Star Dust

National Capital Astronomers, Inc.

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Dr. Steven J. Dick, "Astrobiology and its Cultural Implications"

submitted by Gary Joaquin

Dr. Steven J. Dick will present the featured talk for the December 1 meeting of National Capital Astronomers, "Astrobiology and its Cultural Implications". The meeting will be held in the Bethesda-Chevy Chase Regional Services Center of Montgomery County, 4805 Edgemoor Lane (Second Floor), Bethesda, MD at 3:00 P.M. The synopsis and biography that follow were written by the speaker.

Synopsis

Whether or not you believe aliens have physically invaded Earth, they have certainly invaded our culture in literature, art, film, history and philosophy. This illustrated lecture traces how the alien invasion occurred through history, provides an update on where astrobiology stands as a discipline today, and discusses how the discovery of actual life beyond Earth might affect our future. The lack of any such discovery over the next millennium would also have interesting consequences. Will it be the universe of Isaac Asimov, in which human destiny is to expand into an other-

(Continued on page 2)

November Lecture "Galileo at Jupiter", by Dr. James R. Zimbelman

Reviewed by Dr. Andrew W. Seacord, II

Dr. Zimbelman placed two posters at the front of the room. One showed the trajectory of the Galileo mission to Jupiter and its satellites and the other displayed several photographs of Jupiter's satellites. An explanation of the trajectory provided his introduction to the Galileo mission. His first slide was a picture of Galileo Galilei, the man, placed over a page of his observation notes that included a sketch of Jupiter and the positions of its four largest satellites.

In order to illustrate the size of Jupiter, the next slide presented the images of the Earth and Jupiter shown to the same scale. Jupiter's diameter is eleven times that of the Earth. The image of Earth shows cloud tops, oceans, and land masses whereas all that we can see of Jupiter is cloud tops. From accurate tracking of a spacecraft trajectory during a close planetary encounter - a swingby or orbital motion - it is possible to derive a gravity model for the planet and from this it may be possible to deduce the nature of the planet's interior. In the case of Jupiter, however, it has not been possible to determine the size of a rocky core. Present calculations give a range of core size between one smaller than the Earth to one about ten times larger.

Returning to the mission itself, Dr. Zimbelman iterated the goals of the mission. The primary goal is to study the chemistry

(Continued on page 3)

Review of the October Lecture "Why Do Planets Explode?", by Dr. Tom Van Flandern

Will appear in the next issue of *Star Dust*.

NCA Events This Month

The Public is Welcome!

NCA Home Page: http://capitalastronomers.org

Wednesdays, **December 5, 12, and 19. from 7:00 to 10:00 P.M.** The NCA Mirror-Making Class will continue to be on ***Wednesdays*** in November. See article on this page.

Fridays, December 7, 14, 21, and 28, 8:30 P.M. Open nights with NCA's 14-inch telescope at Ridgeview Observatory near Alexandria, Virginia. See below.

Saturday, December 1, 3:00 P.M. - NCA meeting in the Bethesda-Chevy Chase Regional Services Center of Montgomery County, 4805 Edgemoor Lane, (Second Floor), Bethesda, MD. See the map and directions on Page 8.

Dr. Steven J. Dick will present the featured talk "Astrobiology and its Cultural Implications".

Saturday, December 1, following the meeting, dinner with the speaker and NCA members at the
North China Restaurant
7814 Old Georgetown Road
Bethesda, MD 301-656-7922. See the map and directions on Page 8.
See Page 5 for more National Capital Area astronomical doings.

To join NCA, use the membership application on Page 9.

Dr. Steven J. Dick

(Continued from page 1)

wise lifeless universe, or the universe of Arthur C. Clarke, filled with intelligence and all that implies?

Biography

Steven J. Dick has worked as an astronomer and historian of science at the U. S. Naval Observatory since 1979. He obtained his B.S. in astrophysics (1971), and M.A. and Ph.D. (1977) in history and philosophy of science from Indiana University, and is well known as an expert in the field of astrobiology and its cultural implications. He is the author of "Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant" (1982), "The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science" (Cambridge University Press, 1996), and "Life on Other Worlds" (1998). He was also editor of "Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications" (2000). Dr Dick served on Vice President Gore's panel to examine the societal implications of possible life in the Mars rock, and is the recipient of the NASA Group Achievement Award for helping to initiate NASA's multidisciplinary program in astrobiology. He is associate editor for the new "International Journal of Astrobiology". He has served as Chairman of the Historical Astronomy Division of the American Astronomical Society (1993-1994), and as President of the History of Astronomy Commission of the International Astronomical Union (1997-2000).

Observing with the NCA C-14

by Bob Bolster

Date (All at 8:30 p.m.)	**Prime Objects**
December 7 and 14	M15, M32, Double Cluster, Saturn after 9:30
December 21	Orion Nebula, Saturn
December 28	Gibbous Moon, Saturn, Jupiter after 10:30

At Ridgeview Observatory in Bob Bolster's backyard, 6007 Ridge View Drive, Franconia, Virginia (off Franconia Road between Telegraph Road and Rose Hill Drive). Call Bob at 703-960-9126 before 6:00 p.m., to let him know you are coming.

