

S T A R

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D U S T

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NASM Director Harwit: Science Fair Awards



DR. HARWIT

Dr. Martin Harwit, Director of the National Air and Space Museum, and the NCA science fair award ceremony will be featured at the June 6 meeting of National Capital Astronomers. Dr. Harwit's topic will be "Astronomical Discovery and Astrophysical Understanding."

The factors which permit astronomical discoveries to be made differ considerably from those elements normally stressed in

anecdotes about discoverers and their work. Dr. Harwit will first discuss how observational discoveries in astronomy have generally come about, stressing features of discovery that can be quantified. Then he will show that the process of discovery has little in common with an increase in our understanding of the universe, which often comes many decades later. Finally, he will stress those factors which seem to lay the groundwork for increased astrophysical understanding.

Born in Prague, Martin Harwit came to the United States in 1946. He was graduated from the Bronx High School of Science, obtained a B.A. in physics in 1951, and the M.A. in physics at the University of Michigan in 1953. Drafted into the U.S. Army in 1955, he served until he was honorably discharged, in 1957, married Marianne Mark, and returned to graduate school at M.I.T. There, he obtained his Ph.D. in physics in 1960. After a year as a post-doctoral fellow at Cambridge University, England, he joined the Astronomy faculty at Cornell, where he served as Department Chairman for five years and as full professor since 1968. He is now professor emeritus at Cornell.

Harwit's primary research at Cornell was both theoretical and practical work in exospheric infrared sensors. Another of his research interests at Cornell was the history of science and science policy.

In 1987 Harwit became the Director of the National Air and Space Museum of the Smithsonian Institution.

MAY CALENDAR — *The public is welcome.*

Tuesday, June 5, 12, 19, 26, 7:30 pm — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, June 2, 9, 16, 23, 30, 7:30 pm — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, June 3, 5:45 pm — Dinner with the speakers at the Smithsonian Restaurant, 6th and C Streets, SW., inside the Holiday Inn. Reservations unnecessary. Use the 7th Street and Maryland Avenue exit of the U'Enfant Plaza Metrorail station.

Saturday, June 3, 7:30 pm — NCA Science Fair Awards, followed by the NCA monthly colloquium in the Einstein Planetarium of the National Air and Space Museum, Seventh Street and Independence Avenue, SW. Enter Independence Avenue side. Dr. Harwit will speak.

Friday, June 9, 16, 23, July 7, 14, 21, 9:30 pm — NCA 14-inch telescope open nights with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob at 960-9126.

Saturday, June 10, 9:00 pm — *Exploring the Sky*, presented jointly for the public by NCA and the National Park Service, on Glover Road south of Military Road, NW, near Rock Creek Nature Center. Planetarium if cloudy. Information: John Lohman, 820,4194, or NCA, 320-3621.

For other organizations' events of interest see elsewhere in this issue.

M. HARWIT
1989

MAY COLLOQUIUM

Dr. Frank J. Kerr, Astronomy Program, University of Maryland, and Patricia A. Henning, graduate student, discussed their search for and discovery of galaxies hidden behind the Milky Way and in cosmic voids, at the May NCA colloquium in the National Air and Space Museum.

Their purpose is to study the large-scale structure of the universe at and beyond the largest known systems: superclusters of galaxies on "bubble" surfaces of apparent cosmic voids.

With the 1952 discovery of the cosmic 21-cm line radiation from neutral hydrogen, Kerr, in Australia, and other astronomers observing this line, detected hydrogen from all over the galaxy. This finding that the galaxy is transparent to 21-cm radiation suggested the possibility of detecting galaxies behind the Milky Way. About 20 percent of the sky is hidden from optical view by the multitude of stars and galactic dust of the Milky Way.

Receivers of those days were not sufficiently sensitive. A good survey of the region had to await development of improved detectors, radio telescopes, operations, data-handling techniques, and other improvements. Modern technology has made possible Kerr's present survey, begun three years ago, and joined by Henning shortly afterward.

