Can you believe it? This fall marks the 58th anniversary of the founding of the DAS. I wonder if those six DuPont engineers who shared a common interest in 1956 ever imagined that the organization they started would still be going strong more than a half century later. I think it proves something: that a large number of people, whether scientifically educated or not, have a curiosity about the sky and what it contains. Witness the enthusiasm of the folks at our recent outreach event at the Woodside Creamery. The kids say “That’s cool”. The adults say “I’ve always had an interest”.

I’ve been looking over some of the earliest copies of the FOCUS and found a mimeographed sheet that must have been posted around town inviting interested folks to attend the next meeting. It said:

“Our Society was organized just recently and its activities and progress will depend largely upon membership interest and participation, whether it be telescope making, photography, satellite tracking [Sputnik had just recently been launched], star and planet study – or just plain learning the constellations. Previous knowledge of astronomy is not required; sincere interest is.”

Obviously, the sincere interest is still around. As we begin our 59th year of sharing and encouraging our common interest I’m looking forward to having some fun and learning something new. Like the kids said above “That’s cool!”

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Each issue of FOCUS is full of useful hyperlinks. Just click on any graphic or telltale blue web address and your browser should take you to additional linked web resources.
DASOC (DAS Observing Committee)  

Fred De Lucia

An ad hoc Observing Committee is being formed to address the observing proclivities of DAS. Consider this another extension of the DAS as are the Astrophotography and Telescope Making Special Interest Groups but centered on visual astronomy. The DASOC will formally meet as needed, but routinely will correspond via individual email or phone and then inform DAS members of a Clear Sky Session for telescope observing by posting observing plans on the DAS Yahoo Group. DASOC will also plan any overnight observing trips, working as necessary with other area astronomy clubs, sometimes for overnight observing excursions. Observing sites would include the Sawin, ChesLen Preserve, Tuckahoe State Park, Coyle Field, NJ, Cherry Springs State Park or any astronomy friendly place. Possibly, depending on participation, more than one site could be involved on a given night.

Also, did you just buy or want to buy a telescope? If you would like to be paired with a DAS Mentor, then DASOC is a good resource to utilize. You can spend time with an experienced observer to learn your way around your telescope and the night sky - something more personal than the group sessions at star parties. These mentoring sessions can be at home, the Sawin and scheduled at the convenience of the participants.

We want to expand the number of our volunteer “mentors” who are willing to work one-on-one (or 2, 3 on-one) with beginners and new members to work together at their homes or at the Sawin.

Email me, Fred De Lucia, DAS Observing Chair at fredworld@verizon.net or call me at 609-410-8943 if you have an interest in being part of the DASOC or would just like more information or have questions.

Sawin Certification Program  

Fred De Lucia

The Sawin is the major centerpiece of DAS. In the past it was in use much more often and by a number of members on every clear Friday night. It has been largely underutilized for a number of reasons. One reason, I believe, is that newer members or members who do not own a telescope might feel intimidated by the equipment and the observatory’s layout. We hope to address this by instituting the Sawin Certification Program. With the new upgrades installed, its use will be more inviting and user friendly to both new and experienced members. Certified Key Holders of the Sawin have access to its use at any time without supervision.

The Program will consist of a minimum of 2 sessions, scheduled at the Sawin, to obtain the necessary knowledge and experience in using the Sawin equipment. These sessions will be supervised by a current Sawin Key Holder.

The first session, likely set for a weekend in the daylight (even if it’s cloudy), will familiarize learners with the layout of the Sawin and overall operation, including opening the roof, uncovering and covering the telescopes, handling eyepieces and pointing the telescopes, etc.

If the supervising Sawin Key Holder determines that progression during the first session is acceptable, then the second session will be scheduled for a clear sky night session to address night time use of the equipment.

The Sawin Certification Program is for DAS members only who are in good standing and 16 years of age or older. Participants in the program who are under 18 years of age must be accompanied by a parent or guardian.

For information or sign-up, please, contact Greg Lee, DAS President at greglee288@gmail.com.
The ChesMont Astronomical Society is in the preliminary stages of organizing their annual observing trip to Spruce Knob, WV, the darkest observing site on the east coast, a black zone on the Light Pollution map. (See the November 2012 FOCUS pages 10, 11 & 30 for a full observing report on the 2012 trip available in The FOCUS Archive at www.delastro.org)

This annual stay is in the Canaan Valley Ski Resorts area in West Virginia. Members (plus spouses or companions) of various clubs make the trip. Any number, usually from 8 to 18 or more stay for 2 to 4 nights or more or less depending on everyone's schedules and spend the daytime non-observing hours however and with whomever desired, be it sightseeing, horseback riding, visiting area shops, restaurant hopping, etc. There is no formal schedule. Dinner gatherings, cell phones and texting make it easy to stay in touch for the night's observing plans. It's a complete no pressure, relaxation-filled, tension depleting getaway that just happens to involve banding together with each other's favorite telescope(s) to observe West Virginia's magnificent night skies from several of the area's outstanding vantage points.

This year's trip is planned during the best dates for observing, Sept. 20 to Sept. 27. Figure on check-in on or after Sept. 20 and check-out on or before Sept. 28 for however many days/nights you intend to stay. Those with flexible schedules will have the most leeway to take advantage of any last minute weather changes or even piggy-backing your trip to WV after the DelMarva Stargaze.

So as not to clutter up the inboxes of others, anyone who has questions or is otherwise interested should email me off line at fredworld@verizon.net. Over the next week or so, information regarding accommodations and room rates will be available and as I'm made aware of it, I'll communicate it to all respondents, also, off line.

Clear, dark and steady skies,
Fred De Lucia,
Observing Chair

---

**New Slate of Officers Selected in May’s Elections Took Office July 1st**

A new slate of officers for the Delaware Astronomical Society was chosen in the May elections and began their terms and took office on July 1. The newly elected members are:

- Gregory Lee - President
- Rob Lancaster - Vice-President
- Bill McKibben - Secretary
- Jeff Lawrence - Treasurer

Congratulations to all, may you reign in good health!
Fred De Lucia
Election Chair

---

**Call for DAS AstroImages for Display in Mt. Cuba Lobby**

MCAO is asking for any DAS members to submit their astroimages for display in the Observatory. It would like to display the club member's talents and update some of the images currently on display in the lobby of the Observatory.

Images will be displayed for up to a year and replaced as new images are submitted. Full credits to the imager will be included. Please include all technical information with the image (date, telescope and camera used, exposure time, image processing software, etc.). You may email digital images to the Mt. Cuba website. Photos may be sent to the Observatory or brought to a DAS meeting.

The Observatory looks forward to displaying your beautiful images! Contact Greg at mtcuba@physics.udel.edu.

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FOCUS uses plenty of photos in banners & elsewhere each issue, and we want to use YOURS...not Hubble's!!

Please forward photos to the FOCUS editor Joe Neuberger at JRNeuberger@gmail.com

Click to Sign up for Science@NASA News Alerts and Stay Informed About EVERYTHING to do with Man’s Exploration of the Universe!
Refiguring of the DAS 17.5” Mirror has been Completed with a Strehl Ratio of 0.971

By Bill Hanagan

The refiguring of the DAS 17.5” Newtonian mirror is now complete. This is an epic story and I don’t have time to go into it in depth at the moment, so for now I’ll just report the end results and mention a few key points. The key figures of merit for the mirror are these: the final Strehl ratio = 0.971 and the RMS error on the wavefront = 0.027 waves. The best fit conic constant is -0.997. All of this means that the figure is very, very close to a perfect paraboloid. A contour plot for the mirror appears in Figure 1 at a scale that we commonly used during the work.

A wire mesh plot of the wavefront error viewed from the side appears in Figure 2. The white numbers should be ignored. The separation between the highest and lowest points on the wavefront (P-V error) is 1/6.2 waves, but the areas involved are very small, which is why P-V error is not widely favored as a quality metric by optical experts.

Note in particular that there is no spiking up or down at the edges of this wire mesh plot, which means that no significant area around the edge is turned either up or down.

Is the mirror perfect? As a practical matter, I think it is, but there is still some residual medium scale roughness that is readily seen in the Ronchi test and the Foucault knife edge test. However, both of those tests can be said to be overly sensitive to medium scale roughness. In Star Testing Astronomical Telescopes, Optical Guru H.R. Suiter notes that medium scale roughness of 0.05 waves RMS on the wavefront is acceptable and at 0.025 (continued on next page)
waves the MTF function of medium scale roughness is nearly indistinguishable from a perfect unobstructed aperture. With an overall RMS error of 0.027 waves, our 17.5" mirror should be a great performer when coupled with our new Antares optics secondary mirror, provided that optical problems with the mirror cell and heat in the telescope are fully addressed.

Lastly, on behalf of the DAS, I’d like to thank all of those who in addition to myself have helped in the refiguring of the 17.5" mirror. They are Rob Lancaster, Jeff Lawrence, Greg Lee, Terry Lisansky, Diana Metzger, my wife Mary Ann, and all of the spouses and significant others who gave up time with these DAS members so they could work on the club’s 17.5" mirror (and share in a few goodies).

“PUBLIC NIGHTS” at the Mt. CUBA OBSERVATORY...

MCAO PUBLIC NIGHTS

The Mt. Cuba Observatory Public Nights continue year round! In addition to learning about many aspects of the heavens, you’ll have a chance to visit and view our all-digital full-dome planetarium. You can pick up a schedule when you next come to a meeting or get the latest updated version off the website at: http://MountCuba.org. Programs are presented on Monday nights at 8pm. Please check the website for full details and updates on programs planned. Interested individuals or groups can apply by letter or call 654-6407 (preferably between the hours of 9 and 11 am, Monday through Friday) to the Observatory to obtain reservations for these “Public Nights”.

