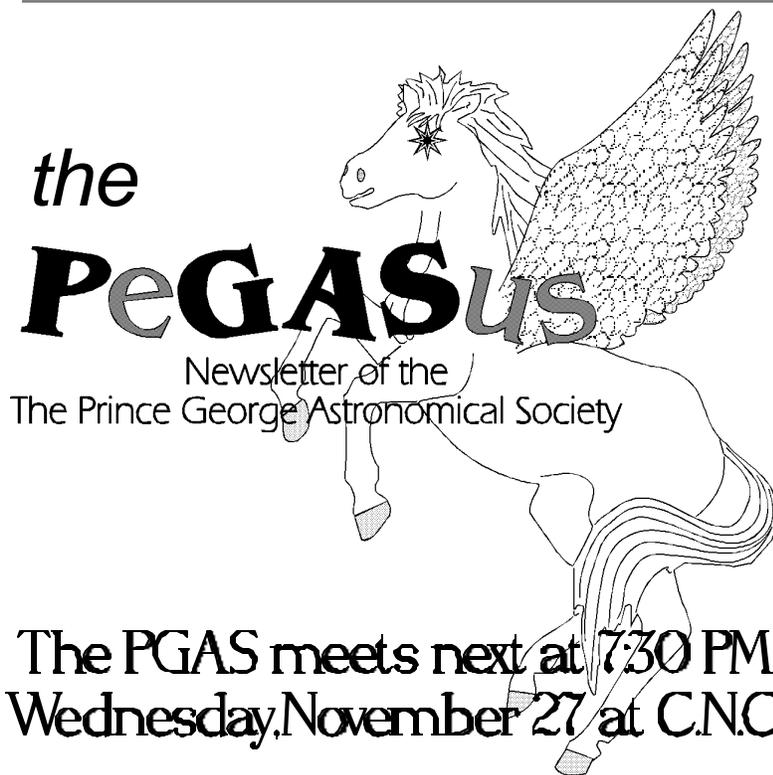


**1996 NOVEMBER ISSUE #69**



**The PGAS meets next at 7:30 PM  
Wednesday, November 27 at C.N.C.**

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P.G.A.S. WEB SITE <http://www.pgweb.com/astronomical/>



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

Our pursuits are out of this world.  
Our activities are astronomical.  
Our aim is the sky.

Contributions to the newsletter are  
welcome.

**Deadline for the next issue is DEC 14**  
*at the latest*

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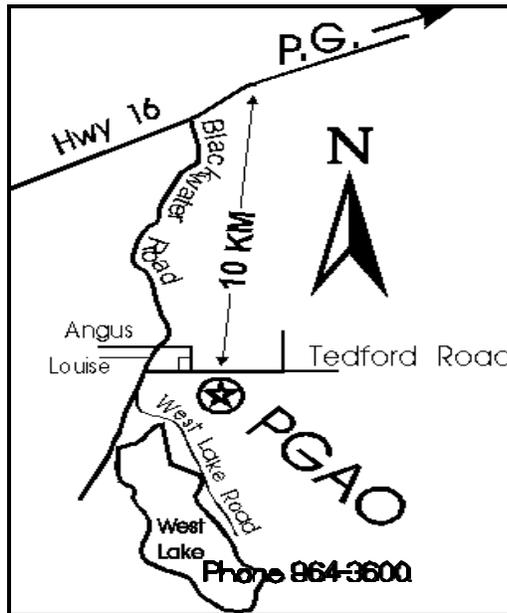
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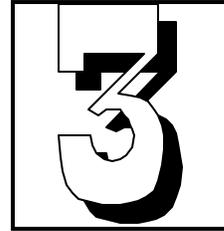
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## EDITORIAL

by Gil Self



I began last months editorial by pointing out that we had some big shoes to fill since several large footed members had moved on . Elections were held at Octobers meeting and I believe we have an able group of people to meet the challenges of the coming year. ( I was tempted to stretch the metaphor a bit further and call them big footed , but that would have been a step too far ---overstepping perhaps ) . We have a leg-up in that we have already had a successful casino . The clubs ledger is in much better shape now thanks to the efforts of the many members who pitched in and did a shift at the casino . Thanks to Bob Nelson , Jon Bowen , Gerhard Bierman , Rob Frith, Steve Senger , and Gil Self .

The final tally should be in soon !

Another event that is always a big success is science day at Pine center and this year was one of the best yet . The day was orchestrated by Steve Senger , and a fine job he did . The only problem is he is in Vancouver , and I only have a partial list of who helped out . So to those I miss , your help is appreciated .

