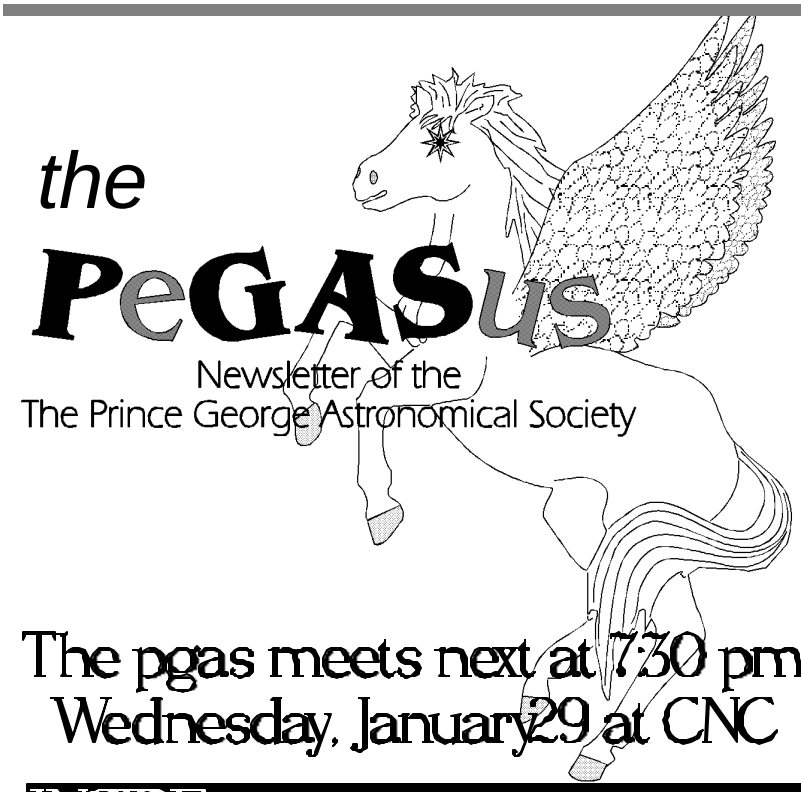
1996 DECEMBER ISSUE # 70



the PeGASus

Newsletter of the
The Prince George Astronomical Society

The pgas meets next at 7:30 pm Wednesday, January 29 at CNC

INSIDE :

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

Deadline for the next issue is February 15

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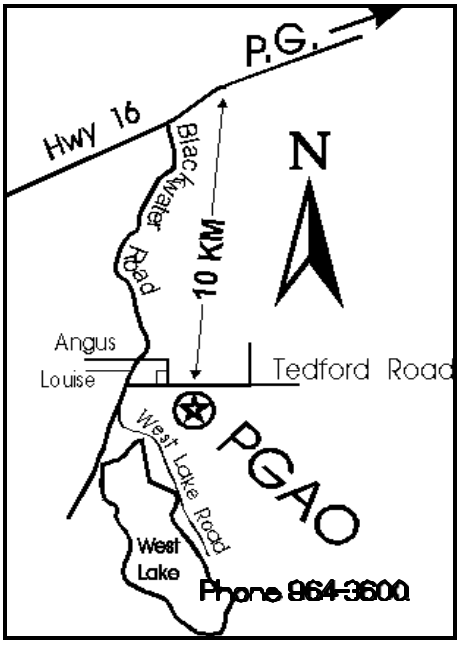

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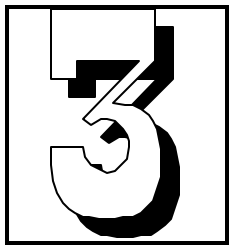
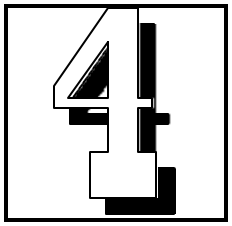