Using the erstwhile 100-meter Green-Bank radiotelescope (which collapsed last October after a quarter century of service), Kerr and Henning searched the large, previously hidden region. They have detected about 5000 new sources. Examining the spectra of these sources, they have already discovered about 50 previously unobserved galaxies. One of these appears to be a member of our local galactic cluster. Its spectrum shows a negative (approaching) radial velocity of 4,000 km per second.

Detected galaxies are differentiated from local galactic radiation by the Doppler shift of their hydrogen line wavelengths. Much can also be determined of their shape, size, and rotation from the line profiles. For example, an edge-on spiral is disclosed by longward and shortward wavelength peaks of the line profile from the approaching (relative to the core) and receding arms, and an amplitude dip between, from the lesser hydrogen concentration in the galactic core. Integration of the area under the profile indicates the amount of hydrogen the object contains.

As controls, Kerr and Henning use the known parameters of galaxies in the clear regions of the sky to calibrate their interpretive techniques.

The next phase of the project will be to study the newly discovered galaxies in detail. Using much higher-resolution radiotelescopes, mostly the Very Large Array (VLA) in New Mexico, they will seek

to determine the sizes, shapes, orientations, and directions of rotation. They have already examined about 20 objects with the VLA, and have mapped galactic shapes at 10-km velocity intervals. In further studies, they expect to use other large radiotelescopes, probably at Parkes, Australia, Bonn, Germany, and elsewhere. Henning plans to complement the radio survey with infrared investigations, which should penetrate the galactic dust better than the 21-cm line.

A magnitude-limited survey of galactic distribution shows no particularly preferential direction. Addition of the distance dimension, however, determined from radial velocity, indicates large apparently empty "bubbles," in which almost no galaxies are detected. Henning's particular interest is in determining whether these regions are largely devoid of matter, or contain faint, undetected galaxies. She described a detailed search of one small area in the clear region, concentrating on one of the cosmic voids.

Using the same technique as in the hidden-galaxy search, Kerr and Henning examined about 500 points in the direction of the void area. Optical surveys of this region show a thin wall-like distribution of galaxies at a distance corresponding to about 5,000 km/sec. Nothing within the magnitude limit is apparent on this side. The 21-cm search, however, disclosed a source of neutral hydrogen at 4,000 km/sec, well in front of the "wall." Because the source was much smaller than the 10 arcminute beam of the telescope, no shape was resolved.

They then used the VLA to map the object at 10km/sec intervals. With these data and the line profiles, they found the object to be an atypically small spiral galaxy. The ratio of hydrogen to total mass is about normal, but the numbers are small; the object is too faint to show on the Center for Astrophysics Redshift Survey. They then successfully obtained optical images of the object, still on tape and unreduced at this time. These should yield further interesting information.

Others have found some other kinds of objects in such structures, but no normal galaxies.

In a new atlas of nearby galaxies, recently published by Tully and Fisher, is a "local void" which straddles the plane of the Milky Way. Unaware of this when searching behind the Milky Way, Kerr and Henning apparently searched within two voids, one, unknowingly, behind the milky way and one, planned, in the clear region.

They have found no large galaxies behind the Milky Way, but many small, faint ones. When their study is completed, a comparison of the characteristics of these objects with those of others found in voids promises to yield much new information about these large structures and their contents. Robert H. McCracken

MISSING LINES FROM APRIL COLLOQUIUM REVIEW IN MAY ISSUE

Because of the importance to everyone of eye damage, we urge attention to the following correction of an unfortunate printing error in the May issue of *Star Dust*. A few lines were lost from the bottom of the review of the April colloquium, breaking the continuity from the first to the second column and from the second column to the next page. To restore continuity, the complete broken paragraphs are reprinted here. They should be read in the context of the review in order to understand their importance.

