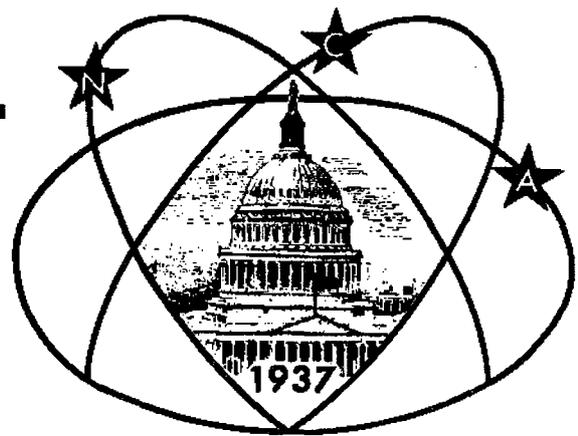


Star



Dust

National Capital Astronomers, Inc.

Phone: 301/320-3621

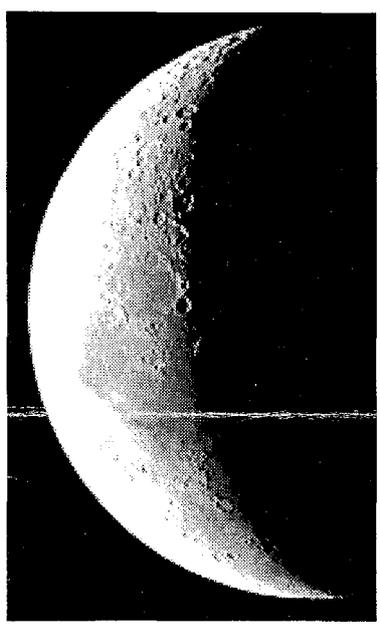
Volume 54, Number 6

February, 1996

ISSN 0898-7548

Robotic Telescopes on the Moon

by Harold Williams



The next meeting of the National Capital Astronomers will be held Saturday, February 3, at 7:30 P.M. in the Lipsett Auditorium of the Clinical Center (Building 10) at the National Institutes of Health (NIH). Peter Chen, who is employed by the Computer Science Corporation (CSC) in the Laboratory for Astronomy and Solar Physics at the Goddard Space Flight Center (GSFC), and combines astronomical research with instrument design, will speak about "Robotic Telescopes on the Moon." He got his Ph.D. from the University of Texas at Austin, where he started doing

occultation timings; Peter recommends this as an exciting and fun thing to do with small portable telescopes used in a time-critical way. As one of many speakers on our Charge Coupled Devices (CCD's) program, he spoke to us in September on Charge Injection Devices (CIDs) and demonstrated a CID camera in operation. He mentioned the projected use of CID chips as image detectors for Lunar telescopes in that meeting, and it was decided to ask him to speak about robotic telescopes on the Moon in greater detail at a future meeting. That future is now.

NCA and Astronomy on the World Wide Web

Reviewed by Harold Williams

On Saturday January 6, 1995 at the National Institutes of Health (NIH) in the Lipsett Amphitheater, the World Wide Web (WWW) and NCA web page were demonstrated by various NCA members. Tom Van Flandern, Jay Miller, Wayne Warren, Nancy Roman, and I were the most conspicuous demonstrators; Michael Marie and Lescelles Linton also contributed URLs worth visiting, and Lescelles had assisted me all of Saturday in improvements on NCA's home page at <http://myhouse.com/NCA/home.htm>.

HTML, HyperText Markup Language, is just a DTD, Document Type Definition, written using SGML, Standard Generalized Markup Language, invented by Tim Berners-Lee while at

CERN, Centre European de Recherches Nucleaires, before he moved to direct the W3 Consortium. It is obvious that for this subject it is easy to construct sentences that are so full of acronyms and abbreviations as to be unintelligible by everyone except the most dedicated WWW adapt. With the rich use of acronyms in this meeting one of our members came up with yet another abbreviation for STARS, (Stop Talking Acronyms Reduce Street-lighting.)

People who have recently discovered the WWW act like people did when the telephone or television was new. They get excited and want to share this new resource with their friends and neighbors. After a short period of over-indulgence in the new media—people

with addictive personalities spend a little longer in this phase—they settle into a responsible use of the now common utility. Perhaps this sort of behavior even happened after Gutenberg invented the printing press, but at that time the majority of the citizenry in Europe could not read.

The program consisted of jumping from site to site on the WWW with people firing questions at the person or persons doing the demonstrating. If the presentation was chaotic at times, its chaos reflected the chaos inherent in the WWW. I have decided that the only thing worth reviewing in detail are the abbreviations, acronyms, and terms, so here it goes.

See WWW, continues on Page 3

Calendar of Monthly Events

The Public is Welcome!

Fridays, February 2, 9, 16, and 23, 7:00-9:30 PM—Mirror-making classes with Jerry Schnall in the basement of McKinley Hall at American University off Nebraska Avenue, NW in Washington. Information: 202/362-8872. See article on page 4.

Saturday, February 3, 5:30 PM—Dinner with our speaker will take place at North China Restaurant, 7814 Old Georgetown Road (near Cordell Avenue), Bethesda, MD., before the monthly meeting. We will start ordering at 5:30 PM. See the map on the back page of this issue for directions.

Saturday, February 3, 1996, 7:30 PM—The February NCA meeting will feature Peter Chen speaking on “Robotic Telescopes on the Moon.”

Mondays, February 5, 12, and 26, 8:30 PM—Public nights at the U.S. Naval Observatory (USNO), in Northwest Washington, D.C. (off Massachusetts Avenue). Includes orientation on USNO’s mission, viewing of operating atomic clocks, and glimpses through the finest optical telescopes in the National Capital region. Information: USNO Public Affairs Office, 202/653-1541.

Tuesdays, February 6, 13, 20, and 27, 7:00-9:30 PM—Mirror-making classes with Jerry Schnall at the Chevy Chase Community Center at Connecticut Avenue and McKinley Street, NW in Washington. Information: 202/362-8872.

