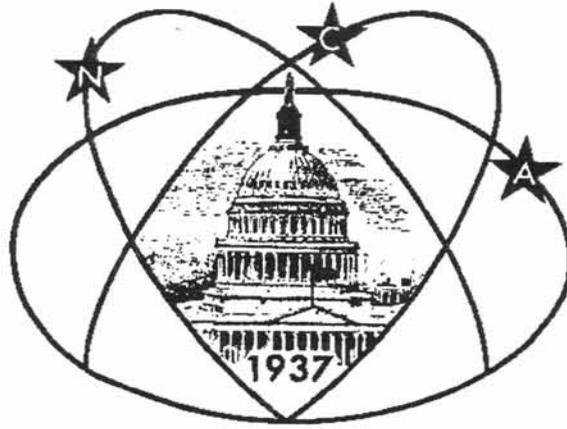


Star



Dust

National Capital Astronomers, Inc.

Washington, DC (301) 320-3621

Volume L, Number 54

December 1991

ISSN 0898-7548

Gregory Paul to Talk on Computers, Robotics and Space Travel

National Capital Astronomers will meet Saturday December 7, 1991, 7:30 PM at the National Institutes of Health (the Bunim Room at the Clinical Center (Floor 9, Building 10). For more information, see map and directions on last page). At this meeting, we will be addressed by Gregory Paul, a dinosaur paleontologist and artist from Baltimore on the subject "Computers Robotics and Space Travel."

Gregory Paul was born in Washington DC and grew up in Northern Virginia. Since 1979 he has been living and working in Baltimore. He is the author of the book "Predatory Dinosaurs of the World" which was published in 1988 by Simon and Schuster and has written a number of technical papers. His broad interests in evolutionary biology, computers and robotics will be brought to the fore in what promises to be an extremely interesting talk.

Observer's Handbook 1992, published by the Royal Astronomical Society of Canada has arrived. Jeff Norman will bring a number of copies to the December meeting. Price is \$10.

Also at this meeting, we shall hear a short presentation from Claudia Villa who received one of our Science Fair Awards earlier in the year. She will describe her science project "Differential Rotation of the Sun."

Short Lead Time Notice:

The Washington Academy of Sciences, NCA, and nine other local scientific societies present a panel discussion on:

OUR SUN, OUR EARTH, THEIR CONSTANT INTERACTION: THE INTERNATIONAL SOLAR-TERRESTRIAL PHYSICS PROGRAM OF THE INTER-AGENCY CONSULTATIVE GROUP FOR SPACE SCIENCE

Wednesday, December 4, 1991, 7:00 - 9:00 PM, at the National Academy of Sciences, 2101 Constitution Ave. NW, Washington, DC. (Enter via C Street only.) See brochure enclosed in this issue for details.

December Calendar

The Public is Welcome!

Wednesday December 4, 7 - 9 PM - The Washington Academy of Sciences panel discussion at 2101 Constitution Avenue, NW, Washington, DC.

Tuesday, December 3, 10, 17, 7:30 PM - Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Friday, December 6, 13, 20, 27, 7:30 PM - Telescope making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 202/362-8872.

Saturday, December 7, 5:30 PM - Dinner with the speaker at Frascati's Restaurant in Bethesda before the monthly meeting. Reservations are for 5:30 Sharp!

Saturday, December 7, 7:30 PM - NCA Monthly 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.

Friday, December 13, 27, 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. The Moon will be the featured object on the 13th.

Sunday, December 22, 7:00 PM - "The Day of the Sun's Return, the Winter Solstice," 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:

January 4, 7:30 PM: NCA monthly colloquium with Maurice Shapiro (NASA), "The Explosive Universe - as revealed by the new astronomies".

Saturday, January 25, 7:30 PM - "Exploring the Sky" at Rock Creek Park on Glover Road, NW, near the Nature Center. Dress warmly, especially hands, feet and head.

