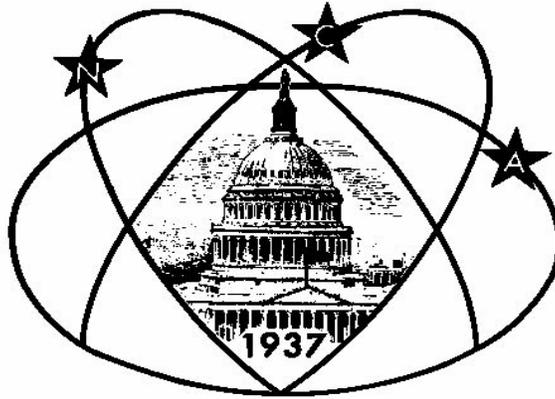


# Star



# Dust

National Capital Astronomers, Inc.

<http://capitalastronomers.org>

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## February Speaker: Dr. Jonathan Gardner, “To the Moon, Mars and Beyond for Science and Exploration”

*Submitted by Jeff Guerber*

Dr. Jonathan Gardner, NASA-Goddard, will present the featured talk at the February 12 meeting of the National Capital Astronomers. The meeting will be held at 7:30 P.M. in the University of Maryland Astronomy Observatory on Metzgerott Road in College Park, MD.

### Abstract

The recently released policy directive, “A Renewed Spirit of Discovery: The President’s Vision for U. S. Space Exploration,” seeks to advance the U. S. scientific, security and economic interests through a program of space exploration which will robotically explore the solar system and extend human presence to the Moon, Mars and beyond. NASA’s implementation of this vision will be guided by compelling questions of scientific and societal importance, including the origin of our Solar System and the search for life beyond Earth. The exploration road map identifies four key targets: the Moon, Mars, the outer Solar System, and extra-solar planets.

First, a lunar investigation will set up exploration test beds, search for resources, and study the geological record of the early Solar System. Human missions to the Moon will serve as precursors for human

missions to Mars and other destinations, but will also be driven by their support for furthering science.

The second key target is the search for past and present water and life on Mars, following up on discoveries by Spirit and Opportunity. By the end of the decade, there will be an additional rover, a lander and two orbiters studying Mars. These will set the

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***guided by  
compelling questions  
of scientific and  
societal importance***

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stage for a sample return mission in 2013, increasingly complex robotic investigations, and an eventual human landing.

The third key target is the study of the biology and chemistry of underground oceans and their potential for life in the outer Solar System. Beginning with the Cassini mission now in orbit around Saturn and a landing on Titan in January 2005, the next decade will see an extended investigation of the Jupiter icy moons by a mission

making use of Project Prometheus, a program to develop nuclear power in space and nuclear-electric propulsion.

Finally, the search for Earth-like planets and life includes a series of telescopic missions designed to find and characterize extra-solar planets and search for evidence of life. These missions include HST and Spitzer, operating now; Kepler, SIM, JWST, and TPF, currently under development; and the vision missions, Life Finder and Planet Imager, which will possibly be constructed in space by astronauts.

### Biography:

Jonathan P. Gardner is an Astrophysicist at NASA’s Goddard Space Flight Center, and the Deputy Senior Project Scientist for the James Webb Space Telescope. He began studying astronomy at Harvard University, while spending his summers as a laboratory assistant at Goddard. After graduating from Harvard he moved to Honolulu to earn a Masters and Ph.D. from the University of Hawaii. During his six years in Hawaii, he spent more than 100 nights on the frigid summit of Mauna Kea Observatory, studying cosmology and the evolution of galaxies, using infrared detectors that

*(Continued on page 5)*

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## NCA February Meeting to be Held on February 12

The February meeting of the National Capital Astronomers will be held on Saturday, February 12 at 7:30 P.M. Prior to the meeting there will a dinner with NCA members at the Garden Restaurant in the UMD University College Inn and Confer-

ence Center. Please see Page 2 for more information about dinner reservations. See Page 8 for directions on getting to the meeting or the dinner. Page 8 also contains information on obtaining a ride from Metro to the dinner or meeting. In addition, there

is a map on Page 8 that can be a help in getting to the meeting by car. All NCA meeting and dinners are open to NCA members and the public as well. Hope to see you there!

