Star Dust

National Capital Astronomers, Inc.

December 2009

Volume 68, Issue 4

http://capitalastronomers.org

Next Meeting

When: Sat. Dec. 12, 2009

Time: 7:30 pm

Where: UM Observatory

Speaker: S. Harvey Moseley, GSFC

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Directions to Dinner/Meeting

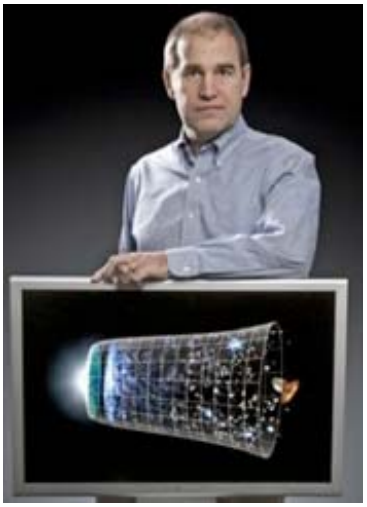
Members and guests are invited to join us for dinner at the Garden Restaurant located in the UMUC Inn & Conference Center, 3501 University Blvd E. The meeting is held at the UM Astronomy Observatory on Metzerott Rd about halfway between Adelphi Rd and University Blvd.

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.

December 2009: Dr. S. Harvey Moseley
NASA Goddard Space Flight Center
Searching for the Light from the First Stars

Abstract: In 1826, Olbers observed that the darkness of the night sky was not consistent with an infinite and static universe. The resolution of this basic observation remained unclear until the work of Hubble showed that the Universe is expanding. Another key recognition, also made in the 1920's by Lemaitre, was that the observed linear expansion implied that the Universe expanded from a condensed state at some time in the past. Thus, by the mid-20th century, Olbers' paradox was resolved, because the universe was found not to be static, and to have a finite age.



The discovery and identification of the Cosmic Microwave Background (CMB) in the 1960s further confirmed this new model of the Universe.

Following Olbers, we can use the brightness of the sky arising from a myriad of faint galaxies, measured between the resolved stars and galaxies, to study the early phase of the Universe, when the first stars and galaxies formed. Careful measurement of this background light provides significant constraints on the epoch and duration of initial star formation in the Universe. These observations are very difficult, since the measured light comes from everything between us and the young Universe. The measurements contain light from the Zodiacal light in the Solar System, light scattered and emitted from gas and dust in our Galaxy, and any light from ensembles of faint unresolved foreground stars and galaxies.

I will describe the long quest for light from the first stars, beginning with our measurements with the COBE satellite up to current work on the spatial distribution of extragalactic background light. This work, combined with the study of distant galaxies and the CMB, has helped create a history of the era of the first stars. Future space missions, like the James Webb Space Telescope and giant ground based telescopes will test our present history and provide a yet clearer picture of the young Universe when the first heavy elements were being formed.

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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Editor: Michael Chesnes

Editorial Advisors:
Elizabeth Warner
Jeffrey Norman
Wayne Warren
Harold Williams
John D. Gaffey, Jr.

PDF Distributor: Jay Miller

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Thank you!

Biography: Harvey Moseley grew up in Ebony, Va, where his father had a general store and a farm. Harvey worked many hours at both. He majored in math and physics at Connecticut College, and then went to the University of Chicago, where he received an MS and PhD, working in the then-new field of far infrared astronomy.

Dr. Moseley then came to the NASA Goddard Space Flight Center (GSFC), where he joined the team that was developing the Cosmic Background Explorer (COBE) satellite. COBE's measurements of the Cosmic Background Radiation transformed cosmology into a field that had enough data to discriminate among theories. In turn, that made cosmology an attractive, dynamic, and fully respectable scientific pursuit, leading to the dramatic advances of today. The impact of COBE was recognized by the award of the 2006 Nobel Prize in Physics to John Mather and George Smoot. Dr. Moseley was among the few team members invited to attend the award ceremonies in Stockholm. Dr. Moseley received the Gruber Prize for Cosmology in recognition of the scientific achievements of the COBE team.