November Colloquium

By Nancy Byrd and John Graham

On November 2nd, 1991 at the National Institutes of Health in Bethesda, Dr. Alan Boss of the Carnegie Institution of Washington presented a talk to the National Capital Astronomers monthly colloquium on the subject of the origin of the Moon.

Dr. Boss began his talk with the observation that the commonly accepted theory of star formation is the Laplacian theory that stars form by gravitational collapse from interstellar gas and dust, and that planets form as a by-product of star formation. If the system has any appreciable angular momentum, the system will spread its mass into a rotating disk from which planets accrete from dust grains approximately 1 micron in size. At greater than 1 micron and less than 1 centimeter in diameter, the mechanism of accretion is probably Van der Waals bonds or inter-

molecular forces. Between one centimeter and one kilometer in diameter the mechanism of accretion is not clear; but over one kilometer, the mechanism is primarily gravity.

Initial coagulation to planetesimals of centimeter size takes place quickly over a time span of the order of 1000 years. Calculations by Safronov and Wetherill show that while accumulation is slower as the larger particles become fewer, gravitation enables moon-sized objects of the order of 1000 kilometers or so to be built up over 10,000 to 100,000 years. This is still a relatively short interval among astronomical time scales. Although fewer impacts will now occur, a final stage of reproducing a system similar to that of the terrestrial planets will proceed through occasional collisional buildup over a time interval of 10 to 100 million years.

The Earth's moon has unusual characteris-

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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
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Grazing Lunar:

Dec. 3	5:39	Newton, NJ	6.4	7	16S	5 cm
Dec. 12	20:09	Richmond, VA	7.5	36	12S	5 cm
Dec. 12	20:26	Richmond, VA	8.1	36	12S	10 cm
Dec. 21	5:31	Pasadena, MD	8.6	E	-	20 cm

Date	Time	Place	Star Mag.	Delta Mag.	Name	Aperture
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Asteroidal:

Dec. 3	22:54	Lake Ontario*	11	0.6	(51) Nemausa	20 cm
Dec. 12	4:46	s. Georgia*	9.5	1.3	(22) Kalliope	5 cm
Dec. 21	1:50	s. Virginia	9.5	2	(287) Nephthys	10 cm
Dec. 25	4:08	Hudson Bay*	8.7	2	(51) Nemausa	10 cm

Planetary:

Dec. 27	4:36	Cuba**	5.5	0	Venus	15 cm
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* Appulse to be observed for possible satellites or path shift. Observers should obtain a finder chart from Dunham or IOTA. For Kalliope chart see Dec. S. & T. P. 645.

** Planetary appulse, 2" separation in DC area.
E: During partial lunar eclipse.

Astronomy and Personal Computers

By Joan Bixby Dunham

STAR CATALOGS IN DATA BASES

I have been working on two projects recently which I did by creating data bases of star catalog data. I found this to be a very nice way to manipulate the catalog data. I did have a few problems, though. The biggest problem was one which frequently occurs when creating or updating star catalogs: handling the -0 degree declination zone. Computer languages, data base managers, and spreadsheet programs do not see any difference between +0 and -0. They are 0. In spherical coordinates, though, -0 is that region between the equator and -1 degree. We like to represent coordinates in degrees, minutes, and seconds, and

we also like to have the sign of the coordinates always appear in the same location and not sometimes attached to the seconds of arc, sometimes the minutes. I have seen negative signs attached to all three, so coordinates might be -1 -2 -3.4 for something at -1 degree 2 minute 3.4 arc seconds. That is OK, but it looks a little lame. I solved the problem by creating a character field for each record that held either a + or a -, and testing that to see what the sign of the declination is.

I also had another problem with signs: the data base manager did not like blanks between the sign and the number. The star catalog data were nicely formatted so that the signs lined up, which meant that there were many entries with one or more fields with a

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blank or two between the + or - and the number. The data base manager interpreted all of these as zero.