Some of those who helped out were Rob Frith , Vince Hogan , Bob Nelson , Steve Senger , and Gil Self . I think everyone will agree it's fun to get out in the public and spread the word.

Something came up the other day that we should mention to everyone using the observatory, although not aimed at anyone , just a caution .

**IF IT'S MADE OUT OF GLASS AND IT LOOKS LIKE IT NEEDS CLEANING PLEASE LET BOB KNOW .** Front surface mirrors and coated optics need special cleaning supplies and procedures to clean them properly . For example only distilled water and a mild soap are used to clean the 24 inch mirror . Ideally the mirror should be perfectly clean , but some dust is always going to be there given our location and the parking lot .

The Astronomical League is holding a convention next July in Colorado , with altitudes of 9,000 to 14,000 feet and 60 miles to the nearest light pollution , it sounds like a big time -good time . For more information see Bob or myself .

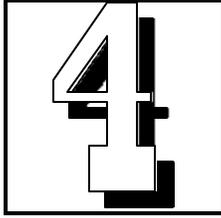
Clear Skies

G.S.

from Matthew Burke--avro100@netbistro.com

My daughter ,Grace Karen Burke was born on October 26th at 11:49 PM. She weighed in at8Lb 5oz. . Both Susan and the baby are doing very well .

**CONGRATULATIONS** to the Burke family and welcome Grace



## Coming Events

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

- Nov 27 - PGAS monthly meeting.
- Dec 14 - Open House, welcome back Orion//Geminid peak
- Dec 21 - winter solstice 6:06 A.M.
- Dec 25 - Meeting cancelled----MERRY CHRISTMAS !!!!

The closest total solar eclipse to North America visible from land until the year 2017 will occur on **February 26, 1998.**

### COMET TABUR WIPES OUT

Even though it doesn't reach perihelion until November 3rd, Comet Tabur (C/1996 Q1) has apparently run out of gas. S&T contributing editor John Bortle reports that the comet has been reduced to a faint 9th-magnitude streak about a third of a degree long but only 2' wide.

This premature demise may be a delayed consequence of Tabur having split off of Comet Liller (C/1988 A1), which has the same orbit.

Bortle notes that such a fast fizzle prior to perihelion is highly unusual but not unprecedented. The same thing happened to Comet Ensenior in 1926.

### HALE-BOPP BRIGHTENS

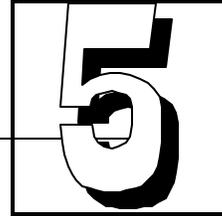
Comet Hale-Bopp (C/1995 O1) appears to be picking up a little steam, so to speak. Some observers now report that it is slightly brighter than 5th magnitude. Bortle pegs Hale-Bopp more conservatively at 5.4, but he notes that the comet has an amazingly star-like nucleus and a short yet pretty eastward-pointing tail containing three distinct rays. Go judge for yourself --

### SUNSPOT DROUGHT ENDS

We've now learned that the long string of days without seeing any spots on the Sun was briefly broken on October 19 and 20, but only for a few hours. So the final official tally is that the Sun remained completely spotless for 36 days -- from September 13th to October 18th. It hasn't done that since 1944. Such a protracted drought is something of a mystery to solar physicist Patrick McIntosh, who notes that other types of solar activity ticked upward months ago. "It's nearing a time," McIntosh says, "when the new solar cycle should display itself with more vigor."

## Vulcan's Contribution to Astronomy

by E. Arthur Beaumont



Some months ago an article in this newsletter mentioned Vulcan as a hypothetical planet. Barbara Hanson had submitted some of the information.

Leverrier predicted the existence of Neptune from the perturbations of comets, and it was discovered in 1846 by Galle at Berlin and was close to its predicted position. Prior to this Leverrier had calculated that Mercury's perihelion advanced by 43 seconds per century after accounting for perturbations of the other planets. The cause was presumed to be another planet situated closer to the sun and it popularly became known as Vulcan. Many searches were carried out especially during solar eclipses but Vulcan was never found.

In 1916 Einstein published his General Theory of Relativity in which he was able to show that the advance in the orbit was accounted for by his theory and that it was not necessary for Vulcan to exist. In reading Einstein's paper, other scientists have remarked on the lack of references to the work of others apart from the basic laws such as Kepler, Newton, Huyghens etc. Therefore when Einstein's only reference in the body of his General Theory text was to Leverrier one can guess that the Vulcan "problem" was of considerable importance to him. It confirmed his theory and at the same time removed a mystery of the missing planet both making an important contribution to astronomy and science. A.B.

