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The Winds of Other Worlds

by Harold Williams

The next meeting of the National Capital Astronomers will be held, Saturday November 4 at 7:30 P.M. in the Lipsett Amphitheater of the Clinical Center (Building 10) at the National Institutes of Health (NIH). Jeff Goldstein, Astrophysicist, Acting Chairman Laboratory for Astrophysics, National Air and Space Museum of the Smithsonian Institution, Washington, DC, will speak on "The Winds of Other Worlds." Jeff, together with researchers at NASA Goddard Space Flight Center, and the Observatoire de Paris at Meudon, made the first direct measurement of the global winds above the Venusian cloud-tops and on Mars. Beyond his research interests, Jeff is extensively involved in educational programming at the National Air and Space Museum. He has given over 200 lectures at schools (concentrating on the elementary and middle level), to the public at large, and at teacher workshops. Jeff Goldstein received a B.A. in physics from the City University of New York in 1980, and an M.S. and Ph.D. in astronomy and astrophysics from the University of Pennsylvania in 1987 and 1989, respectively. The speaker sent the following abstract of his talk:

"From the NASA Infrared Telescope Facility atop 14,000 foot (4,200 meter) Mauna Kea, on the island of Hawaii, researchers are using infrared instruments to measure winds on other planets to

2 meters per second (4 miles per hour [mph]). What about the fact that the planet is usually rushing away or toward the telescope at 8 kilometers/sec (about 1600 mph)? No problem! They make sure they've got that gravitational theory under their belts and they use the right carbon dioxide laser. The frequency of light it creates lets them measure the wind velocities. The frequency of the light, though, depends on the length of the laser's housing which varies when the temperature changes at the telescope. And boy does it change. So they make the laser out of an alloy called Invar which only varies one millionth of a meter per degree Celsius. Yet that's enough to add a 500 mph uncertainty to the wind speed they measure! You're kidding right? No! These guys measure gentle breezes on planets maybe hundreds of millions of miles away by always knowing their laser's length to ten billionths of a meter! How come they're into weather on other worlds anyway? The weather folks on the 6:00 news can't even get it right for our own planet. And how come they need a laser? In fact what is a laser? How do they solve that crazy temperature problem? What's it like to observe when you're sick to your stomach at 14,000 feet? What did they find on Venus, Mars, and Ti-

tan? Hey - come to the talk! It's going to be chock full of concepts that are good for you, and you'll even get to see what it's like to do space science at the top of the World in the Pacific. Astronomy — it's not a job, it's an adventure. Trust me. Well, at least come to the talk."

The abstract may be a little irreverent as is our real New Yorker speaker, but he comes Stephanie Williams (my thirteen year old daughter) approved as one of the best speakers at the 1995 Astronomical Society of the Pacific Universe '95 Conference in College Park, Maryland. The speaker also sent this to me as background for the talk:

"The same physical laws that shape our Earth manifest themselves in dramatically different ways from planet to planet. In every sense, each world has a distinct personality. The field of comparative planetology (CP) holds that Earth is but one member of a family of worlds, and through comparison we can better understand the underlying processes that shape them all. Researchers from the Laboratory for Astrophysics, NASA Goddard Space Flight Center, and the Observatoire de Paris at Meudon, are studying atmospheric circulation on Mars, Venus, Titan, and

See *WINDS*, on page 5

Calendar of Monthly Events

The Public is Welcome!

Wednesday, November 1-November "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many other events for that month.

Fridays, November 3, 10, 17, and 24, 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.

Fridays, November 3, 10, 17, and 24, 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). Saturn is the featured object this month, well placed for observation with the ring plane becoming backlit by the Sun enabling Earthbound observers to see the "dark side" on the 19th. See article on page 70 of the November issue of *Astronomy* magazine. Information: Bob Bolster, 703/960-9126.

Saturday, November 4, 10:30 AM to 4:00 PM-NCA presents "Binoculars! Telescopes! Astronomy!" *Free consumer advice*. The Smithsonian Institution, National Air & Space Museum, Milestones of Flight Gallery. See page 6.

Saturday, November 4, 5:30 PM-Dinner with the speaker, Jeff Goldstein, at Bish Thompson's Seafood Restaurant, 7935 Wisconsin Avenue, Bethesda, Maryland, before the monthly meeting. Reservations are for 5:30 PM sharp. See the map on the back page of this issue for directions.

