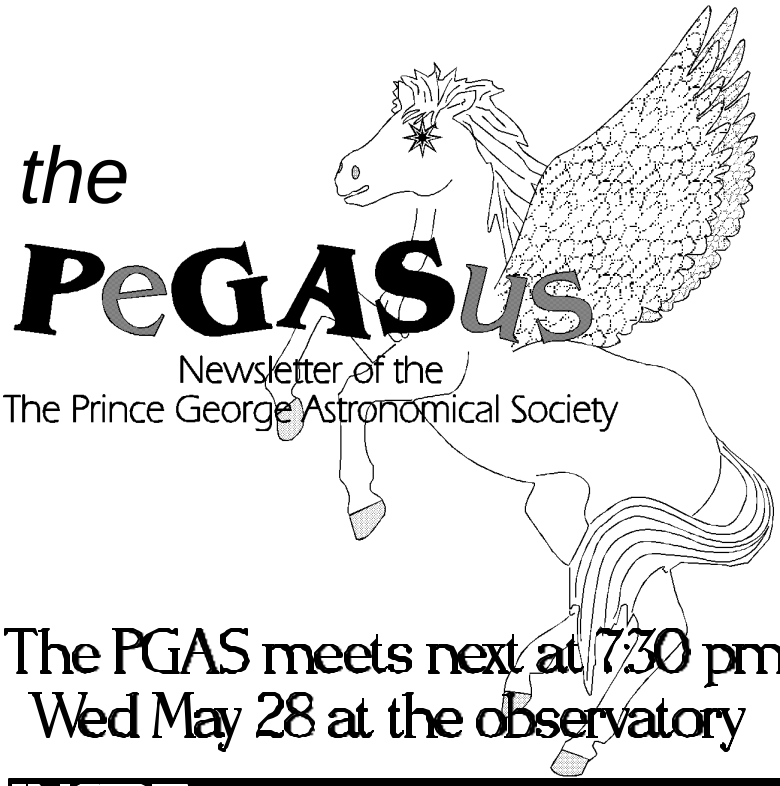
1997 MAY ISSUE #75

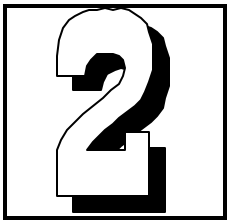


the PeGASus

Newsletter of the
The Prince George Astronomical Society

The PGAS meets next at 7:30 pm Wed May 28 at the observatory

INSIDE :



the PeGASus is published monthly by the *Prince George Astronomical Society*. Contributions to the newsletter are welcome.

Deadline for the next issue is June 18
(last issue this season.)

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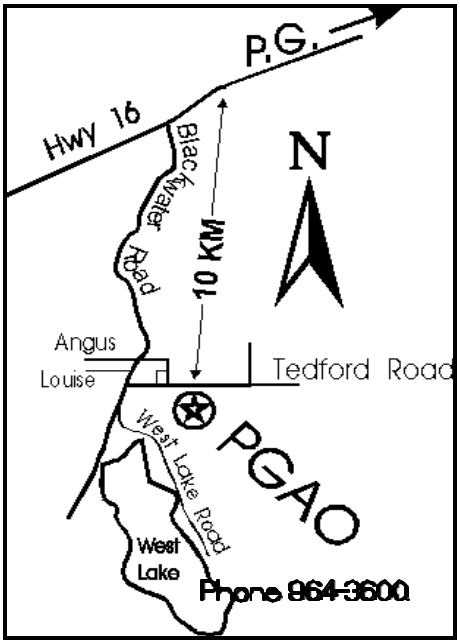

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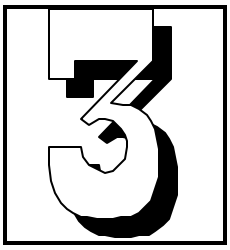
Editorial 75

by Orla Aaquist



Gil asked me to write the editorial for this issue of *the PeGASus.* For those of you who joined the club in the last year, I used to be the editor of this fine newsletter. In fact, I have before me most of the newsletters I helped publish. They date back to October 1992 with newsletter #30 when I took over as editor from Bob Nelson. (Actually, Shannon took over and then I grabbed it from her without permission.) The last newsletter I edited was issue #67, dated June 1996, just before moving to the black hole of Fort McMurray; and it is from here that I write this editorial for the 75th anniversary issue of *the PeGASus.*