### **THE DECEMBER NIGHT SKY**

by Rob Frith

The sun rides low on the horizon as we approach the winter solstice (9:06 a.m. EST December 21st). Although it's getting colder outside, you might want to put on your snowsuit and head outside. Around midnight the constellations Orion, Taurus and Gemini are high in the sky offering spectacular viewing.

As for planets December is a good month for the ringed planet. Saturn is high enough in the sky for good observing and cannot be missed shining brightly in the south at nightfall. The rings are tilted 3 degrees from edgewise.

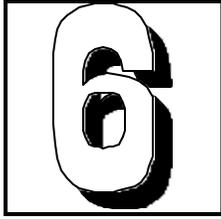
Mars rises after midnight, but one should wait till it's higher for useful observing as its angular size is only 8".

Venus is low in the southeast at the beginning of the month and at dawn, December 8th, is only 1 degree from a thin crescent moon.

Plan to be outside Dec. 13-14 for the Geminid meteor shower. The moon will be absent, perfect for meteor watching. You can start watching around 10 p.m. looking towards Castor, the radiant, in the constellation Gemini. Geminid meteors are known for their brightness.

On Christmas Eve there will be a full moon, don't be surprised if you see a UFO!!!

R.F.



## The Nite Sky Welcome Back Orion

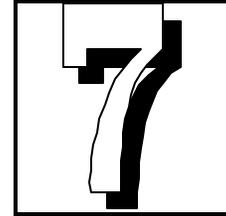
continued from issue #68  
by Gil Self

Last month we looked into some of the outstanding features in the constellation of Orion. This issue we will have a peek into the stellar nursery in the Orion nebula.

I have seen very few areas in the night sky that reveal themselves to visual astronomy as well as the Trapezium. The Orion nebula is a perfect example of the star forming molecular clouds where we see stars and protostars emerging from the cosmic mists.

Protostars are the early stage in a stars evolution, but I am ahead of myself we should travel back a few short years. Maybe a million years will do. With the right instruments we could "see" a vast cloud of interstellar material. The particle density of this cloud is many thousand times higher than intergalactic space but it is still approximately a millionth of a billionth of the density of air at sea level. The most abundant atoms are hydrogen and helium but also present are atoms of oxygen, carbon and many others, up to and including iron. Radio astronomers have detected over 60 different molecules formed in the cold dark heart of these clouds. Complex molecules like ammonia, formaldehyde and ethyl alcohol are known to exist in these giant areas. The Orion nebula is about 5 parsecs across (a parsec is 3.26 lightyears or 30 trillion kilometers) and is approximately 460 parsecs distant. They are not homogeneous areas, but rather some areas are much denser than others, in these areas small clumps of matter form through random collisions and slowly build into larger and larger pockets of material. These small accumulations attract more and more matter, as the size increases so does the temperature, until a hot dense core forms. There is still a lot of gas surrounding this core, but there is a temporary balance struck, the pressure from the heat in the core becomes high enough to hold back the in-falling gas, this is called a protostar.

A protostar would be called cool compared to our sun , as yet there is no nuclear furnace at the core , the protostar will maintain a balance between heat pressure of the core and weight of in-falling gas for a while but as more gas falls into this cosmic sinkhole,



this balance can not be maintained for long . This protostar passes through several stages of giving into the weight of the gas and collapsing and once again finding a balance.

Eventually the temperature of the core is very hot , it reaches tens of millions of degrees Kelvin and thermonuclear reactions take place , hydrogen is fused into helium, a new dynamic equilibrium is struck ,a balance between the tremendous mass of material pressing in on the core and the awesome energies created in this nuclear furnace ,a star is born .