Since COBE, Dr. Moseley has been working on the development of the next generation of missions to probe the early Universe. These missions include the James Webb Space Telescope (successor to the Hubble Space Telescope), the Dark Energy Mission, and future studies of Cosmic Microwave Background (CMB) radiation. He is the Principal Investigator for the JWST's microshutter array. Microshutters are tiny doorways that bring very distant stars and galaxies into better focus. They will allow scientists to look at 100 things in space at the same time, and see deeper into space in less time.

Dr. Moseley is the inventor of the X-ray microcalorimeter, a sensitive detector used in X-ray astronomy. Dr. Moseley has received many prestigious awards recognizing his important contributions to far infrared astronomy, observational cosmology, and detector and instrument development. In 2007 Dr. Moseley received the American Astronomical Society's Joseph Weber Award for his extraordinary contributions to the development of astronomical detectors.

This month's theme of the International Year of Astronomy is "Discovering New Worlds"

Discovering New Worlds

December, 2009

By Tom Koonce

Antelope Valley Astronomy Club, Inc.
Lancaster, California

My Grandfather was born exactly 100 years ago. I remember him telling me that he and his friends used to watch in amazement as early automobiles passed horse-drawn carriages. He was always interested in technology, sometimes wondering if men would ever make it to the Moon, and if they did, what creatures might live there, or even if there might be men who already lived there.

Early Automobile – Library of Congress

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2009-20010 Officers

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j.c.morrris@verizon.net
703-620-0996 (h)
703-983-5672 (w)

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Guy Brandenburg
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202-635-1860

NCA Webmaster
Dr. Harold Williams
Harold.Williams@montgomerycollege.edu
240-567-1463 (w)
301-565-3709 (h)

Meeting Facilities
Jay H. Miller
rigel1@starpower.net
240-401-8693

Star Dust Editor
Michael Chesnes
m.chesnes@verizon.net
301-317-0937

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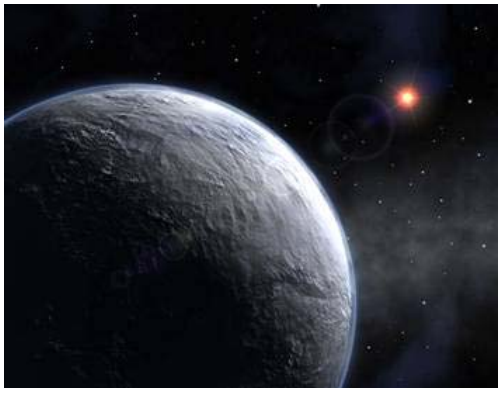
You may have heard similar stories from your grandparents or great-grandparents from that era. In just 100 years our world has experienced tremendous change. The pace of the transformation is accelerating; a "Moore's Law" for information, innovation, and discoveries unimagined even a few decades before.

It wasn't that long ago when the Universe was imagined to extend beyond our own Galaxy. The rough dimensions of the Milky Way have only been known since the 1920's from the initial work of Kapteyn and Shapely. For that matter, considering how long thinking, rational human beings have existed, the concept that the Earth revolves around the Sun and not the other way around is a relatively recent mental model for our species, only with us since Aristarchus of Samos (310 B.C. to c.a. 230 B.C.) proposed it approximately 17 centuries before Copernicus. In both of these cases, it is interesting that the general public at the time did not immediately react to the revolutionary ideas. These fundamental changes in our models of the Universe raised interest in scholarly circles, but were seen as irrelevant information to the everyday lives of the common man and woman.

Mankind is in the midst of yet another fundamental change in its perception of the Universe. Scientists and others interested in astronomy are understandably excited about the discovery of numerous worlds around other stars, but few others outside the astronomical community understand the implications of the discovery. The Universe is populated with a great multitude of planets! The variety of these bodies appears to be unbounded. Their sizes and orbits have been unexpected and will one day lead to a definitive understanding of the process by which planetary systems are formed.



