Star Dust

National Capital Astronomers, Inc.

January 2009

Volume 67, Issue 5

http://capitalastronomers.org

Next Meeting

When: Sat. Jan. 10, 2009

Time: 7:30 pm

Where: UM Observatory

Speaker: Sean Solomon, Carnegie Institution of Washington

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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.

Jan. 2009: Dr. Sean C. Solomon

Exploring Mercury by Spacecraft: The First Two MESSENGER flybys

Department of Terrestrial Magnetism
Carnegie Institution of Washington
Washington, DC 20015, USA

Abstract: The **ME**rcury **S**urface, **S**pace **EN**vironment, **GE**ochemistry, and **R**anging (MESSENGER) spacecraft, developed under NASA's Discovery Program, is the first spacecraft to visit the planet Mercury in more than 30 years. En route to insertion into orbit about Mercury in March 2011, MESSENGER flew by the innermost planet on 14 January and 6 October 2008. Objectives of the flybys included color imaging of the surface, the first high-resolution spectral reflectance measurements (from ultraviolet to near-infrared wavelengths) of surface composition, the first spacecraft altimetric measurements of surface topography, the first measurements of the abundances and compositions of plasma ions in Mercury's magnetosphere, the deepest penetrations yet into Mercury's magnetosphere, and searches for previously undetected species in Mercury's surface-based exosphere and neutral sodium tail. MESSENGER's first flyby confirmed that Mercury's internal magnetic field is primarily dipolar, documented water-group and other ions in the magnetosphere, mapped a north-south asymmetry in the Na tail and determined the Na/Ca ratio near the tail and near the dawn terminator, and detected two outbound current-sheet boundaries that may indicate a planetary ion boundary layer. The laser altimeter demonstrated that the equatorial topographic relief of Mercury is at least 5 km. MESSENGER's images provided evidence for widespread volcanism, and candidate sites for volcanic centers were identified. Also revealed were newly imaged lobate scarps and other tectonic landforms supportive of the hypothesis that Mercury contracted globally in response to interior cooling and growth of a solid inner core. Reflectance spectra show no evidence for FeO in surface silicates, and MESSENGER's neutron spectrometer yielded an upper bound of 6% on the surface Fe abundance. The reflectance and color imaging observations support earlier inferences that Mercury's surface material consists dominantly of iron-poor, calcium-magnesium silicates with an admixture of spectrally neutral opaque minerals. The October encounter revealed another 30% of the planet never before seen at close range, improved knowledge of Mercury's low-degree gravity field and its implications for the structure of the planet's core, and featured targeted observations of the surface, exosphere, and tail.

Biography: Sean C. Solomon is Director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. Educated at Caltech (B.S., 1966) and MIT (Ph.D., 1971), he was a member of the MIT faculty for more than 20 years.

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
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Thank you!

A seismologist, marine geophysicist, and planetary scientist, Solomon has worked on a wide range of problems in earthquake seismology, geodynamics, magmatism, and the geological and geophysical evolution of the terrestrial planets. He served on science teams for the Magellan and Mars Global Surveyor missions, and he is the Principal Investigator for the MESSENGER mission to Mercury.

Solomon is a member of the National Academy of Sciences, a Fellow of the American Academy of Arts and Sciences, and a past President of the American Geophysical Union. He received the Arthur L. Day Prize from the National Academy of Sciences, the G. K. Gilbert Award from the Geological Society of America, the Harry H. Hess Medal from the American Geophysical Union, and the NASA Public Service Medal.

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

Presented by Dr. Steven J. Dick
Reviewed by Dr. Wayne H. Warren Jr.

The monthly NCA meeting of November 8, 2008 was highlighted by a lecture on the history of the National Aeronautics and Space Administration (NASA) over its first 50 years. Since 2008 is the fiftieth year of NASA's existence, this talk was very timely. NASA was created by an act of congress in 1958. Although President Eisenhower signed the legislation on July 1, NASA was officially born on October 1 of that year.