The last paragraph in the first column:

The damage mechanism in the short wavelengths is largely photochemical; in the longer wavelengths, thermal. (Ed. note: The quantum energy of the photon is inversely proportional to wavelength. In the mid-visible band (green) it is about 2 electron volts. The shorter wavelengths, if absorbed, thus deliver more energy in photochemical reactions.) The longer visible and infrared wavelengths raise the temperature and cook the tissue. Photokeratitis, inflammation of the cornea by light, is caused by photochemical damage to the cornea

by ultraviolet. Erythema, sunburn, is the corresponding effect on the skin. Cataracts and skin cancer are caused by ultraviolet in the region of 300 nm.

The last paragraph at the bottom of the second column, and its continuation on the next page:

The cornea is the only living tissue of the eye that is exposed to the Sun, wind, dust, ultraviolet, etc. The outer layer of corneal cells is replaced about every 48 hours. Minor irritation of the cornea, while painful, thus may be repaired within a few days if not severe. The lens, on the other hand, has a very slow metabolic rate; damage to the lens may result in a cataract years later.

The latter paragraph is followed in the review by important warnings about the long-term, cumulative hazards of visible blue light and a strong recommendation to wear sunglasses that block wavelengths shorter than 500 nanometers. They will be amber or reddish brown, and are getting to be known as "blue blockers." Blue or green sunglasses should NEVER be worn.

If you do not have the review available and need a copy, call NCA: (301) 320-3621.

NCA SCIENCE FAIR PRESENTATIONS JUNE 3

The annual National Capital Astronomers Science Fair Awards recognize superior high school science fair projects in astronomy and related sciences in the District of Columbia

Jonathan Bierce
7932 Bolling Drive
Alexandria VA, 22308

Steven Chien
9431 Sunnyfield Court
Potomac, MD 20854

Andrea Dickens
9812 Summerday Drive
Burke, VA 22015

Siu Lee
953 15th Street, SE
Washington, DC 20003

Jennifer Newbury
16532 Sioux Lane
Gaithersburg, MD 20878

Andrew Slutter
7408 Range Road
Alexandria, VA 22308

Claudia Villa
7710 Mulberry Bottom Lane
Springfield, VA 22153

NCA welcomes these young people to junior membership, and thanks our judges, Keith Bell, Robert Bolster,

and the contiguous counties.

NCA is privileged to award Junior NCA memberships, including all membership publications, for one year, to the following young scientists:

Galactic Hydrogen Distribution

A Study of Planetary Observations

Evaluation of Various Solar Features as Reliable Tracers of Differential Rotation

The Coriolis Force and its Effect on Air Currents

Fractals— A New Measurement for Sunspots

Orbital Velocity Dependence upon Orbital Radius

Rotation of Mars

Stanley Cawelti, Leith Holloway, Jay Miller, William Remmers, and Jerry Schnell.

OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following occultations. For further information

Date	Time	Place	Vis Mag	Pent Sunlit	Cusp Angle	Min Aper
Grazing Lunar:						
06-08-89	01:56	Methoni, Greece	6.7	18	13N	5 cm
06-29-89	09:35	Urbana, MD	4.6	17	14S	5 cm
Planetary						
07-03-89	07:35	Western Hemisphere	5.4	occultation by Saturn		5 cm

call the NCA-IOTA Information Line: (301) 474-4945 (Greenbelt, MD).

NCA ELECTS FISCAL 1990 OFFICERS

The National Capital Astronomers elected the following fiscal 1990 officers at the annual May 6 meeting:

President, Kenneth R. Short; Vice President, Scott A. Thurlow; Secretary, Patricia B. Trueblood;

Treasurer, Ruth S. Freitag; Trustee, Walter I. Nissen; Sergeant at Arms, Eric O. Nystrom.

NCA thanks the retiring officers for their services, and the new ones for accepting the responsibilities.

NYSTROM AWARDED ACADEMY MEMBERSHIP

In recognition of his dedicated technical service to the Washington Academy of Sciences, Eric Nystrom, computer scientist and NCA's Sergeant at Arms, was awarded Academy membership at the Academy's

annual award banquet ceremony on Thursday, May 18, at American University. It was noted that the best evidence of Eric's presence is that everything works properly. NCA congratulates you, Eric.

