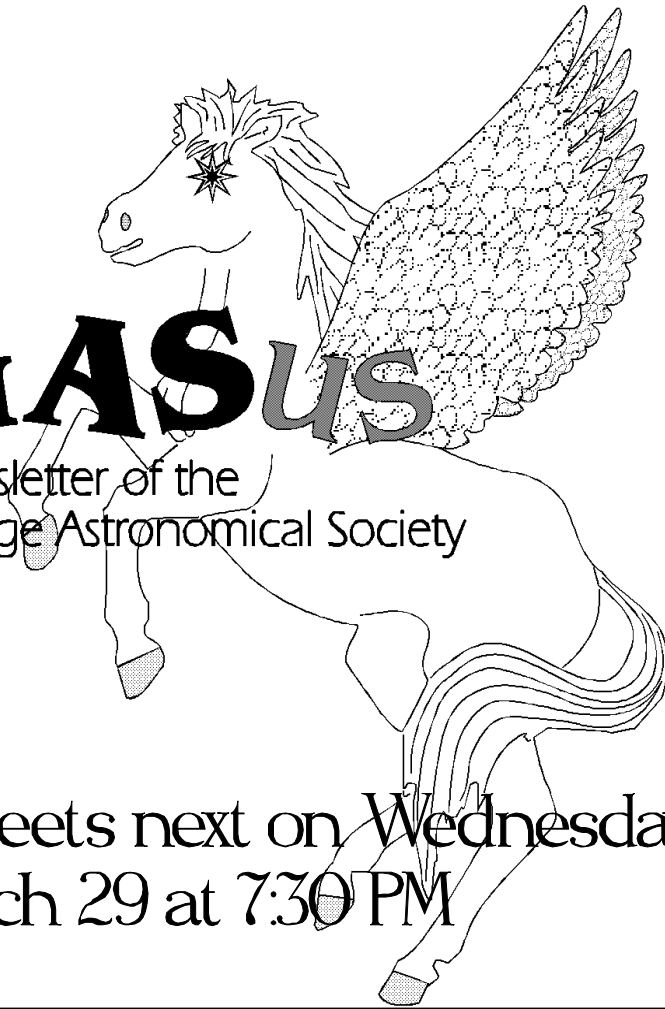


1995

March

Issue #55

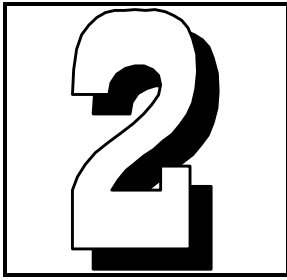
*the*  
**PeGASus**  
Newsletter of the  
The Prince George Astronomical Society



The PGAS meets next on Wednesday  
March 29 at 7:30 PM

**INSIDE :**

Editorial	3
Monthly Meetings	4
The Night Sky	5
Library Exhibit	6
Telescope Resolution	7
Light Pollution	11
AstroSurfing	13

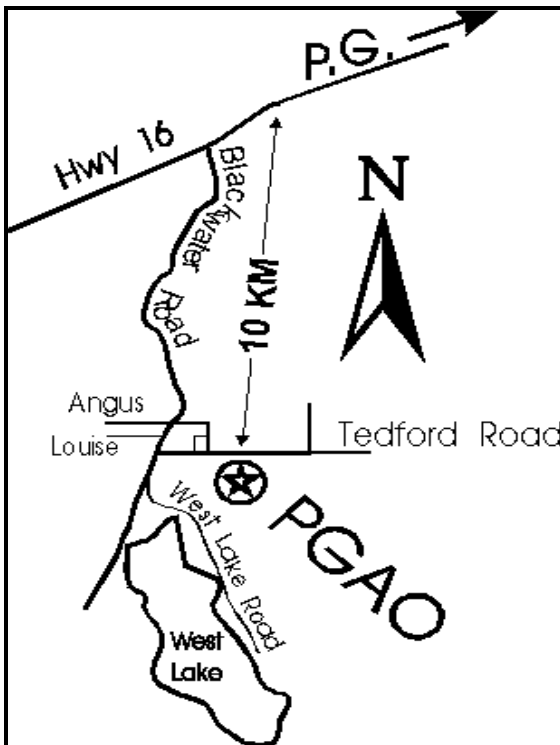


*the  
PeGASus*  
is published  
monthly by the  
*Prince George  
Astronomical*

*Society*. Contributions to the  
newsletter are welcome.

