Star Dust

National Capital Astronomers, Inc. Washington, DC (301) 320-3621

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Penny Sackett to address NCA on "Rings Around Galaxies"

The next meeting of National Capital Astronomers will be held on Saturday February 1, 7:30 pm at the National Institutes of Health (the Bunim Room at the Clinical Center (Floor 9, Building 10)). A talk by Dr. Penny Sackett of the University of Pittsburgh on the subject "Rings around Galaxies" will highlight the evening. One of the great unsolved problems in astronomy today is the apparent existence of matter in the universe, which we can not see but can only detect by its gravitational interaction with visible matter. We have no idea about what this matter is, only that it seems to make up a large, even dominating fraction of the mass of the universe. Dr. Sackett's talk will deal with one way we are hoping to be able to study its distribution in star systems like our own Milky Way.

Dr. Penny Sackett comes from Omaha, Nebraska. After completing her studies at the University of Nebraska and the University of Pittsburgh, she spent two years as a Visiting Assistant Professor at Amherst College. She later traveled to the Netherlands to spend one and a half years at the University of Groningen working at the Kapteyn Astronomical Institute. She then returned to the University of Pittsburgh to take up a position as Assistant Research Professor of Physics and Astronomy. She is currently on leave at the National Science Foundation where she is Program Director for Education, Human Resources, and Special Programs in the Division of Astronomical Sciences. Her primary research interest is determining the distribution of dark matter in galaxies, and she will be telling us at the meeting of a way that this may be done by studying certain galaxies which are surrounded by highly inclined rings. Together with Frank Briggs and Stefano Casertano she recently organized a meeting at the University of Pittsburgh dealing with this subject and co-edited the conference proceedings.

Bob Bolster gives instruction for updating your ephermerides to J2000.0

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February Calendar

The Public is Welcome!

Saturday, February 1, 5:30 PM - Dinner with the speaker at Frascati's Restaurant in Bethesda before the monthly meeting. Reservations are for 5:30 Sharp!

February 1, 7:30 PM - NCA monthly colloquium with Penny Sackett (University of Pittsburgh) "Rings around Galaxies." Meeting will be held in the Bunim Room at the National Institutes of Health. For directions refer to map and description on inside back page.

Tuesday, February 4, 11, 18, 25, 7:30 PM - Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Friday, February 7, 14, 21 and 28, 7:30 PM - Telescope making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 202/362-8872.

Friday, February 7, 21, 28, 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.

Monday, February 17 and Saturday, February 29, 7:00 PM - "African Skies," public planetarium program at Montgomery College Planetarium at 7600 Takoma Avenue (Takoma and Fenton Street). Information: Dr. Harold Williams, 301/650-1463 (office), 301/942-1014 (home).

Next Month:
Saturday, March 7, 7:30PM - Harold Williams (Montgomery College) "The Formation of Stars".

January Colloquium

by John Graham

At their meeting on Saturday January 4, National Capital Astronomers were addressed by Dr. Maurice M. Shapiro on the subject of "The Explosive Universe - as revealed by the new astronomies". Dr Shapiro is a Visiting Professor at the University of Maryland and Chief Scientist Emeritus of the Naval Research Laboratory in Washington DC and has had a direct involvement in many of the experimental techniques which have transformed our knowledge of the universe in recent decades.

Until the present century, our observations were limited to the use of electromagnetic radiation, specifically that very small fraction which is detected by our eyes. The new astronomies have come about firstly by making use of other signals from the stars and the galaxies and also, equally important by the development of complex and highly sensitive instruments to record and measure them. These include, cosmic rays, radio waves, infra-red radiation, X-rays, gamma-rays, neutrinos and gravitational waves. Dr. Shapiro reviewed each of these techniques in turn and described how each gives a complementary view of the way the universe has evolved.

He discussed the standard "Big Bang" cosmology and the way in which direct observation has provided the three pillars of knowledge which have compelled us to accept a beginning of things in a very compact state a finite number of years ago. These three pillars are, the direct measurement of the expansion of the universe through the measurement of the velocities of galaxies, the observation of the extremely weak 3

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OCCULTATION EXPEDITIONS PLANNED

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

Date	Time (EST)	Place	Visible Magnitude	Percent Sunlight	Cusp Angle	Minimum Aperture
Grazing Lunar:						
Feb 9	21:49	Columbia, MD	8.5	33	8N	13 cm
Feb. 10	22:14	North Maine	5.7*	44	9N	6 cm

Date	Time	Place	Star Mag.	Delta Mag.	Name		Aperture
Asteroidal:							
Feb. 19	04:45	Cuba**	7.1	6.5	(849)	Ara	5 cm
Feb. 21	18:59	N. Canada**	12.1	0.5	(10)	Hygiea	25 cm
Feb. 23	03:33	N. Canada**	10.4	1.6	(139)	Juewa	15 cm

*Triple star Mu Ari

**Appulse to be observed for possible satellites or path shift. Observers should obtain a finder chart from Dunham or IOTA.

