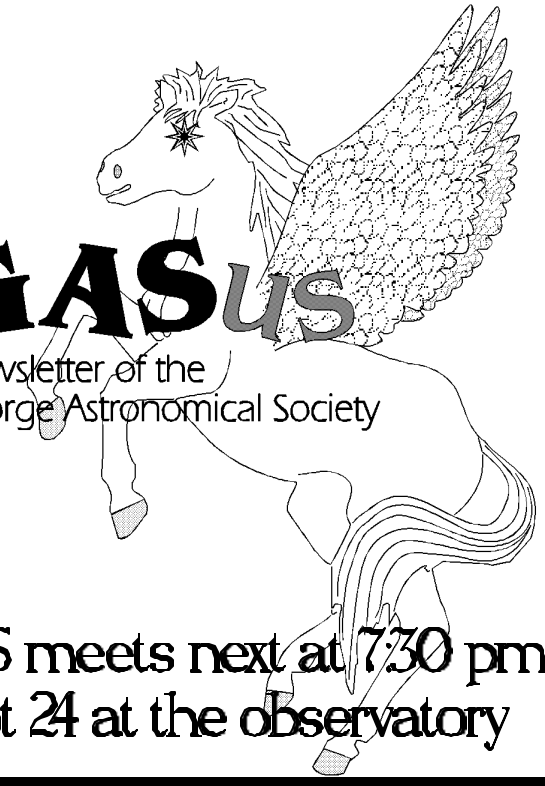
1997 AUGUST ISSUE #76

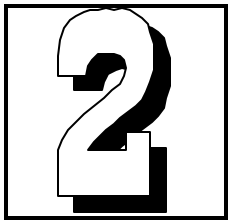
the PeGASus

Newsletter of the
The Prince George Astronomical Society



The PGAS meets next at 7:30 pm Wed Sept 24 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 September 19

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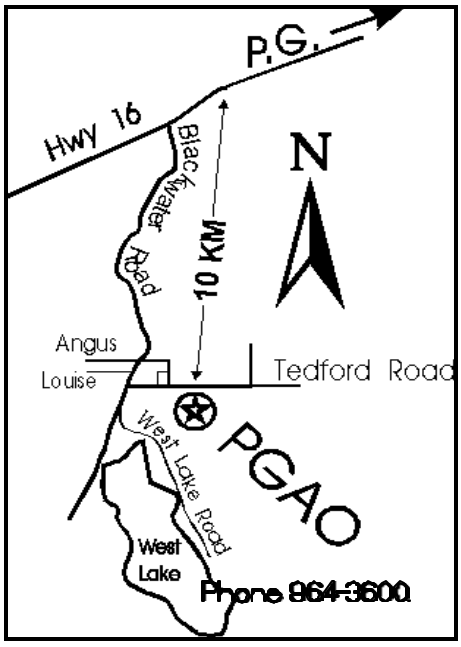

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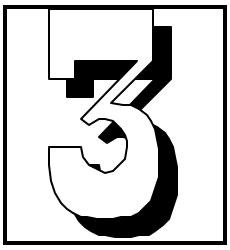


Since I really did not have anything to say and I came upon this editorial like piece from Orla,,what could be more perfect....G.S.

The Price of a Cup of Coffee
by Orla Aaquist

I am a coffee drinker. I drink more coffee than I should but less than I would if the price of a cup of coffee was reasonable. I just wish to remind all you coffee drinkers out there that it is not the price of coffee which determines the price of a cup of coffee.

Let's look at the ingredients of the average cup of coffee: water, cream, sugar and coffee beans. Some of you may also want to include the Styrofoam cup. Which item on this list is contributes the most to the cost of a cup of coffee? With a little arithmetic and consumer knowledge, these contributions can be easily estimated.

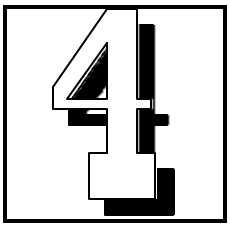
A pound of good coffee (454 grams) cost about $5 in the grocery store. My mother tells me that a pound of coffee can make at least 50 cups of coffee. So that's about 10 cents worth of coffee in each cup.