***Deadline for the next  
issue is April 15, 1995***

Send correspondence to  
The PGAS  
3330 - 22nd Avenue  
Prince George, BC, V2N 1P8  
or  
**Aaquist@cnc.bc.ca**  
phone  
964-9626  
562-2131 (loc 307)



Prince George  
Astronomical Society  
Executive, 1994/5

President  
**Jon Bowen**  
563-9869

Vice President  
**Bob Nelson**  
562-2131/563-6928

Secretary  
**Matthew Burke**  
563-2162

Treasurer  
**David Sundberg**  
562-5774/6655

Members at Large  
**Gil Self** 964-7279  
**Eric Hansen** 962-7477

### **Nominated Positions**

*Technical Director*  
Bob Nelson  
\*

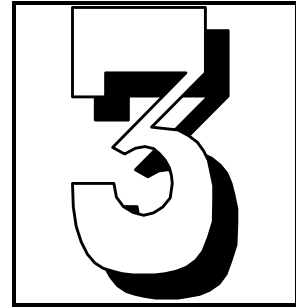
*Observing Director*  
Jon Bowen  
\*

*Promotional Director*  
Orla Aaquist  
\*

*PeGASus Editor*  
Orla Aaquist  
\*

The observatory phone number is  
964-3600. This is a party line, so  
if it rings busy, it does not imply  
that someone is at the

# Editorial

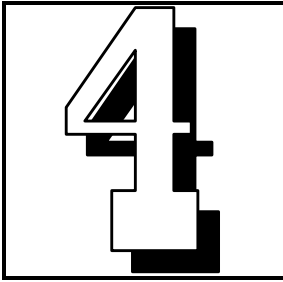


It will be spring before you read this newsletter. March 21 is the day when the sun rises due east and sets due west. The ground is beginning to thaw, and astronomers are becoming more mobile. Hopefully, too, there will be more clear nights than there has been this winter.

I have been telling lies in hopes of turning them into truths. It's a technique I use once in a while to start the ball rolling, but it never works very well. I just end up getting caught in the lie. So I ask myself, "Should I be in politics?" The lie I have been telling is that the observatory is open to the public and PGAS members every Friday night. I have had every intention of spending a few hours at the observatory every Friday, but then something else comes up. Here is my list of excuses: it's snowing, it's raining, it's too cold, I'm too tired, there's a movie on TV I want to watch, it's too cloudy, it's too windy, I forgot, none will be there anyway, I feel a little sick, I have a cold, my neck hurts, it's too dark, the moon is full, the car is low on gas, I don't feel like it, I'm too busy cleaning the litter box, I have to get those papers marked, I think I'll read a book instead, I got lost on the internet, I got home late from work, we have to go shopping, the cat got out and I have to go look for it, the other cat got out, I am scared of the dark, I can't find anyone to go with me, we have visitors, our neighbours invited us over for supper, my kids are sick, the cat is sick, the other cat is sick, I have a headache, I have to vacuum, I'm depressed.

Please let me know why you don't go out to the observatory on Fridays so I can add them to my list.

Seriously, though, we should keep the observatory open to the public and to our own members on a regular basis. It's good for advertising purposes, it keeps the club active, it will attract new members, it will give new members a chance to participate, it will give us a chance to tidy up the observatory when we have no visitors, it will help with our fund raising efforts, and it will add a measure of security to the observatory.