The Public Nights schedule for 2014 follows:

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Friday Night Lights at ChesLen Preserve by Fred De Lucia

The National Land Trust’s Friday Night Lights on July 11, 2014 unfolded under mostly cloudy skies despite weather forecasts for clear to mostly clear. This annual event has been sponsored by the Natural Lands Trust and Univ. of Pennsylvania radio station WXPN for several years in a row and has become the largest outreach event at the ChesLen Preserve in Chester County, PA. The geographic spread of participants who answered the call to bring telescopes covered 6 counties in two states! Members from three astronomy clubs came together to share telescope views with an unsuspecting public as many people saw more amateur telescopes in one night than most see in a lifetime.

Sixteen telescopes were busy all night showing off a full moon and Saturn. The bustling capacity crowd of 300+ when not awed by a view through a telescope was busy with wine, locally crafted beer, s’mores, pretzels and snacks.

 Appropriately so, Ginger Coyle’s band opened the event with Van Morrison’s “Moon Dance” as the full moon peeked out from clouds. I had a line at my scope of at least a dozen at any given time. My wife was busy getting everyone their name tags and keeping me supplied with S’mores and pretzels. Few of us, other than the guests who came with us, found time to see and hear Ginger Coyle up close, and based on what I heard from my hilltop position, I missed some quality entertainment.

So many first time telescope lookers were fascinated by the view of Saturn. “It looks like the pictures I see in books,” was a frequent comment. I just kept my 18” scope on Saturn for the entire night at 283x as I was too busy chatting up astronomy and the hobby with anyone who asked a question, and there were many.

As is now evident after 4 of these annual events, helping with this affair is not about observing under a clear dark sky. It’s about relationships with the NLT, whose associates are so very accommodating and our relationship with the public.

This ever-popular annual event raises the bar for outdoor parties! Next year come out and enjoy a relaxing evening of live music, adult beverages, delicious treats, crackling fire, star gazing, and sunset socializing at the picturesque ChesLen Preserve.

WXPN always provides a local musical artist for a memorable night of entertainment, along with craft beer, wine, and an assortment of sweet and savory treats from local eateries.

Bring your own lawn chairs or blanket, and join us for a casual evening of adult socializing under the night sky.
Delaware State University and the University of Maine team up at NASA Wallops Flight Facility to Collect Data from Space!  

Mike Cimorosi

This summer (June 21 – 26, 2014), Delaware State University and the University of Maine teamed up to participate in NASA’s RockOn! 2014 Workshop at Wallops Flight Facility in Virginia. Thirteen other colleges were in attendance. NASA offers this STEM-motivated workshop for educators and students to engage in a hands-on, space-based mission. The Principal Investigator, Chris Koehler (pronounced KAY LER) of the Colorado Space Grant Consortium (COSGC), and his team of ‘helpers’ (referred hereafter as the A-Team) from the University of Colorado provided pre-designed electronics kits for each team to assemble.

A special thanks go to the Delaware Space Grant Consortium (DESGC), directed by Dr. Dermott Mullan and coordinated by Cathy Cathell, for covering the registration, travel, meals, and lodging (Refuge Inn) expenses. (http://delspace.org/contact-us.html)

Now, let me introduce Team 16 (left to right in Figure 2): Richard Eason is an Electrical and Computer Engineering Professor at the University of Maine – Orono, Michael Cimorosi is a Physics Instructor at Delaware State University, and Dillon Badman is an Engineering Physics major with a Bioengineering track at Delaware State University.

Delivery of our payload into space was provided by a NASA Terrier-Improved Orion suborbital sounding rocket (see Figures 3 and 4). This rail-launched rocket is a remnant of the Nike missile defense program. Of course, it now has a more peaceful mission. With a length of 33 feet, diameter of 14 inches, and payload of 659 pounds, this spin-stabilized rocket took just 173 seconds to deliver our sensors to a maximum altitude of 73 miles (an altitude greater than 60 miles is defined as space).

In addition to Delaware and Maine, the following states were represented at the workshop: California, Colorado, Hawaii, Indiana, Maryland, Mississippi, Montana, Nebraska, New Hampshire, Oregon, Virginia, Vermont, and West Virginia. Fifty undergraduate students and fifteen faculty members participated. The entire group was divided into twenty-one teams, the largest number ever! A complete list of this year’s workshop participants may be found in the Delaware Astronomical Society library.

As some of you are aware, in July, 2012, I was part of a six-member team that participated in NASA’s Reduced Gravity Education Flight Program (RGEFP) at Johnson Space Flight Center (http://delastro.org/archives/focus, September, 2012 issue). During the WorkOn! 2014 workshop, I met with (continued on following page)
Don Edberg, an Aerospace Engineering Professor at California Polytechnic State University – San Luis Obispo, previously participated in NASA’s RGEFP twice. In July, 2014, he and six of his students participated in it, again. A busy NASA summer for Don.

The RockOn workshops are not about building rockets, but about building rocket payloads. Each team was responsible to assemble its own electronic sensor array, which included a Geiger counter, gyroscope, accelerometer, temperature sensor, humidity sensor, and pressure sensor.

On Saturday morning, construction began without a hitch (see Figures 5, 6, and 7). By afternoon, it was noticed that only two teams had a properly functioning Geiger counter. For the remaining teams, the red indicator LED failed to blink, and no clicks were audible on the speaker. The launch count-down was ticking but progress had halted! “Houston, we have a problem!” However, due to some over-time and effort by the A-Team, the problem was diagnosed and corrected.

A special thanks was given to Parker Swanson (see Figure 8) a faculty member of the Computer Science Department at Linn-Benton Community College in Oregon, who determined that a specific IC chip, the 555 timer, was the culprit. Apparently, not all 555 timer chips are created equal! With the 555 timer circuit modified, we were now back on track for launch. After a collective sigh of relief, the teams gave a round of applause to the A-Team and Parker!

On Sunday, construction and testing moved forward now that each team had a functioning Geiger counter. The next major components to assemble were the SHIELD (sensor and data storage board) and Arduino Mega (a computer-to-sensor interface microcontroller). A more detailed copy of the construction agenda may be found in the library of the Delaware Astronomical Society.

By Wednesday, our sensor array was assembled, secured to a mounting plate (see Figure 9), and ready for Chris Koehler’s final approval before canister integration (see Figure 10).

Our sensor array passed ‘inspection’ and was secured to the top of a NASA-designed canister (see top array on left canister in Figure 11). The next step was to walk the canisters to Building F10 for canister-to-payload integration (see Figure 12). (contined on page 8)
DSU and the Univ. of Maine team up at NASA Wallops Flight Facility  
A final systems check verified that each team’s sensor array was functioning and ready for space flight! Now the payload was placed inside the rocket’s protective red casing (see Figure 13), which each team member had previously autographed (see Figure 14)!

Thursday: Launch before lunch! The tentative launch time was 5:30 AM. At ‘O’Dark-thirty’, the 21 teams reported to the NASA launch facility between 4:30 AM and 5:00 AM. However, due to the threat of a lighting storm and fishing boats straying into the splashdown zone, the launch countdown was put on hold. Finally, at precisely 7:20 AM, with clear skies overhead, and the splashdown zone free of wandering fisherman, a one-minute countdown was heard over a PA system. With a voice ringing out “10, 9, 8, …”, we joined in to count the final seconds until lift-off! At precisely 7:21:00 AM (see my video of the launch at https://www.dropbox.com/s/ostmlc5tk54loiu/VID00019.MP4), with a bright flash and a one-second delayed sonic boom, we watched in awe as our payload was on its way to ‘kiss the sky’! This year’s RockOn group observed the launch from a distance of 1600 feet. This is about 600 feet closer to the launch than any other RockOn group had ever been! Just 2.88 minutes after launch, the payload reached maximum altitude. Twelve minutes after lift-off, the payload safely splashed down 45 miles from the launch-site and was bobbing up and down in the Atlantic Ocean … a bit “shaken, but not stirred!”

There was nothing more for us to do but wait until the payload was recovered and returned to Building F10. After lunch, Chris notified us that the payloads were in Building F10 and ready for us to pick up and transport to Building F3. Once our sensor array was removed from the payload (see Figure 15), Rick carefully transported it from Building F10 to Building F3. With the array safely delivered, Rick, Dillon, and I began the data acquisition process. To our astonishment, each sensor had successfully recorded data for the entire flight. Mission accomplished! This successful launch made it seven out of seven since the RockOn! workshop began in 2007! The “Force was with us”! All that remained now was to download a copy of our ‘cleaned up’ post-flight data for the Colorado Space Grant Consortium.

Included in this article is a graph of Inner Payload Temperature vs Time of Flight (see Fig. 16). Prior to the workshop, each team member was approved to send a maximum of 11 grams (no living organisms or explosives permitted) into space as mementos. Before leaving Building F3, our mementos were returned unscathed from the rigors of space flight. However, NASA required each of us to sign an agreement which prohibited the sale of them as having ‘flown in space’! Just in case you’re curious, I sent five dimes. Also, we were permitted to keep the sensors we built. Dillon happily claimed the Arduino Mega, Rick selected the SHIELD, and I was satisfied to get the Geiger counter.

On Friday, with my second NASA mission experience successfully completed, I headed home to share photographs, videos, and my experience with awaiting friends and family!
The last outreach event of the Summer Season at the Woodside Farm Creamery in Hockessin is coming up in early October. This is a fun opportunity to meet with the public and share the hobby of Astronomy.

Witnessing people’s first glimpse of the craters of the moon, rings of Saturn, or moons of Jupiter with a decent telescope is always fun, and a reminder of what got us into the hobby in the first place!

All events fall on Friday nights. The last event scheduled will be as follows:

October 3rd - 5:30pm

I will make a judgment call based on the weather the morning of the event, but I tend to err towards the side of hosting the event. Even if the skies are not cooperative, the ice cream is always cold and it is fun to hang out and socialize. If you have an easy-to-setup telescope or binoculars, please bring them. If not, come anyhow, and share your knowledge and some ice cream with the public. Our focus will be on the moon and whatever planets are up at that time.