Mirror Making Classes

by Guy Brandenburg

The NCA weekly Mirror-Making class will continue to be held on Wednesdays in December, from 7:00 to 10:00 P.M. at the American University's McKinley Hall, Rooms 9 and 13, just off Ward Circle in Northwest Washington, D.C. The days are December 5, 12, and 19. December 26 is canceled. Classes are very informal, and you can start or finish a mirror at any time. We have all the necessary abrasives, glass, pitch, and testing equipment on hand, and you will find that in learning how to make a fine primary mirror, you will learn a lot about optics and astronomy that will be very helpful in observing the sky later on. Plus, you can then brag about how you made your own mirror and how you tested it to be accurate to a small fraction of a wavelength of light! Prices for entire packages (instruction, blank, tool, grit, pitch, other abrasives, rouge, testing, and so on) run about $70 for a 6-inch mirror, and more for larger ones. Our prices are actually lower than ordering an entire kit from Willmann-Bell or Newport Glass. We can also test optics that you purchased or found elsewhere, and can aluminize mirrors up to 12.5 inches for an additional fee. For more information, email Guy Brandenburg at gfbranden@earthlink.net or phone him in the evenings or weekends at 202-635-1860.

Dr. James R. Zimbelman

(Continued from page 1)
and physics of Jupiter and its satellites. One physical component of Jupiter is its magnetic field, which is the strongest planetary magnetic field in the solar system.

The Galileo spacecraft had a launch mass of 2,200 kg., forty percent of which was propellant for its on-board thrusters. The spacecraft consisted of two parts, the orbiter and a probe. The probe separated from the orbiter before reaching Jupiter and entered the Jovian atmosphere. As it descended under a parachute, it transmitted data representing properties of the atmosphere through which it passed.

The orbiter suffered a major problem that reduced the amount of information that could be sent back to Earth. The orbiter has a deployable high-gain antenna which is built like an umbrella in that its reflecting surface is attached to a frame of ribs. When stowed for launch, the ribs and reflecting surface are drawn up to a central shaft in the fashion of a closed umbrella. The ribs are held together at the top by a clamp. The surface of the clamp that touches the rib tips had been coated with a lubricant to facilitate the release of the ribs during deployment. Because of several issues, including the demise of the Space Shuttle Challenger, the Galileo spacecraft was placed in storage for several years. During this time, the clamp lubricant dried out. During antenna deployment, the absence of the lubricant caused some of the ribs to get stuck in the clamp; consequently, the high-gain antenna never deployed fully and could not be used during the mission. Data were transmitted with the low-gain antenna. However, the data rate had to be reduced from that possible with the high-gain antenna; so, the amount of data sent back was less than expected.

Tracking and communication with the Galileo spacecraft is accomplished with NASA's Deep Space Network (DSN). We were shown a photograph of the Canberra, Australia DSN site which has two 34-meter antennas and one 70-meter antenna.

Galileo was launched on 1989 October 18 by the Space Shuttle Atlantis. The spacecraft was stacked on an Inertial Upper Stage (IUS). After release from the shuttle payload bay, the IUS took Galileo out of Earth orbit and inserted it into a nominal trajectory which included three planetary flybys as well as flyby encounters with two asteroids. The planetary flybys provided gravity assists, shaping the trajectory without using propellant. The three planetary flybys were Venus on 1990 February 10, Earth on 1990 December 11 and a second Earth encounter on 1992 December 16. The first asteroid encounter was 951 Gaspera which occurred between the two Earth flybys. The second asteroid, 243 Ida was encountered in 1993 August.

These asteroids are very small, irregularly-shaped bodies. Gaspera has the dimensions 19x11x12 km and Ida is a bit larger with dimensions of 50x20x21 km. There is a considerable distance between asteroids, therefore there was little risk of a collision with an unknown asteroid. Other than the planned encounters, the only objects detected by Galileo were particles of dust.

Galileo, however, did make some serendipitous observations. During the time of the comet Shoemaker-Levy/9 encounter with Jupiter, Galileo was in a position to observe the impact of the W-fragment. The images were spectacular!

Galileo finally arrived at Jupiter on 1995 December 7. Several weeks prior to its arrival, the probe was detached from the orbiter. The mission plan was to have the probe enter the Jovian atmosphere between a belt and a band. However, events sometimes do not occur as planned. The probe actually entered the atmosphere through a "white spot" which is a rotating storm, or hurricane. Consequently, the results of the data collected probably do not represent most of the atmosphere.

The orbiter part of Galileo followed a multi-orbit trajectory shaped by encounters with the Jovian satellites. Satellite encounters served two purposes. They were objects of study and provided orbital maneuvers, further reducing mission propellant requirements. The spacecraft thrusters, however, were used for Jovian orbit insertion and for at least one orbit adjustment.