NCA WELCOMES NEW MEMBERS

James C. Gaffney
6228 30th Street, NW
Washington, DC 20815

Gerrard J. Rolape
2555 Pennsylvania Avenue, NW, #411
Washington, DC 20037

Goetz K. Oertel, AURA
1625 Massachusetts Avenue, NW
Washington, DC 20036

Michael Saginaw
12804 Lamp Post Lane
Rockville, MD 20854

Dan Salkovitz
237D Forrester Court
Richmond, VA 22327

Barbara Sause
1509 South Quincy Street
Arlington, VA 22204

See also "Science Fair Presentations in June"

AAS SOLAR PHYSICS MEETING IN JUNE

The Solar Physics Division of the American Astronomical Society will meet June 5-8 at the Applied Physics Laboratory of

Johns Hopkins University, Laurel, Maryland. For information or to register, call David Rust, 953-5000.

SUMMER PUBLIC PARK SERIES, EXPLORING THE SKY, SCHEDULED

These joint National Capital Astronomers - National Park Service programs for the public have been scheduled through October. All ages are welcome; there is no charge. Make it a family night and share telescopic views of many cosmic objects. The Moon, Saturn, Uranus, colorful multiple stars, nebulae, star clusters, and galaxies are all candidates, depending upon the weather.

All dates are Saturdays: June 10, 9:00 pm; July 29, 9:00 pm; August 19, 8:30 pm; September 23, 7:30 pm;

October 14, 7:00 pm.

An unusual feature of the series will be the full October Moon, usually avoided because the dazzling light washes out the spectacular moonscape and lights the rest of the sky. With proper filtration, however, certain features can be seen best at that time. The telescopes will be equipped accordingly.

For further information, call Dr. John Lohman: (703) 820-4194 (Arlington, VA), or NCA: (301) 320-3621 (Bethesda, MD).

FINAL REMINDER: JUNE 10 DEADLINE FOR NCA CLARK TELESCOPE SIGN-IN LIST

As previously announced, in coordination with the Naval Observatory and Naval Security, we are revising the approval and sign-in procedures for NCA Clark telescope observers. The present approved key-pass list is being accordingly revised. To remain on the present list (others can be approved for future lists), you must provide your social security number and date of birth by June 10, to R.H. McCracken, 5120 Newport Avenue, Bethesda, MD 20816, or call NCA: (301)

320-3621. Naval Security will require this information and photographic identification, both for future approvals and for those presently listed.

For those presently on the list: Pending receipt of your new card (present ones will be cancelled), When signing in at the main gate of the Observatory, be prepared with your current NCA membership card, your key pass, and some form of photoidentification.

AIR AND SPACE MUSEUM OFFERS PROGRAMS IN JUNE

The following free, public programs will be held during June in the Einstein Planetarium of the National Air and Space Museum:

Saturday, June 3, 9:30 am — **Monthly Sky Lecture:** "Astronomy for the Fun of it," Geoffrey R. Chester, NASM staff and NCA member. Safe telescopic viewing of Sunspots will follow, weather permitting.

Suggestion: Attend the Sky Lecture, tour the Museum during the day, then return to the planetarium at 7:30 pm for the NCA science fair awards and monthly NCA Colloquium.

Wednesday, June 7, 7:30 pm — **Exploring Space Lecture Series:** "The Supernova Story," Laurence A. Marschall, Professor of Physics, Gettysburg College, Gettysburg, Pennsylvania.

U.S. NAVAL OBSERVATORY TOURS IN JUNE

The Monday night public tours of the Naval Observatory begin at 8:30 pm EDT. The next tours are scheduled for June 5, 12, 19, and 26. Passes will be issued to the first 100 persons in line at the gate across from the British Embassy, at Massachusetts Avenue and the southeast side of Observatory Circle. Some form of photoidentification will be required.

Parking is not allowed on the grounds. For the tours except for the handicapped;

ample parking is available near the gate.

Visitors will see various observatory facilities and, weather permitting, appropriately selected celestial objects, with the historic 26-inch Clark refractor with which the satellites of Mars were discovered more than a century ago.

