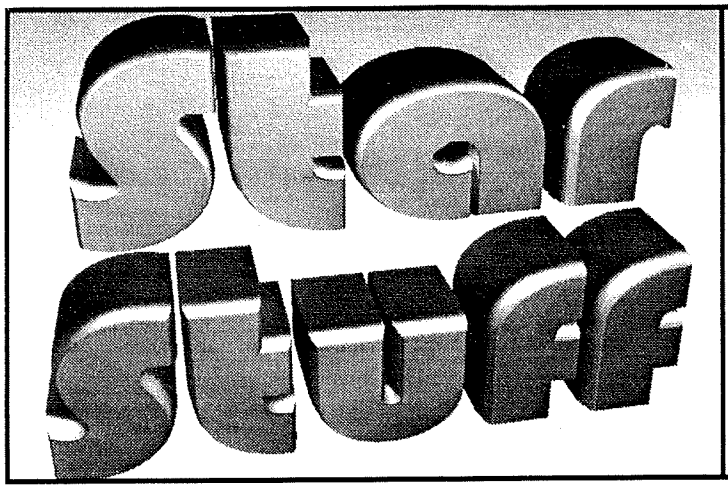

The Ford Amateur Astronomy Club Newsletter

Volume 5, Number 2 February 1996

HUBBLE'S VIEW OF UNIVERSE UNVEILS OVER 1,500 GALAXIES

One peek into a small part of the sky, one giant leap back in time...

Mankind's deepest, most detailed optical view of the universe — provided courtesy of NASA's Hubble Space Telescope — was unveiled January 15, 1996 to eager scientists at the 187th meeting of the American Astronomical Society in San Antonio, Texas. The image, called the Hubble Deep Field (HDF), was assembled from 342 separate exposures taken with the Wide Field and Planetary Camera 2 (WFPC2) for ten consecutive days between December 18 and 28, 1995.

Representing a narrow "keyhole" view stretching to the visible horizon of the universe, the HDF image covers a speck of the sky only about the width of a dime located 75 feet away. Though the field is a very small sample of the heavens, it is considered representative of the typical distribution of galaxies in space because the universe, statistically, looks largely the same in all directions. Gazing into this small field, Hubble uncovered a bewildering assortment of at least 1,500 galaxies at various stages of evolution.

Most of the galaxies are so faint (nearly 30th magnitude or about four-billion times fainter than can be seen by the human eye) they have never before been seen by even the largest telescopes. Some fraction of the galaxies in this menagerie probably date back to nearly the beginning of the universe.

"The variety of galaxies we see is amazing. In time these Hubble data could turn out to be the double helix of galaxy formation. We are clearly seeing some of the galaxies as they were more than ten billion years ago, in the process of formation," said Robert Williams, Director of the Space Telescope Science Institute Baltimore, Maryland. "As the images have come up on our screens, we have not been able to keep from wondering if we might somehow be seeing our own origins in all of this. The past ten days have been an unbelievable experience."

> *"In time this Hubble data could turn out to be the double helix of galaxy information"*

Harry Ferguson, one of the HDF team astronomers added: "One of the great legacies of the Hubble Telescope will be these deep images of the sky showing galaxies to the faintest possible limits with the greatest possible clarity from here out to the very horizon of the universe." The term "deep" in an astronomical sense means looking at the faintest objects in the universe. Because the most distant objects are also among the dimmest, the image is the equivalent of using a "time machine" to look into the past to witness the early formation of galaxies, perhaps less than one billion years after the universe's birth in the Big Bang.

The image data are so important (the astronomical equivalent of the Dead Sea Scrolls, one scientist quipped) they are being made available immediately to astronomers around the world to pursue research on the formation of galaxies and for probing basic questions about the structure and evolution of the universe. Though months of detailed research and analysis lie ahead, HDF team astronomers believe they see evidence for a significant population of galaxies that existed when the universe was less than a billion years old.

The landmark research was carried out under Williams' direction, and using a significant fraction of his own director's discretionary time on the Space Telescope. He decided to conduct the Hubble Deep Field program to use Space Telescope's exquisite resolution and high sensitivity to push back the very limits of time and space. Williams, and the ST ScI team he assembled to conduct the observations, hopes it will unlock clues to fundamental cosmological questions: Will the universe expand forever? How long ago did the first galaxies appear? How have galaxies evolved over the life history of the universe?

Essentially a narrow, deep "core sample" of sky, the HDF is analogous to a geologic core sample of the Earth's crust. Just as a terrestrial core sample is a history of events which took place as Earth's surface evolved, the HDF image contains information about the universe at many different stages in time. Unlike a geologic sample though, it is not clear what galaxies are nearby and therefore old, and what fraction are very distant and therefore existed when the universe was newborn. "It's like looking down a long tube and seeing all the galaxies along that line of sight. They're all stacked up against one another in this picture and the challenge now is to disentangle them," said Mark Dickinson of the HDF team.

PLANNING TO "DIP DEEP INTO THE DIPPER"

Nearly a year of preparation preceded the observation. The HDF team selected a piece of sky near the handle of the Big Dipper (part of the northern circumpolar constellation Ursa Major, the Great Bear). The field is far from the plane of our Galaxy and so is "uncluttered" of nearby objects, such as foreground stars. The field provides a "peephole" out of the galaxy that allows for a clear view all the way to the horizon of the universe.

Test exposures made in early 1995 with Hubble and the 4-meter telescope at Kitt Peak National Observatory also confirmed the field is devoid of large galaxy clusters, which would interfere with seeing farther and fainter objects. The target field is, by necessity, in the continuous viewing zone (CVZ) of Hubble's orbit, a special region where Hubble can view the sky without being blocked by Earth or interference from the Sun or Moon.

Staring at one spot in the sky for ten days, Hubble kept taking pictures one after another for the entire exposure time, accumulating data. Each exposure was typically 15 to 40 minutes long. Separate images were taken in ultraviolet, blue, red, and infrared light. By combining these separate images into a single color picture, astronomers will be able to infer — at least statistically — the distances, ages, and composition of the galaxies in the HDF image. Astronomers at ST ScI processed the frames, removing cosmic rays and other artifacts, and put them together into one final picture. Each time they add a picture, the view got deeper, revealing fainter objects. When they were done they had the deepest picture ever taken of the heavens.

Follow-up observations will be conducted by a variety of ground and space-base telescopes at other wavelengths of the electromagnetic spectrum, from X-ray through radio. An infrared camera scheduled to be installed in Hubble during the 1997 Servicing Mission will likely image the field to search for even farther primeval galaxies, whose light has been shifted to the infrared region of the spectrum by the expansion of the universe.

GALILEO PROBE SUGGESTS PLANETARY SCIENCE REAPPRAISAL

Preliminary analysis of early data returned by NASA's historic Galileo probe mission into Jupiter's atmosphere has provided a series of startling discoveries for project scientists. Information on the extent of water and clouds and on the chemical composition of the Jovian atmosphere is particularly revealing. Probe instruments found the entry region of Jupiter to be drier than anticipated, and they did not detect the three-tiered cloud structure that most researchers had postulated. The amount of helium measured was about one-half of what was expected. These initial findings are encouraging scientists to rethink their theories of Jupiter's formation and the nature of planetary evolution processes, according to probe project scientist Dr. Richard Young of NASA's Ames Research Center. "The quality of the Galileo probe data exceeds all of our most optimistic predictions," said Dr. Wesley Huntress, NASA Associate Administrator for Space Science. "It will allow the scientific community to develop valuable new insights into the formation and evolution of our solar system, and the origins of life within it."

