Star Dust

National Capital Astronomers, Inc.

May 2009

Volume 67, Issue 9

http://capitalastronomers.org

Next Meeting

When: Sat. May 9, 2009

Time: 7:30 pm

Where: UM Observatory

Speaker: Tom Armstrong, Naval Research Laboratory

Table of Contents

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.

May 2009: Dr. Tom Armstrong
Naval Research Laboratory

Interferometric Imaging at Visible Wavelengths: Why, How, and Initial Results

Abstract: Advances in technology in the last 20 years have revolutionized optical astronomy in a number of ways--bigger telescopes, large-format detectors, and adaptive optics, to name a few. Another revolution is now taking place: the explosive increase in angular resolution at optical wavelengths, using optical interferometry. Current interferometers in Chile, California, Arizona, and elsewhere are measuring the changing sizes of Cepheids, temperature variations across the surfaces of oblate, rapidly rotating stars, and even the sizes of the central engines in active galactic nuclei, all at resolutions measured as small as 0.00007 arcsec. I will briefly describe the technique of optical interferometry, and then discuss some of the most recent results in using interferometers to weigh and measure stars, to make images of stellar surfaces, and even help determine the diameters of extrasolar planets.

Biography: Tom Armstrong has been a member of the optical interferometry team at the Naval Research Laboratory (NRL) since 1989. He observed with the Mark III Interferometer on Mt. Wilson, helped design the Navy Prototype Optical Interferometer (NPOI) now operating at the Lowell Observatory near Flagstaff, Arizona, and is now the principal NRL investigator on the NPOI project. His research interests include fundamental parameters of binary stars and rapidly rotating stars. Before coming to NRL, he was a radio astronomer at the National Radio Astronomy Observatory and at the University of Cologne, using centimeter- and millimeter-wavelength telescopes to investigate star formation regions and the Galactic Center. An English major as an undergraduate, and a former cab driver and guitar maker's apprentice, he received his PhD in physics from MIT in 1983.

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!

The Uses of Stellar Flares

Review April 2009: Dr. Rachel Osten,
Space Telescope Science Institute

Reviewed by Nancy Grace Roman

The only flares we can resolve spatially are those on the sun. They occur when magnetic field lines leaving active regions on the sun reconnect in the corona. They cause particle acceleration and shocks, heat the entire solar chromosphere to ten million degrees and produce emission across the electromagnetic spectrum. Flare temperatures are in the millions of degrees. A coronal mass ejection in July 2002 accompanied a flare that produced 10^31 ergs in thermal plasma, 8X10^31 ergs in non-thermal radiation and a coronal mass ejection carrying 10^32 ergs. Energetic particles carried less than 10^30 ergs.

We have known since the mid 1900s that many cool dwarfs flare. Because the flare radiation is very hot, it stood out against the normal, cool stellar radiation. As we broadened the wave-length coverage, we realized that flare stars are much more wide-spread in characteristics. They occur in rotating stars with relatively high convective zones and magnetic activity. Flare strength increases with faster rotation. Flares occur in F- and cooler dwarfs, including brown dwarfs, as well as in giants with outer convection zones. Time scales for flares can vary from seconds to hours. The frequency decreases with the age of stars but we do not know if intensity varies with age. Young, active flare stars can flare several times a day. Most of the activity is in the corona. The optical emission in classical white-light flares is only a small fraction of the total emission.

In close binaries, tidal coupling can cause rapid stellar rotation leading to exceedingly strong flares. In a flare in II Peg, the plasma temperature was greater than 120 MK, the peak luminosity in the 8 - 200 KeV range was 38% of the normal total bolometric luminosity of the star with the total radiative energy from the star of 10^37 ergs. This was the first evidence of hard X-ray emission from a stellar flare. A flare on EV Lac, a dwarf M star, was even stronger with the X-ray emission alone exceeding the normal bolometric emission from the star. The flare, which lasted 15 minutes, was also visible optically. The exact optical magnitude is unknown as it saturated the detector but the star probably reached 5th magnitude. These very large flares mimic gamma-ray bursts and Swift is detecting them.