Wednesday, February 7—February “Sky Watch” column appears in *The Washington Post* “Style” section. It lists many events for that month.

Fridays, February 9, 16, and 23, 8:30 PM—NCA’s Celestron-14 telescope open nights with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob at 703/960-9126.

Saturday, February 10, Night—Waning Gibbous Moon provides this month’s *third longest* night “deep night” period, including mostly Moonless skies from dusk through Midnight EST, (The second longest such Saturday night period, 24/25 February, only begins after Midnight EST.) See explanation below.

Saturday, February 17, Night—Waning Crescent Moon provides this month’s *longest* Saturday night “deep night” period, with Moonless skies all night long. See explanation below.

Saturday, March 2, 1996, 7:30 PM—The March NCA meeting will feature Eli Dwek speaking on “Searching for the Cosmic Infrared Background.”

Wednesday, March 6, 1996—March “Sky Watch” column appears in *The Washington Post* “Style” section. It lists many events for that month.

The Calendar’s Saturday “Deep Night” Periods—Astronomy is quite unique among the sciences in that the original specimen of study, the Universe itself, is accessible to each of us possessing the gift of sight. We need only look up at the sky with wonder. And there is no better place to experience that original specimen than at a dark-sky site during “deep night” periods. For many, Saturday nights represent the most convenient times to do that.

The Saturday deep night periods listed in this issue’s “Calendar of Monthly Events” occur on two to three Saturday nights each month. They are continuous time intervals, of three or more hours duration, that start on Saturday night before Midnight EST, when neither daylight, twilight, nor Moonlight interferes with experiencing the dark sky. However, artificial light, in the form of light pollution, can interfere. To avoid this problem, several relatively dark-sky sites are available for NCA members’ use in Maryland, Virginia, and West Virginia. Information: Daniel Costanzo, 703/841-4765.

This deep night listing was prepared by Daniel Costanzo from data generated by Jay Miller using MICA, the Multiyear Interactive Computer Almanac software package, created by the U.S. Naval Observatory. MICA is publicly available in both PC and Macintosh versions. Several NCA members can assist those interested in learning to use MICA.

Other events too numerous to mention here are listed in the publications *Sky & Telescope*, the *Astronomical Calendar 1996*, and *Observer’s Handbook 1996*, and in numerous software packages. NCA members can purchase all these at a discount. To join NCA, use membership application on page 9.

A browser is a program on your computer that allows you to surf the WWW. Surf is used here as a metaphor. There are only four browsers worth mentioning: Lynx, a text based browser that will run on a shell account; Netscape, the best graphic and text-based browser on the market; Mosaic, the original graphic and text-based browser created by some of the Netscape people when they were students at the University of Illinois and connected with the NCSA, National Center for Supercomputer Applications; and all the rest of the graphic browsers, which are mostly lame or just a little lame when compared to Netscape.

A shell account is what you have when you log on to an Internet service if all you ever get is a prompt of some sort with a command line interpreter, CLI, or shell. You can run Lynx from a shell account by typing lynx and the URL at the prompt. SLIP stands for Serial Line Internet Protocol, an unofficial but widely used method of running TCP/IP over serial lines such as dial-up phone lines. TCP/IP, strictly speaking, is Transmission Control Protocol, which runs on top of the Internet Protocol, but by metaphoric extension TCP/IP generally refers to a suite of network and application protocols including TCP, IP, UDP, ICMP, Telnet, FTP, and others. You don't need to know what UDP and ICMP are unless you are a network administrator—I haven't a clue and couldn't care less at the moment.

Telnet is the standard TCP/IP application for remote login, and it allows you to emulate some sort of terminal. That must be what the T is for. Generally after you telnet you are asked for logonid and password.

Rlogin is another standard TCP/IP application for remote login; as far as I can figure out it does not allow you to emulate a terminal. You generally have to rlogin instead of telneting if you want to run TIA or Sliper to make your shell account behave like a SLIP or PPP account. Generally after you rlogin you are asked for logonid and password. PPP stands for Point-to-Point Protocol, a standard for networking connections on serial hardware; it is most often used with TCP/IP but can support other pro-

ocols simultaneously—whatever they are. PPP is generally agreed to be superior to SLIP by those that know. ATM (Asynchronous Transfer Mode) is something superior to SLIP and PPP; all the hardware makers are bragging about it, but it isn't here yet. TIA or Sliper are two different products that reside on an Internet host provider that allow those of us that are either too cheap or are not properly network connected to run graphic browsers that normally require SLIP or PPP connections. TIA stands for The Internet Adapter and is sold by marketplace.com for \$30, but you get a three-week free trial. Sliper is free, but you probably get what you pay for.

FTP is File Transfer Protocol, an application that does what it name says. You can use FTP to logon to another system and get and put files. Of course, file security could prevent you from getting or putting on a specific site. FTP has a few simple commands, and it can be invoked from the shell. Enter FTP and then press ? or h to list the available commands. Help or ? and the name of the command will tell you more. Netscape will allow you to FTP as well. FTP is typically where and how you go to get lots of free and shareware programs and data. You can get Netscape that way, too.

