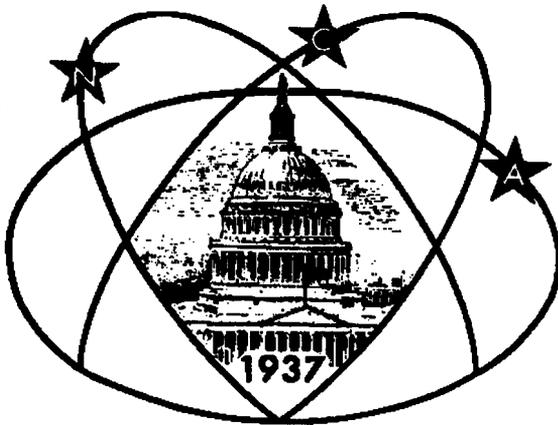


# Star



# Dust

National Capital Astronomers, Inc.

Phone: 301/565-3709

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## Roving and Revolving Over the Red Planet

by James R. Zimbelman

The next meeting of the National Capital Astronomers will be held on Saturday, November 1 at 7:30 P.M., in the Lippsett Auditorium on the main floor of the Clinical Center (Building 10) at the National Institutes of Health (NIH). James R. Zimbelman of Center for Earth and Planetary Studies will speak on "Roving and Revolving Over the Red Planet." The speaker sent the following abstract and biography.

The dramatic landing of Mars Pathfinder on July 4 brought Mars back to the attention of the world. After an absence of 15 years (since we lost contact with Viking lander 1), we were back on the Martian surface. The mobility of the Sojourner rover has brought a new dimension to exploring Mars, and this lecture will summarize some of the major activities and preliminary results obtained by Pathfinder to date. On Sept. 11, Mars Global Surveyor (MGS) went into orbit around Mars, becoming the

first U.S. orbiter at the Red Planet since Viking Orbiter 2 arrived in 1976. The spacecraft will adjust its orbit using aerobraking passes through the upper atmosphere of Mars for several months, but prior to the aerobraking one periapsis pass was devoted to the science instruments. The first results from the MGS science teams were presented at a science conference on October 2, and these results will also be summarized in the lecture. Both Pathfinder and MGS represent a resurgence of attention on Mars by NASA, and the lecture will close with some of the plans for other spacecraft that are scheduled to be launched during the next several years.

James Zimbelman received a B.A. in physics and Mathematics from Northwest Nazarene College, Nampa, ID in 1976. He received his M.S. in Geophysics and Space Physics from U.C.L.A in 1978. In 1984, he received

a Ph.D. in Geology, Arizona State University, Tempe, AZ. From 1984 to 1988, he was a post-doctoral fellow and staff scientist at the Lunar and Planetary Institute in Houston, TX. From 1988 to the present, he has worked as a geologist at the Center for Earth Planetary Studies at the National Air and Space Museum at the Smithsonian Institution in Washington, DC. Dr. Zimbelman's research interests are geologic mapping and remote sensing analysis of Mars and Venus, computer simulations of lava flows on the terrestrial planets, and sand transport in the Mojave Desert of California. During graduate school, he was a member of the Science Flight Team for the Viking orbiter mission to Mars on the Infrared Thermal Mapper experiment (Hugh Keiffer, P.I.). He is currently the Chairman of the Planetary Geology Division of the Geological Society of America. ○

## Extra Solar Planets

Review by Andrew W. Seacord, III

The 1997 September NCA meeting featured the presentation "Extra Solar Planets" given by Alan Boss of Carnegie Institution of Washington, Department of Terrestrial Magnetism. Extra solar planets are those which have been discovered orbiting around stars. Most of these stars are similar in size and temperature to our sun, a G2 main sequence dwarf.

For the first part of his presentation, Dr. Boss discussed methods by which the planets are detected. These methods fall under two categories, direct and indirect. By direct, it is meant that the planet itself, is observed as an object separate from the star it orbits. To do so, the light of the star must be masked by a device (a coronagraph) because the planet only reflects light from the star

and, therefore, its faint brightness is overwhelmed by the star's light. Current technology does not permit this

*PLANETS, Continued on page 2*

### Next Generation Space Telescope

The review of *Seeing the First Objects With the Next Generation Space Telescope* was not available at press time. It will be published in the next Newsletter.

