



## Rust to Report Recent Developments in Helioseismology



DR. RUST

**D**r. David M. Rust, Head of the Solar and Interplanetary Physics Section, Applied Physics Laboratory, Johns Hopkins University, will address National Capital Astronomers at the National Air and Space Museum on **January 9**. **Note date.** He will describe new helioseismological instrumentation and recent results in the study of global oscillations of the Sun.

A relatively new science, helioseismology has already yielded a precise determination of the internal solar helium abundance, and promises to reveal other details of fundamental importance to the understanding of stellar structure and dynamics.

Surface oscillations are caused by acoustic and gravity waves that have passed through the solar interior. The oscillations may be detected with ground-based and space telescopes by their effects on the atomic emissions from the solar surface. A number of new instruments have been developed with exciting results for helioseismology at observatories around the world. The solar interior rotation rate has been measured, and there is hope that the solar neutrino deficit will eventually be solved by the results of the extensive helioseismology work being

funded by NASA and the National Science Foundation.

David M. Rust received the Ph.D. in astrophysics from the University of Colorado in 1966. Before joining APL in 1983, he was employed by American Science and Engineering, Cambridge, MA, and Greenbelt, MD, where he served as the Solar Maximum Mission Observatory Coordinator, and as Chairman of the Solar Maximum Year Study of Energy Release in Flares. His specialties are solar activity physics and solar observatory instrumentation. Dr. Rust serves on the NASA Helioseismology Steering Committee, is a member of the Principal Professional Staff at APL, Head of the Solar and Interplanetary Physics Section of the Space Physics Group, Principal Investigator for the Solar Maximum Mission Hard X-ray Imaging Spectrometer data analysis, and Manager of the Solar Magnetograph project.

### JANUARY CALENDAR — *The public is welcome.*

- Tuesday, January 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, January 8, 15, 22, 29, 7:30 pm — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.
- Saturday, January 15, 7:30 pm — Discussion group on light pollution. Room A06, Building 42, UDC, behind Building 42, on Van Ness Street, a half block west of Connecticut Avenue. From UDC Metro: Walk between columns toward 4250, up 4 flights at left to elevated walk to Building 42.
- Friday, January 8, 22, 29, 8:00 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, January 9, 5:45 pm — Dinner with the speaker at the Smithson Restaurant, 6th and C Streets, SW, inside the Holiday Inn. Reservations unnecessary. Use the 7th Street and Maryland Avenue exit of the L'Enfant Plaza Metrorail station.
- Saturday, January 9, 7:30 pm — NCA monthly lecture in the Einstein Planetarium of the National Air and Space Museum, Seventh Street and Independence Avenue, SW. Enter Independence Avenue side. Dr. Rust will speak.
- Saturday, January 15, 7:30 pm — Discussion group on light pollution. Room A06, Building 42, UDC, on Van Ness Street, NW, a half block west of Connecticut Avenue. Park under Building 44. From UDC Metrorail Station, go between columns at 4250 Connecticut Ave, to steps at left, up four flights to elevated walkway to Building 42.

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

## DECEMBER COLLOQUIUM

Dr. Roger A. Bell, Director, Astronomy Program, University of Maryland, spoke to NCA on December 5 at the National Air and Space Museum. He discussed the recently launched program to expand the Hat Creek, California radio interferometer. Hat Creek is about 250 miles north of San Francisco.

The existing array of three 6-meter telescope dishes is operated by the University of California at Berkeley. It is to be extended by three additional 6-meter dishes to make it the largest millimeter-wave interferometer in the world. The new work is being undertaken by a consortium of three universities, for which it is known as the BIMA: Berkeley, Illinois, Maryland Array. The figure of each dish will be held to about 0.1 mm to make the array useful to wavelengths as short as 1 mm. A 300-meter maximum baseline will provide angular resolution of a few arcseconds. This is sufficient to examine carbon stars for CO envelopes and measure molecular concentrations in the galaxy, but only integrated totals in other galaxies. Dr. Bell pointed out that the free-space diffraction-limited resolution of the 200-inch Palomar reflector at a wavelength of 0.5 micron would be about 0.02 arcsecond, or 1 foot at nearly 2000 miles. An equal resolution at a 5-mm wavelength would require a 30-mile baseline.

In order to reposition the dishes as needed to fill in aperture parameters, they will be jacked up, transported by a special tractor cart, and realigned with the array. Such a move will be about a day's work; observations will be planned to minimize the frequency of moves. More telescopes require less moves to fill in aperture parameters.

Three telescope dishes can be paired in three ways; six dishes can be paired in 15 combinations. Since all can collect data simultaneously for later computer processing, the observational speed will be increased by five times. Electronic complexity, however, increases rapidly with the number of telescopes as interconnections multiply.

Observations possible at millimeter wavelengths with the new system include rotational emission 0-1 transition lines of CO at 2.6 mm, 2-1 transitions at 1.3 mm, and others such as HCN, measurement of CO abundances in galaxies, supernova ejecta, search for dust in supernova remnants, interstellar media, thermal radiation of interstellar dust, star-formation processes, mass-loss rate of carbon stars, giant molecular clouds — among the most massive objects on galaxy, and measurement of temperature and molecular mapping of planets. Atmospheric water vapor must also be monitored in order to evaluate the data.