The Galileo orbiter provided some impressive images of the Great Red Spot (GRS), a huge, oval-shaped cyclone in the Jovian atmosphere, first observed by Galileo in 1610. Its longer dimension is at least twice the diameter of Earth. Unlike Earth's cyclones, which are low-pressure systems driven by (exterior) solar energy, the GRS is a high pressure system driven by internal heating. It is thought that Jupiter's internal heating is generated by the gravitational contraction which Jupiter has undergone since it was formed 4.5 billion years ago. In addition to the GRS itself, we were shown time-shot images of thunderstorm cells around it.

The remainder of Dr. Zimbelman's presentation of the Galileo mission was devoted to the Galilean satellites, the four largest Jovian satellites which Galileo, himself, observed in 1610. The first of these was Io, the most volcanically active body in the solar system. Some volcanoes, observed by the Galileo spacecraft in 1997, are known to have been active since they were first observed by the Voyager spacecraft in 1980. The color scheme of Io's surface includes regions of white, yellow, orange, red, and black. The white areas are covered by sulphur dioxide. The other colors are created by sulphur in different forms which depend on the temperature at which they were formed. The several black specks seen on the surface are regions where the sulphur has been heated to a high temperature and are known to be volcanic calderas.

Io is about the same size as our Moon. As is the case for all major solar system satellites, Io is rotationally locked (spin- orbit resonance) so that one of its hemispheres always faces its planet. Also, Io and two other Jovian satellites, Europa and Ganymede, have resonant orbital motions with each other. Io is in a 2:1 resonance with Europa and, also, Europa is in a 2:1 resonance with Ganymede. In other words, Io revolves around Jupiter twice while Europa revolves around Jupiter once and, likewise, Europa makes two revolutions around Jupiter for each one made by Ganymede. The effect of these resonances creates large tides on Io. The vertical tidal displacement of the surface is thought to be as much as 100 meters. The internal motion generates frictional heating which is the source of energy for Io's volcanism. Because Io's interior has not cooled since it was formed, its interior is very hot and plastic and easily deformed by tidal interactions. Infrared measurements suggest a surface temperature, away from active volcanic centers, in the range of 90 to 160K.

Dr. Zimbelman pointed out that Io exists in a harsh radiation environment due to the proximity of Jupiter and its magneto-

(Continued on page 4)

Dr. James R. Zimbelman

(Continued from page 3)
sphere. A spacecraft, manned or unmanned, could not survive very long on its surface.

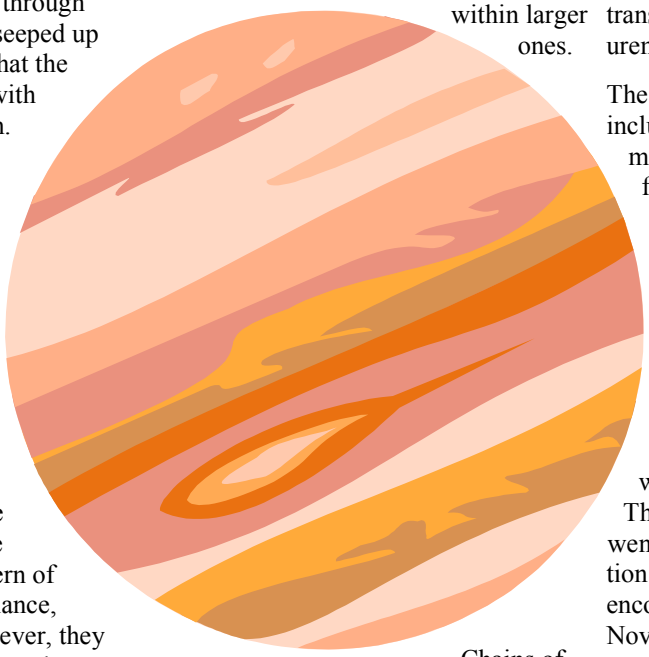
Images of Io indicate an absence of impact craters. The heavy volcanism during four billion years has buried any impact craters with a layer of sulphur and sulphur dioxide. The bulk density of Io is about 3.3 grams/cc, which is about the same as that of our Moon. Since our Moon is a silicate body, the density of Io suggests that its interior is also composed of silicates. This leads to the question: are silicates showing up in the ejecta of Io's volcanoes? The answer to this has not yet been decided. The hottest of Io's ultramafic lava flows are several hundred degrees hotter than those measured from Hawaiian lava flows.

The next object on the Galileo Jupiter tour is the satellite Europa. Its Galileo images show a bright surface crisscrossed with dark lines; some surface regions are darkened. The bright areas are water ice. The dark lines are fractures in the ice through which dark material (mud?) has seeped up from underneath. This suggests that the ice is floating on a liquid ocean with the possibility of life in the ocean. The darker surface regions are probably the result of material dissolved in the ice. Like Io, Europa is tidally locked so that the same hemisphere always faces Jupiter. As Europa revolves around Jupiter, the distribution of this dark material dissolved in the ice varies between the leading and trailing hemispheres.