Exoplanet artwork - ESO

We have gone from science fantasy regarding the existence of other planets – Flash Gordon and Star Trek – to scientific fact. The existence of extra-solar planets was confirmed in the 1990's, and now we are stunned in 2009 by the sheer number of planets being detected. Within the past 100 years, we've discovered that there are likely planets around nearly every star.

We can assume that this is representative of the rest of our Galaxy and logically, the rest of the observable Universe. The NASA planet-finding mission, the Kepler Mission, is on the verge of discovering how many Earth-like planets exist in a typical part of the sky. Isn't this exciting stuff?! We've progressed from horse-drawn carriages to discovering Earth-like words around distant stars - in only 100 years!

As we wrap up 2009, the International Year of Astronomy, amateur astronomers have gone out of their way to conduct public outreach events to get the general public involved in amateur astronomy and to get them to look through telescopes. Perhaps as we go forward into 2010, we can take it upon ourselves to share our sense of wonder and awe for the heavens, and to *make the time* to truly inspire young minds with the wondrous changing view of a Universe filled with planets… and promise for future adventure. Let's inspire the next generation to challenge our understanding of the Universe as we discover endless new worlds.

Sky and Telescope Subscriptions

By Jay Miller

As you should know, NCA members get a discount on Sky and Telescope subscriptions. The club rate is $32.95 per year. As a further incentive S&T has added a few items to sweeten the deal. You also get a 2010 SKY Starter Pack, which contains Messier and Caldwell observation guides, Let's Go Stargazing, the 2010 Stargazer's Almanac and a Mars DVD and there is an official 2010 S&T decal. They say the whole thing, including the subscription, is worth $100. You can subscribe or renew through Michael Brabanski, our treasurer, or directly with S&T via the website:

www.skyandtelescope.com/4CLB09

If you already subscribe and want to take advantage of this offer these same procedures apply. If you get a renewal notice in the mail you can send payment to the address on the notice or on line. If you have any other questions contact me.

Science News

Thank you Nancy Grace Roman for finding these articles.

NASA Rover Sees Variable Environmental History at Martian Crater

NASA News, Gay Yee Hill, Jet Propulsion Laboratory, Pasadena, Calif.
Thu, 21 May 2009

One of NASA's two Mars rovers has recorded a compelling saga of environmental changes that occurred over billions of years at a Martian crater.

The rover revealed the effects of wind and water. The data show water repeatedly came and left billions of years ago. Wind persisted much longer, heaping sand into dunes between ancient water episodes. These activities still shape the landscape today. At Victoria, steep cliffs and gentler alcoves alternate around the edge of a bowl about a half a mile in diameter. The scalloped edge and other features indicate the crater once was smaller than it is today, but wind erosion has widened it gradually.

"What drew us to Victoria Crater is the thick cross-section of rock layers exposed there," said Steve Squyres of Cornell University in Ithaca, N.Y. Squyres is the principal investigator for the science payloads on Opportunity and its twin rover Spirit. "The impact that excavated the crater millions of years ago provided a golden opportunity, and the durability of the rover enabled us to take advantage of it."

Imaging the crater's rim and interior, Opportunity inspected layers in the cliffs around the crater, including layered stacks more than 30 feet thick. Distinctive patterns indicate the rocks formed from shifting dunes that later hardened into sandstone.

Instruments on the rover's arm studied the composition and detailed texture of rocks just outside the crater and exposed layers in one alcove called Duck Bay. Rocks found beside the crater include pieces of a meteorite, which may have been part of the impacting space rock that made the crater.

Other rocks on the rim of the crater apparently were excavated from deep within it when the object hit. These rocks bear a type of iron-rich small spheres, or spherules, that the rover team nicknamed "blueberries" when Opportunity first saw them in 2004. The spherules formed from interaction with water penetrating the rocks. The spherules in rocks deeper in the crater are larger than those in overlying layers, suggesting the action of groundwater was more intense at greater depth.