## **NCA Events This Month**

**The Public is Welcome!**

**NCA Home Page:** <http://capitalastronomers.org>

**Fridays, February 4, 11, 18, and 25,** 6:30 to 9:30 P.M. NCA mirror- and telescope-making classes 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 [gfbrendenburg@yahoo.com](mailto:gfbrendenburg@yahoo.com).

**Saturdays February 5, 19, and 26.** Observing with NCA's 14-inch telescope in Chevy Chase, MD. In Mike McNeal's backyard, 5410 Grove St, Chevy Chase, MD, (Friendship Heights Metro). Please make reservations by 10 p.m. the Friday before. Call Mike at 301-907-9449 or email him at [mnealmi@verizon.net](mailto:mnealmi@verizon.net) to let him know you are coming.

**University of Maryland Observatory, in College Park** on the 5th and 20th of every month at 9 P.M. The talks are non-technical.

ere is telescope viewing after the observatory open house talks if the sky is clear

**Saturday, February 12 at 7:30 P.M.** NCA meeting at the University of Maryland Astronomy Observatory on Metzertott Road in College Park, MD. There is observing through the observatory's telescopes at the end of the meeting if the sky is clear.

**Saturday, February 12 at 5:30 P.M.,** preceding the meeting, dinner with NCA members at the Garden Restaurant in the UMD University College Inn and Conference Center. See map and directions on Page 8.

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail [st88@ioip.com](mailto:st88@ioip.com), so that we can make reservations for the right number of people.

**Upcoming NCA Meetings**

*The deadline for the March Star Dust is February 15.*

*Please send your material to Elliott Fein by that date to ensure inclusion.*

*Send submissions to Elliott Fein at [elliott.fein@erols.com](mailto:elliott.fein@erols.com).*

*Text must be in ASCII, MS Word (97 or earlier), or WordPerfect.*

*All articles submitted may be edited to fit the space available.*

## **News from the NCA Telescope- and Mirror-Making Workshop** *Guy Brandenburg*

We have just begun experimenting with the use of black rouge as a polishing agent. It is very, very slow, but appears to create an extremely fine polish. It is also very messy, but only somewhat more messy than the ordinary red rouge we normally use as a final polishing agent. John Palmer is our 'guinea pig' in this endeavor, and is in fact using surgical gloves while he does so! In the past, we also have used zirconium oxide, cerium oxide, and barnesite. Cerium oxide works much faster than any of the other polishing agents, but seems to leave a much rougher final polish than most of the others. Very few people use barnesite any more, and that seems like a good idea, since it is both rough AND slow, it appears to me. Zirconium oxide seems to be intermediate in smoothness and in speed of action between red rouge and cerium oxide.

We are also beginning to experiment with the use of a webcam to make Ronchi testing and Foucault testing much easier to do. Orbital Communications donated an old computer to the NCA scope-making club, by way of John Applegate (an NCA member), and Nagesh Kanvindeh (another NCA

member) plans to donate a webcam. John Palmer brought in a used laptop that he bought for about \$90, that he also plans to donate, and using that we were able to run the calculations we needed to do on the measurements on his as-yet-still-

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***We are experimenting with the use of a webcam to make Ronchi and Foucault testing much easier to do.***

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overcorrected mirror quite easily. That was a big timesaver, because before this, we would have to either try to do the calculations by hand, which is an ENORMOUS headache, or else try to find a working computer in the Center that is able to run some of the amateur-telescope-making number-crunching software (and that's hard because most of them either are broken or won't allow anybody to install any software), or else we would have to wait until one of the participants got home and

could type the numbers into their computer at home. We still need to put an operating system on the computer donated by Orbital. It does have USB ports, so adding a webcam should be pretty easy; this will make it so that many people can view the Ronchi-grams or Foucault-grams at the same time, and analyze them objectively without squinting.

We also recently found that adding a bit of copper sulfate to the muriatic acid (aka HCl) makes removing old aluminum coating extremely fast — just a few minutes. We had previously just been using plain muriatic acid, and that would take many, many hours, and even so would be incomplete. We had been told by some of the technicians at or around Palomar or Mount Wilson or CalTech that using this combination would make removing old coatings go very quickly, and they were right. A couple of years ago, someone tried using ammonia to remove the coating on a very old mirror, and then sent it to a commercial aluminizing firm. We discovered later that the ammonia had seriously de-

*(Continued on page 3)*

# Elementary Astronomy -- Spectral Classification

Nancy Grace Roman

When astronomers started to look at stars through a prism in the mid-nineteenth century, they noticed that the spectra of stars differed. In Italy, a priest divided the appearances into four classes. Occasionally a reference to Father Secchi's fourth type occurs in the literature. These are the very red stars with molecular bands.