URL stands for Universal Resource Locator, a WWW address that you type into your browser or click on the highlighted tag (sometimes called an anchor, a curious name for something that takes you elsewhere). <http://myhouse.com/NCA/home.htm> is the URL for NCA's WWW page. URLs are broken down into five and occasionally six parts, which are scheme://host.domain[:port]/path/filename. Schemes can be http, a file on the WWW server; file, a file on your local system (for example, c: would generally be on your hard drive on an IBM compatible system, a: or b: would be a diskette on your system); FTP, an FTP server in this context; news, a Usenet newsgroup (there are more than 10,000 of these and several astronomy ones are available from the NCA home page); gopher, a gopher server (a more primitive text-based menu-driven information server than the WWW); WAIS, a Wide Area Information Server database search engine (I have heard of them but never used one.); and telnet. Host.domain is a specific

computer on the Internet, such as marlowe.umd.edu or myhouse.com or www.altvista.digital.com or even an IP address such as 198.69.192.1. Actually the word names in the host.domain have to be translated to IP numbers by a domain name server into IP addresses like 198.69.192.1, but you generally don't have to be too aware of all of this unless you are configuring TIA during setup or you are a network administrator. As for what is the host and what is the domain, that is somewhat a judgement call. umd.edu is a domain for University of Maryland computers; obviously digital.com is a domain name for Digital, the big computer company; but myhouse.com is in some ways the domain and myhouse the host. Marlowe, Tracy, Wolfe, and Marple are host individual machines at umd.edu in a UNIX cluster. Now when it comes to domains, knowing a little will sometimes help you a lot: edu is an educational institution, com is company, gov is the government, mil is the US military, org is an organization; but two letters on the end are country codes: de is Germany, fi is Finland, ca is Canada, uk is the United Kingdom, jp is Japan, and au is Australia. [:port] is a number, and you generally don't need one unless the network administrator at the host.domain is stupid or has been fouled up by some higher administrator that is stupid. Path is the path through the host.domain's directory file structure to get you to the file. So what is <http://boas3.bo.astro.it/dip/Museum/MuseumTurret.html#astrolabe>, you say? http is the scheme, so it must be an html document. boas3.bo.astro.it is the host.domain, a unique computer on the Internet, evidently in Italy. dip/Museum/ is the path to a file called MuseumTurret.html, and the #astrolabe takes you directly partway into this long file to the astrolabe stuff in your browser.

Windsock is a piece of software that you must have on your computer to enable it to set up the TCP/IP stacks and magic unless you have a UNIX box; then I don't think you need a Windsock. The name must be a metaphor or allusion to something about catching data packets on the wind or something, I suppose. Anyway you have to have one or Netscape generally won't even

USNO and NCA Celebrate Clark Refractor Centennial

by Wayne H. Warren Jr.

On Friday evening, January 5, 1996, astronomers and guests from the U.S. Naval Observatory and the National Capital Astronomers gathered in Building 1 (the main administration building) at USNO to celebrate the centennial of the historic 12-inch (30.5-cm) Alvan Clark refractor now housed in the dome atop that building. Following remarks about the history of this fine instrument by the USNO Historian Steve Dick, USNO Superintendent Captain Kent W. Foster, USNO Scientific Director Ken Johnston, and NCA member Dan Costanzo, NCA President Wayne Warren presented commemorative plaques to USNO staff members Ted Rafferty and Richard Schmidt, who restored the telescope from its constituent parts retrieved from the USNO dump. Not only did they do this on their own time, but, although they were originally allocated \$1500 by then Scientific Director Gart Westerhout, following funding cut-backs, they were eventually allowed to spend only \$500, an incredibly small sum considering the telescope's present condition and historical value. The refurbished instrument is now used mainly for public viewing on USNO open nights.

The mounting for the 12-inch was designed and constructed by George N. Saegmuller of Glenn Dale, Maryland and was completed in November, 1892. The objective lens, made by Alvan Clark, was installed on December 19, 1895 and has a focal length of 180.6 inches (459 cm), with a focal ratio of $f/15$. A 4.5-inch (11.4-cm) guide telescope by John Clacy is mounted on the main tube.

In addition to the superb optics of the 12-inch telescope (it is said that David Levy stated that its

images were the finest that he'd ever seen in any refractor with which he has observed), the instrument was fitted with an intricate set of "star dials" designed by the then Astronomical Director of the Naval Observatory, William Harkness. These dials, which have since disappeared, gave a direct mechanical readout of right ascension and declination. Similar dials can still be seen on the 12-inch Saegmuller refractor at Georgetown University, which has also been restored by Ted Rafferty.

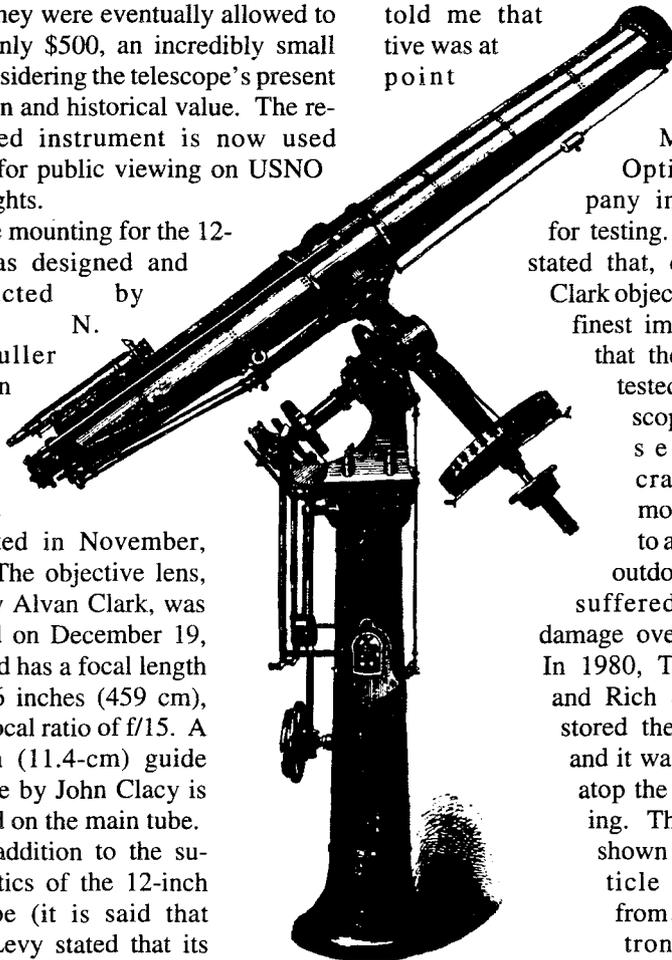
The Clark telescope, along with others at USNO, was used mainly to observe satellites and diameters of planets, double stars, minor planets and comets, and lunar occultations of stars. It was used until 1957, when it was put into storage, but it was reactivated in 1962 and used until 1971 to observe double stars. Charles Worley and Dick Walker were the main observers during that period.