Woodside is located at 378 North Star Road, Newark, DE 19711. More information can be found on their website: [http://woodsidefarmcreamery.com/](http://woodsidefarmcreamery.com/).

Here's hoping to see you there for some great outreach, homemade ice cream and comaraderie among existing members and potential new members experiencing the night sky for the first time!!

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**DAS Now has a Discount Subscription Rate for *Astronomy Technology Today* Magazine and *Amateur Astronomy* Magazine**

*Astronomy Technology Today*: Members can subscribe directly on-line and then in the appropriate box enter the club’s discount code which is: **DAS**. During the order process, members simply enter the discount code and they will receive the discounted rate at checkout. **Print subscribers also have unlimited access to all current and past digital issues at no additional cost.** Normal print subscriptions are $18 per year. The club rate is $14 per year. The magazine is issued bi-monthly. [https://www.astronomytechnologytoday.com/](https://www.astronomytechnologytoday.com/)

*Amateur Astronomy Magazine: DAS members must print, fill out and mail the form found in the “Files” section of our Yahoo email list website. The magazine is issued quarterly. [http://www.amateurastronomy.com/index.htm](http://www.amateurastronomy.com/index.htm)

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One of the most beautiful stargazing locations on Earth. . .

Hundreds of amateur astronomers gather at Cherry Springs, MD to catch a glimpse of the stars and the Milky Way.
by Fred De Lucia,  
DAS Observing Chair

With Greg Lee’s election as President he had to vacate the Observing Chair position that he held for over 10 years. So, Greg appointed me as his successor to the Observing Chair, and honestly, it’s with some trepidation that I accepted the role. Greg’s engaging monthly “What’s Up” talks at our meetings and his encyclopedic knowledge of the sky is a tough act to follow and one that I hope to follow through on in my own way. It’s particularly challenging for a number of other reasons. Most notably, the DAS meetings through December 2015 all fall in the dark window, that time of the Lunar Calendar which is most favorable for observing at dark sites. Consequently, my concern is that meeting attendance could drop if skies are clear on meeting nights. We will plan to have the Sawin open for observing on every clear sky meeting night. If members wish to bring a telescope on a meeting night that’s forecast for clear skies, they are welcome to do so. I think this could work well, especially, with the new Sawin upgrades that will be implemented soon, if they are not already in play by the time you read this. Additionally, we are implementing a plan for broader use of the Sawin that is outlined elsewhere in this FOCUS.

Too Cold in the Sawin for you?

Rob Lancaster’s video transmission of SN2014j, the supernova from last February in M82, was an engaging adjunct during one of our meetings. He set up the image from the Sawin and sent it to the MCAO lecture room. Perhaps we can keep you warm with similar sessions. I’ll be working with Rob on that for ideas.

MSPs Being Replaced with “Clear Sky Sessions”

The MSP (Members’ Star Party) schedule that was limited to weekends during the least intrusive Lunar Phases will be discontinued. Instead, we are replacing them with “Clear Sky Sessions.” These Clear Sky Sessions are designed to observe the night sky during any phase of the moon so as to engage as broad a spectrum of members as possible, during clear sky nights. This could be any night of the week. On occasions, perhaps we will even have a Solar Saturday observing session of the Sun during daylight.

Bellevue State Park and the Delaware Museum of Natural History

I am in discussions for scheduling our 2015 participation with the Bellevue State Park and Delaware Museum of Natural History events so as to avoid any overlapping or back-to-back dates with these venues. By doing so, we should be able to ease the burden on the few members who regularly bring their telescopes to these events and hopefully, we will enlist the assistance of more members.

And for Those who Don’t Venture out to Darker Areas

During our monthly meetings I should be able to provide an overview of notable backyard sky events, similar to “What’s Up” but more or less, it will be about seeing what one can see “From the Observing Chair.”

Click to and Stay Informed About EVERYTHING to do with Man’s Exploration of the Universe!
September 5 saw DAS at the Woodside Creamery for the creamery’s Telescope Night. Greg Lee, Rob Lancaster, Jeff Lawrence, Bill Hanagan, new members Phil Moyer and Rusty along with family members and myself handled the ice cream satiated public in their ongoing thirst for repeated views of an 11 day old Waxing Gibbous Moon, Saturn and Mars. Initially, the clouds limited my telescope to targeting the pine cones at the top of a distant tree, described as bananas by one very young female, but what started as a near cloud-out turned into a very successful night. As the ice cream was scooped out of containers the clouds were pushed off unveiling an inviting view of our nearest celestial neighbor. Several sets of large binoculars, a pair of refractors, a 10” Dob and Rusty’s 8” equatorially mounted Newt kept the curious crowd of slurping youngsters and their attentive adult overseers thrilled with the views. Many made repeated rounds to the various optics for comparison views (perhaps there are some budding astronomy equipment junkies among them).

Next month is our last Telescope Night at the Woodside for the year, so we hope to see you there on October 3.
Images by Member Frank Colosimo from His Blue Mountain Vista Observatory at New Ringgold, PA

Both of these images were taken with wide-field imaging equipment - a Takahashi FSQ106 and SBIG STL-11000 camera on an Orion Atlas mount.

IC 1318 (Gamma Cygni Region in Cygnus) is a diffuse emission nebula complex surrounding the bright star Gamma Cygni, or Sadr, which is the center star of the Northern Cross. Sadr is a bright yellow-white F8 supergiant star of magnitude 2.2 and lies around 1800 light years away.

Date: July, 2014
Location: New Ringgold PA
Optics: Takahashi FSQ106ED 530 mm focal length
Mount: Orion Atlas
Camera: SBIG STL 11000
Guiding: SBIG onboard guide chip
Exposure: RGBHA - R:13x6 min, G:21x6 min, B:17x6 min, HA: 27x10 min for a total of 9.6 hrs
Processing: Image acquisition using CCD Autopilot. Initial processing was done using Maxim DL with subsequent processing with Photoshop.

See full sized image above at: http://www.star-watcher.org/IC1318-FCC.jpg

NGC 7000 (Sharpless 2-117, Caldwell 20, North American Nebula) is an emission nebula in Cygnus not far from Deneb. It is commonly called the 'North America' nebula due to its shape which has a remarkable similarity to the continent. In this wide view, the Pelican Nebula, (IC 5070) can be seen to the right. The red cloud of ionized hydrogen is made more visible in the photograph by use of an HA filter which increases the contrast of this relatively faint emission.

Date: June 2014
Location: New Ringgold PA
Optics: Takahashi FSQ106ED 530 mm focal length
Mount: Orion Atlas
Camera: SBIG STL 11000
Guiding: SBIG onboard guide chip
Exposure: RGBHA - R:9x6 min, G:9x6 min, B:9x6 min, HA: 10x10 min for a total of 4.4 hrs
Processing: Image acquisition using CCD Autopilot. Initial processing was done using Maxim DL with subsequent processing with Photoshop.

See full sized image above at: http://www.star-watcher.org/NGC7000-SynL-HaRGB2.jpg
Star Parties, Upcoming Events and Activities

September 5, 2014 6:30 pm - 9:00 pm
The International Observe the Moon Night at Woodside Creamery

Enjoy ice cream during InOMN as DAS shares telescope views of the Moon.
http://www.woodsidefarmcreamery.com/
http://observethemoonnight.org/

September 12, 2014 7:00 pm - 9:00 pm
VATICAN OBSERVATORY ASTRONOMER at DVAA

Brother Guy Consolmagno - Astronomer, Author, Vatican Scientist is the guest speaker at the 9/12/14 DVAA Meeting. TOPIC: “Is Vesta a Protoplanet? (Probably not!”

September 13, 2014 8:00 pm - 9:30 pm
Introduction to the Night Sky at Bellevue State Park

Bellevue State Park offers an evening of stargazing as DAS shows constellations and gives an introduction to observing the night sky. Equipment will be available, or you may bring your own. Red-filtered lights only please. No fee for this program.
Call the Park to pre-register 302-761-6963.
Meet in the Hunter Barn parking lot.
http://www.destateparks.com/park/bellevue/programs/

September 15, 2015 8:00 pm - 9:30 pm
DAS Monthly Meeting

Topic: TBD; DAS Board meeting at 7PM, all are welcome. General meeting at 8PM.
Topic: What Did You Do This Summer? Various DAS members present their Summer astronomy activities. DAS Board meeting at 7PM, all are welcome. General meeting at 8PM.

September 18, 2014 - September 21, 2014
DelMarva Fall No Frills Star Party

DelMarva Fall No Frills Star Party at the Tuckahoe Equestrian Center http://www.delmarvastargazers.org/
Many DAS members attend this event every year. Join the fun.

September 24, 2014 - September 28, 2014
DAS Partners with ChesMont on a WV Observing Trip

Annual observing trip to Spruce Knob, WV, the darkest observing site on the east coast. Interested? Contact Fred De Lucia, DAS Observing Chair.
Star Parties, Upcoming Events and Activities (continued)

October 3, 2014 5:30 pm - 8:00 pm
**Woodside Creamery Telescope Night**
Enjoy farm fresh homemade ice cream under the waxing gibbous Moon as DAS members share telescope views with all. [http://www.woodsidefarmcreamery.com/](http://www.woodsidefarmcreamery.com/)

October 4, 2014 7:00 pm - 8:30 pm
**Astronomy Day at the Delaware Museum of Natural History**
Astronomy presentation in the lecture hall and if weather permits a star party on the rear lawn. DAS and MCAO Partners with DelMNH for Astronomy Day. [http://www.delmnh.org/calendars.php](http://www.delmnh.org/calendars.php)

October 20, 2015 8:00 pm - 9:30 pm
**DAS Monthly Meeting**
Topic: TBD; DAS Board meeting at 7PM, all are welcome. General meeting at 8PM.
Topic: Visitors from Space, Part II: Bob Summerfield of Astronomy to Go is the Guest Speaker at the General Meeting; The overwhelming response to Part I at the June meeting demanded a return visit. DAS Board meeting at 7PM, all are welcome. General meeting at 8PM.