"The probe detected extremely strong winds and very intense turbulence during its descent through Jupiter's thick atmosphere. This provides evidence that the energy source driving much of Jupiter's distinctive circulation phenomena is probably heat escaping from the deep interior of the planet," Young said. "The probe also discovered an intense new radiation belt approximately 31,000 miles above Jupiter's cloud tops, and a veritable absence of lightning," he noted. The composition of Jupiter's atmosphere offered some surprises, according to project scientists. It contains significantly lower than expected levels of helium, neon, and certain heavy elements, such as carbon, oxygen and sulfur. The issue of the colors of Jupiter's atmosphere has been much-debated, but no consensus has developed from probe data to date. The probe encountered no solid objects or surfaces during its entire 373-mile (600 km) journey. This was as expected for a gas-giant planet such as Jupiter.

What are the implications of these findings? Most scientists believe that Jupiter has a bulk composition similar to that of the gas and dust cloud of the primitive solar nebula from which the planets and our Sun were formed, with added heavy elements from comets and meteorites. The probe's measurements may necessitate a re-evaluation of existing views of how Jupiter evolved from the solar nebula. For example, the lower-than-expected helium and neon levels on Jupiter relative to the Sun influence scientific understanding of the process of fractionation, the "raining out" of helium and neon during planetary evolution. During the probe's high-speed, atmospheric-entry phase, deceleration measurements high in the atmosphere showed atmospheric density to be much greater than expected. Corresponding temperatures were also much higher than predicted. The high temperatures appear to require an unidentified heating mechanism for this region of the atmosphere.

Following probe parachute deployment, six science instruments on the probe collected data throughout 97 miles of the descent. During that time, the probe endured severe winds, periods of intense cold and heat and strong turbulence. The extreme temperatures and pressures of the Jovian environment eventually caused the probe communications subsystem to terminate data transmission operations. Earth-based telescopic observations suggest that the probe entry site may well have been one of the least cloudy areas on Jupiter. At this location, the probe did not detect the three distinct layers of clouds (a topmost layer of ammonia crystals, a middle layer of ammonium hydrosulfide, and a final, thick layer of water and ice crystals) that researchers had anticipated. Some indication of a high-level ammonia ice cloud was detected by the net flux radiometer. Evidence for a thin cloud which might be the postulated ammonium hydrosulfide cloud was provided by the nephelometer experiment. There was no data to suggest the presence of water clouds of any significance. The vertical temperature gradient obtained by the atmospheric structure instrument was characteristic of a dry atmosphere, free of condensation. Only the one, distinctive cloud structure was identified, and that was of modest proportion.

The latest analyses of data from the Voyager spacecraft that flew by Jupiter in 1979 have suggested a water abundance for the planet of twice the solar level (based on the Sun's oxygen content). Observations of the propagation of atmospheric waves across Jupiter's cloud tops from the Comet Shoemaker-Levy 9 impacts implied that Jupiter might have a water content of ten times the solar level. Actual probe measurements, while subject to scientific debate, suggest a level near that of the Sun. Scientists are left to wonder, "where is the oxygen?," "where is the water?," and to reconsider their interpretation of the S-L 9 impacts. Scientists had expected to find severe winds on Jupiter ranging up to 220 mph. However, the probe appears to have detected winds far greater, perhaps up to 330 mph. The winds remained fairly constant as the probe

(continued on page 4)

STAR STUFF
Monthly Publication of the Ford Amateur Astronomy Club

Star Stuff Newsletter
P.O. Box 7527
Dearborn, Michigan 48121-7527

1996 CLUB OFFICERS

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Vice President:	Patti Forton	84-51740
Secretary:	Harry Kindt	313-835-1831
Treasurer:	Kevan Granat	24-87628

GENERAL MEETINGS

The Ford Amateur Astronomy Club holds regular general meetings open to the public on the fourth Thursday of the month at 5:00 PM. Meetings are held at the Ford Motor Credit Company (FMCC) building, Northeast of the World Headquarters build in Dearborn, in conference room 1491, lower floor, East side of the building.

OBSERVING SITE

The Ford Amateur Astronomy Club has an established observing site, by permit, at the Spring Mill Pond area of the Island Lake Recreational Area in Brighton, Michigan located near the intersections of I-96 and US-23. Members are responsible for opening and closing the gate after the parks 10:00pm closing time. The combination for the lock should be available on our hotline number. Always close the gate behind you after 10:00pm whether entering or leaving the park.

OBSERVING HOTLINE NUMBER - (313) 39-05456

On Friday and Saturday nights, or nights before holidays, you can call the hotline number up to 2 hours before sunset to find out if we will be observing that night. Assume that any clear Friday or Saturday night is a candidate observing night unless something else is going on or none of the club officers are able to make it.

MEMBERSHIP AND DUES

Membership to the Ford Amateur Astronomy Club is open to both Ford and Non-Ford Motor Company employees. The general public is also welcome to join. The dues structure is as follows:

Annual Individual/Family	$20.00
Lifetime Membership	$100.00

Membership benefits include a subscription to the Star Stuff newsletter, discounts on subscriptions to Astronomy and/or Sky & Telescope magazine(s), after hour use of the observing site at Island Lake, and discounts at selected area astronomical equipment retailers.

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NEWSLETTER SUBSCRIPTION

A yearly subscription at a rate of $12.00 is available to those who are not members of the Ford Amateur Astronomy Club. Subscription are free to any other astronomy clubs wishing to participate in a newsletter exchange.

FEBRUARY 1996

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22 FAAC Meeting	23	24
25	26	27	28	29		

Feb 03 Comet Schwassmann-Wachmann 1, Closest Approach to Earth
Feb 04 Full Moon (10:31 am EST ± 2 mins)
Feb 06 Comet Honda-Mrkos-Pajdusakova Near-Earth Flyby (0.1702 AU)
Feb 11 Saturn, Rings Edge-On from Earth's Perspective
Feb 12 Last Quarter Moon (3:10 am EST ± 2 mins)
Feb 14 Chiron, Perihelion
Feb 18 New Moon (6:04 pm EST ± 2 mins)
Feb 26 First Quarter Moon (0:24 am EST ± 2 mins)

MEETING ANNOUNCEMENT

The Ford Amateur Astronomy Club (FAAC) holds regular general meetings on the fourth Thursday of each month, except November and December. Our next meeting will be **Thursday, February 22, at 5:00 pm.** The program for the meeting has not been determined at this time.

The FAAC meets in the Ford Motor Credit Company (FMCC) building, conference room 1491, located on the lower floor on the east side of the building. FMCC is the low building immediately northeast of (but not attached to) Ford World Headquarters in Dearborn. The FMCC building is secured with a card entry system. The easiest way to enter the building for meetings is to park in the northeast lot (Employee Lot 7) and enter through the lower northeast door or lower east door. At 5:00 pm no one seems to have much trouble getting in because many people are leaving around that time. At the east door you can dial 0911 on the security phone and say that you are here to attend a Ford club meeting, and security will admit you. You may, of course, find your way into the building any way you see fit, but direction signs will only be posted fromthe lower northeast and lower east doors. ☆

MEETING MINUTES 1/25/96

by Harry Kindt (Sec'y FAAC)

The meeting was called to order at 5:03pm by our president Chuck Boren. There were 34 members and guests present. The treasurers report was read and accepted. Chuck mentioned that we still have baseball caps available for sale which proudly display our club logo. The 1996 calendars are no longer available, however, we are now looking into the purchase of the 1996 Observers Handbook for sale to our membership. Bob MacFarland reported on our clubs participation in the Ice Days Carnival at the Lake Erie Huron-Metropolitan Park in Gibraltar MI. A head count indicated a total of some 65 people who sat in on our show. Thanks to Bob, Greg Burnett and Patti Forton for their presentations.