Charles told me that the objective was at point

the objective sent to the

Muffoletto Optical Com-

pany in Baltimore for testing. The report stated that, on-axis, the Clark objective gave the finest images of any that they had ever tested. The telescope was disassembled, crated, and moved in 1971 to a storage area outdoors, where it suffered exposure damage over the years. In 1980, Ted Rafferty and Rich Schmidt restored the instrument and it was remounted atop the main building. The engraving shown with this article was taken from a book on astronomical in-



Welcome New Members

Harold & Mary Birch

3330 N. Leisure World Blvd., #906
Silver Spring, MD 20906-5653

Ross S. Gersten

1011 Elm Ave.
Takoma Park, MD 20912

Mark Miller

741 Monroe St., #203
Rockville, MD 20850

Sherry Patterson

10802 Henderson Road
Fairfax Station, VA 22039

Adam Sieminski, III

2930 Brandywine St., NW
Washington, DC 20008-2138

John C. & Bobbie Stewart

1812 Monroe St., NW
Washington, DC 20010-1015

struments published in Germany in 1899. It shows the telescope as it looked when originally mounted in the rooftop dome. The engraving, as well as much of the information in this article, was adapted from an anonymous write-up available at the celebratory gathering.

Following some refreshments, most attendees proceeded up to the roof of Building 1 to observe with the telescope. Although the seeing was not as good as it could have been, I was impressed with the quality of the images and the instrument's resolution. It is no exaggeration to say that one of the targets, a double star with separation 2 seconds of arc, appeared as a star of separation about 20 seconds of arc does in my 8-inch (20.3-cm) Celestron. The detail on the surface of the Moon was quite extraordinary.

The NCA wishes to thank the USNO staff for the opportunity to participate in this celebration. I would personally like to thank Dan Costanzo and Jim Roy for doing most of the work necessary on NCA's part to arrange the gathering. The cake that Mr. Roy had made, which contained a fine, sugary replica of the 12-inch telescope, was not only beautiful, but tasted good too.

NEAR Watch #1

By Daniel Costanzo

This month opens the launch window for NEAR, the Near-Earth Asteroid Rendezvous mission. NEAR inaugurates the first of NASA's Discovery Program missions extolling the new-found virtues of a "faster, cheaper, better" approach to Solar System exploration. NEAR will be the first test of this philosophy in the planetary mission arena.

Among its many other firsts, the NEAR mission involves the first flyby of a C-class (carbon-rich) asteroid (253 Mathilde), a swingby of Earth, and the first rendezvous with a near-Earth asteroid (433 Eros). If this rendezvous is successful, then NEAR will become the first spacecraft to orbit a small Solar System body, opening a whole new era of exploration.

The NEAR mission is particularly important to NCA because longtime NCA member David Dunham is one of the key members of the NEAR Mission Design Team at The Johns Hopkins University, Applied Physics Laboratory. This past October 7th he gave a thorough, enjoyable, and informative presentation to NCA on NEAR and his role in it. It was one of those rare instances where NCA heard a lecture about a mission *before* it occurred. A thorough review of Dave's October presentation is forthcoming from me. But I prefer to do things the Soviet way: don't give all the details until after a mission is successfully launched. So with Dave's concurrence, I have decided to provide this review *after* the launch is attempted.

NEAR's sixteen day launch window runs from February 16 through March 2, which should be enough, weather permitting, to allow a launch to

take place. The first eleven days of this window can support a Mathilde flyby. Each individual day's launch window lasts only twenty seconds. But the magnificent Delta booster can be launched to within 0.01 seconds of the needed mission time. So this is fully within its capabilities. As the flagship of the Discovery series, NEAR is the first planetary mission using the Delta. But while the Delta has one of the best launching success records of any rocket known, there have been failures. However, should NEAR sail off successfully, this installment will inaugurate a regular series of updates on the mission in *Star Dust*, as this wonderful little "astrobot" sails forth on a voyage of Cosmic Discovery through the Solar System.

So let's all wish the best of luck to Dave and the NEAR team, which includes all of us, who support and fund this essential and pioneering work.

MORE WEB, from page 3

bother to install itself on your computer without telling you to go out and get one first. Windssocks can be downloaded for free if you don't already have one, but you of course have to know how to do this.

GIF, JPEG or JPG, MOV, MPEG, or MPG, VOC, WAVE, 8SVN, HSN, COXL, ILBM, Targa, FIXT, ANIM, and WPG are all file extensions like html in Index.html that give some information to the viewer, browser, or player about what type of file it is receiving and what it should do with it. GIF and JPEG or JPG are picture files. MOV are Quicktime movie files. MPEG or MPG are another type of movie, animation file that require a different viewer. VOC and WAVE are sound files that require players and speakers to listen to. As for 8SVN, HSN, COXL, ILBM, Targa, FIXT, ANIM, and WPG, they are rarer file types that do various things that you will encounter less often. Currently file types allow only two of the five human senses to be addressed over the Internet, sight and sound. I will leave to your imagination the file extensions and devices that would make for a more intimate computer experience including taste, smell, and touch.

So much for buzz words; think

STARS. Any NCA member who can write HTML code and is willing to help maintain and improve the NCA home page should e-mail to me code fragments or entire pages. Any NCA member who, while browsing the WWW, comes across a URL that is not already referenced on the NCA home page that they think is generally useful to other NCA members should e-mail me these URLs. You can send me e-mail directly in your WWW browser while viewing NCA's home page by clicking on the "Send e-mail to Harold Williams" tag at the bottom of the NCA's home page.

