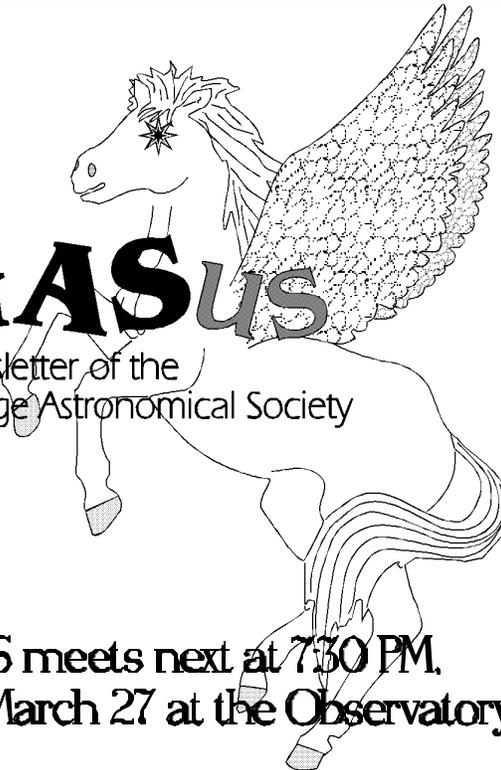


1996 MARCH Issue #64

the
PeGASus

Newsletter of the
The Prince George Astronomical Society



The PGAS meets next at 7:30 PM,
Wednesday, March 27 at the Observatory.

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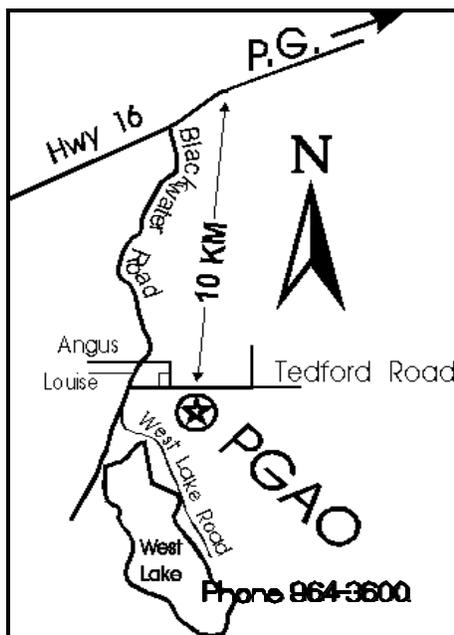


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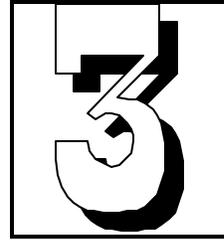
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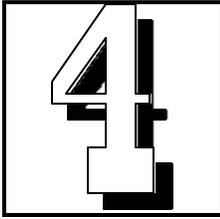
by Orla Aaquist



Get out and look for Comet Hyakutake! This is an opportunity you do not want to miss. Your membership in the PGAS depends on you making an effort to see this comet. There will be a skill testing question when you next see our president, Jon Bowen. He will casually ask you, "So, what did you think of Hyakutake"? If you answer, "What is a Hyakutake"? then Jon will immediately scratch your name from his list without checking it twice. Because of the appearance of this new comet, the next meeting of the PGAS (which was scheduled to be held at CNC) will be held at the observatory. This will give you a chance to get out of town to a relatively dark site and have a look at this very bright comet. Friday, March 22 is also a good evening to visit the observatory, and we will also be opening the door to members and the public on the 23rd and 24th.

Now for my second topic. Isn't it strange that the world seems so simple? We can go through a day and not worry about gravity, quantum mechanics, electromagnetism, chemistry, and all the other detailed descriptions on which the universe seems to operate. Look below the surface of any object, and you will be confronted by a chaotic jungle of molecules which make up the object. Below the level of the atom and molecules lies a complex world of elementary particles and forces. Does the complexity stop there? I doubt it. The complexity extends outwards too. The galaxy consists of billions of stars which revolve around the centre of the galaxy in complex ways, and the galaxies themselves are scattered chaotically throughout the universe as far as telescopes can see. Does the complexity extend beyond the reach of earth-bound telescopes? I will be surprised if it does not. I am not a great believer in a finite universe in either direction -- towards the very big or towards the very small.