# Monthly Meetings

The next meeting of the PGAS will be held at **CNC** on Wednesday, March 29th at 7:30 PM.

The last meeting was held at the observatory rather than CNC because of the CNC faculty strike. We hope that we got in touch with everyone prior to the meeting, and we apologize to anyone we missed. In attendance were Orla A, Bob N, Mike L, Eric H, Brian P, Matthew B, Gil S and Vince H. And it was clear! Wonderfully clear! The entire meeting was spent observing. Orla even started his Messier hunt by single handedly finding the Orion Nebula five times. He did this because the Orion Nebula was totally tubular through Bob's 13". Bob Nelson seems to be leading the Messier hunt with about 50 objects under his belt.

For the next meeting of the PGAS we will be back at CNC. Yes the strike is over, in case you haven't heard. At this meeting Dr. Elie Korkmaz from UNBC's Physics Department will give a talk entitled

**The very small and the very large:  
a very intimate connection.**

Dr. Korkmaz is a particle physicist doing research at TRIUMF and various other world class facilities. As most of you know, particle physics is very closely connected to astrophysics through the study of the big bang and black holes.

For the shuttle fans, Orla Aaquist will take you on a tour of the shuttle's home page on the World Wide Web. Although the shuttle Endeavour has landed by the time of the meeting, NASA is continuing with the internet connection to this site.

# The Night Sky

by Alan Whitman



**Mars**, lying between *The Sickle* of Leo and *The Beehive* star cluster, is still the second brightest object in the evening sky through March (after Sirius). By month-end its disk is becoming too small (10") for useful telescopic viewing. Mars continues to fade, and by mid-April Arcturus will be the brightest orange object in the sky, not Mars.

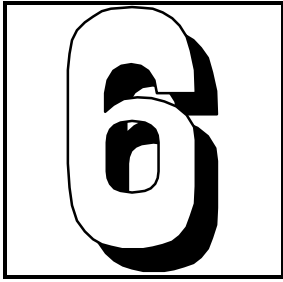
**Jupiter** rules the morning sky, low in the south near the orange star Antares (whose name means Rival of Mars). **Venus** continues to close in on the sun but can still be found low in the ESE just before sunrise.

The moon occults the first magnitude star Spica on April 15th. Unfortunately, the moon is full. This will greatly detract from the event -- try using a polarizing filter and keeping most of the moon out of the field of view. Disappearance is at 2:28 AM PDT and reappearance is at 3:35 AM PDT. There is also a slight partial lunar eclipse that morning, as the lunar north polar region slips through the earth's umbral shadow between 4:41 AM and 5:55 AM (moonset and sunrise are at 6:10 AM).

Two occultations which might actually be more attractive, as they involve the first quarter moon, are the disappearances of mag 4.7 119 Tauri at 9:58 PM PDT April 5th and Lambda Geminorum (mag 3.7) at 12:40 AM PDT April 8th.

**Messier Corner:** Want to see eight galaxies at once? The giant elliptical galaxies M84 and M86 lie near the centre of the Virgo cluster of galaxies. An eight-inch telescope will show six NGC galaxies surrounding the giant pair, in the same low power field of view. Several of the NGC galaxies are edge-on spirals. For a preview, look at the top half of the photo on p. 2077 of Burnham's *Celestial Handbook* (one of the galaxies on the photo was invisible in my scope but I could see eight).

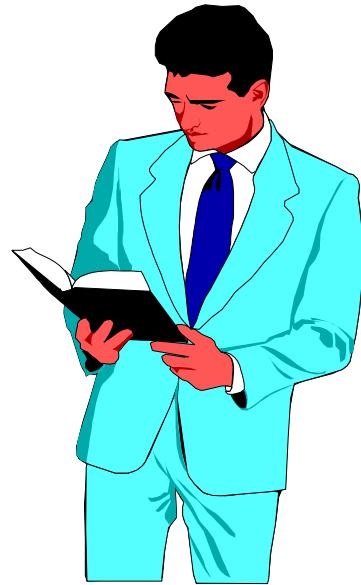
ASTRO TIDBIT: There was no new Moon in the entire month of February, and that won't happen again until the year 2014.