As usual, we are indebted to NIH and NCA member Jay Miller for arranging to meet at NIH, where he works. Our two computer network engineers were Jay Miller and Tom Van Flandern. Both made multiple trips to the Lipsett amphitheater weeks in advance of our program testing computers, network connections, and video display projection screens so every thing would run as smoothly as it did. The meeting blessedly adjourned just before the large snowfall began. Leith Holloway, NCA's meteorologist and secretary, checked several times during the meeting to make sure it had not yet started to snow.

Astronomical Calendar Still Available

The "Astronomical Calendar" for 1996, is available for \$19.95. If you wish to order a copy, please inform Wayne Warren (NCA President). The price of the calendar goes down to \$15.95 when four or more are ordered. For more information: 301/474-0814

Newsletter Deadline for March *Star Dust* FEBRUARY 15, 1996

*** DO NOT BE LATE!!! ***

February is a short month. We need everyone to work together. Please send your submissions in on time so that all NCA members will receive newsletters on time. Send your submissions to Gary & Alisa Joaquin, at 7821 Winona Ct., Annandale, VA, 22003.

Leave a message on voice mail 703/750-1636 or send an ASCII file via e-mail at 71561.1747@compuserve.com or AGJAOQ@ix.netcom.com or fax to 703/658-2233. Submissions must be on time or they may not get in.

ASTRONOMY NEWS UPDATE

The American Institute of Physics Bulletin of Physics News Number 255 January 19, 1996

by Phillip F. Schewe and Ben Stein

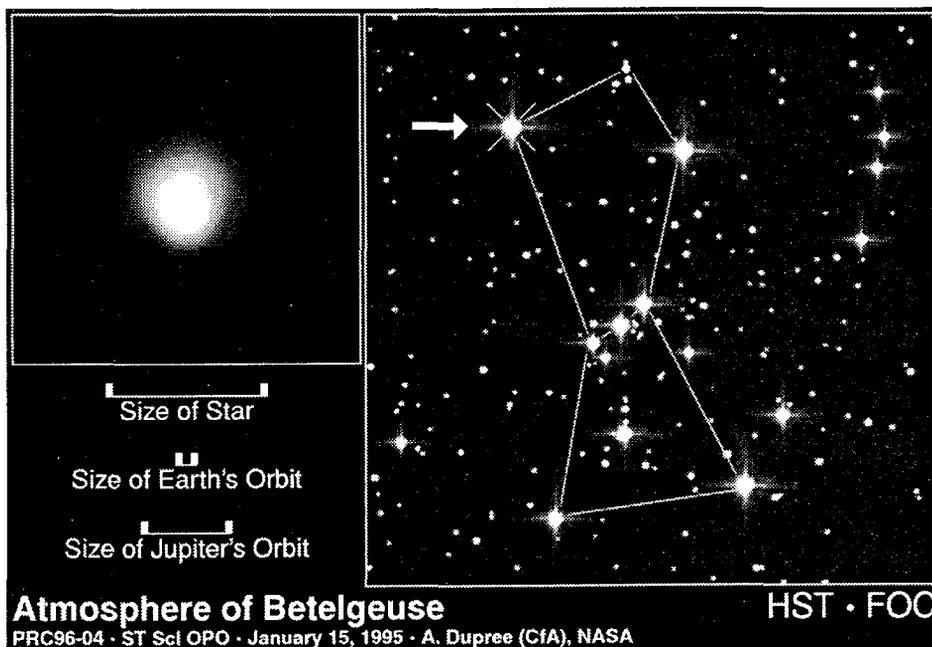
Waterworlds: New Extrasolar Planets have been discovered, and they might support liquid water. Scientists discussing the new observations at this week's meeting of the American Astronomical Society in San Antonio, Texas sense that with solar systems other than our own available for inspection, a new era in astronomy is opening up. This study of regular planets orbiting Sun-like stars (planets around pulsars were detected a few years ago) began only in October 1995 with the discovery of a planet around the star 51 Pegasi (Update 246). That planet orbits its star at a radius of only 0.05 AU (an astronomical unit is the distance between Earth and Sun), making it very hot 1000°C (1830°F) and inhospitable for life. Geoffrey Marcy of San Francisco State announced at the AAS meeting the discovery of two planets, both about 35 light years from Earth. One orbits the star 70 Virginis at a distance of 0.43 AU with a period of 116 days; it has a mass of about 8 or 9 Jupiters and a surface temperature of about 83°C (185°F). Liquid water and conceivably life forms could be sustained at such a planet or on a nearby moon, Marcy said. The other planet orbits the star 47 Ursae Majoris at a distance of 2.1 AU with a period of 1100 days. It has an estimated mass of 3.5 Jupiters and a surface temperature of -90°C (-130°F). Marcy notes that some zones in the planet's atmosphere could harbor liquid water. Marcy hinted that his long-term study of 120 nearby stars, carried out at the Lick Observatory, would soon yield more planets. Basically, his evidence for planets consists of slight modulations in the light coming from the stars as a result of the tug between planet and star. Meanwhile, Christopher Burrows of the Space Telescope Science Institute reported that the star Beta Pictoris (see figure on page 8), whose circumstellar dust disk has long been thought of as a possible nursery for planets, did in fact possess a Jupiter-sized planet. The evidence for this, he argued, was a warping of the inner part

of the dust disk caused by the tidal effects of a presumed planet orbiting in the clear zone between the star and the inner edge of the dust disk.

The Hubble Deep Field (HDF), a picture of a tiny patch of sky taken by the Hubble Space Telescope, is the deepest optical image of the Universe ever recorded. Actually, it would be more accurate to say that the HDF has captured the faintest galaxies (down to an unprecedented 30th magnitude) rather than the deepest or furthest galaxies because the distances to many of the objects are not yet known. Still, if as expected deepness goes with faintness and if thereby the image serves partly as a snapshot of the Universe at a very early time in its history, then it is significant that the density of galaxies in the field is quite high; an estimated 1500 of all types and shapes crowd the frame. This would suggest that telescopically as-

tronomers had not yet glimpsed the epoch of the first galaxies. The observations were carried out over a ten-day period in December 1995 and used four wavelength bands in order to achieve a true color image.