Astronomy and Personal Computers

by Joan Bixby Dunham

Have you ever felt that your typewriter has too many functions, your VCR does too much, your word processor or spreadsheet has more features than you would ever use? It seems like everything we get has a few too many buttons. Also, for some reason, everything has to have a clock, which then must be set. A standard comedian's joke is that all the VCR's show the same time — flashing 12:00 — because the VCR's are too complex and the instructions too hard to understand. Actually, its because we like to be able to unplug VCR's and move them, and its just too much of a nuisance to reset the clock every time. Besides, who needs the clock on the VCR? We have the clocks on the mantle, the stove, the microwave, the coffee maker, the answering machine, the radio, to say nothing of the watches on our wrists. Similarly, our software also suffers from "featuritis."

If the number of features on our software are too numerous, then the manuals that explain these features are even worse. Sometimes it can take hours to read through all these features trying to determine how to do something that seems relatively simple, but never seems to be exactly what the software will do. I find that manuals are often too detailed and tutorials too simplistic. (Almost every tutorial starts with how to put the diskette in the drive, and few tutorials are designed so that you can skip lessons.) The tutorials always seem to stop slightly before the complexity of what I want to do, while the manuals spend vast amounts of paper describing in detail each and every command. Also, far too often it seems to me that the manuals are written by someone who never envisioned that the software would be used as I want to use it. Spreadsheet authors, for example, rarely acknowledge that their software would be used for analyzing anything other than business data.

I find most manuals to be great references if I already know how to do what I want to do, and just need to know exactly how many commas are needed in the command, but are very frustrating when I am fairly

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degree background radiation, a relic of the Big Bang itself, and the determination of the chemical abundances of the lightest elements and their isotopes which demands that they were created by nucleosynthesis under conditions far hotter and denser than we see around us today.

Some of the new astronomies are very young indeed. Neutrino astronomy was born as an observational science 5 years ago when Supernova 1987a exploded in the Large Magellanic Cloud and produced neutrinos which were observed here on Earth. Significantly, these neutrinos were observed in the northern hemisphere where the Large Magellanic Cloud cannot be seen directly. The neutrinos had come through the Earth before being detected. Another of the new astronomies appears still to be waiting for its first direct observations. Whether gravitational waves have or have not been detected is still controversial, but almost all scientists agree that the observations by Joseph Taylor and his collaborators of binary pulsars with slowly decaying orbits is strong evidence indeed for their existence.

Cosmic rays, discovered by Victor Hess in 1912, have become probes of the most energetic events in the universe. Mostly charges particles, they are accelerated to very high velocities and gain enormous energies through their encounters with immense gas clouds and warped magnetic fields of interstellar space. These same events unfortunately cause them to lose their original directions and it is by making use of other astronomies such as radio astronomy that we can gain understanding about their origin. Dr. Shapiro pointed out the irony that we combine observations of extremely low energy radio waves with measurements of extremely high energy cosmic rays to give ourselves a more complete picture of the origin of both. The new astronomies deal with very different phenomena and use quite different measuring techniques but have a close and intimate relation with each other.

Cosmic rays almost certainly come from places like the Crab Nebula, which is the remnant of a supernova which exploded in the year 1054. Here we directly observe synchrotron radiation which is generated by electrons moving at velocities very close to that of light in strong magnetic fields. Here, with the violent shock waves between colliding gas clouds, there are almost certainly appropriate conditions for the acceleration of cosmic rays. Until the detection of the embedded pulsar in the Crab Nebula, it was a puzzle as to how the nebula could continue to lose so much energy in the form of radiation and particle acceleration. This pulsar, an incredibly dense neutron star, rotating 30 times a second, can provide the energy input for the other phenomena that we observe.

High energy cosmic rays are mostly detected now through the construction of large arrays of detectors. Unfortunately, the winding paths of charged cosmic rays, as they bounce from one magnetized cloud to another, makes it difficult to determine their origin. However, even before they arrive in our neighborhood, the fast cosmic ray particles produce progeny which do not have an electric charge, such as gamma rays and neutrinos, which can travel to us in a straight line and be observed by different techniques. In this way we can hope to discover the directions from which they come.