One thing I have not checked was whether or not the data base needs more room than the original files. I was not attempting to minimize file space, but what I did notice was that the files were not using significantly more disk space than the original files. I think that someone trying to be clever in data space usage could arrange to use less space for the data base than the original input file by truncating all of the fields which have blanks.

When converting a file of data to a data base, I have found the easiest method to be to define my data base fields so that each is exactly the

same length as the data, and that their total length is exactly the same as the individual records in the files. This assumes that the file is a fixed field representation — that is, the same information is presented in the same place for each field. Then I import the data (in PC-File) or append it (DBase terminology), and check to see that I counted the record lengths correctly. I did any modifications after the data base was created. For example, the records from the machine-readable General Catalog of Variable Stars included lots of blanks that I wanted to remove. I defined a field that was always empty, and, after creating a data base, I modified it to remove that field. That is not difficult to do with PC-File, and is very easy to do with DBase III+.

EXCERPTS FROM THE IAU CIRCULARS

By R.N. Bolster

1. October 11 - With the 91 cm Spacewatch telescope at Kitt Peak, Rabinowitz and Scotti observed a band of light 2' wide extending more than 10 degrees from the head of Comet P/Faye (1991n). The Earth crossed through the plane of the comet's orbit on October 13.
2. October 13 - French observers detected surface features on the night side of Venus at a wavelength of 1 micrometer in the infrared with a CCD detector on the Pic-du-Midi 1.05 m reflector. Known high-altitude regions were seen as dark features due to their lower temperatures.
3. November 6 - J.V. Scotti discovered a fast-moving object of 21st magnitude in Aries with the Spacewatch telescope. Numerous position measurements made over 5 days enabled Marsden to calculate the orbital elements, which he found to be very similar to those of the Earth. It is speculated that the object may be a returning spacecraft. Its closest approach to the Earth will be on December 5 at a distance of 0.0031 AU or 460 000 km (1.2 x the distance to the Moon).
4. November 7 - C.S. and E.M. Shoemaker and D.H. Levy discovered a comet (1991 b1) of 13th magnitude in Pisces with the 46 cm Palomar Schmidt. The elements by Nakano show that it has a period of 7.46 years and passed perihelion on October 13th.

tics and its origin must be less straightforward than this. Much has been learned from the Apollo missions of the 1970s which were largely sold scientifically on being able to settle the question of the origin of the Moon. Apollo 11 gave us just a quick first look and it was the subsequent Apollo missions, in particular Apollo 16, which were more involved in geological sampling and seismology. However, it turned out that, although the Apollo missions did not rule out competing theories, they told us a lot. Apollo 11 landed in a smooth area (in Mare Tranquillitatis) and sample collecting methods were quite crude compared to those of later missions, in which machine power-assisted core sampling was performed. Some of these cores have not yet been opened in order to preserve undisturbed samples for study with improved techniques, when these techniques are available.

Geophysical evidence suggests that the Moon has no appreciable iron core (less than 5% by mass). Moon rocks are strongly depleted in potassium and sodium, water and other volatile species relative to the Earth. Many moon rocks resemble the mantle of the Earth in oxygen isotope ratios. (These ratios are a function of temperature of formation.) The abundance of siderophile elements (e.g. nickel, chromium, cobalt, manganese and titanium, in the maria basalts is similar to that of the mantle on Earth.

The three mostly commonly invoked theories of lunar formation, according to Dr. Boss, are fission from the proto-earth, capture of the Moon from elsewhere in the solar system and separate, binary accretion. The fission theory was first proposed by George Darwin (son of Charles Darwin) in 1880 and variations of it have been proposed by others. George Darwin was the first person to understand tides, deducing that the Moon is moving away from the Earth as a result of tidal friction. If the Moon is moving away from the Earth, then it may

have been much closer to Earth in the past, and possibly it came from Earth. Maybe, he proposed, the Earth rotated too fast and thus broke up.