A closer look at Europa's surface shows a complicated terrain. One peculiar feature is a circular pattern of cracks in the ice which, at first glance, appear to be impact craters. However, they are thought not to be due to impacts, but to have been caused by tides. One worker has shown that the tidal deformation of the ice layer can cause fracturing which propagates in circular patterns like those found on Europa.

The next stop beyond Europa was Ganymede, the largest satellite in Jupiter's family and, in fact, the largest satellite in the solar system. Ganymede is even larger than the planet Mercury. The images of Ganymede show impact craters, a feature not seen on the inner two satellites we have been discussing. The appearance of the many craters seen on Ganymede indicates that its surface is very old. In addition to impact craters, we see many cracks, fractures, and bands of intense fracturing. The surface of Ganymede appears to be water ice with dark gunk frozen in it. Spectroscopic observations show band structure of metals and molecules in the surface reflection spectra. We were shown a perspective view of a fractured region. This view was made from two images of this region, each obtained from a different orbit and, therefore, from a slightly different position. The two images were used to compute a digital image of the fracture topography. A computer generated the picture we saw by draping one of the actual Galileo images over the derived digital topography.

The last stop on our Galileo tour was Callisto, which we considered briefly. The images of its surface showed a broad view of impact craters and impact crater chains. Some craters were small craters nested within larger ones.



Chains of craters suggest the impact of an object torn apart by a tidal interaction like that which created the line of fragments of Shoemaker- Levy/9. At the temperature of Callisto's surface, water ice behaves like rock.

For the last part of his presentation, Dr. Zimbelman turned to another spacecraft mission, Cassini, which encountered Jupiter in 2000 December on its way to Saturn. Cassini is scheduled to encounter Saturn on 2004 July 1.

The main thruster on the Cassini spacecraft will burn for 1-1/2 hours to place the spacecraft in orbit around Saturn. This is much longer than the 49-minute insertion burn required to put Galileo in a Jupiter orbit. The Cassini trajectory, planned for a four-year mission, will not pass through the Saturnian ring system; however, it will use gravity assists from the satellites for orbit adjustment. The Cassini spacecraft has a high gain dish antenna. However, unlike Galileo's deployable dish, the reflector is a hard, permanent surface.

Cassini carries a probe, named Huygens, that is targeted to Saturn's largest satellite, Titan. Titan is unique among the solar system families of planetary satellites in that it is the only one to have a dense atmosphere. Titan's atmosphere has a dense hydrocarbon haze that prevents a visual image of its surface. The Huygens probe will be released from the orbiter several weeks before the Saturn encounter and will follow its own trajectory to Titan. It will descend through the atmosphere under a parachute, transmitting data from atmospheric measurements on its way down.

The Cassini orbiter instrument manifest includes a radar mapper for Titan surface mapping. This radar is similar to that flown on the Magellan spacecraft which mapped 98 percent of Venus' surface.

With the discussion of Cassini and its Huygens probe, Dr. Zimbelman concluded his formal presentation and entertained questions from the audience. One question was directed to the current status of the Galileo spacecraft. The spacecraft is still working well and is now on its "farewell tour". The 2001 October 16 closest pass of Io went very well in spite of the intense radiation environment. There will be another Io encounter on 2002 January 17. On 2002 November 5, it will fly by Amalthea, a small satellite 200 km across and the largest satellite interior to Io. The final Galileo event will be its demise, the Jupiter impact, scheduled for 2003 October 21. The reason for the Jupiter impact is to prevent the spacecraft from impacting Europa at a later time. A Europa impact by the Galileo spacecraft would adversely affect a Europa orbiter mission which is currently being planned.

We thank Dr. Zimbelman for an enjoyable and informative presentation.

Other National Capital Area Meetings

Northern Virginia Astronomy Club (NOVAC) meets 7:00 p.m. on the second Sunday of every month.
The meeting site is Enterprise Hall, Room 80 at George Mason University.
Source: http://novac.com

Stellar & Extragalactic Astronomy Lunch
Talks are Wednesdays at 12:00 Noon in Room 191 of Building 21, GSFC
December 5 Bob Silverberg, GSFC, "TOPHAT"
December 12 Nick Collins, GSFC/CUA, "Physical Conditions of the NLR in Mrk 3"
December 19 Sergei Ipatov, Russian Acad. Sci., "Migration of Celestial Bodies in the Solar System"
For more information, contact Jonathan P. Gardner, email gardner@harmony.gsfc.nasa.gov.
Source: http://hires.gsfc.nasa.gov/~gardner/seal

