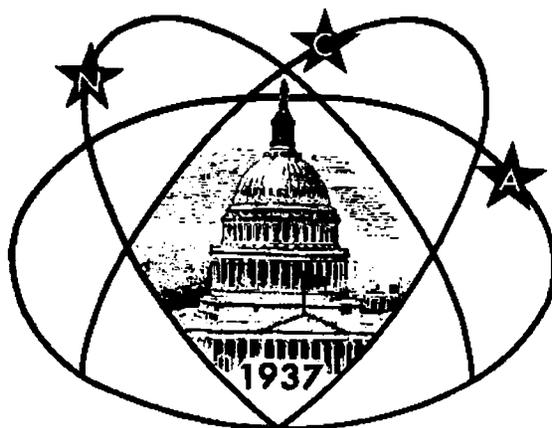


Star



Dust

National Capital Astronomers, Inc.

Phone: 301/320-3621

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Dimitris Christodoulou to speak on "The Formation of Binary Stars Through Fission of a Single Mass: Past and Present."

by Harold Williams

The next meeting of the National Capital Astronomers will be held on Saturday January 7 at 7:30 P.M., in the Bunim room on the ninth floor of the Clinical Center (building 10) at the National Institutes of Health (NIH). Dimitris Christodoulou of Louisiana State University will speak on "The Formation of Binary Stars through Fission of a Single Mass: Past and Present." The speaker sent the following abstract:

"We return to the ideas of Darwin and Poincare dating back to the previous century and to the oldest known theory for the formation of double stars from fission of a single, rapidly rotating fluid mass. This is known as the binary fission hypothesis but has been shelved since 1924 when Cartan discovered an "inconsistency" somewhere along the evolutionary path proposed by Poincare and Darwin.

We return to the fission theory armed with a new understanding of the powerful instabilities which can break a fluid mass into two pieces. This understanding stems from an application of the thermodynamical theory of phase transitions to rotating astrophysical objects! The transitions of such objects proceed

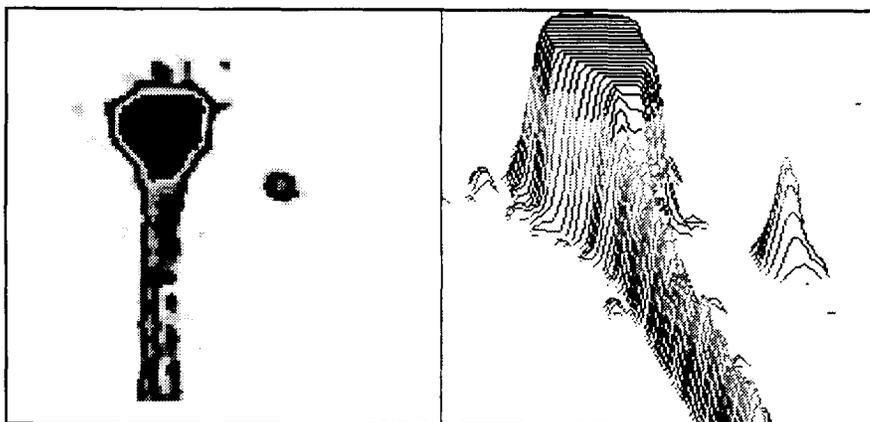
through forms described as "concave hamburgers," "donuts," "dumbbells," and not through "pears" or "eggs" as was originally believed in the 1920s.

We have shown that Cartan's results, although technically correct, are irrelevant to the particular evolutionary path that leads to the formation of binary stars. Therefore, we need to reevaluate the older ideas on the subject and credit to Darwin and

Poincare what is rightfully theirs: the first evolutionary path that leads to fission of a single fluid mass."

Most stars are binaries. A conservative estimate of the number of stars that are binary is 70% and the number may be nearly 100%. The formation of binary stars is one of the holy Grails of star formation. In his book *Ellipsoidal Figures of*

See DIMITRIS, Page 2



Gamma Andromedae A & B imaged in full daylight (here reversed) through the 30-inch Keeler telescope at Allegheny Observatory by Michael Castelaz and Tim Persinger using an ST4 CCD. Only Gamma and A (mag 2.1) is visible in the raw image. This blue light frame (4400A +/- 160A), seen in black and white, has been flatfielded, stretched without mercy, smoothed, color-coded, deconvolved, 3-D projected, and otherwise processed using The Better Image (v1.00) to bring out the companion star (mag 5.1).