Dr. Dick began by asking why NASA has been important and where does it stand in history? His answer in one word is "exploration". The age of spaceflight exploration can be characterized well by using as an analogy the Age of Discovery that began in the renaissance and lasted through the 15th and 16th centuries, plus the age of geographical exploration that took place in the 18th and 19th centuries. The age of space exploration began, of course, with the launch in 1957 of the first artificial satellite (Sputnik) by the Soviet Union (now Russia), while there was a parallel effort to explore the oceans with missions such as that of the bathyscaphe Trieste, which dove to the deepest part of any ocean on Earth when it navigated to the bottom of the Mariana trench at a depth of 10900 meters in 1960. While the drivers for the Age of Discovery were economic gain and religious conversion, those for the Age of Space are exploration, national defense and prestige, scientific knowledge, economic competitiveness, and possible survival of our species if life on the Earth is destroyed by a natural disaster such as an asteroid or comet impact as it has been multiple times in the past.

Other factors that can be compared are the modes of transportation, which differ in that new technology and vehicles were not developed during the Age of Discovery, whereas the technology improvement of rockets and rocket motors has been a significant factor for space travel. Ports of debarkation were also compared, as were maps and other navigation tools that helped to guide the journeys and were often critical for success. The technical training of the voyagers is also in great contrast and the funding agencies differ somewhat (kings and queens versus large agencies such as NASA), although such expensive endeavors are almost always funded by governments.

The journey of the Space Age is a story of voyages farther and farther from the home planet. The first missions were to the upper reaches of Earth's atmosphere. We then progressed to orbital missions by humans and to

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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

robotic missions to bodies other than the Earth. Manned missions to the Moon followed in the late 1960s, but robotic missions to Venus and Mars had already been realized. Mercury was reached in 1974 by Mariner 10, while Venus and Mars landers were successful by the mid 1970s. Robotic missions to the outer planets followed in the late 1970s and through the 1980s until we have now visited all of the planets and made close-up observations of them. In the meantime, spacecraft have visited several asteroids and comets and the NEAR-Shoemaker spacecraft even landed on the asteroid Eros on Valentine's Day (February 12) 2001.

We have studied the Sun from several spacecraft, including SOHO and STEREO, and have gained a wealth of new information about the various solar features, solar physics, the conditions appropriate to solar-flare production, and many other useful things. We have also sent two Voyager spacecraft through the heliopause and out into interstellar space while taking measurements along the way. We are now studying planets outside the Solar System and expect that many more than the present several hundred will be discovered following the launch of the Kepler mission in 2009. So, with the exception of Pluto and the other dwarf planets beyond it, we have pretty much studied representatives of all of the bodies in the Solar System.

Dr. Dick next briefly discussed the many NASA missions that have studied objects beyond the Solar System. These include the Hubble Space Telescope (HST), the Spitzer Infrared Telescope Facility (SIRTF), the Chandra X-Ray Observatory, and many others. These missions have revolutionized our knowledge of stars, galaxies, quasars, and even black holes. Missions such as COBE and WMAP have put cosmology in a new light, contributing much to our understanding of the birth and evolution of the Universe. Just the fact that we have now pinned down the age of the Universe to 13.7 ± 0.1 billion years is mind boggling, but WMAP has actually allowed us to determine fairly accurately most of the cosmological parameters that astronomers had sought for decades.

In general, NASA has played a key role in our development of an understanding of cosmic birth and evolution by allowing us to expand our views of the Universe from only the visible, near-infrared, and radio regions of the electromagnetic spectrum to all the other regions as well. Since each spectral region gives us insight into different phenomena, observations across the entire spectrum are needed to form a big picture of all the different processes that contribute to the evolution of the Universe.