October 24, 2014 - October 26, 2014
**Kopernik AstroFest 2014**
[http://kopernikastro.org/astrofest/](http://kopernikastro.org/astrofest/)

November 1, 2014 7:00 pm - 10:00 pm
**Introduction to the Night Sky at Bellevue State Park**
Bellevue State Park offers an evening of stargazing as DAS shows constellations and gives an introduction to observing the night sky. Equipment will be available, or you may bring your own. Red-filtered lights only please. No fee for this program.
Call the Park to pre-register 302-761-6963.

November 18, 2014 8:00 pm - 9:00 pm
**DAS Monthly Meeting**
Topic: TBD; DAS Board meeting at 7PM, all are welcome. General meeting at 8PM.

December 13, 2014 7:00 pm - 10:00 pm
**Delaware Museum of Natural History: The Geminid Meteor Shower**
Astronomy presentation in the lecture hall on the Geminid Meteor shower presented by DAS and if weather permits a star party on the rear lawn. [http://www.delmnh.org/calendars.php](http://www.delmnh.org/calendars.php)

December 16, 2014 7:00 pm - 9:00 pm
**DAS Holiday Party at MCAO**
DAS Holiday Party for DAS members and invited guests only; No Board Meeting tonight.
This news release is reprinted courtesy of the European Space Agency, which is leading the Rosetta mission to Comet 67P.

August 2, 2014: As the ESA's Rosetta spacecraft closes to within 1000 km of Comet 67P/Churyumov-Gerasimenko, the Rosetta science team has released a new image and made the first temperature measurements of the comet's core. The temperature data show that 67P is too hot to be covered in ice and must instead have a dark, dusty crust.

The new image was acquired on August 1st at 02:48 UTC by the OSIRIS Narrow Angle Camera onboard Rosetta at a distance of approximately 1000 km. It shows the rough surface of the double-lobed core in amazing detail.

Thermal observations of comet 67P/Churyumov-Gerasimenko were made by Rosetta's visible, infrared and thermal imaging spectrometer, VIRTIS, between 13 and 21 July, when Rosetta closed in from 14 000 km to the comet to just over 5000 km.

At these distances, the comet covered only a few pixels in the field of view and so it was not possible to determine the temperatures of individual features. But, using the sensor to collect infrared light emitted by the whole comet, scientists determined that its average surface temperature is about -70°C. Although -70°C may seem rather cold, importantly, it is some 20–30°C warmer than predicted for a comet at that distance covered exclusively in ice.

"This result gives us the first clues on the composition and physical properties of the comet's surface," says VIRTIS principal investigator Fabrizio Capaccioni from INAF-IAPS, Rome, Italy.

Other comets such as 1P/Halley are known to have very dark surfaces owing to a covering of dust, and Rosetta's comet was already known to have a low reflectance from ground-based observations, excluding an entirely 'clean' icy surface. The temperature measurements provide direct confirmation that much of 67P's surface must be dusty, because darker material heats up and emits heat more readily than ice when it is exposed to sunlight.

"This doesn't exclude the presence of patches of relatively clean ice, however, and very soon, VIRTIS will be able to start generating maps showing the temperature of individual features," adds Dr Capaccioni.

As Rosetta approaches and later orbits the comet, the sensor will study the variation of daily surface temperature in order to understand how quickly the surface reacts to solar illumination. In turn, this will provide insight into the thermal conductivity, density and porosity of the top tens of centimetres of the surface--important data to help select a target site for Rosetta's lander, Philae.

It will also measure the changes in temperature as the comet flies closer to the Sun along its orbit, providing substantially more heating of the surface.

"Combined with observations from the other 10 science experiments on Rosetta and those on the lander, VIRTIS will provide a thorough description of the surface physical properties and the gases in the comet's coma, watching as conditions change on a daily basis and as the comet loops around the Sun over the course of the next year," says Matt Taylor, ESA's Rosetta project scientist.

"With only a few days until we arrive at just 100 km distance from the comet, we are excited to start analysing this fascinating little world in more and more detail."

CREDIT: Author: Dr. Tony Phillips | Credit: Science@NASA

Web links:
European Space Agency home page
Rosetta -- from the ESA
Rosetta -- from NASA
NASA Instruments on Rosetta
Rosetta Comet Comes Alive -- from Science@NASA
MYSTERY IN THE OZONE LAYER

Sept. 5, 2014:
High above Earth, more than 20 miles above sea level, a diaphanous layer of ozone surrounds our planet, absorbing energetic UV rays from the sun. It is, essentially, sunscreen for planet Earth. Without the ozone layer, we would be bathed in dangerous radiation on a daily basis, with side effects ranging from cataracts to cancer.

People were understandably alarmed, then, in the 1980s when scientists noticed that manmade chemicals in the atmosphere were destroying this layer. Governments quickly enacted an international treaty, called the Montreal Protocol, to ban ozone-destroying gases such as CFCs then found in aerosol cans and air conditioners. On September 16, 1987, the first 24 nations signed the treaty; 173 more have signed on in the years since.

Fast forward 27 years. Ozone-depleting chemicals have declined and the ozone hole appears to be on the mend. The United Nations has called the Montreal Protocol “the most successful treaty in UN history.” Yet, despite Montreal’s success, something is not … quite … right.

A new study by NASA researchers shows that a key ozone-depleting compound named carbon tetrachloride (CCl₄) is surprisingly abundant in the ozone layer. “We are not supposed to be seeing this at all,” says NASA atmospheric scientist Qing Liang.

Between 2007 and 2012, countries around the world reported zero emissions of CCl₄, yet measurements by satellites, weather balloons, aircraft, and surface-based sensors tell a different story. A study led by Liang shows worldwide emissions of CCl₄ average 39 kilotons per year, approximately 30 percent of peak emissions prior to the international treaty going into effect.

Liang and colleagues took CCI₄ data gathered by NOAA and NASA and plugged it into a NASA computer program, the 3-D GEOS Chemistry Climate Model. This sophisticated program takes into account the way CCI₄ is broken apart by solar radiation in the stratosphere as well as how the compound can be absorbed and degraded by contact with soil and ocean waters. Model simulations pointed to an unidentified ongoing current source of CCI₄.

“ ‘It is now apparent there are either unidentified industrial leakages, large emissions from contaminated sites, or unknown CCI₄ sources,’ says Liang.

Another possibility is that the chemistry of CCI₄ might not be fully understood. Tellingly, the model showed that CCI₄ is lingering in the atmosphere 40% longer than previously thought. " ‘Is there something about the physical CCI₄ loss process that we don't understand?’ she wonders.

It all adds up to a mystery in the ozone layer. Liang’s research was published online in the Aug. 18th issue of Geophysical Research Letters. More information about the extra CCI₄ may be found there.

Credits:
Author: Dr. Tony Phillips,
| Production editor: Dr. Tony Phillips | Credit: Science@NASA
Rosetta Arrives at Target Comet

August 6, 2014: Today, after a decade-long journey chasing its target, the European Space Agency’s Rosetta probe, carrying three NASA instruments, became the first spacecraft to rendezvous with a comet, 67P/Churyumov-Gerasimenko.

"After 10 years, five months and four days travelling towards our destination, looping around the sun five times and clocking up 6.4 billion kilometers, we are delighted to announce finally we are here,” said Jean-Jacques Dordain, ESA’s director General.

The latest images of the comet taken by Rosetta are available at http://www.nasa.gov/rosetta.

Comet 67P/Churyumov-Gerasimenko and Rosetta are 252 million miles (405 million kilometers) from Earth, about halfway between the orbits of Jupiter and Mars. The comet is in an elliptical, 6.5-year orbit that takes it from beyond Jupiter at its farthest point, to between the orbits of Mars and Earth at its closest to the sun. Rosetta will accompany the comet for over a year as it swings around the sun and back out towards Jupiter again.

Rosetta is 62 miles (100 kilometers) from the comet’s surface. Over the next six weeks, it will fly two triangular-shaped trajectories in front of the comet, first at the 62-mile (100-kilometer) altitude and then down at 31 miles (50 kilometers). At the same time, the spacecraft’s suite of instruments will provide a detailed scientific study of the comet, scanning the surface to identify a target site for its comet lander, Philae. Eventually, Rosetta will attempt a close, near-circular orbit at 19 miles (30 kilometers) and, depending on the activity of the comet, may come even closer.

"Over the next few months, in addition to characterizing the comet nucleus and setting the bar for the rest of the mission, we will begin final preparations for another space history first: landing on a comet," said Matt Taylor, Rosetta’s project scientist from the European Space Agency’s Science and Technology Centre in Noordwijk, The Netherlands.

As many as five possible landing sites will be identified by late August, before the primary site is identified in mid-September. The final timeline for the sequence of events for deploying Philae -- currently expected for Nov. 11 -- will be confirmed by the middle of October.

Comets are considered to be primitive building blocks of the solar system and may have helped to “seed” Earth with water, perhaps even the ingredients for life. But many fundamental questions about these enigmatic objects remain, and through a comprehensive, in situ study of the comet, Rosetta aims to unlock the secrets within.

The three U.S. instruments aboard the spacecraft are the Microwave Instrument for Rosetta Orbiter (MIRO), an ultraviolet spectrometer called Alice, and the Ion and Electron Sensor (IES). They are part of a suite of 11 science instruments aboard the Rosetta orbiter.

MIRO is designed to provide data on how gas and dust leave the surface of the nucleus to form the coma and tail that give comets their intrinsic beauty. Studying the surface temperature and evolution of the coma and tail provides information on how the comet evolves as it approaches and leaves the vicinity of the sun.

Alice will analyze gases in the comet’s coma, which is the bright envelope of gas around the nucleus of the comet developed as it approaches the sun. Alice also will measure the rate at which the comet produces water, carbon monoxide and carbon dioxide. These measurements will provide valuable information about the surface composition of the nucleus.

