Star Dust

National Capital Astronomers, Inc.

November 2008

Volume 67, Issue 3

http://capitalastronomers.org

Next Meeting

When: Sat. Nov. 8, 2008

Time: 7:30 pm

Where: UM Observatory

Speaker: Steven Dick, NASA

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Directions to Dinner/Meeting

Members and guests are invited to join us for dinner at the Garden Restaurant located in the UMUC Inn & Conference Center, 3501 University Blvd E. The meeting is held at the UM Astronomy Observatory on Metzerott Rd about halfway between Adelphi and University Blvd.

Need a Ride?

Please contact Jay Miller, 240-401-8693, if you need a ride from the metro to dinner or to the meeting at the observatory. Please try to let him know in advance by e-mail at rigel1@starpower.net.

November 8, 2008: Dr. Steven J. Dick, NASA Chief Historian

Exploration, Discovery and Culture: NASA's Role in History

ABSTRACT: The theme of "exploration and discovery" provides an important framework for understanding the meaning of the Space Age and NASA as we ponder the significance of the last 50 years. When NASA was tasked with a new "Vision for Space Exploration" in 2004, when the President's commission on the implementation of that policy produced a report entitled "A Journey to Inspire, Innovate, and Discover," and when NASA's new strategic objectives were released in a report on "The New Age of Exploration," they were drawing on a long tradition emphasizing the importance of exploration and discovery in the American experience. More than that, they were also reflecting a long tradition of exploration by our species. Thirty years ago when J. H. Parry published his classic volume *The Age of Reconnaissance: Discovery, Exploration and Settlement, 1450-1650*, he tackled his theme by discussing the conditions for discovery, then the story of the discoveries themselves, and finally the "fruits of discovery". A parallel tripartite structure allows us to examine the importance of NASA and the Space Age: If indeed space exploration is all about exploration and discovery, how does the Space Age compare to the classical Age of Discovery in the Renaissance? What are the similarities and differences? What were the conditions for the space age, the story of the journeys, and their impact? This lecture examines the meaning of NASA and the Space Age in the context of those three questions.

BIOGRAPHY: Steven J. Dick is the Chief Historian for NASA and Director of the NASA History Office. He worked as an astronomer and historian of science at the U. S. Naval Observatory in Washington, D.C. for 24 years before coming to NASA Headquarters in 2003. He is the author of numerous books, including *The Biological Universe* (1996) and *Life on Other Worlds* (1998). Among his recent books are *America in Space: NASA's First 50 Years* (with Neil Armstrong et al.), *Societal Impact of Spaceflight* (NASA SP 4801, 2007, edited with Roger Launius), *Critical Issues in the History of Spaceflight* (NASA SP-4702, 2006, edited with Roger Launius), *The Living Universe: NASA and the Development of Astrobiology* (2004, with James Strick), and *Sky and Ocean Joined: The U. S. Naval Observatory, 1830-2000* (2003).

Dr. Dick is the recipient of the Navy Meritorious Civilian Service Medal, the NASA Group Achievement Award for his role in NASA's multidisciplinary program in astrobiology, the NASA Group Achievement Award (2008) for the book *America in Space*, and the 2006 LeRoy E. Doggett Prize for Historical Astronomy of the American Astronomical Society. He has served as Chairman of the Historical Astronomy Division of the American Astronomical Society, as President of the History of Astronomy Commission of the International Astronomical Union, and as President of the Philosophical Society of Washington. He is a corresponding member of the International Academy of Astronautics.

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Observing after the Meeting

Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

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Thank you!

Review September 2008: Dr. T. Joseph Lazio, Naval Research Laboratory,

The Dark Ages Lunar Interferometer (DALI)

John Hornstein

At the September 13, 2008 meeting of the NCA, Dr. Joseph Lazio described the cosmological Dark Ages, and showed why an interferometric imaging array of radio telescopes on the far side of the Moon would be the best way of obtaining data on this crucial period of cosmological evolution. He then described the status of a novel design for such an array, and how it might be deployed and operated.

What are the cosmological Dark Ages? After the expansion of space had cooled the Universe enough for protons and electrons to remain bound as hydrogen atoms, the previously thermalized light could at last travel long distances without being scattered. That light became the Cosmic Background Radiation, whose redshifted version is the Cosmic Microwave Background that we see today. But almost another half billion years would pass before matter had clumped enough to form the first stars. The intervening epoch, devoid of points of light, constituted the cosmological Dark Ages.