December Calendar

The Public is Welcome!

Tuesdays, January 3, 10, 17, 24, and 31, 1995, 7:30 PM-Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Wednesday, January 4, 1995-“Sky-Watch” column by Blaine P. Friedlander, Jr. appears in *The Washington Post* “Style” section. It lists many other events for the month.

Fridays, January 6, 13, 20, and 27, 1995, 8:30 PM-Open nights with NCA’s Celestron 14-inch telescope at Ridgeview Observatory; near Alexandria, 6007 Ridgeview Drive (off Franconia Road between Telegraph Road and Rose Hill Drive). Information: Bob Bolster at 703/960-9126.

Fridays, January 6, 13, 20, and 27, 1995, 7:30 PM-Telescope making classes at American University, McKinley Hall Basement. Information: Jerry Schnall, 202/362-8872.

Friday, January 6, 1995, 7:00-8:30-Sandy Spring Friends School Presents, Star Party: Astronomy Activities. Free to the public. See the ad on page 6.

Saturday, January 7, 1995, 5:30 PM-Dinner with the speaker at the La Panetteria Restaurant, 4921 Cordell Ave., Bethesda, MD, before the monthly meeting. Reservations are for 5:30 p.m., sharp. For directions, refer to map on back page.

Saturday, January 7, 1995, 7:30 PM-The January NCA meeting will feature Dimitris Christodolou of Louisiana State University speaking about “The For-

mation of Binary Stars through Fission of a Single Mass: Past and Present.”

Saturday January 7, 1994, Night (After The Meeting)-Waxing crescent Moon provides this month’s Saturday night with *second longest* deep night period (i.e., continuous time interval with neither daylight, twilight, nor Moonlight), although period doesn’t begin until after Moon sets after midnight (early Sunday morning). See January 28th listing. Information: Daniel Costanzo, 703/841-4765.

Mondays, January 9, 16, 24, and 30, 1995, 8:30 PM-Public nights at U.S. Naval Observatory (USNO), in Northwest Washington, DC (off Massachusetts Avenue). Includes orientation program on USNO’s mission, viewing of operating atomic clocks, and glimpses through the finest optical telescopes in the Washington-Baltimore region. Information: USNO Public Affairs Office, 202/653-1541.

Saturday, January 28, 1995, Night-December’s second best night for dark-sky observing and “absorbing” (“Moon-dark” until around Midnight). See December 3rd listing.

Saturday, February 4, 1995, 7:30 PM-The February NCA meeting will feature Carol Jo Crannell speaking about “Imaging Solar Flares From Hard X-Rays and Gamma Rays From Balloon-Born Platforms.”

Other events too numerous to mention here are listed in *Sky & Telescope*, the *Astronomical Calendar 1995*, the *Observe’s* handbook 1995, and in numerous software packages.

DIMITRIS, from Page 2

Equilibrium, Chandrasekhar eloquently describes the attempts of many researchers to follow the evolutionary path of binary star formation and explains that Cartan found a point of instability where this path ends before fission can occur; “[A]nd at this point the subject quietly went into a coma.” Our speaker has helped revive this subject from its comatose state by finding that

Cartan’s instability is not at all related to the original evolutionary path suggested by Poincare and Darwin.

Our speaker is a Research Associate with Professor Joel Tohline at Louisiana State University in Baton Rouge. He received his B.Sc. in physics from Aristotelian University, Thessaloniki, Macedonia, Greece and his Ph.D. from Louisiana State University with a dissertation on numerical simulations of the

structure and evolution of gaseous galaxy disks. He has subsequently held Research Associateships at Steward Observatory (University of Arizona in Tucson), at the Harvard Smithsonian Center for Astrophysics in Cambridge, Massachusetts (with Professor Ramesh Narayan) and with Professor John Hawley at the Virginia Institute for Theoretical Astronomy (University of Virginia, Charlottesville). Our speaker has published more than thirty papers in

such subjects as star formation, galaxy kinematics and dynamics, and astrophysical phase transitions; and none of this would have happened had he made a different choice at the age of 15.

Here is how the speaker describes his decision to study astronomy rather than ancient Greek. "When I went through the Greek educational system (high school), the system was different than nowadays. In particular, in the summer between junior high and high school, all students had to visit the school accompanied by a parent and formally declare which of two possible directions they would take in high school: natural sciences or humanities.

