Star Dust

National Capital Astronomers, Inc.

June 2009

Volume 67, Issue 10

http://capitalastronomers.org

Next Meeting

When: Sat. June 13, 2009

Time: 7:30 pm

Where: UM Observatory

Speaker: John Mather, NASA Goddard

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Directions to Dinner/Meeting

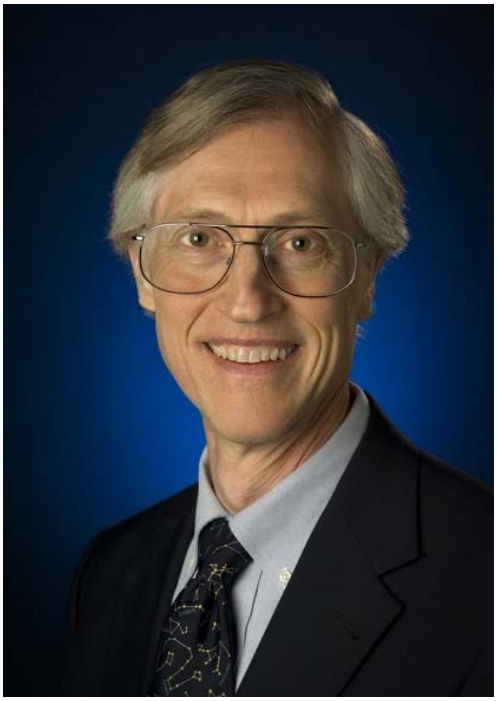
Members and guests are invited to join us for dinner at the Garden Restaurant located in the UMUC Inn & Conference Center, 3501 University Blvd E. The meeting is held at the UM Astronomy Observatory on Metzerott Rd about halfway between Adelphi Rd and University Blvd.

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.

June 2009: Dr. John Mather
NASA Goddard Space Flight Center

Update on JWST and Its Ability to See Exoplanets



Abstract: The James Webb Space Telescope is on track for a launch in 2014. I will review the status and progress on the key hardware. The first primary mirror segments are already at MSFC for cryogenic tests, the mid IR instrument (MIRI) has already had successful tests of the engineering model, and the detectors are showing excellent performance. I will describe the scientific objectives of the mission, with emphasis on the predicted capabilities for observing planets by the transit technique and through direct imaging. Recent direct observations of planets by HST and by adaptive optics from the ground have shown that, under favorable circumstances, much can be learned.

Biography: Dr. John C. Mather is a Senior Astrophysicist in the Observational Cosmology Laboratory at NASA's Goddard Space Flight Center. His research centers on infrared astronomy and cosmology. As an NRC postdoctoral fellow at the Goddard Institute for Space Studies (New York City), he led the proposal efforts for the Cosmic Background Explorer (74-76), and came to GSFC to be the Study Scientist (76-88), Project Scientist (88-98), and the Principal Investigator for the Far IR Absolute Spectrophotometer (FIRAS) on COBE. He and his team showed that the cosmic microwave background radiation has a blackbody spectrum within 50 parts per million, confirming the Big Bang theory to extraordinary accuracy. As Senior Project Scientist (95-present) for the James Webb Space Telescope, he leads the science team, and represents scientific interests within the project management. He is the recipient of many awards, including the Nobel Prize in Physics (2006) with George Smoot, for the COBE work.

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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!

Middle School Students Make Their Own Refractors at the Carnegie Institution of Washington

By Guy Brandenburg, NCA member and co-leader of the NCA Telescope-Making Workshop

What better way to honor the 400th anniversary of the invention of the astronomical telescope than to have about 20 middle-school students make and use their very own telescopes? Recently, the participants in the First Light Saturday Science Academy at the Carnegie Institution of Washington at 16th and P Streets NW, got to do just that.

We adult instructors (Julie, Toby, Maxine and I) first had to decide on what sort of telescope to have the students make. About 2 years earlier, the student participants, with considerable adult assistance, had already made five Newtonian reflectors on Dobsonian alt-az mounts using 4 to 6 inch mirrors that had been figured by me or by others. It was a fun project, and the students got a lot of experience in woodworking and using power and hand tools, but in retrospect, the scopes are a bit too large and complicated for 6th to 8th grade students to handle by themselves. Even Dobsonian reflectors need constant adult supervision, not to mention a car to carry the telescope to a good location. What we were looking for this time was something that ten- to thirteen-year-old students could fabricate and handle all by themselves. Also, it needed to be inexpensive, rugged, and of decent quality. Did I mention inexpensive?