University of Maryland at College Park Astronomy Colloquia
All Astronomy Colloquia are held in Room CSS 2400 on Wednesdays at 4:00-5:00 p.m. unless otherwise noted.
December 5 Prof. Mitchell Begelman, University of Colorado, "Defeating the Eddington Limit: Photon Bubbles in Luminous Accretion Disks"
Special accommodations for individuals with disabilities can be made by calling (301) 405-3001. It would be appreciated if we are notified at least one week in advance. Parking: Most parking meters in Parking Garage 2 have been removed. Parking for visitors is available in the Cashier-Attended Parking Lot at the intersection of Paint Branch & Technology Drive. It is a 5-10 minute walk from the parking lot to the Computer & Space Sciences building.
Source: http://www.astro.umd.edu/colloquia/colloquium.html

University of Maryland Observatory on Metzerott Road. Open house on the 5th and 20th of each month. The talk begins at 8:00 PM. And is followed by observing if the weather permits.
December 5 Dr. Andy Harris on "Kapow! When things smash into the Earth".
December 20 Dr. Casey Lisse on "Comets in the Solor System and in the Kitchen".
Info: (301) 405-3001 Source: http://www.astro.umd.edu/openhouse/

Laboratory for High Energy Astrophysics (LHEA) Goddard's Tuesday Seminar Series. NASA Goddard Space Flight Center Building 2, Ground Floor Conference Room 3:30 P.M. Cookies, Coffee and Tea 3;45 P.M. Seminar
Monday, December 3, 11:00 A.M., Bldg. 2, Rm. 8, Dr. Robyn Millan, SSL, UC Berkeley, "Observations of Terrestrial MeV X-ray Bursts with MAXIS".
Monday, December 3, 2:00 P.M., Bldg. 2, Rm. 8, Dr. Carlos Mendoza, NRC & GSFC/LHEA, "Atomic Models for Iron K Lines".
December 04 Dr. Diego Torres, Princeton, TBA.
Wednesday, December 5, 2:00 P.M., Bldg. 2 Rm. 8, , Dr. Panjak Jain, U. of Kansas, TBA.
December 11 Dr. Feryal Ozel, Harvard, TBA.
December 18 Dr. Derek Richardson, U. Md., TBA.
Source: http://lhea.gsfc.nasa.gov/docs/seminar.html

Space Telescope Science Institute (STScI). Public Lectures at the Space Telescope Science Institute. Are you interested in planets, stars, galaxies, black holes? Come to the free public lectures at the Space Telescope Science Institute. Each month a noted scientist discusses a different cosmic topic. Lectures are at 8 p.m. the first Tuesday of every month in the STScI auditorium, on the campus of Johns Hopkins University. Free parking is available. For directions, call 410-338-4700.
Source: http://hubble.stsci.edu/about_us/open-night.shtml

Montgomery College's Planetarium
Fenton St. in Takoma Park, MD.
Planetarium Montgomery College's Planetarium at Takoma Park, Maryland. Exciting public planetarium programs are offered at Takoma Park's own planetarium. Astronomy is the oldest science and one of the few sciences that welcomes amateurs. Astronomy is one of the few sciences accessible to any inquiring mind. Come to a public planetarium program and explore the universe with us. Everyone who looks up at the stars with wonder is an astronomer. The planetarium is open from the last week in August until the Friday before Memorial day in May. This is an academic institution so there are a few holidays like Thanksgiving and around Christmas and new year's day when the entire institution is closed.
Friday, December 21 at 7:00 P.M., the winter solstice is at 2:22 p.m. today, "The Day of the Sun's Return, the Winter Solstice"
The winter solstice, the dreariest day with the shortest day light and longest night of the year, our ancestors celebrated the beginning of the return of the Sun to the higher heavens. The planetarium show will explore the astronomical events associated with the first day of winter and will demonstrate how the position of the solstice with respect to the fixed stars has changed over the millennium. The patch of the sky in which the modern solstice occurs contains the galactic center and the delightfully beautiful Trifid nebulae. These places and objects are visible to modern stargazers through long exposure photography with large telescopes. The planetarium celebration of the winter solstice will include the presentation of spectacular slides of the region.
Phone 301-650-1463
Source: http://www.mc.cc.md.us/Departments/planet/

U.S. Naval Observatory (USNO)
All Public Tours of the USNO have been suspended until further notice.
Call the USNO Public Affairs Office, 202/762-1438 for further information
Source: http://www.usno.navy.mil

Deadline for January *Star Dust*: December 15

Please send submissions to Elliott Fein at elliott.fein@erols.com.
Text must be in ASCII, MS Word, or WordPerfect.
Thanks.

Happy Anniversary, Viking Lander!

On July 20, 1976, NASA's Viking 1 Lander touched down safely on the surface of Mars, revealing an alien world that continues to puzzle scientists and tempt explorers.

It was the first probe from Earth to land intact on the Red Planet, and the first American spacecraft to land on any world since the Apollo program.