By Gil Self

It was probably great to be around in the early 1600's . Science was really coming of age , although still a risky occupation since the church had some pretty definite ideas on the workings of the cosmos About 50 years earlier Copernicus had laid the cornerstone by placing the sun in the center of the universe This was refined by Tycho Brahe a few years later with measurements and mathematics He realized that the universe was larger than the moons orbit .Before long Johannes Kepler could describe the shape of a planetary orbit , perhaps the most startling of all because he denied the perfect geometry of the church . But the stage was set , the dam was leaking, and along comes Galileo Galilei . With his high-tech equipment he was able to see our moon up close , discover the moons of Jupiter and among many other things the phases of Venus as well he was able to see stars in the Milky Way His insights lead science out of the mists . He should have had fan mail and Galileo groupies . Or you could have been a Newton nut ,his contributions were many . But the world was different then , some of these men were scorned or jailed for their insight. Generally you weren't rewarded for new and controversial thinking or insights

Through the ages science has advanced by fits and starts or sometimes by leaps and bounds . Even in the enlightened twentieth century new ideas were not always welcomed. Just ask Charles Townes who spent many years basically ignored while he looked for interstellar molecules . Or Fritz Zwicky who was not proven correct in his claim of proof of gravitational lensing until after his death. Open minds make good science. This certainly is a remarkable time for science. Amateur equipment is on a par with professional equipment of just a few years ago. For less than the cost of a car you can buy a telescope a ccd camera and a computer that would have made Mr. Hubble salivate. And on a larger scale some major equipment is in use such as the Hubble space telescope
and many more technological marvels only slightly removed from magic. Mirrors that jitter about to compensate for our atmosphere, optical interferometry ,super computers ---on your desk and last and perhaps greatest ,communications. Specifically the net ,scientists are in touch. New ideas are bounced around the world instantly a new idea no matter how radical will find an audience somewhere. And best of all thanks to the net we are there. From my home I can tune in on this pipeline of goodies almost as its happening. This truly is the Golden Age of science

G.S.



Coming Events

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

Dec 25 - Meeting cancelled---MERRY CHRISTMAS
Jan 29 -Monthly meeting at cnc (bring a friend)

There is not much planned as far as astronomical events in January, we are planning two work-bees. If you can help us please contact Mike or Bob. We would like to get the observatory spruced up for our spring opening and comet Hale-Bopp, which should see hundreds of guests visiting us in March and April

COMET HALE-BOPP

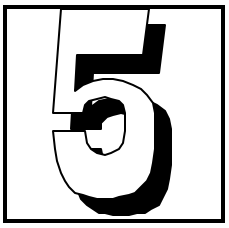
Even for those living at high northern latitudes, Comet Hale-Bopp is becoming ever more challenging to see after sunset. The farther north you live, the better your chances. Meanwhile, the comet continues its steady march inward and has reached magnitude 4.0 in the process. Catch it this week before moonlight swamps the sky. Here is the position for December 20th at 0 hours Universal Time:

Date	R. A.	Deci.
December 20	18h *25.9m*	+2 15

If I read my map correctly that puts it <u>about</u> 8 degs east of beta Ophiuchus, good hunting! Some are calling this the super comet .1

didn't think anything could top HYAKUTAKE, lets see what spring brings.

Membership Dues



If you have not paid you membership dues yet, we would really like you to do so as soon as possible. By now you should have received a telephone call from someone reminding you of your unpaid dues. If you have not, then either you have paid your dues or we were not able to get a hold of you for one reason or another. Unpaid members will be deleted from our mailing list in March or April.
Dues are still $10.00 for students ; $20.00 for adults and $30.00 family.
Please mail your dues to our treasurer Steve Senger at

7161 Hartford cres
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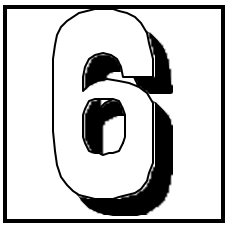
V2N2W2

Thank you

LUNAR GOLD?