The First Direct Image of the surface of a star other than our Sun was reported by Andrea Dupree of Harvard-Smithsonian. The surface of the star, Betelgeuse, had been indirectly imaged earlier using speckle interferometry, in which many brief exposures are added up to make a composite image. Dupree's picture (see figure below, made with the Hubble Space Telescope, confirm previous suspicions that Betelgeuse's surface exhibits a giant bright spot. According to Dupree, the spot is 2000°K (3140°F) warmer than its surroundings and that this might be indicative of a new physical phenomenon at work in some stellar atmospheres.



This is the first direct image of a star other than the Sun, made with NASA's Hubble Space Telescope. Called Alpha Orionis, or Betelgeuse, it is a bright red supergiant star (shown here in black and white) marking the shoulder of the Winter constellation Orion the Hunter. The Hubble image reveals a huge ultraviolet atmosphere with a mysterious hot spot on the stellar behemoth's surface. Credit: Andrea Dupree (Harvard-Smithsonian Center for Astrophysics), Ronald Gilliland, Space Telescope Science Institute (STScI), NASA and the European Space Agency (ESA).

“Earth is the cradle of humanity, but we cannot stay in the cradle forever.”

Georg A. Donde (via Harold Williams)

<sampo@uclink4.berkeley.edu>

Wednesday, January 17, 1996

Time of press conference at the San Antonio meeting of The American Astronomical Society

Released jointly by University of California Berkley and San Francisco State University

1/17/96—File #14301

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Discovery of Two New Planets — the second and third within the last three months — proves they aren't rare in our Galaxy.

San Antonio — Astronomers have discovered two new Jupiter-sized planets within about 35 light years of Earth, both at temperatures that mean they could harbor water in liquid form.

The discoveries were announced January 17, 1996 at a meeting of the American Astronomical Society in San Antonio, Texas, by astronomers Geoffrey Marcy, a professor of physics and astronomy at San Francisco State University and a visiting scholar at the University of California at Berkeley, and Paul Butler, a postdoctoral researcher with a joint appointment at UC Berkeley and SF State. Marcy and Butler were the ones who last year confirmed the first discovery of a planet outside our Solar System, 51 Pegasi. “After the discovery of 51 Peg everyone wondered if it was a freak, a one in a million observation,” Marcy said. “The answer is no. Planets aren't rare after all.”

The two new planets were found around the stars 70 Virginis, in the constellation Virgo, and 47 Ursae Majoris, in Ursa Major. Both stars are visible to the naked eye, but the planets are too small and dim to be seen against the glare of their parent star. Nevertheless the planets create a telltale wobble in the stars' motion, which the astronomers were able to detect with sensitive equipment mounted on the 3-meter (120-inch) Shane reflector telescope at the University of California's Lick Observatory.

“These new discoveries are important because they spawn a new subfield of astrophysics, the study of planetary systems,” Marcy said. “We can now probe the characteristics of these planets, such as their orbits and masses.”

Discovery of the first extrasolar planet was announced Oct. 6 at meeting in Florence, Italy, by Michel Mayor and Didier Queloz of the Geneva Observatory in Switzerland, and confirmed a week later by Marcy and Butler at Lick Observatory. Circling the star 51 Pegasi about 40 light years distant, the planet was unofficially dubbed Bellerophon by Marcy, in keeping with the name 51 Peg B given by Mayor and Queloz, and the convention of naming planets after Greek and Roman mythological figures. Bellerophon was a Greek hero who rode the winged horse Pegasus to slay the fire-breathing Chimera. Unlike Bellerophon, which is about half the mass of Jupiter and orbits its star in 4.3 days — so close it is baked to 1000° C (1800° F) — the two new planets are several times the mass of Jupiter and orbit their stars at a distance typical of our own Solar System.

The planet around 70 Virginis orbits the star in an eccentric, elongated orbit every 116 days and has a mass about nine times that of Jupiter. Using standard formulas that balance the sunlight absorbed and the heat radiated, Marcy and Butler calculated the temperature of the planet at about 85° C (185° F). “That's cool enough to permit complex molecules to exist, ranging from carbon dioxide to complicated organic molecules,” Marcy said. “And because 85° C is below the boiling point of water, this planet could conceivably

have rain or even oceans.” The star 70 Virginis is nearly identical to the Sun, though several hundred degrees cooler and perhaps three billion years older.

The planet around 47 Ursae Majoris was discovered after analysis of eight years of observations at Lick. Its period is a little over three years (1100 days), its mass about three times that of Jupiter, and its orbital radius about twice the Earth's distance from the Sun. This planet, too, probably has a region in its atmosphere where the temperature would allow liquid water. “There is going to be a zone where a cauldron of organic molecules cooks with water,” Butler said. “This system is the closest thing we've seen to anything like our own Solar System.”

Marcy notes also that during their recent observations they failed to detect a second planet around 51 Peg, in apparent contradiction to data obtained by the Swiss team that discovered it.

The San Francisco State and University of California at Berkeley astronomers expect to announce the discovery of more new planets in the coming years, now that they have perfected a unique system for detecting the tiny wobbles in distant stars that indicate the presence of a planet. The two started their efforts in 1987 and have been monitoring 120 stars — all between 10 and 100 light years from Earth — for up to eight years in search of periodic changes in the star's speed. The wobble in a star's velocity is determined from the Doppler shift in the star's spectrum. The Doppler shift is a shift of wavelength or color caused by the motion of

See NEW PLANETS, page 8

NEW PLANETS, from page 7

a star toward or away from the observer. Objects moving away have their entire spectrum shifted toward the red, while those moving toward us have their spectrum shifted toward the blue.