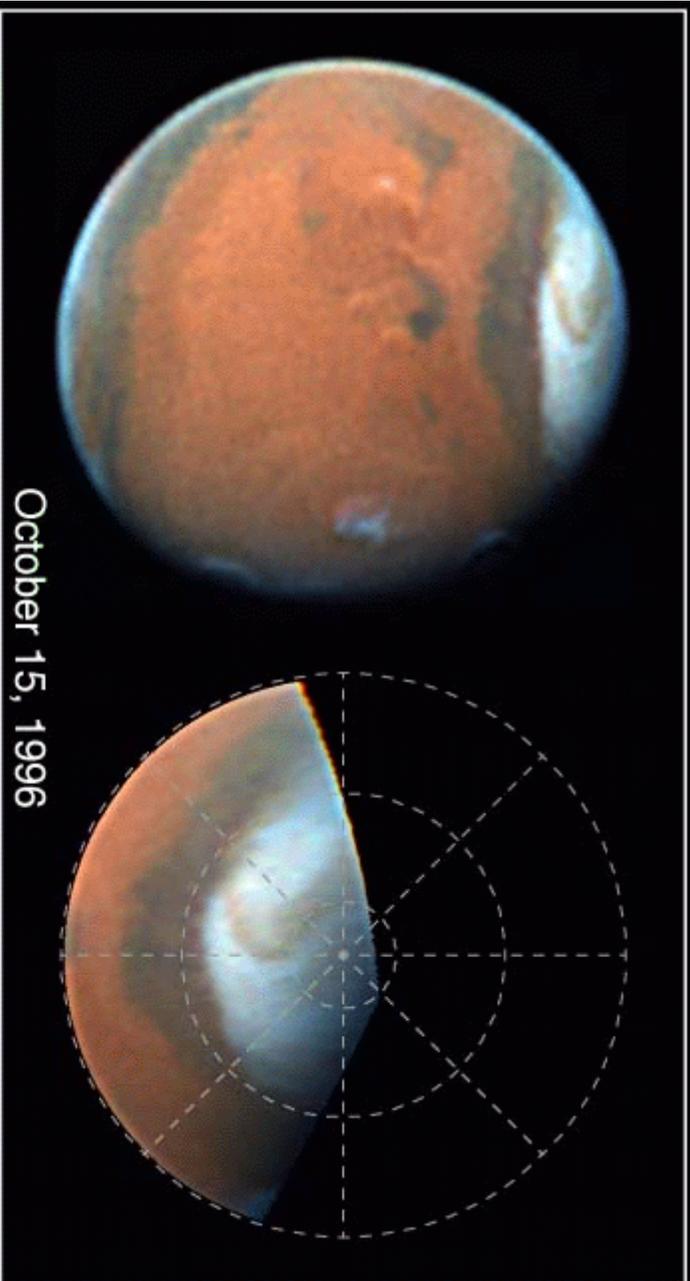
This young star now has an engine to maintain its size and temperature and to blow off this cloud of gas that has kept it hidden for so long . This is exactly what we see in the Trapezium at the center of the Orion nebula , four young stars just emerging from the great cloud of gas . There are several hundred young stars in this area but they are not at all crowded , remember this is a vast area in the sky and there is plenty of room for these many new stars to form systems of planets from the leftovers after the stars formation .

There are many examples in the night sky of areas of star formation .The process is far to lengthy to ever be able to watch it from beginning to end . Astronomers have found many examples of star formation at different stages . A fine illustration of early star formation is seen in the Eagle nebula ( M-16 ) . The now famous columns shown in the close-up pictures from the Hubble space telescope show protostars in relative early stages having their gas envelopes blown off by nearby hot active stars.

On December 14th , our observatory will be open to the public . We hope to see some of these star forming regions and since this is the night of the peak of the second best meteor shower of the year --the Geminids ,there should be lots of great meteors.

CLEAR SKIES

G.S.

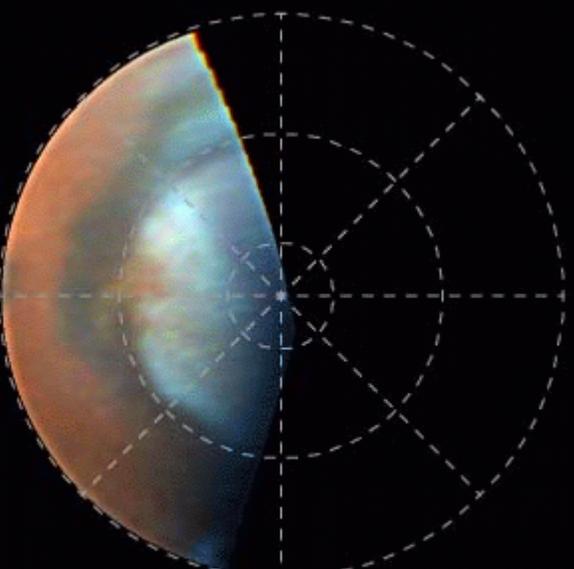


October 15, 1996

# Dust Storms on Mars

PRC96-34 · ST ScI OPO · November 4, 1996  
P. James (University of Toledo), S. Lee (University of Colorado) and NASA