About 50 megabytes of data are expected from the BIMA per day, the equivalent of 50 200-page books. Data transportation to users' locations is a problem.

Bell will be the first head of the University of Maryland's Laboratory for Millimeter-wave Astronomy. The Laboratory will operate the East Coast observing site, remotely control BIMA, and analyze the data. A Cray X-MP supercomputer will acquire the data from BIMA.

Robert H. McCracken

## ADVANCE PLANNING COMMITTEE LONG-RANGE PROGRAM ADOPTED

Under the leadership of Kenneth R. Short, Chairman, the NCA Advance Planning Committee has met weekly throughout the summer to develop a well structured plan for NCA's present and future operations. In many ways, the plan reflects current reality; it also offers formal guidance toward the future health and increased usefulness of the society. The final report was adopted by the trustees, and the schedule was activated on 1 December 1987. The year 1988 will be the year of transition to significantly expanded participation in NCA activities. Four new divisions, Operations, Education, Research and Development, and Junior, are being established to accomplish this with well-focused and dedicated leadership.

The Cornerstone of this plan is the recruitment and selection of the right people for each function. The first-scheduled action item, formation of the Committee for Human Resources, was accomplished at a meeting on December 15 at the University of DC. Sixteen volunteers have been selected as members of the committee. The committee will perform the recruiting, selection, and staffing activities for the new organization.

The inaugural committee members are as follows by division subcommittees:

Operations	Education	R&D	Junior
Stanley Cawelti	Keith Bell	Keith Bell	Keith Bell
Elaine Estep	Robert Bolster	Andrew Davis	Michael Feinberg
Robert McCracken	Michael Feinberg	Jeffrey Guerber	Susan Harrison
Jeffrey Norman	Robert McCracken	Patrick Lowry	Patrick Lowry
	Jay Miller	Robert McCracken	
	Allen Moek	E. Nystrom	
		Allen. Taylor	

Additional participants are invited to attend the next meeting of the Committee on Human Resources at the University of DC, at 7:30 pm in room A06, Building 42, behind Building 44, on Van Ness Street, NW, a half block west of Connecticut Avenue. Park under building 44.

NCA thanks several persons and organizations for supporting, facilitating, and assisting: Dr. Marilyn Krupsaw, Washington Academy of Sciences, for initiating the UDC Chapter of NCA, and for providing conference space; at UDC, Dr. Phillip Brock, Dean, and Mr. Alfred Taylor, assistant Dean, College of Science, Engineering, and Technology, Drs. Anthony Donfor and Richard Johnson, physics Department, UDC; Dr. Walter Boek, Washington Academy of Sciences and President of National Graduate University, the Academy offices location, for providing conference rooms. National Capital Astronomers is the astronomical affiliate of the Academy.

### OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following occultations. For further information call (301) 495-9062 (Silver Spring, MD).

Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
Grazing Lunar:						
01-12-88	08:32	Near Camden, NJ	7.1	49	15S	6 cm
01-15-88	09:28	Near Richmond, VA	3.0	19	15S	2 cm
Asteroidal:						
01-12-88	02:45	Bahamas	Star Mag 8.9	Delta Mag 3.9	Name (690) Wrataslavia	6 cm
01-25-88	09:30	Texas	11.7	1.3	(87) Sylvia	15 cm

### NCA WELCOMES NEW MEMBERS

Nancy L. Aldrich  
1900 Lyttonsville Road #902  
Silver Spring, MD 20910

Helen I. Alexander & R. Weiss  
2800 Quebec Street, NW, #844  
Washington, DC 20008

H. Hille  
401 Rollins Avenue  
Prince Georges County, MD 20743

Adrian J. Kerod  
515 Constitution Avenue  
Washington, DC 20002

Alan R. Moek  
11515 Ivy Bush Court  
Reston, VA 22091

Robert L. Steinberger  
15004 Emory Lane  
Rockville, MD 20853

Anthony & Josephine Zukas Family  
2655 Conquest Place  
Reston, VA 22071

Dr. William W. Remmers  
5550 Friendship Boulelvd, Room 446  
Chevy Chase, MD 20815

### AIR AND SPACE MUSEUM OFFERS PROGRAMS, TELESCOPIC SKY VIEWING

The following free, public programs will be held in the the National Air and Space Museum during January.

Saturday, January 9, 9:30 am -- Dr. Martin O. Harwit, Director, National Air and Space Museum, will present "Cosmic Discoveries," in the Einstein Planetarium. Here's a chance to meet the new director of NASM (since August 17) and to learn about recent discoveries in the cosmos. Following the program, weather permitting, NCA Trustee and NASM Docent Stanley Cawelti will offer safe telescopic viewing of the Sun.

Thursday, January 28, 8:00 pm -- Dr. Samuel C. Phillips, USAF (RET.) will present "Managing Our Nation's Space Program," in the Samuel P. Langley Theater. Following the lecture Stanley Cawelti will offer a telescopic tour of the night sky.