If the universe is so complex, and for all practical purposes infinite in extent and complexity, why is the human mind able to muddle through its day-to-day tasks without being overcome by information overload? We seem to live in a calm sea within a chaotic ocean. How safe is this haven of ours? In order to find out, we have to look beyond it. This is what science does, and this is why science is absolutely necessary. It is not something to be sacrificed for the sake of industrial training and decreasing the deficit. Education is the future. Anyone who does not understand this should be sent back to school.



Coming Events

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

- March 20 -Spring Equinox at 12:03 AM
- March 22 -Friday night observing. Come to the observatory to see Comet Hyakutake, the very bright Venus, the always-spectacular Orion Nebula, and the quarter moon.
- March 27 -Monthly meeting at the Observatory. Bring your binoculars so you can hunt for Comet Hyakutake. John Bowen talks on astrophotography.
- March 29 -Friday night observing. Come to the observatory to see Comet Hyakutake, the very bright Venus and a nearly full moon.
- April 3 -Total Lunar eclipse NOT visible in Prince George.
- April 5 -Friday night observing. Come to the observatory to see Comet Hyakutake, the very bright Venus.
- April 7 -Daylight savings time begins (spring forward)**
- April 12 -Friday night observing. Come to the observatory to see the fading Comet Hyakutake.
- April 19 -Friday night observing.
- April 20 -Astronomy Day at the Observatory!**
- April 21 -Lyrid meteors peak
- April 24 -PGAS meeting at observatory.
- April 26 -Friday night observing.
- May 3 -Friday night observing.
- May 10 -Friday night observing.
- May 17 -Friday night observing.
- May 24 -Friday night observing.
- May 29 -PGAS meeting at observatory.
- May 31 -Friday night observing. This is the last observing session for the season. Observing starts up again on August 2.
- June 19 -Galilean satellites dance across Jupiter (watch upcoming newsletters for more information)
- June 22 -PGAS picnic at Observatory
- June 27 -RASC General Assembly in Edmonton
- June 29/30 -PGAS participation with Canada Day.

Announcements

Announcements have been moved to this page to make room for your new centerfold. Enjoy!



Monthly Meeting at Observatory.

Please note the change in meeting place from that announced in the last issue and at last month's meeting. We are meeting at the observatory on March 27 because of the appearance of the very bright comet Hyakutake.

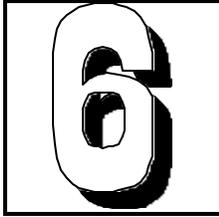
Friday Night Observing: The observatory is open to the public and PGAS members every Friday evening from 7:30 PM to midnight during the months of **March, April, May and August, September, October.** Let your friends and neighbours know about us. Spread the word. These evenings are a good opportunity for new members to visit our facility on Tedford Road near West Lake.

Hyakutake Observing on March 22, 23, 24. Make a point of coming out to the observatory. Bring a friend. Tell your neighbours.

Who Reads the PeGASus? Seven people, according to last month's survey. Make that eight. I forgot to count myself.

Hypering Film: Jon Bowen reports that it is now possible to hyper your film at the observatory. Come to the next meeting of the PGAS and hear Jon's talk on astrophotography where he will likely demonstrate the process.

Telescope Clutch: The clutch on the 24" telescope has been replaced. If you have any problems, please report them on the login sheet and call Jon Bowen.



The Night Sky

Taken in part from 'The Skywatcher's Diary' prepared by Robert C. Victor from Abrams Planetarium, and the 'RASC Observers' Calendar'.

Mars was in conjunction with the sun on March 4, and it will not be visible in the morning sky until late May.

During March and April, spectacular Venus is well up in WSW to W at dusk, and setting about four hours after sundown. The geometry of this month's appearance of Venus, placing the planet very high in the sky at sunset and making it visible for long afterward, is the best for observers at mid-northern latitudes since 1988, and won't be equalled again until the year 2004. Watch Venus approach the Pleiades star cluster during all of March. Planet and cluster will appear within a degree of each other on April 2 and 3. The greatest elongation (46 degrees) of Venus occurs on April 1st and its greatest brilliancy occurs one month later on May 4th. By early June, Venus disappears into the evening twilight. If you have a small telescope, keep an eye on Venus and note its growing, but waning crescent disk.