The instrument also will measure the amount of argon present, an important clue about the temperature of the solar system at the time the comet’s nucleus originally formed more than 4.6 billion years ago.

IES is part of a suite of five instruments to analyze the plasma environment of the comet, particularly the coma. The instrument will measure the charged particles in the sun’s outer atmosphere, or solar wind, as they interact with the gas flowing out from the comet while Rosetta is drawing nearer to the comet’s nucleus.

NASA also provided part of the electronics package for the Double Focusing Mass Spectrometer, which is part of the Swiss-built Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) instrument. ROSINA will be the first instrument in space with sufficient resolution to be able to distinguish between molecular nitrogen and carbon monoxide, two molecules with approximately the same mass. Clear identification of nitrogen will help scientists understand conditions at the time the (continued on following page)
Rosetta Arrives at Target Comet

The scientific imaging system, OSIRIS, was built by a consortium led by the Max Planck Institute for Solar System Research (Germany) in collaboration with Center of Studies and Activities for Space, University of Padua (Italy), the Astrophysical Laboratory of Marseille (France), the Institute of Astrophysics of Andalusia, CSIC (Spain), the Scientific Support Office of the European Space Agency (Netherlands), the National Institute for Aerospace Technology (Spain), the Technical University of Madrid (Spain), the Department of Physics and Astronomy of Uppsala University (Sweden) and the Institute of Computer and Network Engineering of the TU Braunschweig (Germany). OSIRIS was financially supported by the national funding agencies of Germany (DLR), France (CNES), Italy (ASI), Spain, and Sweden and the ESA Technical Directorate.

Rosetta is an ESA mission with contributions from its member states and NASA. Rosetta's Philae lander is provided by a consortium led by the German Aerospace Center, Cologne; Max Planck Institute for Solar System Research, Gottingen; French National Space Agency, Paris; and the Italian Space Agency, Rome. JPL, a division of the California Institute of Technology, Pasadena, manages the U.S. participation in the Rosetta mission for NASA's Science Mission Directorate in Washington.

Web links:
- European Space Agency home page
- Rosetta -- from the ESA
- Rosetta -- from NASA
- NASA Instruments on Rosetta
- Rosetta Comet Comes Alive -- from Science@NASA
MARS ROVER SETS OFF-WORLD DRIVING RECORD

July 28, 2014:
NASA’s Opportunity Mars rover, which landed on the Red Planet in 2004, now holds the off-Earth roving distance record after accruing 25 miles (40 kilometers) of driving, and is not far from completing the first extraterrestrial marathon. The previous record was held by the Soviet Union’s Lunokhod 2 rover.

“Opportunity has driven farther than any other wheeled vehicle on another world,” said Mars Exploration Rover Project Manager John Callas, of NASA’s Jet Propulsion Laboratory (JPL) in Pasadena, California.

“This is so remarkable considering Opportunity was intended to drive about one kilometer and was never designed for distance.”

A drive of 157 feet (48 meters) on July 27 put Opportunity’s total odometry at 25.01 miles (40.25 kilometers). This month’s driving brought the rover southward along the western rim of Endeavour Crater. The rover had driven more than 20 miles (32 kilometers) before arriving at Endeavour Crater in 2011, where it has examined outcrops on the crater’s rim containing clay and sulfate-bearing minerals. The sites are yielding evidence of ancient environments with less acidic water than those examined at Opportunity’s landing site.

If the rover can continue to operate the distance of a marathon – 26.2 miles (about 42.2 kilometers) - it will approach the next major investigation site mission scientists have dubbed “Marathon Valley.” Observations from spacecraft orbiting Mars suggest several clay minerals are exposed close together at this valley site, surrounded by steep slopes where the relationships among different layers may be evident.

The Russian Lunokhod 2 rover, a successor to the first Lunokhod mission in 1970, landed on Earth’s moon on Jan. 15, 1973, where it drove about 24.2 miles (39 kilometers) in less than five months, according to calculations recently made using images from NASA’s Lunar Reconnaissance Orbiter (LRO) cameras that reveal Lunokhod Z’s tracks.

Irina Karachevtseva at Moscow State University of Geodesy and Cartography’s Extraterrestrial Laboratory in Russia, Brad Jolliff of Washington University in St. Louis, Tim Parker of JPL, and others, collaborated to verify the map-based methods for computing distances are comparable for Lunokhod-2 and Opportunity. The Lunokhod missions still stand as

PERSEID METEORS VS. THE SUPERMOON

10th – also known as a supermoon – will be as much as 14% closer and 30% brighter than other full Moons of the year.

“This is bad news for the Perseids,” says Bill Cooke of NASA’s Meteoroid Environment Office. “Lunar glare wipes out the black-velvety backdrop required to see faint meteors, and sharply reduces counts.”

But there’s good news, too.

The debris stream of Comet Swift-Tuttle is broad, and it is possible to see Perseids as early as late July, well before the Moon becomes full.

Also, notes Cooke, “the Perseids are rich in fireballs as bright as Jupiter or Venus. These will be visible in spite of the glare.”

Using a network of meteor cameras distributed across the USA, Cooke’s team has been tracking fireball activity since 2008, and they have built up a database of hundreds of events to analyze. Their data show the Perseids are the undisputed ‘fireball champion’ of annual meteor showers. “We see more fireballs from Swift-Tuttle than any other parent comet,” he says.

A warm summer night, a moonlit landscape, and an occasional fireball cutting past a supermoon: that’s an ensemble with a special beauty all its own. Enjoy the show.

Credits:
Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips
Credit: Science@NASA

Related video:
Summer Supermoons -- from Science@NASA

Since 2008, the Perseids have produced more fireballs than any other annual meteor shower. The Geminids are a close second. See the data
MYSTERY IN THE PERSEUS CLUSTER

A new ScienceCast video explores the mystery signal coming from the heart of the Perseus Cluster. Click to Play It!

July 24, 2014: The Universe is a big place, full of unknowns. Astronomers using NASA's Chandra X-ray Observatory have just cataloged a new one.

"I couldn't believe my eyes," says Esra Bulbul of the Harvard Center for Astrophysics. "What we found, at first glance, could not be explained by known physics."

Together with a team of more than a dozen colleagues, Bulbul has been using Chandra to explore the Perseus Cluster, a swarm of galaxies approximately 250 million light years from Earth. Imagine a cloud of gas in which each atom is a whole galaxy—that's a bit what the Perseus cluster is like. It is one of the most massive known objects in the Universe.

The cluster itself is immersed in an enormous "atmosphere" of superheated plasma—and it is there that the mystery resides. Bulbul explains: "The cluster's atmosphere is full of ions such as Fe XXV, Si XIV, and S XV. Each one produces a 'bump' or 'line' in the x-ray spectrum, which we can map using Chandra. These spectral lines are at well-known x-ray energies."

Yet, in 2012 when Bulbul added together 17 day's worth of Chandra data, a new line popped up where no line should be. "A line appeared at 3.56 keV (kilo-electron volts) which does not correspond to any known atomic transition," she says. "It was a great surprise."

At first, Bulbul herself did not believe it. "It took a long time to convince myself that this line is neither a detector artifact, nor a known atomic line," she says. "I have done very careful checks. I have reanalyzed the data; split the data set into different sub groups; and checked the data from four other detectors on board two different observatories. None of these efforts made the line disappear."

In short, it appears to be real. The reality of the line was further confirmed when Bulbul's team found the same spectral signature in X-ray emissions from 73 other galaxy clusters. Those data were gathered by Europe's XMM-Newton, a completely independent X-ray telescope.

Moreover, about a week after Bulbul team posted their paper online, a different group led by Alexey Boyarsky of Leiden University in the Netherlands reported evidence for the same spectral line in XMM-Newton observations of the Andromeda galaxy. They also confirmed the line in the outskirts of the Perseus cluster.

The spectral line appears not to come from any known type of matter, which shifts suspicion to the unknown: dark matter. "After we submitted the paper, theoreticians came up with about 60 different dark matter types which could explain this line. Some particle physicists have jokingly called this particle a 'bulbulon,'" she laughs.

The menagerie of dark matter candidates that might produce this kind of line include axions, sterile neutrinos, and "moduli dark matter" that may result from the curling up of extra dimensions in string theory. (Continued on Page 22)

MARS ROVER SETS OFF-WORLD DRIVING RECORD

(continued from page 20)

two signature accomplishments of what I think of as the first golden age of planetary exploration, the 1960s and '70s," said Steve Squyres of University in Ithaca, New York, and principal investigator for NASA's twin Mars rovers, Opportunity and Spirit. "We're in a second golden age now, and what we've tried to do on Mars with Spirit and Opportunity has been very much inspired by the accomplishments of the Lunokhod team on the moon so many years ago. It has been a real honor to follow in their historical wheel tracks." As Opportunity neared the mileage record earlier this year, the rover team chose the name Lunokhod 2 for a crater about 20 feet (6 meters) in diameter on the outer slope of Endeavour's rim on Mars. As impressive as the distance record is, concludes Callas, even more impressive is "how much exploration and discovery we have accomplished over that distance." For more information about the many discoveries of NASA's Mars rovers, visit: http://www.nasa.gov/rovers

Credits:
Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips | Credit: Science@NASA

More information
The Mars Exploration Rover Project is one element of NASA's ongoing and future Mars missions preparing for a human mission to the planet in the 2030s. JPL manages the project for NASA's Science Mission Directorate (SMD), in Washington. NASA's Goddard Space Flight Center, in Greenbelt, Maryland, manages LRO for SMD.

An image of Lunokhod 2's tracks, as imaged by NASA's LRO, is available online at: http://lroc.sese.asu.edu/posts/774

The Mars rover home page at JPL is http://marsrovers.jpl.nasa.gov

Follow the Mars rover project on Twitter at: http://twitter.com/MarsRovers

On Facebook, visit: http://www.facebook.com/mars.rovers
NEW HORIZONS ONLY ONE YEAR FROM PLUTO

July 14, 2014: In July 2015, NASA will discover a new world. No one knows what to expect when the alien landscape comes into focus. There could be icy geysers, towering mountains, deep valleys, even planetary rings.