Because it is "dark," i.e., unaffected by light, dark matter should have begun clumping even before the time of the formation of the Cosmic Background Radiation. After the formation of the Cosmic Background Radiation, the hydrogen gas would start collecting in the potential wells created by these dark matter clumps. Those clouds of hydrogen would then become the sites where the first stars would form. Data on the Dark Ages would allow us to quantitatively follow the history of the clumping of matter during this critical period of cosmic evolution. That, in turn, would allow us to test and correct our detailed models of the formation of large scale structure in the Universe. We would learn whether any important factors were missing from our models. We might also learn more about the properties of Dark Matter.

How might data on the Dark Ages be obtained?

The spectrum of the Cosmic Background Radiation that is now reaching us should show absorption features caused by its passage through the neutral atomic hydrogen that was abundant during the Dark Ages. Neutral hydrogen can produce emission or absorption at 1420 MHz. Because of the expansion of the Universe, we would see those absorption features redshifted to around 100 MHz by the subsequent cosmological expansion. So radio astronomy between 10 and 100 MHz (wavelengths between 3 and 30 meters) would be the best way to see them. Dr. Lazio pointed out that measurements at these frequencies would give us a 3D image of the evolution of the Universe during the Dark Ages.

Two obstacles must be overcome for radio astronomy to become feasible at such low frequencies. Surprisingly, the most serious obstacle is manmade radio noise, from cell phones, TVs, TV stations reflecting from passing airplanes, etc. Dr. Lazio showed a striking example of the spectrum of manmade radio signals at a fairly remote location in New Mexico. No place on Earth is exempt from our collective chatter. The second obstacle is the Earth's ionosphere, whose effects rapidly become stronger as the frequency of the electromagnetic astronomical signal is lowered. The Earth's ionosphere becomes completely opaque at 10MHz.

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The combination of human-generated interference and the ionospheric effects means that the best place to conduct these very difficult observations of the Dark Ages is not on the Earth's surface. Receivers orbiting the Earth would be above the ionosphere, but would still be immersed in our radio chatter. Receivers in orbit around the Sun would hear less of our chatter, and if they orbited far enough from the Sun they would not be deluged by low frequency radio emissions by the Sun. But receivers on the far side of the Moon would be best. The same side of the Moon always faces away from the Earth, so receivers on the far side of the Moon would always be shielded from our radio chatter by the Moon itself. Dr, Lazio noted that the far side of the Moon is the most radio quiet location in the inner solar system. The Moon does have an ionosphere, but it is much less significant than Earth's, and is transient.

The radio signals of interest have large wavelengths: 3 to 30 meters. To image the sky with adequate angular resolution at these wavelengths, a single dish radio telescope would have to be impracticably large. So, aperture synthesis will be needed: an array of radio antennas sparsely dispersed over the area that would have been covered by the impossibly large single dish, with their coherent signals being combined interferometrically to produce data that can be Fourier transformed to yield an image of the sky.

Aperture synthesis arrays at somewhat higher radio frequencies have already made great strides in overcoming the problems posed by manmade radio noise and ionospheric refraction. Large ground based arrays are being developed for frequencies as low as 20 MHz, motivated by the unique information they can provide on a host of important phenomena: the huge jets of relativistic electrons that are produced by accretion onto the super-massive black holes at the centers of galaxies; clusters of galaxies; the effect of the huge jets on the evolution of the clusters; the crucial cosmological Epoch of Reionization (when the first stars formed, and emitted radiation that ionized most of the hydrogen in the Universe); and also solar and planetary phenomena. Dr. Lazio reviewed these arrays: the Long Wavelength Array (LWA) in New Mexico, the Murchison Widefield Array (MWA) in Australia, the Low Frequency Array (LOFAR) in the Netherlands, the Square Kilometer Array (SKA), and many others, as well as existing arrays that operate at somewhat higher frequencies. He showed a fascinating movie of the ionospherically driven dance of the images of strong astronomical radio sources at 74 MHz, obtained at a pathfinder to the LWA.

Dr. Lazio then described innovative designs for deploying and operating a low frequency interferometric radio astronomy array on the Moon. Particularly striking is a method of embedding many radio antennas into thin sheets of plastic that can be unrolled on the Moon's surface by rovers.
The effects of lunar dust were discussed: the dust is non-conductive, and should not cause problems for this application. Receivers and beamformers, interferometric correlators, data storage and transmission, and the downlinking of commands were all discussed, as well as the capabilities of the rovers and the spacecraft that would carry all the equipment to the Moon. While more remains to be done, the development has already become impressively detailed. A scientifically valuable radio astronomy array on the far side of the Moon appears to be affordably achievable.