Gamma ray astronomy has received an immense thrust through the launch in April 1991 of the Compton Gamma Ray Observatory, the latest and heaviest of the four great observatories planned for space astrophysics. At present it is carrying out a gamma-ray sky survey of many well known objects, the Crab Nebula among them as early targets and we can expect to hear soon of new and exciting results from this window of the electromagnetic spectrum.

Neutrinos are not a new concept even though they have only been very recently observed in interstellar space. They were first "invented" by Wolfgang Pauli in 1930 as unseen particles to satisfy the conservation laws of nuclear beta decay. Their existence was not confirmed until over 20 years later by Clyde Cowan and Fred Reines who constructed detectors outside a nuclear reactor in Savanna, Georgia. Since

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then, techniques for detecting neutrinos have continued to improve. Neutrinos from the Sun have been detected, although not in sufficient numbers to agree with theoretical predictions, and now have been discovered in a supernova. Neutrino astronomy has an exciting future ahead!

Dr. Shapiro concluded his talk with a spectacular series of slides which illustrated many of the objects towards which the new astronomies are being applied.

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certain the software will do what I want, but I have never done it before. Sometimes, I find myself just perusing the table of contents, or, even worse, the index, trying to determine what the authors of this manual call the actions I want to take. (Even more infuriating can be discovering that they do use the same terminology I do — it just wasn't considered important enough to make a reference in the index or the table of contents.) Also, most complex software will have more than one way to accomplish a task, but the manuals do not give much guidance in which of the several ways is "better."

What I think is needed are not tutorials but concepts of use and example scenarios. I want to know how did the software developers think the software would be used best, and I want some examples. In a spreadsheet concepts of use document, for example, I want to see what commands and steps are suggested for importing a text file, formatting it into a table, and plotting one column against another. Or, for a word processor, an example of use might be subdividing a table, making a file of a subsection, and putting it into a format that can be used by someone else. These do not need to be presented in the same chatty style often adopted in software tutorial documents. It would probably be enough just to give the sequence of commands that would be used to accomplish a given task.

Hubble Performs

by Nancy Byrd

About 40 papers presented at the American Astronomical Society in Atlanta, GA this week have demonstrated that the Hubble Space Telescope, in spite of its flawed mirror, is opening new doors on our understanding of the universe. One such result, presented by Tod Lauer, Roger Lynds and Sandra Faber, suggests that the black hole at the center of M87 (NGC 4486) may be as large as 2.6×10^9 solar masses. M87 is an elliptical galaxy, with strong radio emissions and a jet of ionized matter, located in the constellation, Virgo, about 22,000 kiloparsecs distant. Image deconvolution and modeling studies of infrared images, taken with the wide-field/planetary camera on the Hubble show an increase in brightness with a "cusp" of bright light toward the center. The authors report an increase to 1000 solar luminosity per parsec within a radius of 10 parsecs, with a spike within 1 parsec. Using the Hubble's faint-object camera, scientists also have obtained much more detailed images of the jet.

In another study using the Hubble's High Resolution Spectrograph, Jeffrey Linsky measured the ratio of deuterium to hydrogen, line-of sight, between here and Capella. The ratio determined is 15 ppm. If the distribution of deuterium and hydrogen are uniform, this result would suggest that there is substantially less matter in the universe than has heretofore been thought.

Sources: Abstracts of the Proceedings of the 1991 Meeting of the American Astronomical Society, The Washington Post and conversations with participants.

Updating Ephemeris Calculations to the Year 2000

by R.N. Bolster

If you have been computing comet or asteroid ephemerides from the elements provided by sources such as the IAU *Circulars* or the *Minor Planet Circulars* you may have to make some changes in your software. The angular elements, which have been in the coordinate system based on the standard equinox of 1950.0, have now been precessed to the J2000.0 equinox. The old system used the position of the vernal equinox on 1950 January 0.9235 (Julian Day 2 433 282.4235) as the starting point for measuring right ascension, while the new will use the position of 2000 January 1.5 (JD 2 451 545.0).

Two or three changes to your program are needed:

a) Change the value of the obliquity of the ecliptic (formerly about 23.4458 degrees) to 23.43929.

b) Change the calculation of the rectangular coordinates of the Sun (X, Y, and Z) to allow for the precession.

c) Remove any calculation which corrected the coordinates of the object from 1950.0 to 2000.0. This is now not needed, as the calculated positions will already be in 2000.0 coordinates.