At this point, only one thing is certain: Its name is Pluto.

On July 14th, 2015, NASA's New Horizons spacecraft will make a close flyby of that distant world. "Because Pluto has never been visited up-close by a spacecraft from Earth, everything we see will be a first," says Adriana Ocampo, the Program Executive for NASA's New Frontiers program at NASA headquarters. "I know this will be an astonishing experience full of history making moments."

The mission's principal investigator, Alan Stern of the Southwest Research Institute, has likened the way New Horizons will revolutionize knowledge about the Pluto system to the way that Mariner 4, which flew past Mars in July 1965, revolutionized knowledge of that planet. At the time, many people on Earth thought the Red Planet was a lush world with water and vegetation friendly to life. Instead, Mariner 4 revealed a desert world of haunting beauty.

New Horizons' flyby of Pluto will occur almost exactly 50 years after Mariner 4's flyby of Mars—and it could shock observers just as much. Pluto is almost completely unknown. It is so far away, that even the Hubble Space Telescope strains to see it. The best images so far show little more than Pluto's shape (spherical) and color (reddish). Over the years, changes in those color patterns hint at a dynamic planet where something is happening, but no one knows what.

By late April 2015, New Horizons will be close enough to Pluto to take pictures rivaling those of Hubble—and it only gets better from there. At closest approach in July 2015, New Horizons will be a scant 10,000 km above the surface of Pluto. If New Horizons flew over Earth at the same altitude, it could see individual buildings and their shapes.

Flying so close to Pluto could be risky business. Pluto has five known moons: Charon, Styx, Nix, Kerberos, and Hydra. Numerical simulations show that meteoroids striking those satellites could send debris into orbit around Pluto, forming a debris system that waxes and wanes over time in response to changes in the bombardment. During the approach to Pluto, the science team will keep a wary eye out for debris, and guide the spacecraft away from danger.

"The New Horizons Team continues to do a magnificent job in keeping the spacecraft healthy and No one knows what New Horizons will discover. "Many predictions have being made by the science community, including possible rings, geyser eruptions, and even lakes," says Ocampo. "Whatever we find, I believe Pluto and its satellites will surpass all our expectations and surprise us beyond our imagination." "Think about seeing something for the first time and discovering the unknown," she concludes. "That's what we're about to do."

July 14, 2015: Click to Play It.

A new ScienceCast video previews what New Horizons might see when it reaches Pluto in July 2015.

Credits:
Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips | Credit: Science@NASA

MYSTERY IN THE PERSEUS CLUSTER (continued from page 21)
Solving the mystery could require a whole new observatory. In 2015, the Japanese space agency is planning to launch an advanced X-ray telescope called "Astro-H." It has a new type of X-ray detector, developed collaboratively by NASA and University of Wisconsin scientists, which will be able to measure the mystery line with more precision than currently possible.

"Maybe then," says Bulbul, "we'll get to the bottom of this."

Credits:
Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips | Credit: Science@NASA
Colliding Atmospheres: Mars vs Comet Siding Spring

August 12, 2014: On October 19, 2014, Comet Siding Spring will pass by Mars only 132,000 km away—which would be like a comet passing about 1/3 of the distance between Earth and the Moon.

The nucleus of the comet won’t hit Mars, but there could be a different kind of collision. "We hope to witness two atmospheres colliding," explains David Brain of the University of Colorado’s Laboratory for Atmospheric and Space Physics (LASP). "This is a once in a lifetime event!"

Everyone knows that planets have atmospheres. Lesser known is that comets do, too. The atmosphere of a comet, called its "coma," is made of gas and dust that spew out of the sun-warmed nucleus. The atmosphere of a typical comet is wider than Jupiter.

"It is possible," says Brain, "that the atmosphere of the comet will interact with the atmosphere of Mars. This could lead to some remarkable effects—including Martian auroras."

The timing could scarcely be better. Just last year, NASA launched a spacecraft named MAVEN to study the upper atmosphere of Mars, and it will be arriving in Sept. 2014 barely a month before the comet.

MAVEN is on a mission to solve a longstanding mystery: What happened to the atmosphere of Mars? Billions of years ago, Mars had a substantial atmosphere that blanketed the planet, keeping Mars warm and sustaining liquid water on its surface. Today, only a wispy shroud of CO2 remains, and the planet below is colder and dryer than any desert on Earth. Theories for this planetary catastrophe center on erosion of the atmosphere by solar wind.

"The goal of the MAVEN mission is to understand how external stimuli affect the atmosphere of Mars," says Bruce Jakosky of LASP, MAVEN’s principal investigator. "Of course, when we planned the mission, we were thinking about the sun and the solar wind. But Comet Siding Spring represents an opportunity to observe a natural experiment, in which a perturbation is applied and we can see the response."

Brain, who is a member of the MAVEN science team, thinks the comet could spark Martian auroras. Unlike Earth, which has a global magnetic field that shields our entire planet, Mars has a patchwork of "magnetic umbrellas" that sprout out of the surface in hundreds of places all around the planet. If Martian auroras occur, they would appear in the canopies of these magnetic umbrellas.

"That is one thing that we will be looking for with use as a diagnostic tool for how the comet and the Martian atmosphere have interacted."

"It’s not yet clear whether any significant dust or gas will hit the Mars atmosphere," cautions Jakosky. "But if it does, it would have the greatest effects on the upper atmosphere."

Meteoroids disintegrating would deposit heat and temporarily alter the chemistry of upper air layers. The mixing of cometary and Martian gases could have further unpredictable effects. Although MAVEN, having just arrived at Mars, will still be in a commissioning phase, it will use its full suite of instruments to monitor the Martian atmosphere for changes.

"By observing both before and after, we hope to determine what effects the comet dust and gas have on Mars, if any," says Jakosky.

Whatever happens, MAVEN will have a ringside seat.

Credits:

Authors: Dr. Tony Phillips, | Production editor: Dr. Tony Phillips | Credit: Science@NASA

A new ScienceCast video examines what might happen if the atmosphere of Comet Siding Spring hits the atmosphere of Mars. Click to Play It.

Click to visit the MAVEN home page
T HREE  S UPERMOONS  I N  A  R OW

July 10, 2014: In June of last year, a full Moon made headlines. The news media called it a “supermoon” because it was 14% bigger and 30% brighter than other full Moons of 2013. Around the world, people went outside to marvel at its luminosity.

If you thought one supermoon was bright, how about three….? The full Moons of summer 2014—July 12th, August 10th, and Sept. 9th—will all be supermoons.

The scientific term for the phenomenon is “perigee moon.” Full Moons vary in size because of the oval shape of the Moon’s orbit. The Moon follows an elliptical path around Earth with one side (“perigee”) about 50,000 km closer than the other (“apogee”). Full Moons that occur on the perigee side of the Moon’s orbit seem extra big and bright.

This coincidence happens three times in 2014. On July 12th and Sept 9th the Moon becomes full on the same day as perigee. On August 10th it becomes full during the same hour as perigee—arguably making it an extra-super Moon.”

It might seem that such a sequence must be rare. Not so, says Geoff Chester of the US Naval Observatory. “Generally speaking, full Moons occur near perigee every 13 months and 18 days, so it’s not all that unusual,” he says. “In fact, just last year there were three perigee Moons in a row, but only one was widely reported.”

In practice, it’s not always easy to tell the difference between a supermoon and an ordinary full Moon. A 30% difference in brightness can easily be masked by clouds and haze. Also, there are no rulers floating in the sky to measure lunar diameters. Hanging high overhead with no reference points to provide a sense of scale, one full Moon looks about the same size as any other.

Chester expects most reports of giant Moons this summer to be … illusory.

“The ‘Moon Illusion’ is probably what will make people remember this coming set of Full Moons, more than the actual view of the Moon itself,” he says.

A new ScienceCast video counts the supermoons of summer 2014. Click to Play It.

The illusion occurs when the Moon is near the horizon. For reasons not fully understood by astronomers or psychologists, low-hanging Moons look unnaturally large when they beam through trees, buildings and other foreground objects. When the Moon illusion amplifies a perigee Moon, the swollen orb rising in the east at sunset can seem super indeed.

“I guarantee that some folks will think it’s the biggest Moon they’ve ever seen if they catch it rising over a distant horizon, because the media will have told them to pay attention to this particular one,” says Chester. “There’s a part of me that wishes that this ‘super-Moon’ moniker would just dry up and blow away, like the ‘Blood-Moon’ that accompanied the most recent lunar eclipse, because it tends to promulgate a lot of misinformation,” admits Chester. “However, if it gets people out and looking at the night sky and maybe hooks them into astronomy, then it’s a good thing.”

Indeed it is.

You may have missed the moons on July 12th and August 10th, but mark your calendar for Sept. 9th—(here’s hoping the FOCUS will be out by then) and enjoy the super-moonlight.

Credits:

Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips
| Credit: Science@NASA

NASA Launches New Carbon Observatory

July 2, 2014: NASA has successfully launched its first spacecraft dedicated to studying atmospheric carbon dioxide.

On Wednesday, July 2nd, at 2:56 a.m. PDT, the Orbiting Carbon Observatory-2 (OCO-2) raced skyward from Vandenberg Air Force Base, California, on a United Launch Alliance Delta II rocket. Approximately 56 minutes after the launch, the observatory separated from the rocket's second stage into an initial 429-mile (690-kilometer) orbit. Initial telemetry shows the spacecraft is in excellent condition.

OCO-2 soon will begin a minimum two-year mission to locate Earth’s sources of and storage places for atmospheric carbon dioxide, the leading human-produced greenhouse gas responsible for warming our world and a critical component of the planet’s carbon cycle.

