Star Dust

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NCA Science Fair Winners to Report and Eclipse Video

by Harold Williams

The next meeting of the National Capital Astronomers will be held, Saturday June 3 at 7:30 P.M. in the Lipsett Amphitheater of the Clinical Center (building 10) at the National Institutes of Health (NIH). We will hear reports from the NCA science fair winners. The following people have been invited to talk: Michael Maire, whose project was on the Hubble Constant; Pollyanna Williams, whose project was on the Jupiter Watch 1994; Tom Chi, whose project was on NGC 1068; Elizabeth Bibb, whose project was on Intrinsic and Apparent Luminosities of Selected Radio Sources; and Lindsay McCullock, whose project was on Intrinsic and Apparent Luminosities of Selected Radio Sources. In addition to these science fair winners, Caleb Fassett will tell us about his project, "An observation of Seyfert Galaxies for use in the small-angle formula to compute the Hubble constant," which won second place in the Space Science Student Involvement Program Aerospace Internship: In Astronomy sponsored by NASA and NSTA (National Science Teachers Association).

In addition to these reports by young astronomers, Wayne Warren, David Dunham, and Tom Van Flandern will show videos from last year's trip to Chile and Bolivia for the November 3, 1994 total solar eclipse. Hopefully this time the video projection equipment will function. If you wish to read more about the Solar Eclipse expeditions, see the April 1995 issue of *Star Dust*.

"Alternatives to Dark Matter"

Reviewed by Harold Williams

On Saturday May 6, 1995 at the National Institutes of Health (NIH) in the Bunim room we heard and saw Demosthenes Kazanas, an astrophysicist in the Laboratory for High Energy Astrophysics of the National Aeronautics and Space Administration (NASA)/ Goddard Space Flight Center (GSFC). Demos first briefly reviewed the evidence for so-called dark matter: the clustering of galaxies first noted by Zwicky in 1933 for the Coma Cluster, the dynamics of disk galaxies studied by Rubin and collaborators, the dynamics of ellipticals, and the x-ray emitting gas in clusters of galaxies. The last two pieces of evidence are not as unequivocal as the first two. One could also consider the flat thin shape of disk galaxies and their stability. All of these measures boil down to the fact that the velocities that we see are too large to be held by the gravitation of the matter that we see.

The physics has three parts: (1) Matter energy-momentum tensor = (2) gravitational field tensor and (3) the geodesic equation, i.e., some generalization of Newton's second law relating forces and accelerations (commonly called F=ma or F=dp/dt). All three involve new physics. The Dark Matter solution in (1) changes the matter energy-momentum tensor to include some dark stuff that we currently do not see. For a listing of the dark stuff, see the review of Virginia Trimble's talk from December 1994 in the January 1995 *Star Dust*. The second choice (2) is to change the gravitational field tensor to something other than the Einstein gravity one; conformal invarience, for instance, is favored by Kazanas and Mannheim. The third choice (3), generally called Modified Newtonian Dynamics (MOND), as done by Milgram, Felten, and others, generally violates energy-momentum conservation.

*See **ALTERNATIVES**, on page 3*

Calendar of Monthly Events

The Public is Welcome!

Thursday, June 1, 8, 15, 22, 29, 7:30 PM-Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Saturday June 3, 11:00 AM to 4:00 PM-NCA and the Smithsoniam Institution, National Air and Space Museum (NASM), free consumer workshop: "Binoculars! Telescopes! Astronomy!" NASM, Briefing Room. NCA volunteers still needed. See page 10.

Saturday June 3, 5:30 PM-Dinner with the speakers and Science Fair winners at Shakey's, East-West Highway and Wisconsin Avenune. See the map on the back page of this issue for directions.

Saturday, June 3, 7:30 PM-NCA meeting, featuring Wayne Warren, David Dunham, and Tom Van Flandern speaking about "The Solar Eclipse Expedition on November 1994 to Chile and Bolivia" along with NCA 1995 Science Fair Awards. For directions, see back page.

Mondays, June 5, 12, 19, and 26, 8:30 PM-Public nights at the U.S. Naval Observatory (USNO), in Northwest Washington, D.C. (off Massachusetts Avenue). Includes orientation on USNO's mission, viewing of operating atomic clocks, and glimpses through the finest optical telescopes in the National Capital region. Information: USNO Public Affairs Office, 202/653-1541.

Thursdays, June 1; July 6, 13, 20, and 27, 7:00 PM-"Astronomy O! O! O!: You, The Universe, & Everyone In Between." Taught by Daniel Costanzo (NCA). Details, page 4.

Wednesday, June 7-"Sky Watch" column appears in *The Washington Post* "Style" section. It lists many other events for the month.

Fridays, June 2, 9, 16, 23, 30; July 7, 14, 21, 28, 9:30 PM-Open nights with NCA's Celestron-14 telescope at Ridgeview Observatory; near Alexandria, Virginia; 6007 Ridgeview Drive (off Franconia Road between Telegraph Road and Rose Hill Drive). Information: Bob Bolster, 703/960-9126.

Wednesday, June 14, 7:30 PM-National Air and Space Museum Exploring Space Lecture Series, "The 1997 Servicing Mission: New Horizons for the Hubble Space Telescope" featuring Mark Clampin of the Space Telescope Science Institute of Baltimore, MD.

Saturday, June 17, 9:00 PM-"Exploring the Sky", Rock Creek Park. Coordinator will be either Bob Bolster or Joe Morris. See March issue, page 4.

Thursday through Tuesday, June 22-27-107th Annual Meeting of the Astronomical Society of the Pacific, including "Universe 95," University of Maryland, College Park campus. See March issue, page 5.

Mondays, July 3, 10, 17, 24, and 31, 8:30 PM-USNO public nights. See June listing.

Wednesday, July 5-July "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many events for that month.

Saturday July 15, 9:00 PM-"Exploring the Sky." See June 17th listing.

Friday through Sunday July 28-30-"Summer Escape to Blackwater Falls, West Virginia." Smithsonian Resident Associate Program (SRAP), three-day weekend study-tour on nature and astronomy (SRAP Code: 11N-001). Led by Daniel Costanzo and Rob Gibbs. Information, cost, and registration: SRAP, 202/357-3030.