Chuck announced the first meeting, this year, of the telescope builders group. The meeting is to be held at the home of Pat and George Korody on February 3rd at 1:00pm. If you think you might be interested in building your own telescope, or are interested in the process, please contact Chuck Boren for more information. Patti Forton suggested that the members should utilize the clubs hot line more frequently. Patti is now the official "keeper of the hot-line" and she would like the members suggestions on improving the quality of the information on the hot-line. She suggested that if you plan on going out to Island Lake for a viewing session, that you leave a message on the hot-line indicating your plans so that she can up-date the hot-line to let others know that someone will be out viewing that evening. By the time you read this it will be old news, but Doug Bock announced he was heading to Skokie IL Saturday (1/27/96) taking with him, about eight mirrors to be re-coated. Barry Craig proposed that we look into the possibility of co-sponsoring a late Spring? early Summer? star party with the Detroit Astronomical Society. The tentative site is a KOA camp-ground near Bad Axe MI. in the thumb area, about a 2 hour drive from Detroit. The suggested dates for this event would be May 17, 18, 19, 1996. Plans are being formulated now and more information will be available as it is received. Barry also announced that the DAS will now be holding observing sessions immediately following their Friday night meetings. The DAS meets at the South-field Civic Center twice a month on Friday evenings (contact Barry for time and dates). The observing sessions will take place on the golf course just East of the Civic Center Building, weather permitting. Elections for club officers were held and the following candidates were elected by acclimation by those members present:

President:	**Bob MacFarland**
Vice President:	**Patti Forton**
Treasurer:	**Kevan Granat**
Secretary:	**Harry Kindt**

This concluded the business part of our meeting. Our speaker for the evening was Doug Bock who presented a slide show about the construction of his Northern Cross Observatory in Fenton MI. The meeting adjourned at 6:50pm. ☆

FEBRUARY SPACE HISTORY

by Harry A. Kindt (73521.1710@compuserve.com, or hakindt@aol.com)

Feb 01 1918 Gregorian calendar replaced the Julian calendar in Russia.
Feb 03 1966 Luna 9 (USSR) made first soft landing on the Moon.
Feb 05 1971 Apollo 14 (US) made third manned landing on the Moon.
1974 Mariner 10 (US) made a flyby of Venus.
Feb 06 1963 4th magnitude Nova in Hercules, discovered (Elis Dahlgren).
Feb 07 1889 Astronomical Society of the Pacific's first meeting.
1984 Two US astronauts performed first untethered space walk.
Feb 08 1974 Three Skylab astronauts returned to Earth after an 84 day orbit.
Feb 09 1489 Born, George Hartmann, designer of Astrolabes, timepieces ...
Feb 12 1947 Sikhote-Alin meteorite fell in Eastern Siberia.
Feb 13 1882 Born, Thaddeus Banachiewicz, Polish astronomer.
Feb 14 1963 Syncom 1 (US) (first geosynchronous satellite), launched.
Feb 15 1564 Born Galileo Galilei, Italian astronomer and physicist.
Feb 16 1678 Born, Pierre Bouguer, founder of photometry.
Feb 18 1930 Pluto discovered (Clyde Tombaugh)
Feb 19 1473 Born, Nicolaus Copernicus, Polish astronomer.
1986 MIR space station (USSR), launched (2/20?).
Feb 20 1962 Mercury Friendship 7 (US) (first American to orbit Earth-John Glenn), launched.
Feb 21 1744 Born, Eise Eisinga, Dutch amateur astronomer.
Feb 22 1838 Born, Pierre Janssen, discoverer of Hydrogen in the Sun.
1787 J.H. Schroeter, began surveying the lunar surface.
Feb 23 1901 Nova Persei attained maximum light (magnitude +0.2).
1956 Intense solar flare.
Feb 25 1723 Sir Christopher Wren, English architect and astronomer, died.
Feb 26 1979 Last total solar eclipse in continental US until 2017.
Feb 27 1897 Born, Bernard Lyot, French astronomer.
1826 Wilhelm von Biela discovered the comet which bears his name.
1906 Samuel P. Langley, American physicist and astronomer, died.
Feb 29 1968 Discovery of "pulsar" announced (Jocelyn Burnell).

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FEBRUARY 1996 SPACE EVENTS

The following February 1996 events come from the 12/28/95 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov). Note that launch dates are subject to change.

Feb ?? SAC-B Pegasus XL Launch
Feb ?? MSAT-1 Ariane 4 Launch
Feb ?? Intelsat 707 Ariane 4 Launch
Feb 01 N-Star B Ariane 4 Launch
Feb 09 Gonets Tsiklon-3 Launch (Russia)
Feb 09 Palapa Atlas IIA Launch
Feb 16 NEAR Delta 2 Launch (Asteroid Eros Orbiter)
Feb 20 Soyuz TM-23 Launch (Russia)
Feb 22 STS-75, Columbia, Tethered Satellite System (TSS-1R)
Feb 28 Raduga Proton Launch (Russia) ☆

ASTRONOMY BOOK REVIEW

by Sam Wormley (swormley@iastate.edu) via sci.astro.amateur newsgroup

THE OBSERVER'S GUIDE TO ASTRONOMY, Vol. I & Vol. II
Edited by Patrick Martinez, translator Storm Dunlop

Standard handbooks for amatuer astronomers include famous texts such as Amateur Astronomer's Handbook by J. B. Sidgwick, Observational Astronomy For Amateurs by J. B. Sidgwick, and Muirden's own The Amateur Astronomer's Handbook. Books like these have been the amateur's reference classics on all matters relating to astronomical instrumentation and practice. Sidgwick first published his handbook in 1955, knowing that a person would use a telescope more efficiently after understanding the fine points of its theory and operation.

As technology has advanced, so have the capability and knowledge of amateur astronomers. Vol. I topics range from spectroscopy of the Sun and photoelectric photometry of comets to tracking artificial satellites and predicting their reentry and break-up. For each topic, sound practical methods of observation and the scientific background are given to lead you to better observations. Guidelines also show you how to record and catalogue your observations using the recognized professional terminology and classification schemes. From the simplest pencil drawing of the Moon to CCD photometry of rotating minor planets, this guide is loaded with practical tips for all types of amateur observations. Vol. II includes spectroscopy of meteors, photographic observations of aurora, meteors, double stars and deep-sky objects.

These volumes examine all the different types of objects available to amateur astronomers, and for each one it describes the types of observations that are possible (paying particular attention to their scientific value), the equipment required, the methods to be employed, where appropriate information may be found, and the organizations to which the results should be reported. Each chapter has been written by a French or Belgian expert (or experts) in the subject concerned; the authors include both professional and amateur astronomers. The first fifteen chapters describe observational programs, divided into individual classes of astronomical object. The last five chapters discuss techniques that relate to several of the subject areas previously described. Observer's Guide To Astronomy should be regarded as a catalog of what types of observation are possible given the facilities that amateurs have available. The text describes all the steps and equipment necessary to take the first step.

COMPENDIUM OF PRACTICAL ASTRONOMY, Vol. I & Vol. II & Vol. III
Edited by Gunter D. Roth, translator Harry J. Augensen and Wulff D. Heintz

If you are interested in being an amateur scientist as opposed to being just a stargazer, these volumes are for you. The ability to employ objective techniques to appreciate the wide variety of cosmic phenomena quantitatively is not restricted to professional astronomers. It is the principal aim of the Compendium Of Practical Astronomy to provide the astronomically interested public—amateur observers as well as teachers—with instruction and guidance in practical astronomical activities. This goal has remained unchanged since the first edition in 1960. What has changed is the technical content and organizational structure in various areas. Larger and more effective telescopes are currently within the reach of non-professionals. The professional accessories used in photography, photometry, and spectroscopy are now being operated by amateurs. These changes are reflected in every chapter of the present work.

Vol. I covers: Introduction to Astronomical Literature and Nomenclature, Fundamentals of Spherical Astronomy, Applied Mathematics and Error Theory, Optical Telescopes and Instrumentation, Telescope Mountings, Drives, and Electrical Equipment, Astrophotography, Fundamentals of Spectral Analysis, Principals of Photometry, Fundamentals of Radio Astronomy, Modern Sundials, An Historical Exploration of Modern Astronomy, Astronomy Education and Instructional Aids, Appendix A: Educational and Instructional Aids, Supplemental Reading List for Vol. 1, Index.