Well, I remember that at the time I was in a big dilemma because, although I was interested in "the stuff up in the sky" (yes, my initial interest in astronomy came by just looking up!), I was also very-very good in ancient Greek in my junior high years. Not only that, but because I understood ancient Greek, I really enjoyed it! [At the time, I did not know even one of my fellow students who enjoyed ancient Greek. They all hated it with all their

hearts!] So, I was really considering seriously to go to college and study ancient Greek (the language, the philosophy, etc.).

The reason I was in a dilemma is partly that I did not know much about astronomy and I did not know how to go about obtaining the necessary information. On the other hand, the teachers who taught us ancient Greek were very explicit in describing their subject and praising it. Contrast this with the mere raising of eyes toward the night sky... (At the time, I did, however, know that in order to study astronomy I had to study first physics or mathematics.)

Well, I could not figure out the following puzzle: How come someone can study either physics or math and still end up in astronomy? (I was too shy to ask grown-ups because I did not want to give them a chance to say that was a silly question. It turns out that if I had asked this question, there would not be that many grown-ups who could answer.)

Anyway, that summer I realized I had to make a final decision that would affect my entire future. You see, if I declared natural sciences as my high school subject I would not be eligible to change my mind 3

years down the road and go back to ancient Greek while at college. If, on the other hand, I chose humanities I would have to stay with ancient Greek for the rest of my life.

I walked into the room frozen while, I am sure, my mother (who was with me at the time) did not know how I was feeling. I just could not make up my mind. And, then, this teacher sitting in front of a table full of papers asked the dreadful question and I heard someone say "natural sciences" and I realized it was my voice like I had never heard it before. And then it was all over...

I walked out of the building thinking I messed up because I had chosen a direction in life that I did not know anything about. (I did not even know whether I should study physics or math — but that decision was 3 years down the road.) But, one way or another, my studies would finally concern this "stuff" I saw every night when I looked up.

Thinking back at that summer decision, I know I guessed right by accident, not because I had all the necessary information for an educated decision — and I do miss ancient Greek even now..."

The Universe You Don't See: Existence and Nature of Dark Matter

Reviewed by Harold Williams

On Saturday December 3, 1994 at the National Institutes of Health (NIH), Virginia Trimble of the University of Maryland at College Park and the University of California at Irvine spoke to us on "The Universe You Don't See: Existence and Nature of Dark Matter."

Ninety percent or more of the stuff in the universe that gives rise to gravitational fields and forces does not emit its fair share of light. We call this dark matter. The ancient Greeks taught that our world was composed of earth, air, fire, and

water, but that the celestial realm was composed of quintessence. Many introductory science courses used to start with what the ancient Greeks thought about the universe; this has largely gone out of fashion, except in introductory astronomy courses. The unfortunate result for students who have poor attention spans can sometimes be that they end up believing that the Sun goes around the Earth and that they learned this in astro100. (At Montgomery College in Takoma Park, the instructor starts with the ancient

Sumerians, so perhaps students leave thinking that the Earth rests on the back of a turtle; reviewer's comment.)

The overall stuff responsible for the gravitational potential measured from the matter (baryons) we do see is made up of things that we cannot see. The one equation that we will use, so you will know that this is a serious science talk, is

$$M = \frac{v^2 R}{G}$$

See TRIMBLE, on page 4

TRIMBLE, from Page 3

where M is the mass, v is a characteristic velocity, R is a characteristic size, and G is the Newtonian gravitational constant.

