



Johnston to Report Current Progress in LBOI



DR. JOHNSTON

Dr. Kenneth Johnston, Chief, Radio and Infrared Astronomy Branch, U.S. Naval Research Laboratory, will speak at the November 5 National Capital Astronomers colloquium in the National Air and Space Museum. He will report on further developments in long-baseline optical interferometry (LBOI).

Interferometric techniques, both radio and optical, have spectacularly increased angular resolution in recent years. The advances that interferometry has contributed to astrometry were described by Dr. James Hughes, our March 1988 lecturer; the review in our April issue is suggested as preparaton.

Current developments in LBOI promise measurements with unprecedented accuracy of all the fundamental parameters necessary to deduce a complete model for stellar evolution. Johnston anticipates future detailed imaging of stellar disks, which will allow direct study of flares and starspots,

pulsation, rotation, and magnetic fields.

Some of the obstacles to practical LBOI have been overcome more easily in radioastronomy. The much longer wavelengths allow the use of atomic time references to extend the baselines from direct connection to worldwide. Johnston will describe recent significant advances that have been made in overcoming these and other difficulties with the experimental Mount Wilson Long-base Optical Interferometer.

Dr. Johnston received his B.S.E.E. from Manhattan College in 1964, and his Ph.D. in astronomy from Georgetown University in 1969. He is Chief of the Radio and Infrared Astronomy Branch of the U.S. Naval Research Laboratory, and is a member of the International Astronomical Union, the International Union of Radio Science, the American Association for the Advancement of Science, and Sigma Xi.

NOVEMBER CALENDAR -- *The public is welcome.*

Tuesday, November 1, 8, 15, 22, 7:30 pm -- Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, November 4, 11, 18, 25, 7:30 pm -- Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, November 5, 5:45 pm -- Dinner with the speaker 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 L'Enfant Plaza Metrorail station.

Saturday, November 5, 7:30 pm -- 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. Johnston will speak.

Friday, November 11, 18, 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 960-9126.

Saturday, November 19, 7:30 pm -- Annual free, public NCA seminar: How to Select, Use, and Care For a Telescope. Room A06, Building 42, University of DC.

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

OCTOBER COLLOQUIUM

Dr. John Graham, Department of Terrestrial Magnetism, Carnegie Institution and member of NCA, addressed National Capital Astronomers at the National Air and Space Museum on October 1. He described his proposed Space Telescope experiment to resolve the discrepancy in the Hubble constant, which relates extragalactic distances to velocities determined by redshift.

Perhaps the most important astronomical discovery of the century has been that of the expansion of the universe.

Galaxies, star systems more or less like our own, apparently are receding faster as we look farther out into space. The large-scale distribution of matter and its evolution with time are fully determined by the expansion parameter H_0 (the Hubble constant), and the deceleration parameter q_0 :

$$q_0 = -(\ddot{R}/R)_0 H_0^{-2}, \quad \text{where } H_0 = (\dot{R}/R)_0,$$

provided that we have a theoretical model which fits. In the last 50 years or so the problem has not been so much in finding a model as in fitting the scale to it. In many basic problems of physics and astrophysics we need to know how fast the universe is expanding and at what distance.

Distance determination in astronomy has always been a tough job. Setting up a distance scale from first principles is an immense task which requires years of painstaking measurements of small quantities. Only for the nearest stars can we measure parallaxes directly. At distances of 300 lightyears or more we have to depend on "standard candles," objects whose intrinsic luminosity we know. This presentation deals mostly with the calibration of these.

Variable stars are important standard candles. They are easy to detect, the underlying physics is well understood, and their observable quantities, such as brightness and period, are easy to determine. Amateurs have provided input on long-period variables and cataclysmic variables.

We can do some calibration in our own galaxy, studying variable stars in clusters with known distances, for example. But, generally speaking, it is hard to do the calibrations in our own galaxy because of all the local smog and the enormous variation in distance among the individual objects. We find it better to go to the closest external galaxies, such as the Magellanic clouds, where we have everything at the one distance.

Variable stars are only helpful if they are bright enough to be picked out in distant galaxies. We can do this out to about 30 million lightyears, but farther out we have to use less direct methods. One of the best in use today is the Fisher-Tully relation. The apparent magnitude of a galaxy depends upon its total mass and distance. The rotational velocity depends only upon total mass, and is independent of distance. Fisher-Tully relates the apparent magnitude to the logarithm of the rotationally doppler-broadened hydrogen line widths of galaxies observed edge-on. Using this relation we can extend our distance measurements by a factor of 10.

The Fisher-Tully relation is calibrated by earlier distance indicators, Cepheid variables in nearby galaxies out to about 30 million lightyears. With the Space Telescope, this distance can be doubled, and will include 20 galaxies.

