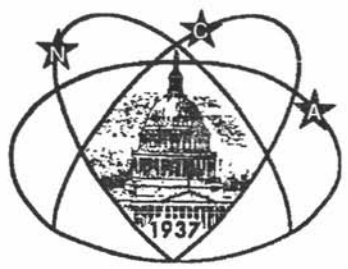


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National Capital Astronomers, Inc.

Washington, DC (301)320-3621

Volume 1L, Number 5

January 1991

ISSN 0898-7548

Dr. Judith Lean to Speak on Variations in Solar Radiation



Judith Lean is currently a Research Physicist with the Hulburt Center for Space Research at the Naval Research Laboratory. Dr. Lean's is a member of the Solar Ultraviolet Spectral Irradiance Monitor (SUSIM) team studying variations in the ultraviolet portion of the spectrum that is absorbed in the Earth's ozone layer. She received her B.Sc. in Physics from Australian National University and a Ph.D. from the University of Adelaide. Dr. Lean spent several years at the Cooperative Institute for Research in Environmental Sciences at the University of Colorado/NOAA

in Boulder as a Research Associate, then two years with Applied Research Corporation before coming to the Naval Research Laboratory.

Dr. Lean will discuss correlations between the data from two independent, satellite-borne solar radiometers deployed during 1980-1990, and observed solar phenomena. Is the radiation that heats the earth, or the radiation that maintains the ozone layer, affected by the sun's activity cycle? This question, when posed of the sun's total (i.e., spectrally integrated) irradiance (also called the "solar constant") has been debated for over a century. Because total solar irradiance is dominated by visible radiation that reaches the earth's surface, its variability has long been suspected as a driver of climate change. Measurements of the solar constant made from the ground during an entire century were unable to clarify whether or not variations in the data were the consequence of true solar variability, atmospheric "seeing" effects or measurement inaccuracies.

Measurements of solar radiation, both spectrally integrated, and at ultraviolet wavelengths, will be used to demonstrate how the sun's radiation varies. These variations will be related to active region features of the sun's disc, and the relevance of their variability for the earth will be identified.

January Calendar -- *The Public is Welcome*

Saturday, January 5, 7:30 pm - NCA Monthly Colloquium will be held in room A-06 of Building #42 on the Van Ness Campus of the University of the District of Columbia (UDC), at 4200 Connecticut Ave NW. Dinner with the speaker at 5:45 PM at Charlie Chaing's Restaurant at 4250 Conn Ave. NW (dinner will be in upper level of restaurant).

DIRECTIONS: From the Van Ness Metro station exit, walk west through entrance of UDC, crossing bus lane into garage. Exit garage on North side, climbing to level A of the campus. Building 42 is to the west as you emerge. (Alternatively, there is an elevator in Building 42.) The parking garage may be entered by car from Van Ness street. Charlie Chaing's restaurant is to the west of the entrance to UDC, and may be accessed from Connecticut Avenue or from the rear.

Tuesday, January 8, 15, 22, 29, 7:30 pm - Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, (202) 362-8872.

Friday, January 4, 11, 18, 25, 7:30 pm - Telescope-making classes at American University, McKinley Hall Basement. Information: Jerry Schnall, (202) 362-8872.

Friday, January 4, 11, 25, 8:30 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 (703) 960-9126.

Saturday, January 12, 7:00 pm - We are holding *Exploring The Sky* evening beginning at 7 PM on Saturday January 12. We need members with telescopes. The location is in Rock Creek Park, on Glover Rd. NW, near the Nature Center. For further information call John Lohman at (703)820-4194 (Arlington).

The rest of the 1991 *Exploring the Sky* schedule runs from May through November on the second Saturday evening of the month (except in September when we use the third Saturday). Times vary with the season.

December Colloquium

Dr. Joseph Weber of the University of Maryland addressed the National Capital Astronomers at their December meeting with a stimulating talk about "Advances in Methods for Detection of Neutrinos and Gravitational Waves". In his introduction to the speaker, Dr. Maurice Shapiro commented that, like Enrico Fermi, Weber has the talents of a first class theorist as well as those of a first class experimentalist. He is working in one of the most exciting research fields of the present time.