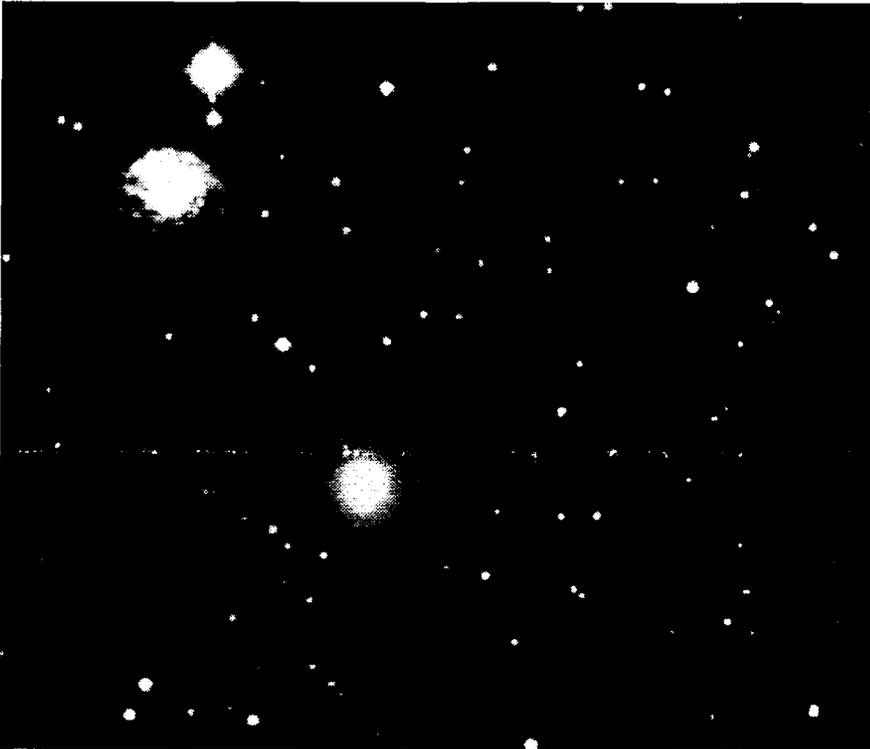
The history of dark matter begins with the neolithic period, which had three important ideas. The first was that something could be so dense as to absorb its own light, an idea put forward in 1784 by John Mitchell of England and in 1799 by Laplace of France. This idea is now called black holes. The second idea

was that something currently unseen could pull by gravitation something that was seen and this led to the discovery of Neptune because of its pull on Uranus. This idea is now called a brown dwarf or gas giant. The third idea originated with Bessel in 1844, who realized that Sirius and Procyon must have companions. These companions are now known as white dwarfs.

Starting with Zwicky and his observations of the velocity dispersion of galaxies in a cluster of galaxies we enter a medieval period. The

most secure evidence for dark matter is the flat rotation curve of disk galaxies. From nucleosynthesis we can set a limit on the amount baryonic matter in the universe. But as to what the dark matter actually is made of, we have almost no observational constraints and all too many theoretical possibilities, such as: non Newtonian gravity, cosmological constant within general relativity, axions, majorions, goldstone bosons, ordinary neutrinos (left handed), right handed neutrinos, light higgsino, photino, gravitinos, axino, neutrino, preons, monopoles, pyrgon, maximon, Perry pole, supersymmetric strings, cosmic strings, domain walls, primordial (mini) black holes, quark nuggets, nuclearites, and Missing Laundry Socks (MLS). So many that we need to group some of them together into things like WIMPS, Weakly Interactive Massive ParticleS, and MACHOS, MASSive Compact Halo ObjectS and listing them by their astrophysical clumping scale properties CDM, Cold Dark Matter, and HDM, Hot Dark Matter.

Many anecdotes and humorous stories were told. If you were not there you missed a good talk. As usual, we are indebted to NIH and NCA member Jay Miller for arranging to meet at NIH, where he works.



This is a visible light picture of three galaxies known as NGC 2300 group combined with a false-color image (seen in black and white), taken in x-ray light by ROSAT (Roentgen Satellite, a joint project of Germany, the United States, and the United Kingdom). The x-ray image taken between April 25-27, 1992 with ROSAT's Position Sensitive Proportional Counter instrument shows that the small group of galaxies is immersed in a huge cloud of hot gas about 1.3 million light-years in diameter. Astronomers estimate the cloud has a mass equal to 500 billion times that of the Sun and has a temperature of about 10 million degrees Kelvin (about 18 million degrees Fahrenheit). Although such gaseous material previously has been seen in rich clusters of galaxies, this is the first time such a hot medium has been found in a small group that is typical of most clusters in the universe. The existence of this gaseous envelope allows astronomers to measure the total mass of that particular system. The surprising result is the total amount of material in the group is much larger than the sum of the mass of hot gas and the stars in the galaxies. This means that a substantial amount of invisible "dark matter" envelopes the system, keeping the hot gas contained. The NGC 2300 group is located about 150 million light-years from Earth in the direction of the northern circumpolar constellation Cepheus. Photo Credit: NASA.