A team of NASA and Defense scientists believe they have detected the presence of water ice at the Moon's south pole. That astounding result is the most likely outcome of an experiment conducted in 1994, when
the radio beam of the Clementine spacecraft was aimed at both poles and the resulting reflections received on Earth. Nothing unusual was seen in the radar return from the north pole. However, the strength and polarization of the signal from the south pole was unlike what would be expected for bare rock; instead, it strongly suggested the presence of ice.
Ice at the Moon's poles has been considered possible in theory for 35 years. The lunar equator points almost directly at the Sun, and Clementine images show that an area of up to 15,000 square kilometers at the lunar south pole has not been exposed to sunlight for billions of years. It's thought that water vapor from impacting comets can migrate to the pole, trapping out as ice in the shadowed interiors of deep craters
Water ice , accessible on the lunar surface could open the door to early exploitation of the moons unique place in our solar system . Since ice can be converted into hydrogen fuel , oxygen ,and among many other things drinking water. Water is one of the heaviest payloads that must be lofted to the moons surface , the discovery of water on the moon could well be the breakthrough we have all been waiting for on the long road back to the moon.



The Night Sky for Late December

by Bob Nelson PhD

Well, winter's cloudiness has descended upon us once again here in the Central Interior (I can't remember, was it ever *not* here?). However, every so often we are surprised with clear breaks, and it's great to see what the heavens have in store for us. Here is a roundup of predicted solar system and other phenomena that the Observer's Handbook and various computer planetarium programs indicate for us:

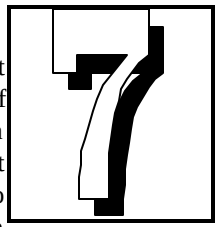
MERCURY is visible low in the southwest just after sunset. It reaches greatest eastern elongation (GEE) on Dec 15th at 19h UT. [Elongation is the angular separation of a planet from the Sun as seen by an observer on the Earth. The GEE therefore represents the maximum distance to the east (left) of the sun as the planet gets in a given orbital pass.J This time the angle is some 200 (the greatest it ever gets is 280). Do not get too excited, however, because, at a declination of ~25, it is *very* close to the horizon at sunset. You will be lucky to see it at all.

VENUS shines brightly in the morning sky (I saw it a week ago; it was nice). Since Venus is at a visual magnitude of -4.0, you'll see with your naked eyes it well into the pre-dawn twilight. If you follow it with a small telescope after the Sun rises, you'll see that it's a small gibbous blob about 12" across (the higher it is in the sky, the better the resolution). It's a good target for early risers.

MARS, in Virgo, rises near midnight. It's still quite small (about 7" across) and is some 1.33 astronomical units (AU.) away (the Earth is 1.0 AU. from the Sun). It will get progressively closer in the corning months, as Earth catches up in its celestial racetrack, until opposition on 1997 March 16. [At opposition, the elongation is 1800.] At that time it will be some 14" in diameter and will rise near sunset. As oppositions go, this is not a particularly good one, however, as the best ones feature a disk up to 24" (as will occur next in 2003 June 24). Oppositions with Mars occur 780 days (or about two years) apart.

JUPITER is low in the southwest at sunset and hard to see. Catch it next year

SATURN, in Pisces, is near the local meridian at sunset and is a glorious evening sight. It's at visual magnitude 0.9 and is a disk some 18" in diameter



(the maximum at opposition is 20"). The rings are inclined at 3.20 (i.e. we are viewing from 3 degrees *south* of the plane of the rings) and are therefore still rather close to edge-on. In good viewing conditions, you may just he able to make out the Cassini Division. However, this is a good opportunity to view the satellites of Saturn. With our 24" telescope, we should, over time, be able to see the eight brightest moons. Let's have another contest!

URANUS and NEPTUNE are low in the southwest at sunset and are almost as close to the Sun as Jupiter is. PLUTO is a morning object and is close to the Sun near sunrise. Forget them, we'll catch them next time the Earth swings on by, next fall.

Comet HALE-BOPP is with us still. In early December it sets in the west at around 7:00 PM local time. It's at visual magnitude 4.0 and should be visible before being swamped by moonlight.