Dr. Weber first reviewed the roles of the four known forces in nature: the nuclear, electromagnetic, weak interaction, and gravitational forces. While it is very much the weakest of the four, gravity is the force that we are the most aware of in everyday life simply because we happen to live very close to a large massive body, the earth. Einstein, in his General Theory of Relativity, linked gravity with the geometrical properties of space-time. He showed how a change in gravity, such as that seen in a collapsing star, manifests itself as a change in the geometry. The kink in the space-time continuum thus induced, propagates out at the speed of light and can be regarded as a gravitational wave.

Discussion then moved on to the ways that such a wave might be detected as it passes by us. One way might be to look for the change produced in the local geometry; for example, in the sum of the three angles of a triangle made by light rays. The expected effect, 10^{-24} degrees, is however much too small to be observed. Since the 1960's, Dr. Weber has advocated that the best way is to measure the changes in the length or strain of an elastic, solid cylinder. In this case, the fractional length

change, a small contraction, is of the order of ten million times larger than the fractional change in the angles of a triangle and is thus much more likely to be measurable. The length changes are determined by fastening piezoelectric crystals to the 3000 kg cylinder. Changes in the strain within the crystals will give rise to small voltage pulses which can be amplified and analysed. Not surprisingly, the instrument is exceedingly sensitive to external interference, such as that due to mechanical vibration and a multitude of extraneous pulses must be removed if the detection is to be successful. Such discrimination is achieved basically by having a second gravitational wave antenna elsewhere; in this case at the Argonne Laboratory in Chicago. By removing local causes from consideration, a rate of accidental coincidences can be determined experimentally.

Excess pulses were detected in 1969 at the 3 standard deviation level and were believed to be real gravitational wave signals. At first, it seemed surprising that the sensitivity or effective area of the detector was so high until it was realized that a gravitational wave antenna of this type could be regarded as not just one, but as a very large number of small quadrupoles acting together.

The appearance of supernova 1987A was for most astronomers the most exciting event of the decade and attention was refocused on the University of Maryland detector when it was learned that it was the only one operating in the western hemisphere at the time of the collapse and subsequent outburst of the formerly massive star. A second similar detector was operating in Rome and a correlation between the two produced about a dozen events distributed over

a two hour period at the time of outburst. However, some controversy has been generated because the gravitational wave pulses were apparently coincident with the Mount Blanc neutrino burst rather than with the more widely accepted signals from the IMB and Kamiokande detectors about four hours later.

Dr. Weber discussed some of the ways to improve the sensitivity of gravitational wave antennae so as to be able to detect supernovae as far distant as the Virgo cluster of galaxies. He is currently working on methods involving large crystals rather than metal cylinders. Another kind of antenna which he has proposed is based on interferometric techniques. The whole subject, he pointed out, is very much the coupling of 20th century technology and computers to the worlds of Einstein, Riemann and Gauss.

The concluding section of the talk dealt with improvements in neutrino detecting techniques.

By their nature, neutrinos are exceedingly difficult to register. Until now, the most commonly used detectors consist of large tanks filled with liquid, located deep down inside underground mines. In a new method, Dr. Weber proposes the use of stiff, nearly perfect crystals as detectors. The principal has been tried using neutrinos from a tritium source to trigger events. With new technology now available, neutrino and gravitational detectors could be in the same room, in the same vacuum enclosure with the same large, near perfect crystal as a centerpiece. It appears to be possible to build for both purposes, one observatory about the size of a table at less than a million dollars for the entire installation. With an ability to detect supernovae as far off as the Virgo cluster, present controversies, based on supernova 1987A alone, could easily be settled.

John Graham

NCA Welcomes New Members

Dr. Harold A. Williams
2348 Glenmont Circle
Wheaton, MD 20902-1320

Richard L. Orr
14015 Bramble La #T-1
Laurel, MD 20708

Steven & Betsy Long
1541 Powells Tavern Pl.
Herndon, VA 22070

Pei Pei Mao
5704 Chapman Mill Dr. #150
Rockville, MD 20852

Occultation Expeditions Planned

Dr. David Dunham is organizing observers for the following occultations. For further information call the NCA-IOTA information line (301) 474-4945 (Greenbelt, MD).