Saturday, November 4, 7:30 PM-The November NCA meeting will feature Jeff Goldstein speaking on "The Winds of Other Worlds." Meeting will take place at the National Institutes of Health in the Lipsett Amphitheater, Room 1c114 in the Clinical Center (Building 10). See back page for directions.

Mondays, November 6, 13, 20, and 27, 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, November 7, 14, 21, and 28, 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. See article on page 4

Saturday, November 11, 7:30 PM-NCA presents "Exploring the Sky", in Rock Creek Park at Military and Glover roads, NW. Information: Rock Creek Nature Center, 202/426-6829; Joe Morris (NCA), 703/620-0996. See March 1995 issue, page 4.

Saturday, November 18, Before Dawn-Leonid meteor shower peak. See article in November *Sky & Telescope* and "Meteors" section of the *Astronomical Calendar 1995*.

Saturday, November 18, Night-Waning crescent Moon provides this month's *second longest* Saturday night "deep night" period, including completely Moonless skies from dusk through Midnight EST. See November 25 listing. (November's first two Saturday nights, November 4 and 11, each provide Moonless skies of less than two hour's duration — not very much time for experiencing "deep night.")

Saturday, November 25, Night-Waxing crescent Moon provides this month's *longest* Saturday night "deep night" period (i.e., continuous time interval with neither daylight, twilight, nor Moonlight), with Moonless skies starting after Moonset early Saturday night. Several relatively dark-sky sites are available for NCA members' use in Maryland, Virginia, and West Virginia. Information: Daniel Costanzo, 703/841-4765.

Saturday, December 2, 7:30 PM-The December NCA meeting will feature Richard Gelderman speaking on "Understanding Active Galaxies Through Observations of their Ionized Gas."

Wednesday, December 6-December "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many events for that month.

S*T*A*R*S Space Technology, Astronomy & Related Sciences

by Daniel J. Costanzo

Welcome to S*T*A*R*S: space technology, astronomy, and related sciences, all united for the common good. S*T*A*R*S is the totality of what NCA is all about, as described below.

Below is a working listing I have created of the fields of human endeavor enclosed under the dome of knowledge I call S*T*A*R*S. Under each category, the fields are simply listed in alphabetical order, without explanation. NCA draws on these fields for subjects and speakers considered appropriate for NCA's publications, meetings, and other activities.

This is an evolving list. So it can be improved, modified, and added to as time goes on. I welcome constructive comments, suggestions, and additions:

Space Technology

Aerospace Engineering
Astronautics
Computer Systems

Earth Information Systems

Photo-Electro-Optical Instrumentation
Engineering
Scientific Visualization
Space-Based Communication
Space-Based Navigation & Guidance
Speckle Interferometry

Astronomy

Astroseismology
Astrometry
Celestial Mechanics
Cosmic Ray Astronomy
Extreme Ultraviolet Astronomy
Gamma Ray Astronomy
Gravity Wave Astronomy
Infrared Astronomy
Microwave Astronomy
Millimeter Wave Astronomy
Neutrino Astronomy
Observational Cosmology
Optical Astronomy
Radar Astronomy
Radio Astronomy
Stellar Astronomy
Submillimeter Wave Astronomy
Ultraviolet Astronomy
X-Ray Astronomy

Related Sciences

Archeology / Archaeoastronomy
Astrophysics / Space Physics
Biology / Life Sciences
Computer Science / Cybernetics
Earth System Science
Ecology / Paleocology
General Chemistry
Geodesy / Geodetic Science
Geography / Geographic Sciences
Geology & Geophysics
High Energy Physics / Particle Physics
Mathematics
Medical Research
Meteorology & Climatology
Oceanography / Oceanology
Paleontology / Paleobiology
Physical & Cultural Anthropology
Planetary Sciences / Planetology
Plasma Physics / Space Plasma Physics
Solar Physics
Statistics
Theoretical Cosmology

To paraphrase Mark Twain, "the difference between the right acronym and any acronym is the difference between lightning and a lightning bug." I believe that with "S*T*A*R*S" I have created the right acronym to describe the community of knowledge where NCA's interest lie. However, while my developing it was a long and drawn out process, the acronym itself actually came to me in an instant one day (1992 March 5 to be exact), like a flash of lightning. I know the exact date because at the time I was traveling to the appropriately named Star Hill Inn in Sapello, New Mexico, a self-styled astronomy retreat in the Rockies. I am certain that anticipating the dark skies over the Star Hill Inn had something to do with shaking "S*T*A*R*S" loose from my tangled net of neurons. However, that flash of insight had about two decades of thought behind it. And most of that train of thought was sparked and maintained by my participation in NCA.