Wednesday, August 2-August "Sky Watch" column appears in *The Washington Post* "Style" section. It lists many events for that month.

Mondays, August 7, 14, 21, and 28, 8:30 PM-USNO public nights. See June listing.

Saturday August 12, 9:00 PM-"Exploring the Sky." See June 17th listing.

NOTE-The next *Star Dust* issue will be the September one. The next NCA meeting will be in September. Have an enjoyable and safe summer!

ALTERNATIVES, from page 1

In the past, solar system tests of our understanding of gravity have caused methods one and two to be used. When Neptune was discovered by inference from the gravitational effect that it had on the orbit of the known planet Uranus, this was a discovery of a type of previously unseen dark matter—Neptune—an example of method one. When the orbit of Mercury was shown to have a perihelion that shifted, the dark matter method would have predicted an unseen planet orbiting within Mercury's orbit; this planet was provisionally called Vulcan. But despite the search for Vulcan, it was never found, because it does not exist. The correct method for explaining the perihelion shift of Mercury was to modify the gravitational field itself and to go from a linear Newtonian universal gravity to a more involved, nonlinear gravitational field tensor of Einstein's general theory of relativity. The third method, so-called MOND, has never been successfully used.

As Bacall pointed out in 1985, the use of dark matter to explain flat rotation curves in disk galaxies requires a disk-**halo conspiracy. The mass in each core** region of each halo must be separately adjusted so that the disk and the core parts of the halo give a perfectly flat curve where they join, with no obvious dips. For the distribution of the dark matter in the outer halo, see the integral calculus part of the derivation in December 1994 *Star Dust* introducing Virginia Trimble's talk. The density of the halo away from the disk's core must be isothermal,

$$\rho = \frac{\text{constant}}{r^2}$$

but the halo cannot have a density like this in the disk's center, or the velocities, as well as the density and the potential, would diverge to infinity in the center. Therefore if there were dark matter then there would be this disk-halo conspiracy in each galaxy that would ultimately have to be dealt with. Personally, the reviewer thinks this disk-halo conspiracy is the best reason for seriously looking at how to modify gravity without invoking dark matter.

The rest of the talk was about how one could modify the gravitational field tensor principally by using Weyl gravity to yield results consistent with observations of flat rotation curves in disk galaxies. The gauge theory electromagnetism, the strong nuclear force, and the weak nuclear force are all gauge theories—of conformal invarience of spacetime naturally results in the Weyl tensor. By using computers to do the awful algebra in this frightfully complex nonlinear theory, Kazanas and Mannheim actually found five exact solutions under different, somewhat symmetrical conditions, to eliminate some of the variables. The most important solution is the one for the metric tensor in a static, spherically symmetric case. This solution has the usual 1/r part of the gravitational potential, just like the Einstein theory, where r is the distance from the mass and three additional terms. One term is just a constant, and Kazanas argued that it is a small term; another term is a kr^2 term, which Kazanas argued is of cosmological origin and unimportant; but the remaining term is γr, which would lead to a gradually rising velocity rotation curve with r. While everyone would be overjoyed with a theory that had a Log (r/a) term in the potential, since this would lead to flat rotational velocity curves in r and this theory does not produce such a term, it at least is not yet eliminated by observation. It is an honest theory based on a minimum of assumptions or constants that can be adjusted to fit the data. Evidently one of the best observed galaxies is NGC3198. Kazanas and Mannheim are planning to do a maximum likelihood analysis, also called Beysian statistics, to compare dark matter fits with disk-halo conspiracy and Weyl gravity. The dark matter fits have about twice the number of adjustable parameters, and if Weyl gravity turned out to fit better with half of the number of adjustable parameters, then this would represent strong evidence in its favor. Unfortunately there seems to be no feasible solar system test to eliminate or demonstrate Weyl gravity or distinguish it from Einstein gravity except for comparing fits to data of very large objects such as galaxies.

As usual, we are indebted to NIH and NCA member Jay Miller for arranging to meet at NIH, where he works.

Meet Harold Williams

Harold Williams is the director of the Montgomery College Planetarium in Takoma Park Maryland. He always teaches introduction to astronomy and sometimes teaches mathematics, physics, geology, and a telecourse called *Oceanus* at Montgomery College.

He was born in Gainesville, Florida and grew up in Jacksonville, Florida. He studied at Florida State University in Tallahassee, where he received a Bachelors of Science with a double major in physics and mathematics. He studied at the State University of New York at Stony Brook, where he received a Masters of Science and became depressed in what he now calls "the quantum gravity madness years," while attempting to formulate a renormalizable quantum field theory consistent with Einstein's general theory of gravity. He then regrouped and studied at Louisiana State University in Baton Rouge under the supervision of Dr. Joel Tohline, where he received a doctorate of philosophy while studying star formation by using 3-D explicit Eulerian hydrodynamics. His current 3-D hydrocode, which is second-order in time as well as space, he immodestly calls *Halcyon*, after the ancient legend, of a bird, believed to have been the kingfisher, who supposedly has a calming influence on the sea at the time of the winter solstice. After LSU, Harold worked for two years as a postdoctoral fellow at the Department of Terrestrial Magnetism (DTM) of the Carnegie Institution of Washington, where he continued his star formation studies.

After DTM, he became planetarium director and developed grade-specific programs for local school field trips and a vigorous program of monthly public astronomy lecture/planetarium performances. Several thousand people visit the planetarium every year. He has also become a musical *impresario* with monthly music/laser light shows, though he does not perform the music, being musically disadvantaged, having spent three years as a youth playing the

*See **HAROLD**, on page 4*

HAROLD, from Page 3

piano—only getting through the second grade piano book. One summer he directed *Astronomy Across the Curriculum: A Workshop for Teachers in Grades 6 through 9*, funded by the Eisenhower Mathematics and Science Education Act administered by the Maryland Higher Education Commission. He is very interested in doing teacher workshops again. He has written an Internet proposal to NSF so that Montgomery College at Takoma Park can be connected to this national and international computer network. His personal agenda for NSFNET connectivity is to enable him to run his computer intensive 3-D hydrocode at the NSF supercomputer centers while he sits at his computer in the planetarium at Takoma Park. He currently has a courtesy Internet account that he log on to daily, you may send him e-mail at haroldw@umd5.umd.edu. He hopes to have a Montgomery College Internet account soon, one that he does not have to telephone into.