Before Viking 1 touched down, many people thought Mars might harbor abundant plant life and microbes living among the rust-colored rocks. Scientists guessed the skies might be tinged deep purple like Earth's stratosphere, which is about as tenuous as the Martian atmosphere. But Viking 1 and its sister ship Viking 2, which arrived on Mars a few months later, quickly dispelled those notions. The landers revealed an alien world with sterile soil and eerie salmon-pink skies. No plants swayed in the breeze. No animals scurried from rock to rock.

On the bright side, there were no hostile aliens either. If there was to be a "War of the Worlds" — like the one popularized by Orson Well's famous 1938 radio broadcast — it wouldn't likely begin on Mars!

The Viking 1 Lander set down on Chryse Planitia, a flood plain at 23 degrees north latitude. "Chryse Planitia is an interesting place," says Jim Garvin, Mars program scientist at NASA Headquarters. "Long ago — perhaps billions of years — it was the dumping ground for five wide outflow channels apparently carved by flowing water." Scientists were attracted to it because of its watery history. Viking mission planners liked it because it was flat and seemed to offer a safe landing spot. "[Before Viking], Mars had been examined from orbit by the Mariner spacecraft . . . but the images were on the scale of a football field," explains former Viking project manager James Martin of NASA's Langley Research Center. "That was the smallest thing we could see and that's not very distinct when you consider the landers are only six or eight feet across. We didn't have the slightest idea what was on the surface [at such small scales]." Landing anywhere was risky!

Nevertheless, Viking 1 touched down safely and transmitted its first image 25 seconds later. The lander's seismometer failed to uncage, and a sampler arm locking pin was stuck and took 5 days to shake out. Otherwise, all the experiments functioned as planned. The lander went about its business for more than six years, from July 20, 1976 until November 1982, substantially exceeding its design lifetime of 90 days! On Sept. 3, 1976, Viking 2 set down at Utopia Planitia — a gently-sloping plain half a world away from the Viking 1 site (6725 km, to be exact). "Viking 2 landed at 48 degrees north latitude near the Mie crater,"says Garvin. "It was a very different environment from the flood plains of Chryse." The weather at Utopia Planitia was different — a result of its more northern latitude. There were curious pedestals that scientists thought might be small volcanoes, and the terrain was littered with the ejecta of the nearby impact crater. (NASA Science News)

Meteor Showers

December Radiants

Full Moon: December 30

Major Activity

Radiant	Duration	Maximum
Geminids (GEM)	Dec. 6 - 19	Dec. 13 at 23:10 UT

Moderate Activity

Radiant	Duration	Maximum
Ursids (URS)	Dec. 17 - 25	Dec. 22 @ 12:00 UT

Minor Activity

Radiant	Duration	Maximum
Delta Arietids	Dec. 8 - Jan. 2	Dec. 8/9
11 Canis Minorids	Dec. 4 - 15	Dec. 10/11
Coma Berenicids (COM)	Dec. 8 - Jan. 23	Dec. 18-Jan. 6
Sigma Hydrids (HYD)	Dec. 4 - 15	Dec. 11/12
December Monocerotids (MON)	Nov. 9 - Dec. 18	Dec. 11/12
Northern Chi Orionids (XOR)	Nov. 16 - Dec. 16	Dec. 10/11
Southern Chi Orionids (XOR)	Dec. 2 - 18	Dec. 10/11
Phoenicids (PHO)	Nov. 29 - Dec. 9	Dec. 5/6
Alpha Puppids (PUP)	Nov. 17 - Dec. 9	Dec. 2-5

Source:http://comets.amsmeteors.org/meteors

Mid-Atlantic Occultations and Expeditions

by David Dunham

Asteroidal Occultations

DATE	Day	EST	Star	Mag	Asteroid	dmag	Dur s	Ap. in.	Location
Dec 3	Mon	20:01	TYC58140754	11.4	Huberta	3.3	5	8	n.w. Penn.
Dec 8	Sat	21:03	TYC18301346	9.8	Delia	4.7	4	5	Dakotas
Dec 15	Sat	2:19	TYC24600063	9.8	Luthera	3.9	7	5	Texas
Dec 18	Tue	22:30	TYC07170435	11.0	Boliviana	0.7	14	8	n.w. Penn.
Dec 21	Fri	6:16	TYC01850663	10.7	Kriemhild	3.0	6	8	Carolinas
Dec 23	Sun	22:28	TYC01460733	11.6	Arctica	2.5	6	8	Michigan
Dec 30	Sun	20:15	SAO 59812	6.4	Luthera	7.1	6	1	Winnipeg
Dec 29	Sat	1:12	TYC23891074	11.9	Kalliope	0.2	18	10	Pennsylvania
Dec 31	Mon	1:03	TYC24300705	11.1	Bower	2.6	4	8	n. VA, s.e. MD