Some of the problems involved include interstellar absorption, resolution of stars in distant galaxies, uniqueness of the Fisher-Tully relation, and the inhomogeneity of the universe.

The ultimate aim is to get accurate distances to clusters of galaxies out to 300 million lightyears. This is only about 20 percent of the farthest distances we can observe, but if we can establish a firm distance scale for the universe out to this distance, we will be in very good shape for understanding what we observe out at the fringes, where the galaxies had only just put in an appearance.

The editor thanks Dr. Graham for providing extensive notes and much of the text of this review.

Robert H. McCracken

CRANNELL TO DISCUSS HIGH SOLAR ACTIVITY WITH NCA IN DECEMBER

At the December NCA colloquium, Dr. Carol Jo Crannell, NASA Goddard Space Flight Center, will report on her studies of the present high solar activity, unusual so early in the solar activity cycle.

NCA MARS MONITORS FIND GOOD MARTIAN WEATHER NEAR PERIGEE



The National Capital Astronomers Research Division, led by Bob Bolster, closely monitored Mars during the recent approach of the planet to the Earth. It is the season during which dust storms are frequent on Mars, which often thoroughly obscure the surface beneath a thick, yellow cloud of dust. Fortunately, there were no significant weather problems on Mars. On the Earth however, the special public NCA Park program with the National Park Service was rained out.

Using both the NCA C-14 and the Naval Observatory's 12-inch Clark refractor, and being blessed with good seeing, members of the NCA research Division were able to see Mars' two tiny satellites, Deimos and Phobos, using an occulting bar to block the glare of the planet. The satellites were also seen at Hopewell Observatory with a 14-inch telescope. While

monitoring for transient events, some of the team, particularly Daniel Costanzo, have also made highly detailed drawings.

The accompanying photograph is one of several taken by Bolster with the 14-inch telescope On 1988 September 29 04:27 UT. The exposure was one second at F/72, using Eastman 2415 Technical Panchromatic film and a Wratten 25 (red) filter. The central meridian was 284 degrees.

ERIC SCHEIRER, AWARD WINNER, TO ADDRESS MATHEMATICAL SOCIETY

A brilliant young scientist who won an NCA membership award for his outstanding science-fair project last spring, Eric Scheirer and three of his schoolmates have since brought national distinction to their Thomas Jefferson School, and to themselves.

On November 12, at American University, Eric will address the four-day seminar of the Maryland-District of Columbia-Virginia Section of the Mathematics Association of America. For information on attendance, call Elizabeth Teles at Montgomery College, Takoma Park, 587-4090, extension 305.

Eric's topic, "A Chaotic Analysis Technique for the Planar-restricted Three-Body Problem," is that for which he won the NCA award, and for which in August his team won the National Superquest. The sponsor, ETA Division of Control Data Corporation, donated the prize, an ETA supercomputer, to their school.

The three-body problem deals with the complicated dynamics of three gravitationally bound, mutually orbiting celestial bodies. (It has been said that the only known general solution to the three-body problem is divorce! - ed.)

Of about 1500 such teams nationwide, 99 survived to the semifinals. Of the four subsequent finalists, two were local: Montgomery Blair and Thomas Jefferson. The latter team emerged as the winner.

AIR AND SPACE MUSEUM OFFERS PROGRAMS

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

Saturday, November 5, 9:30 am -- John Mihran Miranian, U.S. Naval Observatory, will present the Monthly Sky Lecture, "Keeping the Nation's Clock, a review of the history of the USNO Time Service from the 1845 noon "time ball" to atomic time distributed by satellites. Safe Telescopic viewing of the Sun will follow the program, weather permitting.

Wednesday, November 16, 8:00 pm -- John Simpson, Astrophysicist, will present **The Solar Neighborhood**, the giant, magnetic "cocoon" filled with solar wind and high-energy phenomena around the solar system, known as the heliosphere. Telescopic viewing of the sky will follow the program, weather permitting.

Tuesday, November 22, 7:30 pm -- Ellen V. Sprouls, Einstein Planetarium staff, will speak on the contributions made by many cultures, including early American, to the history of the constellations. Telescopic viewing of the sky will follow the program, weather permitting.

ANNUAL NCA PUBLIC TELESCOPE SELECTION SEMINAR SET

The annual NCA free, public seminar, "How to Select, Use, and Care for a Telescope," will be held on Saturday, November 19, at 7:30 pm; in Room A06, Building 42, on the Van Ness Campus of the University of DC. Guidance will be provided, myths will be dispelled, and the uninitiated will be equipped to select and purchase wisely. After a basic presentation and discussion, hands-on experience with representative types will be offered.

By Metrorail, exit the UDC station (Red Line), turn left, go between the columns under the "4250," up steps at the left, four flights to the elevated walkway to Building 42. By Auto, park in garage under building 44, on north side of Van Ness Street a short distance from Connecticut Avenue. Continue to rear (north) of garage, walk out back door. Building 42 is immediately north of Building 44. Take elevator up one floor to A level, or, use outdoor stairs to upper (A) level.