"Climate change is the challenge of our generation," said NASA Administrator Charles Bolden. "With OCO-2 and our existing fleet of satellites, NASA is uniquely qualified to take on the challenge of documenting and understanding these changes, predicting the ramifications, and sharing information about these changes for the benefit of society.”

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(continued on next page)
Saturn's Moon Titan has a Very Salty Ocean

July 2, 2014: Scientists analyzing data from NASA's Cassini mission have firm evidence of an ocean inside Saturn's largest moon, Titan, which might be as salty as the Earth's Dead Sea. The findings are published in this week's edition of the journal Icarus.

"This is an extremely salty ocean by Earth standards," said the paper's lead author, Giuseppe Mitri of the University of Nantes in France. "Knowing this may change the way we view this ocean as a possible abode for present-day life, but conditions might have been very different there in the past."

The new results come from a study of gravity and topography data collected during Cassini's repeated flybys of Titan during the past 10 years. Researchers found that a relatively high density was required for Titan's subsurface ocean in order to explain the gravity data. This indicates the ocean is probably an extremely salty brine of water mixed with dissolved salts likely composed of sulfur, sodium and potassium. The density indicated for this brine would give the ocean a salt content roughly equal to the saltiest bodies of water on Earth.

Their findings also support the idea that the moon's icy shell is rigid and in the process of freezing solid.

The thickness of Titan's ice crust appears to vary slightly from place to place. The researchers said this can best be explained if the moon's outer shell is stiff, as would be the case if the ocean were slowly crystallizing, and turning to ice. Otherwise, the moon's shape would tend to even itself out over time, like warm candle wax. This freezing process would have important implications for the habitability of Titan's ocean, as it would limit the ability of materials to exchange between the surface and the ocean.

The data also touch on a major mystery: The presence of methane in Titan's atmosphere. Scientists have long known that Titan's atmosphere contains methane, ethane, acetylene and many other hydrocarbon compounds. But sunlight irreversibly destroys methane after tens of millions of years, so something has replenished methane in Titan's thick air during the moon's 4.5 billion-year history.

The rigid ice shell model published in Icarus suggests that any outgassing of methane into Titan's atmosphere must happen at scattered "hot spots" (like the hot spot on Earth that gave rise to the Hawaiian Island chain), not from a broader process such as convection or plate tectonics.

"Titan continues to prove itself as an endlessly fascinating world," said Linda Spilker, Cassini project scientist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, who was not involved in the study. "With our long-lived Cassini spacecraft, we're unlocking new mysteries as fast as we solve old ones."

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. JPL manages the mission for NASA's Science Mission Directorate in Washington. For more information about Cassini, visit http://www.nasa.gov/cassini.

Credits:
| Production editor: Dr. Tony Phillips | Credit: Science@NASA

NASA Launches Carbon Observatory (continued from preceeding page)

OCO-2 will take NASA's studies of carbon dioxide and the global carbon cycle to new heights. The mission will produce the most detailed picture to date of natural sources of carbon dioxide, as well as their "sinks" -- places on Earth's surface where carbon dioxide is removed from the atmosphere. The observatory will study how these sources and sinks are distributed around the globe and how they change over time.

"This challenging mission is both timely and important," said Michael Freilich, director of the Earth Science Division of NASA's Science Mission Directorate in Washington. "OCO-2 will produce exquisitely precise measurements of atmospheric carbon dioxide concentrations near Earth's surface, laying the foundation for informed policy decisions on how to adapt to and reduce future climate change."

Carbon dioxide sinks are at the heart of a longstanding scientific puzzle that has made it difficult for scientists to accurately predict how carbon dioxide levels will change in the future and how these changing concentrations will affect Earth's climate. (continued on page 26)
A Laser Message From Space

June 18, 2014: Anyone who remembers dialup internet can sympathize with the plight of NASA mission controllers. Waiting for images to arrive from deep space, slowly downloading line by line, can be a little like the World Wide Web of the 1990s. Patience is required.

A laser on the International Space Station (ISS) could change all that. On June 5th, 2014, the ISS passed over the Table Mountain Observatory in Wrightwood, California, and beamed an HD video to researchers waiting below. Unlike normal data transmissions, which are encoded in radio waves, this one came to Earth on a beam of light.

"It was incredible to see this magnificent beam of light arriving from our tiny payload on the space station," says Matt Abrahamson, who manages the Optical Payload for Lasercomm Science at NASA's Jet Propulsion Laboratory. Better known as "OPALS," the experimental laser device was launched to the space station onboard a Space-X Dragon spacecraft in the spring of 2014. Its goal is to explore the possibility of high-bandwidth space communications using light instead of radio waves. If successful, researchers say OPALS would be like an upgrade from dial-up to DSL, achieving data rates 10 to 1,000 times higher than current space communications. So far so good.

The entire transmission on June 5th lasted 148 seconds and achieved a maximum data rate of 50 megabits per second. It took OPALS 3.5 seconds to transmit a single copy of the video message, which would have taken more than 10 minutes using traditional downlink methods. The message was sent multiple times during the transmission.

Abrahamson says "the video is an homage to the first output of any standard computer program: 'Hello, World.'"

Because the space station whips (continued on next page)

NASA Launches Carbon Observatory (continued from page 25)

"Scientists currently don’t know exactly where and how Earth’s oceans and plants have absorbed more than half the carbon dioxide that human activities have emitted into our atmosphere since the beginning of the industrial era," said David Crisp, OCO-2 science team leader at NASA’s Jet Propulsion Laboratory (JPL) in Pasadena, California. "Because of this we cannot predict precisely how these processes will operate in the future as climate changes. For society to better manage carbon dioxide levels in our atmosphere, we need to be able to measure the natural source and sink processes."

Precise measurements of the concentration of atmospheric carbon dioxide are needed because background levels vary by less than two percent on regional to continental scales. Typical changes can be as small as one-third of one percent. OCO-2 measurements are designed to measure these small changes clearly.

During the next 10 days, the spacecraft will go through a checkout process and then begin three weeks of maneuvers that will place it in its final 438-mile (705-kilometer), near-polar operational orbit at the head of the international Afternoon Constellation, or "A-Train," of Earth-observing satellites. The A-Train, the first multi-satellite, formation flying "super observatory" to record the health of Earth’s atmosphere and surface environment, collects an unprecedented quantity of nearly simultaneous climate and weather measurements.

OCO-2 science operations will begin about 45 days after launch. Scientists expect to begin archiving calibrated mission data in about six months and plan to release their first initial estimates of atmospheric carbon dioxide concentrations in early 2015.

The observatory will uniformly sample the atmosphere above Earth’s land and waters, collecting more than 100,000 precise individual measurements of carbon dioxide over Earth’s entire sunlit hemisphere every day. Scientists will use these data in computer models to generate maps of carbon dioxide emission and uptake at Earth’s surface on scales comparable in size to the state of Colorado. These regional-scale maps will provide new tools for locating and identifying carbon dioxide sources and sinks.

OCO-2 also will measure a phenomenon called solar-induced fluorescence, an indicator of plant growth and health. As plants photosynthesize and take up carbon dioxide, they fluoresce and give off a tiny amount of light that is invisible to the naked eye. Because more photosynthesis translates into more fluorescence, fluorescence data from OCO-2 will help shed new light on the uptake of carbon dioxide by plants.

For more information about OCO-2, visit: http://www.nasa.gov/oco2.

Credits: Author: Dr. Tony Phillips | Production Editor: Dr. Tony Phillips | Credit: Science@NASA

Web Links: Global Climate Change -- climate.nasa.gov OCO-2 -- mission home page
A LASER MESSAGE FROM SPACE (continued from preceding page)

around Earth at 17,500 mph, "laser-tagging" a telescope on the fast-moving ground below can be tricky. To accomplish the precision tag-up, a laser at the ground station illuminated the station. OPALS responded by sending its own 2.5 watt encoded laser signal right back in the same direction, carrying the HD video. During the 148-second transmission, OPALS maintained pointing to the ground station within 0.01 degrees while tracking at speeds up to 1 degree per second.

"NASA missions collect an enormous amount of data out in space," says Abrahamson. "Laser communications is a faster alternative for getting those data to the ground."

As a result, many researchers have started calling the ongoing peak a "Mini-Max."

Pesnell believes that "Solar Cycle 24, such as it is, will probably start fading by 2015." Ironically, that is when some of the bigger flares and magnetic storms could occur. Biesecker has analyzed historical records of solar activity and he finds that most large events such as strong flares and significant geomagnetic storms typically occur in the declining phase of solar cycles—even weak ones.

Indeed, this "Mini-Max" has already unleashed one of the strongest storms in recorded history. On July 23, 2012, a plasma cloud or "CME" rocketed away from the sun as fast as 3000 km/s, more than four times faster than a typical eruption. The storm tore through Earth orbit, but fortunately Earth wasn't there. Instead it hit NASA's STEREO-A spacecraft, which recorded the event for analysis. Researchers now believe the eruption was as significant as the iconic Carrington Event of 1859—a solar storm that set telegraph offices on fire and sparked Northern Lights as far south as Hawaii. If the 2012 "superstorm" had hit Earth, the damage to power grids and satellites would have been significant.

It all adds up to one thing: "We're not out of the woods yet," says Pesnell. Even a "Mini-Max" can stir up major space weather—and there's more to come as the cycle declines.

Credits:

Author: Dr. Tony Phillips | Production editor: Dr. Tony Phillips | Credit: Science@NASA

Web Links:

OPALS -- home page at JPL
OPALS -- information from NASA HQ
June 2, 2014: It only sounds like science fiction. To test a new technology for landing heavy payloads on Mars, NASA is about to drop a flying-saucer shaped vehicle from a helium balloon high above Earth's surface.

The first launch opportunity for the Low Density Supersonic Decelerator (LDSD) is June 3rd at 8:30 a.m. HST, when the launch window opens at the U.S. Navy's Pacific Missile Range Facility in Kauai, Hawaii. Officials are calling it an "engineering shakeout flight."