Jupiter rises at about 3AM. Dawn skywatchers can see bright Jupiter low in SE to SSE an hour before sunup. Your first view of an evening crescent Moon occurs low in the west in early dusk on March 20, with the Moon climbing just lower left of brilliant Venus on March 22. The moon can be found closely above Aldebaran on the evening of March 24.

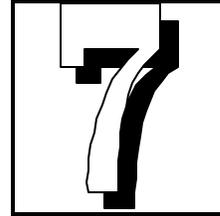
Around March 15, Sirius, the brightest nighttime star, passes due south about an hour after sunset.

On March 16, have an early look at Comet Hyakutake, which is brightening with its rapid approach to Earth. Face south about three hours before sunrise, and locate the two 3rd-magnitude stars Alpha and Beta in Libra. On Sunday morning, the comet is expected to glow between 3rd and 4th magnitude, within 7 degrees above Alpha and 6 degrees right of Beta. Use binoculars. See the map in the centre of this newsletter. See also the article by Alan Whitman on page 10.

Sunday, March 17, Saturn is in conjunction with the Sun, and is invisible on Sun's far side. By the end of April, Saturn will emerge into view in the eastern morning sky to join Jupiter. March 17, and not the equinox date of March 20, is when the duration of day and night come closest to exactly 12 hours each. One contributing factor is refraction by Earth's atmosphere, which lifts the Sun's image when it's near the horizon, hastening sunrise and delaying sunset. Another factor arises from the definition of sunrise and sunset. In particular, sunrise really happens when the top of the solar disk, rather than its centre, appears on an ideal, flat horizon. In total, these two factors lengthen the day at mid-latitudes by about 9 minutes.

By Thursday, March 21, Comet Hyakutake will now have brightened to 2nd magnitude, and is visible from late evening through rest of night. See the starchart on page 7. Using binoculars, look for a fuzzy ball of light 10 or 11 degrees below Arcturus.

The Lunar Eclipse of Wednesday, April 3 will not be visible in Prince George. If you are planning to be out of town, the farther east you are, the better. A total eclipse on September 26 will occur later in the evening and be more widely visible.