What we finally decided to do was to send me on a 3-hour drive over Easter weekend to Surplus Shed in the tiny town of Fleetwood, PA (about a dozen miles northeast of Reading) to look for inexpensive, but decent-quality, achromatic doublets and eyepieces. My plan was to install the lenses into tubes made of various pieces of plastic PVC pipe. With the help of the staff at Surplus Shed, I purchased two dozen cemented doublet lenses with a diameter of 52 millimeters and a focal length of 220 mm, which is pretty 'fast' for achromats. To go with the objective lenses, I also purchased enough 20 mm and 12 mm 0.965" eyepieces so that each student would get one of each. The eyepieces only cost $3.75 each. So far, the total price of the optics, for each scope, was $13.50. The normal retail price for these things, if purchased new from a standard optical store, would probably be an order of magnitude greater.

For the sake of historical authenticity, I also decided to get about four singlet convex objective lenses of the type that Galileo used, along with smaller concave lenses to use as eyepieces. The lenses cost four dollars each, or $8 per scope.

If you've never been to Surplus Shed, and you like to make astronomical stuff, then you definitely need to go for a visit some Friday! It's a former school building that is stocked from basement to attic with all sorts of lenses, eyepieces, micrometers, tubes, pieces of telescopes, electronic odds and ends, and other surplus stuff that they have picked up from a variety of sources. To be frank, the place is a bit on the cluttered side, and you can't even go in the front door. But the staff there was very friendly, and they gave me a lot of assistance, suggestions and encouragement on choosing lenses that would fit into various types of PVC pipe and would not be hard for the students to use. Once I had decided on the type of objective lens we would use, I had to take about half an hour to pick out the two dozen lenses that I thought were in the best shape.

When I got back home, I still had to figure out how to get from a nominal 2 inch inner diameter PVC tube, which would hold the objective lens securely, to a 1 inch inner diameter PVC tube, in such a way that the components would be held steady, but students could slide something in and out to focus on near or distant objects.

I took my problem to my local Brookland Servicestar Hardware store, and one of the veteran salespeople immediately solved it. I needed a PVC 2 inch to 1.5 inch reducer, followed by a PVC 1.5 inch to 1.25 inch junction, followed by a piece of 1.25 inch PVC pipe. Inside that, we would slide a piece of 1 inch PVC pipe which had an outside diameter that was almost, but not quite, 1.25 inches. A few layers of masking tape would build up the outer diameter of the last 1-inch PVC pipe so that it would fit snugly inside the 1.25 inch pipe and allow the student to slide it back and forth for the purpose of focusing. The 0.965 inch outer diameter eyepieces would also need a few layers of

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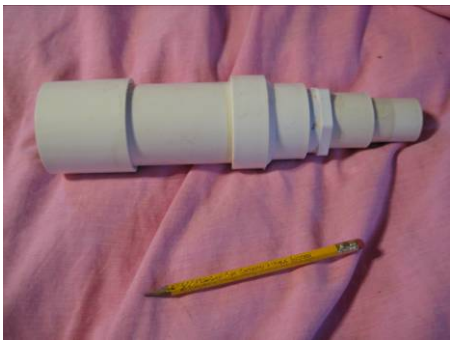
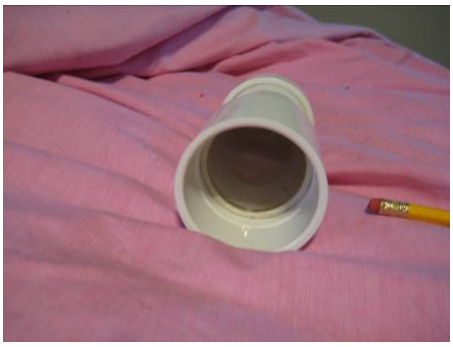
masking tape so that they would fit into the 1 inch tubing. Finally, to protect and shade the achromatic objective, a 2 inch to 2 inch PVC junction collar would be put on the front of the telescope.

Here are a couple of photographs of one of the telescopes (mine). The entire telescope, including eyepieces and sunshield, is about 12 inches (30 cm) long. The students' telescopes are much better-looking than mine, since they used fast-drying plastic spray paint, indelible markers, and colored tape to make them beautiful. They also painted the inside of the tube black to reduce internal reflections. Not having remembered to ask their parents' permission to include, in Stardust, photos of them hard at work, I am unfortunately not submitting any such photos.