Finally, Dr. Dick discussed some aspects of the societal impact of the Space Age, including the search for extraterrestrial intelligence (SETI), the fascination of children with NASA and spaceflight, and the spin offs from the space program that have benefited society in general. Rather than trying to pin down individual spin offs, which is very difficult, Dr. Dick listed general categories in which advances can be attributed in part to the funding of NASA programs. These include: commercial and economic, satellite and environmental applications, scientific benefits, education and inspiration, national security, philosophical impact, exploration and creative society, and survival of our species, the latter in connection with possible future impacts of extraterrestrial objects on Earth.

Dr. Dick concluded that it is and always has been in our nature to explore and that exploration is needed to keep a society forward-looking and vibrant.

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Thus, NASA has been and will continue to be an important cog in the wheel of American society. This is pretty much supported by the fact that all of the advanced countries have similar programs of exploration, or at least participate in the programs of other countries.

The NCA is indebted to Dr. Dick for an interesting lecture, as indicated by the large number of questions and comments following the talk. I thank Steve Dick for reading this review.

A Conversation with Anousheh Ansari, First Female Private Space Explorer, at the Air and Space Museum

Peggy Dickie

I found out about this public interview the Air and Space Museum conducted on November 1 from "What's Up," their monthly Calendar of Events e-mailed to people on the Museum's mailing list. Lectures and other events which deal with astronomy and the space program are so fascinating to begin with, and I wanted to learn what a private astronaut who paid her own way had to say about her experiences. The interview more than exceeded my expectations.

It was the childhood dream of Anousheh Raissian Ansari, the first astronaut of Iranian descent and the fourth of six private space explorers to date, to go into space. She loved to watch sci-fi series dubbed in Farsi on TV and look at the stars. A native of Masshad, Iran, she and her parents moved to Tehran shortly after she was born. They witnessed the Ayatollah Khomeini's revolution in 1979, and when she was 16 years old they moved to northern Virginia. Knowing no English, she attended Braddock High School and spoke fluent English one year later. After high school she attended George Mason University, where she received a B.S. in electronics and computer engineering. She went on to get an M.S. in electrical engineering from George Washington University. After Ansari received her university degrees, she got a job at MCI.

She, her husband Hamid - whom she met at MCI - and her brother-in-law Amir then co-founded their own telecommunications company, Telecom Technologies, Inc. They eventually sold it and founded another telecommunications company. She said at the interview that she is now preparing to found another one. She is Chairman and CEO of her own investment firm, Prodea Systems, Inc., which eventually partnered with Space Adventures, Ltd., and the Federal Space Agency of the Russian Federation (FSA) to create a fleet of suborbital space flight vehicles for global commercial use. More about Prodea is on www.prodeasystems.com In addition she is now working online toward an M.S. in astronomy from Swinburne University of Technology, which is located in Melbourne, Australia.

She initially trained as a backup for Daisuke Enomoto for a Soyuz flight to the ISS, but Enomoto was medically disqualified on August 21, 2006. The next day, she was elevated to replace him. Like all astronauts who prepare to work with Russian cosmonauts aboard the ISS, Ansari was required to learn Russian beforehand. She then trained for six months at the Yuri Gagarin Cosmonaut Training Center in Star City, Russia, about 32 km. northeast of Moscow.

Ansari, commander Mikhail Tyurin, and Spanish-born NASA astronaut Michael Lopez-Alegria lifted off aboard the Soyuz TMA-9 from Baikonur, Kazakhstan, on September 18, 2006. She was aboard the ISS for ten days and had agreed to perform four experiments for the European Space Agency. These included

- Researching the mechanisms behind anemia;
- Researching how changes in muscles influence lower back pain and helping to develop countermeasures to assist astronauts;
- Researching the consequences of space radiation on ISS crew members and the different species of microbes which are on the ISS; and
- Studying the effects of weightlessness on the hematopoietic system.

Whenever the ISS flew over Iran, Ansari communicated in Farsi with some Iranians over ham radio. She said that there is only one ham radio in all of Iran. Their reactions are on the website www.anoushehansari.com

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One gun is aboard each Soyuz spacecraft. She said that "only the commander is allowed to use it; it is there in case they land in a remote area, because you need to hunt in order to eat."