Date	Time	Locality	Visible Magnitude	Percent Sunlight	Cusp Angle	Minimum Aperture
1-05	1:19	South suburbs	7.9	75	7S	15cm
1-21	19:55	Virginia	8.7	33	5S	20cm
1-21	22:23	Greenbelt, MD	8.7	34	3N	20cm
Asteroidal:			Star Mag.	Delta Mag.	Name	
1-03	19:28	VA, Carolinas?	7.4	0.8	(4)Vesta	5cm
1-19	0:15	New York*	9.1	1.7	(216)Kleopatra	15cm
1-25	23:31#	Canada*	10.1	1.7	(34)Circe	20cm

*Appulse to be observed for possible satellites or path shift.
#EST

Air and Space Museum - January Programs

Daily - The new IMAX film, *Blue Planet* joins *The Dream is Alive* in the Langley Theater. The new film is a dynamic portrait of the earth and its environs taken from space. Admission is \$2.75 for adults and \$1.25 for children and senior citizens.

January 5, 9:30 AM - A lecture on *Light Pollution*, by Jeff Chester at the Air & Space Museum Planetarium.

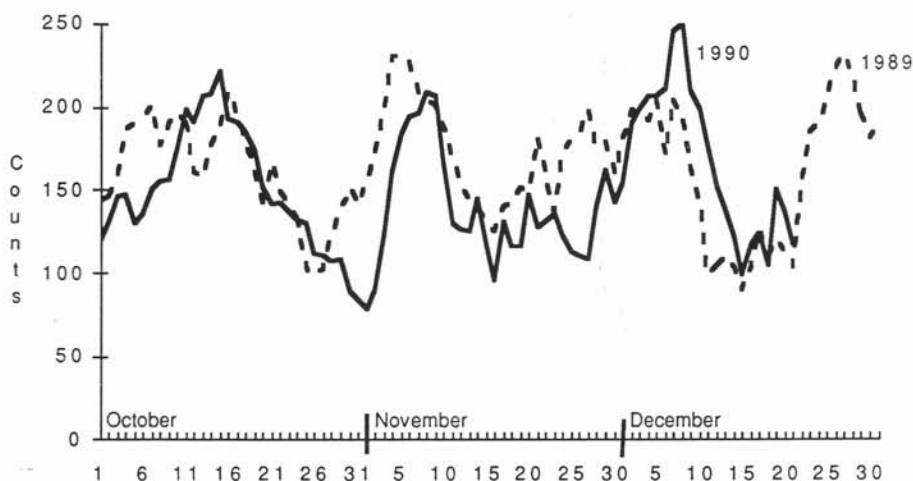
Trip to the Mexican Total Eclipse in July 1991

On July 11, 1991, the last total solar eclipse in North America until the year 2017 will be visible from Mexico. Join an expedition organized by astronomer and NCA member Tom Van Flandern to the path edges, where shadow bands, Bailey's Beads, crescent projections, the Diamond Ring, and the Flash Spectrum are more likely to occur, and will last up to ten times longer than on the center line! My team and I will conduct a week of exciting sky viewing, including the Moon passing through

the Pleiades star cluster, lectures on new cosmology and solar system ideas, and the eclipse everyone has been waiting for. The trip will last 7 days and 6 nights in beautiful Puerto Vallarta, Mexico, July 6-12, 1991. Estimated cost: \$700 single, \$900 double + air fare (\$250-\$450 from USA). July 9-12 only, half price (except air). Write or call for details: The Eclipse Edge / PO Box 15186 / Chevy Chase, MD 20815 / Recorded announcement: (202)362-8279.

Sunspot Activity: Last Year and Now

Nancy Byrd



Source: Peter O. Taylor, American Relative Sunspot Numbers

Excerpts from the IAU Circulars

R.N. Bolster

1• October 7 - Baron and Owen, University of Hawaii, obtained images of the distribution of H₃ on Jupiter in the 4-micrometer band with the NASA Infrared Telescope Facility. Spots of emission were seen over the north pole and near the south pole.

