anhydrous"* fabrics. It's a bit more expensive than cotton and

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The Hamilton Amateur Junior Astronomers will be having their holiday meeting on Monday, December 15th, at 7:00 pm. Astronomically great treats will be served!

We will be reading our articles that we've put together for the Event Horizon and coming up with some great ideas for more!

HAJA meets every third Monday of the month. Interested parents can contact Rosa Assalone at 540-8793 If you are interested but Monday nights are bad please let us know - we'd like to find the best night for everyone.

Ask the Expert ...

QUESTION

What is the Event Horizon?

ANSWER

For a Black Hole, the Event Horizon is an imaginary sphere with a radius that corresponds to the distance from the centre of the Black Hole where the escape velocity equals the speed of light.

As you know, on the Earth if you throw something like a ball up in the air it will eventually fall back down. This is because you don't have the strength to throw the ball fast enough to exceed the force of gravity which manifests itself as a constant acceleration towards the centre of an object such as the Earth. At the surface of the Earth this acceleration is about 9.8 metres/sec/sec. If you could ride an elevator that would allow you to travel far beyond the Earth's atmosphere, you would find that the farther you move away from the Earth the farther you could throw the ball before it fell back down. Eventually, you would reach a point where the thrown ball would keep going. The reason this happens is that the acceleration due to gravity diminishes as you move away from all massive objects.

A Black Hole is an object that has all of its mass at a single point in space. Right at the Black Hole the acceleration due to gravity is so high that even light doesn't have enough energy to overcome the escape velocity. As with the previous example, the farther you move away from the Black Hole the lower the escape velocity. Eventually, at some distance away from the Black Hole the influence of gravity is low enough that light can escape its pull. This distance is the same all around a Black Hole and forms a sphere which to us might appear to be its "surface". This is the Event Horizon.

QUESTION

I have read that the small mass of the planet Pluto is not enough to account for the perceived irregularities in the orbits of Uranus and Neptune thereby implying that there may be yet another planet beyond Pluto which is exerting some gravitational force. Is this true? If so, is there any kind of interest or a serious search being carried out these days for a tenth planet?

ANSWER

The possible existence of a tenth planet (technically ninth since Pluto has been demoted to asteroid status) is an old theory that has just recently been laid to rest.

In the mid-nineteenth century perturbations in the motion of the planet Uranus lead astronomers to predict the existence of an unknown planet beyond the orbit of Uranus. This planet, Neptune, was discovered in 1846 but its mass and orbit were unable to account for the deviations in the orbit of Uranus. This lead to the search for another planet beyond the orbit of Neptune which was not found until almost 100 years later in 1930.

Again the mass of this planet, Pluto, was disappointingly small; the total mass of the Pluto-Charon system (although Charon was as yet undiscovered) is only 1/1000 Earth masses. Astronomers once again postulated that there must be something else out there.

From the turn of the century to the present numerous scenarios have been suggested from planets well beyond Neptune's orbit to those inside it with varying sizes. One astronomer named Pickering proposed the existence of a total of nine different planets in a period of 20 years. Extensive searches were made so that today most of the sky down to approximately 23rd magnitude has been searched - with no planet found.

The launch of the Voyager probes has allowed for more accurate determinations of the masses of the outer planets. When these new, improved masses are used in the orbit calculations no wobbles or residuals remain. That is to say, our solar system is running quite nicely without the need for a tenth planet. In fact, the calculations rule out any undetected Earth sized planet within approximately 50 AU. There could be massive planets beyond this distance but current solar system formation theories show that forming a massive planet at this great distance would be extremely difficult. However, it is likely that there are a few Pluto sized asteroids.

All that precious telescope time used to search for the the tenth planet wasn't wasted, however. While looking for the mystery planet astronomers have discovered comets, asteroids, star clusters and even galaxies.

-Keep those great questions coming!

Warm Buns cont ...