## Calendar of Monthly Events

### The Public is Welcome!

NCA Home Page: <http://myhouse.com/NCA/home.htm>

**Saturday, November 1, 5:30 PM**-Dinner with the speaker and other NCA members at the Faryab Afghan Restaurant, 4917 Cordell, Bethesda, MD. See map and description on back page.

**Saturday, November 1, 7:30 PM**-NCA meeting, will feature James Zimbelman speaking on "Roving and Revolving Over the Red Planet." For directions, see map and description on back page.

**Mondays, November 3, 10, 17, and 24, 7:30 PM**-Public nights at 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 Washington-Baltimore region. Held regardless of cloud cover. Information: USNO Public Affairs Office, 202/762-1438. Home page: <http://www.usno.navy.mil>.

**Tuesdays, November 4, 11, 18, and 25, 7:30 PM**-Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

**Fridays, November 7, 14, 21, and 28, 7:30 PM**-Telescope making classes at American University,

McKinley Hall Basement. Information: Jerry Schnall, 202/362-8872.

**Fridays, November 7, 21, and 28, 8:30 PM**-Open nights with NCA's Celestron-14 telescope at Ridgeview Observatory; near Alexandria, Virginia; 6007 Ridgeview Drive (off Franconia Road between Telegraph Road and Rose Hill Drive). Information: Bob Bolster, 703/960-9126. Jupiter and Saturn are featured.

**Saturday, November 8, 7:00 PM**-"Exploring the Sky," Rock Creek Park, near the Nature Center. Information: 202/426-6829. This program will return in the spring.

During questionable weather, call the IOTA Hotline (Phone: 301/474-4945) for NCA meeting status. The absence of a cancellation notice on the Hotline means the meeting will take place.

See page 8 for more Washington area astronomical events. Other events too numerous to list in *Star Dust* are listed in the publications *Sky & Telescope*, the *Astronomical Calendar 1997*, the *Observer's Handbook 1997*, in numerous software packages, and other links available on the NCA Home Page (see above for address). NCA members can purchase all these (and much more) at a discount. To join NCA, use membership application on page 9.

### PLANETS, Continued from page 1

because no existing telescope can resolve the planet and star as two separate objects. So far, all extra solar planets have been detected only by indirect means.

Two indirect methods were discussed. Earlier attempts to detect the presence of a planet orbiting the star were based on the wobble of its star's position caused by its motion around the star-planet common center of mass (barycenter). From observations made between 1916 and 1963, Peter Van de Kamp, at the Swarthmore College Observatory, claimed the detection of such motion of Barnard's star. However, George Gatewood, using new data ob-

tained with a different telescope, failed to duplicate Van de Kamp's results. Furthermore, John Hershey, also of the Swarthmore College Observatory, later discovered that the "jump" which Peter Van de Kamp detected in Barnard's star's proper motion, resulted from the refurbishment of the telescope's optics during the observation period.

The technique which two Swiss astronomers, Michel Mayor and Didier Queloz, observing at the Haute Provence Observatory in France employed to detect the planet around 51 Pegasi was based upon measuring the velocity along the observer's line of sight (the radial velocity) which changes periodically toward and away from the observer. The position of the

spectral lines in the star light shift periodically toward the red end of the spectrum (as the planet moves away from the observer) and then toward the blue end of the spectrum (as the planet moves toward the observer). By means of the Doppler principle, the planet's orbital velocity is computed from the magnitude of the spectral line shift. Mayor and Queloz measured a Doppler velocity magnitude of 60 meters per second. The velocity curve was a sine curve between -60 and +60 m/s with a period of 4.3 days. Applying Kepler's laws to the data shows that the mass of the planet is on the order of 0.46 times the mass of Jupiter and the planet's orbit is circular

PLANETS, Continued on page 3

with a distance from the star (the orbital radius) of 0.05 times that of the average Earth-Sun distance; that is, a distance of 0.05 astronomical units (au). Therefore, this massive planet would lie well inside Mercury's orbit if it were in an orbit around our Sun. For comparison, Mercury has an orbit radius of 0.39 au and a period of 88 days.