One problem, stated Dr. Boss, is that Darwin and others didn't consider viscosity. With a viscous body, a differential rotation between its parts would be quickly damped out; so the proto-earth, in uniform rotation, would never be able to develop the different rotation rates necessary for fission to occur. Dr. Boss then demonstrated with computer simulations what would happen to a rapidly-rotating viscous body. He showed that such a body, rotating at too high a rate to be stable, would first flatten out, then eject a ring from the outer part. Can you make a moon from the ring? The problem here, says Boss, is that you would need four times the angular momentum of the earth-moon system to do so, and then would need some way to get rid of the excess angular momentum afterwards.

Gerstenkorn (1955) proposed that the Moon was made elsewhere in the solar system and then was captured by the Earth's gravitational field. Dr. Boss invoked the billiards analogy to show that capture is a highly unlikely possibility. First you would need a very accurate shot in order to encounter the potential well of the Earth's gravity, and second, you would then need a mechanism for dissipating energy, otherwise, like a billiard ball that is moving too fast to enter the pocket, the Moon would slingshot away from the Earth. Atmospheric drag has been invoked as an energy dissipation means. However, to be effective, this atmosphere must also blow away soon thereafter, lest it drag the Moon into the Earth entirely. Tidal dissipation could account for the capture of another body, but only if its relative velocity at infinity is about 0.1 km/sec, which is very unlikely considering the

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orbital velocity of the Earth is about 30 km/sec.

He also demonstrated a viscosity free example of tidal disruption as a means of capture, with a body falling toward Earth with initial velocity 0 km/sec at infinity. At 1.4 earth radii, it gets totally disrupted with 1/3 the mass falling onto the Earth. If you postulate an initial velocity of 5 km/sec at infinity, the body gets distorted but loses only a few percent of its mass and survives. Here you do not get much trapped in orbit, and the final mass would be too small.

Ruskol proposed in 1962 that the Moon accreted from fragments in orbit around Earth and was made at about the same time. This theory can explain compositional differences from preferentially trapped silicates but fails in the long run on dynamical grounds as it is hard to produce sufficient angular momentum to avoid complete infall back to Earth.

The most favored theory at present for the origin of the Moon was originally proposed by Hartmann and Davis and by Cameron and Ward. They suggested that a grazing collision of a Mars-sized body with the proto-earth would remove enough mantle-like material with just the right angular momentum to produce the sort of moon we have today. Wetherill's work has shown that the probability of such an impact is high. Cameron and Benz modeled the impact of a Mars-sized body with the Earth in several different ways. A grazing impact at 10 km/sec would cause temperatures of the order of 10,000° K and significant disruption of both bodies; the core of the Mars-sized body would fuse with the Earth's core. Mantle from both bodies would be ejected, some of which would remain in orbit to form the Moon. This last theory, states Dr. Boss, known as the large impact hypothesis, successfully explains the bulk chemistry and the angular momentum of the

Moon, making it more satisfactory than the previous three theories.

From the Local Group

Member to Member Communications

Astronomical League Membership

This past summer, NCA trustees and officers voted to cancel NCA's membership in the Astronomical League. Thus a member of NCA is no longer automatically a member of the Astronomical League. Subscription to the *Reflector*, the quarterly newsletter of the League is \$4.00 for one year. You should have already received communication from the Astronomical League to that effect, with contact information within the League. If you think that NCA's dropping out of the Astronomical League was a mistake, or if you feel strongly in any way about it, or need the League contact information, please contact Jeff Norman, phone number: 202/966-0739.

For Sale

Two astronomical telescopes for sale, one a refractor. Call Nancy Byrd (703/978-3440) if you are interested, and she will try to put you in contact with the owner of the telescopes.

WILL THE PERSON WHO TRIED TO PLACE AN AD IN STAR DUST FOR TWO TELESCOPES PLEASE CONTACT NANCY BYRD AS SOON AS POSSIBLE, SO THAT SHE MAY RELAY INQUIRIES TO YOU. I DO NOT HAVE YOUR NAME, ETC.