HST · WFPCC2



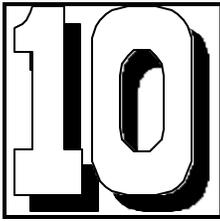
September 18, 1996

## Dust Storms on Mars

PRC96-34 · ST ScI OPO · November 4, 1996

P. James (University of Toledo), S. Lee (University of Colorado) and NASA

HST · WFPC2



## FROM MARS ...WITH LOVE

by STEVEN SENGER af115@freenet.unbc.edu

MARS.....WHEN I HEAR THIS WORD I THINK BACK TO MOVIES I HAD SEEN AS A CHILD. " WAR OF THE WORLDS , INVASION FROM MARS ".HEARING ABOUT MARTIAN CANALS, AND THAT IT WAS AN ANGRY RED

PLANET. I WONDERED WHY IT WAS SO ANGRY? I CERTAINLY HADNT DONE ANYTHING TO PROVOKE IT, EXCEPT PERHAPS EATEN THE ODD MARS CHOCOLATE BAR. NEVERTHELESS, IT HAD MY RESPECT. LATER, TO MY RELIEF, I HEARD IT WAS A COLD AND DEAD PLANET. I WAS SOMEWHAT DISAPPOINTED, MY INNOCENT PERCEPTIONS WERE GONE ( I've heard rumors about " THE GREAT PUMPKIN " I choose to ignore them).

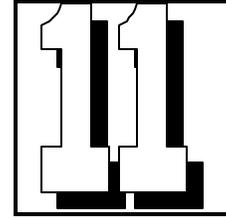
" LIFE ON MARS ". I HEARD IT IN THE MEDIA FIRST. EAGERLY I WAITED FOR ANY ARTICLES . " SKY & TELESCOPE " CAME OUT WITH THE FIRST ARTICLE WAS VERY IMPRESSED WITH THE THOROUGHNESS THIS TEAM OF SCIENTISTS DISPLAYED IN CONDUCTING THEIR STUDY OF THE MARTIAN METEORITE. IN FACT THE RESEARCHERS (there were 9) SPENT 2 YEARS ANALYZING THIS MARTIAN ROCK BEFORE RELEASING THERE FINDINGS TO THE SCIENTIFIC COMMUNITY. ( one doesn't casually announces " LIFE ON MARS " without hard scientific data ). THIS COULD BE THE DISCOVERY OF THE CENTURY. THINK ABOUT IT -- A FEW 100 YEARS FROM NOW, THEY'LL LOOK BACK AND SAY...OKAY CLASS, WHAT CENTURY WAS THE BIGGEST DISCOVERY MADE? THAT'S RIGHT JANE, THE 20th CENTURY. THEY FOUND THE "ROCK." BUT DONT FORGET ABOUT EINSTEIN AND THE MOON LANDINGS.

IM SURPRISED THAT THE TABLOID MAGAZINES HAVE NOT TOUCHED MORE ON THIS ANNOUNCEMENT. AFTER ALL THE HOOPLA THEY CREATED ABOUT NASA SECRETLY PHOTOGRAPHING GIANT MARTIAN SCULPTURES ON THE SURFACE OF MARS, DEPICTING A MAN.. OR WAS IT A MONKEY'S FACE?

THE POINT I WAS MOST SKEPTICAL ABOUT WAS -- HOW DID THEY KNOW THE ROCK CAME FROM MARS? UNFORTUNATELY S&T REFERRED TO A PREVIOUS ARTICLE DATED JUNE 1994, WHICH I HAVE NOT HAD ACCESS TO. ONE OF MY CONCERNS WAS IF THIS ROCK WAS 4.5 BILLION YEARS OLD, THE GAS TRAPPED IN BUBBLES OF THE ROCK WOULD NOT REFLECT THE CURRENT MARTIAN ATMOSPHERE THE VIKING LANDERS SAMPLED IN THE 70'S.