Vol. II covers: The Sun, Observations of Total Solar Eclipses, The Moon, Lunar Eclipses, Occultations of Stars by the Moon, Artificial Earth Satellites, Observation of the Planets, Comets, Meteors and Bolides, Noctilucent Clouds, Polar Aurorae, and the Zodiacal Light, The Terrestrial Atmosphere and Its Effects on Astronomical Observations, Supplemental Reading List for Vol. 2, Index.

Vol. III covers: The Stars, Variable Stars, Binary Stars, The Milky Way Galaxy and the Objects Composing It, Extragalactic Objects, Appendix B: Astronomical Data, Supplemental Reading List for Vol. 3, Index. ☆

SPRING MILL POND IN HIBERNATION

by Greg Burnett

Saturday, January 6-th, one day after full moon. The weather forecast is unfavorable for observing; thin overcast. A peek out the window confirms the prediction. None-the-less, my son and daughter and I decide that a trip out to Island Lake would be an appropriate adventure for the evening. There is some snow on the ground, which might facilitate some moonlight sledding. We bundle up and load into the car. Nathan monitors our course with his new GPS receiver (courtesy of Santa Claus).

The road through the park is icy in places, necessitating some care in negotiating the 2-1/2 miles to Spring Mill Pond. Our observing site lies quiet under an inch of snow. Frosty moonlight illuminates the scene through a high, thin veil of cirrus. The bathhouse is dark, sulking. It seems small and out of place amidst the snow-scape, but provides a familiar landmark in an otherwise alien vista. The pond is an arctic-like expanse of foot-thick ice, disturbed in only a few spots by the augers of intrepid fishermen. We shine our flashlights down through the ice. It's clear enough in places that the bottom can be seen through ghostly translucence. What an odd perspective, standing in the middle of the pond, surveying a scene normally observed only from the parking lot. The hills south of the site are only partially snow-covered, but worthy of investigation. Sled in tow, we proceed.

The high gravel hill south-east of the site offers only a couple narrow strips of snow to its full height. That's too daunting for Nora anyway, and she makes a partial pass from mid-slope. Hmmm.... her velocity at the bottom was pretty high, and the run finishes with a sharp upturn onto bare gravel. Not the best sledding we've seen. Nathan attacks the hill sans sled, only quilted snow pants to cushion the ride. "Enough!" cries, Dad. Climbing the hill again would be too much work! Everyone's toes are beginning to betray the chill by this time anyway. We head back to the car. Though far from a wilderness, the park provides refreshing, quiet solitude. The peace is disturbed only by two snowmobilers; raucous bouncing lights that eventually fade back into the darkness.

Well... we came, we saw, we collected souvenirs: a piece of ice from the lake, a stick that took a particular liking to Nora ("We can't leave it here, Dad!"), and of course the usual complement of flotsam that somehow gets tracked in to the car without notice. The semi-shrouded moon provided just enough light to drive to the gate without headlights, a small tribute to observers unseen, and to many observations yet to come. ☆

PHYSICS NEWS UPDATE

from The American Institute of Physics (physnews@aip.org)

A GIGANTIC CELESTIAL MASER provides evidence for the presence of a supermassive black hole in an active galaxy. Theorists believe that in galactic masers coherent microwaves are produced and amplified within gas clouds; the energy supply would come from a nearby black hole. The new maser is ten times more powerful than any previous specimen. Furthermore, the astronomers at the Max Planck Institute (Germany) who discovered the new water-vapor giga-maser believe that it hints at the existence of yet more powerful masers at higher red shifts and that the study of such distant objects may facilitate an alternative measurement of the Hubble constant. ☆

(continued from page 2)
descended deep into the Jovian atmosphere. This suggests Jupiter's winds are not caused by differential sunlight at the equator versus the poles or by heat released by water condensation. "The origin of Jupiter's winds appears to be the internal heat source which radiates energy up into the atmosphere from the planet's interior," Young said. "This impacts Jupiter's climate and circulation patterns, and suggests a jet stream-like mechanism rather than swirling hurricane or tornado-like storms." The probe found lightning occurs on Jupiter only about one-tenth as often as on Earth. This is puzzling, but consistent with the absence of water clouds. A virtual absence of lightning reduces the probability of finding complex organic molecules in Jupiter's atmosphere, particularly given its hostile, predominantly hydrogen composition.

Scientists caution that results obtained to date are only preliminary and subject to much further analysis and refinement. Data transmission problems associated with solar conjunction between the Earth and Jupiter, the need to refine estimates based on probe and orbiter trajectories, the presence of higher than anticipated instrument temperatures, and the need for improved calibration all require a cautious approach to these early findings. ☆

ASTRONOMY AND MYTHOLOGY

by Steve Renshaw (stever@gol.com)

The following article was reprinted from ASTRONET, Issue 30, January 15, 1996. For more information, please contact resource@resource-intl.com.

Recent discussion of mythological events and celestial phenomena prompted Saori Ihara and me to write the following little piece on a respected Japanese scholar's inferences with regard to an incident which occurred here in Kochi (called Tosa in older times) in the late 17th century. This was based in part on an original article by amateur astronomer Keiichiro Okamura in his recently published book Tosa Astronomical Promenade. Hope you enjoy it...

In the early stages of the Edo era (1600-1867), Confucian pragmatism began to persuade Tokugawa Shogunates to value the mathematical aspects of astronomy more than celestial divination in the development of calendar systems. However, as in Europe, Japanese astronomy continued to be a rough mix of "scientific" standards and astrology for some time. A good example of this mix is found in the work of a respected calendar scholar who lived in Tosa (modern Kochi, Japan) in the late 17th century.

Similar to Kepler, his earlier counterpart in Europe, Jinzan Tani is now respected more for his knowledge in precise calculation of ephemerides than for his astrological thinking. However, in the 17th century, he advanced a "system" based on ancient suppositions of Chinese astrology. He termed this "astronomical system" the "Theory of Areas"... no, not a Keplerian concept, but a concept that areas on earth correspond to areas in the sky. As in most Asian antiquity, Japanese conceptions of separation between heaven and earth were quite nebulous. Somewhat similar to Western astrology, each domain on earth had a "sign" in the heavens. Events such as wars and territorial change that occurred in "earthly" domains were associated with complementary events in the sky, and vice versa. Sometimes these events were indeed "real" and seen at the same time; in others, imagination in one realm or the other often ruled.

Following the ancient line of reasoning formalized by Tani in the "Theory of Areas", the Edo era found most prefectures in Japan with "sister" constellations or asterisms in the sky. The stars sometimes called "Neko no Me" (cat's eyes) in Japan and called Castor and Pollux in the West were the celestial domain corresponding to the earthly domain of Tosa. Though it is difficult to discern exactly when and why Tosa adopted the two bright stars of Gemini, it is probable that these stars were chosen because of their celestial (declination) proximity to Tosa's corresponding geographic latitude as well as their position along the ecliptic (one of the 28 stations of the moon, such found in many cultures' ancient lore). Kochi (old Tosa) is located E 133:33 N 33:33. Allowing for precession, the stars of Castor and Pollux were located closer to the celestial "latitude" of 33:33 in ancient times than they are today. Obviously, under such circumstances, the "cat's eyes" would transit at the zenith. Anyway, the celestial latitude and placement along the ecliptic of Castor and Pollux together with Tosa's geographical latitude probably gave rise to the sibling relation.

Tani found what he considered "evidence" for his "Theory of Areas" in a tragedy that occurred in the year 1698 in Tosa. Here, there was an event on earth and a phenomenon in the sky that indeed appeared conjointly. While fires were all too common in the Edo era, a particularly bad conflagration took place in Tosa that year. At 12:30 P.M. on November 8, flames began to leap from a small home in a northern suburb. By evening, destruction had spread to the castle gate. City records indicate that over 2000 homes were destroyed "including 170 samurai houses". The fire left many dead and injured. Finally, at 10 P.M., the flames were extinguished. But as records of the time indicate, stars became more distinct, and citizens began to see "big" meteors fly. One resident recorded in his diary...