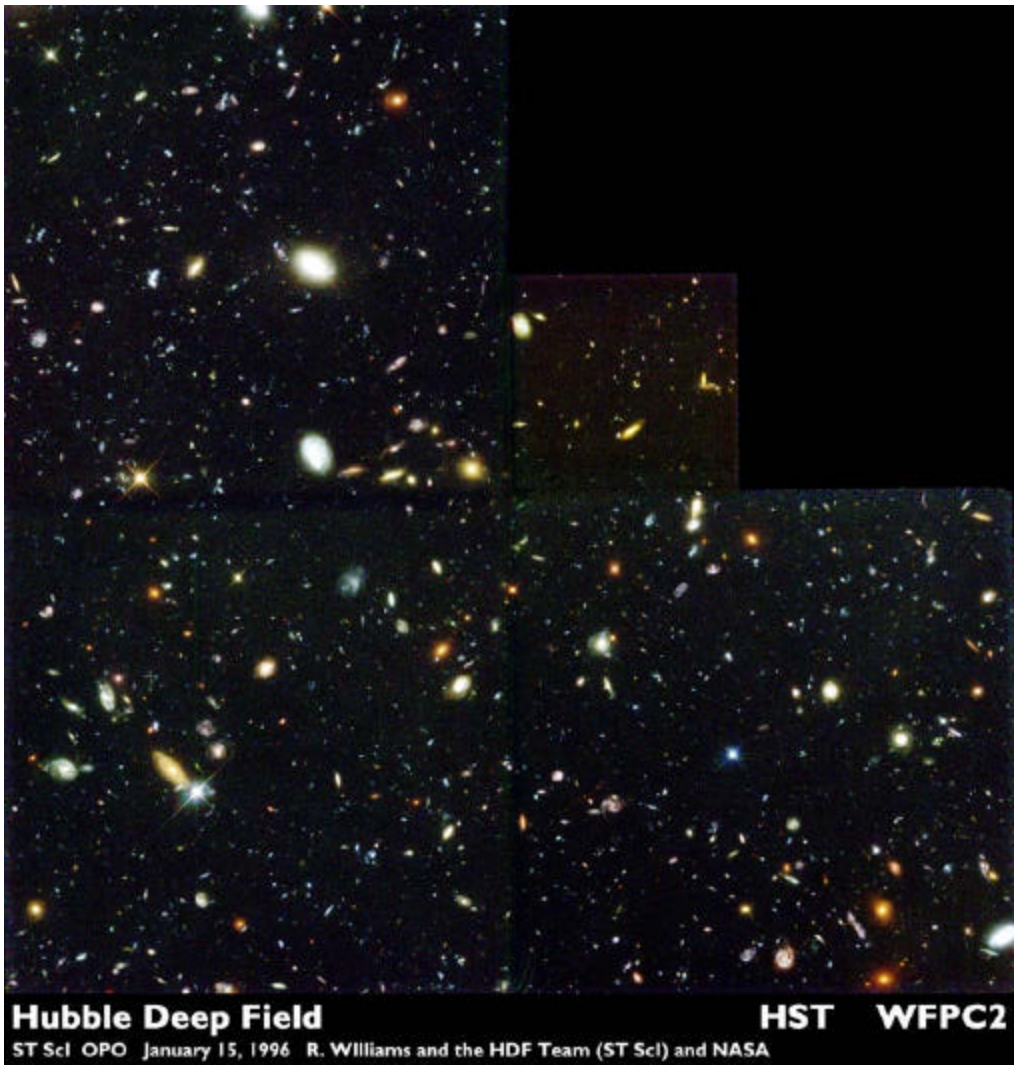
The Ursid meteors are scheduled to occur December 22, reaching a peak at 15 hours UT (7 AM our time). Therefore, look in the early morning on that date. As the name implies, the radiant (the point from which the meteors seem to come) is in the constellation of Ursa Minor (right in the bowl). This is a minor meteor shower, featuring zenith hourly rates (ZHR) of only 15, but rates up to 50 have been noted (see Sky and Tel for 1995 Dec, page 68). Unfortunately, the moon, near full this year, will interfere. (The Geminid meteor shower, having ZHRs of 100-120 and therefore a better show, occurred on Dec 14, before this edition went to press).