NCA WELCOMES NEW MEMBERS

Donald H. Atha
1078 Pipestem Place
Rockville, MD 20854

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2928 North 26th Street
Arlington, VA 22207

Bernard Kaufman
6208 Glen Oak Drive
Temple Hills, MD 20748

David W. Gehring
7205 Stover Drive
Alexandria, VA 22306

Michael S. Walker
5211 Richardson Drive
Fairfax, VA 22032

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 Metzert Road in College Park. Talks and slide shows are presented, followed by telescopic sky viewing, weather permitting.

Saturday, November 5, 8:00 pm -- "Disturbances on the Sun," Dr. M.K. Kundu.
(Note conflict with NCA colloquium.)

Sunday, November 20, 8:00 pm -- "Galactic Collisions," Dr. T.M. Heckman.

The public is invited; there is no charge, and no reservations are necessary for individuals. Groups larger than ten should call (301) 454-3001 at least 5 days prior to the program.

U.S. NAVAL OBSERVATORY TOURS IN NOVEMBER

The Monday night public tours of the Naval Observatory begin at 7:30 pm (EST). The next tour is scheduled for November 7. Tours may be suspended until January; call 653-1543 for specific information on subsequent Monday nights until then. NOTE CHANGE: Passes will be issued to the first 100 persons in line, not at the main gate as previously, but at the gate across from the British Embassy, at Massachusetts Avenue and the southeast side of Observatory Circle. 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.

EXCERPTS FROM THE IAU CIRCULARS Robert N. Bolster

1. August 26 -- J. Lecheux, Observatoire de Paris, confirmed the dark linear feature seen in the Memnomia region on Mars, with the 1.6-m reflector at Pic du Midi, and noticed a linear white feature north of and parallel to it.

2. September 5 -- Cruikshank, Hartmann, and Tholen found that the brightness of (2060) Chiron in the visible and infrared has continued to increase.

3. October 4 -- Comet Machholz (1988j) has been reported to be much fainter than predicted at perihelion. A photo by M. Jager showed it to be of only 12th magnitude.

ASTRONOMY AND PERSONAL COMPUTERS by Joan B. Dunham

Computing the Julian Date -- The Julian date is a numbering scheme used in astronomy which measures time as the number of days since noon, January 1, 4713 BC. Julian dates are used in several ways in astronomy. They can be the independent variable in equations for time or position. They are used to specify the orbital elements of comets, asteroids, binary stars, etc. They are also used for recording the times of observations. Their principal value lies in the fact that they do not repeat.

The Julian dates can be obtained from the *Astronomical Almanac* (from the U.S. Naval Observatory), *Observer's Handbook* (available from the NCA treasurer), some astronomy textbooks, and some calendars. They can also be computed.

If the Julian date is known for any given date, any other Julian date can be computed by counting from the first date. For example, the Julian date for December 31, 1987 is 2447160.5. The Julian date for any date in January is the January date + 2447160.5, in February it is 31 + the February date + 2447160.5. In March, it is 31 + 29 (remember, this is a leap year) + 2447160.5, and so on. This technique is the one recommended by the *Astronomical Almanac*, and works quite well if a source of reference Julian dates is available. In a computer program which will be used within a small range of dates (only for 1988, for example), the Julian date computation can be done quite easily with this method. Sometimes, however, we would want to be independent of a source for a reference Julian date, or we want to allow a very wide range of dates as input. Several astronomers have developed equations for the computation of Julian dates from calendar dates, which are valid for any time. Jean Meeus has published one, and Tom Van Flandern has published two variations of an equation relating calendar and Julian dates.

The Meeus method (from *Astronomical Formulae for Calculators*, Willmann-Bell, 1982) is as follows: Given a year, month, day, and hour:

First, if the date is after October 15, 1582, compute $B = 2 - \text{int}(\text{year}/100) + \text{int}[\text{int}(\text{year}/100)/4]$. Here, $\text{int}(\)$ means the integer part of the quantity inside the (), so $\text{int}(2.2) = 2$, and $\text{int}(3/2) = \text{int}(1.5) = 1$. If the date is before October 15, 1582, $B = 0$. Then:

$$JD = \text{int}(365.25 * \text{year}) + \text{int}[30.6001(\text{month} + 1)] + \text{day} + \text{hour}/24 + 1720994.5 + B.$$

The first Van Flandern method is a FORTRAN algorithm published in *Communications of the ACM*, Vol II, No. 10, October 1986, p. 10:

$$JD = \text{day} - 32075 + 1461[\text{year} + 4800 + (\text{month} - 14)/12]/4 + 367[\text{month} - 2 - (\text{month} - 14)/12 * 12]/12 - 3[(\text{year} + 4900 + (\text{month} - 14)/12)/100]/4.$$

The arithmetic in this equation is integer, which means that the results of each division are truncated, and only the integer parts are kept. The equation produces the Julian date at noon of the Gregorian date. The full Julian date is then

$$TJD = JD - 0.5 + \text{hours}/24.$$

The computation of TJD is done in floating-point arithmetic.