After originating this acronym, I quietly bounced it off a number of colleagues who all thought it was a great

idea. (It helped that I carefully selected them for that purpose.) They felt it would be a shame for such an acronym to go to waste. So I gave S*T*A*R*S a home in NCA, where I have found it to be quite a useful tool. Since 1992, S*T*A*R*S has been put on handouts recruiting new NCA members, and quite successfully I should add. It is now time that S*T*A*R*S was introduced into the pages of *Star Dust* so its origin, meaning, and goals will be duly documented. Hence this article. The acronym S*T*A*R*S may be used by anyone so long as due credit is clearly given (preferably in writing) to both me, and NCA for originating it. And this article may be cited as the reference for where it came from.

What probably first strikes the reader about the above list is the wide range of fields lumped under "Astronomy" and "Related Sciences." While some may disagree with the appropriateness of a number of these fields, every one of them have been covered, in one form or another, by one or more of the rich variety of speakers addressing NCA's monthly meetings over the past two decades. I know that, because since 1974 I have been attending those monthly meetings or reading about them in *Star Dust*. Similarly, a number of speakers have made presentations to NCA that were almost exclusively about "Space Technology" with barely a hint of "Astronomy" and "Related Sciences" in them.

It was my attempting to come up with a way to describe this rich variety of NCA's speakers that led me to create the acronym S*T*A*R*S in the first place. For when asked by the public what kinds of fields of human endeavor we drew on for appropriate speakers, I was astounded to find that I couldn't easily explain. I now can; when NCA's meetings feature presentations of current work by researchers at the horizons of their fields, those researchers are being drawn from the fields of S*T*A*R*S. And while NCA officers recruiting speakers are supposed to

See STARS, on page 5

How to See The Universe, Make A Telescope, And Get The Biggest Bang For Your Buck With The Help of Mirror-Making Classes Conducted by Dr. Jerry Schnall

Part I

by Guy Brandenburg

Only a few of the wonders of the heavens are accessible to the unaided eye: the Milky Way; the Magellanic Clouds if you are south of the Equator, the Moon and planets; the constellations; rainbows, clouds, and moon-dogs; and a hint of a few galaxies and star clusters if the skies are really dark. To see more, you need some optical aids such as a decent pair of binoculars or a telescope of some kind.

But what kind? The choices among commercially available telescopes are staggering. What type of objective should you get — a reflector, a refractor, or a catadioptric which combines both reflection and refraction? What size aperture? What type of mounting? And what price range can you afford?

Even in this day of instant gratification via credit card, it is possible to get excellent results from making your own telescope by hand. What's more, the views from a well-made Newtonian reflector of moderate focal ratio will beat everything except the finest (and most expensive!) refractor. I also submit that a Dobsonian altazimuth mount, even for fairly small (15 to 20 centimeter [6 to 8 inch] aperture) reflectors, makes the use of the scope available instantly, rather than the minutes it takes owners of Maksutovs and Schmidt-Cassegrains or fancy refractors.

All in all, if you really want to see the wonders of the night sky with your own scope, and unless you have a humongous bank account, you should seriously consider making your own mirror and making a Dobsonian mount to go with it.

Making a refractor or a catadioptric is much too difficult for a beginner, but making a 10 to 20 centimeter (4 to 8 inch) aperture reflector is really fairly simple, as long as you learn how to do it

in Jerry Schnall's NCA mirror-making classes. These classes are on Tuesday evenings from about 7:00 to 9:30 p.m., at the Chevy Chase Community Center at Connecticut Avenue and McKinley Street, NW in Washington, and about the same time on Friday evenings in the basement of McKinley Hall at American University off of Nebraska Avenue, NW.

If you have never made a mirror, then you are much better off taking this class (to which you can come whenever you can; no one takes roll!) then you are trying to assemble all the various sizes of grit and polisher, make a pitch lap, calculate the various zones in your mirror, and so on. Making and learning how to use the Foucault measuring device needed to see which millionth of an inch of glass you need to remove from your mirror would be tricky to do all by yourself, but Jerry's NCA-sponsored class already has these items, and he has the expertise to show you how to use them. You do NOT need to be a machinist or an expert carpenter or refinisher or anything like that. Just be reasonably competent with your hands.

What's Involved In Making A Mirror?