For details, call the taped Observatory message: (202) 653-1543. Have a pad and pencil ready; there is much information.

NASA GODDARD COLLOQUIUM AND SEMINAR SCHEDULED

During the academic year, Goddard Space Flight Center at Greenbelt, Maryland, holds weekly colloquia on Fridays, biweekly seminars on alternate tuesdays, on a wide variety of scientific subjects, frequently astronomy-related.

The following lecture and seminar will be held at 3:30 pm at the indicated locations at the Center. Coffee and tea will be served from 3:00. Enter the main gate and obtain a visitor's pass from the guard. Call Tracy Parlate, 286-8543, for

further information.

Friday, June 9 — **Scientific Colloquium Series** in Building 3 Auditorium: **Lindsay Lecture** "The Age of the Milky Way and the Age of the Universe," Allan Sandage, Hale Observatory.

Tuesday, June 6 — **Laboratory for Atmospheres Seminar Series** in Building 21, Conference Room 183: "New Methods of Satellite Data Assimilation," Michael Ghil, University of California at Los Angeles.

UNIVERSITY OF MARYLAND OPEN HOUSE SCHEDULED

The Astronomy Program, University of Maryland, holds open house on the 5th and 20th of each month at the University's observatory on Metzger Road in College Park. Talks and slide shows are presented at 9:00 pm, followed by telescopic sky viewing, weather permitting. The public is invited; there is no charge.

Monday, June 5, — "How the Universe was Born," Dr. L. Blitz.

Tuesday, June 20, — "Exploding Galaxies" Dr. A.S. Wilson.

No reservations are necessary for individuals. Groups larger than ten should call (301) 454-3001 at least 5 days prior to the program.

Sources for Software — On Saturday, I demonstrated a half-dozen pieces of software which generate starfields or plots of solar system objects for viewing at a given time and location. All but one of these programs are non-commercial, user-distributed software. (The commercial package is a European product sent to me for evaluation of its marketability in this country. Although it has nice graphics, the user interface is very badly done and I advised the author to do some more work on it.) These programs have been gathered through IBS's, user groups, friends, or direct purchases from the author. There is very little astronomical software for sale commercially, and rarely is any found in a local computer store. The following is a list of places where I have found astronomy software, and where you might start:

— **Bulletin-Board Systems (BBS's)**. My favorite in the local area for astronomical software for PC's that use MS-DOS is Kurt Rigel's **ASTRO**, (703) 524-1837. There are other BBS's that have astronomy software, but **ASTRO** is the best for MS-DOS machines (IBM PC's and their clones).

— **Distributors of software, user-supported software, etc.** You might call these "semi-commercial" outfits. My favorite is **PC SIG**, 1030D East Duane Avenue, Sunnyvale, CA 94086. This is a membership organization (\$20/yr) which has more than 1,000 diskettes of software distributed at \$6.00 per diskette. **Deep Space** is on diskettes 866 and 867, **Starmap** on diskette 83, **Planets** on diskette 298, **Starfind** on 447.

— **Sky & Telescope** and **Astronomy** both publish small program listings, and have many ads for computer software. The **Reflector** also has ads for software, as well as for the **AI's Computer-Calculator User's Group**.

Computer Languages — Computer programmers commanded the first computers in machine code, strings of numbers (in binary or octal) that directed the machines to perform computations, retrieve input, store results. Machine code is very hard to read, and very difficult to write. Every step of the computations has to be specified — fetch a value from memory, store it in an arithmetic register, operate on the register, store the result to memory. Computer languages were developed to ease the chore or software writing, as well as to make the programs hardware-independent. The following are a few of the languages available for personal computers today:

— **Assembly languages** were the first

computer languages, developed to assemble machine code that could then be loaded into executable programs. While current assemblers are tremendously improved over their predecessors, they are still difficult to use and are very hardware specific. These languages are still used today for times when processing speed or computer memory limitations are such that absolutely nothing else but assembly language will do the job.