Side view



Front end view

These telescopes have relatively short focal ratios (about f/4.2) and relatively wide fields of view. With the 12 mm eyepieces, they magnify things by about 18 times, and with the 20 mm eyepieces, it's about 11 times.

The students had a great time putting the telescopes together. Following directions, and under adult supervision, they measured and sawed appropriate lengths of 1.5 inch and 1 inch PVC tubing, wrapped masking tape around the latter, fitted all of the parts together, and then used PVC pipe cement to glue the appropriate parts together. I had previously used a metal lathe to square off the sections of 2 inch PVC pipe and to make a small "lip" inside the front end, for the objective lens. (The lathe resides at the Chevy Chase Community Center's woodshop, where Bill Blackmore and I conduct a telescope-making workshop every Friday evening.)

Unfortunately, we discovered that there was quite a bit of variation in the interior diameter of the supposedly 2 inch PVC pipe, so in some cases we had to use some more masking tape, and other methods, to make sure the lenses stayed in place. The PVC fittings were about $1.50 each at various local DC hardware stores, and we needed three of them per scope plus a few inches of PVC piping, so that added something between $5 and $6 to the price of each telescope, for a grand total of about $13 or $14 each.

At a subsequent Saturday session, the students took bars of aluminum that were about 50 mm by 10 mm by 3 mm, drilled holes in the center of the bars, and then tapped the holes with ¼-20 tap and die bits so that they will fit on most standard tripods.

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ALCON EXPO 2009

Date: **Sunday August 2nd through Saturday August 8th, 2009**

Place: **Hofstra University on Long Island, New York**

Sponsored by: **Amateur Observers' Society of NY, Inc.**

For more details visit: www.alcon2009.org

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They then put on, and tightened, a couple of hose clamps to fasten the aluminum bars to the longest section of their telescopes. Again, the hose clamps cost about $1.50 each, so the total now per scope is about $16 or $19 for what is, in essence, a very decent f/4.2 spotting scope with a nice wide, color-corrected field of view.

As a final present to mark the end of the year's session, the Carnegie Institution also gave each student a small, but serviceable, commercial tripod from Best Buy, so that the students could mount their telescopes on them, using the little mounting screw hole they had made, and so that they can easily keep a single object in view. (The tripods, which cost about $16 each, nearly doubled the price of the scopes!)

As is apparently normal when one does this sort of thing, every single Saturday since we began the project, the weather has been either rainy or cloudy – even when First Light took an overnight camping trip to the Eastern Shore of Maryland on April 24-25, specifically so that they could try out their telescopes! However, on that night, they did get to see the rings of Saturn through one of the telescopes that previous classes had made. This required dodging various holes in the cloud cover. A number of the children said that seeing Saturn was the most awesome thing that they had ever done.

You may recall that Galileo's telescopes were much simpler in design than today's telescopes. (And I'm not referring to the PVC!) For one thing, the achromatic doublet, which bends the rays of light so that at least some of the colors seen by the eye aren't all spread out, hadn't been invented yet, so all of his images had annoying rainbows around the stars and planets. Plus, the glass that he used was of extremely poor quality by the standards of today, being filled with bubbles and striae, or places where the index of refraction of the glass changes right inside the lens. And, finally, instead of using convex lenses for his eyepieces, he instead used a bi-concave lens, which is supposed to provide an upright image, but gives an extremely narrow field of view. Inspired by a recent article in Sky and Telescope, we wanted to see this for ourselves. Here, we just used two pieces of PVC tubing, one sliding inside the other. To hold the lenses in place, I simply cut very short cylinders of PVC tube, about 5 mm long, in the shape of a ring. Then I cut away roughly 1/3 of the ring. Using considerable force, I was then able to bend the ring into a smaller shape that would fit inside the tube. Two of these rings, one in front of the lens, and one in back of the lens, held it quite firmly.

Did Galileo have a narrow field of view? Oh, yes he did. I found the experience much like looking through a pea-shooter. One does indeed see things right-side up, but I began to understand why some of Galileo's contemporaries, when asked to look at celestial objects through his telescope, might perhaps have been telling the truth when they said that they couldn't see anything.