"Meet the Milky Way"

*co-authored by
Virginia Trimble*

**Appearing in January's
Sky & Telescope magazine
(pp. 26-33). It gives an
up-to-date big picture
tour of the splendors and
mysteries of "The Home
Galaxy."**

The IDA North American Star-Watch Program

by

Daniel J. Costanzo & Walter I. Nissen, Jr.

This Fall, Winter, and Spring, The International Dark Sky Association, Inc. (IDA) is conducting its annual North American Star-Watch program. Star-Watch serves two important purposes. First, on the quantitative side, it documents environmental degradation caused by light pollution. And second, on the qualitative side, it fosters dark-sky awareness and sensitivity to light pollution across the broad spectrum of society.

Star-Watch observations are incredibly simple to make by any observer, from any location in North America (or anywhere else in the Northern Hemisphere), using a minimum of optical or photographic equipment. They consist of simply going outside on any very clear and Moonless night in Fall, Winter, or Spring to count or photograph stars in the easily visible Pleiades star cluster using one's unaided eyes, binoculars, small telescopes, or simple camera setups. The total number of detectable stars determines how much light pollution is present at a particular site. The Pleiades are visible even from heavily light polluted areas; from a dark-sky location they are a breathtaking sight even with simple optical aid. From November through March they are situated high in the early night sky and any quality constellation chart, guidebook, or software package will show them. Under the Star-Watch program, observing the Pleiades is being put to practical use documenting light pollution's adverse environmental impact.

As the National Capital region's IDA representative, NCA heartily endorses this worthwhile effort. NCA encourages all members (and *Star Dust* readers) to participate in Star-Watch themselves, and to

urge others to do so. This program is a vital volunteer observing activity in service to science and society. NCA educators, mentors, Juniors, and Family members, please take note: Star-Watch makes an excellent (and quite inexpensive) science class exercise, scouting merit badge task, or science fair project.

For background, instructions, and a Star-Watch observing form, see *Sky & Telescope*, 1992, December (Vol. 84, No. 6), p. 692. NCA members Daniel Costanzo (voice mail: 703/841-4765) and Walter Nissen (e-mail: dk058@cleveland.freenet.edu) can advise, answer questions, and supply copies of the above mentioned Star-Watch observing form (available from Dan Costanzo only). If you wish to participate, please contact one of us first. There is no charge for Star-Watch.

NCA has long been an IDA organizational member, and has even hosted David Crawford, IDA's cofounder and Executive Director (and NCA member) as our monthly meetings' featured speaker. NCA urges all, astronomers and conservationists alike, to join and support this very fine nonprofit organization. The individual IDA membership is very inexpensive, and is the best way of demonstrating your personal support toward protecting this endangered part of Planet Earth's natural heritage. For if you don't speak up for the dark sky, then who else will?

To join IDA, or for more information and data sheets, write to: David Crawford (Executive Director), International Dark-Sky Association, Inc., 3545 North Stewart Avenue, Tuscon, Arizona, 85716. NCA can also provide information through the above mentioned NCA points of contact.

NCA Welcomes These New Members!

Donald Albers
Apt 1510
4000 Massachusetts Ave NW
Washington, DC 20016

James H Chesson
1200 N Quaker Ln
Alexandria, VA 22302

George R Corbin
5 S Floyd St
Alexandria, VA 22304

Michael W Gallagher
14511 Faraday Dr
Rockville, MD 20853-1941

Monique E LaFlamme
8741 Contee Rd Apt 402
Laurel, MD 20708

Christa D Lee
6826 Farmbrook Ct
Frederick, MD 21701

Michael R Maire
(Junior member)
1614 Maydale Dr
Silver Spring, MD 20905

Dr. David L Martin
1313 Downs Dr
Silver Spring, MD 20904-2036

Kenneth & Margot Pettijohn
7916 Ivymount Ter
Potomac, MD 20854

David S Schuman
2 President Point Dr Apt 2A
Annapolis, MD 21403

Denis E Snyder
4450 S Park Ave Apt 1210
Chevy Chase, MD 20815-3642

Matthew Cary Taylor
18339 Sharon Rd
Triangle, VA 22172

Greg Westergaard
4915 Strathmore Ave
Kensington, MD 20895

Timothy A Williams
7767 Shooting Star Dr
Springfield, VA 22152

Montgomery College's Public Planetarium

Exciting public planetarium programs are offered at Takoma Park's own planetarium. Astronomy is one of the few sciences accessible to any inquiring mind. All programs begin at 7:00 p.m. There is no admission charge.