Comparing theoretical modeling with observations indicates that the flares occur about 0.1 stellar radii above the photosphere. The Fe Ka emission indicates slightly smaller height.

M stars flare in the radio region. Some very short flares can be detected with a receiver at Arecibo that has been designed to respond to rapidly varying radiation from pulsars. The radio characteristics determine the electron density in the flare.

Theory has indicated that turbulence is needed in protoplanetary disks to produce planets. Stellar flares that can affect the disks to a distance 60 AU may be the cause of this turbulence.

Continued on Page 3

2008-2009 Officers

Continued from Page 2

A very strong flare could delete the ozone layer in the terrestrial atmosphere. It has been suggested that the late Ordovician mass extinction may have been caused by a galactic gamma-ray burst that eroded the terrestrial ozone and thus led to the extinction. The characteristics of the large flares that Swift is detecting have similar characteristics. Such flares may have destructive effects also. The EV Lac flare was more than 2 million times the strongest solar flare. Although the high-energy radiation would not come through the atmosphere, it can be degraded to ultraviolet of which 4% could reach the earth. Particles from coronal mass ejections would have a stronger effect.

There are still things we do not really understand about flares:

- How much energy goes into particle acceleration vs. plasma heating?
- What controls similar flare parameters on wildly different types of stars?
- What is the source of the white light stellar flare?
- In what ways do flares affect their environment?

The NCA thanks Dr. Osten for presenting to us.

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

Science News

Thank you Nancy Grace Roman for finding these articles.

ExoMars Development

ExoMars Project Scientist Jorge Vago to the Mars Exploration Program Analysis Group

The European Space Agency is proceeding with development of its ExoMars mission with an eye toward a 2016 launch, despite questions of funding and international participation that still loom over the program. ExoMars was conceived as a way for the European Space Agency (ESA) to beef up its rover knowledge and experience. According this presentation, the mission's primary technology objectives include entry, descent and landing with a large payload on Mars, demonstrating multikilometer mobility with a rover, and automatic drilling of the Martian surface down to a depth of two meters. The rover's science instruments will search for signs of past and present life and characterize Mars' water/geochemical environment, while the lander will study the surface environment and identify potential hazards to future human missions. Current plans call for launch on an Ariane 5, Proton or Atlas V rocket in January 2016, with arrival at Mars in September 2017. The mission would wait in orbit until the planet's atmospheric density is at maximum, then deploy its 2.3 metric ton descent module. After discarding its backshell and parachutes and then firing its descent engines, a capsule containing the lander and rover will be dropped the last 10 meters to the ground, cushioned by airbags. The bags will deflate and the lander will deploy the 270-kilogram (595-pound) rover. In the coming year, ESA will be testing thermal protection materials, dropping test capsules from a high-altitude balloon, testing the spacecraft's Doppler radar system, and conducting the first tests in which the drill is mated with the rover. "So far the results [in separate tests] have been great, but it may be a different ball game altogether when we mate the two systems," Vago said. The baseline mission is 180 Martian days. The team hopes to visit seven sites with the rover, collecting samples and drilling down to a depth of two meters. The team is currently looking at candidate landing sites in the Meridiani region.

The lander and rover carry 11 science instruments each. The science payload on the lander ballooned from an estimated 20 kilograms (44 pounds) up to 60-80 kilograms (130-180 pounds) after the decision was made to power the instruments with solar panels rather than radioisotope thermal generators. This growth caused the lander's mass margins to go below ESA's comfort levels, but they hope to have them back at acceptable levels by the end of the year via a payload confirmation review due to end by April or May.

ExoMars currently doesn't have a full funding commitment from ESA member states, which will most likely result in the ambitious rover/lander mission being downscoped. So far, only 850 million euros ($1 billion) of the mission's estimated $1.2 billion euro ($1.5 billion) price tag has been committed, although ESA is in talks with NASA about possibly joining forces on the mission (Aerospace DAILY, Feb. 2). In the meantime, informal consultations are under way with ESA member states "trying to find out, if we have to compromise, how we should do that in a manner [so that] the ministers are still interested in the mission".