Lunar Grazing Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Location
Dec 14	Fri	17:30	The Sun	-27	0	13	N	Costa Rica; eclipse *
Dec 18	Tue	19:07	SAO 190125	7.9	16+	11	11S	Greencastle, PA
Dec 20	Thu	19:54	tau 2 Aqr	4.0	32+	24	12S	Currituck, NC; ZC 3349
Dec 21	Fri	22:29	ZC 3484	6.9	42+	9	6S	Chesapeake, VA
Dec 28	Fri	4:16	Saturn	-0.1	94+	8	6N	Portland, ME

* see http://iota.jhuapl.edu for more about this annular solar eclipse

Total Lunar Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Sp.	Notes
Dec 1	Sat	21:38	R ZC 0861	6.4	98-	43	49S	K2	
Dec 2	Sun	19:43	R ZC 1017	6.7	94-	12	84S	K0	
Dec 3	Mon	20:22	R ZC 1161	5.9	88-	8	42S	K5	
Dec 3	Mon	23:42	R 82 Gem	6.2	87-	45	58S	G2	ZC 1178; close double
Dec 4	Tue	5:33	R ZC 1200	6.9	85-	57	23N	K0	
Dec 7	Fri	0:54	R ZC 1569	6.9	56-	20	56S	A2	
Dec 7	Fri	4:47	R ZC 1586	7.5	54-	59	13N	K0	
Dec 8	Sat	3:47	R SAO 119038	6.9	43-	39	35N	M2	
Dec 8	Sat	3:49	R SAO 119030	7.1	43-	39	86N	K0	
Dec 12	Wed	6:42	D omicronLib	6.1	6-	18	-29N	F2	ZC 2193; Sun alt. -7
Dec 12	Wed	7:06	R omicronLib	6.1	6-	22	10N	F2	ZC 2193; Sun alt. -3
Dec 16	Sun	18:10	D chi1 Sgr	5.0	4+	2	58N	A4	ZC 2834; close double
Dec 19	Wed	18:26	D SAO 164803	7.9	24+	26	17N	A9	
Dec 19	Wed	18:28	D SAO 164816	7.7	24+	25	81N	K1	2nd 10.8mag. 3.7",PA 345
Dec 20	Thu	19:31	D tau 2 Aqr	4.0	32+	27	46S	K5	graze in n.e. N.Carolina
Dec 20	Thu	20:15	R tau 2 Aqr	4.0	32+	27	-23S	K5	ZC 3349
Dec 21	Fri	20:34	D ZC 3480	7.2	42+	28	87S	F5	
Dec 21	Fri	22:10	D ZC 3484	6.9	42+	12	38S	G5	
Dec 28	Fri	3:59	D Saturn	-0.1	94+	15	55N		disk duration 48 seconds
Dec 28	Fri	4:42	R Saturn	-0.1	94+	7	-43N		disk duration 45 seconds
Dec 28	Fri	21:28	D 109 Tauri	5.0	98+	65	79S	G8	ZC 0792
Dec 29	Sat	3:52	D ZC 828	6.3	98+	28	76S	K0	

For updates, etc., call the IOTA phone line at 301-474-4945 or see http://www.lunar-occultations.com/iota
David Dunham, e-mail dunham@erols.com Phone 301-474-4722

Star Dust Is Now Available Electronically

Any member wishing to receive *Star Dust,* the newsletter of the National Capital Astronomers, via e-mail as a PDF file attachment, instead of hardcopy via U.S. Mail, should contact Nancy Grace Roman, the NCA Secretary, at ngroman@erols.com, or via telephone at 301-656-6092 (home).

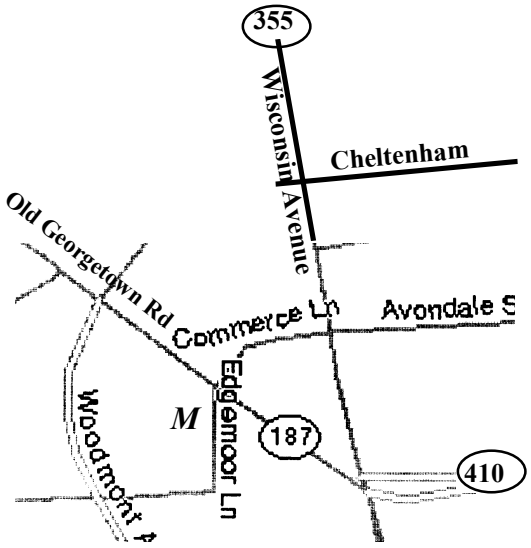
Getting to the NCA Monthly Meeting

Saturday, December 1

3:00 P.M. - NCA Meeting in the Bethesda-Chevy Chase Regional Services Center of Montgomery County, 4805 Edgemoor Lane **(2nd Floor)**, Bethesda, MD.

Dr. Steven J. Dick will present the featured talk "Astrobiology and its Cultural Implications".