Star Dust needs help!

Although Bob McCracken handled the job of putting out Star Dust alone for years, the new editor is convinced that no ordinary mortal can reasonably handle production of this newsletter alone. The most acute needs are to convert submitted files to a consistent form suitable for page layout; that is removing hard carriage returns, extra blanks and other special characters that appear in submitted text. (Development of guidelines for article submission should help as well.) On the output side, affixing postage and address labels is also a time consuming job. We also need reporters. If you are interested in helping, please contact Nancy Byrd, 703/978-3440. Those who have already volunteered will be contacted.

Because of the holidays, the "deadline" of the 15th of the month is a must if the article is to make the January issue. Preferred form of submission is on floppy disk, either 3 1/2 inch or 5 1/4 inches, in any of the standard word-processor or spreadsheet formats for Macintosh or IBM compatibles.

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, *Stardust*.

The NCA Public Information Service answers many as-

tronomy-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.

PLEASE ENROLL ME IN NATIONAL CAPITAL ASTRONOMERS MEMBERSHIP

Regular (\$38 per year) Each regular membership receives *Sky & Telescope* & *Star Dust*.

Junior (Only open to those under age 18) Date of birth: _____

Junior members pay a reduced rate and may elect not to receive *Sky & Telescope*.

Sky & Telescope and *Star Dust*. (\$25 per year)

Star Dust only (\$10 per year)

First name Middle Last name (____) _____
Telephone

Street or Box Apartment City State Zip

If family membership, list names of additional participating immediate family members in same household, with birthdates of all those under 18 years old: _____

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

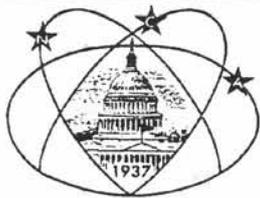
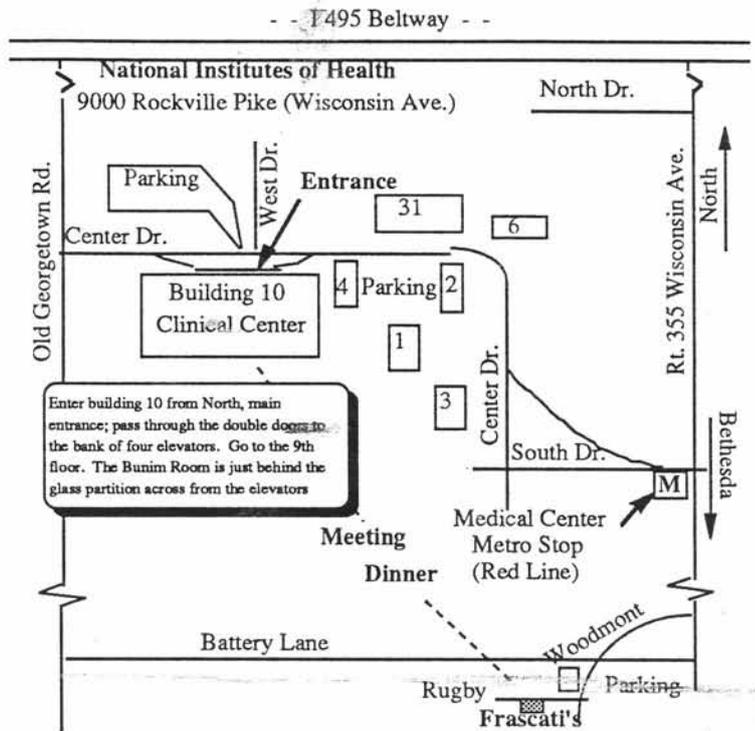
Thank you, and welcome!

Getting to the November 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.

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 Daniel Costanzo. Deadline for *Stardust* is the 15th of the preceding month. Editor, Nancy Byrd (703)978-3440 NCA Phone No. 301-320-3621



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