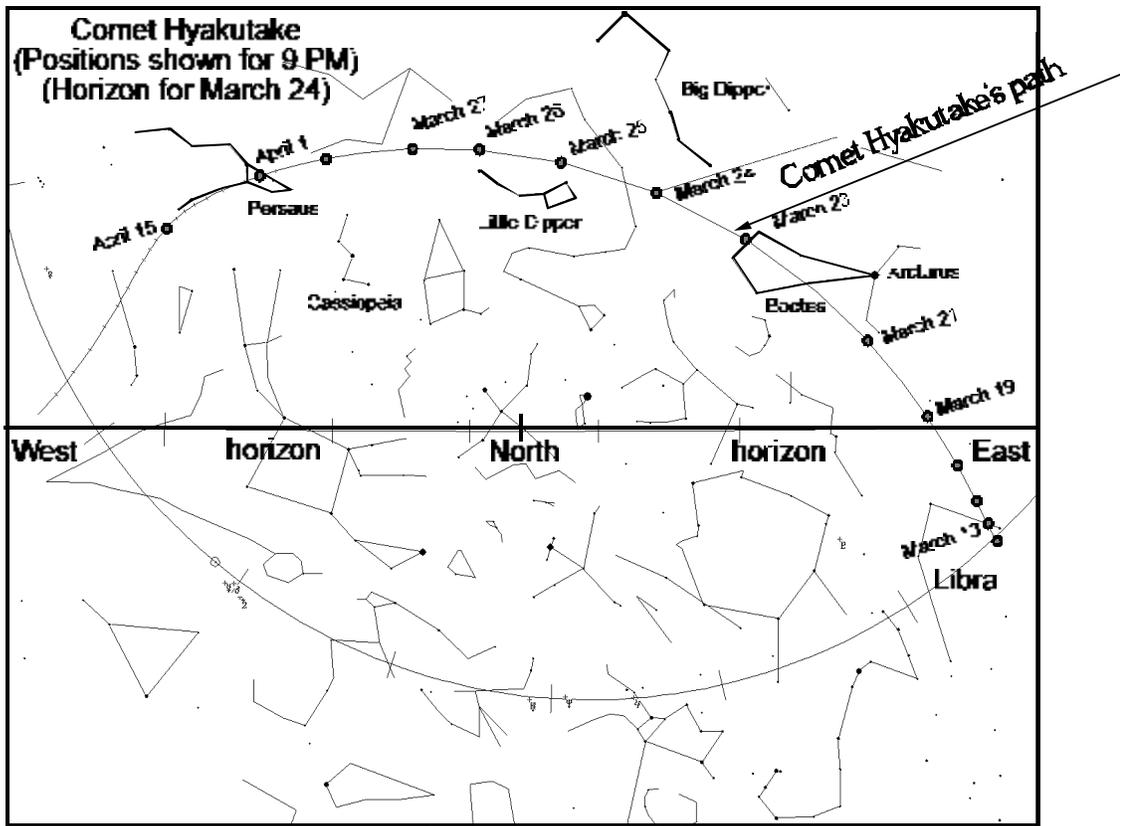
Venus passes within a degree of the Pleiades on April 2nd and 3rd. On Astronomy Day, Saturday April 20th, the beautiful three-day-old crescent moon is in the bright Hyades star cluster while the Pleiades, Venus, Mercury, and probably Comet Hyakutake all join the scene. The spring apparition of Mercury is always the best evening one of the year because of the favourable celestial geometry.

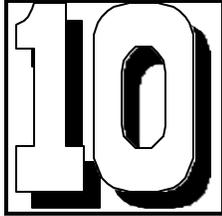
Seeing Sirius by Day

Around this time each year, Sirius, the brightest nighttime star. It passes due south about an hour after sunset. Have you ever seen a star (not the Sun, or the planet Venus) in the daytime? Here's how you can spot Sirius in the daytime in about a dozen days. On the next clear evening, watch Sirius pass due south. As it does so, pick a place to stand so that Sirius appears very narrowly above an object such as the tip of a treetop, a pole, or the corner of a building. Carefully mark the spot where you stood and return there at least 4 minutes earlier the next evening and watch a repeat performance of Sirius passing above the object. On each successive night, Sirius will reach the same spot 3 minutes 56 seconds (3.93 minutes) earlier. With Sirius passing over your marker nearly 4 minutes earlier each day and the Sun setting about a minute later, pretty soon Sirius will pass over your marker right around sunset. As that date approaches (about March 27), use binoculars if necessary to help you spot Sirius over your marker. (Be sure to prefocus your binoculars on a distant object, such as the Moon.) If the sky is very clear, you may be able to spot it with the unaided eye.

Finding Due West

Spring will begin on Wednesday, March 20 at 12:03 a.m. PST (that's Tuesday just past midnight), when the Sun crosses directly over Earth's equator. Hence on Tuesday night the Sun sets nearly due west and rises nearly due east on Wednesday morning. Pick a favourite spot for watching sunsets (or sunrise) and note where on the horizon the sun first dips below the horizon (or peaks above the horizon). When you look towards this point, you are looking due west (east). Return there on different evenings (or mornings), and see how soon you can notice any changes in the position of the setting (rising) Sun along your horizon. From day to day, you should notice that the setting point (or rising point) of the sun moves north. It continues to do so until the summer solstice, at which time the sun is directly over the Tropic of Cancer. ... I just checked my starchart.





A Comet This Way Cometh

Comet Hyakutake -- The Brightest Comet in 20 Years?

By Alan Whitman

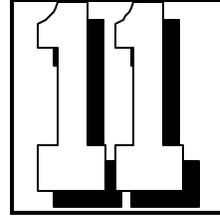
Comet Hyakutake will sweep past the earth on March 25th only about 40 times as far away as the moon. This is the fifth closest comet passage by the earth this century even though about ten comets pass through the inner solar system in most years. Comets usually have very elongated orbits so they spend tens to thousands of years in the frozen depths of the outer solar system between their brief rushes through the inner solar system as they round the sun at great speed.