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Occultation Notes

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.

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.

Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

Asteroidal Occultations

Date	Day	EDT	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Dec 11	Fri	6:45	TYC49960001	10.0	Hertzsprung	6.7	1	5	neOH,swPA,MD,DE
Dec 13	Sun	0:30	sigma Ari	5.5	Gopalan	11.3	2	1	sVA,nNC,TN
Dec 14	Mon	6:13	2UC33192743	11.7	Barbara	1.4	4	7	NC,swVA,nTN,sKY
Dec 14	Mon	21:06	2UC44805740	11.6	Uzbekistania	2.4	5	7	sNE,nNJ,sPA,nMD
Dec 15	Tue	19:06	TYC24101818	11.4	Muazzez	4.3	3	7	DE,sMD,VA,NC
Dec 24	Thu	4:58	PPM 705092	10.7	Kleopatra	1.6	26	5	WY,eUT,AZ,Baja
Dec 24	Thu	21:00	SAO 75766	8.5	Terpsichore	3.5	44	3	sID,nNV,cenCA
Dec 25	Fri	18:06	SAO 190640	9.7	Luanda	6.6	1	4	seMD,seVA,cenNC
Dec 25	Fri	22:59	TYC19520843	10.4	Murray	5.6	2	5	DE,sMD,DC,nVA
Jan 1	Fri	0:24	TYC47010160	12.5	Hrabal	4.1	10	9	wSC,wNC,VA,seMD
Jan 7	Thu	21:13	TYC17611087	9.3	Juewa	3.6	34	4	PA,neMD,nDE,sNJ
Jan 8	Fri	0:10	TYC29261736	10.5	Bamberga	0.5	23	6	sDE,sMD,sVA,nNC
Jan 9	Sat	23:42	2UC33888820	11.5	Barbara	1.5	3	7	NC,wVA,eTN;nSC?
Jan 11	Mon	1:12	TYC12951316	11.1	Ophelia	1.9	13	7	MD,DE,DC,nVA,WV

Lunar Grazing Occultations (*, Dunham plans no expedition)

Date	Day	EDT	Star	Mag.	%	alt	CA	Location
Dec 23	Wed	18:51	SAO 128207	8.9	42+	47	14S	*FrontRoyal,VA;Westminster,MD
Dec 23	Wed	19:09	SAO 128208	8.0	42+	45	13S	*Hagerstown,MD; Harrisburg,PA
Dec 28	Mon	20:08	ZC 552	2.9	90+	68	-8N	nWV; Frostburg, MD; e.Penn.
Dec 28	Mon	21:07	ZC 564	6.2	90+	75	7S	Chrltsvl&Stafrd,VA;Waldorf,MD
Dec 29	Tue	1:29	ZC 587	6.2	91+	39	5N	*York, PA; Newark, DE
Jan 4	Mon	1:41	SAO 118158	8.5	83-	51	10S	*Elkwood,Falmouth,&Keller, VA
Jan 11	Mon	6:06	ZC 2360	8.3	13-	11	11S	New Freedom, PA; Bel Air, MD