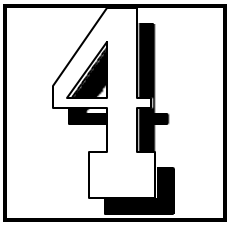
First of all, I wish to thank Gil for keeping the horse. Thanks, Gil. You are doing a great job. I am especially impressed by the wonderful centrefold of Hale-Bopp in the last issue. I am also impressed by the astrophotographs of Hale-Bopp that I received from Rob Frith a few weeks back. I promptly framed the colour copy of the photograph by Frank Badey (taken through the shutter from inside the dome) and hung it in my physics display case. I think that the PGAS has some real talent, and if you keep working at it, eventually national recognition will come your way.

I am proud to be affiliated with the PGAS. Over the years there has been a lot of hard work put into the society by many members, but I will not venture to mention any of these people for fear of missing someone. However, there is one person whom I can safely mention, namely Dr. Bob Nelson. Everyone will recognise Bob as having been there from the very beginning, participated in every aspect of the club, and dedicated a large part of his time and expertise to the growth of your society. I think that it is safe to say that the PGAS would never have existed in its present form if it was not for the efforts of this individual.

Here is a little known story about Bob. I can safely tell it now because I am a safe distance away from Prince George, and you can't get here from there. Bob's contribution to the PGAS is a fact that has been long appreciated by many of us. So, when the completion of the current observatory on Tedford Road was near at hand, a few of us talked about giving the telescope a name which honoured his contributions. A few possibilities were considered, but the only name which had any magic to it was 'Bob's Eye'. However, the problem with this name is that we could not help smiling (loudly) when we used it. You see, when you work with Bob you soon realise that he has a certain way of looking at you when the work get a little intense. In particular, if you try to get his attention when his mind is focused on a task, part of his mind immediately wanders back to the task and you realise that he hasn't really paid much attention to what you were trying to say. The sensation was that one of his eyes wandered longingly back to his work if you tried to distract him from it, and you never really got his full attention.

We were never brave enough to discuss this with Bob for fear of it being taken the wrong way (or we were afraid that we couldn't keep a straight face). However, I do think that the subject should be raised again, and what better time than the 75th issue of *the PeGASus.* Therefore, as a no-longer-paying member of the PGAS with

(cont page 4)



no say what-so-ever in the business of the society, I would like to propose that the telescope (or some other appropriate piece of architecture) at the PGAO be given a name which properly reflects Bob Nelson's contributions to the society.

One last word. At the time I left Prince George, two other active PGAS members left: Alan and Jennifer Whitman. Also, Jon Bowen ran away to Prince Rupert. From what I see, you are doing fine without us; and this is as it should be. It means that the PGAS has matured enough that it does not rely on a few individuals for survival. It means that you are generating enough interest so that when a hole is created, there is someone willing to step in and fill it. It is another reason why you should be proud of belonging to the PGAS.

O.A.

Coming Events

If you are involved with any astronomical or otherwise scientific activity on behalf of the PGAS, please list the activity here.

Last open house of the season ----May 30
since it is not very dark until just about closing time, lets all show up and make it a social evening.

N.O.V.A.

New Observers to Visual Astronomy

A new program has already started, but it is not too late to get involved.
If you would like to register, please call Bob Nelson
562-2131 or 563-6928

Night Skies for June 1997

(Unless otherwise noted, all events are for the 15th of the month.)

MERCURY is not visible for observers in Prince George this month.

VENUS, in Gemini for most of the month, is a bright evening object, setting about 90 minutes after sunset. On June 15, it will be magnitude -3.9, angular size 10.5" and in the gibbous phase.

At year's end, its magnitude and size will rise to -4.50 mags and 56.3" resp., and it will be in the crescent phase. (The brightest it gets will be -4.67 in the second week of December; it will be half illuminated on Nov 1.) It will reach inferior conjunction 1998 Jan 15.