A comet is much like an iceberg in orbit around the sun. As it approaches the sun, the solid comet nucleus becomes hidden in the cloud of gas and dust which the sun vaporizes from its surface. The comet's head and tail are formed by fluorescing gas and the dust which shines by reflected sunlight. Rare great comets are a memorable sight as they cross the night sky over a few weeks. The last great comet was Comet West in 1976 and the next was expected to be Comet Hale-Bopp in the spring of 1997. Then Yuji Hyakutake, a Japanese amateur, discovered his comet on January 30th and its potential to upstage Comet Hale-Bopp soon became apparent.

Predictions of how bright and prominent a comet will become are risky and since this article has to be written in advance, there is always a chance that the comet may disappoint (just as a sporting event sometimes does). But Comet Hyakutake's steady brightening (it's brightening faster than forecast) and the closeness of its approach to earth have resulted in increasingly more confident forecasts that it will be an impressive sight near March 25th. Its total brightness should equal the brighter stars between March 23rd and 27th but it may look fainter since starlight is concentrated into a point while the comet's fuzzy head will be about the size of the moon or larger. Telescopes may show gas jets in the head (coma).

The comet's tail will be foreshortened during approach but lengthen as it passes broadside on the 25th. In a very dark rural sky, binocular users with fully dark-adapted eyes may be able to trace the tail for as much as a sixth of the way across the sky although the narrow gas tail will probably be rather faint and low in contrast. (On the night of the 24th - 25th moonset isn't until 12:47 AM, unfortunately. Moonset on the 26th is 1:37 AM, on the 27th is 2:20 AM, and on the 28th is 2:56 AM).

An intrinsically brighter dust tail should form in mid-April as the comet nears the sun but by then it will be in the twilight sky and probably thus hard to see. No one really knows--if it's as bright as the most optimistic forecasts, the comet may dominate even the brighter skies of twilight. Follow the comet nightly and see!



The accompanying chart on page 7 and 8 of this newsletter shows where to find Hyakutake in late March and early April. Face north and hold the chart in front of you with the North towards the north horizon. First find The Big Dipper nearly overhead and then follow 'The Pointers' to Polaris. From the 24th to the 27th the comet will track between The Big Dipper and Polaris and be above the horizon all night. Earlier, from the 21st to 23rd, it will be near yellow-orange Arcturus, the brightest star in the east in late evening. The arc of the dipper's handle leads to Arcturus; remember, arc to Arcturus!

While the head may be visible from the city, this is no place to view this celestial visitor. Drive out into the country, preferably after moonset when the sky is darkest, bring binoculars if you have them, and bring your children. If you seek out dark skies and if this comet performs as well as expected, the night that you showed your children the comet should be a lifetime memory for them!

Our observatory is open every Friday evening from 7:30 PM until midnight. In addition to the regularly scheduled public observing on Friday the 22nd (when Venus and the crescent moon make a pretty pairing), someone will be at the observatory on Saturday the 23rd and Sunday the 24th after 9 PM for comet viewing, if the sky is clear. The observatory phone number is 964-3600; if in doubt, call before you come.

What If the Moon Didn't Exist?

(extracted in part from The Universe in the Classroom)

"What if the Moon didn't exist? What would the Earth be like?" This is a question asked by Neil F. Comins, professor of physics and astronomy at the University of Maine in Orono, in 1990. As a result, between 1991 and 1993, he wrote a series of articles for *Astronomy* magazine exploring a few different changes in Earth's astronomical environment and the likely results of those changes if Earth had never possessed a moon. These articles led to the publication of his book *What If the Moon Didn't Exist? Voyages to Earths That Might Have Been* (New York: HarperCollins, 1993).