This result was soon verified by two American astronomers, Geoff Marcy and Paul Butler, using the 120 inch telescope of the Lick Observatory. That was followed by Marcy and Butler's own detection of a planet around another solar type star, 47 Ursa Majoris. That planet has an orbital period of 1,103 days (3 years, 7 days) and a mass of about 2 to 3 times that of Jupiter.

These planets revolve around main sequence stars similar to our Sun. 51 Peg has a spectral type G3, 47 UMa is a G3 star, and the Sun is a G2 star. However, in 1992, Alexander Wolszczan and Dale Faril announced their discovery of two planets revolving around the pulsar PSR1257+12, a planet of 3.4 Earth masses with an orbital period of 66.6 days and a planet of 2.8 Earth masses with a period of 98.2 days. In 1994, Wolszczan announced that a third planet exists in the PSR1257+12 system, an Earth-moon sized planet with a period of 25.3 days.

Two questions motivated a discussion of the theories of stellar and planetary formation: "How can a Jupiter-sized planet for so close to the parent star?" and "What is the difference between a brown dwarf and a large planet?"

Stars are formed when a cloud of gas collapses around a cool, dense region in the interstellar medium. The collapse starts slowly at first. As the speed of the gas toward the center increases, the cloud may fragment into two or more components. Higher density clouds heat up quickly. Fragmentation will continue until the gas density increases to the extent that thermal pressure prevents further fragmentation. Two fragments orbiting around their common center of mass will form a binary star, usually with an elliptical orbit with a high eccentricity. A star, produces its energy from the thermo-

nuclear fusion of hydrogen. Hydrogen fusion can only take place when there is enough mass — at least 0.08 solar masses — to create the necessary temperature and pressure at the core. Jupiter has a mass of 0.001 solar masses; therefore, the minimum stellar mass is about 80 Jupiter masses. When a proto-stellar fragment has a mass less than 80 Jupiter masses, a brown dwarf is formed. Dr. Boss pointed out that the image of Gliese 229B, a brown dwarf orbiting at a distance from its companion, Gliese 229A, is sufficient enough that it can be resolved.

Planets seem to be formed from circumstellar discs of rotating gas and dust resulting from the collapse of the star. Dust grains settle in less than 10,000 years and collide with each other, eventually forming clumps. The clumps accrete into 10 km sized proto-planetary objects within about 100,000 years and terrestrial sized planets within 100 million years. Jovian planets have large rocky cores which are for enough from the hot star that they collect gasses and form thick envelopes. For a solar-type star, they must form no closer in than about 5 times the Earth-Sun distance (5 au) from the star. (Jupiter is 5.2 au from the Sun.) Also, they must form soon enough before the gas in the circumstellar disc is driven off by the stellar wind. The rocky, or terrestrial, planets are formed inside the 5 au limit.

If this process is correct, the question is "How can the Jupiter-sized planet around 51 Pegasi form so close to the star?". The answer to this, as Dr. Boss explained, is that the planet may have formed in the gas giant region and migrated inward toward the star. He presented two mechanisms for the migration. One mechanism involves a spiral structure which develops in the planetary disc; the spiral arms pull the planet inward. The other mechanism involves viscosity in the proto-planetary which causes some mass to move inward and other mass to move outward.

The resulting stellar system structure is as follows. Brown dwarfs form in

a highly eccentric orbit if the stellar companion mass is greater than 5 Jupiter masses. If this mass is less than 5 Jupiter masses, a gas giant planet in a low eccentric (close to circular) orbit is formed. Hot Jovian planets would migrate inward. The disc from which the 51 Pegasi system was formed survived long enough for the planet to migrate in to its current location. The disc no longer acts on the planet which is now, apparently, in a stable orbit.