2• November 15 - Carolyn and Eugene Shoemaker and David Levy discovered a comet (1990o) of 13th magnitude in Cetus with the Palomar 46-cm Schmidt telescope. The orbital elements by Nakano indicate that the comet passed perihelion on September 17.

3• November - R.J. Lavery, Mount Stromlo Observatory, reported his discovery of a dwarf galaxy in Tucana which is probably a member of the local group. Although only 2.5 by 5' in size, the galaxy is resolved into stars on CCD images.

Astronomy and Personal Computers

Joan Bixby Dunham

Articles on Software Development

In early December, *The Washington Post* had a series of articles on software called "The Software Snarl." Much of the series concerned the difficulties in developing reliable software quickly. Examples were given of how software is developed, how some think it should be developed, and what happened when software had mistakes. The series was interesting in spite of too much stress on the dire consequences of software errors and of American firms being surpassed in software development by ones from other countries.

Software development is a labor-intensive business that always, even for what may appear to be the simplest programs, seems to take longer and cost more than expected. While most software developers are rather ordinary people, the field is known for its superstars, people with an almost intuitive understanding of how programs should flow and how to get the most performance from the hardware. The challenge is to devise methods for software development so that the more average person can develop code that is equally useful as the code from a programming superstar. Some of the ways this is done involve design methods which break the programs into small components and structure them in accordance with sets of rules for good design. Someone familiar with the rules can then examine the design proposed by someone else and judge whether or not the design has flaws.

On point the series did not make very well was the impact of improvements in hardware on software development as a discipline. When

hardware was slow and the memory available for storing program commands was small, every command counted. Programs had to be very specific and programmers had to take advantage of every nuance of the hardware. I remember inspecting code from a hardware board that became different commands depending on where the code was entered. It was rather like a string of letters that formed one sentence if it started for the first letter, but carried a different message if it started from the second or the third letter. Someone spent many hours devising that code, and the only reason it was necessary was that there was very little space to store the code. With greater storage, such an effort is no longer necessary, and an employer might well regard time spent doing that as wasted.

When hardware runs faster and with greater storage capacity, there is less of a penalty for having code perform functions in a more roundabout manner. This means that more general pieces of code can be strung together to accomplish a given task, instead of having to develop custom software for each and every task. This idea of using many common elements in the instructions needed to perform various tasks is a major feature in the current theories on how to improve software development. The code to perform any specific task, when constructed from these common elements is likely to have more instructions and take longer to run than a customized piece of code. This trades the efficiency of the code for the efficiency of its development.

The above graph is a composite of final American Relative Sunspot Numbers from October 1990 and previous, provisional American Relative Sunspot Numbers for November 1990, and estimated numbers for December 1990. The estimated numbers are the daily SESC (Space Environment Services Center) numbers multiplied by the factor 0.78. These numbers are to be considered preliminary. The provisional American Sunspot numbers include data from approximately one-fourth of the collaborators in the production of

the final American Sunspot numbers. The formula for relative sunspot number is of the form, $R = 10g + s$, where R is the relative sunspot number, g is the number of groups counted and s is the number of individual sunspots counted.

As can be seen from the graph, solar activity continues in the moderate to high range. During the week of 14 to 21 December, 1990, thirteen solar flares reaching M-level x-ray intensity were reported, mostly in the SESC regions 6412 (17 December) and 6415 (20 December).

National Capital Astronomers, Inc.

is a non-profit, public-service corporation for advancement of the astronomical sciences and 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. (See monthly *Stardust* for time and location.) 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 monthly publication of NCA, *Stardust*.

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 leads 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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Nancy Byrd, Secretary, 4215 Holborn Ave., Annandale, VA. 22003.

The following information is optional. Please indicate briefly any special interests, skills, vocation, education, experience, or other qualifications which you might contribute to NCA

Thank you, and welcome!

Stardust is published eleven times yearly by National Capital Astronomers, Inc. (NCA), 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 Kenneth R. Short. Deadline for *Stardust* is the 15th of the preceding month. Information: Nancy Byrd, 4215 Holborn Ave. Annandale, VA 22003. Editors, Therese & Brady Byrd (703)237-0369

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