# Library Exhibit

*by Mathew Burke*

I have scheduled an exhibit at the Prince George Public Library for the month of September, 1995. We will have two 2' x 3 1/2' glass cases at our disposal for the entire month. The cases are located near the entrance to the Civic Centre. I am going to design an exhibit that will show off our club and educate the public about Astronomy. At this time my ideas for the exhibit are:



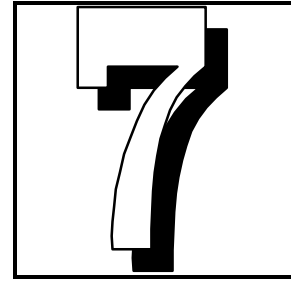
- Astronomical photographs we have taken at the club
- Photographs of the observatory
- Telescopes / Lenses
- Our newsletter
- Astronomy books

If anyone has any suggestions please contact me and I will put it into the exhibit (I am especially interested in any astronomical photographs you may have).

During the exhibit or this summer I would like to have a solar viewing day in the Civic Centre plaza. If anyone is interested in helping out please let me know. My phone number is 563-2162.

# Telescope Resolution

by Orla Aaquist



Often I am asked if we can see the orbiting shuttle through our telescope at the PGOA. While the Apollo program was taking place, it was generally believed by the public that if you had a powerful telescope you could see all the activity up on the moon. Just how much detail can be seen through a telescope?

The amount of detail seen through an Earth-bound telescope depends upon several things: the quality of the telescope, the diameter of the telescope's main lens or mirror (that is, the aperture of the telescope), the distance the object is away from the telescope, and the condition of the atmosphere in front of the telescope.

There is a certain limit to the optical quality of any telescope that cannot be surpassed by making the lenses or mirrors of the telescope more perfect. This limit sets the amount of detail that can be resolved by the telescope and it is dependant almost exclusively on the aperture of the telescope. The greater the aperture of the telescope, the greater the resolving power of the telescope. Of course, the farther that an object is away from the telescope the less surface detail will be revealed by the telescope. If we are given a high quality telescope of aperture **A**, and if we look at a distance **D** away from the telescope, then the linear size, **L**, of the smallest possible detail that can be detected on the object by the telescope under the best possible atmospheric conditions is given by the formula

$$L = 0.000073 D/A$$

where **A** is measured in centimeters and **L** takes on the units of **D**. This formula can be derived by any second year physics student who paid attention during first year optics.

The moon is about 370,000 km away from the Earth. If we look at it through our 60 cm telescope at the PGOA, then the linear size of the smallest feature visible through the telescope under the best possible seeing conditions is

$$L = 0.000073 \times 370,000/60 = 0.45 \text{ km}$$

or 450 meters. This means that there is no way to detect an astronaut on the surface of the moon with our telescope. In fact, you would need an optical telescope with an aperture of 2.7 km

... Continued on page 10

# Announcements

## Thank You

The *Regional District of Fraser-Fort George* has generously contributed \$1000 to assist the PGAS with the completion of our observatory. THANK YOU to the district board members who took the time to visit our observatory and gave us their confidence.

## For Sale

New Meade 8" telescope (never assembled), coated optics, German mount, motor drive, tripod, 2 eyepieces, diagonal, telrad for only \$1100. Call Rocky McCann 563-1325 (Prince George).

## CASCA

The 26th annual meeting of the Canadian Astronomical Society will be held this year from May 27 to May 31 in Penticton, BC. Most of the activities will take place at the Coast Lakeside Resort. The focus of the science sessions will be "**Physics & Phenomena of the Interstellar Medium**". More information can be obtained from Orla Aaquist (964-9626)

## SHUTTLE

The current shuttle mission will be over by the time you receive this newsletter. If you wish to discover the latest news about the mission and future missions, connect to the WWW at the following address

[http://www.msfc.nasa.gov/mol/astro\\_home.html/](http://www.msfc.nasa.gov/mol/astro_home.html/)

## CCD Astronomy Magazine

The club's subscription to the CCD Astronomy Magazine has expired. If anyone is interested in maintaining this magazine, please let your executive know. Copies of the

magazine will be available at the next meeting of the PGAS.