The First Light Saturday program is a part of the Carnegie Academy for Science Education, or CASE, which was founded by Dr. Maxine Singer about 20 years ago, when she was head of the Carnegie Institution of Washington (CIW). The URL for First Light is http://www.ciw.edu/first_light_case/. CIW funds basic research in all sorts of areas of science, including some of the largest observatories in the world. A number of CIW astrophysicists have spoken to NCA on a wide variety of astronomical topics. The CASE co-directors are Dr. Julie Edmonds and Dr. Toby Horn. I am an instructor in the program, which is open to any student in grades 6 through 8 who attends any school in the District of Columbia and who is interested in science in a hands-on way. It runs for 18 Saturdays during the school year, and also happens to be absolutely free! (So if you know any young person who is eligible, you might want to suggest that they apply for next fall.)

Spacecraft Radio Astronomy of the Solar System: Detecting the Sources of Particle Acceleration

Dr. Robert J. MacDowall
Laboratory for Planetary Magnetospheres, Solar System Exploration Division
NASA/Goddard Space Flight Center

March 14, 2009 NCA Lecture reviewed by Jack Gaffey

In the solar corona and the in the interplanetary medium there are processes, such as shock acceleration and magnetic reconnection, that produce unstable electron distributions. These perturbed electrons excite radio waves that can be detected remotely. Except for the inner solar corona, the emission frequencies are sufficiently low (less than 10 MHz) so that the waves cannot penetrate the Earth's ionosphere and can only be detected by spacecraft. These observations provide the best opportunity to observe these particle accelerations processes up close and are important for understanding the solar wind and space weather, which can disrupt communications and electric power distribution grids.

There are four kinds of solar activity that produce radio waves: sunspots, flares, coronal mass ejections, and prominences/filaments. Coronal mass ejection shocks and blast wave shocks produce type II radio bursts; whereas energetic electrons and solar flares produce type III radio bursts. Sunspots and prominences/filaments are much less effective in producing radio emissions.

These radio waves are detected by simple monopole antennas (like the telescoping antennas on automobiles) and by dipole antennas (like television rabbit-ears) on spacecraft. The Unified Radio and Plasma wave instrument (URAP) on the Ulysses spacecraft has two long wire dipoles that are seventy meters tip to tip, and a ten meter axial monopole antenna. The Waves instrument on the Wind spacecraft has two long wire dipole booms that are one hundred meters tip to tip, and two wire axial booms. The Waves instrument on each of the two STEREO spacecraft has three orthogonal monopole antennas, each of which is six meters in length.

The STEREO mission has two identical spacecraft that orbit the Sun in orbits similar to that of the Earth. The Ahead spacecraft leads the Earth and the Behind spacecraft lags the Earth. Each of the STEREO spacecraft has four instruments.

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Summer Occultations

The occultations that will be of most interest to observers in the eastern USA during the next three months will be two lunar occultations of the red giant star Antares (alpha Scorpii) and the best passage of the Moon through the Pleiades star cluster shortly before sunrise on Friday morning, August 14th. The times and circumstances for these events for the Wasington, DC region are given in the total occultation list (except the June 6th Antares event, which was given in last month's Stardust).

The Antares Occultations

Lunar occultations of Antares occur primarily in the Southern Hemisphere during their 4-year-long series, which occur every 18 years, like eclipse Saros cycles. Near the end of the current series, we have just two occutations that will be visible from the Mid-Alantic region, an occultation by the nearly full Moon late Saturday evening, June 6, and a daytime event with a first quarter Moon a little more than an hour before sunset late Thursday afternoon, August 27th. Those who might want to observe more than just a single disappearance and reappearance of the star can join one of my planned expeditions to Massachusetts, which is crossed by the northern limits of both of these occultations.

Near the northern limit, the star will disappear and reappear several times among the mountains and craters near the northern pole of the Moon; for the first time, we'll have a predicted profile based on laser ranging data from the Japanese Kaguya lunar orbiting spacecraft, which will be much more accurate than the profiles predicted from Watts' 1963 data that we've used previously.

Most of these events will appear gradual, due to the 0.03" angular size of Antares; even with a small telescope, you'll be able to directly observe the effects of the red giant star's size. Information about these grazes is in the grazing occultation list.

For the August 27th graze, the path also passes over southern Vermont, s.w. New Hampshire, and part of Ontario, passing near Ottawa. We plan to observe it either from a semi-rural area northwest of Boston, or from Cape Cod.