ASTRONOMY NOV 1996 EXPLAIN THE ORIGINS OF THE METEORITE. FIRSTLY, THE METEORITE WAS DISCOVERED IN 1984 IN THE ALLAN HILLS ICE FIELDS IN THE ANTARCTIC, THUS IT IS CODED AS SAMPLE ALH84001. IT WEIGHS 1.9 KG (4.2LBS) AND IS THE SIZE OF A LARGE POTATO. THE THEORY GOES THAT THE ROCK WAS FORMED 4.5 BILLION YEARS AGO AND SAT DEEP IN THE MARTIAN CRUST. 15 MILLION YEARS AGO IT WAS LITERALLY BLASTED OFF MARS BY A GLANCING BLOW FROM A COMET, OR ASTEROID THAT HAD IMPACTED WITH MARS. (they can calculate its time in space by measuring the different radioisotopes created by cosmic radiation in space.).AFTER 15 MILLION YEARS OF TUMBLING IN SPACE, ROCK MEETS EARTH. AT THAT POINT THEY SUSPECT THE METEORITE SANK BELOW THE ANTARCTIC AND WAS BROUGHT BACK UP TO THE SURFACE 13,000 YEARS LATER, VIA SUBSURFACE ICE FLOWS. THIS TAKES US UP TO DEC 27 1984, WHEN A FORTUNATE ROBERTA SCORE, A MEMBER OF THE NATIONAL SCIENCE FOUNDATION, HIT " PAY DIRT "

WELL, THAT FINALLY ANSWERED MY QUESTION ABOUT THE VIKING LANDERS SAMPLE AND ALH84001. THE MARTIAN ROCK OBTAINING ESCAPE VELOCITY WOULD TRAP THE MARTIAN ATMOSPHERE IN THE FORM OF BUBBLES. THE ROCK SAMPLED MARS ATMOSPHERE ONLY 15 MILLION YEARS AGO, IT SHOULD THEREFORE REFLECT CURRENT SAMPLES TAKEN OF MARS. AFTER ALL, DINOSAURS WALKED THE EARTH 60 MILLION YEARS AGO. IT WOULD HAVE BEEN PRETTY HARD FOR THEM TO DO THIS WITHOUT AIR. EVEN THE STRONGEST CRITICS ABOUT LIFE ON MARS DID ACCEPT THAT THE ROCKS ORIGIN WAS PROBABLY MARS! IN FACT THERE HAS BEEN 12 OTHER MARTIAN ROCKS CATALOGUED THAT CONTAIN THE SAME RARE GASES IN THE EXACT PROPORTIONS MEASURED BY BOTH VIKING LANDERS. ( other rocks are much younger - about 1.5 billion years). ALSO, CORNEAL UNIVERSITY USING COMPUTER SIMULATIONS PROJECTED ABOUT 4% OF EJECTED MATTER FROM MARS COULD EVENTUALLY REACH EARTH.



THE CRITICS MAJOR BEEF IS THAT ALL THE DIFFERENT CHEMICAL DEPOSIT FOUND INSIDE THE MARTIAN ROCK CAN ALSO BE FOUND FROM NATURAL CHEMICAL REACTIONS. ALTHOUGH THIS IS TRUE, THE FACT THAT ALL OF THESE CHEMICALS TOGETHER WERE FOUND IN CLOSE PROXIMITY, PLUS THE QUANTITY AND QUALITY OF SOME OF THESE CHEMICALS MAKES A VERY GOOD ARGUMENT FOR ORGANIC LIFE.

#### A QUICK VIEW OF THE 4 ITEMS DISCOVERED :

#1 THEY FOUND TINY GLOBULES OF CARBONATE WHICH IS A MINERAL THAT CRYSTALLIZES IN THE PRESENCE OF WATER SATURATED WITH CARBON DIOXIDE THREE METHODS OF DATING THIS REVEALED THAT IT COULD HAVE FORMED 3.5 BILLION YEARS AGO.

#2 ORGANIC COMPOUNDS WERE FOUND CALLED PAH POLYCYCLIC AROMATIC HYDROCARBONS

(as Astronomy put it - "the stuff of LIFE" ) ON EARTH SOME OF THESE HYDROCARBONS BECOME THE FOSSIL FUELS WE BURN.

#3 INSIDE THE CARBONATE GLOBULES THEY FOUND MAGNETITE (iron and oxygen  $Fe_3O_4$ ), IRON SULPHIDE, GREGITE, & PYRRHOTILE. THESE ARE ALL COMMON BY-PRODUCTS OF ARTICLE STATES THIS COMBINATION IS ALMOST NEVER SEEN IN TERRESTRIAL ROCKS.

#4 FINALLY THE ELECTRON MICROSCOPE REVEALED TINY TUBE AND EGG SHAPED STRUCTURES WHICH COULD BE THE MICROFOSSIL REMAINS OF MARTIAN MICROBES. I WAS MOST IMPRESSED WITH THE IMAGES OF THESE FOSSILS. THEY REMIND ME OF SINGLE CELL BACTERIA ON EARTH (although these ones are about 100 times smaller..).