Total Lunar Occultations

DATE	Day	EDT	Ph	Star	Mag.	%	alt	CA	Sp.	Notes
Dec 19	Sat	16:25	D	pi Cap	5.1	10+	28	7N	B4	Sun+3,ZC2981,mg2 8sep4"
Dec 20	Sun	20:16	D	SAO 164315	7.2	17+	5	54S	B8	Az 248, close double
Dec 21	Mon	20:07	D	SAO 145833	7.4	25+	17	9N	K0	
Dec 21	Mon	20:19	D	ZC 3233	7.3	25+	15	63S	F0	Az 245
Dec 23	Wed	16:56	D	9 Piscium	6.3	42+	52	47N	G7	Sun -2,ZC3455,spec.bin.
Dec 27	Sun	16:09	D	mu Arietis	5.7	81+	33	51S	A0	Sun +6,ZC399,close dbl.
Dec 28	Mon	1:44	D	ZC 438	6.8	83+	24	70N	A3	close double
Dec 28	Mon	1:53	D	epsilonAri	5.2	83+	22	45S	A2	ZC 440,mg2 5.6,sep 1.5"
Dec 28	Mon	19:01	D	Merope	4.1	89+	57	37N	B6	ZC545= 23Tau inPleiades
Dec 28	Mon	19:56	D	Alcyone	2.9	90+	66	13N	B7	ZC552= eta Tau, TmD 14"
Dec 28	Mon	20:09	D	26 Tauri	6.5	90+	68	81S	F0	ZC 559, very close dbl.
Dec 28	Mon	20:24	D	Atlas	3.6	90+	70	61N	B8	ZC 560 = 27 Tauri
Dec 28	Mon	20:26	R	Alcyone	2.9	90+	71	-32N	B7	WA 334, ZC 552= eta Tau
Dec 28	Mon	20:35	D	Pleione	5.1	90+	72	42N	B7	ZC 561=28 Tau,spec.bin.
Dec 28	Mon	20:47	D	ZC 567	6.8	90+	73	64S	A0	mg2 10,3",mg3 9,10",235
Dec 28	Mon	20:59	D	ZC 564	6.2	90+	74	19S	B8	
Dec 29	Tue	1:19	D	ZC 587	6.2	91+	41	24N	K0	
Dec 29	Tue	3:55	D	36 Tauri	5.5	91+	12	61S	G0	Az 291,ZC 598,close dbl
Dec 31	Thu	2:57	D	5 Gem	5.8	100+	46	40S	K0	ZC 936,WA 152,Term.d.3"
Jan 1	Fri	4:55	R	delta Gem	3.5	100-	34	40N	F0	WA325,ZC1110=Wasat,TD3"
Jan 2	Sat	6:43	R	25 Cancri	6.1	96-	23	71S	F6	Sun -8,WA258,ZC1262,dbl
Jan 6	Wed	0:50	R	ZC 1723	7.2	63-	17	65N	A2	
Jan 8	Fri	2:36	R	ZC 1960	6.7	40-	11	90N	K3	Az 122, close double
Jan 10	Sun	7:04	R	SAO 183565	7.1	20-	24	62S	A3	Sun-5,comp.ZC2220,dbl.
Jan 10	Sun	7:05	R	ZC 2220	7.0	20-	24	62S	A3	CloseDbl;SAO183565R+20s
Jan 12	Tue	6:16	R	SAO 185305	7.5	7-	6	84S	A2	Az 131

Explanations & more information are at http://iota.jhuapl.edu/exped.htm.
David Dunham, dunham@starpower.net, phone 301-526-5590

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 into their schedules, 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.

An Appeal to Help Mt. Wilson Observatory

By Jeff Guerber

As many of you are likely aware, this summer the famed (and still very active!) Mt. Wilson Observatory in California narrowly escaped destruction in the huge Station forest fire in the San Gabriel Mountains.

The fire reached as close as 500 yards to one of the telescopes, and it was only through the concerted effort of some 150 fire fighters on the ground, plus aerial water-bombing, that the Observatory was not overrun. Observatory director Hal McAlister has an ongoing blog about the fire and its aftermath at:

http://www.mtwilson.edu/fire.php

Although the observatory was saved from major damage, they still have much cleanup work to do, and a lot of work to make the observatory less vulnerable in the future. Furthermore, one of their major sources of revenue is rental of the 60" telescope, which had to be curtailed due first to the fire itself, and then hazards along the roadways in the forest as a result of the fire.

You can assist by making a contribution; details of how to do so are at the web site mentioned above, where gifts can also be made online. The Mt. Wilson Institute, which operates the observatory for the Carnegie Institution, is a 501(c)(3) non-profit corporation, so contributions are tax deductible.