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Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

Asteroidal Occultations

Date	Day	EDT	Star	mag.	Asteroid	dmag	dur. s	Ap. "	Location
Jul 2	Thu	5:19	SAO 165262	9.1	Xanthe	4.3	10	4	MD,DC,eVA-Sun-4
Jul 11	Sat	21:54	SAO 126670	9.6	Bolyai	6.7	2	4	DE,MD;DC,nVA?
Jul 18	Sat	3:46	SAO 92572	8.7	Yerkes	7.0	1	3	NC,eVA,eMD,sNJ
Aug 2	Sun	5:21	TYC06290522	10.2	Genua	3.2	5	5	nOH,nPA,Sun -9
Aug 19	Wed	0:40	2UC26025505	13.1	Crantor	8.1	11	9	Americas?Centaur
Aug 19	Wed	21:46	33 Librae	6.8	Vanadis	8.1	7	2	s.LA,cen.FL
Aug 20	Thu	0:53	TYC46660902	10.2	Berolina	2.4	20	5	sN.Car.,nTenn.
Sep 9	Wed	1:48	SAO 128871	9.2	Hamburga	4.4	8	4	sNJ,DE,eMD,DC,VA
Sep 13	Sun	1:50	2UC34227523	11.7	Elfriede	2.4	10	7	w&nNC,seVA

Lunar Grazing Occultations (*, Dunham plans no expedition)

Date	Day	EDT	Star	Mag	% alt	CA	Location
Jun 24	Wed	21:47	SAO 97833	7.9	7+ 7	8N	Bethesda,CollegePk,&sBowie,MD
Aug 14	Fri	5:25	Taygeta	4.3	43- 62	8N	Concrd,NC;Carson&NewChurch,VA
Aug 14	Fri	5:48	Asterope	5.8	43- 67	8N	*Beulaville & Nags Head, NC
Aug 14	Fri	5:54	22 Tauri	6.4	43- 67	8N	*Richmond, VA & Salisbury, MD
Aug 14	Fri	5:38	Merope	4.1	43- 63	-8S	*Greenbank,WV &WagnersXrds,MD
Aug 14	Fri	5:39	SAO 76149	8.9	43- 64	8N	*FtRoyalVA,MarstonMD,NarvonPA
Aug 14	Fri	6:13	Alcyone	2.9	43- 72	-7S	*Clinton,Kinston,KilDvlHls,NC
Aug 16	Sun	3:59	SAO 77584	8.9	22- 24	6N	Doswell, VA; Hollywood, MD
Aug 25	Tue	21:08	SAO 182852	7.6	35+ 11	7S	FrtRoyal,VA;Barnesv.&Alpha,MD
Aug 27	Thu	18:02	Antares	1.1	54+ 21	2N	Potsdam,NY; Boston&CapeCod,MA