### ASTRONOMY AND PERSONAL COMPUTERS

The U.S. Naval Observatory has a bulletin board for time services at (202) 653-1079, and a separate, computer-accessible, time service for digital clocks at (202) 653-0352. Both of these services expect 7-bit ASCII with even parity and full duplex communications at 300 or 1200 baud. The bulletin-board commands begin with an "@" with @TCO the command to procure a table of codes for the digital data access system. The information given provides UT and polar-motion data, codes and explanations for various time-transmission services (NES, OMEGA, VLF, GPS, TRANSIT, LORAN, TV), Standard times for all countries, sunset and twilight computations, and time information for those who do not need high-accuracy time. (Uncorrected transmission-path-time delays may in some cases be as large as 0.25 second. See below. - Ed.) The bulletin board also contains information on measuring transmission delays in the telephone communications. The *Floppy Almanac* can also be ordered through this bulletin board.

The bulletin board documentation warns users that time taken from that bulletin board is not suitable for precision uses, due to delays from the bulletin board system and, for long-distance callers, delays from the telephone system. The standard long-distance telephone connections to USNO may go either by satellite or landline. Satellite communications add a delay of 250 ms, making telephone time useless for precision timing. The USNO maintains voice announcements at 900-410-TIME, which go exclusively by landlines (\$.50 per minute for the calls) to avoid the satellite communications delays.

There is a method to measure and remove these telephone communication path delays, which can be used with the service at (202) 653-0516 to get more precise timing information. The bulletin board contains an explanation of the service and an example program in BASIC. The technique involves use of computer hardware or a modem that supports the CCITT V.54 Remote Digital Loopback (RDLB), where RDLB allows the calling computer to measure the telephone-line delay and apply it as a correction to the time mark. The service can also be accessed with a standard modem, but the path delays cannot be measured then.

The service at (202) 653-0351 expects 7-bit ASCII, even parity, at 1200 baud. The time is broadcast in a continuous stream with the format:

MJD DOY HHMMSS-UTC [cr] [lf] \* [cr] [lf]

The \* is the time mark for the preceding information and is delayed from UTC by 1.7 ms +/- 0.4 ms. This timing generator is independent of computers and is driven directly from master clock reference signals. The [cr] is the ASCII carriage return, and [lf] stands for line feed. MJD is the mean Julian date, DOY is the day of the year. On UTC December 20, it appears as

47148 353 050532

\*

47148 353 050533

\*

and so on.

Joan B. Dunham

### EXCERPTS FROM THE IAU CIRCULARS

1. Kenneth Beckman, Lewiston, Michigan, and Peter Collins, Scottsdale, Arizona, independently discovered a nova of 7th magnitude in Vulpecula at right ascension 19h 25m, declination +21° 42'.

2. November 22 — Yoshimi Ichimura, Yoshimi-Machi, Japan, discovered a comet (1987b1) of 9th magnitude in Eridanus with 12-cm binoculars. The orbital elements of Comet Ichimura indicate that it will reach 0.2 AU from the Sun on January 10.

3. November 23 — Sigeru, Furuyama, Ibaraki, Japan, discovered a comet (1987f1) of 10th magnitude in Taurus on photographs taken with a 30-cm reflector.

4. November 24 — C. and E. Shoemaker, Palomar Observatory, discovered a comet (1987g1) of 17th magnitude in Pisces with the 45-cm Schmidt camera. The comet appears to be the same object found by P. Jensen on photographs taken at Copenhagen Observatory, Brorfelde Station. The comet has thus been named Jensen-Shoemaker.

NOTE: Comet Ichimura may reach naked-eye brightness by the end of December, but will be quite far south. Although moving northward in January, it will remain close to the Sun and difficult to observe. The best opportunity will be at and shortly after perihelion. Look in the east before dawn beginning January 9. Robert N. Bolster

### THE NEW LOGO

National Capital Astronomers is entering its second half century with a general organizational restructuring to improve the efficiency with which it serves its ever-expanding role in the scientific community.

Reflecting this progress, the new logo symbolizes the centrality, hence importance, of our locale, the Nation's Capital, as the nerve center of science. It also symbolizes, in the intersections of the orbits, the love of science and of the humanity it must serve. A nostalgic fragment of the previous fat little triangle represents continuity with the past, progress built upon NCA's historic foundation. Robert H. McCracken

*STAR DUST may be reproduced with credit to National Capital Astronomers.*



Published eleven times yearly by NATIONAL CAPITAL ASTRONOMERS, INC., a non-profit, public-service corporation for advancement of astronomy and related sciences through lectures, expeditions, discussion groups, conferences, tours, classes, public programs, and

publications. NCA is an affiliate of the Washington Academy of Sciences. President, Walter I. Nissen. *Star Dust* deadline 15th of preceding month. Information: (301) 320-3621. Material for publication: Robert H. McCracken, Editor, 5120 Newport Avenue, Bethesda, MD 20816.

# FIRST CLASS