The NCA thanks Dr. Lazio for a fascinating and instructive presentation.

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Science News

Thank you Nancy Grace Roman for finding these articles

Flowing Toward Oblivion?

From Phil Berardelli
Science/NOW Daily News
Based on ASA/WMAP/A. Kashlinsky /et al./
26 September 2008

Researchers have discovered that 700 distant clusters of galaxies, gas, and dust are all being pulled in the same direction, apparently toward something invisible and possibly very large, confounding current cosmological models. So far, what that "something" is remains speculative, but it could turn out to be a vestige of the universe's earliest days.

Shortly after the big bang occurred some 13.7 billion years ago, cosmologists think, the universe underwent a brief period that defied current physical laws. During this time, called inflation, space itself expanded at a rate much, much faster than the speed of light. As a result, some of the matter formed with the big bang was pulled more than 13.7 billion light-years away--so far that its light hasn't reached us yet.

Now a team led by astrophysicist Alexander Kashlinsky of NASA's Goddard Space Flight Center in Greenbelt, Maryland, has unearthed what could be indirect evidence of inflation. The researchers had been surveying the motion of clusters of galaxies when they made a startling discovery: all 700 clusters whose motions the team surveyed are flowing basically in the same direction and at speeds of as much as 1000 kilometers per second--or more than 30 times faster than Earth revolves around the sun. The clusters, which appear headed toward a region of the sky where the constellation Centaurus resides, are moving faster than they should be if their acceleration were due only to dark energy.

The volume of galaxy clusters affected is much too big to be reacting to some single, massive object. Instead, the team speculates that the flow is moving the clusters toward an irregularity in the mass distribution of the universe that was already in place before inflation began. If this result holds up, then theorists will have to make some major revisions to the standard cosmological model.

Planets Turned to Dust

From Phil Berardelli
Science/NOW Daily News
25 September 2008

Astronomers have discovered the remains of a collision of two planet-sized bodies in a well-established planetary system in the Milky Way. They think this kind of event is rare, but the findings suggest that there's no such thing as a safe planetary neighborhood.

Although collisions between young planets are commonplace, other than occasional and relatively small-scale smash-ups, such as
Comet Shoemaker-Levy's 21 pieces pelting Jupiter in 1994, no nearby worlds have been destroyed for billions of years.

Not so in a system located about 300 light-years away in the constellation Aries. When, in 2004, a team of astronomers discovered a huge cloud of dust encircling a binary star system called BD+20 307, they thought it was a young star. Now measurements using NASA's orbiting Chandra X-ray Observatory and Tennessee State University's automated ground-based instrument have revealed two old stars, each about the same age as the Sun, locked in close orbit. That means the dust must have come from a collision between two planetary bodies, a collision that must have occurred recently because the dust is hanging so close to the twin stars, and there was no other reason for it to be there. Over time, dust particles will either spiral into a star or be blown away by stellar winds. Based on the mass of the dust clouds which is a million times heavier than the dust hanging in our own solar system, the crash involved "planets with at least the mass of our Moon or Mercury" and possibly even as large as Earth.

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Occultation Expedition to Jefferson, MD

Michael Chesnes

On Monday, October 6 I helped to record on video the star phi Sagitarii as it grazed along the Southern limb of the Moon. The occasion was an expedition of the International Occultation Timing Association. Our team of observers that evening included Steve Conard and Alin Tolea along with NCA members David Dunham, Wayne Warren, and Jeff Guerber.

In order to measure the profile of mountains along the limb of the Moon during a grazing occultation, it is necessary to spread out on an expedition. Since I was late to our meeting point, I only got to see David and Alin. Fortunately the kind people at Tresie's Pizza and Sub Shop helped me on my way.

Grazing occultations are an exciting, but technically demanding branch of amateur astronomy which enable ordinary people to contribute data used to study solar eclipses. I borrowed a video station from David which included a camera on a small tripod and a hand-held recorder with a monitor. I got a thrill each time I observed the star flicker in and out as it passed behind a lunar mountain. I did lose some data when I adjusted a tripod leg, but I caught most of the disappearances and reappearances of phi Sagitarii on video. I recommend participating in an occultation expedition when you get the chance.

For more information on future Mid-Atlantic occultation expeditions, visit: http://iota.jhuapl.edu/exped.htm.

Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

D following the time denotes a disappearance, while R indicates that the event is a reappearance. When a power (x; actually, zoom factor) is given in the notes, the event can probably be recorded directly with a camcorder of that power with no telescope needed. The times are for Greenbelt, MD, and will be good to within +/-1 min. for other locations in the Washington-Baltimore metropolitan areas unless the cusp angle (CA) is less than 30 deg., in which case, it might be as much as 5 minutes different for other locations across the region. Some stars in Flamsteed's catalog are in the wrong constellation, according to the official IAU constellation boundaries that were established well after Flamsteed's catalog was published. In these cases, Flamsteed's constellation is in parentheses and the actual constellation is given in the notes following a /.

Mag is the star's magnitude. % is the percent of the Moon's visible disk that is sunlit, followed by a + indicating that the Moon is waxing and - showing that it is waning. So 0 is new moon, 50+ is first quarter, 100+ or - is full moon, and 50- is last quarter. The Moon is crescent if % is less than 50 and is gibbous if it is more than 50. Cusp Angle is described more fully at the main IOTA Web site - see above. Sp. is the star's spectral type (color), O,B,blue; A,F,white; G,yellow; K,orange; M,N,S,C red. Also in the notes, information about double stars is often given. "Close double" with no other information usually means nearly equal components with a separation less than 0.2". "mg2" or "m2" means the magnitude of the secondary component, followed by its separation in arc seconds ("), and sometimes its PA from the primary. If there is a 3rd component (for a triple star), it might be indicated with "mg3" or "m3". Double is sometime abbreviated "dbl". Sometimes the Watts angle (WA) is given; it is aligned with the Moon's rotation axis and can be used to estimate where a star will reappear relative to lunar features. The selenographic latitude is WA -270. For example, WA 305 - 310 is near Mare Crisium.

Asteroidal Occultations

Date	Day	EST	Star	mag.	Asteroid	dmag	dur. S	"	Ap. Location
Nov 3	Mon	01:12	2UC45445471	11.9C	Alauda	0.3	14	10	NJ,sPA,nMD,WV
Nov 6	Thu	03:39	TYC13080324	9.3	Tuttle	7	3	3	NC,TN
Nov 12	Wed	18:43	2UC27768869	11.9	Charis	3.1	7	8	nOH,nwPA,LakON
Nov 16	Sun	04:22	SAO 96841	9.6	Klotilde	4.3	24	4	MD,DC,VA
Nov 23	Sun	01:50	SAO 99697	8.4	Ianthe	5.1	4	3	nPA,sNY,CT,MA
Nov 24	Mon	02:50	PPM 144322	10.0	Abanderada	6.5	6	5	TN,NC-low
Nov 27	Thu	17:47	SAO 186319	8.0	Sigelinde	7.2	2	2	nVA,DC,MD-low
Nov 29	Sat	03:52	2UC41886989	10.8C	Egernia	0.5	12	7	Ohio,nwPA,w&nNY
Dec 1	Mon	18:29	TYC00060493	11.3C	Sarita	0.8	4	7	seDE?,eNJ,eNY
Dec 3	Wed	02:04	TYC02500667	10.4	Alphonsina	2.7	4	4	nePA,nNJ,NYC,LI
Dec 4	Thu	19:15	TYC52420706	11.3	Ariadne	1.3	4	7	TN,VA,seMD,DE

Lunar Grazing Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Location, Notes
Nov 4	Tue	21:02	ZC 2941	8.3	38+	10	17S	Newmarket, MD; Ladysmith, VA
Nov 6	Thu	20:38	X180642	8.1	58+	32	18S	LaPlata&KentIs,MD;Thornbrg,VA
Nov 6	Thu	22:18	ZC 3196	6.3	58+	19	15S	UprMrlbro&KentIs,MD;Dumfrs,VA
Nov 12	Wed	20:16	epsilonAri	4.7	100+	44	71S	*Salisbury,MD;StonyCreek,VA
Nov 18	Tue	00:21	ZC 1276	6.5	68-	29	2S	Frederick,Gamber,Bel Air, MD
Nov 19	Wed	01:12	SAO 98587	7.8	57-	26	4S	Westminster & Rayville, MD
Nov 22	Sat	05:41	SAO 138517	9.0	25-	35	17S	Narvon,ChaddsFd,PA;SomersPt,NJ
Dec 4	Thu	18:53	SAO 145976	8.9	40+	37	18S	Hazelton, WV; Rockingham, PA
Dec 5	Fri	19:14	SAO 146456	7.5	50+	45	18S	Petrsbg,VA;PtLkout,MardelaS,MD
Dec 6	Sat	23:57	SAO 128467	8.3	62+	14	6S	Garrisnville,VA;Hughesville,MD