Winter solstice occurs this year on Dec 22 at 12:17 AM PST. It's the shortest day of the year; sunrise here occurs at 8:28 AM and sunset, at 3:51 PM. Strange as it must seem, by convention, this date is taken as the first day of winter (!!!). Residents of the Central Interior know that we've had winter conditions for well over a month, so why is there this lag? Well, first of all, winter is longer in this part of the world. Secondly, there is a lag of about six weeks in the seasons. In spite of the fact that the Sun's rays are weakest at solstice (and strengthen thereafter), the ground is still giving up energy. The coldest part of winter (on average) occurs somewhere near the end of January. (A similar phenomenon occurs nightly with the lowest temperatures occurring just before dawn.)

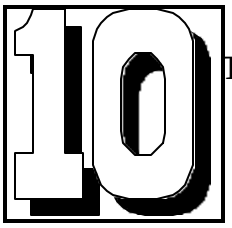
B.N.

This is my pick for the best image of 1996

It was taken over a ten day period and is composed of over three hundred images. It is a core sample of a dark region of sky near the galactic north pole, an area equivilent to a dime edgewise at 75 feet.



Page 8 is an enlarged portion of this, the complete image



The Five Minute Tour of the Universe

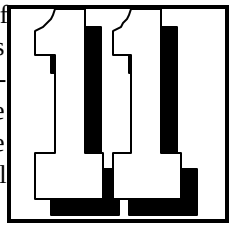
by Wes Stone

Sometimes, the most rewarding observing sessions are brief forays during a break in the clouds. A quirky shift of the wind is all it takes to render the sky completely clear after a day of storms. In a few minutes, the telescope is ready, but the next bank of clouds is already approaching.

What to observe? Orion is rising over the treetops. I swing over to the Great Nebula, admiring its fuzzy tendrils and the Trapezium at its center. My eyes are not yet dark-adapted, but the nebula is bright enough to forgive me. Anyway, I do not have time to trace its full extent, for the clouds are moving in. On impulse, I try for a much fainter target: the Crab Nebula in Taurus. I slowly sweep the scope around the vicinity of the bright star Zeta Tauri. The Crab suddenly pops into view, a soft blur against a field of faint stars. It is shimmering from atmospheric turbulence. On another night, I might let my telescope stabilize in temperature by exposing the optics to the cold air for several minutes longer, but I do not have that luxury now. I zoom up to the Pleiades. The brightest ones, intensely hot and blue stars, tend to obscure the-dimmer members of this cluster of hundreds. Even as the first clouds sweep over the field of view, I can see many more than the nine that I usually discern with my naked eye on the darkest clear nights.

My next stop is the farthest from Earth. The Andromeda Galaxy, also known as M3 1, is high overhead. I pick up the bright inner section and quite a bit of the faint surrounding area. Near the edge of the same field lies a companion to M3~. This small, fuzzy spot is M32, an elliptical galaxy. Another elliptical galaxy, fainter but larger than M32, lies on the opposite side of the Andromeda Galaxy. This is known as Ml 10 or NGC 205. It does not have the bright nucleus of M32, and because of this is not as easy to see. On the other hand, M32 is so small that at low magnifications it may be mistaken for just another star. Ml 10 is not likely to be overlooked in this way. The Andromeda Galaxy itself can be appreciated without the aid of a telescope or even binoculars, although these instruments will be helpful. Using a good plani sphere or star chart, find the constellation of Andromeda and note when it will be high in the sky. At that time, go out and find the constellation in the night sky. The galaxy's position should he marked on your chart or planisphere. Compare the map with the sky. Under clear, dark skies the galaxy will be visible to the naked eye as a fairly large and oval patch of light. If you do have binoculars, this will make it much easier to find the galaxy. From this distant object a couple of million light years away, I traveled to somewhere much closer to home, in the realm of the open star clusters. I had seen the Pleiades earlier, but there are many

other attractive open star clusters along the Milky Way. Chief among these is the Double Cluster in Perseus, a pair of clusters that are visible to the naked eye and appear in the same low-power telescope field. There seem to be countless stars visible when one looks at these stellar gems. I had to make one more stop, and make it quickly, for the clouds had covered almost all the sky. NGC 457 in



Cassiopeia is known as the Owl Cluster. In a small telescope, it certainly looks like a bird with two projecting wings, a triangular tail, and two bright eyes, all made up of stars. As I put away my scope, I thought about all that I had seen in this short time. My count totaled four open clusters, two gaseous nebulae, and three galaxies. It occurred to me that, with a little planning, I could set up a sequential observing session in which I would start out close to home and end up in the outer reaches of the universe. In other words, I would observe the following objects in this order:

A planet	A double star	A gaseous nebula
An open star cluster	A globular star cluster	A galaxy

These objects represent the stepping stones of distance in our universe. Oddly enough, I got to try out this sequence later on the same night.