At the beginning of the twentieth century, astronomers started to use photography to observe stellar spectra, thus reaching more and fainter stars. In particular, Harvard began an extensive program of objective prism observations. With this technique, a thin prism is placed over the objective of a refracting telescope, providing a short spectrum of every star in the field. Women were set to work studying these spectra and assigning them a designation on the basis of appearance. Antonia Maury noted that some stars had sharper lines or other features that distinguished them

from others of the same temperature. She called these "c" stars. We now know that they are supergiants. Pickering, the director, had also developed a scheme and it was this that Annie Cannon used for the

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***As nothing was known at the time to explain the appearances of the spectra, each was assigned a letter on the basis of the complexity of the spectrum.***

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nearly 300,000 stars she classified.

As nothing was known at the time to explain the appearances of the spectra, each was assigned a letter on the basis of the complexity of the spectrum. Thus, A

stars had the simplest spectra, B stars slightly more complicated spectra, etc. through the M stars with banded spectra. One or more letters designated spectra in which the plate had shifted so that the spectra were double; other letters indicated composite spectra in which two stars were unresolved; some indicated other errors. In the 1920's, when it was recognized that the differing appearances of spectra resulted from differing temperatures of the stars, the letters were rearranged to form a temperature sequence and the letters that did not indicate real spectra were discarded. P was kept to denote planetary nebula; R, N, and S were added for carbon stars; and, more recently, L and T were added to denote stars cooler than M stars. The new arrangement led to the mnemonic: O Be A Fine Girl (Guy) Kiss Me Right Now Sweetheart. (I am unaware of a generally used mnemonic incorporating L and T.)

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## News from the NCA Telescope- and Mirror-Making Workshop, continued

*(Continued from page 2)*

graded and etched the glass, so badly that it had to be re-polished and refigured almost as if it had never been polished at all! So if you want to have your mirror re-aluminized, we can do it, and we also can remove the old coating - whatever you do, don't use ammonia or lye or any other strong base (alkali) to take it off!

There are several methods for testing whether a mirror has been correctly parabolized or not. The most common ones are the star-test, the Ronchi test, the Foucault test, and the Couder test, which we use regularly. Recently we tried a test known as the Mobsby Null Test, which we bought from Willmann-Bell. This consists of some very small test patterns carefully printed on a 35-mm slide. To carry out the test, we had to fabricate a very bright light source that cast light out of an extremely tiny pin-hole. This meant taking apart an old halogen lamp from Ikea, salvaging the transformer and switch, attaching a rectifier to run a 12-volt DC muffin fan to keep it all from overheating, and then putting all of this in a box. It also meant that we had to modify a government-surplus, high-

precision XYZ stand to hold the 35-mm slide in a very precise location relative to the center of curvature. Unfortunately, the test was so difficult to use and to interpret, that I feel that the entire experiment was a waste of time. I do not recommend it.

Nagesh Kanvindeh, Michael Chesnes, and I are continuing to work on making a Lurie-Houghton telescope. This is a catadioptric telescope (one that has both lenses and mirrors) that has two corrector plates in front, made out of identical glass, with curvatures that are exactly opposite each other. It also has a spherical primary, which we have already finished. We were thinking of using some Water White clear glass, which the workshop had on hand, but we later decided it was too thin (only 3/8" thick), and we purchased some crown glass from a private party. We also had to fabricate a wedge-meter, which measures the thickness of the corrector plates. They need to have precisely the same thickness all the way around, or else the image will be very seriously distorted. We made the wedge-meter out of an old instrument stand, some 1/2-inch-diameter ball bearings, some bolts, and a dial indicator. It

works like a charm!

If you want to make a telescope, or think you might want to find out what it's all about, by all means drop by some evening. We have all the materials you need to start and complete a mirror, and can help you with the rest of the process for making the rest of the scope. The materials fee for a 6-inch mirror is \$70, and for an 8-inch mirror is \$110, but prices may be increasing a bit next summer. Aluminizing is a bit extra.

The NCA telescope- and mirror-making class continues at the Chevy Chase Community Center in February, on every Friday evening, from 6:30 to 9:30 PM. The dates for February 2005 are the 4th, the 11th, the 18th, and the 25th. However, if the Center is closed by the D.C. Government because of snow, then the class will obviously not meet!