Scientifically his current hope is to understand how angular momentum is redistributed during star formation. Finally, if he lives long enough, he would like to understand how 10^8 times too much angular momentum is generated in the collapsing interstellar clouds which form stars in the first place.

His planetarium experience has taught him how to be a shameless promoter. His self-deprecating sense of humor and enthusiasm save him from being a total bore.

He is currently the vice-president, and therefore program chairman, of the National Capital Astronomers which is a non-profit, public-service corporation for advancement of the astronomical sciences and is the astronomy affiliate of the Washington Academy of Sciences.

"I consider myself an amateur astronomer, because I do astronomy for the pleasure of doing it. I have been interested in science since I was a small child. I want to know the way the universe works. When I was in the six grade, my elementary school library had a book titled *What is Relativity?* by Landau and Rummer. My father, an accountant, had taught me Pythagora's right triangle theorem when I was in the fifth grade. The only mathematics used in the discussion of the special theory of relativity in this little yellow book was Pythagora's right triangle theorem. I remember reading and rereading it enough times so that I understood the arguments. The traditional light beam in a train problem was the trans-Siberian rail line. Landau and Rummer are Russian and the book had been translated. This made me realize that I wanted to be a physicist, before I had only wanted to be some sort of scientist.

I sort of stumbled into astronomy/astrophysics in graduate school at LSU the first day I was there. I went to the graduate advisor; as all good entering graduate students do on the first day I got to town. Every school that I had been a student of before was just a physics department, but LSU's was a physics and astronomy department. I enjoyed reading the astronomy articles in *Scientific American* and thought that I would like to learn some astronomy. At that moment I did not want to become an astrophysicist. So I said to the graduate advisor, "I see you are not offering any 7000 level astronomy courses this semester." He said, "Yes, that is right," and said nothing more. The 7000 level courses were the lowest level graduate courses. The advisor, a particle theorist, Dick Haymaker, took this as an indication that I had a deep and abiding interest in astronomy and assigned me to teach an astronomy lab course the next day. It was only three days before the first class meet, and I did not even know what right ascension and declination were at the time. So I had three days to become an astronomer. Being a physicist, I of course knew that they must use some sort of spherical coordinate system but how it was defined and what it was referenced to I had no clue. But I checked out several introductory astronomy books from the library that day and started to read like crazy. I rapidly discovered by teaching astronomy that astronomy was a lot of fun. I also discovered that astronomy was more approachable by everyone than physics. All you had to do was look up and think about the results of what you saw in the sky. I cherish the quote from the *Astronomers* video series, 'All who look up at the sky with wonder are astronomers.' "

Scientific (Mostly Astronomical) Talks and Seminars in the Local Area

By Wayne H. Warren Jr.

Every month there are usually quite a few talks, seminars, colloquia, etc., at local-area institutions that would be of interest to NCA members. It had been planned to start a new column listing many of these talks far enough in advance so that interested persons could plan ahead for possible attendance. (It has always been necessary to plan ahead when attending talks at the U. S. Naval Observatory; now, in the wake of the Oklahoma City tragedy, this is also the case for Goddard Space Flight Center and probably for most other federal facilities. At GSFC it is necessary to contact security at least 24 or 48 hours ahead of time to be put onto a list at the front gate in order to gain admittance for talks. If you are interested in a GSFC colloquium, please contact me at 301/286-6784 for additional information.)

In any case, after considering the various institutions that have (usually) weekly talks, it turns out that most do not send out their announcements far enough in advance to allow their publication in *Star Dust*. One reason for this is that many of the talks are arranged on almost the spur of the moment if a speaker will be in town for other reasons. Since all (to my knowledge) institutes mail out announcements for colloquia and other special events, it doesn't seem useful enough to repeat those announcements in this publication.

In cases where special events will occur, we will try to inform NCA members by including a short announcement in our Monthly Calendar. There are two lectures at GSFC in June for which we have seen announcements far enough in advance to list here. If anyone wishes to attend either of these, please contact me so that I can tell you who must be called to gain admission to the center.

Tuesday, June 6, 1995
GSFC, Building 26, Room 205
Dr. Drake Deming
GSFC, Code 693
"Extra-Solar Planetary Systems"

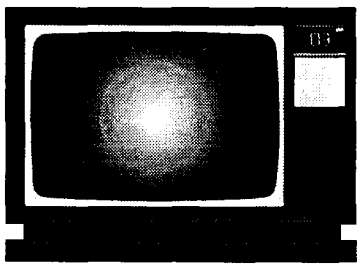
This is part of a new series of tutorial lectures on the most important scientific problems that can be addressed by space science.

Friday, June 9, 1995
GSFC, Building 2 auditorium
Dr. Vera C. Rubin
CIW/DTM
"Bright Galaxies and Dark Matter"

Each year the John C. Lindsay Memorial Award is presented to one or more Goddard scientists who have done outstanding scientific work. The award is accompanied by a lecture by a distinguished scientist doing work on a currently active topic. Vera Rubin is a pioneer in the area of dark matter and has made many important contributions to astronomy, plus she is personally known to many of us.

Audio/Visual Engineer Wanted

A volunteer is needed to assist with A/V responsibilities during NCA meetings and to look after our A/V equipment. This job consists mainly of tape recording lectures and looking after slide projection. As long as we are meeting at NIH, all equipment is available on-site except a tape recorder for the lectures; therefore, this job can be shared among several members and we do have a few people who are willing to record the lectures. However, we still need to find someone willing to store our A/V equipment, consisting of a few wooden boxes. If you would be willing to help the NCA in this way, please contact Wayne Warren at 301/474-0814.