A kilogram of sugar costs a few dollars, say $2. Each cup of coffee takes 1 teaspoon (about 5 grams) of sugar. So, a kilogram is good for 200 cups of coffee, which means that there is about 1 cent worth of sugar in each cup of coffee.

A litre of cream costs about $2. I put about 10 millilitres in one cup, so one litre serves about 100 cups. At $2 per litre, this means that each cup of coffee uses 2 cents worth of cream.

My water/sewage/garbage utility bill is about $60 every two months. During this time I use about 30 cubic metres of water. Lets say that half of the bill is the cost of water, which means that I pay $30 for 30 cubic metres of water or $1 for 1 cubic metre. Now, a cubic metre of water is 1000 litres, and a cup contains about 250 millilitres (0.25 litres). Hence, 1000 litres of water can make 4000 cups of coffee at a cost of $1 for the water. This means that each cup of coffee uses 0.025 cents worth of water. Of course, you have to heat the water.

The amount of energy required to heat 250 millilitres of water from 15 degrees Celsius to 100 degrees Celsius can be determined using some basic physics and your electric bill. My first year physics textbook tells me that it takes 1 kilocalorie of heat to raise one kilogram of water one degree Celsius. One millilitre of water weighs one gram, so 250 milliletres of water weighs 250 grams or 0.25 kilograms. Then, to raise one cup of water 85 degrees (from 15 to 100 degrees), takes 22 kilocalories, which is equivalent to 92 kilojoules. If you examine your electrical bill carefully, you will see that you pay about 8



Coming Events

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

We are open to the public every Friday night until the end of October, call Brian Potts if you can help out as a host

Next meeting September 24th 7:30pm at the Observatory.

The Night Sky for September '97

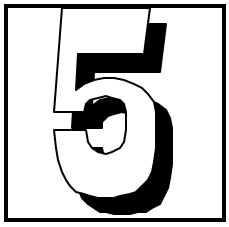
by Bob Nelson, PhD

Hi folks, and welcome back from the summer holidays! As the Earth travels in its orbit, we move away from summer (with its abbreviated nighttime) and into fall. Fall is pretty well our best observing season since the temperatures are still mild, darkness occurs at a reasonable time, and we often get a string of clear nights as the 'Indian summer' makes its appearance. We can only hope that the latter will happen again this year.

There are two eclipses this month, but unfortunately neither is visible from Prince George. The first is a partial solar eclipse; it occurs Sept 2 and is visible from Australia, New Zealand, and in the part of Antarctica bordering on the Pacific. The second is a total lunar eclipse; it occurs Sept 16 (max at 18:50 UT) and is visible from the eastern hemisphere (centred on India).

As I worked through the planets this month, I realized that September this year should be a good month for viewing planets -- so many of them well placed for convenient viewing. In a 12 hour period, it should be possible to view all eight! As usual, information on each planet as to size, brightness, etc. applies to the 15th of the month, unless otherwise noted.

MERCURY is visible in the pre-dawn sky and presents the best view of the year for northern observers in the third week of September (because of the steep angle that the ecliptic makes with the celestial equator in the fall). It reaches greatest western elongation (the angular distance from the Sun) of 18 degrees on Sept. 16. The disk's angular size is only 7", the brightness is -0.2 magnitudes, and the illumination is 50% (like a first quarter Moon). By the end of the month, the values change to 5", -1.1 mag and 93% (like a nearly full Moon) respectively as Mercury gets further away from the Earth and moves into the gibbous phase. A good object for early risers.



VENUS is low in the southwest at sunset and sets about an hour later. Venus is moving steadily eastward (away from the Sun) before it catches up to the Earth in its orbit and should get better and better as the weeks go by. If you can catch it in a telescope while it is high enough in the sky (before sunset if possible), you should see a 16" disk in the gibbous phase at magnitude -4.1.

MARS, in Libra for most of the month, is low in the southwest at sunset and sets an hour later.