Mars was the first object on my list, a mere 100 million kilometers from Earth. Its ruddy disk was large and bright, but showed no detail. Not to worry; I had other worlds to visit.

Directly overhead was the double star Gamma Andromedae, lying about 150 light years away. The brighter star is orange, and the fainter one blue. They were close but separate at 36x.

For the gaseous nebula, I chose M78, 1400 light years away. This nebula is in the constellation of Orion, above the belt. Unlike the much

brighter Great Nebula to the South, M78 shines by reflecting starlight rather than emitting its own light. M78 was a wispy patch in my telescope, slightly larger and brighter than the Crab Nebula.

An open cluster of the winter sky is M35, 2800 light years away.

This cluster is usually visible to the naked eye, and is resolved into a sparkling field of stars in a small telescope.

I knew that the globular cluster would be tough. M2 and M15, the best globulars of the fall sky, had already set. There was only one globular cluster above the horizon, and that was M79. This cluster was low in the southern sky, where the clouds were thickest. With binoculars, I could tell that the sky was quite clear around M79, and I located it without much trouble. Unlike most open clusters, globulars are distinctly round. Also, most "globs" are not resolved into their component stars in small telescopes. This is because of

their greater distance from us. M79, at 35,000 light years, appeared as a soft, round glow with a brighter center.

This left me with only a galaxy to find. My natural choice was M33 in the constellation of Triangulum. For northern observers, this **(cont)**

galaxy is second in brightness (and fame) only to the Andromeda Galaxy. In spite of this, M33 can be difficult to find in a telescope. The reason is that M33's light is spread over an area greater than that of the Full Moon in the sky. 5 a result, the surface brightness is quite low and there is little contrast between the galaxy and the sky background. Binoculars make the search easier, since they condense the galaxy's light by applying only slight magnification. A seasoned observer of M33, I used only my telescope. I star-hopped from the third magnitude star Alpha Trianguli and found the galaxy without a hitch. Although faint, its shimmering silver light covered most of the telescope field and was very pretty. This light was very old as well. As I looked through the telescope, I was seeing the galaxy as it was 2.3 million years ago. My tour of the universe had taken me not only out into space but back in time.

You can make the same type of journey. Set up your own itinerary and goals. You will find that this will sharpen your skills in telescope use and object location. Sometimes there will not be an easy member from each class of object in the sky. Be flexible, and do not be discouraged. You may wish to expand the list to include other types of objects. Or, you might select an object from each magnitude class down to the limit of your telescope. It is easy to increase or decrease the difficulty and challenge of such an endeavor. In any case, this is one more way to have the most fun in the shortest time allotted for telescope use.

The Magnitude Scale

How bright is that star? Astronomers use a logarithmic magnitude scale to assign brightnesses to stars. This notation is derived from that of the Greek astronomer Hipparchus, who assigned a brightness of "first magnitude" to the brightest stars, and "sixth magnitude" to the faintest stars visible with the unaided eye. The scale has been standardized and quantified, so that one star five magnitudes brighter than another gives 100 times more light to Earth. This scale is useful for telescopic astronomy, as it can be applied to objects of any brightness

Object	Magnitude
Sun	-27
Full Moon	- 12
Venus at brightest	- 4.9
Mars, Jupiter, and Mercury at brightest	- 2.8
Sirius (Brightest Nighttime Star)	- 1.5
Vega, Arcturus, Capella, Alpha Centauri	- 0.0
Saturn at brightest	- 0.2
Betelgeuse, Antares, Aldebaran	- 1.0
Polaris	2.0
Andromeda Galaxy	3~5*