Ansari, U.S. astronaut Jeffrey Williams, and Russian cosmonaut Pavel Vinogradov landed aboard the Soyuz TMA-8 on the steppes of Kazakhstan 87 km north of the town of Arkalyk on September 29, 2006. She said that it takes about four hours to descend from the ISS to Earth.

Ansari mentioned an organization called *Astronomers Without Borders*. She said that it is an organization which is trying to bring together people with a common interest in astronomy.

The Ansari family came up with the X Prize with the intention of giving incentives to entrepreneurs to get involved in the space program and bring down the costs of going into space. She said that government agencies and private industries need to work hand in hand. The Ansaris exclude private companies which work with government agencies under contract.

Ansari is also involved with educational outreach, including to middle schools.

A fan who is also an author persuaded her to co-author [with him] her autobiography. They are currently working on its final touches, and she hopes that the book will be released in 2009.

While I was on my way home from this interview with preceding video, I thought of how wonderful and exciting it would be if Anousheh Ansari were invited -- hopefully for next season -- to give a lecture to the NCA.

Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

Asteroidal Occultations

Date	Day	EST	Star	mag.	Asteroid	dmag	dur(s)	"	Ap. Location
Jan 04	Sun	18:49	108 Tauri	6.3	Ogiria	10.5	1	1	se VA, NC
Jan 05	Mon	19:29	TYC13451700	10.0	1993 FR2	10.0	.5	4	DE,sMD,nVA
Jan 06	Tue	01:45	SAO 80559	7.7	1989 GE	9.5	.6	2	e&cenVA,WV,sOH
Jan 07	Wed	03:07	TYC12960262	10.2	2000 HN36	8.3	.5	4	VA,MD,DE,DC,swPA
Jan 08	Thu	05:53	TYC24611821	9.7	Billings	9.7	.5	4	eVA,MD,DC?,wPA
Jan 09	Fri	06:01	SAO 82683	8.3	Bezovec	6.5	2	2	WV,s&ePA,seNY
Jan 14	Wed	20:21	SAO 75804	8.6	2000 FF20	10.8	2	3	NYC,NJ,DE,eMD,VA
Jan 15	Thu	22:52	TYC01052305	10.2	Baerbel	5.9	2	4	DE,MD,swPA,nOH
Jan 18	Sun	19:32	PPM 125192	10.4	Ando	5.5	1	5	DE,MD,DC,nVA
Jan 27	Tue	02:07	SAO 139001	9.9	Prudentia	5.7	8	4	DE,sMD,VA,wNC
Jan 27	Tue	04:05	2UC37182324	13.6	2000 CL105	9.3	7	10	TNO, Americas?
Feb 07	Sat	05:35	2UC27676531	12.6C	Panopaea	0.6	8	9	NJ,PA;MD?,nVA?
Feb 04	Wed	18:37	2UC42395270	12.7	Bredichina	1.5	9	9	sNJ,DE,MD,DC,nVA
Feb 05	Thu	19:15	TYC28920986	9.5	Mashona	2.9	10	3	cenPA,MD,DC,eVA
Feb 06	Fri	00:54	TYC19640787	9.9C	Davida	0.2	26	8	VA,s&wMD,WV,OH
Feb 06	Fri	20:06	2UC38792257	12.8	Penthesilea	1.5	5	10	DE,MD,DC,nVA,WV
Feb 12	Thu	19:55	2UC37889966	11.2	Antigone	0.9	10	7	DE,MD,sPA,OH