Future research into planetary systems will require the ability to detect the presence of Earth-sized planets and, hopefully, be able to separate the image of large planets from their star. This requires telescopes with greater sensitivity and resolving power than are currently available. The 10 meter Keck telescope on Mauna Kea in Hawaii will be outfitted with 2 meter outrigger telescopes to form an interferometer which will be able to resolve two objects spaced 10 micro-arc seconds apart. Also, a space interferometer is being considered which will be placed in a 5 au orbit around the Sun. This large orbit is required so that interferometer will be outside the band of interplanetary dust which creates the zodiacal light. The interferometer, itself will consist of two telescopes at the ends of a 75 meter boom. The instrument will be sensitive to infrared radiation with a wavelength around 10 microns so that it has a chance of detecting the thermal radiation of a planet close to a star.

Following the talk, Dr. Boss responded to a question from the audience which was "Can 51 Peg be an intrinsic variable?". This question refers to the conjecture which tries to explain the variation in the star's spectrum to be due to a periodic expansion and contraction of its atmosphere rather than due to a periodic motion caused by an orbiting planet. Boss, reply was that the luminosity (total power output) of the star is known to be constant to 1/5,000. A periodic expansion and contraction would cause the luminosity to vary as well. ○



Don't throw this newsletter away. If you're finished with it, pass it on to someone else to read or recycle it. It's right for astronomy and the environment.

# Images From Mars Pathfinder

October 8, 1997 Press Conference Photos by Dr. Henry Moore



The Sojourner rover image of the "Cabbage Patch" shows small rounded objects on the surface that are about 3-4 cm across. Some of these are within excavations, which are about 0.5 cm wide. Several questions arise about the pebbles: 1) Why are they round? 2) Where did they come from? 3) What do they mean? Geologists use Multiple Working Hypotheses when attempting to explain observations. Some hypotheses that could account for the pebbles are:

- They were rounded during transport by waters or catastrophic floods and deposited on the Ares Vallis flood plain.
- They were rounded by wave action on an ancient Martian beach.
- They were rounded by glacial transport.
- They are glasses that were produced by melting during impact cratering. The glass was first ejected from the crater, then molded into spherical shapes or drops as it traveled through the atmosphere, and finally was deposited at the sites.

- They are spatter from lava flows.
- They are nodules brought up from the deep Martian interior by lava flows or pyroclastic eruptions.
- They are concretions formed in sedimentary rocks.
- They came from ancient conglomerate rocks. The pebbles were rounded by water action and subsequently lithified into conglomerate rocks. Later, the waters of catastrophic floods transported the conglomerates and deposited them on the Ares flood plain. The pebbles were then freed from the rocks by weathering.
- A combination of the above.



Pebbles are also seen in lander images, along with cobbles. For example, in this picture, we see the same pebbles that were visible in the Sojourner rover image of the "Cabbage Patch". In addition, a cobble within the rock "Lamb" (upper left) is apparent. This indicates that Lamb may be a conglomerate (Lamb is 0.32 m x 0.15 m).



*The composite image from the Pathfinder lander shows the rock "Shark" at upper right (Shark is about 0.69 m wide, 0.40 m high, and 6.4 m from the lander). The rock looks like a conglomerate in Sojourner rover images, but only the large elements of its surface textures can be seen here. This demonstrates the usefulness of having a robot geologist able to examine rocks up close.*

*The composite image of the "Rock Garden" shows the rocks "Shark" and "Half Dome" at upper and middle, respectively. Between these two large rocks is a smaller rock (about 0.20 m wide, 0.10 m high, and 6.33 m from the Lander) that was observed close-up with the Sojourner rover .*



## PEBBLES, COBBLES, AND SOCKETS



### SHARK - SOL 71

Henry Moore

*This Rover image of "Shark" (upper left center), "Half Dome" (upper right), and a small rock (right foreground) reveal textures and structures not visible in lander camera images. These rocks are interpreted as conglomerates because their surfaces have rounded protrusions up to several centimeters in size. It is suggested that the protrusions are pebbles and granules.*