DESPITE THE DRAMATIC EFFECT THESE FOSSIL IMAGES CAN HAVE ON US (emotional) HUMANS, IT IS THE MOST CONTROVERSIAL PART OF THE EVIDENCE.

ANOTHER ARGUMENT STATES POSSIBLE CONTAMINATION OF THE ROCK OCCURRED WHILE ON EARTH. THIS IS UNLIKELY BECAUSE CONCENTRATIONS OF PAHs INCREASED AS THEY PROBED DEEPER IN THE ROCK. AT CALTECH: THE BIOGENIC MINERALS HAVE THE EXACT SAME SIZE, SHAPE AND COMPOSITION AS THOSE PRODUCED BY TERRESTRIAL BACTERIA. MAGNETITE CRYSTALS SIMPLY

CONTINUED ON PAGE 14



## **NEW HUBBLE IMAGES SHOW DUST STORMS AT MARS** **NORTH POLE**

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Two Hubble Space Telescope images of Mars, taken about a month apart on September 18 and October 15, 1996, reveal a Texas-sized dust storm churning near the edge of the Martian north polar cap. The polar storm is probably a consequence of large temperature differences between the polar ice and the dark regions to the south, which are heated by the springtime Sun.

Mars is famous for large, planet-wide dust storms. Smaller storms resembling the one seen here were observed in other regions by Viking orbiters in the late 1970s.

However, this is the first time that such an event has been caught near the receding north polar cap. This kind of advanced planetary "weather report" will be invaluable for aiding preparation for the landing of NASA's Pathfinder spacecraft in July 1997 and the arrival of Mars Global Surveyor (MGS) orbiter in September 1997. The MGS mission is scheduled for launch on November 6, and the Mars Pathfinder is scheduled for launch December 2.

see page 8/9 for photos

## **HUBBLE FOLLOWS RAPID CHANGES IN JUPITER'S AURORA**

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Hubble Space Telescope's sharp view of the rapid, spectacular dance of luminescent gasses high in Jupiter's atmosphere -- better known as aurora -- is allowing astronomers to map Jupiter's immense magnetic field and better understand how it generates such phenomena. "Now that we have pinpointed the general location of the auroral curtains and have mapped their daily changes, eventually we should be able to find out what causes the aurora on Jupiter," said John T. Clarke, an astronomer at the University of Michigan's College of Engineering. The new Hubble observations simultaneously show warped oval rings at the north and south poles (offset from Jupiter's spin axis by 10-15 degrees), as well as an auroral "footprint" created by a river of electrical current of about one million amperes flowing between Jupiter and the volcanic moon Io.

The Hubble images provide enough detail to allow Clarke and his colleagues to record daily changes in the auroras' intensity and motion. They find that changes in brightness occur over the course of a Jovian day, perhaps due to compression of Jupiter's magnetic field on the sun-facing side of the planet. They also find emission features that are fixed on the planet, co-rotating with it. This global view is complemented by in situ measurements of the magnetic field and charged particles by the Galileo spacecraft, now orbiting

Jupiter. By comparing close-up and global views scientists expect to refine theories about how Jupiter creates and maintains its electrical, incandescent light shows.



By studying images of Jupiter's entire disk, the investigators found, surprisingly, the auroras mirror each other at the north and south poles. Though Earth's auroras at each pole also are carbon copies of each other, previous spatially-unresolved observations and theories for Jupiter suggested that some locations on the auroral ovals should be brighter. That's because, in Jupiter's case, the magnetic field has large asymmetries and more charged particles trapped in the field could, under specific mechanisms, eventually fall into the atmosphere at the weaker locations, and would thus create a brighter light show.

A critical difference is that auroras on Earth are triggered by a barrage of charged particles from the Sun. This process is different on Jupiter, although not well understood. Fundamentally, the planet's immense magnetic field, coupled with its fast, 10-hour rotation, helps generate auroras that are 1,000 times more powerful than Earth's spectacular light shows.