JUPITER, in Capricornus, is low in the southeast at sunset and sets around 3 A.M. (PDT). It's a fine object of diameter 46" and magnitude -2.7. According to the Observer's Handbook for 1997, Jupiter also undergoes a phenomenon known as a 'double shadow transit' once on Sept 7 and twice on Sept 21. This is presumably the shadows of two of Jupiter's moons appearing on the surface of the planet. Unfortunately, we cannot see any of these events. There will, however be a double and a triple shadow transit in November that we will be able to see. More in the October issue.

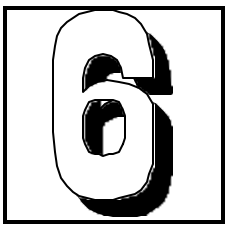
SATURN, in Pisces, rises around 7 P.M. (PDT) and is up all night. It too is a fine object (a 20" disk of magnitude -0.7) and is worthy of study. You might want to look for as many of Saturn's moons that you can find (aided by Guide 4, PC Sky and other fine planetary programs that we have on the observatory's computer).

URANUS, in Capricornus, is low in the south-southeast at sunset and sets around 2 P.M. (PDT). Its moons, too, should be good targets for the 24" telescope. It's a 3.7" disk at magnitude 5.7.

NEPTUNE rises at about 4:25 P.M. and sets at about 12:35 A.M. It's only a 2" disk at magnitude 7.7 but should not be difficult to find with the 24" telescope and finder charts from Guide 4. As you get better at finding it, you should be able to capture it with one of the smaller telescopes or even binoculars (a nice challenge).

PLUTO rises at about 11:30 A.M. and sets at about 10 P.M. It's a faint star-like object at magnitude 13.8 but should be findable in the 24" telescope with good finder charts.

DEEP SKY observing should also be good in early September with the new Moon occurring on Sept 1. Sagittarius and all the glories of the southern Milky Way (all that we can see from our northern location, that is) are visible to the south at 9 P.M. Now would be a good time to catch up on all those Messier objects that you can't see at other times of the year! Fall equinox occurs on September 22 at 16:54 PDT. The nights become longer than the days and stargazing gets better and better. B.N.



WORLD'S MOST POWERFUL TELESCOPES TEAM UP WITH A LENS IN NATURE TO DISCOVER FARTHEST GALAXY IN THE UNIVERSE

An international team of astronomers has discovered the most distant galaxy found in the universe to date, by combining the unique sharpness of the images from NASA's Hubble Space Telescope with the light-collecting power of the W. M. Keck Telescopes -- with an added boost from a gravitational lens in space.

The results show the young galaxy is as far as 13 billion light years from us, based on an estimated age for the universe of approximately 14 billion years. This would place the galaxy far back in time during the "formative years" of galaxy birth and evolution, less than a billion years after the birth of the universe in the Big Bang.

The detailed image shows that bright dense knots of massive stars power this object. Due to the firestorm of starbirth within it, the galaxy is intrinsically one of the brightest young galaxies in the universe, blazing with the brilliance of more than ten times our own Milky Way.

"We are fascinated to be witnessing the very early stages of the construction of what could well become a massive galaxy like our own Milky Way," says Garth Illingworth of the University of California, Santa Cruz. "This object is a pathfinder for deciphering what is happening in young galaxies, and offers a rare glimpse of the powerful events that transpired during the formation of galaxies."

"We were excited by the possibility that we may have found a unique example of a galaxy in formation at the time of the earliest quasars," said Marijn Franx of the University of Groningen in the Netherlands.

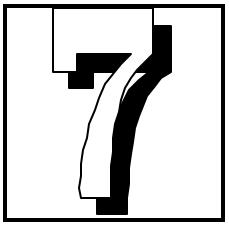
Predicted by Einstein's theory of general relativity, gravitational lenses are collections of matter (such as clusters of galaxies) that are so massive they warp space in their vicinity, allowing the light of even more-distant objects to curve around the central lens-mass and be seen from Earth as greatly magnified.