Within the past year and a half Marcy and Butler have refined their technique to the point where they can measure this velocity within an accuracy of three meters per second — the speed of a brisk walk. Jupiter, for example, produces a 12.5 meter per second wobble in the Sun's orbit. With a few more years of observations, Marcy said, the team could detect a Jupiter-sized planet orbiting a distant sun — assuming it is located at Jupiter's distance from our Sun and has a similar period of about 12 years. They achieve this precision by putting a glass chamber of iodine gas in front of the telescope so that light from the star passes through and is partly absorbed, superimposing the absorption spectrum of iodine onto that of the distant star. Spreading out the composite

spectrum and cutting it into chunks, they then measure how much the starlight spectrum has shifted to the blue or red relative to the known spectrum of iodine. Each chunk provides an estimate of the shift, and averaging the results of 500 such chunks yields a very precise measurement of the Doppler shift, Marcy said. They were greatly aided in these measurements by a state-of-the-art spectrometer on the Lick telescope that was recently refurbished by astronomer Steve Vogt of UC Santa Cruz.

Geoffrey Marcy and Paul Butler can be reached by calling the Public Information Offices at UC Berkeley or SF State, or via e-mail at gmarcy@etoile.berkeley.edu and paul@further.berkeley.edu.

Graphics, photos, and a short video also are available from the Public Information Offices, phone: 510-642-3734, Fax: 510-643-7461. Or download them from the WWW site <http://pio06.urel.berkeley.edu/>.

WWW Bookmarks of the Month

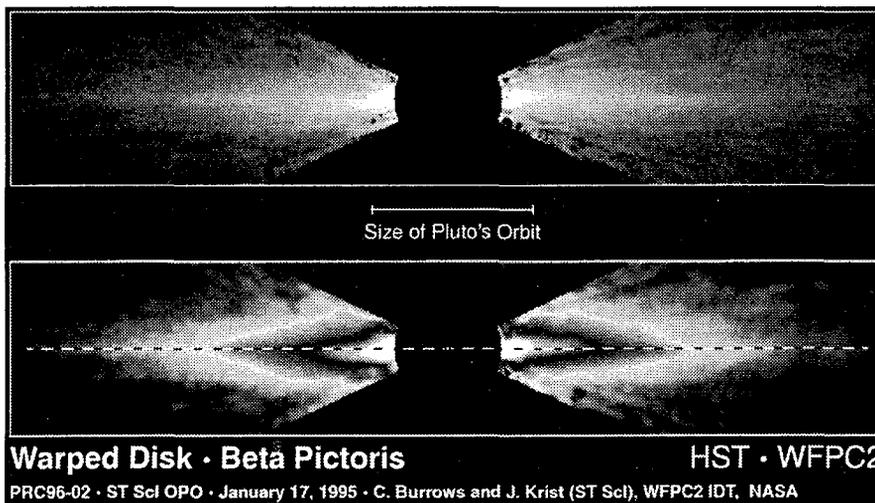
Jay Miller has come across two more web sites for exploration. The first is from Australia and the second from France.

<http://www.ozemail.com.au/~putney/Woodlands>

http://www.alpes-net.fr/~j_p_desm/sunspots.html

This may become a new column feature from time to time. If you find a web site that other members may enjoy, think about publishing it here so others can try it. While you are exploring, if you find any useful information that would be worth publishing in *Star Dust*, download a copy with a short note to the editors. Thank You.

Another Planet About to be Discovered? You Decide



This Hubble image shows for the first time the inner region of a dust disk around the bright Beta Pictoris. This region has long since been hidden from ground-based telescopes because of the glare from the central star. By looking at the dotted line, note how the disk is slightly warped. If the warp was there when the star was formed, it would long since have flattened out, unless maintained by the gravitational pull of a planet. Credit: Chris Burrows, Space Telescope Science Institute (STScI), the European Space Agency (ESA), J Krist (STScI), the Wide Field Planetary Camera 2 (WFPC2) IDT team, and NASA. (Note: The bottom image though viewed in black and white, shows the color spectrum. The color spectrum helps to see that the disk is slightly warped by the lack of symmetry.)

1996

Observer's Handbook

Copies of the 1996 *Observer's Handbook*, published by the Royal Astronomical Society of Canada, will be on sale for \$12 apiece at the NCA monthly meetings until they are sold out. This means you can obtain this fine annual publication at a substantial discount through NCA, making it another astronomical shopping benefit of NCA membership. Please bring a check made out to "National Capital Astronomers" rather than cash. If you wish to buy a copy but cannot attend the meeting, please call me evenings or weekends to make other arrangements. Thanks.

Jeff Norman, (202) 966-0739

Don't throw this newsletter away. If you are finished with it, pass it on to someone else to read. If not, then recycle it. It's right for the environment.



National Capital Astronomers, Inc.

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NCA is a non-profit, membership supported, volunteer run, public-service corporation dedicated to advancing space technology, astronomy, and related sciences through information, participation, and inspiration, via research, lectures, presentations, publications, expeditions, tours, public interpretation, and education. NCA is the astronomy affiliate of the Washington Academy of Sciences. All are welcome to join NCA. For information: 301/320-3621 or 703/841-4765.

SERVICES & ACTIVITIES:

Monthly Meetings feature presentations of current work by researchers at the horizons of their fields. All are welcome; there is no charge. See monthly *Star Dust* for time and location.

NCA Volunteers serve as skilled observers frequently deploying to many parts of the National Capital region, and beyond, on campaigns and expeditions collecting vital scientific data for astronomy and related sciences. They also serve locally by assisting with scientific conferences, judge science fairs, and interpreting astronomy and related subjects during public programs.

Discussion Groups exchange information, ideas, and questions on preselected topics, moderated by an NCA member or guest expert.

Publications received by members include the monthly newsletter of NCA, *Star Dust*, and an optional discount subscription to *Sky & Telescope* magazine.

NCA Information Service answers a wide variety of inquiries about space technology, astronomy, and related subjects from the public, the media, and other organizations.