(Continued from page 6)

you've got to be careful to wash it in cold water and hang to dry. Otherwise you'll be lucky if it'll fit the cat after a good hot wash & dry. We refer to such fabrics as having the ability to *"wick"* the water away. And that is just what happens. The perspiration is conducted away from the skin, often before it can even condense. Condensation, if it occurs at all, takes place on the outside surface of the garment all undetected by our lily whites and we feel warm. Kewel!!

The Layered Look...

Layer 1: winter lingerie

We have seen how important it is to choose the right kind of undergarment fabric for staying warm in winter. The undergarment is part of a system of *"layers"* designed to maximize our heat retention and stay cozy while at the eyepiece or some other activity. This garment ought to be snug fitting. Let's refer to this as **Layer 1**.

Layer 2: the Fluffies

Next, comes the insulation layer. This, as the name states, is to insulate us from the cold of night. Garments are better to be loose fitting than tight. Appropriate fabrics are characteristically bulky, lightweight, and able to trap still air in its tangled fibres or "tiny air pockets"; air movement being a "no-no" for heat retention. Roughly speaking, they can be divided into 2 piles... *natural* and *synthetic*. Each of these have pros and cons.

The most popular natural ones are down and wool. Down is *"nature's own snuggly blanket"* and the most efficient insulator for our purposes. High grade goose down is able to provide more insulation value per unit weight *AND* per unit volume than any other material for this application. It has, however, one serious drawback. If it ever gets damp or wet (God forbid!) you've got *BIG TROUBLE!* It takes days to dry out and it's insulating value plummets to uselessness in this state. Down is definitely *NOT* anhydrous. Remember the perspiration that passes through **Layer 1**? If it collects in **Layer 2** (and it will!) you're in for discomfort. Down is beautiful stuff and a great temptation, but, I've come to avoid it in clothing for this very reason. Well... that, and the fact that they want my firstborn for it!

Wool, on the other hand, is relatively affordable, and, while not having as high an insulation value as down, it does a pretty good job in clothing. Hey! One can always get *two* sweaters on... Right? More about this later...

What about dampness? Wool has the wonderful quality of retaining much of its insulation value even when its wet! It is much more forgiving than down. Think of it as having built-in insurance. I like it. My skin doesn't!! Many, like me, have skin that rebels against dressing up like sheep. We either put up with the itching, tickling, and general torture, or, find something else...

Enter the synthetics. There are now quite a lot of great synthetic fabrics with excellent insulation qualities on the market. Names like Hollofil, Quallofil, and Thinsulate come to mind. They're all anhydrous and a good choice for **Layer 2**. My favourite, though, is Polartec by Malden Mills. This stuff is very lightweight, has a luxurious fluffy feel to it, doesn't *"pill"* (form little balls of fabric on the surface after repeated use; aka *'nubblies'*), and comes in an endless array of colours and patterns. It is so anhydrous, that if you, get it completely soaked, just squeeze out the water, and it'll hang dry in 20 minutes. It will even dry while you're wearing it! I had the privilege of confirming this empirically on a Fall canoe trip once. But that's another story...

OK! There you have it. Some **Layer 2** facts and personal biases. The last thing to remember about **Layer 2** is that it is far better to wear multiple thin layers than a single thick one. The wisdom in this is as follows... If you are warm to the point that you are feeling perspiration, then, you can (must?) peel a layer or two until your brain turns off the water tap. If not, you continue to push moisture through **Layer 2** at a high rate. Even the best will have trouble keeping up with this and leave you with a jacket full of water to keep warm. So... **Layer 2** is actually as many thin layers of insulation as you will need for the coldest temperature of the night in question minus 10 degrees C. Remember the additional -10 degree rule of thumb?

Layer 3: the Wrapper

Layer 3 is an outer shell with 2 important functions. It has to keep the wind and rain from getting to you, and, it has to pass the moisture that's been travelling out through **Layers 1 & 2** from your skin. Now, we don't do much observing in the

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rain, so that's not a concern here, but, keep it in mind for other outings when buying.

Wind? We don't observe in the *wind!* Even the slightest of breezes will meander through **Layers 1 & 2** and kiss you with frozen lips. We need to keep that air movement, however small, outside **Layer 3!** At the same time, **Layer 3** must allow our inner moisture free access to the universe. These two requirements may seem to be mutually exclusive in a single garment. Not any more!