## CISE Display

Between 9 AM and 4 PM on Wednesday, March 29, the PGAS will have a display at the Central Interior Science Exhibition (CISE) in the Civic Centre, downtown Prince George. Anyone wishing to help out should contact Jon Bowen (563-9869).

## Explore Prince George

On Sunday, June 11, Tourism Prince George is offering an opportunity for the public to explore their city and see just how much our city has to offer its visitors. "*Explore Prince George*" includes four tours that will visit different points of interest in Prince George and allow the residents of the city to see their home town from a visitor's perspective. The PGAS has been invited to participate in this event. If you are willing to help, call Orla Aaquist (964-9626). This will be excellent promotion for the club.

## The Talk Was Cancelled

Because of the strike by CNC faculty, the astronomy talk by astronomer Dr. Lloyd Higgs was cancelled. Apologies are extended to anyone who drove up to UNBC for the presentation.



# 10

to resolve an astronaut on the moon.

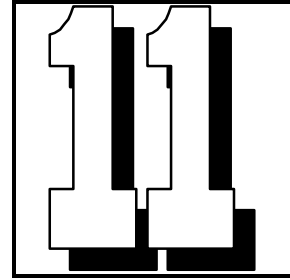
What about the shuttle? It measures 37 meters long, 17 meters high and has a 23 meter wingspan. If it was on the moon, we would not be able to discern its structure. but it is only in a 250 km orbit around the Earth. With a 60 cm telescope the smallest detail (according to the above formula) is just 30 cm which should give lots of detail. With the Mt. Palomar telescope, an amazing 4 cm of detail results.

Before you rush out to the observatory to observe the shuttle before it lands, let me point out a few difficulties with all of this. Firstly, telescopes are clumsy instruments and unless they are specially designed they cannot be made to track fast moving objects like meteors, satellites, birds in flight, and naked people on the beach. So, even though a small telescope might be able to detect some detail on some satellite moving overhead, it would be almost impossible to find it and track it. Secondly, the shuttle is in a low equatorial orbit and therefore does not pass over Prince George. It is never above the horizon at this latitude. Thirdly, the Earth's atmosphere always limits the resolving power of a telescope to something less than ideal. At our altitude, the most detail you could hope to see at 250 km is about 6 meters with any telescope. The shuttle would be an oblong blob and an astronaut would be a point source. At higher altitudes, the atmospheric disturbance is less, and on a high mountain such as Kitt Peak the amount of detail could increase by a factor of 5; that is, the smallest detail could be as little as 1 meter at 250 km. Higher resolution can be obtained using active or adaptive optics. Many professional observatories are currently using and refining active optics techniques and achieving resolutions near the theoretical limit expressed by the formula

$$L = 0.000073 D/A.$$

A question I'll leave you with is this. If active optics is allowing Earth bound telescopes to eliminate the effects of atmospheric turbulence, what good is the Hubble telescope?

# Light Pollution



*Soon, more houses will be built near our observatory on Tedford Road. More houses means more light. More light means brighter skies. Brighter skies means fewer (visible) stars. Fewer stars means less astronomy ... Therefore, we should prepare to fight for less light. As a first step, Vince Hogan has had the foresight to contact the International Dark-Sky Association (IDA) to enquire about light pollution. This article is a summary of some of the material sent to us by the IDA, much of it being simply copied from their information sheets.*

The increased sky glow which adversely affects the environment and compromises astronomical observations is called "*Light Pollution*", for it is wasted light that does nothing to increase nighttime safety, utility, or security. At present, the lack of awareness rather than resistance is generally the biggest problem in controlling light pollution, therefore education should be the main thrust of any program to minimize light pollution. Astronomers are NOT against night lighting (just like instructors at CNC are NOT against contracting out). However, they do advocate the best possible lighting for the task, with lighting designed 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 the efficiency and utility of the nighttime lighting. Everyone wins.