NCA Officer Nominations

The nominating committee, consisting of Bob Bolster, John Graham, and Benson Simon, selected the following slate of nominees for positions as officers of the National Capital Astronomers for the 1995-1996 year. All persons were approved at the May meeting.

President: Wayne H. Warren Jr.

Vice President: Harold A. Williams

Secretary: Leith Holloway

Treasurer: Jeffrey B. Norman

Audio-Visual Engineer: Vacant

Trustee: Jay H. Miller

Trustees whose terms do not expire this year are: Bob Bolster, Nancy Byrd, and John Graham. As required by the NCA by-laws, the slate of officers should have been published in the May issue of *Star Dust*. Although the article was submitted, problems in the editorial office prevented it from appearing last month. We apologize for any inconvenience.

NCA Electronic Mail Directory

By Wayne H. Warren Jr.

Many NCA members now have electronic mail addresses either at their places of business or at home. It would seem an appropriate time to compile a list of members with electronic addresses to be contained in a separate directory or to incorporate into the membership directory maintained by our Secretary. This list could be used to distribute urgent messages such as meeting cancelations or last-minute items that have come up after the deadline for *Star Dust*. All members who agree to be listed in such a directory are requested to send a mail message to me at address **w3whw@gibbs.gsfc.nasa.gov**. Following the completion of the directory, I will distribute it electronically to all those listed.

Universe '95 Update

By Wayne Warren, Jr.

Note From the President

The unexpected adjournment of the May 6 meeting following the election procedure precluded a few items that I wished to call to the attention of members. Harold and I have both received this announcement from John Trasco, University of Maryland, about the Astronomical Society of the Pacific's Universe '95 meeting, which we have discussed before and can be reviewed in the March Star Dust. The responsibilities and benefits are pretty much spelled out in the attached text. John wishes to receive a list of interested parties and any constraints they have, times that they wish to work, whether or not they are interested in any of the symposia, etc., as he spells out. The location of the star party has not been finalized as yet (I believe) but it will be in the College Park or Greenbelt area.* Volunteering for Universe '95 can mean providing a telescope for the star party as well as the miscellaneous duties discussed by John.

Either Harold or I will compile a list of names for NCA members who wish to work at Universe '95, then send it to John Trasco this coming week. If you have an interest (remember conflicting Mason-Dixon Star Party) please send your information to one of us.

Volunteers Needed

We will be looking for volunteers to help at the ASP meeting. The tasks that need to be covered include:

1. Star Party - Saturday June 24. This will probably start around 8:30 with some allowance for those bringing telescopes to come earlier to set up. This will be fairly free form. I expect that anyone bringing a telescope will also act as friend of the telescope. I could probably use a few persons who can help with traffic control - cars and people. However, for the most part I want to encourage persons to come. This will be at the Goddard Visitors Center.

2. Universe 95 - Saturday and Sunday June 24 - 25. Help is needed for both the talks and the displays. Talks will be in 3 rooms simultaneously. We need at least 2 persons (preferably 3) for each room. At the auditorium, there should be one person at each door checking name tags so that only those registered are admitted. They should also keep an eye on capacity and close off the room if it fills. (This is not very likely to happen as the auditorium has a large capacity.) One person should be inside to handle the lights and slides. The projector is in the projector booth on the upper level. It is handled by one of the staff of the Inn and Conference center. So, handling slides means getting them up to the projectionist before the start of the talk. At the other two rooms, it will only require one person to handle the doors as we will limit entrance to a single door. However, this is likely to be more critical than in the auditorium as there is a greater likelihood that capacity will be reached in the room. It will probably require two persons to handle lights and projectors. (We handle the AV in the two rooms other than the auditorium.) I anticipate that there will be some Maryland students helping out in these jobs. People helping at these talks will of course be able to listen to the talks as long as their job is inside the room. There is no problem with the doorkeeper coming in and listening once everything is underway as long as there is no difficulty with the seating in the room. If it is filled, one person will have to stay outside the room at the door to keep others from trying to get in. The bottom line is that helping at the talks may mean that you will be unable to listen to a particular talk. Clearly, if there are several person helping in a room, they can rotate jobs so that one person is not stuck with door duty for the entire session.

Helping at the Exhibits is somewhat different. The most continuing jobs are at the entrances, checking name tags. These persons must be at the entrance and therefore cannot be inside looking at the exhibits. Clearly, we can arrange for split duties so that people aren't stuck at the door for extensive periods. There are also a couple of miscellaneous jobs associated with trouble shooting inside the Exhibit Room — carrying messages from the exhibitors, helping out expediting matters, etc. It may also be useful to have someone available Friday evening and Saturday morning to help out as the exhibitors arrive and set up.

3. Audio Visual and Lighting - We will also need help - largely with AV and lights at the Teacher Workshop (June 22,23), the Education Symposium (June 24,25) and the Science Symposium (June 26-28). The needs here are a lot less and can probably be handled by UMD students. However, if any NCA members are interested, they might want to work in those venues.

The Deal

I will probably subdivide the major part of the work (#2 above) into Morning and Afternoon sessions. Working any two sessions (e.g., Sat AM and Sun PM) gets you free admission to any of the EXPO events for the weekend. If persons are interested in attending one of the other events e.g. the science symposium, we will work out a specific deal on a one by one basis. I need to get a list of who is willing to help and in what capacity (and what constraints, e.g., can work only on Saturday, or only in the afternoon). I would like to get the list as soon as possible. We will ultimately be in touch with the volunteers to discuss details of what needs to be done.

*Goddard Visitors Center has been chosen.

Attention Summer Vacationers!

By

Daniel J. Costanzo

Summertime's traditional vacation season, combined with its comfortable nighttime temperatures, can provide some of the best opportunities for those wishing to personally experience the Universe under a relatively dark sky. The Milky Way's band is at its brightest, as seen from dark-sky sites throughout much of the World, including the Lower Forty-Eight States. And the dome of night is filled with bright "deep-sky" objects suitable for inspection via binoculars and small telescopes.