Total Lunar Occultations

DATE	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Nov 3	Mon	17:09	D	psi Sgr	4.9	29+	25	59N	K0	ZC2809; dbl.; Sun alt.-2
Nov 5	Wed	21:12	D	21 Cap	6.1	49+	19	77N	K3	ZC 3071; close dbl.
Nov 6	Thu	20:30	D	X180642	8.1	58+	33	29S	A5	Graze in VA & s. MD
Nov 6	Thu	20:45	R	X180642	8.1	58+	31	7S	A5	Dbl, mag2 9,sep 4",PA 81
Nov 6	Thu	22:12	D	ZC 3196	6.3	59+	20	25S	A1	Graze in VA & s. MD
Nov 6	Thu	22:23	R	ZC 3196	6.3	59+	18	6S	A1	In DC, D&R on dark side
Nov 8	Sat	00:18	D	SAO 146232	7.2	69+	11	51S	G0	Az. 252 deg.
Nov 12	Wed	20:08	D	epsilonAri	4.7	100+	42	90S	A2	term.dist.4"; mgs 5.2, 5.5
Nov 12	Wed	20:30	R	= ZC 440	4.7	100+	42	90S	A2	term.dist.2"; sep. 1.4"

Explanations & more information are at http://iota.jhuapl.edu/exped.htm.
David Dunham, dunham@starpower.net, phone 301-474-4722

Timing equipment and even telescopes can be loaned for most expeditions that we actually undertake; we are always shortest of observers who can fit these events in their schedule, so we hope that you might be able to. Information on timing occultations is at http://iota.jhuapl.edu/timng920.htm. Good luck with your observations.

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Like a Rolling Sun?

From Phil Berardelli
Science/NOW Daily News
17 September 2008

It has been suggested that life evolved on Earth partly because our entire solar system happened to coalesce within a relatively quiet corner of the Milky Way far from the lethal radiation, fast-flying supernova debris, and black holes that afflict other parts of the galaxy. Actually, the sun and all its planets may have been born in a far more dangerous corner of the galaxy and only later migrated to the suburbs.

New findings suggest that many young stars, our sun included, can migrate from one part of the galaxy to another. The clues come from the chemical composition of our sun, which differs from that of nearby stars of about the same age. Astronomers believe that as stars form in particular parts of a galaxy, they should resemble their neighbors because they all congealed from the same clouds of gas and dust. But our sun is an oddball among its nearby companions, containing a higher proportion of heavy elements, such as iron. Why the discrepancy?

