STAR DUST

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Barbara Becker to Speak on Quasar Redshifts and Coping With Alternative Theoretical Viewpoints

Barbara Becker is a doctoral candidate in the History of Science Dept. at the Johns Hopkins University in Baltimore. She has been teaching astronomy at Goucher College for the past ten years and has served as a part-time instructor in the Physics Department at Towson State University from 1980 until she began her graduate studies in 1986. She has recently begun the task of transcribing and analyzing the material collected during this past year of her research on the life and work of the Victorian astronomer, Sir William Huggins.

Her topic for the November Colloquium will focus on the controversy regarding the interpretation of quasar redshifts, a topic which grew out of her effort to merge her interests in history and in science. First, as an historian, she was anxious to learn more in a general way about the thinking and behavior of a group of scientific investigators when the structural unity of its cognitive and theoretical work space is threatened from within. Second, as a teacher of astronomy, she wanted to understand enough about the terms of this specific debate to engage her students in the vigorous, on-going, present-day reality of astrophysical research. She hopes that the ideas presented will provide some new insights into the persistent problem of understanding the process of how the scientific community copes with the introduction of alternative theoretical viewpoints.

NOVEMBER CALENDAR -- ***The Public is Welcome***

Saturday, November 3, 5:45 pm - Dinner with the speaker at Bish Thompson's Seafood Restaurant 7935 Wisconsin Ave., Bethesda MD on the upper deck, (301) 656-2400. Get off at Bethesda metro stop.

Saturday, November 3, 7:30 pm - NCA colloquium featuring Barbara Becker at the Lipsett Auditorium, located in the Clinical Center (Building 10, the large black glass building) on Center Drive at the National Institutes of Health, Bethesda, MD. NIH may be entered from either Wisconson Ave. or Old Georgetown Road. Get off at NIH metro stop.

Tuesday, November 6, 13, 20, 27, 7:30 pm - Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, (202) 362-8872.

Friday, November 2, 9, 16, 23, 30, 7:30 pm - Telescope-making classes at American University, McKinley Hall Basement. Information: Jerry Schnall, (202) 362-8872.

Friday, November 16, 23, 30, 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.

Occultation Expeditions Planned

by R.N. Bolster

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	Local Time	Place	Vis. Mag.	Pcnt. Sunlit	Cusp Angle	Min. Aper.
Grazing Lunar:						
11-09	3:44	Atlee, VA	7.5	51	10S	5 cm
11-09	5:02	Brandywine, MD	8.5	51	14S	15 cm
12-04	6:26	Arcadia, VA	5.8	93	16S	5 cm
Asteroidal:			Star Mag.	Delta Mag.	Name	
11-14	22:46	Miami, FL*	10.9	0.7	(704) Interam.	20 cm
11-17	4:34#	Texas*	11.2	0.6	(216) Kleopatra	20 cm
11-29	3:41	Florida*	12.6	1.3	(90) Antiope	25 cm

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

Exerpts From The IAU Circulars

by R.N. Bolster

1. September 17 - Larsen and Levy, University of Arizona, obtained CCD images of Comet Levy with the 1.5-m Catalina telescope showing two hoods 12 300 and 22 200 km sunward of the nucleus.

2. September 24 - J. Mueller discovered a comet (1990l) of 18th magnitude in Cetus with the 1.2-m Oschin Schmidt at Palomar. Preliminary orbital elements by Bowell indicate that comet 1990l has a period of 8.56 years.

3. September 25 - S. Wilber, Las Cruces, New Mexico, observed a white spot on Saturn with a 25-cm reflector. Located on the southern side of the north equatorial belt, the spot has reportedly expanded in longitude to span the disk, but new spots have appeared at the active site. The spots were observed to transit the central meridian at October 10.92, and have had a rotation period of 10 hours and 17 minutes.

4. October 5 - D. Parker, ALPO, reported that an expanding dust cloud had been seen on Mars on October 4 and 5 in the vicinity of Aurorae Sinus.

July 1991 Solar Eclipse, Costa Rica

by Dan Costanzo

Spaces are still available for seeing the upcoming total solar eclipse, July 11, 1991 from Costa Rica. Accomodations will be at the Flamingo Beach Resort located on the Pacific coast. Located in the driest area of Costa Rica, the site promises favorable eclipse observation. The trip will extend from July 8 to July 14, 1991 and includes side trips to local points of interest. It is being organized by the Goddard Spaceflight Center Travel Club through Solar Tours and costs less than $1000 total. Contact Dan Costanzo at 301/230-5524 for more information.