Sadly, all to many people deny themselves, and their children, this sky viewing experience by inadvertently scheduling summertime vacations during Moonlit nights. While Summer Moonlight may seem appropriate to some, please realize that a creamy Summer Moon can be just as easily seen from Rock Creek Park as from Shenandoah National Park. However, a bejeweled Summer Milky Way is an astonishingly rare spectacle for many thanks to light pollution's pervasive scourge of wasted light.

Because light pollution has smothered the Milky Way out of their lives, many vacationers lucky enough to be under dark skies now mistake it for a pesky bright cloud marring an otherwise clear night sky. (See the marvelous book *The River That Flows Uphill* for a description of just such an incident.) Children, in particular, are denied this marvelous sight during their formative years. Sadly, they will grow up without noting any connection between themselves and this vast Universe we all share. That will translate into future taxpayers unwilling to spend any money on space technology, astronomy, and related sciences. And its all from being denied that breathtaking sight of the bright Milky Way on a clear and soft Summer night, while young and impressionable.

Luckily, any Summer vacation away from light pollution can be turned into a dark-sky vacation, weather permitting of course, by scheduling it when the Moon is near New, or well below the horizon. The most conveniently accessible of these "deep night" periods are those between dusk and Midnight, local time, when neither daylight, twilight, nor Moonlight brightens the sky. For most people, particularly children and their parents, these are the best times for being outside under dark skies.

All of the information below was gleaned from many years experience in planning dark-sky vacations for both myself and others. I was aided by analyzing the *Astronomical Calendar 1995**, and the *Sky-Gazer's Almanac 1995**. These sources, and *Sky & Telescope** magazine describe many sights to see and activities to do during dark-sky vacations. Unfortunately, useful as they are, these publications don't customize their information for the needs of harried vacation planners using ordinary calendars. Hence this article.

Below are calendar date periods when no Moon is present in the dusk to Midnight sky for at least one hour each night during this year's traditional Summertime season—Memorial Day (May 29) through Labor Day (September 4). These periods more or less apply throughout the entire Lower Forty-Eight States:

May 29 - June 5	July 16 - August 2
June 17 - July 4	August 15 - Sept. 1

This means that each month, the majority of nights meet this criterion, except for roughly ten to thirteen nights. To maximize the hours of deep night during this convenient dusk to Midnight time, plan for as much of your vacation as possible to fall during the roughly seven nights before New Moon, out through the roughly three nights after New Moon. Below are calendar dates for these "core" deep night periods during this year's Summertime season. Calendar dates closest to New Moon are in parentheses:

May 29-31 (May 28)
July 19-29 (July 26)
June 20-30 (June 27)
August 18-28 (August 25)

Although this guide is intended for the Lower Forty-Eight States, it also, very crudely applies to most of the rest of the World, including the Southern Hemisphere. For the Moon is full or new no matter where you are on Earth's surface, although many people don't realize this fact. So these same dates roughly apply for a dark-sky vacation to the Peruvian Amazon, a tad south of the Equator, just as they do for one to the Blue Ridge Mountains. In fact, both these places are in the same time zone (and roughly the same geographic longitude—West 78°). Just remember that our Summer is their Winter (actually, their dry season since Peru is so close to the Equator). Traveling to places like Australia adds the complication of crossing the International Date Line, but dealing with that is beyond the scope of this article.

When planning your Summer vacation, keep in mind the geographic latitude of your vacation site. Remember, the farther north you travel from the National Capital area in Summer, the longer it takes the sky to get dark on any given evening, and thus the shorter your night's duration will be. So, on any given Summer date, nightfall takes noticeably longer to arrive in southern Maine than in Northern Virginia (latitudes North 44° and 39°, respectively). And if you travel north far enough, e.g., into northern Canada and Alaska, skies will never get dark at all. That might be good for experiencing The Land Of The Midnight Sun. But its not good for experiencing the dark-sky.

Likewise, the lower the latitude you travel to in Summer, the higher in a dark sky will be the incredibly beautiful southern Milky Way, situated among the constellations Scorpius and Sagittarius. Even traveling a few hundred miles south of the National Capital region provides a noticeable improve-

*These publications can be purchased at a discount through your NCA membership.

see ***VACATIONERS,*** *on page 8*

VACATIONERS, from page 7

ment in the altitude above the horizon of this part of the southern Summer sky. For instance there is a five degree latitude difference between Northern Virginia and southern North Carolina (latitudes North 39° and 34°, respectively). Although five degrees may seem trivial against the great dome of the sky, for objects low on the horizon it is quite noticeable.

Conversely, while from Northern Virginia this part of the sky is situated above the horizon at a low but comfortable altitude, from southern Maine (five degrees north) it is at a disappointingly low altitude, and partially cut off. Unfortunately, weatherwise, the farther south you travel from the National Capital area in Summer, and the closer you get to Florida, the more you encounter what I call "the bad three C's" — Cloudy, Clammy & Campbell's (as in Campbell's Soup). Meanwhile, the farther north you travel from the Nation's Capital, the more you encounter "the good three C's" — Clear, Cool & Canadian (as in Canadian high pressure systems). But, as already noted, you also start losing both hours of darkness and the deep southern constellations. So, as with everything else in life and the Universe, its a tradeoff.

For true globe-trotting vacationers traveling during this time of year, areas well south of the Equator (between latitudes South 30° to 40°), e.g., southern South America, southern Australia, and southern Africa, display this southern celestial region as a spectacular sight in their dark skies. It is placed almost straight overhead, although its part of their Winter sky.