The situation is complicated by material released by Jupiter's moon, Io. Scientists believe that volcanic eruptions on Io churn out particles that become ionized, expand radially, and are trapped by Jupiter's immense magnetic field. These charges are forced to co-rotate with the planet, creating an immense sheet of current that in turn modifies Jupiter's magnetic field. What has not been clear on Jupiter is the balance of the internal processes versus the Sun-driven processes, and how these processes produce the auroral light

Some of the material released by Io produces a fierce current of charged particles. The particles become ionized and are then drawn into Jupiter's intense magnetic field along an invisible "flux tube," which bridges both worlds. This creates small auroral spots just outside the ovals around both magnetic poles. By studying changes in the intensity of these spots, Clarke and his colleagues were able to map Jupiter's magnetic field as Io orbits through it. The scientists linked the spots to Io's "flux tube" because the auroral emissions rotate with Jupiter while the spots remain in a fixed location underneath Io.

"The size of the aurora at the magnetic footprint of Io is 600 to 1,200 miles (1,000 to 2,000 kilometers) across," Clarke said. "If you were at Jupiter's cloud tops, under Io's footprint, the aurora would fill the entire sky. You would see an explosion as the gasses 250 miles above you rapidly heated to more than 10,000 degrees Fahrenheit. The aurora would speed overhead from east to west at more than 10,000 miles per hour (5 kilometers per second) because Jupiter's fast rotation moves it rapidly underneath Io, which orbits more slowly."

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#### **MORE RESULTS FROM GALILEO**

So far Ganymede has been visited twice at close range, and the huge moon



now seems certain to have a dense, metal-rich core and magnetic field of its own. Instruments also detected a substantial ionosphere around Ganymede, which implies that it has a tenuous atmosphere of hydrogen and oxygen derived from the ice on its surface. And investigators using the Hubble Space Telescope believe they have detected a faint ultraviolet aurora near the satellite's polar regions. Galileo will pass the moon Callisto at close range on November 4th and enigmatic Europa on December 19th.

#### **PLANET IN A MULTIPLE STAR SYSTEM**

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Researchers at McDonald and Lick observatories have independently discovered a planet orbiting the star 16 Cygni B, which is part of a triple-star system about 100 light-years from Earth. The teams have not actually seen the planet itself, but rather the wobbling motion it induces in the star. The teams have been monitoring this star system since the late 1980s, and they combined their data for this joint announcement. No large planets have been detected yet around the other two stars. 16 Cygni B is considered a close match to our Sun in brightness and temperature.

The first-ever detection of a planet in a multiple-star system would be unusual enough, but this planet has some interesting quirks of its own. First, it is much less massive than most of the other extrasolar planets found to date, with a mass that could be as little as 1.6 times that of Jupiter. Thus it is probably a true planet rather than a brown dwarf. Also, it circles the star every 2.2 years in a highly eccentric orbit ( $e = 0.67$ ), which means its distance from the star ranges between 84 and 425 million km, averaging about 250. How a planet can be so big yet in such an eccentric orbit is a puzzling challenge to theorists.

DONT FORM TO THESE SHAPES FROM NON-BIOLOGICAL CONDITIONS.

ONCE AGAIN THE ARTICLE POINTS OUT NO SINGLE PIECE OF THE EVIDENCE IS VERY CONCLUSIVE, BUT.. THE COMBINATION ALL THESE ITEMS BEING FOUND EXTREMELY CLOSE TOGETHER MAKES A VERY GOOD CASE FOR EXTRATERRESTRIAL LIFE. THERE IS AN EQUATION THAT WAS CREATED BY FRANK DRAKE OF CORNWELL 1961. IT DEALT WITH THE PROBABILITY OF INTELLIGENT LIFE IN THE UNIVERSE. IT GOES LIKE THIS:  $N=R*Fp*Ne*Fi*Fc*L$

#### **FROM MARS WITH Love (CONTINUED FROM PAGE 11)**

---

N = # of civilizations in our galaxy that could Communicate with each other.

R = rate of star formation, FP=% THAT HAVE PLANETS ,

Ne = % of planets suitable for life per solar system

Fi = % of these planets where life actually arises \*\*\*

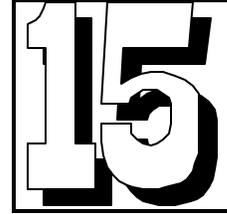
Fc = % of those who develop into intelligent life and choose to communicate with us

L = the life time of such civilizations

\*\*\* FI IS THE BIGGEST UNCERTAINTY. WILL LIFE ARISE IF A PLANET HAS THE RIGHT " PORRIDGE " (not too hot..not too cold)? THE VARIABLE COULD BE GIVEN ANYTHING FROM "1" DOWN TO ALMOST ZERO! THE MARTIAN ROCK COULD GIVE FI A LOVELY

## **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
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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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