### Greetings

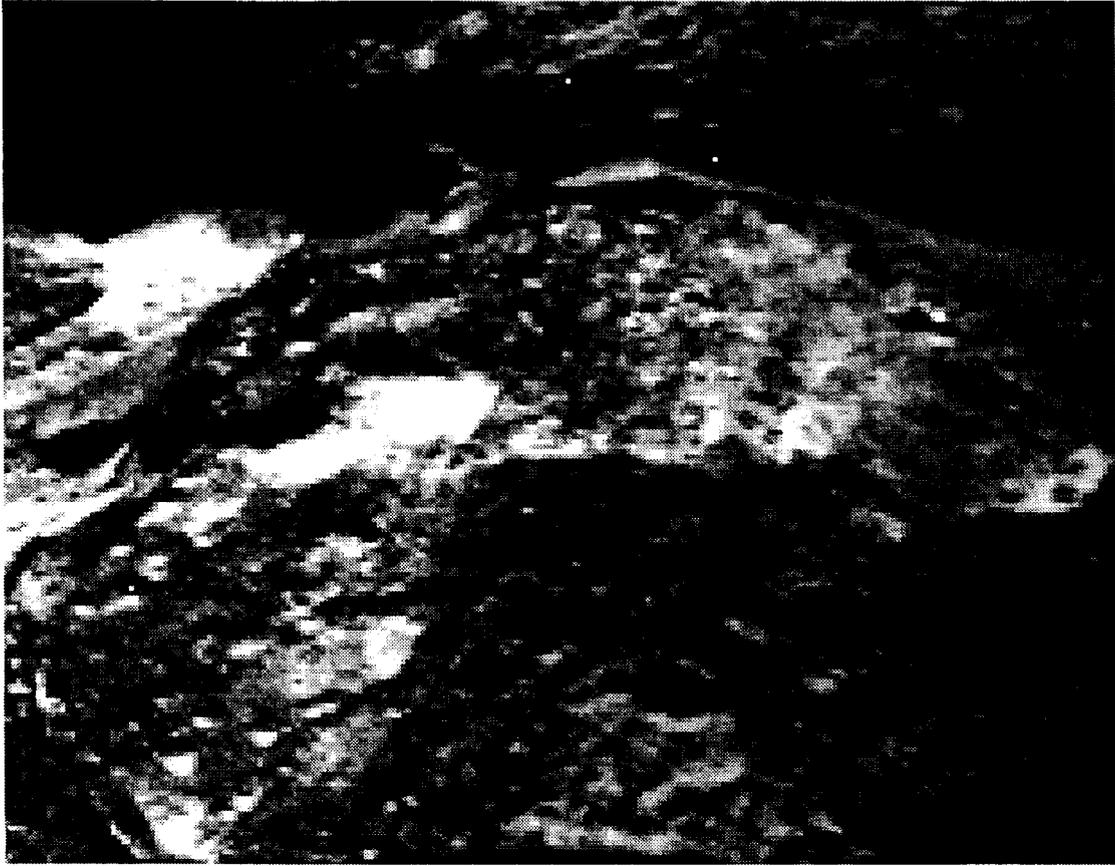
*An open letter from  
Geoffrey Lane*

It is with great sadness in my heart that I must inform you and all the members, friends, and associates of the National Capital Astronomers that I am moving to Hawaii and our program "Comet Crashers" will become a fading memory.

We at the nature center appreciate all the support and advertising that we have received from the *Star Dust* and all the members which joined us during the last 3 years and made the "Comet Crashers" one of the most successful long term programs in not only our nature center, but also in our entire Natural & Historical Resources Division.

*(Geoffrey Lane gives his thanks. The stargazing programs at Patuxent River Park will still continue. For more information, call 301/627-6074 and ask for Jean Tierney.)*

## SOCKETS AND PEBBLES



### small rock - Sol 71

**Henry Moore**

*This close-up Sojourner rover image of a small rock shows that weathering has etched-out pebbles to produce sockets. In the image, sunlight is coming from the upper left. Sockets (with shadows on top) are visible at the lower left and pebbles (with bright tops and shadowed bases) are seen at the lower center and lower right. Two pebbles (about 0.5 cm across) are visible at the lower center.*

To view more images from the Mars Pathfinder October 8, 1997 Press Conference , you can find them at the following web site: [mpfwww.jpl.nasa.gov/ops.html](http://mpfwww.jpl.nasa.gov/ops.html) — ed.