Change b) may be difficult. If your X, Y, Z of the Sun is based on the program given on page 470 of the November 1985 issue of *Sky and Telescope*, the following will do the job: In line 506 P0 = 1.396041 + 0.000308 * (T+0.5), delete the parentheses and the +0.5 at the end. In line 507 P0 = P0 * (T-0.499998), change 0.499998 to 1. If the six formulae including T and T0 given in the *Explanatory Supplement* are used, recalculate the constants involving T0 using T0 = 0.5. Calculate T by subtracting 4,451,545 instead of 2,433,282.4235. The books by Jean Meeus show how to correct his algorithms. These changes may not be sufficient for high-precision calculations such as occultation predictions, but should be more than adequate for locating the object telescopically.

What do you do if you are using commercial software which you cannot change? As a last resort you can precess the three angular elements backward from 2000.0 to 1950.0 using a routine such as "REDELMT" in Duffett-Smith's book, *Astronomy With Your Personal Computer*. The books by Meeus also show how to do this in the chapter titled "Reduction of Ecliptical Elements from one Equinox to another one."

EXCERPTS FROM THE IAU CIRCULARS

by R.N. Bolster

1. December 13 - Jean Mueller discovered a comet (1991h1) of 17th magnitude in Ursa Major on a photo taken with the 1.2-m Oschin telescope at Palomar.

2. December 24 - Mauro Zanotta, Milan, Italy, and Howard Brewington, Cloudcroft, New Mexico, independently discovered a comet (1991g1) of 9th magnitude in Delphinius with 15- and 40-cm reflectors. The orbital elements by Marsden indicate that it will reach perihelion on January 31 at a distance of 0.64 AU.

3. December 27 - Paul Camilleri, Cobram, Australia, discovered a nova of 7th magnitude in Puppis on a photograph taken with a 135-mm lens and T-Max 400 film. Spectra taken at La Silla confirmed that the object is a nova, and showed an expansion velocity of 3000 km/s.

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 Meeting. (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, *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 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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Note: If you already subscribe to ***Sky & Telescope***, please attach a recent mail label, or indicate the expiration date: _____. A prorated adjustment will be made. Make check payable to National Capital Astronomers, Inc., and send with this form to:

Leith Holloway 10500 Rockville Pike Apartment. M-10, Rockville, MD 20852.

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!

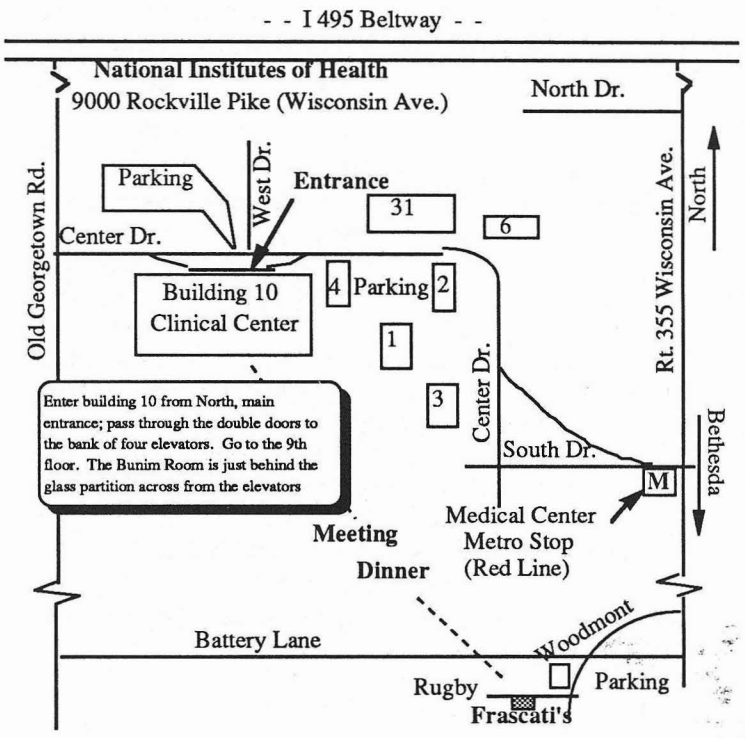
_____

_____

Getting to the NCA Monthly Meeting

•Subway Riders - From Medical Center Metro Stop: Walk down the hill, pass the bus stops and turn right at the anchor (onto Center Drive). Continue uphill to building 10, the largest building on campus.

•To Frascati's: Proceed down Wisconsin Avenue toward Bethesda. Bear right onto Woodmont (or the next right onto Battery Lane), follow Woodmont across Battery, take a right onto Rugby and park. The restaurant will not guarantee seats after 5:30.



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