What is Saturn's White Spot?

by Tom Van Flandern

Observations

In attempting to determine the cause and nature of the large, bright, new white spot which suddenly appeared on Saturn on September 25, 1990, the first step is to gather together all relevant facts. I appreciate the help of Alan MacRobert and Steve O'Meara of *Sky & Telescope* magazine for sharing much of the observational data they have collected.

The appearance of the new white spot on Saturn was predicted last year in *Sky & Telescope*, based on the regularity of appearance of four previous large white spots. These were seen on December 7, 1876; June 15, 1903; August 3, 1933; and March 31, 1960. In each case the spot remained visible for a few months. Those spots slowly faded away as they gradually spread out in longitude.

All five large white spots which we know about have appeared in Saturn's northern hemisphere. The 1876, 1933, and 1990 spots were near the equator. The present (1990) spot resides near the south edge of the north equatorial belt, and seems to be affecting the appearance of the belt: to the west, the belt is very dark and active; to the east, it has narrowed and faded considerably. The 1903 spot appeared at about 45 degrees north latitude. The 1960 spot appeared at about 60 degrees north latitude. To judge by the reports, the overall appearance of each of these spots is rather similar.

Spots have been seen earlier in history, but dates and details are not readily available. For the five appearances of known date, Saturn has been in the southern zodiacal stars, near the constellation of Capricornus on each occasion. The period of Saturn around the Sun, hence the length of Saturn's year, is 29.5 Earth-years, which roughly agrees with the average interval between major white spot appearances.

Lavega and Battenar pointed out that when Saturn is in the part of its orbit where the spots appear, it is mid-summer for Saturn's northern hemisphere. In other words solar heating, though only 1% of what it is for the Earth, is at its greatest.

At first, the 1990 spot had a period of rotation of about 10 hours and 16 minutes, plus or minus one minute. (Since Saturn is not solid, different parts of it rotate at slightly different speeds.) Within less than a day the spot had grown 20% in diameter, and rotated with a period of 10 hours and 23 minutes. The spot diameter is about one-fifth of Saturn's diameter.

Analysis

The white spot is the visible manifestation of some sort of change or disturbance in the clouds surrounding Saturn. (The planet is a gaseous giant with no solid or liquid surface, at least to great depths.) The cause of the change or disturbance might have originated where we see it, at Saturn's visible outer surface. Or it might have originated from deeper within Saturn; or from something outside of Saturn.

Surface Origin Hypothesis

If the spot originated at Saturn's surface, the most probable cause would be some seasonal "weather"-type event associated with summer in Saturn's northern hemisphere. Given the speed and strength of the winds observed at Saturn by the Voyager spacecraft, a disturbance there might aptly be described as a "hurricane". The strongest argument for this origin is the association of the spots with mid-summer in Saturn's northern hemisphere. However, the behavior of sudden appearance, rapid growth, spreading, and fading of the white spot is not the behavior of typical Earth hurricanes. Moreover, to change rotation period the spot would have to move in latitude. The amount of period change would require a latitude motion of 10 degrees in a day, which is apparently much greater than what the observations suggest. One might have expected that, if the spot were a "weather" phenomenon, changes in the north equatorial belt might have preceded the spot's appearance, rather than follow it. Subjective probability for this origin: 20%.

External Origin Hypothesis

The disturbance in Saturn's clouds which we see as a growing white spot might be the result of the impact of some mass on Saturn. A comet or minor planet of appreciable diameter would surely create quite a disturbance as it disintegrated and exploded in Saturn's atmosphere. We can imagine that such an external mass might come from the decay of material from Saturn's rings, or from outside the Saturn system. If it were ring material, the spots would all seem to originate right on the equator of the planet, contrary to observations. Moreover, ring particles are known to be of small enough size that the impact of one or a few of them would be inconsequential. And no particular periodicity would be expected for such decays. So we consider instead that the orbit of some meteor stream

perhaps from a disintegrated comet or minor planet, intersects Saturn's orbit in the direction from the Sun where most spots seem to appear. The physical behavior of the spots, spreading outward from a focus, is suggestive of such an impact-caused, sudden disturbance. Moreover, the intervals between spot appearances is rather more regular than one might have expected from any cause on or within the planet. Especially, the 1876, 1933, and 1990 appearances of equatorial spots are at closely 57-year intervals, as are the 1903 and 1960 high-latitude spots, although the two series are offset from each other by three years. But the probability of collision events is very small indeed. And even if there were, by fortuitous coincidence, just such a well-populated meteor stream, we would expect sometimes no impacts, and sometimes two or more, during that part of each Saturn year when the planet passes through the stream. Moreover, the distribution in latitude of the impacts on Saturn would probably be more random than has been seen. Subjective probability for this origin: 10%.