The most obvious effect that the moon has on Earth is to produce tides. Tides occur because the gravitational force between two bodies decreases with distance. The oceans closest to the moon feel the greatest attraction to the moon and the oceans on the far side of the earth feel the least attraction. This causes high tides on the nearside and the farside. These tides have a major effect on the earth's rotation. In particular, they provide a source of friction which slows the earth down. This means that the earth used to spin much faster, consequently the day was much shorter. How much shorter? Presently, the day is getting longer by about 0.002 seconds per century. It doesn't sound like much, but over billions of years it adds up. From a combination of physics and geology, scientists have estimated that 3 billion years ago the earth was rotating on its axis four times faster than it is today. This makes for a 6 hour day! So, if the moon had never been, we may have maintained a 6 hour day. Ask a biologist how a 6 hour day would change the the biology of the world.

Early in the earth's history, the moon would also have been much closer to the earth by as much as 1/10th of its present distance. Hence, the tidal forces would have been much greater. Earth's tides would have been 1000 times higher than they are today. These humongous tides would plunge miles inland and withdraw every three hours. As the sea moved over the land, the awesome volumes of water would scrape and pound the land, pulverizing it and dragging the material back into the ocean. Without the moon, this rapid erosion would never have happened. There still would be some tides from the sun, of course, but only about 1/3rd of our present day tides are due to the sun's gravitational pull.

The faster a planet rotates, the faster its winds blow. We see the effects of extreme rotation by looking at Jupiter, which rotates every 10 hours. On an earth without a moon, we may expect winds of 150 km/hr on a daily basis, and hurricanes would have even higher wind speeds.

Assuming that humans evolved on an earth without a moon, these humans would have never experienced a solar eclipse. However, the skies would be much darker for the astronomers. We wouldn't have a lunar calendar. We wouldn't have a nearby place for astronauts to go to (no Apollo program). And what about those romantic nights you spend with your girlfriend under the light of the moon? How many times does the moon appear in love songs?

If you are a teacher, challenge your students by asking them what the earth would be like if it never had a moon. See what ideas they generate.

AstroSurfing

*Details of the Science News posted here are available
on the astronomy forum on the Prince George Free-
Net.*



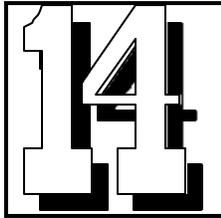
Next March 14th, students all across America will watch and participate as the Hubble Space Telescope performs astronomical observations which they themselves have helped design. To find out more and to receive the latest information about the project, from now through April 1996, send e-mail to: listmanager@quest.arc.nasa.gov. In the message body write these words: subscribe updates-hst. Also, check out the Web site at "<http://quest.arc.nasa.gov/livefrom/hst.html>". There you'll find additional background on the project, and pointers to further print and on-line resources to help students research the choices that face them.

Using data from the Japanese/U.S. X-ray satellite ASCA, physicists have found what they term "the first strong observational evidence" for the production of high energy cosmic rays in the shock wave of a supernova remnant, the expanding fireball produced by the explosion of a star. Approximately 25 cosmic rays bombard one square inch every second in space just outside the Earth's atmosphere. The atmosphere shields the surface of the Earth from these "primary" cosmic rays. However, collisions of the primary cosmic rays with atoms in the upper atmosphere produce slower moving "secondary" cosmic rays, some of which reach ground level and even may penetrate to depths of many feet below the ground.

Astronomers have made the first unambiguous detection and image of Gliese 229B (GL229B), an elusive type of object known as a brown dwarf. The evidence consists of an image from the 60-inch observatory on Mt. Palomar, a spectrum from the 200-inch Hale telescope on Mt. Palomar and a confirmatory image from NASA's Hubble Space Telescope. Astronomers have been trying to detect brown dwarfs for three decades. Their lack of success is partly due to the fact that as brown dwarfs age they become cooler, fainter, and more difficult to see. Another reason brown dwarfs were not detected years ago is that imaging technology really wasn't up to the task.

Two Internet home pages exist to provide information on the atmospheric probe, Galileo orbiter spacecraft, mission operations and science returns. The Galileo Project home page may be accessed at <http://www.jpl.nasa.gov/galileo>. A home page sponsored by the atmospheric probe team at NASA Ames Research Center, Mountain View, CA, may be accessed at http://ccf.arc.nasa.gov/galileo_probe/.