The second Van Flandern method was published in the *Astrophysical Journal Supplement*, Vol 41, November 1979, pp 391-411, and is

$$JD = 367 * \text{year} - 7[\text{year} + (\text{month} + 9)/12]/4 - 3[(\text{year} + (\text{month} - 9)/7)/100 + 1]/4 + 275 * \text{month}/9 + \text{day} + 1721029,$$

where the arithmetic is integer, as above. For the JD at the correct time,

$$TJD = JD - 0.5 + t.$$

A shorter form of this second equation for dates since March, 1900 is

$$JD = 367 * \text{year} - 7[\text{year} + (\text{month} + 9)/12]/4 + 275 * \text{month}/9 + \text{day} + 1721014.$$

In many implementations of languages on PC's, and in particular, BASIC, integers are restricted to values between -32768 and 32767. This is not enough to accommodate the full Julian Date, which, for noon on November 1, 1988, is 2447467. I find that, in Microsoft GW-BASIC, the computations can be done in integer as long as JD is real (single precision floating point). However, if the fractional part of a day is also wanted, as shown in TJD above, the single precision floating point is also too small, and it must be declared a double precision.

NASA GODDARD SEMINAR SERIES SCHEDULED FOR NOVEMBER

Tuesday, November 8, 3:30 pm, in Building 21, Conference Room 183: "Solar Irradiance Variations," Judith Lean, Applied Research Corporation.

Coffee and tea will be served from 3:00. Enter the main gate and obtain a visitor's pass from the guard. Ca.; 286-8701 for further information.

BELIEVE IT OR NOT: OCTOBER STAR DUST WAS MAILED ON TIME

You may have heard me frequently say (although it usually comes back to bite me), "The best darned excuse in the world never got a job done!" Accordingly, the following is offered simply as an explanation for those who wonder.

In keeping with the policy set by the trustees many years ago,, we always mail early in the week of the lecture meeting. As usual, many obstacles emerged to make it difficult, but in spite of them all, it was ready by mid week. We didn't leave the printer, Dan Daniels, in Bethesda, much time, but he is one of the most dedicated, cooperative, helpful businessmen I know -- and he never compromises quality. We do appreciate him!

Somehow, a water main knew just when to burst, requiring the evacuation of the building for a day. Then, working under an overwhelming backlog, but still sympathetic with our problem, he put top priority on our work, and got it out in one day. That meant "burning" the metal plates, opaquing, printing, collating, folding, saddle-stitching, and cutting -- all in one day. By then it was Thursday, not early in the week. but then, in an effort to shorten the delivery time, I drove it out to the main center at Brentwood and mailed it promptly, in reasonable time for first-class delivery, albeit Thursday, the latest it has been mailed since April 1971.

By meeting time no one had received it. The following Tuesday evening our secretary, Pat Trueblood, called. She had just received a large package from the Post Office, containing -- you guessed it -- the entire mailing. Enclosed was a note demanding ten cents additional postage for "nonstandard size!" The note is reproduced here:

RETURN TO SENDER

~~10¢~~ Postage due for NONSTANDARD SURCHARGE.

Your mail piece is of a nonstandard size and is subject to a surcharge in addition to the applicable postage and fees.

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has a length which is less than 1.3 times

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TO REMAIL: Affix ~~10¢~~ additional postage to your mail piece,

~~10¢~~ remove this label and remail.

Label 100, March 1981

Star Dust certainly does not exceed 1/4 inch in thickness. It is 5 1/2 inches wide which does not exceed 6 1/8. The minimum length, 1.3 times 5 1/2 is 7.15. It is 8 1/2 inches long, not less than 7.15 inches. The maximum length, 2.5 times 5 1/2 inches, is 13.75 inches. It wouldn't be that long unfolded!

Could the mail rules be just too complicated for a mere postal employee? After all, we need a block party every evening just to exchange mis-delivered mail!



National Capital Astronomers, Inc.

is a non-profit, public-service corporation for advancement of the astronomical sciences. NCA is an affiliate of the Washington Academy of Sciences.

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

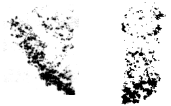
NOTE: If you already subscribe to *Sky & Telescope*, please attach a recent mailing label, or indicate expiration date: _____. An adjustment will be made. Make check payable to National Capital Astronomers, Inc., and send with this form to: Patricia B. Trueblood, Secretary, 10912 Broad Green Terrace, Potomac, MD 20854.



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