MARS, in Virgo, is in the southwest at sunset and sets around 1:30 A.M. It's become a shadow of its former self since the opposition of March 17 of this year: the magnitude (formerly -1.2) will have faded to +0.5; the angular size (formerly 14.2") will have shrunk to 8.2". In other words, if you look at it with a telescope on a good night, you'll still see a disk but will be very hard-pressed to see any surface details. We really should be at the latitude of Los Angeles or Hawaii to do top- notch observations of Mars.

JUPITER, in Capricornus, rise around 12:30 A.M. and is in the south at sunrise. It begins retrograde motion on June 10. It will reach opposition on Aug 9 -- that is when viewing should be best. However, because of its large orbital radius (5.2 AU), Jupiter does not go through as large a range of distances that Mars does (0.5 to 2.5 AU). Jupiter's distance will vary from about 4.2 to 6.2 AU; its angular size will vary from around 48" down to 32" (resp.). Therefore, you can look at Jupiter anytime you can catch it -- because of its large size, you'll be rewarded by a good view. In June, Jupiter's angular size will be around 44" and its visual magnitude will be -2.6 (quite bright!).

SATURN, in Pisces, rises around 2 A.M. and is in the south-southeast at dawn.

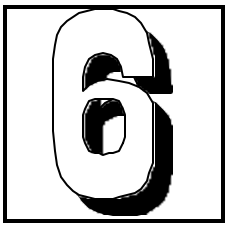
URANUS, in Capricornus, rises about midnight and is up until dawn.

NEPTUNE, on the Capricornus-Sagittarius border rises about 11:30 P.M. and is up until dawn.

Summer solstice occurs this year on June 21 at 1:18 PDT. See my article on summer solstice elsewhere in this issue.

There are many deep sky objects are located in Sagittarius which is prominent in the southern skies this month. Last time I was out at the observatory, I managed to add another ten Messier objects to my list -- I'm at 99 and need only 11 to complete my list! These eleven are mostly in Sagittarius which is notoriously hard to observe here in P.G. -- the constellation is most visible when the nights are only two hours long! However, if you make the effort to observe, I think you'll find that the many splendid objects that Sagittarius contains (including the Lagoon Nebula M8, the Swan Nebula M17, the Trifid nebula M20 and the dense centre of the Milky Way) make it well worth while.

B.N.



Feeling Lucky?

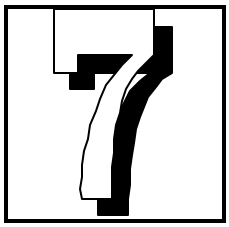
by **V. HOGAN**

At the beginning of **The Hitchhikers Guide to the Galaxy**, Arthur Dent is trying to prevent the local council from bulldozing his expropriated home. While he is chatting with a friend, a giant Vogon demolition spaceship arrives from outerspace, and announces that the earth has to be destroyed for the construction of a space thruway. As the earthlings furiously scream out their objections, the Vogons calmly point out that all legalities have been observed, that the required notices were posted on Alpha Centuri, and if the earthlings weren't keeping up with their reading, too bad! Moments later, the earth is destroyed, but by a miraculous chance, Arthur survives. In a circuitous way, the concepts of chance, the destruction of the Earth, and the evolution of life are intertwined.

But, that's science fiction, and the Earth couldn't really be destroyed from outer space. For roughly 5 billion years, the Earth has moved around the Sun, and until our star exhausts its nuclear furnace, in approximately 5 billion years, and envelopes the earth in a final fiery cataclysm, it is not likely anything will. And despite popular culture's enthusiasm for the proposition that Lizard people from Alpha Five will arrive to enslave us, or at the very least travel through hyperspace for the purposes of leaving circles in wheat fields, it's not likely we face any real threat from that direction. However, there is a small debate, primarily in the USA, about whether comets and asteroids, provide a significant threat to human existence. On the one hand, it seems a ridiculous proposition, because for the past 5000 years of human existence, there is not a single recorded case of crash into a human community where even one death has occurred. As well, there are less than a handful of accounts of people being struck by meteorites, the last being in Alabama in the 1950's, when a meteorite crashed through the victim's roof and struck her in the leg, while she was reclining on a couch.