> Today, there was a fire in the town of Tosa. At night, meteors flew into Gemini. And several hours after that, stars just flew like crazy...

Other Tosa residents described many "large stars just streaming down". Some said meteors were flying as though "they were weaving a cloth". Most residents reported that meteors were "streaming" into the constellation of Gemini. To the residents of Tosa, these meteors were merely the heavenly manifestation of the conflagration they had experienced on earth. The meteors flew into Gemini as the fire had flown through Tosa. The meteor shower was, of course, associated with the Leonids which result from the periodic passage of comet Tempel-Tuttle. 1698 was a year quite close to the 33 year cycle of this often spectacular display, and reports of large "storms" on November 8 and 9 were reported not only in Japan, but in Europe as well. Whether or not meteors truly "streamed" into Gemini is doubtful. [Using both The Sky and SkyMap, and correcting for precession, we simulated the date, time (Japan is 9 hours ahead of UT) and coordinates for ancient Tosa.] At 10:00 P.M. local time, the bright stars of Gemini had just risen about an hour earlier; the showers radiant, Leo, was quite below the Eastern horizon. However, as the night progressed, and Gemini rose higher and higher, residents may have indeed seen meteors moving from the East toward the top of the sky (though this might contradict the idea of meteors "streaming down"). Regardless, the association of the fire, meteors, and Gemini was exactly the kind of "evidence" Tani sought.

It is often difficult to establish actual celestial events corresponding to "supposed" phenomena drawn by ancient Asian cartographers of the sky. As seen in so much world history, "belief" can often determine what is "observed". However, the ironic relation of real events in the earthly and "heavenly" domains of Tosa in 1698 doubtlessly reinforced belief in such earth/sky associations. Earlier history of science seems to be full of such combinations of observation and faulty logic, worthwhile contributions and mystical lore. In comparison, we can no more fault Tani for his inferences than we can fault Kepler for his. Both were a part of their historical circumstances. Unfortunately, edicts of Edo Shogunates precluding Western exchange probably deprived Tani of both the instruments and rapidly advancing methods of Western science that might have been the basis for more substantial contributions.

These nights, the "cat's eyes" still peak at us through the winter months, though they transit a bit further south of zenith here in Kochi than they use to. As the century closes, we look forward to spectacular displays of the Leonids. Predictions are for increased activity through the late 90's. Hopefully, no great conflagration will occur conjointly. However light pollution here in Japan may be quite a nemesis at that time. Anyway, these days I hope your fires are only in appropriate places, and that you have clear nights with the twins. ☆

OBSERVING CARBON STARS

by Craig Nance, Northeast Florida Astronomical Society

The following article was reprinted from ASTRONET, Issue 30, January 15, 1996. For more information, please contact resource@resource-intl.com.

An interesting and often overlooked target for observing is the carbon star. Here is a list of carbon stars.These stars are visually stunning deep reds. Some call them blood red or crimson red. Others say they look like a glowing coal or a celestial ruby.These stars lay within the red end of the spectral class; most are N stars. An N9 star is redder and cooler than a N1 star.

Since all of these stars are variable, they are named according to variable star nomenclature. The first variable to be discovered in a constellation is named R, followed by the name of the constellation in genitive form. For example, R Leporis. However the list below uses the more "common" form of the name, such as R Lepus. The second variable is named S, then T,U,...Z. Then the naming continues with RR, RS,...,RZ.It continues with SS (not SR) through SZ, TT through TZ, and continuing in this fashion through ZZ. This methodology covers the first 334 variables. Any more variables are named V335, then V336,... Some variables are also known by a common name, such as Polaris.

The coordinates below are given for Epoch 2000.0. Most good star charts will have the brighter members of the list plotted. Even if not plotted, these stars are so visually striking that you will find them almost instantly. The magnitude range of the stars is also given. Although the stars are easier to see when brighter, they have a deeper shade of red when they are in the minimum range of the cycle. Try to catch these stars when they are dimmest for greatest effect. The average period of the variation, in days, is given in the fourth column. Some stars have no regular period and are indicated by "Irr" for irregular.

Since the Uranometria 2000.0 star chart is becoming so widely used, the fifth column indicates the volume and chart on which the particular variable is located. Start out by observing those stars listed in the table below. They are the best of the best. Five objects on this short list can be observed during midwinter, beginning with 19 Pisces as soon as it is dark enough to see and ending with Y Canes Venatici which is well placed by 2 a.m.

STAR NAME	R.A.	DEC.	MAG.	PER.	SPEC.	URAN.
Y Canes Ven.	12h45.1m	+45.27	5.0-6.4	158	N3	I 75
Mu Cephi	21h43.2m	+58.47	3.7-5.0	Irr	M2e	I 57
S Cephi	21h35.2m	+78.37	7.4-12.9	487	N8e	I 14
V Hydra	10h51.6m	-21.15	6.5-12..	533	N6e	II 325
R Lepus	04h59.6m	-14.48	5.9-11..	432	N6e	II 269
19 Pisces (TX)	23h46.4m	+03.30	5.5-6.0	Irr	N0	I 215 ☆

JOURNAL OF RETRO-ASTRONOMY

by Val Germann (germannvh@aol.com), Central Missouri Astronomical Asso. (via sci.astro.amateur USENET newsgroup)

I've known it all along, of course, that I'm a "retro" kind of guy. I was a "retro" back in the 1960s, reveling in black and white photography and eschewing color until much later. I am a "retro" in audio, running vacuum tube amplifiers and black vinyl discs on a turntable. I'm even a "retro" in motorcycles, my favorite ride being a pumped-up R-75/5 BMW with an R-90S fairing and a cut-down seat. Even though I have ridden the latest stuff, I am still drawn to the retro-techno, naked bike. Is it really true that in Japan, seat of the highest tech on Earth, a "naked-bike" and "retro" mania is sweeping the land? Yes, it is true. Ah, those inscrutable orientals, can it be that I am one of them? Hmmmm.

My pioneer status in this field of Retro-Astronomy (TM) means that for now I can define it as I will, make it anything I want it to be. So, I am defining Retro-Astronomy (TM) as consisting of four (4) elements, without ALL of which the astronomy in question is a fraud, an imposter, and not really "retro" at all. Now, many will call this "elitism" (and may even spell it right) but if they will think about it they might wonder how it is that one can practice Retro-Astronomy with a pair of binoculars? So, for now and for all time, Retro-Astronomy (TM) must be:

1) SIMPLE, the simpler the better. The ultimate here is naked-eye Astronomy, which costs absolutely nothing to practice and is so very, very rewarding. Learning the names and colors of the stars, the constellations and how they link together, the names and locations of ancient asterisms, this is ultimate Retro (TM). All is within YOU, within yourself, enriching, enhancing, YOU. Next in holiness is the exploration of the sky with binoculars, an activity that will abundantly bless its practioners, both in this life and the next. Trust me. At the other end of the Retro (TM) food chain, I, the Sultan Of Retro-Astronomy (TM) will allow telescopes up to 12.5-inches in aperture and, yes, they may have a motor drive and setting circles, but THAT'S IT. This kind of thing was good enough for Webb and Calver and it's good enough, maybe even TOO good, for me. But it's Retro (TM) nonetheless.

2) QUIET, the quieter the better. No space music, no slewing gears, slewing noisily, hither, thither and yon. I, the Sultan of Retro-Astronomy (TM) say, "A pox on such things. Be gone!" The quiet tick of clockwork or the all-but-inaudible hum of an electric drive is acceptable. Beyond that, NO, nothing more!