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Inside Duck Bay, the rover found that, in some ways, the lower layers differ from overlying ones. The lower layers showed less sulfur and iron, more aluminum and silicon. This composition matches patterns Opportunity found earlier at the smaller Endurance Crater, about 4 miles away from Victoria, indicating the processes that varied the environmental conditions recorded in the rocks were regional, not just local.

Opportunity's first observations showed interaction of volcanic rock with acidic water to produce sulfate salts. Dry sand rich in these salts blew into dunes. Under the influence of water, the dunes hardened to sandstone. Further alteration by water produced the iron-rich spherules, mineral changes, and angular pores left when crystals dissolved away. A rock from space blasted a hole about 2,000 feet wide and 400 feet deep. Wind erosion chewed at the edges of the hole and partially refilled it, increasing the diameter by about 25 percent and reducing the depth by about 40 percent.

A Violent Collision Near a Near-by Star

From Physics Today
October 2009
Search/Discovery

For some time, astronomers have recognized that large bodies collided in the early Solar System. The best known example is the collision of a Mars-sized body with the Earth, the debris from which formed the Moon. Carey Lisse used the spectroscopic techniques that had been developed for analyzing the Deep Impact collision to study the debris from such a collision around a nearby star, HD 172555, finding amorphous silica dust and silicon monoxide gas. The star is about 12 million years old, young enough to harbor a disk where planet formation is still going on. The mass of the debris is at least 10^{22} kg, implying an impact speed of at least 10 km/sec, similar to the speed of the impact that formed the Moon.

Short-Lived Exoplanet

From Physics Today
October 2009
Physics Update
Also from Hellier et al., Nature 460, 1098, 2009

Almost 400 extrasolar planets have been found to date but a new planet stands out. WASP-18b is 10 times the mass of Jupiter with an orbital radius of only 0.02 AU and the shortest orbital period of any hot Jupiter yet observed, 0.94 days. According to current theory, the tidal bulge that the planet raises on the star exerts a torque that will cause the planet to spiral inward. If the star's tidal dissipation rate is comparable to that which has been measured for binary stars and the gas giants in our own Solar System, WASP-18b has less than a million years to live. Over the next decade, its death spiral should produce a measurable shift in the planet's observed transit time. The absence of tidal decay – a possibility, given the rarity of finding a planet so close to the end of its life – would constitute direct evidence for a different class of tidal interactions in the host star and provide new constraints on models of stellar interiors.

Star Dust Speaker Reviews

By Michael Chesnes

I warmly encourage NCA members to write reviews for the talks at our meetings, so that they can be published in Star Dust. We have an excellent lineup of speakers every year, and our reviews are both a valuable historical record of our activities and a way to recognize our speakers.

Reminder

After the meeting, everyone is invited to join us at Plato's Diner in College Park. Plato's is at 7150 Baltimore Ave. (US Rt. 1 at Calvert Rd.), just south of the university's campus. What if it's clear and you want to stick around and observe? No problem -- just come over when you're through. This is very informal, and we fully expect people to wander in and out.

Calendar of Events

NCA Mirror- and Telescope-making Classes: Fridays, Dec. 4, 11, 18, 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.

Dinner: Saturday, Dec. 12 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

Dec. 12, 2009
S. Harvey Moseley Jr. (GSFC)
Searching for the Light from the First Stars
IYA theme of the month: Discovering New Worlds. (Featured Object: Orion Nebula)

Jan. 9, 2010
Peter Teuben (U. Md.)
The Dynamics of Barred Galaxies

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All members receive Star Dust, the monthly newsletter announcing NCA activities. The basic dues cover an electronic copy of Star Dust; paper copies are $10 extra. You may also choose to get Sky & Telescope magazine at the discounted rate of $33.

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Paper copy of Star Dust	$10
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Total	_____

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Mr. Michael L. Brabanski, NCA Treasurer; 10610 Bucknell Drive, Silver Spring, MD 20902-4254

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First Class
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Next NCA Mtg:

Dec. 12

7:30 pm

@ UM Obs

Dr. S. Harvey Moseley

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