Consumer Programs on selection, use, and care of binoculars and telescopes, provide myth-breaking information, guidance, and demonstrations for those contemplating acquiring their first astronomical instrument.

Dark-Sky Protection Efforts educate society at large about the serious environmental threat of light pollution, plus seek ways and means of light pollution avoidance and abatement. NCA is an organizational member of the International Dark-Sky Association (IDA), and the National Capital region's IDA representative.

Classes teach about subjects ranging from basic astronomy to hand-making a fine astronomical telescope. NCA's instructors also train educators in how to better teach about space technology, astronomy, and related sciences.

Tours travel to dark-sky sites, observatories, laboratories, museums, and other points of interest around the National Capital region, the Nation, and the World.

Discounts are available to members on many publications, products, and services, including *Sky & Telescope* magazine.

Public Sky Viewing Programs are offered jointly with the National Park Service, the Smithsonian Institution, the U.S. Naval Observatory, and others.

NCA Juniors Program fosters children's and young adults' interest in space technology, astronomy, and related sciences through discounted memberships, mentorship from dedicated members, and NCA's annual Science Fair Awards.

Fine Quality Telescopes up to 36-cm (14-inch) aperture are available free for member's use. NCA also has access to several relatively dark-sky sites in Maryland, Virginia, and West Virginia.

YES! I'D LIKE TO JOIN THE NATIONAL CAPITAL ASTRONOMERS

Enclosed is my payment for the following membership category:

- Regular
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 Star Dust only (\$24 per year)
- Junior (Only open to those under age 18) Date of birth: _____
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If family membership, list names of additional participating immediate family members in same household, with birthdates of all those under 18 years old: _____

Note: If you already subscribe to *Sky & Telescope*, please attach a recent mailing label. You may renew this subscription through NCA for \$24 when it expires.

Make check payable to: **National Capital Astronomers, Inc.**, and send with this form to:

NCA c/o Jeffrey B. Norman, 5410 Connecticut Avenue, NW, Apt. #717, Washington, D.C. 20015-2837.

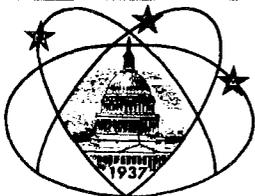
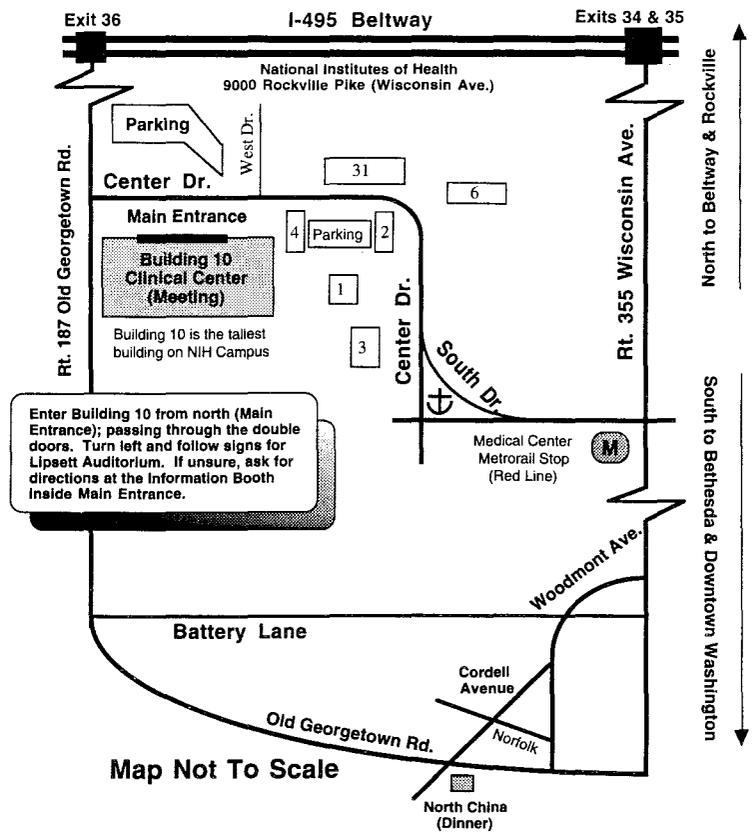
The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

Getting to the NCA Monthly Meeting

Metrorail Riders - From Medical Center Metro Stop: Walk down the hill, pass the bus stops and turn right at the anchor onto Center Drive. Continue uphill to Building 10 (walking time about 10 minutes), the tallest building on campus. Also, the J2 bus line connects the Bethesda (7:16 PM) and NIH (7:23 PM) Metro stops with Building 10 (7:25 PM).

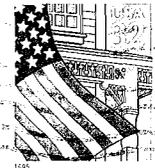
To North China Restaurant—Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont (or take the next right onto Battery Lane). Follow Woodmont to Old Georgetown Road and make a right. The restaurant is a few blocks on the left (7814 Old Georgetown Road). Alternatively, turn right on Cordell from Woodmont and proceed a few blocks to Old Georgetown, where you will come out right near the restaurant. There is parking around the corner on a side street. Seats are not guaranteed after 5:30.

Star Dust is published ten times yearly (September through June) by the National Capital Astronomers, Inc. (NCA), a non-profit, astronomical organization serving the entire National Capital region, and beyond. NCA is the astronomy affiliate of the Washington Academy of Sciences and the National Capital region's representative of the International Dark-Sky Association. Phone Numbers: 301/320-3621 or 703/841-4765. President, Wayne H. Warren, Jr., 301/474-0814. Deadline for *Star Dust* is the 15th of the preceding month. Editors Alisa & Gary Joaquin, 7821 Winona Ct., Annandale, VA 22003, 703/750-1636, E-mail-see deadline box for new address. Daniel J. Costanzo, Editorial Advisor. *Star Dust* © 1995 may be reproduced with credit to National Capital Astronomers, Inc.



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