Saturday, January 28, 1995

"Astrolabes"

The planetarium is located on Fenton Street on the Takoma Park campus of Montgomery College. It is attached to the Science South building on the ground level and has a conspicuous silver-colored domed roof.

Shoemaker at Carnegie

By Gary Joaquin

On December 13th, at a free Carnegie Institute lecture, Dr. Eugene Shoemaker, planetary geologist, and co-discoverer of the comet Shoemaker-Levy 9, reviewed the comet's impact on Jupiter and presented some new findings.

In the last 12 years at Palomar Observatory over 45,000 photographs have been taken of the sky while Dr. Shoemaker and his wife, Carolyn, have discovered 32 comets. He revealed that about two weeks and 100 observations from around the world were required to calculate the orbit of Shoemaker-Levy 9. Two weeks after the discovery, it was determined that the comet was in orbit around Jupiter. Two months later it became apparent that the comet's 21 fragments would probably strike Jupiter.

Current photos of fragment impact sites show they are stretching into bands. This supports that comet impacts are not a likely cause of atmospheric storms. Computer simulations have shown that such storms can be spontaneously generated in Jupiter's atmosphere. Furthermore, storms like the Great Red Spot contain more energy than all of the fragment impacts combined.

Dr. Shoemaker showed a Hubble telescope photo of fragment K's dark impact site taken in ultraviolet light. 45 minutes later, a dark echo appeared in the opposite hemisphere. The matter appears to have been transported along the field lines of Jupiter's powerful magnetosphere. Dr. Shoemaker reported that the comet fragments have left behind much more dark matter in Jupiter's atmosphere than expected. The dark substance is believed to be part of the comet's complex carbon structure. A similar dark cloud may have caused mass extinction of life on Earth 65 million years ago.



**Newsletter Deadline for
February *Star Dust*
Thursday,
January 15, 1994**

Send Submissions to Gary & Alisa Joaquin, at 7821 Winona Ct., Annandale, VA 22003, or send an ASCII files via E-mail at 71561.1747@compuserve.com, or fax to 703/658-2233. Submissions must be on time or they may not get in. Have a Happy New Year!

Sandy Spring Friends School Presents . . .

Star Party: Astronomy Activities

Third Program in Science Symposium Series

Co-sponsored by Sandy Spring Museum Astronomy Club

Friday, January 6, 1995

7:00 - 8:30 p.m.

Yarnall Hall

Free To The Public — Everyone Invited

Sandy Spring Friends School • 16923 Norwood Road • 301-774-7455

Important Numbers For Information

Smithsonian Sky Watchers' Report: Nontechnical information recording on astronomical events, objects, and phenomena in the Washington, D.C. region's sky. Updated weekly. 202/357-2000

Sky & Telescope's "Skyline": Moderately technical information recording on latest in space technology, astronomy, and related sciences. Updated weekly, or sooner if necessary. 617/497-4168

McDonald Observatory's "Star Date": Nontechnical information on space technology, astronomy, and related subjects. Broadcast weeknights, around 8:00 PM, by listener-supported public radio station WAMU FM 88.5

U.S. Naval Observatory's Time Service: Accurate Eastern Time (in 24 hour mode) and Universal Time given every few seconds. Excellent for synchronizing clocks and watches. (Voice Recordings) 202/653-1800, 900/410-TIME, and 303/499-7111; (Modem Time Service) 202/653-0351

NOAA "Space Weather" Indices: Highly technical, but quite useful recording on Solar activity and its effect on Planet Earth. From the National Oceanic and Atmospheric Administration (NOAA). Updated every three hours. 303/497-3235 (anytime) or WWV at 2.5, 5, 10, 15, and 20 MHz (at 18 minutes after every hour)

Local Weather, Weather, Sunrise/Sunset, & UV Index: Recording of latest weather forecast out to five days, plus Sunrise/Sunset times, and forecasted Solar ultraviolet radiation index. Covers Washington, DC and vicinity. 703/260-0307

NCA Artificial Satellite Prediction Service: Free customized prediction of viewing opportunities. Satellites frequently are clearly visible with unaided eyes or binoculars, even from light polluted areas. Contact Walter I. Nissen, Jr., (voice phone) 216/243-4980, (e-mail) dk058@cleveland.freenet.deu

NCA Jupiter Galilean Moon Prediction Service: Free customized prediction of viewing opportunities for Jupiter's four Galilean moons. They are clearly visible with unaided eyes or binoculars, even from light polluted areas. Contact John Lohman (voice phone) 703/820-4194 at least one week prior to anticipated viewing.