Total Lunar Occultations

DATE	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Jun 14	Sun	5:46	R	ZC 3294	6.9	65- 44		44S	F0	occurs at sunrise
Jun 16	Tue	2:26	R	22 Piscium	5.6	46- 15		53S	K4	Az. 98, ZC 3512
Jun 20	Sat	4:57	R	66 Arietis	6.2	8- 17		30S	K0	Sun -8,ZC 501,closeDbl?
Jun 20	Sat	14:00	D	Alcyone	2.9	7- 49	-35S	B7		Sun+71,ZC 552 = eta Tau
Jun 20	Sat	14:40	R	Alcyone	2.9	6- 41		35S	B7	Sun+65,ZC 552
Jun 27	Sat	23:33	D	69 Leonis	5.4	35+ 4		34N	A0	Az. 266, ZC 1623
Jul 9	Thu	4:22	R	Loo Sieu	5.2	97- 28		70N	M1	WA288,ZC3017=upsilonCap
Jul 13	Mon	0:46	R	15 Piscium	6.5	72- 18		63N	K0	ZC3477
Jul 14	Tue	4:00	R	45 Piscium	6.8	61- 48		45N	K0	ZC 51, close double?
Jul 15	Wed	2:26	R	ZC 177	6.9	51- 27		30S	F5	
Jul 17	Fri	2:42	R	ZC 438	6.8	30- 16		53N	A3	close double
Jul 17	Fri	2:44	R	epsilonAri	4.7	30- 17		61S	A2	ZC 440, close double
Jul 30	Thu	22:07	D	pi Scorpii	2.9	71+ 21		41S	B1	ZC 2287
Jul 30	Thu	23:01	R	pi Scorpii	2.9	71+ 16	-34S	B1		WA 211, ZC 2287
Aug 1	Sat	23:03	D	ZC 2558	6.3	87+ 23		64N	B3	
Aug 14	Fri	1:17	R	9 Tauri	6.7	45- 15		19S	A2	Az. 72,ZC 521
Aug 14	Fri	5:38	R	Celaeno	5.5	43- 64		62N	B7	Sun -8,ZC 536,double?
Aug 14	Fri	5:38	R	Electra	3.7	43- 64		79S	B6	Sun -8,ZC 537=17 Tauri
Aug 14	Fri	5:58	D	Alcyone	2.9	43- 67	-42S	B7		Sun -5,WA 139,ZC 552
Aug 14	Fri	6:14	R	Maia=20Tau	3.9	43- 70		63N	B8	Sun -2, ZC 541
Aug 14	Fri	6:46	R	Alcyone	2.9	43- 73		30S	B7	Sun +4,ZC 552=eta Tau,
Aug 15	Sat	2:01	R	ZC 703	6.2	33- 13		27S	A5	Az. 68
Aug 16	Sun	3:50	R	ZC 877	6.5	22- 22		40S	K1	
Aug 17	Mon	4:46	R	ZC 1052	6.8	13- 20		40N	F8	
Aug 27	Thu	17:23	D	Antares =	1.1	54+ 20		41N	M1	Sun +27 deg., ZC 2366
Aug 27	Thu	18:15	R	alpha Sco	1.1	55+ 23	-31N	M1		Sun +16,WA 327,ZC 2366
Aug 30	Sun	21:36	D	ZC 2811	6.3	82+ 27		73N	F8	
Sep 3	Thu	3:19	D	lambda Cap	5.6	98+ 22		60N	A1	ZC 3188
Sep 5	Sat	20:48	R	22 Piscium	5.6	98- 12		65S	K4	Az. 95, WA 232, ZC 3512
Sep 9	Wed	4:23	R	26 Arietis	6.1	78- 71		74N	A9	ZC 370

Explanations & more information are at http://iota.jhuapl.edu/exped.htm.
David Dunham, dunham@starpower.net, phone 301-220-0415

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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We may hold a regional meeting of the International Occultation Timing Association (IOTA) in Cambridge, Mass. following this graze, on Friday Aug. 28 and Sat. morning, Aug. 29; let me know if you might be interested in attending such a meeting in order to see if there is enough interest to justify setting it up. The main (annual) meeting of IOTA will be held on Nov. 21 and 22 in the Orlando, Florida area.

Pleiades Occultations

The Pleiades provides the best sequence of occultations of bright stars by the Moon; it's quite striking to see the crescent Moon surrounded by the stars of this relatively dense cluster. We have two passages of the Moon across the Pleiades, the first being early Saturday afternoon, June 20th. This daytime event with the 7% waning crescent Moon only 30 deg. from the Sun will be very difficult to observe, even the brightest star in the cluster, 3rd-mag. Alcyone (eta Tauri). The occultation on Friday morning, August 14th, occurring in a twilit sky before sunrise, will be much more spectacular; like the Antares events, you should mark your calendar for the morning of Aug. 14. You can observe the total occultations from any convenient location, but the most interesting view will be from the northern limits of the occultations of the brighter stars, from which you can observe a spectacular graze (the northern limit events will occur on the dark side of the Moon and therefore will be much easier to observe than the southern-limit sunlit side events).

The best, on which we plan to concentrate our effort, will be for the graze of 4th-mag. Taygeta (19 Tauri), which was discovered to be a close binary star during a similar graze near Kansas City in August 1969. I plan to lead an expedition to observe the graze either near New Church, VA (near US 13 just s. of the Maryland border near Chincoteague) or near Carson, VA, near I-95 s. of Petersburg (which location will be decided by the weather forecast a day or two beforehand). Let me know if you might be able to join and we'll car pool to the sites. The Sun alt. will be -10 deg. on the Delmarva Peninsula, plenty dark enough for this bright star. The path also passes over the southern part of Assateague Is., near the end of Bayberry Drive. I can provide details to anyone who might find that other events might fit their schedule better than the Taygeta graze.

Science News

Thank you Nancy Grace Roman for finding this article.