The object is so far away, observing it in such detail would tax the capabilities of both Hubble and Keck without the magnification of the gravitational lens, provided by a foreground cluster of galaxies that is much closer to us at five billion light-years.

Due to a rare and fortunate alignment of the young galaxy behind the foreground cluster, astronomers gain a magnified view that is five to ten times better than Hubble alone can yield for an object at such a great distance.

A telltale sign of the lensing is the smearing of the remote galaxy's image into an

arc-shape by the gravitational influence of the intervening galaxy cluster .



The smeared image of the galaxy stood out because of its unusual reddish color. "Such magnified galaxies had been observed before, but never with such a color. The special color of the galaxy in the arc is due to absorption by the matter in the universe between us and the galaxy, and suggested to us that it was at a great distance," says Franx.

The suspected remoteness of the lensed object was confirmed when the team of astronomers made spectroscopic observations with one of the twin 10-meter Keck telescopes on Mauna Kea, HI, to measure its redshift, and therefore its distance, based on the shifting of its light towards the red end of the visible light spectrum. The resulting high redshift corresponds to a very early era when the universe was just beginning to form galaxies.

Though candidates for still more distant objects have been proposed, they have not been confirmed spectroscopically. The previous most-distant known object was the quasar PC1247+34.

"Based on this image we can begin to make some conclusions about the early growth of galaxies," says Illingworth. "The knots show that starbirth happens in very tiny regions compared with the size of the final galaxy." This helps clarify the astronomer's view of the formation of galaxies as occurring within a cauldron of hot gas, with knots of intense star formation, strong winds, and "mergers" -- collisions of the dense star-forming knots.

Using Keck's spectroscopic capabilities, the astronomers have also, for the first time, been able to measure the motions of the gas within such a distant galaxy. The observations reveal gas flowing at nearly 500,000 miles per hour (200 km/sec), presumably accelerated by energy from supernova explosions going off like a string of firecrackers.

"The strong winds that we observe suggest that galaxies may lose a lot of material when they are young and thereby enrich the empty space around them," says Franx. "Many astronomers had speculated about the existence of such winds in such distant galaxies, and we now have an object where we can see them directly. It is striking that the most distant galaxy found to date is also the one that provides us the most detailed picture of events in such distant galaxies."

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA). The W.M. Keck observatory is operated by the University of California, the California Institute of Technology and NASA.

THE NIGHT SKY

by Alan Whitman

For the fourth consecutive year the Mount Kobau Star Party (MKSP) enjoyed clear or partly clear skies on all four official nights. Thus MKSP has a string of 16 nights out of 16 going!! Mark down next summer's dates: Saturday, August 15th through Sunday, the 23rd. That's right--eight straight nights!

The naked eye Prancing Horse Dark Nebula accompanied me each evening on the hike from my campsite up to my telescope on the peak. This huge dark nebula is visible on any photograph of the centre of the Milky Way. Look halfway between M24 and Antares. The better known Pipe Nebula forms the rear legs and hindquarters of the horse.

My 16-inch telescope at 350x and 522x allowed Jim Failes, George Loveseth, and me to follow Uranus' moons Oberon and Titania and Neptune's moon Triton in their orbits over several nights, despite the planets' southerly declinations of -19 and -20 degrees respectively. These distant moons were a first for all of us and were confirmed at home with a calculator by checking the dates of elongations and their orbital periods.

Caroline Wallace and I viewed the two little dark nebulae, B92 and 93, in the Small Sagittarius Star Cloud, M24. Save for one solitary star in the centre, B92 is a black pit surrounded and outlined by myriad stars. Wayne Still had his first tour of the Veil Nebula using his 10-inch Meade SCT and my Lumicon OIII filter. I always enjoy listening to observer's reactions when they first see B92 or trace the Veil for field after field.

The November, 1995 SKY&TELESCOPE has a chart on page 68 which allows an observer to starhop 2.5 degrees SW from M31's nucleus to G1, the most luminous globular cluster in the Local Group of galaxies. Use the chart, NOT the sketch. That article assigns G1 a magnitude of 13.7, but that must be a photographic magnitude; visually I estimate it to be about 12th magnitude.