3) STUDY and CONTEMPLATION, not zipping here and there, there and back, all over the place. No talk of hardware, software or any otherware but instead peace, quiet and the sky. Acolytes may speak of celestial objects and great visions they have beheld in the past, but not too much. Let tonight be tonight, that is Retro-Astronomy (TM), and truly holy.

4) PAPER, not a CRT or a CCD chip, that is, DRAWING, which is the education of the eye, not the quick "snap" of an image followed by endless manipulation at a CRT, wasting one's precious life away. (Don't remember that this is what I am in fact doing, typing this material on a computer!) No matter, it is paper that we Retro-Astronomers (TM) revere, not electrons. Oh, we will also accept a pencil, too, or, in a pinch, a pen. But nothing beyond that (well, some drawing utensils if you must, if you MUST!), beyond these NOTHING! I, the Imperial Sultan of Retro-Astronomy, (TM) have spoken. All must obey, or something.

To the greater glory of Retro-Astronomy (TM) I am today launching The Journal Of Retro-Astronomy (TM), the JRA (TM), and soliciting articles for future numbers. Now, I know that you can just post your articles to this newsgroup but, think about it, what kind of fun would that be, especially for me! Send them to me, the Grand Imperial Sultan of Retro-Astronomy, and if they prove worthy they shall be ensconced for all time in the Imperial JRA (TM), mayhaps in the very first number (sure to be a collector's item, don't miss it if you can) which will appear around February 1, 1996, even if I have to write the whole darned thing myself. In order that the unbelieving may believe, what follows is a small example of what might pass muster for the JRA (TM), The Journal of Retro-Astronomy (TM):

SAMPLE ** SAMPLE ** SAMPLE ** SAMPLE ** SAMPLE ** SAMPLE
The Lunar Crater Plato, Black Lake Of Mystery —
Val Germann — Editor, The Journal Of Retro-Astronomy (tm)

The time to begin looking at Plato, the Black Lake Of Mystery, is at local sunrise, a day and a half after first quarter. In your binoculars the crater will look like a bullet hole shot through the northern part of the Moon; in your telescope it will show as a enigmatic, dark, elliptical lagoon, seemingly deep and strangely inviting, like a public swimming pool after hours. As you settle in with your instrument, adjusting the power, making sure your drawing supplies are handy, you will notice the change in sun-angle and thrillingly observe the long black shadows of Plato's rim as they suddenly begin to sweep across its floor. Do these speeding shadows move at a constant velocity? How fast do they move? Is the floor they are moving over level or does it undulate, alternately speeding and slowing the shadow? When do the several tiny craters concealed therein become visible? . . .

Get the idea? I sure do.

☆

HUBBLE FINDS POWERFUL LASER

Darth Vader take heart. Astronomers have discovered a powerful ultraviolet laser beam, several times brighter than our Sun, shooting toward Earth from a super-hot "death star." The observations, made with NASA's Hubble Space Telescope have identified a gas cloud that acts as a natural ultraviolet laser, near the huge, unstable star called Eta Carinae — one of most massive and energetic stars in our Milky Way Galaxy. The interstellar laser may result from Eta Carinae's violently chaotic eruptions, in which it blasts parts of itself out into space, like an interstellar geyser.

Sveneric Johansson, a specialist in atomic spectroscopy at the University of Lund in Sweden, has been analyzing Hubble Space Telescope observations of Eta Carinae, made with the Goddard High-Resolution Spectrograph (GHRS). Johansson reports that his interpretation is not yet proven, but that it appears to be the most plausible explanation of the data.

A laser, (which is an acronym for Light Amplification by Stimulated Emission of Radiation) creates an intense coherent beam of light when atoms or molecules in a gas, liquid or solid medium, force an incoming mix of wavelengths (or colors) of light to work in phase, or, at the same wavelength. Laser light is analogous to a loud, single-pitch note, while normal white light is analogous to audio static on a radio. The ultraviolet laser in Eta Carinae shines by the same physics that led to the invention of artificial optical lasers in 1960 and similar, microwave devices called masers, in 1954. Natural masers have been seen in space since the mid-1960s, and an infrared laser was discovered around the hot young star MWC 349, earlier this year.

"Each ultraviolet light particle (photon) generated in the Eta Carinae laser has almost 700 times the energy of a photon in MWC 349, and so the total energy output is far greater," said Kris Davidson of the University of Minnesota. "Natural infrared lasers are very rare in space; this ultraviolet laser is even more difficult for nature to arrange, and nothing like it has been seen before."Eta Carinae is several million times brighter than the Sun, and one hundred times as massive. The superstar, located 8,000 light-years away underwent a colossal outburst 150 years ago. Radio and X-ray astronomers have recently detected smaller outbursts in gas around the star. Previous HST observations found that the gas from the earlier giant explosion now forms a bizarre double-lobed nebula pinched in the center by a ragged equatorial disk.

In a Hubble Space Telescope investigation led by Davidson, including nine other collaborators in the U.S., Germany, and Sweden, ultraviolet light from the same gas is being closely studied. (This ultraviolet emission is in the wavelength range that is absorbed by the Earth's ozone layer, and hence must be studied from space). Team member Johansson was particularly interested in emission by iron ions that seemed unnaturally bright in the new data. He has found the only plausible explanation of the relative brightness of the iron emission lines is a natural laser emitting at energetic ultraviolet light. "The spectrum of singly-ionized iron (an iron atom with one electron removed) has almost a thousand known energy states and some of these are apparently well-suited to making a laser effect," said Davidson.

The gas was ejected along the equatorial plane of Eta Carinae about 100 years ago. Moving outward at about 100 thousand miles per hour, the gas is now about 60 billion miles, (100 billion kilometers), or 700 times the distance between Earth and the Sun. The discovery could provide scientists with a new tool for studying gas recently shot out of unstable stars, interactions of radiation with atoms in space, and atomic structure in cosmic gas clouds.

The researchers are planing to use Hubble's Faint Object Spectrograph to observe the same gas, covering a wider range of wavelengths than the GHRS data. This will hopefully lead to a better understanding of how the monster laser actually works.

☆

STATISTICALLY SPEAKING

Location (Dearborn, MI): 42°22'00" N, 83°17'00" W, 180 meters elevation
Local Time = Universal Time - 5.5 hours (Eastern Standard Time)

Abbreviations used in reports:

FM	Full Moon	FQ	First Qtr Moon	LQ	Last Qtr Moon	NM	New Moon
MR	Moon Rise	MS	Moon Set	SR	Sun Rise	SS	Sun Set

Calendar Report for February 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Lunar Events FM: 10:29 Feb 04 LQ: 3:08 Feb 12 NM: 18:02 Feb 18 FQ: 0:22 Feb 26			1 SR: 7:17 SS: 17:16 MR: 14:58 MS: 4:57	2 SR: 7:16 SS: 17:18 MR: 15:51 MS: 5:39	3 SR: 7:15 SS: 17:19 MR: 16:47 MS: 6:16
4 SR: 7:14 SS: 17:20 MR: 17:45 MS: 6:51	5 SR: 7:13 SS: 17:22 MR: 18:43 MS: 7:23	6 SR: 7:12 SS: 17:23 MR: 19:43 MS: 7:53	7 SR: 7:11 SS: 17:24 MR: 20:43 MS: 8:23	8 SR: 7:10 SS: 17:26 MR: 21:45 MS: 8:52	9 SR: 7:08 SS: 17:27 MR: 22:47 MS: 9:23	10 SR: 7:07 SS: 17:28 MR: 23:51 MS: 9:56
11 SR: 7:06 SS: 17:30 MR: None MS: 10:34	12 SR: 7:05 SS: 17:31 MR: 0:56 MS: 11:16	13 SR: 7:03 SS: 17:32 MR: 2:01 MS: 12:05	14 SR: 7:02 SS: 17:33 MR: 3:03 MS: 13:02	15 SR: 7:00 SS: 17:35 MR: 4:02 MS: 14:05	16 SR: 6:59 SS: 17:36 MR: 4:55 MS: 15:15	17 SR: 6:58 SS: 17:37 MR: 5:42 MS: 16:27
18 SR: 6:56 SS: 17:39 MR: 6:24 MS: 17:40	19 SR: 6:55 SS: 17:40 MR: 7:02 MS: 18:53	20 SR: 6:53 SS: 17:41 MR: 7:37 MS: 20:03	21 SR: 6:52 SS: 17:42 MR: 8:11 MS: 21:11	22 SR: 6:50 SS: 17:44 MR: 8:45 MS: 22:16	23 SR: 6:49 SS: 17:45 MR: 9:19 MS: 23:19	24 SR: 6:47 SS: 17:46 MR: 9:56 MS: None
25 SR: 6:46 SS: 17:47 MR: 10:35 MS: 0:18	26 SR: 6:44 SS: 17:49 MR: 11:17 MS: 1:14	27 SR: 6:43 SS: 17:50 MR: 12:03 MS: 2:05	28 SR: 6:41 SS: 17:51 MR: 12:52 MS: 2:53	29 SR: 6:40 SS: 17:52 MR: 13:44 MS: 3:36		