Occultation Line: Highly technical, but quite useful voice recording with latest updates on occultations and grazings; from the International Occultation Timing Association (OTA). Many of these events are visible with the unaided eye, binoculars, and small telescopes. 301/474-4945

Other Free Public Science & Technology Lectures: National Air and Space Museum (NASM): 202/357-1552 (ask to receive NASM bimonthly calendar by mail); University of Maryland Astronomy Department: 301/405-3001; Goddard Space Flight Center (Goddard Visitor Center): 301/286-8981; Carnegie Institution of Washington: 202/328-6988 or 202/265-2752

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, workshops, expeditions, tours, public interpretation, education, and outreach. NCA is the astronomy affiliate of the Washington Academy of Sciences (WAS). 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 international 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 Workshops 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, INC.

Enclosed is my payment for the following membership category:

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Star Dust only (\$24 per year)

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Junior members pay a reduced rate.

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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 \$22 when it expires.

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

NCA c/o Jeffrey B. Norman, Suite #717, The Garfield Building, 5410 Connecticut Avenue, NW, Washington, D.C. 20015.

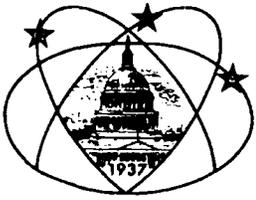
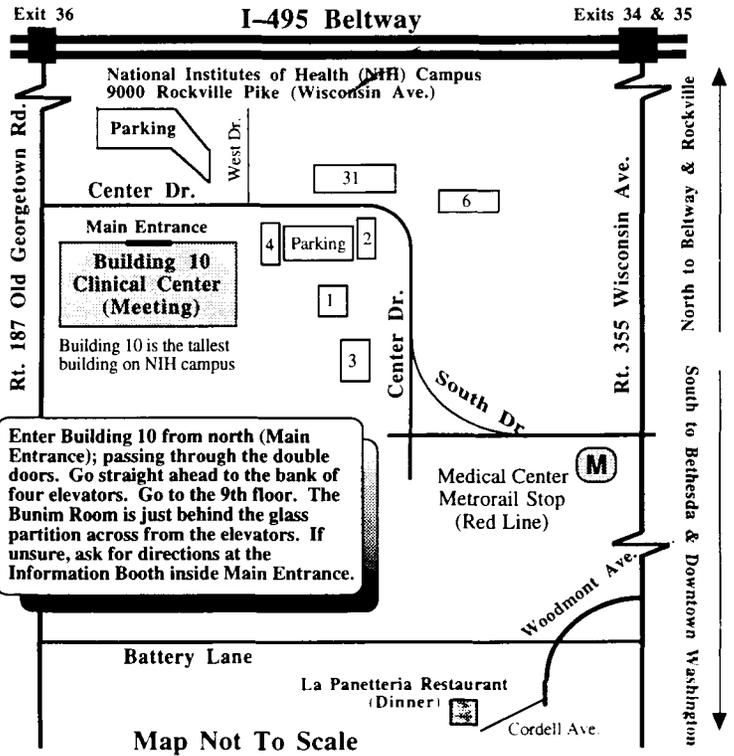
The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

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 (walking time about 10 minutes). Continue uphill to Building 10, the largest 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).

La Panetteria Restaurant - Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont Avenue (or take the next right onto Battery Lane). Follow Woodmont to Cordell Avenue (2 blocks south of Battery) and make a right at the Thai Place Restaurant. La Panetteria is one block on the right (next corner, 4921 Cordell Avenue). There should be adequate parking on the street outside the restaurant. Seats are not guaranteed after 5:30PM.

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 (WAS) and the National Capital region's International Dark-Sky Association (IDA) representative. NCA's 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, 703/750-1636/71561.1747@compuserve.com. *Star Dust* may be reproduced with credit to National Capital Astronomers, Inc.



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Jan. 1995

NOTE POSTAL RATES WILL BE GOING UP JANUARY 1, 1995!