G1 was fuzzy even at 65x in the 16-inch reflector--it looked like a very tiny globular cluster. At 261x it was as large as Saturn's 19" disk at the same power. Jim Failes found G1 in Gary Seronik's high contrast 6-inch reflector (featured in the June S&T) on a Kobau night with excellent seeing and superb transparency, a feat later duplicated by Gary. The magazine article had said that a 10-inch would be required.

The night after Jim and I left the mountain, several experienced observers reported finding an uncharted fuzzy object about 7' east of the plotted position for G1. They reasonably concluded that the fuzzy was the globular when they found that several stars were visible at G1's plotted location at

high power. [M73 was a mistake of that nature--it consists of nothing but a nice little group of four stars.]

Jim and I were nonplussed when we received their e-mail as we felt certain that we had seen a tiny globular cluster where G1 is plotted. E-mail flew for a week and all observers agreed that another look through big glass was needed. Jim found that the 'serious observer's atlas', Uranometria, did not plot a second fuzzy.

The weekend after MKSP I called Brian Potts to book a two night observing run on the Prince George Astronomical Society's 24-inch Cassegrain. Eight hundred kilometres later my daughter Jennifer and I were back in a dome full of great memories. At 424x three foreground stars were indeed visible on the fuzzy face of G1 surrounding the slightly larger than stellar core of the cluster, but the foreground stars were in exactly the positions that photos of G1 show--they belonged there! I found the reported second fuzzy 11 minutes of arc ESE of G1 and judged it to be a 14th or 15th magnitude galaxy.

When I e-mailed my findings to our group of observers, return e-mail from the Coast stated that no second fuzzy was visible on an Internet version of the Palomar Observatory Sky Survey (POSS). More than one of us started thinking seriously about a five-letter word beginning with 'c' meaning "moving faint fuzzy". The originally reported position was close to the one that I had measured in Prince George a week later but not identical. In early August a solar system object at 00 hours RA would be near its stationary point and moving very slowly.

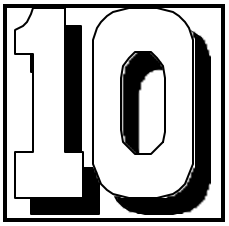
With mounting excitement I contacted Chris Purton at the Dominion Radio Astrophysical Observatory. The observatory's library has the original photographic version of the POSS and there was a tiny edge-on spiral on those photographs at the position that I had charted the fuzzy when observing in Prince George. In the Uppsala catalogue the fuzzy is UGC 00330.

Ah well, mystery solved without the 'c' word. We learned not to blindly trust either Uranometria or Internet versions of the POSS--the limits of both can be exceeded by trained eyes using big glass!

A.W.

"Not for redistribution at the author's request"

Alan (and Jennifer) are both long time members of the PGAS,who have left Prince George . Both are valued members, who are missed by our club---GS



Orla's Summer of '97

by Orla Aaquist

My objective this summer was to prove that a lone astronomer teaching physics in a small-town college can get involved with things other than drinking beer, going on vacation, and working on the house for three months during the summer. I was going to prove that it was possible to do astronomical research.

Since completing my Ph.D. in 1991, I have planned to use my old data, collected between 1983 to 1988, to measure the distance to several compact planetary nebulae (PNs). All I needed was to wait until the PNs had expanded enough, observe them again and measure their angular growth. Then, using spectroscopy to measure the expansion velocity, I could derive the distance to these objects for the first time.

Usually, drinking beer, going on vacation, and working on the house distracts from research if you do not have tenure at a university. Once you have tenure, you have an entourage of graduate students and postdocs to do the research for you while you drink beer, go on vacation and work on your house.

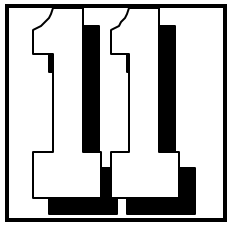
For me, not going on vacation was easy. Shannon and I have no money. Please send some.