Yet, we are just opening our eyes as a technological civilization, and it's clear that the Earth is wandering through a cosmic shooting gallery. For the first time, we have been able to witness a comet, crash into another plant, Jupiter. As well, it has been only since the 1980's that technology has been available to catalogue the sky. American spy satellites have recorded numerous explosions of meteorites in the upper atmosphere. During the Gulf War, a meteorite exploded high over the Pacific, shining with more intensity than the sun, and had it come in over the Mid East, it's easy to imagine what chaos might have arisen. On average, about 5 garage-sized objects are coming into the atmosphere yearly, although none since 1908 have come through intact. During May 1996, the 6th closest known asteroid to pass by Earth, was at 280,000 miles, about the distance to the moon. This asteroid, about 300 to 500 metres in diameter, is roughly 10 times the size of the object that created Meteor Crater, Arizona. "This asteroid wouldn't destroy civilization if it hit Earth, but it sure would mess things up" said one of the co-discovers who noticed it 2 days before its closest

pass to Earth. It's not very comforting to know that Canada is pockmarked with collision craters!



Try consulting a dinosaur about the effects of a 10 km. comet or asteroid crashing into the Yucutan, 65 million years ago! On the other hand, you have a far greater risk of being injured or killed in your bathroom.

If however you do wish to look into this further, just look up "Asteroid" or "Comet" or "Near Earth Objects" on the internet.

Four good sites to start are:

(I) Asteroid and Compact Impact Hazards
http://ccf.arc.nasa.gov/sst/main.html
This is everybody's favorite!

(II) Near Earth News
http://www.transatlantech.com/TPS/9sp-neo-0l95-neoabc.html

(III) Asteroid Links
hhp://ptolemy.gps.caltech.edu/rbottke/asteroid.htm/
A great spot to visit!

(IV) Terestrial Impact Craters
http://bang.lanl.gov/50/solarsys/tercrate.html
Great pictures and information about impact craters around the world! Notice how many major sites are in Canada!

And one site to **AVOID:**
10 Comets Coming This Year
http://www.tldm.org/10comets.html

This boring and commercial site only wants to sell you "Heaven's Home Protection Packet" - which includes 4 crucifixes, a small tube of super adhesive, and instructions, for $8.00 American.

V.H.

Light Pollution-- Theft of the Night

Today, people who live in or near large cities have lost much of their view of the universe. The spectacular view of the night sky that our ancestors had above them on clear dark nights no longer exists. The great increase in urban population has caused an ensuing rapid increase in urban sky glow due to outdoor lighting, which has brightened the heavens to such an extent that the only view most people have of the Milky Way or most stars is when they are well away from cities. This excess light in the sky has an adverse impact on the environment and seriously threatens to remove forever one of mankind's natural wonders -- our view of the universe.

While this increased urban sky glow brightens the night sky for thegeneral public and for amateur astronomers, it is a special threat to professional astronomy. Advances in frontier astronomy require observations of very faint objects that can be studied only with large telescopes located on prime observing sites, well away from sources of air pollution and from urban nighttime skyglow. For example, most observations of cosmological interest deal with extremely remote sources: galaxies or quasars at such distances that the light has traveled several billion year, sometimes twice the age of our solar system, before reaching us. This light is then often lost in the glare of man-made sky glow.

The increased sky glow which adversely affects the environment and compromises astronomical research is called "Light Pollution", for it is wasted light that does nothing to increase nighttime safety, utility, or security. It only serves to produce glare, clutter, light trespass, light pollution, to waste energy and money.

The argument that all astronomy can be done from space is not correct; the largest telescopes will continue to be ground-based for a long time, because of cost factors. It doesn't make sense to do in space, at much higher cost, what can be done from the ground. There are many things that can only be done from space, and the demand for that type of research is and will be severe. The experience of more than two decades of space astronomy is that space research has greatly increased the demand for ground-based facilities. Planning for several ground-based telescopes much larger than anything now in existence is already underway, one such project is nearly completed. There are exciting times ahead for astronomy, using present and future ground-based telescopes, which complement the telescopes in space.