Interview with David Koch on Kepler

Astronomy Now (3/11) Cooper

In an extended interview, David Koch, Deputy Principal Investigator of the Kepler mission explained that "what distinguishes Kepler and the big distinction between COROT and Kepler is just the overall sensitivity to detection, and it comes in several categories." Koch says Kepler "is going to be able to detect smaller planets in wider orbits," due to advances in technology. Koch goes on to detail how the mission will conduct its mission and breakdown the results.

Continued on Page 6

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
May 10	Sun	4:39	TYC73911960	10.4	Laura	5.3	6	5	OH,w&nPA,NY
May 13	Wed	2:30	2UC22521704	11.7	Bathilde	1.7	8	7	eNC,sVA,sWV,sOH
May 13	Wed	21:52	TYC61310608	11.4	Helma	5.1	3	7	neNC,sVA,sWV,OH
May 28	Thu	23:47	2UC19447871	11.7	Merapi	1.7	10	8	NJ,DC,MD,nVA,PA
May 31	Sun	4:58	TYC05491241	10.2	Vienna	2.3	2	4	eSC,eNC,seVA
Jun 5	Fri	22:16	SAO 158793	8.7	Zapesotski	9.5	2	3	MD,DC,nVA,nWV
Jun 6	Sat	3:44	TYC61840208	9.4	Hestia	2.6	12	4	nFL,sTX
Jun 10	Wed	23:20	SAO 160368	8.6	Evita	6.6	3	3	cen.FL,sTX
Jun 14	Sun	22:33	TYC49760706	11.8	Morosovia	3.0	6	7	sNJ,eMD,eVA,eNC

Lunar Grazing Occultations

Date	Day	EDT	Star	Mag	%	alt	CA	Location
May 16	Sat	5:14	ZC 3094	7.5	59-	29	12N	Indiana,PA;Corning,NY-Sun -6
Jun 6	Sat	23:16	Antares	1.1	99+	21	39N	Queensb,NY;Worcstr&Nantckt,MA

Total Lunar Occultations

DATE	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp.	Notes
May 10	Sun	0:44	R	2 Scorpii	4.5	99-	24	49N	B2	WA333,ZC2268,TmD14",3*s
May 10	Sun	0:44	R	2 Scorpii	4.5	99-	24	49N	B2	WA333,ZC2268,TmD14",3*s
May 12	Tue	3:21	R	SAO 185716	7.4	91-	24	43N	A0	
May 12	Tue	5:16	R	ZC 2558	6.3	90-	20	68N	B3	Sun alt. -8 deg.
May 16	Sat	5:28	R	ZC 3094	7.5	59-	33	36N	A9	Sun -5; PA & NY graze
May 25	Mon	20:44	D	125 Tau	5.2	3+	14	68N	B3	Sun-5,Az292,ZC852double
May 27	Wed	20:55	D	SAO 79710	7.8	17+	32	40S	K0	Sun -6
May 28	Thu	22:23	D	52 Cancri	7.4	27+	23	89S	G5	ZC 1324
May 29	Fri	21:43	D	ZC 1433	7.0	38+	37	28S	F8	
May 29	Fri	22:48	D	SAO 98747	6.9	38+	25	26S	K5	
May 29	Fri	23:28	D	SAO 98771	7.9	38+	17	54N	A5	close double
May 29	Fri	23:38	D	ZC 1443	7.5	39+	15	66S	G5	Az271,mg2 10 1.2",PA294
May 30	Sat	21:19	D	SAO 118382	8.0	49+	45	85S	K0	Sun -10
May 31	Sun	23:36	D	ZC 1662	6.4	61+	25	67N	K2	close double
Jun 1	Mon	23:57	D	ZC 1764	7.9	71+	25	41N	K0	
Jun 5	Fri	20:52	D	ZC 2220	7.0	97+	15	86N	A3	Sun -5,Az.140,triple+
Jun 6	Sat	22:38	D	Antares =	1.1	99+	19	75N	M1	ZC2366,Term.Dist. 9"
Jun 6	Sat	23:28	R	alpha Sco	1.1	100+	23	6N	M1	WA 329,red giant,TmD 0"
Jun 6	Sat	23:57	D	ZC 2373	6.1	100+	24	78N	K1	Term.Dist. 8"
Jun 10	Wed	4:07	R	ZC 2811	6.3	94-	26	81N	F8	WA 281
Jun 11	Thu	3:37	R	ZC 2929	7.1	89-	30	74S	G8	May be close double
Jun 14	Sun	5:46	R	ZC 3294	6.9	65-	44	44S	F0	occurs at sunrise
Jun 15	Mon	3:25	R	ZC 3400	7.6	56-	29	6S	F5	

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.