If you would like more information, please call Guy Brandenburg at 202-262-4274 or email him at [gfbrandenburg@yahoo.com](mailto:gfbrandenburg@yahoo.com), or look at his website, [http://home.earthlink.net/~gfbrandenburg/GFB\\_Home\\_Page.html](http://home.earthlink.net/~gfbrandenburg/GFB_Home_Page.html)

# Mid-Atlantic Occultations and Expeditions

## by David Dunham

### Asteroidal Occultations

Date	Day	EST	Star	Mag	Asteroid	dmag	s	in.	Ap.	Location
Feb 7	Mon	21:08	TYC01900347	11.8	Menippe	2.6	3	8		Richmond, VA; WV
Feb 10	Thu	19:17	TYC13951016	11.8	2000 CF105	11.4	6	8		USA? TNO
Feb 11	Fri	22:19	TYC19131223	11.2	Masaryk	4.7	7	8		s. Virginia
Feb 20	Sun	5:50	2UC27863840	11.7	Potomac	5.2	4	8		Carolinas
Feb 24	Thu	21:51	TYC08340330	10.3	Iphigenia	3.4	6	5		New York, Conn.
Mar 7	Mon	19:14	ZC 264	7.1	Belisana	7.7	1	1		TN, w. Carolinas
Mar 3	Thu	0:51	TYC13990043	10.9	Europa	0.6	40	6		NewBrunsn., Que.
Mar 10	Thu	3:57	SAO 207275	8.1	Ianthe	5.3	8	2		Tenn., Georgia

### Grazing Occultations

Feb 17	Thu	22:32	ZC 812	8.0	69+	54	3N	Fred'brg, VA;	close double
Mar 4	Fri	4:40	SAO 185391	9.0	43-	10	14S	Crofton & Mayo, MD	

### Total Lunar Occultations

DATE	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Feb 4	Fri	5:37	R	ZC 2409	7.0	27-	17	27N	B9	
Feb 15	Tue	0:12	D	45 Ari	5.8	41+	2	66S	M6	ZC 432; Az. 292 deg.
Feb 16	Wed	0:16	D	ZC 540	7.8	51+	12	45N	A0	Azimuth 289 deg.
Feb 16	Wed	21:24	D	ZC 683	7.4	60+	55	23S	A2	
Feb 17	Thu	0:16	D	ZC 698	7.5	61+	23	35N	K2	
Feb 18	Fri	1:38	D	SAO 77258	7.8	71+	18	65S	K0	
Feb 18	Fri	19:34	D	SAO 78191	7.7	77+	74	78N	A0	
Feb 18	Fri	22:54	D	SAO 78291	7.7	78+	59	68N	K0	
Feb 19	Sat	2:02	D	SAO 78410	7.7	79+	24	88S	K1	
Feb 19	Sat	20:11	D	ZC 1093	6.6	85+	71	80S	F8	7.2mg2 1"awayD2s before
Feb 24	Thu	19:30	R	ZC 1625	5.8	99-	11	82N	K3	WA264; Az88; term.15"away
Feb 28	Mon	4:14	R	SAO 158105	7.5	83-	37	46S	F5	Maybe close double
Feb 28	Mon	6:42	R	86 Vir	5.5	83-	20	88N	G8	ZC 1971; Sun alt. -1
Mar 2	Wed	3:13	R	X39461	7.5	65-	25	27N	K0	9.2mg2 sep.10", PA192dg
Mar 2	Wed	3:21	R	ZC 2204	7.7	65-	26	64N	K0	/sigma Sco=ZC 2349
Mar 3	Thu	2:21	R	sigma Sco	2.9	54-	10	41N	B1	5.1mg2 sep..4", PA249dg
Mar 3	Thu	6:05	D	Antares =	1.1	53-	25	-82N	M1	ZC 2366; Sun alt. -7
Mar 3	Thu	7:25	R	alpha Sco	1.1	53-	21	69N	M1	Sun alt. +8
Mar 4	Fri	2:48	R	43 Oph	5.3	43-	4	63N	K4	ZC 2505; Az. 131 deg.
Mar 4	Fri	4:12	R	SAO 185394	7.8	42-	14	71S	G8	Azimuth 146 deg.
Mar 4	Fri	4:17	R	SAO 185400	7.2	42-	14	80N	F5	Azimuth 147 deg.
Mar 5	Sat	3:51	R	ZC 2681	7.8	31-	3	44N	A1	Az.131; close double
Mar 5	Sat	4:38	R	ZC 2688	7.0	31-	9	56S	G6	Az. 140 deg.
Mar 6	Sun	6:08	R	SAO 188429	7.7	20-	13	70S	K4	Azimuth 143 deg.