Lunar Grazing Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Location, Notes
Jan 03	Sat	18:46	SAO 109145	6.8	44+	53	13S	Beaver Falls, PA
Jan 04	Sun	18:41	SAO 92279	7.9	55+	62	13S	Hancock, MD
Jan 08	Thu	19:50	ZC 780	6.3	93+	58	10S	Gaithersburg, Dayton, Towson, MD
Jan 17	Sat	01:56	ZC 1858	6.3	58-	10	9S	Loganville, PA; Woodlawn, MD
Jan 28	Wed	19:15	SAO 146199	8.2	6+	7	5S	Charlottesv. &Fredericksbrg, VA
Feb 03	Tue	23:12	ZC 555	6.4	63+	36	7N	Stroudsburg, PA; Cranford, NJ

Total Lunar Occultations

DATE	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Jan 01	Thu	19:56	D	ZC 3348	8.2	25+	22	19N	K0	2nd* mg10 sep".4,PA 1dg
Jan 02	Fri	20:36	D	15 Piscium	6.5	34+	27	57N	K0	ZC 3477
Jan 03	Sat	22:49	D	45 Piscium	6.8	45+	14	44N	K0	ZC 51; maybe close dbl.
Jan 05	Mon	22:00	D	ZC 311	6.6	67+	48	36S	A3	2nd* mg9 sep".03,PA 287
Jan 07	Wed	01:47	D	ZC 470	6.8	78+	19	90N	K0	
Jan 08	Thu	02:51	D	SAO76559	7.8	88+	21	66N	B9	
Jan 08	Thu	03:34	D	chi Tauri	5.4	88+	13	74S	B9	ZC647;2nd*mg8,20",PA25d
Jan 10	Sat	07:02	D	Mebsuta	3.1	99+	10	27N	A3	eps.Gem=ZC1030; Az294dg
Jan 11	Sun	20:52	R	ZC 1276	6.5	99-	31	85N	K0	WA 276 deg.
Jan 12	Mon	23:39	R	ZC 1413	6.8	94-	47	39S	B9	WA 223 deg.
Jan 13	Tue	02:06	R	ZC 1422	6.7	93-	60	21N	G8	WA 344; term. dist. 18"
Jan 21	Wed	05:37	R	ZC 2354	7.5	20-	13	46S	A0	Az. 142; sVA,nNC graze
Jan 28	Wed	19:07	D	SAO 146199	8.8	6+	8	20S	K0	Az. 255; VA graze
Feb 01	Sun	22:16	D	SAO 92645	7.6	39+	43	35S	F0	
Feb 02	Mon	20:03	D	SAO 75537	7.8	50+	58	87S	A2	
Feb 03	Tue	21:17	D	18 Tauri	5.7	62+	57	61N	B8	ZC538;close dbl.;Pleiad
Feb 03	Tue	21:22	D	Taygeta	4.3	62+	56	31S	B6	ZC539; swVA,neNC graze
Feb 03	Tue	21:36	D	Asterope	5.8	62+	53	51S	B8	ZC542 = 21 Tauri
Feb 03	Tue	21:44	D	22 Tauri	6.4	62+	52	42S	B9	ZC543; close double
Feb 03	Tue	22:05	R	Taygeta	4.3	62+	48	-40S	B6	ZC539 = 19 Tauri
Feb 03	Tue	22:17	D	ZC 548	6.8	62+	46	32S	B9	close double
Feb 03	Tue	22:23	D	SAO 76194	7.7	62+	45	49S	A0	ZC539 = 19 Tauri
Feb 03	Tue	22:58	D	ZC 555	6.4	63+	38	37N	K5	PA and NJ graze
Feb 04	Wed	23:29	D	ZC 732	7.5	74+	45	36N	K3	PA&NJgraze;close double
Feb 07	Sat	00:30	D	ZC 1080	6.7	92+	56	62S	M1	
Feb 09	Mon	01:39	D	81 Cancri	6.5	100+	58	79S	G9	ZC 1371; close double
Feb 15	Sun	01:43	R	MW Vir	7.0	65-	18	68S	A5	ZC 2046

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.