Following the meeting, dinner with the speaker and NCA members at the North China Restaurant
7814 Old Georgetown Road
(near Cordell)
Bethesda, MD 301-656-7922



Directions to the New Meeting Place

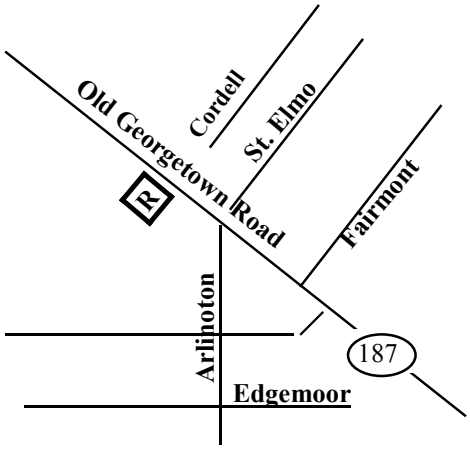
From North of Bethesda

1. Take Rockville Pike/MD-355 South.
2. Rockville Pike/MD-355 S becomes MD-355/Wisconsin Ave.
3. Shortly after Cheltenham Dr. (and one block before reaching Rt. 410), turn right onto Commerce Lane.
4. Commerce Lane becomes Edgemoor Lane.
5. After crossing Old Georgetown Rd., 4805 is the second entrance on the right. (See ***M*** on map.*)*
6. To get to public parking, continue on Edgemoor Lane which will make a sharp right turn. The parking garage is then on your right. See note below.

From South of Bethesda

1. Take MD-355/Wisconsin Ave. North.
2. Turn slight left onto MD-187/Old Georgetown Rd.
3. Turn next left onto Edgemoor Ln. 4805 is the second entrance on the right. (See ***M*** on map.*)*
4. To get to public parking, continue on Edgemoor Lane which will make a sharp right turn. The parking garage is then on your right.

Note: there are two parking lots. The one on Woodmont is for the apartments and may have a fee. The one on Edgemoor is marked "Public" and does not charge on weekends.



Directions to the Restaurant

1. Following the meeting, turn right out of the parking garage.
2. Continue on Edgemoor Lane and cross Woodmont Ave.
3. Turn right onto Arlington Blvd.
4. Turn left onto MD-187/Old Georgetown Rd.
5. The restaurant is almost on the corner of Cordell and Old Georgetown Road.
6. There is a free, public parking garage very close to Old Georgetown Road between Cordell and St. Elmo.

Star Dust is published ten times yearly, September through June, by the National Capital Astronomers, Inc. (NCA).
Editor: Elliott Fein, Co-editor: Adele Fein, Editorial Advisor: Nancy Byrd.

National Capital Astronomers, Inc.

SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a nonprofit, membership-supported, volunteer-run, public-service corporation dedicated to advancing astronomy, space technology, 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.

SERVICES & ACTIVITIES:

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

NCA Volunteers serve in a number of capacities. Many members serve as teachers, clinicians, and science fair judges. Some members observe total or graze occultations of stars occulted by the Moon or asteroids. Most of these NCA members are also members of the International Occultation Timing Association (IOTA).

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

Consumer Clinics: Some members serve as clinicians and provide advice for the selection, use, and care of binoculars and telescopes and their accessories. One such clinic is the semiannual event held at the Smithsonian Institution National Air and Space Museum.

Fighting Light Pollution: NCA is concerned about light pollution and is interested in the technology for reducing or eliminating it. To that purpose, NCA is an Organization Member of the International Dark Sky Association (IDA). Some NCA members are also individual members of IDA.

Classes: Some NCA members are available for educational programs for schools and other organizations. The instruction settings include star parties, classroom instruction, and schoolteacher training programs that provide techniques for teaching astronomy. NCA sponsors a telescope-making class, which is described in the *Star Dust* "Calendar of Monthly Events".

Tours: On several occasions, NCA has sponsored tours of astronomical interest, mainly to observatories (such as the National Radio Astronomy Observatory) and to the solar eclipses of 1998 and 1999. Contact: Sue Bassett wb3enm@amsat.org

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, and others. Contact: Joe Morris. joemorris@erols.com or (703) 620-0996.

Members-Only Viewing Programs periodically, at a dark-sky site.

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

Fine Quality Telescope, 14-inch aperture, see "Calendar of Monthly Events".

Yes! I'd like to join the NATIONAL CAPITAL ASTRONOMERS **Date:**

Name(s): _____

Address: _____

_____

Telephone: _____ E-mail: _____

Other family members who should receive a membership card: _____

Dues:

___ $57 With *Star Dust* and a discount subscription to *Sky & Telescope*.
___ $27 With *Star Dust* ONLY.
___ $45 Junior membership with *Star Dust* and a discount subscription to *Sky & Telescope*.
___ $15 Junior membership with *Star Dust* ONLY.
___ $100 Contributing member (with *Sky & Telescope*) ($43 tax-deductible).
___ $150 Sustaining member (with *Sky & Telescope*) ($93 tax-deductible).

Junior members only: Date of Birth: _____ Only members under the age of 18 may join as juniors.

Tax deductible contribution: ____ Thank You.
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