At the start of the summer, the research I wanted to do seemed quite simple, but as the summer progressed it became more difficult. The main problem I encountered was that I had forgotten how to think for more than 5 minutes at a time -- this is about how long it takes me to prepare a classroom lesson. Also, it is very difficult for me to think when my desk is messy, so I had to clean my desk, put my books in order, sort through my files, and rearrange my hard drive. That took care of week number one.

Step two was to obtain the latest research papers on the subject. My plan was to use the internet to see what scientific literature and data were accessible on the World-Wide-Web. It turns out that most of the scientific journals have a web site where they allow you to search through past publications for titles and abstracts. They are very easy to find if you know the title of the journal. If you want the entire article, however, you are out of luck. You have to subscribe to the journal to get more than the index and a few sample articles; and, not surprisingly, the electronic subscription costs almost as much as the printed journal subscription.

Then I discovered the Strasbourg abstract service. It allows you to search several professional journals to obtain not only titles, authors and abstracts, but the entire article. To my delight, all of the research papers I wanted were 'on-line'. This was great! I celebrated by drinking beer at the local pub.

Of course, I had to read the papers. I first tried putting them under my pillow at night. This used to work for me way back in high school, but then I remembered that this strategy was the main reason I nearly failed first year



calculus. So, I buckled down to read them from start to finish.

I hadn't read very far when I encountered the following sentence, "In this paper we follow the procedure described by Seaquist (1991). His equation 4 implies that ...". Clearly, nothing was going to make much sense unless I read the paper by Seaquist.

This paper, of course, was not 'on-line' (Murphy's 3rd Law). After making sure that there were no more surprises in the existing papers, I called my mother and told her to have supper ready and my bed made. Five hours later I was back in civilization. Here civilization is taken in the western Canadian sense, not in the eastern Canadian sense. That is, I drove from Fort McMurray to Edmonton (not to Toronto or Montreal).

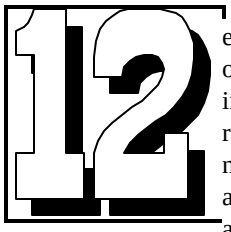
The day following my arrival in Edmonton, I drove to the University of Alberta and located the physics library. Here I was confronted by a ridiculous sign giving the library hours from 1 to 4 PM, Monday to Friday. Of course, I was there on a Saturday. I calmly returned to my mother's place to drink beer and patiently wait until Monday. At 1 PM on Monday I was confronted by a hostile library attendant who made no excuse for the terrible service, even after I complained bitterly to him in a very loud and obnoxious voice.

Honestly, I really didn't complain about the service in a loud and obnoxious voice, and neither do I talk to my mother in the way I implied in a previous paragraph. I also spend considerably more than five minutes preparing my physics lessons. However, as I am writing this, I still wonder how a first rate physics department can have no money to hire a librarian for more than 3 hours a day.

After locating Seaquist's publication, I returned to my mom's place to read it and drink more beer. Three hours is barely enough time to find a paper and photocopy it, especially when you are working in a degraded research mode. In case you are wondering, Seaquist and Aaquist are not related in any way as far as I know. The 'quist' part of Aaquist means a branch of a tree and the double 'a' means a small stream. So, Aaquist is a branch over a small stream, or perhaps a small branch of a stream. I suppose that Seaquist is then a branch over a large body of water. Obviously, completely unrelated. Furthermore, I met Dr. Seaquist many years ago at a conference on the interstellar medium, and there was no family resemblance at all.

After about a week I concluded that it was impossible to stay focused on research while visiting my mom and drinking beer. So, I returned home, but it took me about a week to recover. During this recovery time I did some house work: I put up the soffits on the garage, attached the down-spouts on the eaves, stained the fence, laid an interlocking brick sidewalk to the garage, lowered one section of the deck, stained the deck, finished the family room, bought a new van, and put down new linoleum in the front entrance. I also discover a way to avoid cutting your lawn: don't water or fertilize it. If it rains, just cover it with plastic.