Here are some simple solutions that minimizes light pollution. Use night lighting only when necessary. Direct the light downward, where it is needed. Use low pressure sodium light sources whenever possible; these lamps minimize sky glow and are the most energy efficient light sources that exist.

Low pressure sodium produces its light mostly from two closely spaced yellow lines, and these lines can be easily filtered at the telescope using narrow band filters. Since few astronomical objects glow predominantly in the light of sodium, filtering out this particular colour makes virtually no difference to the astronomer. Astronomers can't filter sky-glow from normal lighting because most lights shine over a



broad spectrum of colours, so if you try to filter out sky-glow from normal lighting you also filter out all of the starlight.

The only disadvantage of low pressure sodium is that it looks somewhat eerie due to its specific (yellow) colour. If colour rendering is needed, (such as sport parks, tennis courts, major roadways and security areas) high pressure sodium should be used. The next efficient light source after high pressure sodium is metal halide, is a white light source and better for colour rendering than sodium light.

Regardless of the type of light used, all outdoor fixtures should be fully shielded and installed in such a way that no light is emitted above a horizontal plane running through the lowest part of the fixture. The shield should efficiently reflect the light downwards towards the ground where the light is needed. The shields can be reflectors, refractors, louvres, or baffles. One wants the minimum of light loss within the fixture itself so as to maximize the use of the light output. Effective baffles will not pass much light at angles greater than 75 degrees above the vertical.

Using too much light can be a problem. As astronomers know well, the human eye can adapt to amazingly low levels of light. Areas that are over illuminated spoil the dark adaptation and make surrounding, moderately lit areas seem dark in comparison. Similarly, outdoor lighting which directs the light into peoples eyes is almost as dangerous as having no lights there at all. The best alternative is a uniform, moderate level of outdoor lighting.

Most of the inexpensive light sources are not recommended for lighting because they produce much glare, wasted light, and are inefficient. Unfortunately, when observatory neighbours or expanding municipalities are looking to light up the night, low prices are appealing. So it is up to the astronomer to help illuminate their mind.

# AstroSurfing

*Astronomy news gathered from surfing through the Internet and other sources.*

*Much of the contents presented here are*

*severely edited for presentation in this Newsletter. For more details, contact the PeGASus editor.*



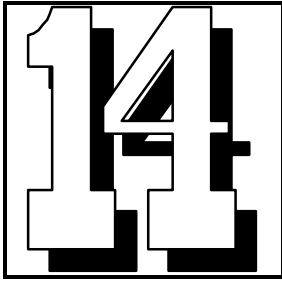
**NEUTRINO NEWS:** A particle accelerator and a tank of mineral oil have provided evidence that neutrinos, the most diminutive of subatomic particles, have the masses predicted by studies of galaxies hundreds of millions of light-years away. Neutrinos, long considered massless, are now believed to have a mass of about 1/100,000 of an electron's mass. This is good news for cosmologists trying to reconcile the tiny variations in the microwave background seen by the COBE satellite with large-scale clustering of galaxies.

**SOLAR (IN)ACTIVITY:** Although there have been a few aurora alerts, January's and early February's solar activity is basically low. Casper Hossfield reports a mean sunspot index of only 25 for the week ending February 8th.

**PLUTO AT 65:** February 18th marked an important date in the history of solar-system observations. On that day in 1930, Clyde Tombaugh made known his discovery of distant Pluto. Charon, Pluto's moon, was discovered in 1978. This discovery proved very fortunate, for just a few years later the orbit of Charon and Earth lined up in a way that caused the two objects to pass repeatedly in front of one another; this will not occur again until early in the 22nd century. In the 65 years since the discovery of Pluto, the planet has completed only about 1/4 of an orbit around the Sun.