David Dunham, e-mail [dunham@starpower.net](mailto:dunham@starpower.net), more info. <http://iota.jhuapl.edu>  
 Phone home 301-474-4722; office 240-228-5609; car 301-526-5590

## More News from the NCA Telescope- and Mirror-Making Workshop

*Guy Brandenburg*

Nagesh Kanvindeh and I (and several other onlookers) had a good lesson on lathe use from Jerry Schnall this evening at the NCA mirror-making class at the Chevy Chase Community Center in Northwest Washington DC.

Nagesh and I are attempting to make a Lurie-Houghton telescope, which requires two corrector plates that have equal and opposite curvatures on identical glass. Getting the radii of the curves correct is extremely important, according to the ray-tracing software that we (mostly Nagesh) are using [OSLO LT}. Our current set of spherometers [made in the past by Bob Bolster and Jerry Schnall] only measure to within about +/- 0.001" on the sagitta (or depth of curve on the glass) which can often mean changes of several inches in the radius of curvature, which is unacceptable because it's not nearly accurate enough.

We happened to have on hand some linear micrometers that were part of some surplus optical equipment we inherited from the physics department at American University. We disconnected one of the micrometers from the rest of the stuff, and tried to figure out how to make the rest of the spherometer. I was planning to make a brand-new base, but Jerry suggested that we simply remove one of the dial indicators in another spherometer, and then use our lathe to make a sleeve that would enable the micrometer to fit into the hole where the dial indicator would go. He told us what to do, and we did it, with plenty of fumbling around. But we got a valuable lesson in the use of a centering tool, boring a hole of the right size, using the cutoff tool, and in the use of the clutch and the gearbox. After all of that, we got a really nice spherometer that measures to the nearest ten-thousandth of an inch. An

experienced machinist could probably have done it in about 10 minutes. We got it done in about 2 hours, but it works great! Reading the micrometer accurately is the tricky part; you always have to read what the number is for a flat surface, and then read the curved surface, then subtract the two, and then calculate what that means.

It was great having somebody (i.e., Jerry) telling us what to do and letting us do it. I'd previously tried making things entirely on my own, and had always screwed up big-time, not able to produce anything useful to speak of. Watching somebody else do it is OK, but it's not nearly as good for learning how to do it yourself.

(Also, our wedge-o-meter works great, too — for this we merely used an old instrument stand and drilled a couple of holes in it.)

### “To the Moon, Mars and Beyond for Science and Exploration”

*(Continued from page 1)*

were being tested for use in the Hubble Space Telescope. In 1992, Dr. Gardner won a NATO fellowship to pursue his research at the University of Durham in the north of England. In 1996, he returned to Goddard just before astronauts installed the infrared detectors in Hubble.

In addition to conducting research with data from Hubble, Dr. Gardner is helping with the plans for Hubble's successor, the James Webb Space Telescope, scheduled for launch in 2011. This mission is de-

signed to study galaxy formation and evolution in the infrared, reaching backwards in time to detect and identify the first light from stars and galaxies in the early history of the Universe.

For six months in 2004, Dr. Gardner took on a temporary assignment at NASA Headquarters as a Special Assistant to NASA's Chief Scientist (astronaut John Grunsfeld) working on the exploration initiative, and as the Spitzer Space Telescope Program Scientist.

### Do You Want to Get Star Dust Electronically?

Any member wishing to receive *Star Dust*, the newsletter of the National Capital Astronomers, via e-mail as a PDF file attachment, instead of hard-copy via U.S. Mail, should contact Nancy Grace Roman, the NCA Secretary, at [nancy.roman6@verizon.net](mailto:nancy.roman6@verizon.net) or 301-656-6092 (home).