Deep Origin Hypothesis

The spots might be some sort of eruptive phenomenon, resulting from a cause deep within the planet. Both the solar heating-cooling cycle and the ring-shadow cycle of 29.5 years are close to the average interval between spot appearances. Perhaps the alternation of high and low latitude spots in alternate Saturn summers is due to some reversing phenomenon, much like the reversal in magnetic polarity with each new sunspot cycle. Moreover, although the cloud thickness prevents us from seeing into Saturn's interior, a cause of disturbance which was rising within Saturn's atmosphere could certainly exhibit the slowing in rotation period which was seen for the 1990 spot. The white spot may then not be the disturbance itself, but simply the visible manifestation in the clouds resulting from a rising column of heat from deeper in the interior of the planet: an "eruption" event of sorts. The strongest argument against this origin is the presumed uniformity of the planet's interior, due to extensive mixing of the gases which comprise the planet. And the periodicity of spot appearances is more regular than one might expect for eruptive phenomena. However, Saturn's atmosphere does have visible bands which persist for at least centuries, so mixing of all ingredients in Saturn is obviously not complete. And it seems entirely possible that comets and asteroids absorbed by the planet long ago in collisions might nonetheless maintain enough physical cohesion in some of their fragments that significant bits of such bodies may float deep within the planet, where the density of the planet's gases reaches the density of a typical comet or minor planet. Subjective probability for this origin: 70%.

In conclusion, Saturn's intriguing white spot may be an impact, weather, or eruptive phenomenon, originating from outside, on, or within the planet. Available evidence is not conclusive, but suggests an eruptive origin from within the planet's interior is most likely. 10/10/90

Astronomy and Personal Computers

by Joan Bixby Dunham

David and I attempted to observe the July 21-22 eclipse, and learned about Mandelbrot sets instead. Our plans were to travel to Siberia from Alaska, and observe in Siberia, near the town of Markovo. The Soviet Consulate in San Francisco would not issue us a visa because, we were told later, our invitation to observe was not issued by a properly formulated group. We spent three days in Nome, Alaska waiting before we gave up and left. (We saw a partial eclipse from the top level of the parking garage in the Anchorage airport.) In Nome, we met Ken Philip, once a radio astronomer, now a lepidopterist studying the similarities and differences of butterflies in Alaska and Siberia. He and his brother are also well-known investigators of Mandelbrot sets. He gave an inpromptu lecture at our bed-and-breakfast hotel on the work they have done, showing many slides of beautiful graphics they have generated with their computers. These were slides he had shown in Siberia, as well as part of a lecture he and his brother had given at several different universities. He remarked that they showed 300 slides at one lecture, 100 while the audience was being seated and 200, two at a time, in an hour lecture.

The French mathematician, Benoit Mandelbrot, first described fractal curves, jagged-edged curves that, when enlarged, are as jagged as the orginal. Snowflakes have fractal edges, as do many other natural objects. The Mandelbrot set is the most famous of the fractals. It is generated from a deceptively simple equation, z^*z+q. Both z and q are complex numbers, so that $q = x + iy$, and $z = a + ib$. If x and y are

coordinates in a rectangular plot (frequently called "X-Y plot" in graphics software), then q represents a single point in the plot. If the graph is a computer display screen, q represents a single pixel. The Mandelbrot set is the set of values of q such that a new value of z is equal to the square of the old value plus q, or z-new = (z-old)*(z-old) + q. The initial value of z is zero, so the first z-new is equal to q. The second value of z-new is then q*q + q, the third is the square of the second plus q, and so on. For a given value of q, the equation is iterated until either it converges so that the equation is clearly satisfied and q is a part of the set, or it is obvious that the equation will never converge and q is not a part of the set. The computer graphics are generated by assigning colors to the values of q based on how many iterations it takes to satisfy the equation. A black-and-white image is generated by assigning the pixel at q the value of white if it is outside the set, and black if it is inside the set. Very attractive images can be generated with a good color graphics display device. The Philips use top-of-the-line Macintosh and IBM equipment for their work. Even with the powerful PC's they are using, the computations take hours.