**NOVA AQUILAE 1995:** Nova Aquilae '95 was discovered photographically on February 7th by Japanese amateur Kesao Takamizawa. Near mid February, the nova was at about 9th magnitude, the erupting star is at right ascension 19h 05m 27s, declination -1 deg 42'. That's about 3 degrees due north of the 3rd-magnitude star Lambda Aquilae. Spectra of the nova taken in February confirm that it is in the early decline stage, with gas rushing outward from it at some 1,200 km per second.

**A COMET'S CONSEQUENCES:** A report in this week's issue of the journal NATURE describes some of the chemical compounds detected



in Jupiter's atmosphere after the impact of Comet Shoemaker-Levy 9 last summer. According to French astronomer Emmanuel Lellouch and his team, the impacts of fragments G and K each generated 100 million metric tons of carbon monoxide, among other things. They believe the CO was not part of the comet or Jupiter, but instead was synthesized during the heat of each blast.

**SPICA OCCULTATION:** On February 19th the waning gibbous Moon occulted the bright star Spica, but the event was visible only from northeast Asia, northern Japan, Alaska, and Hawaii. The next Spica occultation observable from the United States (and Canada?) occurs on April 15th.

**EUROPA'S OXYGEN VEIL:** Astronomers using the Hubble Space Telescope have found that Europa, one of Jupiter's four large satellites, is enveloped by an extremely tenuous atmosphere of molecular oxygen. The discovery is not altogether unexpected, since Europa is thought to be covered with water ice. When sunlight, cosmic rays, and micrometeorites strike the moon's icy surface, water molecules are blasted into space and quickly dissociated into hydrogen and oxygen. The hydrogen escapes readily, leaving the heavier oxygen behind. However, the surface pressure on Europa is barely a hundred billionth that on Earth.

**CLEMENTINE ALIVE?:** The Clementine spacecraft, which fell silent last year soon after leaving lunar orbit, appears to be alive after all. On February 20th tracking engineers used one of the 70-meter antennas in NASA's Deep Space Network to reestablish contact for about 50 minutes.

**ASTRO 2 UNDER WAY:** The Space Shuttle **Endeavour** began a record-breaking 16-day astronomy mission at 1:38 a.m. EST on March 2nd. The principal payload is Astro 2, a suite of three telescopes optimized for studies at ultraviolet wavelengths. Observations will include a search for intergalactic helium, one of the by-products thought to have formed immediately after the Big Bang.

**IO ERUPTS!:** On March 2, astronomers on Mauna Kea were monitoring the Jovian moon Io as part of educational program for young students called Project Jason. But they got more than they bargained for. Observer John Spencer reports that a major volcanic outburst took place on Io on March 2nd. The location, though uncertain, does not obviously match any of the satellite's major volcanic centers. However, it's the first eruption of this type for which

images were obtained in real time. Spencer and his colleagues used NASA's Infrared Telescope Facility and recorded the event from 3.5 to 4.8 microns.