Solutions exist to the problem of light pollution, and control programs are underway now in a number of communities. Programs like these are critical to the long term success of astronomical research and to preserve mankind's view of the universe. There is much more to be done, however, even in these communities, and most places are not yet even aware of the issue.

At present, the lack of awareness rather than resistance is generally the biggest problem in controlling light pollution. Educating the public, government officials and staff, and lighting professionals is a major thrust of the current programs. These efforts have helped. The increase of light

pollution near major observing sites is moderating. More can and must be done, locally, nationally, and internationally. Astronomers, amateurs and professionals, and many others are urging such cooperation.

Astronomers are not against night lighting. They have the same needs for quality lighting as everyone else. They advocate the best possible lighting for the task, with lighting designs that allow for all the relevant factors such as glare control, efficiency, and the need for dark skies. An important added advantage is that everything that is done to minimize light pollution also saves energy by improving efficiency and utility of the nighttime lighting. Everyone wins.

Here are some solutions that minimize light pollution without compromising in any way nighttime safety, security, or utility:

1. Use night lighting only when necessary. Turn off lights when they are not needed. Timers can be very effective. Use the correct amount of light for the need, not overkill.

2. Direct the light downward, where it is needed. The use and effective placement of well-designed fixtures will achieve excellent lighting control. When possible, retrofit present poor fixtures. In all cases, the goal is to use fixtures which control the light well, minimize glare, light trespass, light pollution, and energy usage.

3. Use low pressure sodium (LPS) light sources whenever possible. This is the best possible light source to minimize adverse sky glow effects on professional astronomy. LPS lamps are the most energy efficient light sources that exist. Areas where LPS is especially good: street lighting, parking lot lighting, security lighting, and any application where color rendering is not critical.

4. Avoid growth nearest the observatories, and apply rigid controls on nighttime lighting when such growth is unavoidable. Such controls do not compromise safety and utility. Lighting ordinances have been enacted by many communities to enforce quality, effective nighttime lighting.

All of these solutions to the problem say, really: "Do the best possible professional lighting design for the task. Include all relevant factors, such as glare, light trespass, and light pollution." All the solutions needed for protecting astronomy have positive sides benefits of maximizing the quality of the lighting and of saving energy.

We must do what we can, now, to protect the nighttime environment. It is another of the key environmental issues confronting mankind, one that most people are unaware of, however.

The International Dark-Sky Association, a tax-exempt non-profit membership based organization, has been founded to help overcome this awareness problem and to help preserve dark skies while at the same time maximizing the quality and efficiency of nighttime outdoor lighting.

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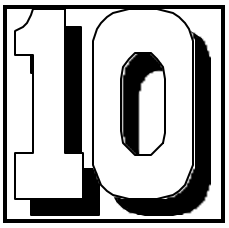

The Light Side of Astronomy

by Orla Aaquist
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I just read a book. Most people are able to do this, but when you have a Ph.D. in astrophysics you don't have much time to read. This is because astrophysicists with Ph.D.'s spend most of our time manipulating equations in their head, so reading a book in two weeks is a big accomplishment for us.

The reason I was able to take time out to read a book is because I live in Fort McMurray, a small town in northern Alberta. There are not very many equations to manipulate this far north. The only laws which apply here are the three laws of Newton, and there is only so much you can do with them.

Living in Fort McMurray is like orbiting a black hole close to the event horizon. Your clock slows down, while the rest of the world passes you by. I drove to Edmonton one Easter weekend and was surprised to see malls, buildings more than three stories high, and tall glowing sticks which turned on at night so you could see the ground but not the stars. Amazing! I wonder what marvels I will see next time I drive to Edmonton? Unfortunately, when I return, all my new Edmontonian friends probably will be 'long gone'.

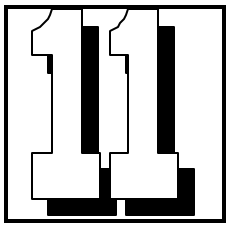
Have you ever wonder why time slows down when you travel close to the speed of light or when you live near a black hole (like Fort McMurray)? If you haven't, then the rest of this isn't going to make much sense, and you may as well find something else to do. Find a book to read. That's what I did, and I found a statement in this book which magically altered my perspective on this question.