Another spacecraft in the news is the international Solar Heliospheric Observatory, or SOHO. The European-built satellite was launched by NASA on December 2nd. In another four months, the spacecraft will reach a position 1.5 million kilometers from the Earth, where the gravitational attraction of the Earth and Sun balance -- a so-called Lagrangian point. From this vantage the spacecraft will make continuous observations of the Sun with a suite of a



dozen instruments.

Evidence is mounting that the nucleus of Comet Schwassmann-Wachmann 3 has split into as many as four parts. Observations by German astronomers on December 12th and 13th show at least four bright points in the nuclear region, and they suggest that the comet's big outburst in September may have signalled the breakup.

A trio of astronomers led by Maria Womack of Penn State observed Comet Hale-Bopp on December 8, 9, and 10th. They detected radio emissions due to carbon monoxide gas, though the spectral lines were no more than half the strength seen last fall. However, in the last few hours of their observing run the CO line abruptly grew four times brighter. The comet is currently too near the Sun to be seen in visible telescopes, but who knows what observers will find once it emerges into the dawn sky next spring?

A surprising new theory has been offered to explain the Star of Bethlehem. After studying ancient writings, coins, and records, astronomer Michael Molnar has concluded that the three Magi followed two occultations of Jupiter by the Moon, spaced a month apart, in the spring of 6 B.C. Molnar's theory, published in the British journal *NEW SCIENTIST*, points out that skywatchers of that era placed great emphasis on occultations as astrological events.

It's true that 1996 will be a leap year, but did you know we just had a leap second? The timekeepers at the U.S. Naval Observatory in Washington rang in the new year by adding an extra second to its master clock at 0:00 Universal Time on January 1st.

Earth reached perihelion on January 4th, when it was 1.778 percent closer to the Sun than on average. That's slightly closer than at any time since 1972.

Antihydrogen atoms have been created at CERN. Although antimatter has been produced in the lab artificially for decades, this is the first time that the matter has formed atoms.

NASA has selected a plan to collect comet dust as its next Discovery mission. The spacecraft, called Stardust, will be launched in early 1999 on a heliocentric orbit, returning to Earth for a gravity-assist flyby 23 months later.

On January 3rd, a cluster of sunspots formed in the middle of the Sun's disk, the site of flare and prominence activity. This is a sign that the next solar cycle has started.

Is Mars undergoing a global dust storm? On January 5th astronomer Todd Clancy reported that his radio observations of carbon monoxide in the Martian atmosphere showed what he interpreted as a jump in temperature of 20 K (38 F). That kind of increase suggests that a major dust storm is in progress. Mars is currently very near the Sun in the evening sky -- too close to be seen easily.

The Sun crossed Saturn's ring plane in mid-November, leaving us with a narrow view of the rings' dark, shadowed night side. Can you detect any sign of light filtering through them? The rings are currently narrowing toward another edge-on presentation February 11th. See the August Sky & Telescope,

PGAS CONTRIBUTORS



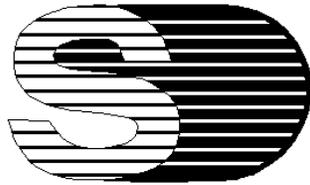
The PGAS would like to thank the following individuals, corporations and government agencies who, since 1991, have donated money, goods or services to the construction and operation of the Prince George Astronomical Observatory.

Ministry of Adv. Ed. Training and Tech.	\$25,000
BC Science Council	16,000
BC Lotteries	3,900
Helmar Kotsch (Acme Mas.)	1,932
Northwood Pulp and Timber	1,665
Electrical Services Ltd.	1,583
Royal Bank of Canada	1,500
Regional District of Fraser-Fort George	1,000
Prince George Rotary Club	1,000
The Pas Lumber Co	750
Canfor Polar Division	744
A.V. Jay Roofing	600
Xerox Canada	500
Russelsteel	465
Lakeland Mills Ltd.	460
Canfor Clear Lake Division	270
Lutz Klaar	200
Canfor Netherlands Division	200
Carrier Lumber Ltd.	160
Tom Laing	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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