Here is roughly what the process of making a parabolic mirror is like: (1) Several hours of rough grinding, in which you take two similar pieces of glass, put water and grit between them, and grind away with a special stroke until one of them (the future mirror) has an indentation of the right-depth in the middle. (2) Several more hours of intermediate grinding with a different stroke, wherein you use finer and finer grades of grit to remove the big marks left by the previous grades of grit, and wherein you

turn the crude indentation into a nice spherical surface of revolution. (3) Several more hours of really fine grinding, where you use slurries that look like diluted mustard sauce or mayonnaise, to get rid of the pits from step two. (4) About six to ten hours of polishing with optical rouge or cerium oxide and water, where you put your mirror on top of a faceted pitch lap. This step smooths out the glass so that it is, well, mirrorlike. (5) An unknown number of hours where you test your mirror using the Foucault tester mentioned earlier, press your mirror on the pitch lap for thirty minutes or so, do five to ten minutes of "figuring" to take off an extra millionth of an inch or two or less in a particular location, and then test some more and repeat the process again. This goes quite slowly, but you can suddenly discover that you are done! Note that most of the time you will be testing and pressing: the total amount of polishing time here is quite small. (6) Then you can either pay Jerry/NCA to aluminize your mirror for you or you could send it off to a lab somewhere else.

These classes are very small, so you can get individual assistance when you need tips or advice on your mirror. Jerry is no longer young nor extremely outgoing, and he favors equatorial mounts over Dobsonians, but he really knows a lot of practical optics — tricks I haven't seen in any of the mirror-making guides I've read. And he does all these classes for free, as far as I can tell. Who knows how long he'll feel like conducting these classes? Take advantage of this incredibly inexpensive opportunity while it lasts. There is nothing else like it in the entire National Capital region. For more information, call 202/362-8872.

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know intuitively who to ask, the above list represents the first time, to my knowledge, anyone in NCA has ever listed the fields NCA draws on.

My creating this acronym also came from an attempt to find a common theme drawing people to NCA membership. With S*T*A*R*S I found it. NCA is a diverse group of people from all walks of life. All are welcome to join NCA, since NCA's only membership criteria are that one have an inquiring mind, a fascination with S*T*A*R*S, and a sense of wonder. Besides the speakers, many NCA members also work as scientists and engineers in a wide variety of fields of S*T*A*R*S in government, academia, and industry.

Many other NCA members are private citizens with an abiding interest in S*T*A*R*S, and the adventure of Cosmic Discovery brought to them by S*T*A*R*S, through their tax dollars. Over the decades, this membership mix has proven most effective in providing a forum for open dialog about S*T*A*R*S through NCA's meetings and other activities.

The key here is to recognize the totality of an integrated whole to knowledge about the Universe that S*T*A*R*S represents. For instance, the catalyst of the Space Age made Earth science into space science, and visa versa. Now, a spacecraft on a mission from Planet Earth is basically on a mission to Planet Earth. That is but one example of this symbiotic relationship

of fields. But all the fields of S*T*A*R*S focus from a cosmic perspective toward one fundamental endeavor: providing a better understanding of who we are, where we came from, and where we are going.

The concept of S*T*A*R*S is spelled out in NCA's grand mission:

NCA is a nonprofit, membership supported, volunteer run, public-service corporation dedicated to advancing S*T*A*R*S — Space Technology, Astronomy & Related Sciences — through information, participation, and inspiration, via research, lectures, publications, workshops, expeditions, tours, public interpretation, education, and outreach.

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Meet Caleb Fassett

by John C. Tomlin

NCA Junior Member Caleb Fassett began to develop his interest in astronomy by reading hand-me-down copies of *Astronomy* magazine. Although he says he was "attracted by the photography," **the more he read, the more he became** interested in the subject matter. Caleb, who is fifteen years old, lives in Washington Grove, Maryland with his father, a research chemist with the National Institute of Standards and Technology, his mother, a librarian with the Montgomery County Department of Libraries, and his eleven year old brother, an aspiring baseball player. Caleb currently attends Montgomery Blair High School in the magnet program for science and mathematics.