Beware the Planet Eaters!

By Phil Berardelli
*Science*NOW Daily News
1 May 2009

Like Icarus, some planets have wandered too close to their parent stars and perished. That's the conclusion of a new simulation, which helps explain why older stars tend to have few planets orbiting close to them.
In nearly 2 decades of planet-hunting, astronomers have discovered 347 worlds circling other stars. Two trends have caught their attention. First, older stars tend not to have planets in very close orbits. And second, younger stars often have planets--including the massive so-called hot Jupiters--orbiting much closer than Mercury does to the Sun. In fact, last week, astronomers found a rocky planet not much bigger than Earth whose orbit around its relatively young star is only 3% of the distance from Earth to the Sun (ScienceNOW, 21 April).

A team of astronomers has proposed a possible solution for these patterns: Stars tend to swallow up planets that wander too close. The idea is relatively simple. Two bodies that pass near each other in space disturb each other's shape. But a star will exert a bigger effect on the smaller planet than the planet does on the star, and the change will cause the planet's orbit to deteriorate--even if that orbit is stable--until it eventually plunges into the star.

Review continued from Page 4

IMPACT measures three dimensional particle distributions and the magnetic field. PLASTIC measures protons, alpha particles, heavy ions and ion composition. SECCHI tracks coronal mass ejections from the Sun to the Earth. WAVES tracks radio bursts and measures electric fields. Comparing the phase information from Wind and Ulysses permits triangulation to locate the position of the source. The sources are found to be on the interplanetary magnetic field lines, which form an Archimedean spiral.

Type II and III radio bursts start out at higher frequencies in the denser plasma closer to the Sun and fall to lower frequencies as the disturbance propagates outward because the frequency is proportional to the square root of the density. Current type III radio burst research is examining the connection among solar energetic particles, the radio waves emitted, and space weather.

Planets, including Earth, are also sources of radio waves. During the twenty-four hours that Ulysses made its closest approach to Jupiter, eight sources of radio waves were found. The Jovian quasi-periodic radio bursts have a forty minute period and are excited by relativistic keV electrons. No correlation with the Jovian moon Io was found.

There are several proposed radio astronomy missions. The proposed Solar Imaging Radio Array consists of sixteen microsatellites, each having four monopole antennas, which are five meters long. The proposed Radio Observatory for Lunar Sortie Science (ROLSS) is a low risk, low mass precursor to a larger array of radio telescopes on the far side of the Moon, which is called the Dark Ages Lunar Interferometer (DALI). Joe Lazio spoke to us about DALI last September.

There remain things that we do not really understand about the Sun: Does electron acceleration in the solar corona occur at parallel or perpendicular shock-magnetic field geometry? Are complex type III burst electrons accelerated at coronal mass injection shocks or at magnetic reconnection sites behind the coronal mass injection?
In summary, the major points are: Throughout the universe, accelerated electrons produce radio emissions, the source for most of radio astronomy. Frequencies below the ionospheric cutoff (about 10 MHz) must be observed from space. Numerous satellites with simple antennas have studied radio emissions from the Sun, the Earth and the major planets. At present, imaging near and below 10 MHz is not possible due to the long wavelengths (30 m) of the emission. Radio astronomers plan to construct radio images in the future using antenna arrays on microsatellites or on the surface of the Moon.
The NCA thanks Dr. MacDowall for his excellent presentation.

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Nominating Committee Report

By Jeff Norman, Chair

The Nominating Committee of NCA (whose members are Harold Williams and Jeff Norman) wants to remind all NCA members that we will elect officers for July 2009 to June 2010 at the June 13, 2009 meeting. We are recommending the following slate of officers; but any member may make additional nominations from the floor.

President	- Joseph Morris
Vice-President	- John Hornstein
Sec/Treasurer	- Michael Brabanski
Asst/Sec/Treas	- Jeff Norman
Trustee	- Benson Simon

Calendar of Events

NCA Mirror- and Telescope-making Classes: Fridays, Jun. 5, 12, 19, 26, 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, Jun. 13 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

Jun. 13, 2009
Dr. John Mather, NASA Goddard Space Flight Center
The James Webb Space Telescope

Sep. 12, 2009
John Chambers (DTM)
How Jupiter and Saturn influenced the development of the Solar System (TBC) The IYA theme of the month is Jupiter.

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Jun. 13

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Dr. John Mather

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