The National Capital region abounds with Summertime opportunities for orienting oneself as to what the dark-sky is like before going on a Summer dark-sky vacation. First, there is the NCA/National Park Service "Exploring the Sky" program at Rock Creek Park, in Washington, D.C. This site has the advantage of being easily accessible by car from the District or the Maryland and Virginia suburbs. This public sky watching program (or planetarium program, if cloudy) is conducted once a month throughout the Summer. Even though under a heavily light polluted sky, NCA's experts will guide the uninitiated as to where and how to find the brightest stars and planets. These can then serve as "sky marks" for orienting oneself under a dark-sky. See this issue's "Calendar of Monthly Events" for the latest dates and details, or contact the park directly (telephone: 202/426-6829). Second, a number of public sky watching programs are conducted throughout the Summer at Sky Meadows State Park, located between Delaplane and Paris, Virginia. The nice thing about this park is it offers reasonably dark skies relatively close to the National Capital area; it's roughly an hour's drive from the Capital Beltway. Unfortunately, nice as they are, these programs frequently have the waxing Moon in the sky, thus marring a true dark-sky experience. Look for listings in *The Washington Post* "Sky Watch" column (see this issue's "Calendar of Monthly Events"), or contact the park directly (telephone: 703/592-3556). Finally, there is "The Stars Tonight," a live daily lecture given seven days a week at 3:00 p.m., in the Smithsonian Institution's National Air and Space Museum (NASM) Albert Einstein Planetarium. Using NASM's magnificent Zeiss planetarium projector, Planetarium's staff give a tour of the current sky for that night. This program is entirely free, but requires obtaining tickets ahead of time, and in person from the Planetarium's box office. However, they may be obtained up to two weeks in advance. I strongly recommend getting them, at the absolute latest, as soon as the museum opens on the morning of your intended visit. Summertime crowds to the most popular museum on the Planet quickly gobble up tickets, especially on weekends. For more details about "The Stars Tonight," call the recordings on the Einstein Planetarium Information Line (202/357-1550), or the Langley Theater & Einstein Planetarium Information Line (202/357-1686). I highly recommend this program to those trying to orient themselves, and others, for dark-sky vacations in the Lower Forty-Eight. It provides a quick, instructive, and cool Summertime outing in its own right, especially for children.

Now for an astronomer's perspective on Summer Sunshine and dark-skies. The Sun is not the carefree symbol plastering advertisements for Summer fun. Instead, Old Sol is a continuously exploding thermonuclear bomb. A life sustaining nuke, but a nuke never the less. You certainly wouldn't look forward to exposing yourself to the radiation from nukes exploding above your head, in a World War III sense. Likewise, always be very careful about protecting yourself from Summer Sunshine. Besides contributing toward skin cancer and cataracts, according to "Deep-Sky Observing Hints" in the *Observer's Handbook* (also available at a discount from NCA), lots of bright Sunlight — such as a day at the beach — has a tendency to temporarily reduce dark adaptation, and cause very tired eyes at night. That's not good for seeing the dark-sky you spent all this money to experience. So, as with everything else you do on vacation; safety first.

And don't forget artificial satellites. Though bright satellites are royal pests to many ground-based astronomers, they can be quite exciting sights to see gently sailing across the sky. Satellites frequently are clearly visible to unaided eyes or binoculars, even from heavily light polluted areas. But in dark skies they stand out even more. And from Northern Hemisphere sites, during Summer, they can be viewed all night long. Watching satellites is an especially enjoyable and instructive Summer activity for children. It is accentu-

... SUMMER on page 9

Newsletter Deadline for September *Star Dust* August 15, 1995

Send Submissions to Gary & Alisa Joaquin, at 7821 Winona Ct., Annandale, VA, 22003, Leave a message on voice mail 703/750-1636 or send an ASCII file via E-Mail at 71561.1747 @compuserve.com or fax to 703/658-2233. Submissions must be on time or they may not get in.

A Note From the Editors:

We have enjoyed putting this publication together and we hope to continue doing so and to try to make this publication the best it can be. Have a great summer! — Alisa & Gary Joaquin

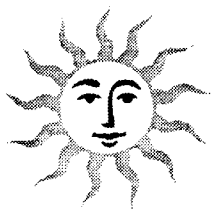
SUMMER, from page 8

ated not only by comfortable temperatures, but also by knowing the names and backgrounds behind the satellites being seen. NCA's Artificial Satellite Prediction Service provides free customized predictions ov viewing opportunities for Summer vacationers. To take advantage of it, contact:

Walter I. Nissen, Jr. (NCA): (voice phone) 216/243-4980, (e-mail) **dk058@cleveland.freenet.edu**.

To aid Walter, please provide him with the latitude and longitude of your expected viewing location to the nearest minute of arc, or better. Having children find geographic coordinates of the dark-sky sites they will visit, and then see satellites sailing across the sky above those places, is an excellent introduction to space technology, astronomy, and related sciences.

One final tip. The biggest meteor shower of Summer is the Perseids (July 23-August 20). And of all major annual meteor showers (ones peaking at more than fifty meteors per hour in clear, dark skies, the Perseids is the only one observable from the Lower Forty-Eight States under comfortable nighttime temperatures. Unfortunately, while meteor showers are best seen in dark, Moonless skies, this year's Perseid peak (nights of August 10, 11, and 12) occurs during full Moon, meaning this will not be a good Summer for them. But since the Perseids are an annual event, they will be back again around the same dates next year. And in future years, the Moon will be conveniently out of the way. So start planning your future vacations now around these August dates. Clear and dark skies, the bright Milky Way, frequent meteors, lots of satellites, and salubrious temperatures are a winning Summertime viewing combination not to be missed. The above information, plus NCA's experts, can help you plan your Summer vacations accordingly.



Important Information Numbers

Smithsonian Sky Watchers' Report: Non-technical information recording on astronomical events, objects, and phenomena in the Washington, D.C. region's sky. Updated weekly. 202/357-2000

***Sky & Telescope* "Skyline"**: Moderately technical information recording on latest in space technology, astronomy, and related sciences. Updated weekly, or sooner if necessary. 617/497-4168

McDonald Observatory "Star Date": Non-technical information on space technology, astronomy, and related subjects. Broadcast weeknights, around 8:00 PM, by listener-supported public radio station WAMU-FM 88.5.