Planet View Info Report for February 1996

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
Mercury							
2/ 1/1996	5:54	15:28	19h21m54s	-19°35'19"	22°16'16"	0.353	0.7972
2/ 8/1996	5:47	15:16	19h38m21s	-20°18'38"	25°32'54"	0.535	0.9200
2/15/1996	5:49	15:20	20h08m12s	-20°11'10"	25°42'33"	0.660	1.0343
2/22/1996	5:54	15:36	20h45m00s	-19°04'22"	24°06'44"	0.748	1.1333
2/29/1996	5:58	15:58	21h25m33s	-16°55'21"	21°20'46"	0.815	1.2159
Venus							
2/ 1/1996	9:01	20:35	23h26m04s	-4°44'04"	38°57'11"	0.758	1.1384
2/ 8/1996	8:50	20:51	23h56m11s	-1°05'21"	40°11'54"	0.736	1.0933
2/15/1996	8:38	21:07	0h25m51s	2°34'47"	41°22'20"	0.712	1.0469
2/22/1996	8:27	21:22	0h55m14s	6°12'22"	42°27'53"	0.687	0.9991
2/29/1996	8:15	21:37	1h24m28s	9°43'25"	43°27'38"	0.660	0.9498
Mars							
2/ 1/1996	7:44	17:48	21h25m18s	-16°17'47"	7°13'33"	0.998	2.3560
2/ 8/1996	7:31	17:49	21h47m01s	-14°30'13"	5°40'59"	0.999	2.3606
2/15/1996	7:17	17:51	22h08m24s	-12°35'28"	4°10'15"	0.999	2.3648
2/22/1996	7:03	17:52	22h29m27s	-10°34'43"	2°42'32"	1.000	2.3686
2/29/1996	6:48	17:53	22h50m12s	-8°29'14"	1°24'29"	1.000	2.3721
Jupiter							
2/ 1/1996	5:15	14:18	18h27m12s	-23°05'00"	35°08'46"	0.997	6.0280
2/ 8/1996	4:53	13:57	18h33m24s	-23°01'03"	40°49'05"	0.996	5.9573
2/15/1996	4:31	13:36	18h39m20s	-22°56'25"	46°31'58"	0.995	5.8783
2/22/1996	4:09	13:14	18h44m58s	-22°51'17"	52°17'50"	0.994	5.7918
2/29/1996	3:46	12:52	18h50m16s	-22°45'47"	58°06'53"	0.994	5.6985
Saturn							
2/ 1/1996	9:08	20:35	23h33m01s	-5°08'15"	40°25'03"	0.999	10.3205
2/ 8/1996	8:42	20:11	23h35m45s	-4°49'58"	34°04'46"	0.999	10.3906
2/15/1996	8:16	19:48	23h38m38s	-4°30'55"	27°47'46"	0.999	10.4500
2/22/1996	7:50	19:24	23h41m37s	-4°11'15"	21°34'04"	1.000	10.4982
2/29/1996	7:24	19:01	23h44m42s	-3°51'09"	15°24'10"	1.000	10.5346
Uranus							
2/ 1/1996	6:49	16:16	20h14m03s	-20°25'09"	10°15'03"	1.000	20.7206
2/ 8/1996	6:23	15:51	20h15m44s	-20°19'54"	16°56'21"	1.000	20.6943
2/15/1996	5:57	15:25	20h17m22s	-20°14'44"	23°37'37"	1.000	20.6548
2/22/1996	5:30	14:59	20h18m57s	-20°09'45"	30°18'47"	1.000	20.6025
2/29/1996	5:04	14:34	20h20m26s	-20°04'59"	36°59'41"	1.000	20.5382
Neptune							
2/ 1/1996	6:26	15:53	19h50m58s	-20°29'46"	15°33'20"	1.000	31.1123
2/ 8/1996	6:00	15:26	19h52m02s	-20°26'58"	22°23'47"	1.000	31.0737
2/15/1996	5:33	15:00	19h53m04s	-20°24'14"	29°13'59"	1.000	31.0220
2/22/1996	5:06	14:34	19h54m02s	-20°21'37"	36°03'57"	1.000	30.9577
2/29/1996	4:40	14:07	19h54m57s	-20°19'08"	42°53'25"	1.000	30.8819
Pluto							
2/ 8/1996	1:32	12:38	16h13m32s	-7°55'15"	75°58'34"	1.000	30.1067
2/15/1996	1:05	12:11	16h13m56s	-7°53'47"	82°46'40"	1.000	29.9924
2/22/1996	0:37	11:44	16h14m14s	-7°51'57"	89°35'38"	1.000	29.8763
2/29/1996	0:10	11:17	16h14m25s	-7°49'47"	96°24'45"	1.000	29.7601

Planet/Moon Apsides Report for February 1996

2/ 1/1996	Moon @ Apogee	Hour: 11	Distance: 406173 km	Diameter: 0.490°
2/17/1996	Moon @ Perigee	Hour: 4	Distance: 360877 km	Diameter: 0.552°
2/20/1996	Mars @ Perihelion		Distance from Sun: 1.38 AU	
2/25/1996	Mercury @ Aphelion		Distance from Sun: 0.47 AU	

Twilight Report for February 1996

Date	Sun Rise	Sun Set	Astronomical Begin	Astronomical End	Nautical Begin	Nautical End	Civil Begin	Civil End
2/ 1/1996	7:17	17:16	5:36	18:58	6:09	18:25	6:43	17:51
2/ 8/1996	7:10	17:26	5:30	19:05	6:02	18:33	6:36	18:00
2/15/1996	7:00	17:35	5:22	19:14	5:54	18:41	6:27	18:08
2/22/1996	6:50	17:44	5:12	19:22	5:45	18:49	6:17	18:17
2/29/1996	6:40	17:52	5:02	19:30	5:34	18:57	6:07	18:25

SKY & TELESCOPE NEWS BULLETINS

from the editors of SKY & TELESCOPE magazine

X-RAY SATELLITE IN ORBIT

After several delays NASA has successfully orbited its X-ray Timing Explorer. The launch was originally planned for last summer, but scheduling conflicts delayed it until December. Then foul weather blanketed Cape Canaveral. A "go" was finally given on December 18th, except the Delta rocket's main engine failed to ignite. The reluctant space traveler at last got off the ground on December 30th. Managed by NASA's Goddard Space Flight Center, XTE is designed to study the variations in the emission of X-ray sources like black-hole candidates and active galactic nuclei. Time scales from microseconds to months will be monitored over a spectral range of 2 to 250 keV.