I love it when that happens.

There I was, meandering peacefully through four dimensional space-time, when suddenly my mind leaps into 10 dimensional superstring space. All because of a single sentence in some silly book (_The Physics of Star Trek_ by Lawrence M. Krauss pages xvi + 188; Basic Books, A Division of Harper Collins Publishers, 1995. Price $28 Canadian, hardcover). At the bottom of page 19 of this book, I read, "In our normal experience, it is time and space that are absolute, while speed is a relative thing: how fast something is perceived to be moving depends upon how fast you yourself are moving. But as one approaches light speed, it is speed that becomes an absolute quantity, and therefore space and time must become relative!"

Most serious thinkers, like people with PhD's in astrophysics and Petro-Canada gas jockeys, undergo these mental leaps into hyperspace from time to time, but no amount of explaining will enable others to make the leap on the same phrase. Therefore, I have no intention of trying to explain why these two sentences had this affect on me. But, because they did, this book will be listed among Orla's top 10 books.

Other than propelling me into hyperspace, _The Physics of Star Trek_ has other interesting passages. For example on page 58 Dr. Krauss explains how it



would be possible to travel at warp speed if space-time could be manipulated in a certain way. As most of you know, warp speed has certain requirements: faster-than-light travel, no time dilation, and no rocket propulsion (or impulse power). All you have to do is expand the space-time behind the ship and contract the space-time in front of the ship leaving the space-time local to the ship undisturbed. The ship would suddenly be closer to its destination and no laws of general relativity would be broken ...except that the scenario requires some parts of space to have negative energy.

Impulse power is sometimes used by the Enterprise to travel short distances across a planetary system. I have vague recollections of Spock calculating the time for the Enterprise to travel to some planet at half-light speed using impulse power. Apparently, the impulse engines use simple fusion as a method of propulsion, spewing the helium atoms backward after being formed from hydrogen. When fusing hydrogen to helium, about 1% of the mass is converted to energy. Let us say that this energy is used to propel the Enterprise forward (which it isn't because the fuel itself retains some of the energy travelling in the opposite direction). But if the final kinetic energy of the Enterprise ($Mv^2/2$) was set equal to the energy extracted from the hydrogen-to-helium conversion ($mc^2/100$), then the mass, m, of hydrogen that the Enterprise must burn is about 12 times the mass, M, of the starship. If the complete rocket propulsion problem is solved (given in most first-year physics textbooks), then the situation is ever worse, with the amount of hydrogen fuel being 81 times the mass of the Enterprise (page 25, Krauss).

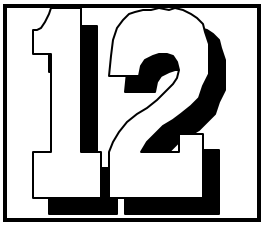
Krauss reviews several Star Trek episodes, pointing out flaws and some surprising truths in them. One particular episode, "Wink of an Eye", described on page 164 is one I remember seeing. Quoting directly from Krauss, "In this episode Kirk is tricked by the Scalosians into drinking a potion that speeds up his actions by a huge factor to the Scalosian level, so that he can become a mate for their queen, Deela. The Scalosians live a hyperaccelerated existence and cannot be sensed by the Enterprise's crew. Before bedding the queen, Kirk first tries to shoot her with his phaser. However, since she can move in the wink of an eye by normal human standards, she moves out of the way before the beam can hit her."

The problem with this scenario is that a phaser beam is supposedly a light beam, and no matter how fast you move, you can't get out of the way of an oncoming light beam because you won't see it coming until it gets there. Moreover, isn't it strange that you can see phaser beams from the side? In the classroom, one way that I enable students to see a laser beam is by clapping chalk laded chalk brushes together over the beam. The particles of chalk dust causes light to scatter out of the beam, enabling the students to see the laser beam. (It interesting to note that on days when I do this demonstration, the cleaning staff has invariably cleaned every chalk brush in the entire college. So, I madly scribble on the blackboard, trying to generate as much chalk dust as fast as I can. As I do this, I lecture to the students about Murphy's Laws. To

my surprise, when I turn around with chalk-laden brushes, I find my students taking notes.) As Krauss points out, there must be a lot of dust in outer space because we always see the phaser fire from the Enterprise.