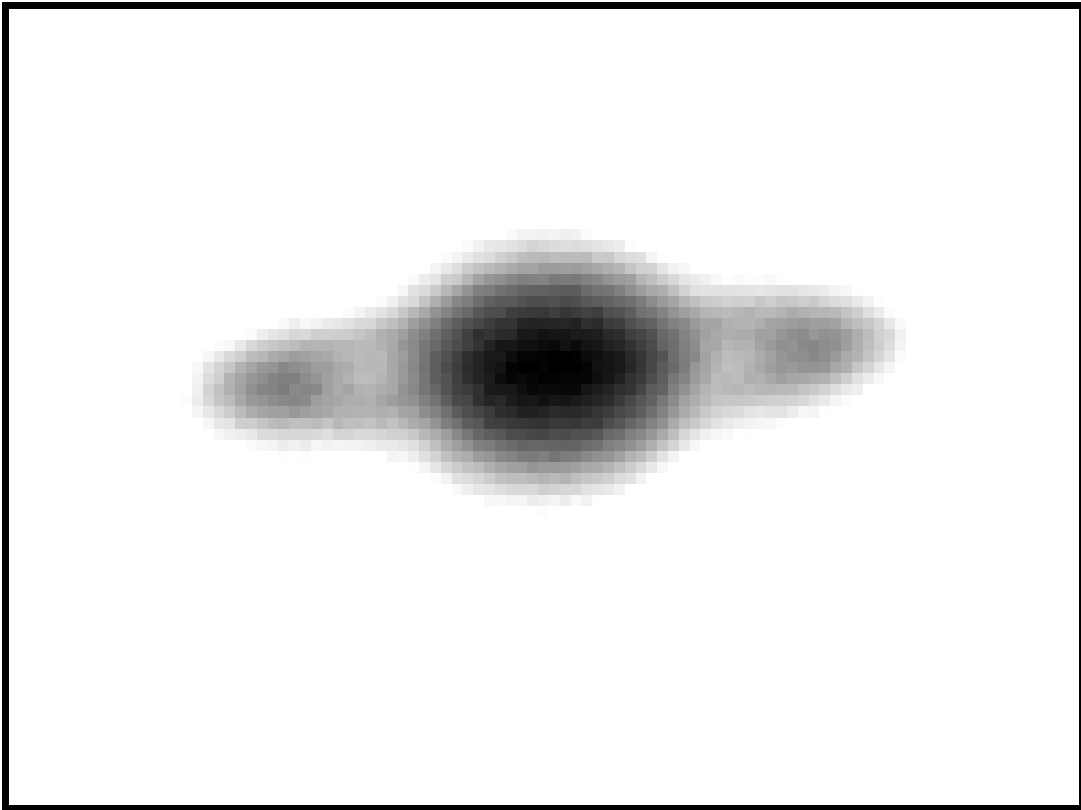
**METEORITES 3, CARS 0:** Japanese scientists report that yet another car has gotten conked by a meteorite. This time a black, egg-shaped stone weighing 325 grams was found atop the trunk of a retired high-school teacher in the town of Neagari, in central Honshu. The precise time of the fall is unknown, but neighbors reported hearing a loud noise on the prior evening, February 18th. So the known collisions of meteorites with cars may now stand at three, counting the Peekskill, New York, fall in October 1992 and the controversial claim of a meteorite hitting a moving car last June near Madrid, Spain.

**MORE TRANS-NEPTUNIANS:** The observing team of Jane Luu and David Jewitt report their discovery of three more objects beyond the orbit of Neptune. Preliminary calculations suggest that the three objects, designated 1995 DA2, DB2, and DC2, are 34, 41, and 45 astronomical units from the Sun. That brings the tally of trans-Neptunian objects to 21, not counting Pluto and its moon, Charon, and all found within the last three years.

**"TOP QUARK" IDENTIFIED:** The zoo of subatomic particles gained a new denizen with the detection of the "top" quark, the sixth -- and presumably last -- member of the quark family.

**SATURN HITS CONJUNCTION:** Saturn reached conjunction, on the far side of the Sun from Earth, on March 5th. Then it entered the morning sky. Obviously, you won't be able to observe Saturn now, but in a couple of months -- the night of May 21st to be exact -- the planet's ring system will be turned edge-on to Earth. Start planning now for some early-morning observing sessions!

# The Image Gallery



**This image of Saturn was taken at the PGOAO on August 2, 1993 with the ST6 CCD camera. Keep an eye on Saturn this year when it moves from behind the morning Sun. As the year progresses, Saturn will rise earlier and earlier until once again it is in the evening sky in August. At some time between now and then, Saturn's ring plane will be edge-on to our line of sight and the rings will seem to disappear. It is a worthwhile event since it only happens once every 13 to 15 years.**