I can accomplish a lot when working around the house because of years of



experience. Even if I don't have a clear plan, I can always think of what to do next. This is one of the key elements of success in any field, including research. You may not have a clear research plan, but a good researcher always know what to do next. It takes experience and success to be able to do this, and apparently I have more experience and success working around the house than doing research. So after reading the necessary research papers, it took me a while to figure out what the next step should be.

The next step came to me in late July while swatting mosquitoes on my back porch. Swatting mosquitoes is a common pastime in Fort McMurray if you insist on going outside without mosquito repellent. Even with repellent, you still get bitten by the blackflies, and since the blackfly bite is much worse than the mosquito bite, no one bothers with the repellent. My philosophy is that if you have lots of bites that are itchy, you can more easily ignore the big, red, painful welts produced by a blackfly bite
. The thought which came to me while swatting mosquitoes was that the next step should be to write a proposal to observe the expansion.

Back on the internet, I visited the NRAO web site and hunted down a blank observing proposal for the Very Large Array. Unfortunately, it was a postscript file, and postscript never hit it big in Fort McMurray. Another week flashed by before I was printing the postscript file to my HP LaserJet IV.

Finally, I sat down to write the 'scientific justification', the blank form in front of me. The very fact that I was able to create the form without a postscript driver on my LaserJet IV deserved some credit, but it is not something that should be mention in a scientific justification. So, I rewarded myself by visiting the local pub. While at the pub, I scribbled down the following ideas to be included in the scientific justification:

1) I am the only one who has the first epoch data.

2) Making the measurements will be a lot of fun.

3) If the experiment doesn't work, I really don't care.

4) ??

5)

By the end of the week, I realised that I had better convince the referees that it was possible to measure the expansion after a period of 12 years, and then convince them that the measurements would produce something useful.

So I started to make some calculations and look at my data critically. At the end of another week, I wasn't convinced that the expansion could be measured. I needed another beer!

The fact is that I don't drink beer except for one or two when I am visiting my mother. My father used to drink beer, so when I visit she feels it necessary to serve me beer, too, and I feel obliged to drink them. In truth, I don't like beer unless I am very hot and thirsty. Therefore, any reference to beer in the above paragraphs should be replaced by coffee. Also, I didn't really do all the aforementioned work

around the house in one week; the work was spread out over the spring and summer ... starting last fall.

It was now August 12, and I felt pretty bad. I remembered someone telling me, when I defended my thesis, that I would have to wait 50 years, not 10 as claimed in my thesis, before I had any chance of measuring the angular expansion with my data. Even my Ph.D.supervisor was not convinced it was a worthwhile effort, and now I, too, had lost faith. Over coffee, I sat down to summarize my efforts and close the binder containing my efforts. The last statement I wrote was that, "In order to successfully detect expansion in our data, first epoch observations with higher dynamic range or higher resolution, are required." As I closed the binder it struck me that I did have data with higher resolution.

I searched through my files of published papers and found the data. I reworked my calculations and found that the sensitivity to expansion was better by a factor of three. This essentially meant that 10 years of waiting with the high resolution data was equivalent to 30 years of waiting with the low resolution data. I had suddenly been transported 20 years into the future.

The next day I completed the observing proposal. I read it over. It looked good.

It's still sitting on my desk in my office as I write this sentence. I am worried because the toughest part is yet to come.

I have to put it in the mail.

O.A.

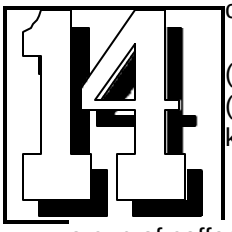
Here I sit trying to figure out the intricacies of this publisher program and Orla is making scientific proposals for the VLA--- Good luck Orla,--- G.S.

ARECIBO UPGRADE

Astronomers and officials gathered on June 14th in the lush vegetation near Arecibo, Puerto Rico, to inaugurate the newly refurbished 305- meter (1,000-foot) Arecibo radio telescope. The five-year, $27 million upgrade includes a set of Gregorian reflectors to collect incoming signals, a powerful megawatt radar transmitter, and a 15-meter metal fence around the dish's perimeter to block stray transmissions from the Earth and thus improve sensitivity. This extensive upgrade will enable astronomers to study everything from the Earth's upper atmosphere to comets, asteroids, and exotic objects in the distant universe. in the Big Bang.