There are available several recent books on fractals and on generating them on PCs, as well as various public-domain programs for the PC, Amiga, and Macintosh. Programs are available through CompuServe and BIX, as well as from various bulletin boards. A recent article published in the June 1990 issue of Byte and another in the July 1990 issue of PC Magazine give more information on software and books.

Even more interesting than generating these images would be applying them to understand natural phenomena. Most of the applications so far have been descriptive — the coastline of Britain, for example, looks like it has a fractal nature. There has been an attempt to model the distribution of galaxies assuming fractal characteristics. The field is still new, and there is still much to learn.

Computer Repair

This summer, we added a second hard disk to our MS-DOS computer, a 20-M "hard card", or hard disk on a card. Installation is simplicity itself, merely insert the card into an empty slot. Just prior to our purchase, we had a serial port fail, and could not communicate with the modem--an event that seemed to be linked to power fluctuations we experienced duing a thunderstorm. Curiously, nothing else, including the modem itself, was affected. We bought another communications card (and a line conditioner). Surge protectors give some protection, but adding a line conditioner is much more protection. They cost 10 times as much, though--$250 and up. So I opened the computer, cleaned out the accumulated dust, replaced the communications card, and added the hard card, with some juggling to get cables and cards to fit. Everything worked well after the computer was turned on, and we transfered files to the new disk. After about a week, we started having trouble with one of the floppy disk drives. It would work in some circumstances, but not others. It got worse, and then one of the hard disks failed. We could not boot the computer. I took off the top, and tried again. With the top off, the floppy disks worked fine, although not the hard disk. As I tried commands, I noticed that cables were moving when the "bad" floppy drive was reading a disk. A cable to the "bad" hard disk was caught in the floppy drive mechanism. Once cables and cards were rearranged, the problems went away. The first thing I did after everything was reassembled? I backed up the hard disk!

Software Upgrades

We wanted another hard disk to upgrade our FORTRAN, C, and Pascal compilers with the latest versions, as well as to give ourselves enough room to add a new word processor. It is one of the laws of computer science that new versions of software always require more disk space than the old versions. Each program came with example files, help files and library files. C and FORTRAN each have associated debugger programs. Pascal and C have their own editors. Everything has marvelous features, many more than we will ever have time to learn to use. And all of this takes space. We filled the entire 20-M hard disk. Now, instead of having a nearly full 22-M hard disk, we have a nearly full 22-M hard disk and a nearly full 20-M hard disk. We also have a shelf of manuals to explain how to use all these features. (As well as a box of now useless

manuals that explained the features of the old versions.)

Our new programs are difficult if not impossible to use without a hard disk. That might be understandable for a compiler, where most users are likely to have hard disks on their computers. It is less acceptable in a word processor. It is particularly aggravating to find that new improved versions of software we have can no longer be used with our floppy-only portable.

SYMPOSIUM HONORS SHAPIRO AT 75

by R.H. McCracken

The 75th birthday of Dr. Maurice M. Shapiro, eminent cosmic-ray physicist and NCA trustee, was celebrated on October 18 by a symposium on high-energy particle physics at the Naval Research Laboratory on October 18.

Shapiro and his history of contributions to astrophysics were lauded, and 12 other eminent workers' presentations throughout the day detailed the overall status of high-energy astrophysics.

The technical sessions were followed by a festive reception and dinner, more accolades, and a birthday cake cutting at Bolling Air Force Base Officers' Club.

Held a month in advance of Shapiro's birthday, the event was scheduled to follow the University of Maryland astrophysics symposium, to accommodate worldwide attendees of both.

Junior Division News

by Leith Holloway

Leith Holloway, director of the NCA Junior Division, is trying to make contact with any interested junior NCA members or potential NCA members. He would like those juniors who received his questionnaire concerning their astronomical interests, to complete and return it, and for those who need one to contact him, Leith Holloway, Director, NCA Junior Division, 10500 Rockville Pike, Apt. M-10, Rockville, MD 20852 Tel: (301) 564-6061.

National Capital Astronomers, Inc.

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

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