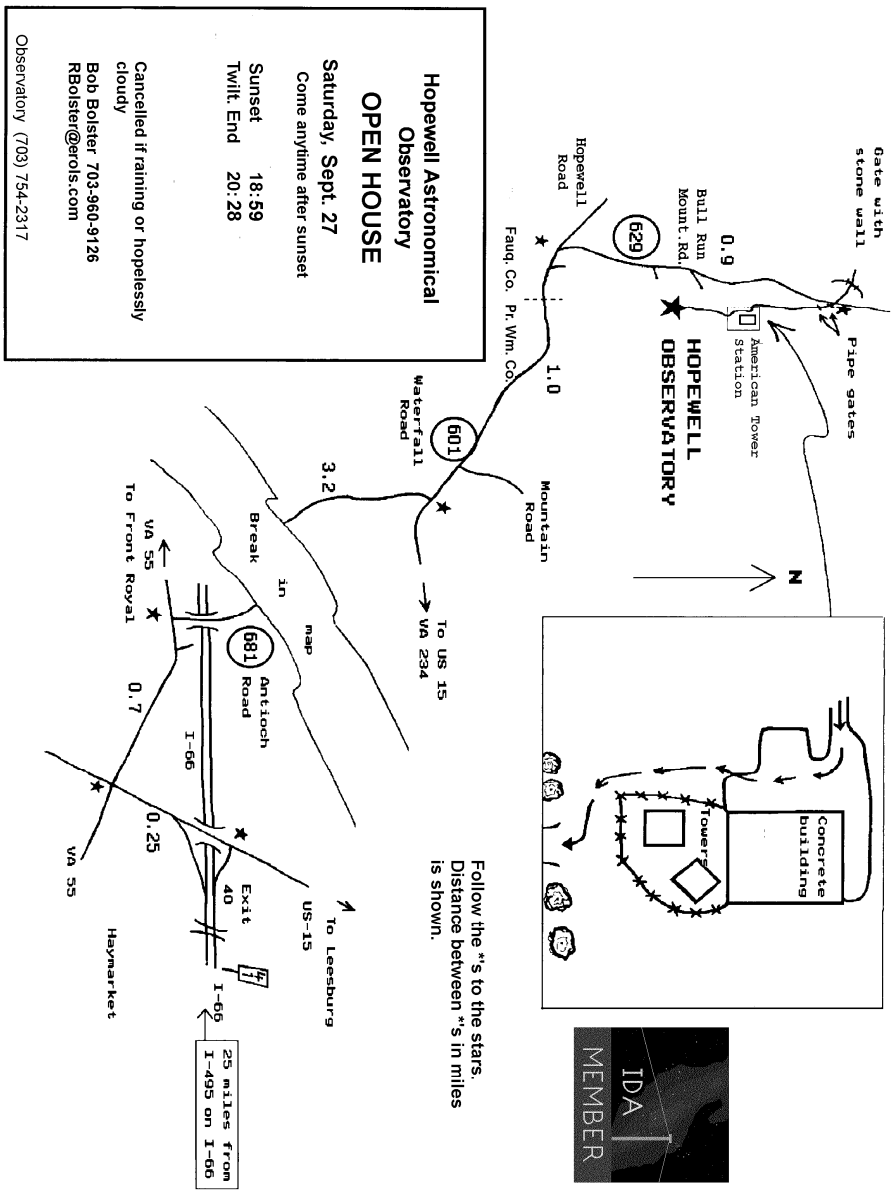
One possibility is a concept that gravitational interactions among young stars can set them spiraling either far outward or inward from the galactic region in which they formed. Researchers in the United States, the United Kingdom, and Canada have run a 100,000-hour supercomputer simulation that strongly supports this concept of radial migration. Starting with the birth of a hypothetical galaxy about 9 billion years ago the simulation showed that the orbits of as many as half of the stars in the galaxy had moved thousands of light-years away from where they started.

Hopewell Observatory Open House Nov. 1

Michael Chesnes

The Fall 2008 Open House for Hopewell Observatory is on SATURDAY EVENING, NOVEMBER 1. The Open House was originally scheduled for September 27, but had to be rescheduled because of inclement weather. Hopewell is a private observatory run by amateur astronomers near Haymarket, VA. If you are interested in attending, please contact Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg@yahoo.com for detailed directions. Visitors are requested to shield their flashlights with red plastic. Also dress warmly, since the observatory is on a hilltop.

Map of Hopewell Observatory



IDA MEMBER

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This Just In

Michael Chesnes

As we are going to press, Jay Miller reported on the NCA Yahoo! Group that an NCA member has received the Kuiper Prize from the American Astronomical Society. According to the University of Maryland's newspaper The Diamondback, astronomy professor Dr. Michael A'Hearn was awarded the prize from the AAS Division of Planetary Science for his work on comets and, as he put it, his lifetime contributions to the field. Check out next month's Star Dust for more information on this story.

Congratulations Dr. A'Hearn!

Calendar of Events

NCA Mirror- and Telescope-making Classes: Fridays, Nov. 7, 14, 21, and 28, 6:30 to 9:30 pm at the Chevy Chase Community Center, at the northeast corner of the intersection of McKinley Street and Connecticut Avenue, N.W. Contact instructor Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg@yahoo.com. In case there is snow, call (202) 282-2204 to see if the CCCC is open.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 8:00 pm (Nov-Apr) or 9:00 pm (May-Oct). There is telescope viewing afterward if the sky is clear.

Eastern Telescope Show: Saturday, Nov. 8 10:00 am to 6:00 pm at Hands on Optics, Damascus, MD.

Dinner: Saturday, Nov. 8 at 5:30 pm, preceding the meeting, at the *Garden Restaurant* in the University of Maryland University College Inn and Conference Center.

Upcoming NCA Meetings at the University of Maryland Observatory

Nov. 8, 2008
Dr. Steven Dick, NASA
NASA's 50th Birthday

Dec. 13, 2008
Dr. Kevin Marvel, AAS
2009, The International Year of Astronomy, and Amateur Astronomers and the AAS

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Total	___

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@ UM Obs

Dr. Steven Dick

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