### Meteor Showers

Full Moon: February 24

Major Activity: None

Minor Activity			Daylight Activity		
Radiant	Duration	Maximum	Radiant	Duration	Maximum
Aurigids	January 31-February 23	Feb. 5-10			
Alpha Centaurids (ACE)	February 2-25	Feb. 8/9	Capricornids-Sagittariids	January 13-February 28	January 30-February 3
Beta Centaurids	February 2-25	Feb. 8/9			
Delta Leonids (DLE)	February 5-March 19	Feb. 22/23	Chi Capricornids	January 29-February 28	February 13/14
Sigma Leonids	February 9-March 13	Feb. 25/26			

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

## Getting to the NCA Monthly Meeting and the Dinner Before the Meeting

*Jeff Guerber*

NCA meetings are now held at 7:30 p.m. at the University of Maryland Observatory, in College Park on Metzerott Rd. between University Blvd. (MD-193) and Adelphi Rd. To get there from the Capital Beltway (I-495), either take US Rt. 1 south about a mile, turning right onto MD-193 West, then at the first light turn right onto Metzerott; or, take New Hampshire Ave. (MD-650) south, turn left at the second light onto Adelphi Rd., two more lights, turn left onto Metzerott, and proceed about a mile to the observatory. The observatory is on the south side of Metzerott Rd., directly opposite the UM System Administration building; you can park there if the observatory lot is full, but be careful crossing Metzerott Rd.

**At 5:30 p.m. before the meeting**, please join us for dinner at the Garden Restaurant in the UMD University College Inn and Conference Center, 3501 University Blvd. East at Adelphi Rd. From the Beltway, either take New Hampshire Ave. south, turn left onto Adelphi, and at the third light (passing Metzerott) turn left onto University then immediately right into the garage; or, take US-1 south, turn right onto University Blvd. west, and take it to the intersection with Adelphi Rd. Park either in the garage (costs), or in Lot 1 nearby (free). To get to the Observatory, exit to the right onto University Blvd. (MD-193) east, and at the second light turn left onto Metzerott Rd.

## Are You Coming to Dinner?

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail st88@ioip.com, so that we can make reservations for the right number of people.

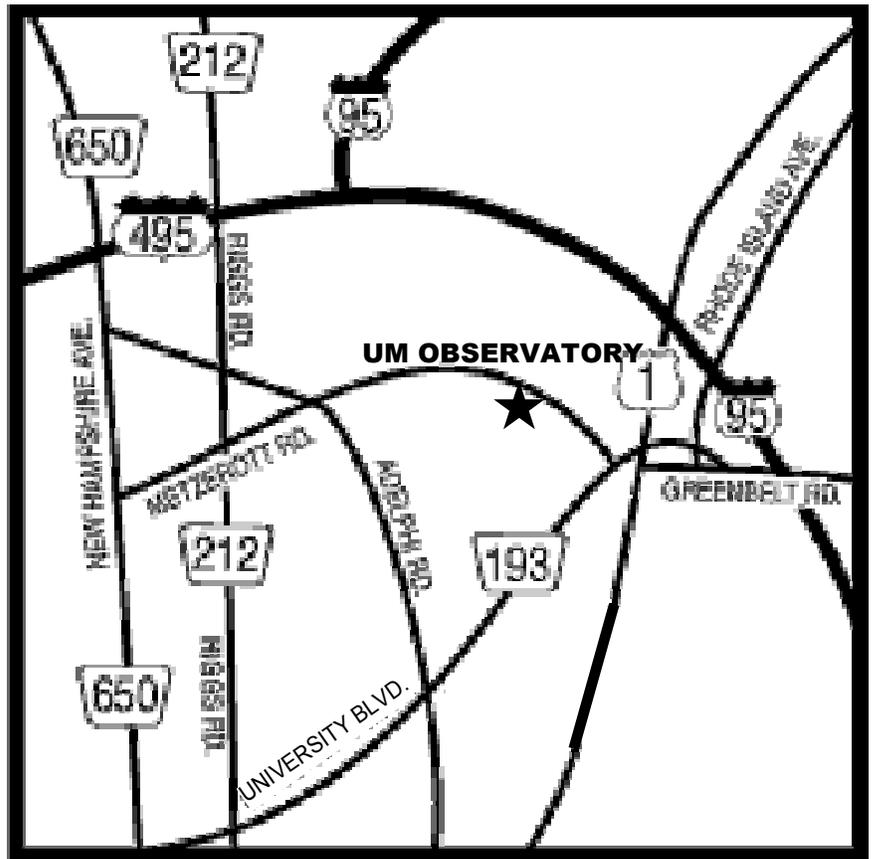
## Do You Need a Ride?

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 email at rigel1@starpower.net.)

## Observing after the Meeting

*Elizabeth Warner*

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.