Typical limiting magnitude**	
from Portland	5.2
Uranus	5.6
Globular Cluster M13	6.0
Standard limiting magnitude	
(perfect site)	*6.5*
Neptune	*8.2*
Pluto	*13.7*
Faintest objects visible in photos taken with large optical telescopes	28

Diffuse objects such as galaxies appear to be fainter than their published magnitudes, because their light is spread out over a large area rather than concentrated into a point. These objects are said to have low surface brightness

The limiting magnitude at any given time is represented by the faintest star which can be seen with the naked eye. Moonlight and light pollution, among other factors, will lower the limiting magnitude

Continuing Exploration Program

NASA's 1996 missions to Mars further the global explorations of the planet begun in 1965 with the Mariner 4 mission to Mars and continued in the mid-'70s by the Viking lander missions.

From earlier investigations, scientists have compiled a portrait of Mars full of stark contrasts.

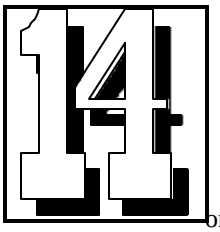
Mars' surface features range from ancient, cratered terrain like Earth's Moon to immense volcanoes that would dwarf Mt. Everest and a canyon that would stretch across the United States.

Mars' atmosphere is less than 1 percent as thick as Earth's, but there are permanent polar caps with reservoirs of water ice. Closeup shots of Mars' terrain resemble that of an Earthly desert, with surface features that look like river channels carved long ago by flowing water.

The next step in Mars exploration, according to scientists, is to obtain an overview of the entire planet and to verify remote observations with measurements taken from the ground. Mars Global Surveyor is designed to study the atmosphere, surface and interior systematically over a full Martian year.

Mars Pathfinder will deploy a mobile rover that will characterize rocks and soil in a landing area over hundreds of square metres (yards) on Mars. Pathfinder's instruments and mobile rover are designed to provide an in-depth portrait of Martian rocks and surface materials over a relatively large landing area, thereby giving scientists an immediate look at the crystal materials that make up the red planet.

Pathfinder Arrival in July 1997



Astrosurfing

MILKY WAY HEAVYWEIGHT

It's becoming ever more obvious that a massive black hole lurks in the heart of the Milky Way.

That notion is based on the motions of stars seen only arcseconds from our galaxy's radio-bright core. Skeptics have pointed out that those stars might be moving in highly eccentric orbits, which would make the calculated mass of the central object artificially high. But new measurements by Andreas Eckart and Reinhard Genzel (Max Planck Institute) show that massive stars near the core are moving, on average, by equal amounts in all directions. Calculations based on that fact argue for a dark, central object that packs the mass of 2.4 million Suns into a space only a fraction of a light-year across.

COMPLETION OF MIRROR ASSEMBLY MARKS MILESTONE FOR NASA'S ADVANCED X-RAY ASTROPHYSICS FACILITY

The world's most powerful X-ray observatory came a major step closer to completion recently with the assembly of its high resolution mirrors. The last of four pairs of unique mirrors of NASA's Advanced X-ray Astrophysics Facility (AXAF) were aligned and cemented into place at Eastman Kodak's lab in Rochester, NY, last month, Testing will begin in mid-November.

-

Unlike the concave, nearly flat mirrors used in optical telescopes, the AXAF mirrors are shallow, almost cylindrical cones. The four pairs of mirrors are nested inside each other. X-rays enter the telescope, graze off the mirrors -- much like a stone skipping across the surface of a pond -- and are focused onto a plane 30 feet behind the front of the mirrors.

The size and accuracy of the mirrors will make AXAF 100 time more sensitive than previous X-ray telescopes, producing images 10 times sharper.

The observatory is scheduled for a Space Shuttle launch in 1998. In orbit, it will obtain never-before-seen images of highly energized X-ray sources --such as neutron stars, black holes, debris from exploding stars, quasars, centers of galaxies and galaxy clusters.

AXAF will rank among NASA's great observatories, along with the Hubble Telescope and the Compton Gamma Ray Observatory. It will explore some of the most intriguing mysteries in space and offer a better understanding and knowledge of the universe.

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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Xerox Canada	500
Russelsteel	465
Lakeland Mills Ltd	460
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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