"GO" FOR STARDUST

Meanwhile, 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. It will encounter the comet Wild 2 in December 2003, snapping images while racing past at 6 km/s and coming within 100 km of the nucleus. Stardust will scoop up dust intact from Wild 2's coma, trapping and preserving the tiny particles in a material called silica aerogel. In 2006 the spacecraft will again swing past Earth, ejecting a retrievable capsule of cometary and interplanetary dust. Stardust's science team chose 81P/Wild 2 because it is a relatively fresh comet with a 6.4-year period. Named for the Swiss astronomer who discovered it (and pronounced "vilt"), the comet first entered the inner solar system in 1974 after being deflected by the gravity of Jupiter.

NEW EXTRASOLAR PLANETS

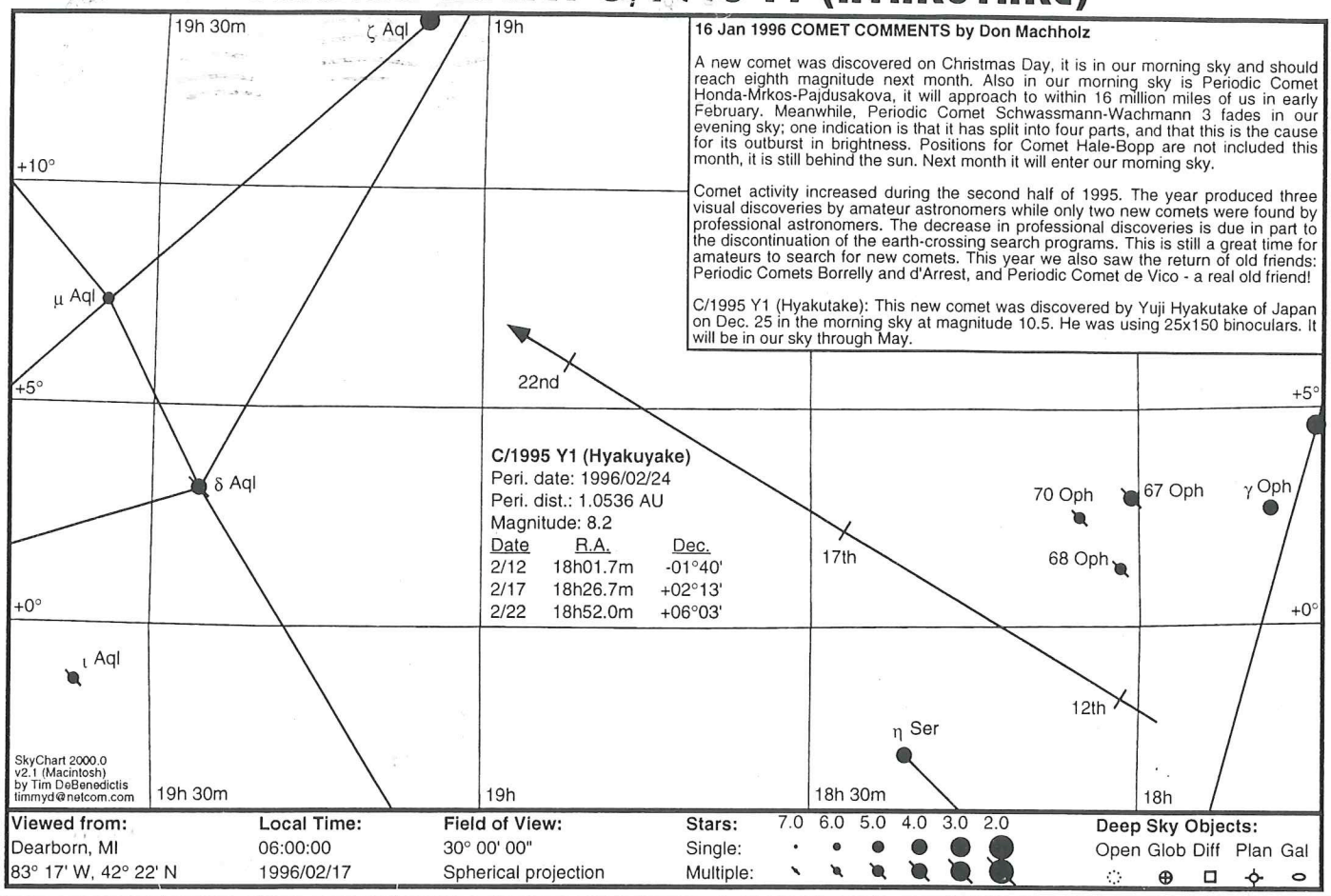
Announced in Texas was indirect but compelling evidence for new planets orbiting nearby stars like our Sun. The first such planet was found last year around 51 Pegasi. Now Geoffrey Marcy (San Francisco State) and Paul Butler (U. of California) have found two more Sunlike stars with planet-size companions. One is 70 Virginis, a 5th-magnitude, G5-type star some 78 light-years away (r.a. 13h 28.4m, dec. +13.8°). Radial-velocity data obtained at Lick Observatory shows that the star bobs toward and away from Earth at up to 311 m/s in a cycle lasting 117 days. From this Marcy and Butler deduce that an object at least 6.5 times the mass of Jupiter is orbiting an average of 0.43 a.u. from the star. Similarly, they've established that a planet at least 2.3 times Jupiter's mass orbits 2.1 a.u. from 47 Ursae Majoris with a period of 1,103 days. This 5th-magnitude star is 46 light-years away at r.a. 10h 59.5m, dec. +40.4d.

These masses assume the planets have orbits seen edge-on to Earth, but they could be higher. At his presentation on January 17th, Marcy noted that the body around 70 Virginis has a markedly eccentric orbit (e=0.35). This suggests to him that it may not have formed from a protoplanetary disk and could be a "brown dwarf" rather than a true planet. But the object orbiting 47 Ursae Majoris travels in a strict circle and has an orbital diameter and mass more like planets within our own Solar System. Finally, Christopher Burrows (STScI) unveiled Hubble images of the dusty disk around Beta Pictoris, a 4th-magnitude star in the southern sky. According to Burrows, an S-shaped warp seen in the disk is likely due to the gravitational pull of a Jupiter-mass planet in an inclined orbit. But the putative planet can't be too massive or too close to Beta Pictoris, because the star has not shown the kind of radial-velocity variations detected in 51 Pegasi, 70 Virginis, and 47 Ursae Majoris.

1996's FIRST COMET

The first comet discovery of 1996 was made on January 16th by Victoria and Robert Jedicke using the Spacewatch telescope on Kitt Peak. But don't reach for the binoculars just yet — Comet Jedicke is a dim 17th magnitude now, with a short tail 5 to 6 arcminutes long. A very preliminary orbit suggests that the comet (desginated 1996 A1) is inbound and will be about 2.5 a.u. from the Sun at perihelion in April 1997.

FINDING COMET C/1995 Y1 (HYAKUTAKE)



16 Jan 1996 COMET COMMENTS by Don Machholz

A new comet was discovered on Christmas Day, it is in our morning sky and should reach eighth magnitude next month. Also in our morning sky is Periodic Comet Honda-Mrkos-Pajdusakova, it will approach to within 16 million miles of us in early February. Meanwhile, Periodic Comet Schwassmann-Wachmann 3 fades in our evening sky; one indication is that it has split into four parts, and that this is the cause for its outburst in brightness. Positions for Comet Hale-Bopp are not included this month, it is still behind the sun. Next month it will enter our morning sky.

Comet activity increased during the second half of 1995. The year produced three visual discoveries by amateur astronomers while only two new comets were found by professional astronomers. The decrease in professional discoveries is due in part to the discontinuation of the earth-crossing search programs. This is still a great time for amateurs to search for new comets. This year we also saw the return of old friends: Periodic Comets Borrelly and d'Arrest, and Periodic Comet de Vico - a real old friend!

C/1995 Y1 (Hyakutake): This new comet was discovered by Yuji Hyakutake of Japan on Dec. 25 in the morning sky at magnitude 10.5. He was using 25x150 binoculars. It will be in our sky through May.

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