The Physics of Star Trek is a good read, and you may even learn a little physics because Krauss is more than a dedicated trekkie with a bit of physics knowledge under his belt. He is Chairman of the Department of Physics at Case Western Reserve
University and author of over 120 scientific articles and two acclaimed books, _Fear of Physics_ and _The Search for Dark Matter in the Universe_.

O.A.



HALE-BOPP's THIRD TAIL

Comet Hale-Bopp (C/1995 O1) has a tail of sodium that is distinct from its dust and gas tails. The third tail was first seen onApril 16th in images filtered to isolate yellow light (the D line)emitted by neutral sodium atoms. It is nearly 7 deg long but only 10'wide. Too faint to be seen in normal photographs, the sodium tail lies a few degrees east of the anti-Sun direction. Spectra show that the sodium atoms are accelerating along the tail and reach 95 km/second at a point 11 million km from the nucleus. Apparently this acceleration is linked to the process that gives rise to sodium's fluorescent glow. Its atoms absorb photons from the Sun but reradiate them in random directions, an imbalance that provides the accelerating force.

HUBBLE FINDS CLOUDY, COLD WEATHER CONDITIONS FOR MARS-BOUND SPACECRAFT

As two NASA spacecraft speed toward a mid-year rendezvous with Mars, astronomers using the Hubble Space Telescope are providing updated planetary weather reports to help plan the missions.

Hubble's new images show that the "martian invasion" of spacecraft will experience considerably different weather conditions than seen by the last U.S. spacecraft to land on Mars 21 years ago.

Martian atmospheric conditions will affect the operation of both the Mars Pathfinder landing on July 4, and the September 11 arrival of the Mars Global Surveyor which will map the planet from orbit. Hubble images taken barely three weeks apart, on March 10 and March 30, reveal dramatic changes in some local conditions, and show overall cloudier and colder conditions than Viking encountered two decades ago."It's not the dusty Mars of the Project Viking days (mid 1970s to early 1980s) or the habitable oasis of science fiction stories," says Todd Clancy of the Space Science Institute in Boulder, CO. "We're finding a Mars that's colder, clearer, cloudier. Hubble is rapidly changing our view of Mars' environment. The planet's weather apparently has a flip-side to it."

Summer Solstice

by Bob Nelson PhD

As most members know, for northern observers summer solstice occurs at the instant when the Sun has reached the highest point on the celestial sphere that it can throughout the year (and therefore is the highest it can be in the sky at midday). [The celestial sphere is a huge imaginary sphere, centred on the Earth, imbedded with zillions of stars and other objects, all at the same huge distance. The Sun, Moon and planets all move against this backdrop. The concept of the celestial sphere is thus a way to translate a Sun-centred solar system to the Earth centred system from which we see things move.]

How high does the Sun get in the celestial sphere and in the sky? Well, according to my copy of the Observer's Handbook for 1997, the obliquity of the ecliptic (tilt of the Earth's axis relative to the ecliptic, which is the plane of the Earth's orbit) deg for the year 2000. (The obliquity of the ecliptic changes slowly with time and is decreasing about 0.013 deg /century). That means that the Sun's declination will be 23.4393 degrees = 23 deg 26' at solstice in that year (and in 1997). Now the latitude here in Prince George is 53 deg 45'. That means that the altitude (above the southern horizon) of the celestial equator (the projection of the Earth's equator on the celestial sphere) as we observe it in P.G. is 90 deg - 53 deg 45' = 36 deg 15'. (It would be 0 deg at the North Pole and 90 deg at the equator.) Therefore, at noon, standard time = 1:00 P.M. daylight time (more correctly 1:13 P.M. here in P.G.), the Sun will be 36 deg 15' above the celestial equator, or 36 deg 15' + 23 deg 26' = 59 deg 41' above the horizon. This is almost 60 degrees -- no wonder that the Sun is so hot at this time of the year!