Getting to the NCA Meeting

## Abigail Fraeman

*Steve Robinson*

Five years ago I mentored Abby Fraeman as she observed the light fluctuations of Delta Cep. She won first place in the Montgomery County Science Fair in her category that year with the work. She also presented her project to NCA as well. In fact, I believe NCA provided at least some of the judges for the event. Today I received an update on Abby's progress from her mom:

From: Kathy Fraeman <fraeman@his.com>

To: srobinso@mindspring.com

Subject: A follow-up on a student you mentored

I don't know if you remember, but 5 years ago you agreed to mentor my daughter, Abigail Fraeman, who was at the time a 7th grader in a local magnet school. She did a science fair project observing Delta Cephei. The last sentence in your post about her was, "Perhaps in the future, we'll be hearing more from Abby."

I thought you might be interested in a quick follow-up from a proud mother! Abby is now a high school senior at the Math/Science magnet program at Montgomery Blair High School. She is currently attending the American Astronomical Society conference in San Diego where she presented a poster session of her astronomy work done during a summer internship at the Carnegie Institute.

She has also just been named as an Intel semifinalist for this astronomy project.

Finally, last year she was selected as one of only 16 international "Student Astronauts" through the Planetary Society's "Red Rover Goes to Mars" program, where she spent 10 days last January at Rover mission control at JPL. All this started with observing Delta Cephei. Thank you again for your mentoring -- I just thought you'd be interested to see the long-term effects of what some positive mentoring can do for a student!

Kathy Fraeman

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### SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a nonprofit, membership-supported, volunteer-run, public-service corporation dedicated to advancing astronomy, space technology, and related sciences through information, participation, and inspiration, via research, lectures, presentations, publications, expeditions, tours, public interpretation, and education. NCA is the astronomy affiliate of the Washington Academy of Sciences. All are welcome to join NCA.

#### SERVICES & ACTIVITIES:

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

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

**Publications** received by members include the

monthly newsletter of NCA, *Star Dust*, and an optional discount subscription to *Sky & Telescope* magazine.

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

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

**Classes:** Some NCA members are available for educational programs for schools and other organizations. The instruction settings include star parties, classroom instruction, and school-teacher training programs that provide techniques for teaching astronomy. NCA sponsors a telescope-making class, which is described in

the *Star Dust* "Calendar of Monthly Events."

**Tours:** On several occasions, NCA has sponsored tours of astronomical interest, mainly to observatories (such as the National Radio Astronomy Observatory) and to the solar eclipses of 1998 and 1999.

**Discounts** are available to members on many publications, products, and services, including *Sky & Telescope* magazine.

**Public Sky Viewing Programs** are offered jointly with the National Park Service, and others. Contact: Joe Morris, [joemorris@erols.com](mailto:joemorris@erols.com) or (703) 620-0996.

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

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

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

### Yes, I'd like to join NATIONAL CAPITAL ASTRONOMERS!

Name: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

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Would you prefer to get *Star Dust* by e-mail?

Present or Former Occupation (or, If Student, Field of Study): \_\_\_\_\_

Academic Degrees: \_\_\_\_\_ Field(s) of Specialization: \_\_\_\_\_

Employer or Educational Institution: \_\_\_\_\_

#### MEMBERSHIP CATEGORIES AND ANNUAL DUES RATES

*All members receive Star Dust, the monthly newsletter announcing NCA activities. As an added optional benefit to extend your knowledge of astronomy you may also choose Sky and Telescope magazine at the discounted rate of \$33.*

Student Membership: ..... \$15 .....with *Sky and Telescope*....\$48

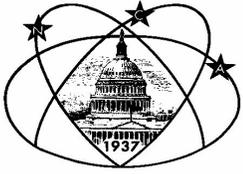
Standard Individual or Family Membership: ..... \$27 .....with *Sky and Telescope*....\$60

NCA offers two premium membership categories for those wishing to make extra contributions to the organization:

Contributing Member: \$60 Sustaining Member: \$125

Please mail this form with your check payable to National Capital Astronomers, to:

Mr. Jeffrey Norman, NCA Treasurer; 5410 Connecticut Avenue, NW #717; Washington, D.C. 20015



## **National Capital Astronomers, Inc.**

If undeliverable, return to  
NCA c/o Nancy Roman  
4620 N. Park Ave., #306W  
Chevy Chase, MD 20815-4551

**FIRST CLASS  
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