Among Hubble's recent observations:

Jets and Gaseous Disk Around the Egg Nebula -- A new infrared instrument peered deep into the dust-obscured central region around a dying star embedded in the Egg nebula, a cloud of dust and gas 3,000 light years from Earth. The new images provide a clear view of a twin pair of narrow bullet-shaped "jets" of gas and dust blasted into space. The instrument, called the Near Infrared Camera and Multi-Object Spectrometer, also revealed an unusual scalloped edge along a doughnut-shaped molecular hydrogen cloud in the nebula.



cents per kilowatt-hour (cont on page 14)

(cont from page 3)

(which is equivalent to 3600 kilojoules) of energy. So, 92 kilojoules of energy costs 0.2 cents.

Let's throw in 2 cents for the price of the cup.

Add up the numbers and you get about 15 cents for a cup of coffee. Now, compare this to the price you are charged at a restaurant: one dollar if you are lucky. Of course, a restaurant has to pay rent, salary and the cost of the coffee maker. All of these will contribute to the cost of a cup of coffee. A professional coffee maker, for example, might cost a restaurant $500. Before it breaks, it could probably serve at least 50,000 cups of coffee. So it will add about one cent to the price of a cup. The big costs are salary and rent, but as a physicist, I am not clever enough to factor these into the cost while sitting at my desk spending some quality time with my computer.

So what is the point of all of this? Well, a recent article in the Edmonton Journal stated that the price of coffee beans had doubled since last year, and so the price of a cup of coffee was destined to increase by as much as 25 cents per cup at local restaurants and coffee houses. This is hogwash! As you can see from the numbers above, the price of a cup of coffee depends very little upon the price of the coffee bean.

Now, that you are an informed consumer, consider investing in a thermos,

and enjoy your coffee! O.A.

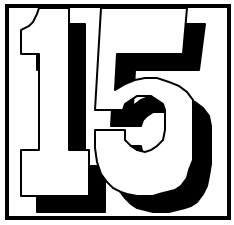
GENE SHOEMAKER, 1928 - 1997

The world has lost one of its most renowned scientists with the death of Eugene Shoemaker at age 69. On the afternoon of July 18th, Gene and his wife, Carolyn, were involved in a car accident in central Australia. He was fatally injured; Carolyn suffered broken ribs but is expected to recover.

Best known for his pioneering work in elucidating the mechanics of impacts and in the discovery of Earth-crossing bodies, Gene gained worldwide fame in March 1993 for his discovery, with Carolyn and colleague David Levy, of a comet that would strike Jupiter 16 months later. Comet Shoemaker-Levy 9 was just one of the finds that made this husband-wife team the leading comet discoverers of this century. While still in his teens, Gene realized that someday astronauts would walk on the Moon, and from that point forward his whole professional life would be directed toward becoming one of them. "Not going to the Moon and banging on it with my own hammer has been the biggest disappointment in life," he said last year. "But then, I probably wouldn't have gone to Palomar Observatory to take some 25,000 films of the night sky

with Carolyn -- she scanned them all -- and we wouldn't have had the

PGAS CONTRIBUTORS



The PGAS would like to thank the following individuals, corporations and government agencies who, since 1991, have donated money, goods or services to the construction and operation of the Prince George Astronomical Observatory.

Ministry of Adv. Ed. Training and Tech	$25,000
BC Science Council	16,000
BC Lotteries	8,000
Helmar Kotsch (Acme Mas.)	1,932
Northwood Pulp and Timber	1,665
Electrical Services Ltd	1,583
Royal Bank of Canada	1,500
Canfor	1,214
Regional District of Fraser-Fort George	1,000
Prince George Rotary Club	1,000
The Pas Lumber Co	750
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Lutz Klaar	200
Carrier Lumber Ltd	160
Art Beaumont	150
Tom's Auto Repairs	150
Pine Drilling	150
Cloverdale Paint Inc	100
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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