Why is the instant when the Sun is at its highest 1:13 P.M. and not 1:00 P.M.? Well, Prince George is at longitude 122 deg 51' west. That means that we're 2 deg 51' = 2.85 deg west of the 120 deg west meridian (where the Pacific Time Zone is centred) and that things should happen 2.85 / 15 x 60 = 11.4 minutes later. Well, why isn't the time 1:11 P.M. then? Well, as any sundial owner knows, owing to the eccentricity of the Earth's orbit and the obliquity of the ecliptic, at certain times of the year the Sun sometimes runs fast and, at other times, runs slow. The difference between apparent solar time and clock time is called the equation of time. According to the chart in Abell's Exploration of the Universe, 3rd edition, on June 21 the Sun is about 2.5 minutes late - that pretty well accounts for the lag.

Traditionally, summer solstice is also referred to as the start of summer. Why is the instant that the Sun is highest on the celestial sphere (and therefore the hottest at noon) considered the start of the summer season and not middle, as one would expect? Well, owing to the thermal inertia of the Earth's surface layer, the seasons lag the appropriate solstices or equinoxes by around six weeks. Since the seasons are around 13 weeks long (or about double this time), then the time that the Sun's rays are theoretically the most intense then advances

Cont on page 14

to become the start of the summer season.

However, it's kind of funny here in Prince George. As I write this on May 14, we have had hot weather for several days - summer's here now, one month before solstice!! There are similar problems where we can have much cold weather in November, one month before the time when winter officially is supposed to start. One should remember, however, that these conventions are only rough approximations.

B.N.

Green Lights -- EPA's Program to Encourage Energy Efficient Lighting

Green Lights is an innovative program sponsored by the United States Environmental Protection Agency (EPA). The program is designed and implemented to encourage major corporations (and others) to install energy efficient lighting, using the best of the new technologies, thereby dramatically reducing energy consumption while delivering equal or better lighting. This new program is voluntary and non-regulatory. While much of the current emphasis is on interior lighting (that is where most of the energy used for lighting goes), outdoor lighting can and should be part of the package.

Green Lights is producing multiple benefits by addressing critical issues of energy efficiency, pollution prevention, and economic competitiveness. Corporations which make a commitment to Green Lights will profit by lowering their electricity bills, improving lighting quality, and increasing worker productivity. They will also reduce the air pollution caused by electricity generation, which includes carbon dioxide, sulfur dioxide, and nitrogen oxides.

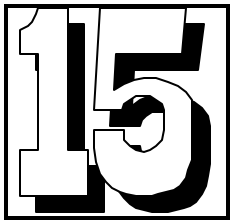
The EPA has established a national lighting product information program in conjunction with utilities and other organizations. The program will provide brand name information so that purchasers will be able to choose products with confidence.

Benefits of Energy Efficient Lighting

Lighting accounts for 20 to 25 percent of the electricity used annually in the United States. Lighting for industry, stores, offices, and warehouses represents from 80 to 90 percent of the total lighting electricity use. If energy efficient lighting were used everywhere that it was profitable, the electricity required for lighting would be cut by at least 50 percent. This reduction would free $18.6 billion from rate payer bills for useful investment and reduce annual carbon dioxide emissions by 232 million tons, the equivalent of 42 million cars. It would also reduce sulfur dioxide emissions by 1.7 million tons and nitrogen oxide emissions by about 1 million tons. Other forms of pollution‹ash, scrubber waste, acidic drainage and waste from coal mining, radioactive waste, and natural gas leakage‹would also be reduced, of course.

The Americian's are on the right track --Ed.

PGAS CONTRIBUTORS



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Ministry of Adv. Ed. Training and Tech	$25,000
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Art Beaumont	150
Tom's Auto Repairs	150
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Claus Schlueter	100

The greatest contributors to the construction and operation of the observatory are from PGAS members who have generously contributed their time to this project. The value of their contribution surpasses all external contributions.

The PGAS is a non-profit organization dedicated to the advancement of astronomy and science in general in Prince George and the neighboring northern communities. Donations of money or materials to the society are greatly appreciated and tax deductible.

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