There are a number of high-tech synthetic fabrics now that can do just this. The best known of these is undoubtedly *Gore-Tex*. Gore-Tex is as waterproof as a rubber glove, yet will allow water vapour or air to pass through the *"micropores"* in its waterproof barrier. If absolute waterproofing is not a biggie for you, then, consider a fabric known as *Super Microft*. It is what the manufacturer calls *"water repellent"*. My experience with this has been that it'll keep you dry long enough to get to shelter... if you run! I like it because it's an excellent wind barrier, lightweight, soft and comfortable, and, above all, it's a good *"breather"* that'll vent my own moisture to the world outside. Get them a size bigger than you normally would and they'll be perfect at the eyepiece or any other cold outing These specialty fabrics, and consequently, the garments, are a bit pricey. But, consider the following...

I have two shells: one in *Gore-Tex*, the other is *Super Microft*. My last Gore-Tex jacket is 10 years old and still going strong. (I grew out of it!) I don't own or need a raincoat, overcoat, leather coat, parka, snowmobile suit, Fall or Spring jacket, K-way shell, or umbrella. I've avoided a lot of purchases over the years... Hmmm? These two are functionally superior and look good too. Well... at least to those who know the magic they hold!

Next Month ...

In part 2 we'll look at keeping your hands, feet and head cozy and comfortable along with a few goodies for a beautiful winter night's observing ...

- Tony Wallace, Observing Director

Cool Astronomy Internet Sites

http://www.sci.muni.cz/~ondra/gl/gl.html
How to dscover a variable star with magazines.

http://antwrp.gsfc.nasa.gov/apod.astropix.html
Astronomy Picture of the day.

http://.science.mcmaster.ca/HAA.index.html
Hamilton Amateur Astronomers

http://www.national geographic.com/features/97/stars/
Star Charts

http://sed.lpl.arazona.edu/messier/Messier.html
The Messier Catalogue

http://www.seds.org/nineplanets/nineplanets/nineplanets.html
Nine Planets Solar System Tour

Announcements

Observer's Handbooks

The observer's handbooks (1998) are available while supplies last for $13 each. Please see Barb Wight at the meeting or call her at 570-1021.

Membership is Tax Deductible!

Commencing with the current year the HAA will be issuing tax receipts for membership fees. Please see Barb Wight at the meeting to pick up your receipt. Absent members will be sent a receipt with their newsletter.

Please Renew!

It's time to renew your HAA membership. Single memberships are $15 and family memberships are $20 (a great deal!). Unfortunately, this will be the last newsletter sent out to members who have not renewed so please don't delay.

Doug's Stuff fer Sale!

Mirror-making material	-contact Steve Barnes
Super 8mm Canon movie camera	$50
Canon TL body plus f.1. f/1.8 lens	$75
300mm f.l. f/4.5 Dimension telephoto	$75
(Canon TL plus 300mm telephoto combo)	$125
Tele-extender	$5
Keychains	$5 each
FAX/Phone line-splitter	$50

Tektronix 2205 20-Mhz dual-channel oscilloscope
Condition: like new. Original packing box plus manuals. $1300 new - Make me an offer

Contact Doug Welch
Telephone: 524-0848
E-mail: welch@physics.mcmaster.ca

CALENDAR OF EVENTS

- Friday, December 19th, 7:00 PM
- January 23,24,30,31, 8:00 PM
- Friday, January 9th, 7:30 PM
- Friday, January 16th, 7:30 PM
- Monday, December 15th, 7:00PM

COUNCIL MEETING - At the home of Marg Walton. Call Stewart at (905)-827-9105 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 J.J. Kavelaars of McMaster University who will be talking about *Darkness on the Edge of Town - Major Search for Minor Planets*

COUNCIL MEETING - Location to be announced..

HAJA MEETING - McMaster Burke Science Building, room B148. Holiday Party! For more information contact Rosa Assalone at 540-8793.