Although Caleb was awarded an NCA membership for his 1994 Science Fair project entitled "Using Estimated Linear Diameter of Seyfert Galaxies and the Small Angle Formula to Compute the Hubble Constant," he had joined NCA on his own the preceding Fall. Caleb currently uses his 10 centimeter (4 inch) Schmidt-Cassegrain to scan the skies in search of favorite objects, which include the Great Nebula of Orion, Jupiter and its moons, and those Messier objects the he can pick out of the Grove's light-polluted skies. He also spends time with his neighbor, NCA member John Tomlin, and Tomlin's 33 centimeter (13 inch) Dob-

sonian in search of more elusive objects. Caleb's future plans definitely include college, but he is as yet undecided as to his favorite institution. "I'd like to go to MIT, because of their fine reputation in science," he says, but other schools such as Cornell are also on his list. His major field of study is also as yet undecided, but he feels that it will probably be one of the physical sciences. If he decided to study astronomy, he says he is more interested now in the observational, rather than the theoretical aspects of the field, but that could change. Caleb credits his mentor, NCA Vice President Harold Williams for the support and encouragement necessary on his science fair project as well as on his garnering National runner-up honors on the 1995 NASA-sponsored Student Space Science Involvement Project (SSIP). His SSIP proposal for the Hubble Space Telescope was to follow up on his previous study of Seyfert Galaxies and attempt to acquire more accurate data on their angular diameters.

Caleb's other academic interests include history and philosophy while in the nonacademic environment, one can find him playing baseball or tennis, working with his PC, surfing the Internet, or during the summer, bodysurfing the Atlantic at Bethany Beach.

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Jupiter. These CP studies are allowing atmospheric theory to be tested in dramatically different environments. Using ground-based infrared and millimeter wave techniques the group has made the first direct measurement of the global winds of Mars, measured the winds above the Venesian cloud tops, and has detected atmospheric circulation on Titan."

Newsletter Deadline for December *Star Dust* NOVEMBER 15, 1995

***** DO NOT BE LATE!!! *****
We will be in Nebraska November 21-28 for Thanksgiving. Submittals must be in by November 15th or there will be NO NEWSLETTER for December!! No submittals, no newsletter. It's that simple.

Send 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 AGJOAQ@ix.netcom.com or fax to 703/658-2233. Submissions must be on time or they may not get in.

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It is also reflected in NCA's being the astronomy affiliate of the Washington Academy of Sciences, quite a cross-disciplinary organization in its own right, and NCA members' direct support of S*T*A*R*S through a wide variety of vital services and activities.

The fact that NCA has long addressed S*T*A*R*S in such a comprehensive way makes NCA a unique organization. Much of this was due to the long leadership of Robert McCracken. Yet, science and technology are moving, both willingly, and by force, to this cross-disciplinary approach toward Cosmic Discovery. Martin Harwit (Former Director, National Air & Space Museum) briefly touched on this unifying of fields in his book *Cosmic Discovery: The Search, Scope, and Heritage of Astronomy* (The MIT Press, Cambridge, Massachusetts, 1984). And others have elsewhere. Today, what has traditionally been a disjointed set of insular disciplines is

finding that the natural phenomena they need to explain have turned out to be so complex as to force a cross-disciplinary approach to answer vexing questions. NCA's decades long heritage of lectures have shown this cross-disciplinary evolution towards an integrated whole of S*T*A*R*S.

Simultaneously, much of the S*T*A*R*S community now find themselves scrambling to explain their worth to the larger society that pays for

S*T*A*R*S connects you to the Universe NCA connects you to S*T*A*R*S

it who ever more loudly ask "you and who's money?" NCA provides a forum to show that taxpaying public just what their money is being used for. But NCA does so by allowing all to personally participate in the adventure of Cosmic Discovery with the assurance that they will be equally treated as colleagues, customers, and compatriots in that adventure. The S*T*A*R*S concept can

be a vehicle to garner and enhance this public support.

In summary, the World has changed many times since the end of World War II and the Cosmic Dawn of Sputnik. What is meant today by the seemingly simple terms "astronomy" and "astronomers" quickly explodes into a whole list of fields. S*T*A*R*S reflects that change, and that explosion of knowledge. But NCA has quite handily adapted to this evolving situation.

For NCA's strength comes from its uniting this diversity of fields under one dome of knowledge: the dome of S*T*A*R*S. NCA's strength also comes from its diversity of members, in

terms of their backgrounds, interests, and expertise. And NCA's inclusive membership unites them under one theme: we are ALL astronomers, and we are ALL astronauts. On the local level at least, NCA shows the World what is needed to carry S*T*A*R*S into the 21st Century and beyond

Binoculars! Telescopes! Astronomy! *Don't forget to attend this free informative consumer advice program.*

Learn to wisely choose, use, and care for astronomical instruments from NCA. Our knowledgeable and unbiased experts are available on Saturday, November 4, **any time** between 10:30 a.m. and 4:00 p.m., with myth-breaking information, guidance, and demonstrations.