IDA News

The International Dark Sky Association celebrated World Night in Defense of Starlight on April 20. This event kicked off International Dark Sky Week from April 20-26. During this time the IDA helped coordinate star parties and other public outreach events designed to raise awareness of light pollution.

A Standing Invitation to Suggest Speakers and Topics for NCA Meetings

John Hornstein

Is there a local speaker on astronomy whom you would like to hear? Have you come across a news item about a new result that you would like to learn more about? Is there some phenomenon on which you would like an update?

If so, send your suggestion to me, at jshgwave@yahoo.com, and we'll try to implement it at a future NCA meeting.

Continued from Page 4

Joint Hubble, VLT Observations Making 3-D Galactic Images

Space.com (3/17)

Astronomers are now using Hubble and Europe's Very Large Telescope (VLT) to obtain detailed 3-D views of galaxies dating back as far as six billion years. Hubble can scope out the structure of faraway galaxies, while the European Southern Observatory's VLT can use a spectrograph to reveal the motions of galactic gases. An international team has selected 100 galaxies for 3-D reconstruction. Francois Hammer of the Paris Observatory said, "The next step will then be to compare this with closer galaxies, and so, piece together a picture of the evolution of galaxies over the past six to eight billion years."

Martian Rover Sights the Endeavour Crater

The panoramic camera on NASA's Mars rover Opportunity has caught a first glimpse on the horizon of the uplifted rim of the big crater that has been Opportunity's long-term destination for six months. Endeavour Crater, 14 miles (22 kilometers) in diameter, is still 7 miles (12 kilometers) away from Opportunity as the crow flies, and at least 30 percent farther away on routes mapped for evading hazards on the plain. 'We can now see our landfall on the horizon. “It's far away, but we can anticipate seeing it gradually look larger and larger as we get closer to Endeavour,” said Steve Squyres of Cornell University, and the principal investigator for the rovers' science instruments. “We had a similar experience during the early months of the mission watching the Columbia Hills get bigger in the images from Spirit as Spirit drove toward them.” Opportunity has already driven about 2 miles (3.2 kilometers) since it climbed out of Victoria Crater last August after two years of studying Victoria, which is less than one-twentieth the size of Endeavour. “It's exciting to see our destination, even if we can't be certain whether we'll ever get all the way there,” said rover project manager John Callas of NASA's Jet Propulsion Laboratory in Pasadena, Calif. “At the pace we've made since leaving Victoria, the rest of the trek will take more than a Martian year” A Martian year lasts about 23 Earth months."

Star Dust Submissions

Do you have an article, photograph, or other item which you want to appear in an upcoming issue of Star Dust? If you would like to share with NCA your experiences at a star party or public outreach event, please consider writing an article about it for Star Dust. If you recently read a good book about astronomy, you can let your fellow NCA members know about it by writing a book review. Your pictures are appreciated too, whether they are astrophotographs, or taken during an eclipse trip or a visit to an observatory. To ensure that your item is included in the next issue of Star Dust, please send it by the second Monday after the next NCA meeting to m.chesnes@verizon.net.

Calendar of Events

NCA Mirror- and Telescope-making Classes: Fridays, May 1, 8, 15, 22, and 29, 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, May 9 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

May 9, 2009
Dr. Tom Armstrong, Naval Research Laboratory
Interferometric Imaging at Visible Wavelengths: Why, How, and Initial Results

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

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Total	_____

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Next NCA Mtg:

May 9

7:30 pm

@ UM Obs

Dr. Tom Armstrong

Inside This Issue