Accurate Time Services (via phone line): Eastern Time (in 24 hour mode) and Universal Time given via the U.S. Naval Observatory and the National Institute of Standards and Technology. Excellent for synchronizing clocks and watches. (Voice Recordings) 202/653-1800, 900/410-TIME, and 303/499-7111; (Modem Time Service) 202/653-0351

"Space Weather" Indices: Highly technical, but quite useful voice recording on Solar activity and its effect on Planet Earth, given via the National Oceanic and Atmospheric Administration. Updated every three hours. 303/497-3235 (anytime) or WWV at 2.5, 5, 10, 15, and 20 MHz (at 18 minutes after every hour)

Local Weather, Sunrise/Sunset, and UV Index: Recording of latest weather forecast out to five days, plus Sunrise/Sunset times, and forecasted Solar ultraviolet radiation index. Covers Washington, DC and vicinity. 703/260-0307

NCA Artificial Satellite Prediction Service: Free customized prediction of viewing opportunities. Satellites frequently are clearly visible to unaided eyes or binoculars, even from heavily light polluted areas. Contact Walter I. Nissen, Jr., (voice phone) 216/243-4980, (e-mail) dk058@cleveland.freenet.edu

NCA Jupiter Galilean Moon Prediction Service: Free customized prediction of viewing opportunities for Jupiter's four Galilean moons. They are clearly visible in small telescopes and binoculars, even from heavily light-polluted areas. Contact John Lohman (voicephone) 703/820-4194 at least one week prior to anticipated viewing.

Occultation Line: Highly technical, but quite useful voice recording with latest updates on occultations and grazings of stars by the Moon, planets, and asteroids; from the International Occultation Timing Association. Many of these events are visible with the unaided eye, binoculars, and small telescopes. 301/474-4945

Other Free Public Science & Technology Lectures: National Air and Space Museum (NASM): 202/357-1552 (ask to receive NASM bimonthly calendar by mail); University of Maryland (Astronomy Department): 301/405-3001; Goddard Space Flight Center (Goddard Visitor Center): 301/286-8981; Carnegie Institution of Washington: 202/328-6988 or 202/265-2752

Science & Technology Public Radio Programs: Quality, informative, and educational radio programs featuring space technology, astronomy, and realated sciences are presented at irregular intervals on WAMU-FM 88.5. For program listing, call WAMU Public Radio Listener Talk Show Hotline: 202/885-1200 and Press 3.

"Star Hustler": Completely non-technical, frequently outrageous, but always informative presentations on astronomical events, objects, and phenomena. Broadcast every night, just before sign-off (generally shortly before 1:00 AM) on Maryland Public Television (MPT) stations. Check your local TV guide for your local MPT Channel. Updated weekly. (MPT can also be picked up in the District and Virginia.

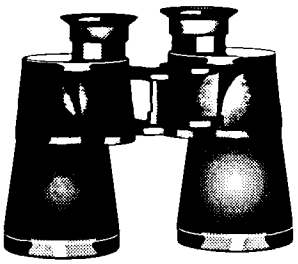
Binoculars! Telescopes! Astronomy!

Free Consumer Workshop

Summer season thoughts of astronomy? Consumer beware! "Bargains" on binoculars and telescopes are just as risky as other "great deals." Learn to wisely choose, use, and care for astronomical instruments from NCA. Their experts are available any time between 11:00 a.m. and 4:00 p.m. with myth-breaking information, guidance, and demonstrations.

Saturday, June 3
National Air & Space Museum
Briefing Room

This workshop is a joint gift of NCA and the Smithsonian Institution, National Air & Space Museum (NASM). See article in *Star Dust*, 1994 October issue, p. 5. NCA volunteers are still needed! NASM provides all volunteers with free parking. Information: Daniel Costanzo (NCA), 703/841-4756; Cheryl Bauer (NASM), 202/357-1529.



Upcoming Lunar Grazing Occultations

DATE	Day	EDT	Star	Mag	%	alt	CA	Location
Jul23	Sun	3:39	ZC 726	6.8	16-	9	-1N	Westminster, MD
Jul23	Sun	4:57	97 Tauri	5.1	16-	23	0N	Doswell, VA
Aug 8	Tue	2:16	ZC 2715	6.0	90+	14	15S	Frederick, MD
Aug19	Sat	4:26	SAO94017	8.5	39-	41	3N	Westminster, MD
Aug19	Sat	5:59	SZ Tauri	6.3	38-	58	2N	Clinton, MD
Aug24	Thu	5:33	50 Cnc	5.7	3-	8	9S	Poughkeepsie, NY
Sep 5	Tue	1:19	Rho Sgr	3.9	80+	12	12S	New Church, VA

There is one good asteroidal occultation possibility, 5.8-mag. Phi 4 Ceti by 1567 Alikoski on Thu. July 6 at 5:00 EDT in NC, duration 6 seconds. For more information and for joining the expedition(s), call David Dunham at 301/474-4722 or 953-5609. Occultation recorded message: 301/474-4945.

NCA Welcomes These New Members

Nicholas L. Costantinople
4422 Garfield St., NW
Washington, DC 20007

Richard & Stephanie Golden
9437 Wooded Glen Ave.
Burke, VA 22015

Chuck Kluepfel
24 Courthouse Sq., Apt. 412
Rockville, MD 20850

Robert H. Purcell
17517 White Ground Rd.
Boyds, MD 20841

John T. Schmitt
1425 Hopkins St., NW, Apt. 302
Washington, DC 20036

Kristina M. Skepton
3609 Woodley Rd., NW
Washington, DC 20016

Alan W. Stone
3614 S St., NW
Washington, DC 20007

Terry & Patty Wrightson
12104 Hitching Post Ln
Rockville, MD 20852-4423

Attention All NCA Junior Members

This summer while school is out, you will probably have more time to devote to astronomy. Let me remind you again that the NCA has a mentor program for its junior members. If you want help with an astronomy project or just have a few scientific questions, call me for referral to an adult member who has expertise in your particular interests. I'll be happy to try to find a mentor whom you may contact when you need assistance. Please don't be timind about calling me. We are eager to help you. All juniors, including youngsters in homes with NCA family memberships, qualify for this help. Information: Leith Holloway, Director of NCA Junior Division, Telephone: 301/564-6061.

National Capital Astronomers, Inc.

SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a non-profit, membership supported, volunteer run, public-service corporation dedicated to advancing space technology, astronomy, and related sciences through information, participation, and inspiration, via research, lectures, presentations, publications, expeditions, tours, public interpretation, and education. NCA is the astronomy affiliate of the Washington Academy of Sciences. All are welcome to join NCA. For information: 301/320-3621 or 703/841-4765.

SERVICES & ACTIVITIES:

Monthly Meetings feature presentations of current work by researchers at the horizons of their fields. All are welcome; there is no charge. *See* monthly *Star Dust* for time and location.

NCA Volunteers serve as skilled observers frequently deploying to many parts of the National Capital region, and beyond, on campaigns and expeditions collecting vital scientific data for astronomy and related sciences. They also serve locally by assisting with scientific conferences, judge science fairs, and interpreting astronomy and related subjects during public programs.

Discussion Groups exchange information, ideas, and questions on preselected topics, moderated by an NCA member or guest expert.

Publications received by members include the monthly newsletter of NCA, *Star Dust*, and an optional discount subscription to *Sky & Telescope* magazine.

NCA Information Service answers a wide variety of inquiries about space technology, astronomy, and related subjects from the public, the media, and other organizations.

Consumer Workshops on selection, use, and care of binoculars and telescopes, provide myth-breaking information, guidance, and demonstrations for those contemplating acquiring their first astronomical instrument.

Dark-Sky Protection Efforts educate society at large about the serious environmental threat of light pollution, plus seek ways and means of light pollution avoidance and abatement. NCA is an organizational member of the International Dark-Sky Association (IDA), and the National Capital region's IDA representative.

Classes teach about subjects ranging from basic astronomy to hand-making a fine astronomical telescope. NCA's instructors also train educators in how to better teach astronomy and related subjects.

Tours travel to dark-sky sites, observatories, laboratories, museums, and other points of interest around the National Capital region, the Nation, and the World.

Discounts are available to members on many publications, products, and services, including *Sky & Telescope* magazine.

Public Sky Viewing Programs are offered jointly with the National Park Service, the Smithsonian Institution, the U.S. Naval Observatory, and others.

NCA Juniors Program fosters children's and young adults' interest in space technology, astronomy, and related sciences through discounted memberships, mentorship from dedicated members, and NCA's annual Science Fair Awards.

Fine Quality Telescopes up to 36-cm (14-inch) aperture are available free for member's use. NCA also has access to several relatively dark-sky sites in Maryland, Virginia, and West Virginia.

YES! I'D LIKE TO JOIN THE NATIONAL CAPITAL ASTRONOMERS

Enclosed is my payment for the following membership category:

[ ] Regular
- [ ] *Sky & Telescope* and *Star Dust*. ($46 per year)
- [ ] Star Dust only ($24 per year)

[ ] Junior (Only open to those under age 18) Date of birth: _____
Junior members pay a reduced rate.
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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 mailing label. You may renew this subscription through NCA for $22 when it expires.

Make check payable to: **National Capital Astronomers, Inc.**, and send with this form to:

NCA c/o Jeffrey B. Norman, 5410 Connecticut Avenue, NW, Apt. #717, Washington, D.C. 20015-2837.

The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

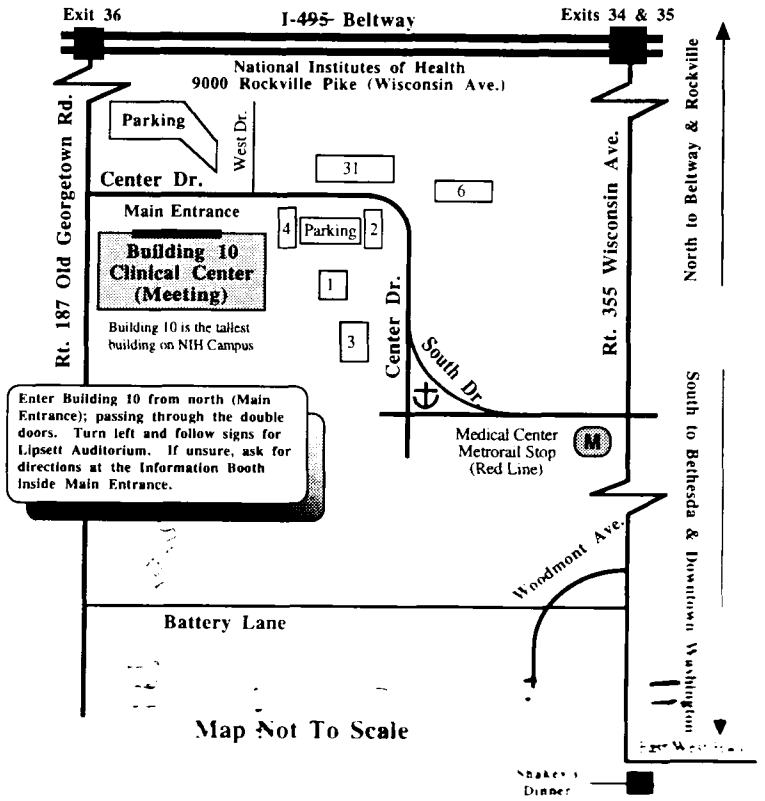
_____

_____

Getting to the NCA Monthly Meeting

Metrorail 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 (walking time about 10 minutes), the tallest building on campus. Also, the J2 bus line connects the Bethesda (7:16 PM) and NIH (7:23 PM) Metro stops with Building 10 (7:25 PM).

To Shakey's - Take Wisconsin Avenue north or south to East-West Highway (Route 410). This is one-half block south of the Bethesda Metro Stop. Shakey's is on the south side of 410 just east of Wisconsin. Parking is available at no charge in lots directly across from the restaurant. Note: that you don't have to eat pizza. Shakey's has a variety of other food, including sandwiches, salads, etc.



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NCA c/o Leith Holloway, Apt. #M-10
10500 Rockville Pike
Rockville, MD 20852-3331

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Leith Holloway
10500 ROCKVILLE PIKE APT M10
ROCKVILLE MD 20852-3331