### Welcome New Members

**Julie McCall**  
739 Rock Creek Church Road, NW  
Washington, DC 20010

**Vincent McCullough**  
13899 Ferrara Court  
Chantilly, VA 20151

**Norman C. Peterson**  
17732 Caddy Drive  
Derwood, MD 20855

**Zacharias P. Walters, Jr.**  
3605 Astoria Road  
Kensington, MD 20895-1404

**John & Abigail Ward**  
(Juniors: Nat & Katie)  
5511 39th Street, NW  
Washington, DC 20015

## National Capital Area Astronomical Events

Free Lectures at the Einstein Planetarium and Other Daily Events  
National Air & Space Museum

202/357-1550, 202/357-1686, or 202/357-1505 (TTY)

Home page: <http://www.nasm.edu>

### Other Area Astronomical Events

#### Other Planetariums, Observatories, and Science Centers in the Area

**Montgomery College Planetarium** — "Total Solar Eclipses" Takoma Park, MD. November 15. (See their web site at <http://myhouse.com/mc/planet.htm>.)

**Campus Observatory Open House** — "Life in the Universe", speaker: Dr. Virginia Trimble. Department of Astronomy, University of Maryland, College Park, MD. November 5, 8:00 PM.

"Nemesis — The Sun's Companion", speaker: Dr. Roger Bell. Department of Astronomy, University of Maryland, College Park, MD. November 20, 8:00 PM.

**U.S. Naval Observatory Colloquia** — "GPS Applications in the NASA Solid Earth and Natural Hazards Program", speaker: Dr. Clark Wilson of Nasa Headquarters and University of Texas, Austin. U.S. Naval Observatory, Building 52, Room 300, Washington, DC. November 14, 10:30 AM. Information: 202/762-1437.

**Mount Rainier Nature & Recreation Center** — "Moon Madness" November 14, 7:00-8:30 PM. Historic Bladensburg Waterfront Visitors Center, 4601 Annapolis Rd, Bladensburg, MD. Due to construction, activities at the Waterfront Center may be moved to an alternate site. Call Jean Tierney at 301/627-6074 for information.

**Center for Adult Education** — "Observing the Highest Energy Particles ( $>10^{20}$  eV) from Space" November 13-15. University of Maryland, College Park, MD. See sidebar for details.

Check your local web sites for any other events that may be happening in the area.

### NCA OPEN HOUSE

**Hopewell Observatory  
Bullrun Mountain**

**November 22, 1997**

*Check your September issue of  
Star Dust for details and  
Directions.*

### Newsletter Deadline for December *Star Dust* November 15, 1997

Send Submissions to Alisa & Gary Joaquin, at 4910 Schuyler Dr, Annandale, VA, 22003-5144, Leave a message on voice mail 703/750-1636. Text files or graphic files in .GIF or .TIFF may be sent via E-Mail to [ajglj@erols.com](mailto:ajglj@erols.com) or fax submissions to 703/658-2233. **No submissions will be accepted after the 20th.** There will be no exceptions. We need a reasonable amount of time to design, edit, and review this newsletter. We would appreciate everyone's help in this matter. Thank you.

## Cosmos Revisited November

November 4	Star Formation by Anneila Sargent
November 18	Extrasolar Planets by Geoff Marcy
November 25	Special Viewing of IMAX Film, "Cosmic Voyage"

Lectures begin at 6:00 PM at the National Air and Space Museum. For more information, call Missy Snelling at 202/357-4260.

### Workshop on "Observing the Highest Energy Particles ( $>10^{20}$ eV) from Space"

**November 13, 14, and 15  
Center for Adult Education  
University of Maryland**

Consecutive topics will be presented in the following areas:

Potential Observation from Space  
New Physics and Astrophysics  
Detector Physics  
Properties of the Atmosphere as a  
Detector Seen from Space  
Plans for Ground Based Observations

Registration Fees:  
\$231.00 (\$31.00 lunches and breaks)  
Dinner (Nov. 13) cost is \$29.00

You may register electronically or contact Jonathan Ormes by email: [Ormes@1heamail.gsfc.nasa.gov](mailto:Ormes@1heamail.gsfc.nasa.gov).