— **BASIC** is certainly the most used computer language today. It suffers from lack of standardization, so that software written for one vendor's BASIC may not run under another's. It also lacks the glamour of the "real" computer languages. This is usually the language of choice for the occasional programmer. It is easy to use, virtually every PC can run some version of BASIC, and there are hundreds of books on "how to."

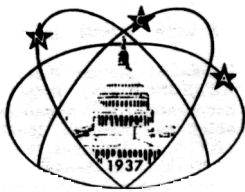
— **PASCAL** is a language originally developed by Wirth for teaching good programming practices. It has been extended and modified from the original, and is the favorite language of many programmers for scientific applications. There are many books on how to program in PASCAL, but not the hundreds we find for BASIC.

— **FORTRAN** was developed (by IBM) to translate scientific formulae into computer code. It is very widely used, and has been standardized to reduce the problems in moving programs from one machine and vendor to another. There are a few books on programming in FORTRAN, and it is considered a difficult language to learn.

— **C** is midway between assembler and PASCAL. It allows more control over the computer hardware than PASCAL, but is not as difficult to use as assembler. Using C can be tricky, but it is quite popular for microcomputers. There are almost as many books on C as there are on PASCAL.

In addition to these languages, the major ones available for the PC, there are also programming capabilities offered within many major programs. **Base** is one of the best known examples. It has its own set of commands that form a language that can be used to manipulate data and prepare reports. Spreadsheet programs, such as **Lotus 1-2-3**, also have these capabilities.

Summer and PC's — Washington, DC summer days are frequently enlivened by thunderstorms. Surge protectors provide some insurance against damage caused by lightning. If you want the best in protection, though, consider a line conditioner. These smooth out the glitches and momentary drops that may cause your computer to crash.



National Capital Astronomers, Inc.

is a non-profit, public-service corporation for advancement of the astronomical sciences. NCA is the astronomy affiliate of the Washington Academy of Sciences. For information, call NCA: (301) 320-3621.

SERVICES AND ACTIVITIES

A Forum for dissemination of the status and results of current work by scientists at the horizons of their fields is provided through the monthly NCA colloquia held at the National Air and Space Museum of the Smithsonian Institution. All interested persons are welcome; there is no charge.

Expeditions frequently go to many parts of the world to acquire observational data from occultations and eclipses which contribute significantly to refinement of orbital parameters, the coordinate system, navigation tables, and timekeeping. Other results of this work under continuing study include the discovery of apparent satellites of some asteroids, discovery of apparent small variations in the solar radius, and profiles of asteroids.

Discussion Groups provide opportunities for participants to exchange information, ideas, and questions on preselected topics, moderated by a member or guest expert.

Publications received by members include *Sky & Telescope* magazine and the NCA newsletter, *Star Dust*.

The **NCA Public Information Service** answers many astronomy-related questions, provides predictions of the paths and times of eclipses and occultations, schedules of expeditions and resulting data, assistance in developing programs, and locating references.

The **Telescope Selection, Use, and Care Seminar**, held annually in November, offers the public guidance for those contemplating the acquisition of a first telescope, and dispels the many common misconceptions which often lead to disappointment.

Working Groups support areas such as computer science and software, photographic materials and techniques, instrumentation, and others.

Telescope-Making Classes teach the student to grind and polish, by hand, the precise optical surface that becomes the heart of a fine astronomical telescope.

NCA Travel offers occasional tours, local and world-wide, to observatories, laboratories, and other points of interest. NCA sponsored tours for comet Halley to many parts of the southern hemisphere.

Discounts are available to members on many publications and other astronomical items.

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

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NOTE: If you already subscribe to *Sky & Telescope*, please attach a recent mail label, or indicate expiration date: _____. A prorata adjustment will be made.

Make check payable to National Capital Astronomers, Inc., and send with this form to: Patricia B. Trueblood, Secretary, 10912 Broad Green Terrace, Potomac, MD 20854.

The following information is optional. If you would like to participate actively in NCA affairs, please indicate briefly any special interest, skills, vocation, education, experience, or other qualifications which you might contribute. Thank you, and welcome!

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