First Planets Lived Fast and Died Young

From Science/NOW Daily News
30 October 2008
By Phil Berardelli

Surprising findings from some of the oldest known meteorites suggest that our Solar System was once chock-full of miniature planets, complete with metallic cores and rocky crusts. The findings could force a rethinking of how the Solar System and its constituent bodies evolved.

Some 4.568 billion years ago, our Sun and Solar System condensed out of a primordial cloud of dust and gas. Within about 3 million years, small, rocky objects called planetesimals were circulating in the nascent Solar System. Fragments of these planetesimals remain today as meteorites called achondrites.

A U.S.-Canadian team,tested samples of three well-preserved achondrite meteorites with an extremely sensitive magnetometer. What they discovered stunned them: The meteorites showed evidence of ancient magnetic fields similar to those of rocks formed on Earth within the planet's magnetic field. In other words, the team reported the 4.565-billion-year-old meteorites once were part of bodies that were either big enough or hot enough to produce central, molten, metallic cores.

The magnetic fields that the team recorded were probably generated by molten metal swirling around inside the planet's core like a giant, rotating dynamo, as happens on Earth.

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Science News

Thank you Nancy Grace Roman for finding the articles on this page.

Most Planets May Be Seeded With Life

From Science/NOW Daily News
26 November 2008
By Phil Berardelli

Astronomers have detected a building block of RNA floating within the hot, compact core of a massive star-forming region in the Milky Way. The molecule appears to have formed with all of the other stuff that makes up planets, suggesting that many other worlds are seeded with some of life's ingredients right from birth.

Using the IRAM radio dish array in France, a team of European astronomers has detected glycolaldehyde--a simple sugar that makes up ribose, one of the constituents of RNA--within the core of what appears to be a coalescing disk of dust and gas in a star-forming region. The sugar molecule can apparently form in a simple reaction between carbon monoxide molecules and dust grains.

The abundance of glycolaldehyde in the cloud suggests that the molecule is "common throughout star-forming regions," says astrophysicist and co-author Serena Viti of University College London. The implication is that wherever there is starmaking and planet formation going on, organic building blocks could be assembling as well.

How large is a supermassive black hole?

Based on Search and Discovery
Physics Today, November 2008
By Bertram Schwarzschild

A team of astronomers using telescopes in Arizona, California, and Hawaii for very long base-line interferometry has measured the angular diameter of the black hole in the center of the Milky Way. Of course, the black hole is invisible but they observed the silhouette of the hole on the more distant radiation. The telescopes operated at 1.3 mm. This short wavelength not only had the advantage of providing higher resolution but it also reduced the scattering by the dense plasma surrounding the galactic center. Although atmospheric turbulence reduced useful observations to less than ten minutes each divided into 8-second segments, they were able to combine spans. The combination of the few successful interferometry fringes led to a diameter of 43 microarcseconds which, when corrected for scattering by the intervening plasma gives about 37 microarcseconds or about 135 miles, for the diameter of the black hole, less than was expected for a source symmetrically centered. However, both the shape of the source and the alignment can influence the result.

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Although most asteroids now are rocky through and through, the new findings suggest that back at the beginning of the Solar System even planetesimals could melt at their cores and retain a rocky crust.

These bodies could be as small as 160 kilometers in diameter, the research suggests. The planetesimals, which eventually merged to form the rocky planets, were more planet-like than previously thought, with cores that must have formed and melted within just a few million years of the formation of the Solar System.

Calendar of Events

NCA Mirror- and Telescope-making Classes: Fridays, Jan. 2, 9, 16, 23, and 30, 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, Jan. 10 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:

Jan. 10, 2008
Dr. Sean Solomon, Carnegie Institution of Washington
Exploring Mercury by Spacecraft: The First Two MESSENGER flybys

Feb. 7, 2009
Dr. Jennifer Wiseman, NASA Goddard Space Flight Center
Star and Planet Formation with Herschel and ALMA

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Total	_____

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Next NCA Mtg:

Jan. 10

7:30 pm

@ UM Obs

Dr. Sean Solomon

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