Information about the University of Maryland Conference Center is located at <http://www.marriot.com/confcenters/WASUM/Index.htm>.

If hotel accommodations are required, a limited number of sleeping rooms have been reserved at The Inn at the University of Maryland. Check our website for conference information and other hotel listings and their rates. (<http://1heawww.gsfc.nasa.gov/docs/gamcosray/hecr/Conferences/U971113/UHECR>)

# National Capital Astronomers, Inc.

## SERVING SCIENCE & SOCIETY SINCE 1937

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: 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, judging 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 Clinics** 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 astronomy and related subjects.

**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

*Sky & Telescope* and *Star Dust*. (\$54 per year)

*Star Dust* only (\$27 per year)

Junior (Only open to those under age 18) Date of birth: \_\_\_\_\_

Junior members pay a reduced rate.

*Sky & Telescope* and *Star Dust*. (\$42 per year)

*Star Dust* only (\$15 per year)

			(____)_____
First name	Middle	Last name	Telephone
Street or Box	Apartment	City	State      Zip Code + 4

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 \$22 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!**

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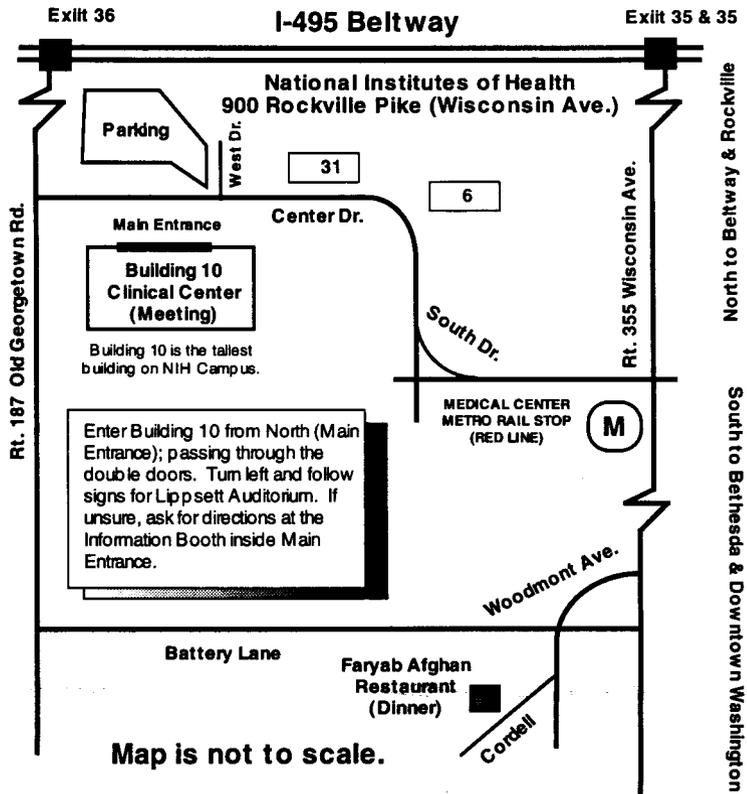


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# Getting to the NCA Monthly Meeting

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

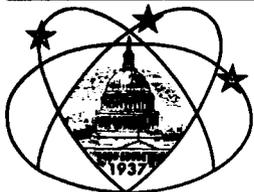
**To Faryab Afghan Restaurant** - Take Wisconsin Avenue toward Bethesda and head right onto Woodmont. Take a right onto Cordell. The restaurant is at 4917 Cordell. There are parking garages nearby.



*Star Dust* is published ten times yearly (September through June) by the National Capital Astronomers, Inc. (NCA), a nonprofit, 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. NCA's Phone Number 03/841-4765. President: Harold Williams, 301/565-3709. Deadline for *Star Dust* is the 15th of the preceding month. Editors: Alisa & Gary Joaquin, 4910 Schuyler Dr., Annandale, VA 22003, 703/750-1636, E-mail: [ajglj@erols.com](mailto:ajglj@erols.com). Editorial Advisor: Wayne H. Warren, Jr. *Star Dust* © 1997 may be reproduced with credit to National Capital Astronomers, Inc.

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Rockville, MD 20852-3331



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November 1997