Saturday, November 4 **National Air & Space Museum** **Milestones of Flight Gallery**

This free program is a joint gift of NCA and the Smithsonian Institution, National Air & Space Museum (NASM). Volunteers are still needed! NASM can provide volunteers with free parking. Information: Daniel Costanzo (NCA), 703/841-4765; Cheryl Bauer (NASM), 202/357-1529. The 10:30 a.m. starting time means this program begins as soon as the November NASM Monthly Sky Lecture ends. So if you arrive at NASM by 9:30 a.m. you can also attend the lecture in the Albert Einstein Planetarium, and this program afterward in the Milestones of Flight Gallery.

Serving Science & Society Since 1937
National Capital Astronomers, Inc. (NCA)



Attention Astronomical Shoppers!

NCA membership makes a great Holiday or birthday gift. It lets that special someone in your life enjoy *Star Dust* and *Sky & Telescope* magazine for an entire year. Renewing an NCA gift membership means these publications can be enjoyed year after year. For further gift shopping savings, NCA membership gets you a significant discount on all Sky Publishing Corporation publications and products. NCA experts are also ready to give free and unbiased consumer advice on buying binoculars, telescopes, etc. So think of NCA when you're doing astronomical gift shopping. For more details, see the membership application page at the end of this issue.



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: 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

Sky & Telescope and *Star Dust*. (\$48 per year)

Star Dust only (\$24 per year)

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

Junior members pay a reduced rate.

Sky & Telescope and *Star Dust*. (\$34 per year)

Star Dust only (\$10 per year)

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

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 Jeffery B. Norman, 5410 Connecticut Avenue, NW, Apt. #717, Washington, D.C. 20015-2837.

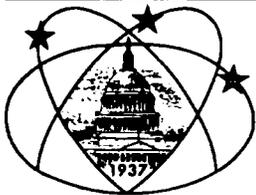
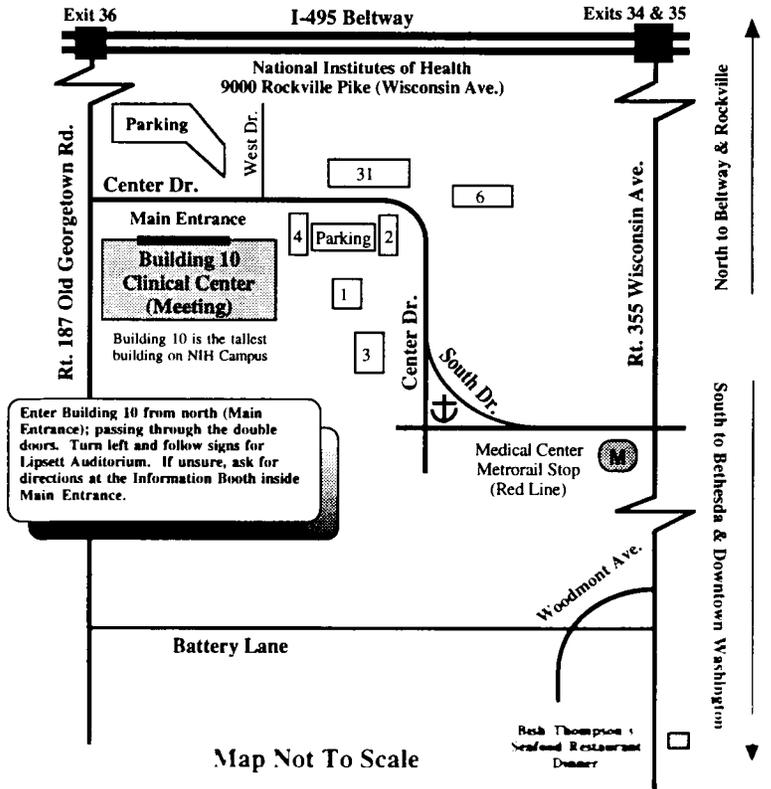
The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

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).

Bish Thompson's Seafood Restaurant - Take Wisconsin Avenue towards Bethesda and look for the restaurant on your left (address 7935 Wisconsin Avenue). Parking is available near the restaurant and in local parking garages. Cars may be ticketed, even on weekends. Seats are not guaranteed after 5:30 so come early. Ordering will begin at that time.

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