"The agency is moving forward and getting ready for Mars as part of NASA's Evolvable Mars campaign," says Michael Gazarik, associate administrator for Space Technology at NASA Headquarters in Washington. As NASA plans increasingly ambitious robotic missions to Mars, laying the groundwork for human science expeditions to come, missions will require larger and heavier spacecraft. The objective of the LDSD project is to see if the cutting-edge, rocket-powered test vehicle operates as it was designed -- in near-space at high Mach numbers.

The way NASA's saucer climbs to test altitude is almost as distinctive as the test vehicle itself.

"We use a helium balloon -- that, when fully inflated, would fit snugly into Pasadena's Rose Bowl -- to lift our vehicle to 120,000 feet," said Mark Adler, project manager for the Low Density Supersonic Decelerator at NASA's Jet Propulsion Laboratory. "From there we drop it for about one and a half seconds. After that, it's all about going higher and faster -- and then it's about putting on the brakes."

A fraction of a second after dropping from the balloon, and a few feet below it, four small rocket motors will fire to spin up and gyroscopically stabilize the saucer. A half second later, a Star 48B long-nozzle, solid-fueled rocket engine will kick in with 17,500 pounds of thrust, sending the test vehicle to the edge of the stratosphere.

"Our goal is to get to an altitude and velocity which simulates the kind of environment one of our vehicles would encounter when it would fly in the Martian atmosphere," said Ian Clark, principal investigator of the LDSD project at JPL. "We top out at about 180,000 feet and Mach 4. Then, as we slow down to Mach 3.8, we deploy the first of two new atmospheric braking systems."

The SIAD-R, essentially an inflatable doughnut that increases the vehicle's size and, as a result, its drag, is deployed at about Mach 3.8. It will quickly slow the vehicle to Mach 2.5 where the parachute, the largest supersonic parachute ever flown, first hits the supersonic flow. About 45 minutes later, the saucer is expected to make a controlled landing onto the Pacific Ocean off Hawaii.

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"After years of imagination, engineering and hard work, we soon will get to see our Keiki o ka honua, our 'boy from Earth,' show us its stuff," says Adler. "If our flying saucer hits its speed and altitude targets, it will be a great day."

The project management team decided also to fly two supersonic decelerator technologies that will be thoroughly tested during two more LDSD flight tests next year. If this year's test vehicle flies as expected, the LDSD team may get a treasure-trove of data on how the 6-meter supersonic inflatable aerodynamic decelerator (SIAD-R) and the supersonic parachute operate a full year ahead of schedule.

NASA TV will carry live images and commentary of LDSD engineering test. The test vehicle itself carries several onboard cameras. It is expected that video of selected portions of the test, including the rocket-powered ascent, will be downlinked during the commentary. Websites streaming live video of the test include http://www.nasa.gov/nasatv and http://www.ustream.tv/nasajpl2

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Web Links:
For more information about LDSD, visit http://www.nasa.gov/mission_pages/tdm/ldsd/

NASA's Space Technology Mission Directorate in Washington funds the LDSD mission, a cooperative effort led by JPL. NASA's Marshall Space Flight Center in Huntsville, Alabama, manages LDSD within the Technology Demonstration Mission Program Office. NASA's Wallops Flight Facility in Virginia is coordinating support with the Pacific Missile Range Facility and providing the balloon systems for the LDSD test.
August 18, 2014:

 Barely 30 years ago, the only planets astronomers had found were located right here in our own solar system. The Milky Way is chock-full of stars, millions of them similar to our own sun. Yet the tally of known worlds in other star systems was exactly zero. What a difference a few decades can make.

 As 2014 unfolds, astronomers have not only found more than a thousand "exoplanets" circling distant suns, but also they're beginning to make precise measurements of them. The old void of ignorance about exoplanets is now being filled with data precise to the second decimal place.

 A team led by Sarah Ballard, a NASA Carl Sagan Fellow at the University of Washington in Seattle, recently measured the diameter of a "super Earth" to within an accuracy of 148 miles total or about 1 percent — remarkable accuracy for an exoplanet located about 300 light years from Earth.

 "It does indeed seem amazing," says Ballard. "The landscape of exoplanet research has changed to an almost unrecognizable degree since I started graduate school in 2007."

 To size up the planet, named "Kepler 93 b," Ballard used data from NASA's Kepler and Spitzer Space Telescopes.

 First, Kepler discovered the planet. As seen from Earth, Kepler 93 b passes directly in front of its parent star, causing the starlight to dim during the transit. That dimming, which occurs once per orbit, is what allowed Kepler mission scientists to find the planet in the first place.

 Next, both Spitzer and Kepler recorded multiple transits at visible and infrared wavelengths. Data from the observatories agreed: Kepler 93 b was really a planet and not some artefact of stellar variability. Ballard then knew that by looking carefully at the light curve she could calculate the size of the planet relative to the star.

 At that point, the only missing piece was the diameter of the star itself.

 "The precision with which we measured the size of the planet is linked directly to our measurement of the star," says Ballard. "And we measured the star using a technique called asteroseismology."

 Most people have heard of "seismology," the study of seismic waves moving through the Earth. "We can learn a lot about the structure of our planet by studying seismic waves," she says.

 Asteroseismology is the same thing, except for stars: The outer layers of stars boil like water on top of a hot stove. Those convective motions create seismic waves that bounce around inside the core, causing the star to ring like an enormous bell. Kepler can detect that "ringing," which reveals itself as fluctuations in a star's brightness.

 Ballard's colleague, University of Birmingham professor Bill Chaplin led the asteroseismic analysis for Kepler-93 b. "By analyzing the seismic modes of the star, he was able to deduce its radius and mass to an accuracy of a percent," she says.

 The new measurements confirm that Kepler-93 b is a "super-Earth" sized exoplanet, with a diameter about one-and-a-half times the size of our planet. Previous measurements by the Keck Observatory in Hawaii had put Kepler-93 b's mass at about 3.8 times that of Earth. The density of Kepler-93 b, derived from its mass and newly obtained radius, suggests the planet is very likely made of iron and rock, like Earth itself.

 Although super-Earths are common in the galaxy, none exist in our solar system. That makes them tricky to study. Ballard's team has shown, however, that it is possible to learn a lot about an exoplanet even when it is very far away.

 Credits:

 Author: Dr. Tony Phillips
 | Production editor: Dr. Tony Phillips | Credit: Science@NASA
NEW HORIZONS CROSSES THE ORBIT OF NEPTUNE

August 25, 2014:

NASA's Pluto-bound New Horizons spacecraft has traversed the orbit of Neptune. This is its last major crossing en route to becoming the first probe to make a close encounter with distant Pluto on July 14, 2015.

The sophisticated piano-sized spacecraft, which launched in January 2006, reached Neptune's orbit -- nearly 2.75 billion miles from Earth -- in a record eight years and eight months. New Horizons' milestone matches precisely the 25th anniversary of the historic encounter of NASA's Voyager 2 spacecraft with Neptune on Aug. 25, 1989.

"It's a cosmic coincidence that connects one of NASA's iconic past outer solar system explorers, with our next outer solar system explorer," said Jim Green, director of NASA's Planetary Science Division, NASA Headquarters in Washington. "Exactly 25 years ago at Neptune, Voyager 2 delivered our 'first' look at an unexplored planet. Now it will be New Horizons' turn to reveal the unexplored Pluto and its moons in stunning detail next summer on its way into the vast outer reaches of the solar system."

New Horizons now is about 2.48 billion miles from Neptune -- nearly 27 times the distance between the Earth and our sun -- as it crosses the giant planet's orbit at 10:04 p.m. EDT Monday. Although the spacecraft will be much farther from the planet than Voyager 2's closest approach, New Horizons' telescopic camera was able to obtain several long-distance "approach" shots of Neptune on July 10.

"NASA's Voyager 1 and 2 explored the entire middle zone of the solar system where the giant planets orbit," said Alan Stern, New Horizons principal investigator at the Southwest Research Institute in Boulder, Colorado. "Now we stand on Voyager's broad shoulders to explore the even more distant and mysterious Pluto system."

Several senior members of the New Horizons science team were young members of Voyager's science team in 1989. Many remember how Voyager 2's approach images of Neptune and its planet-sized moon Triton fueled anticipation of the discoveries to come. They share a similar, growing excitement as New Horizons begins its approach to Pluto.

"The feeling 25 years ago was that this was really cool, because we're going to see Neptune and Triton up-close for the first time," said Ralph McNutt of the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, who leads the New Horizons energetic-particle investigation and served on the Voyager plasma-analysis team. "The same is happening for New Horizons. Even this summer, when we're still a year out and our cameras can only spot Pluto and its largest moon as dots, we know we're in for something incredible ahead."

Voyager's visit to the Neptune system revealed previously unseen features of Neptune itself, such as the Great Dark Spot, a massive storm similar to, but not as long-lived, as Jupiter's Great Red Spot. Voyager also, for the first time, captured clear images of the ice giant's ring system, too faint to be clearly viewed from Earth. "There were surprises at Neptune and there were surprises at Triton," said Ed Stone, Voyager's long-standing project scientist from the California Institute of Technology in Pasadena. "I'm sure that will continue at Pluto."

Many researchers feel the 1989 Neptune flyby -- Voyager's final planetary encounter -- might have offered a preview of what's to come next summer. Scientists suggest that Triton, with its icy surface, bright poles, varied terrain and cryovolcanoes, is a Pluto-like object that Neptune pulled into orbit. Scientists recently restored Voyager's footage of Triton and used it to construct the best global color map of that strange moon yet -- further whetting appetites for a Pluto close-up.

"There is a lot of speculation over whether Pluto will look like Triton, and how well they'll match up," McNutt said. "That's the great thing about first-time encounters like this -- we don't know exactly what we'll see, but we know from decades of experience in first-time exploration of new planets that we will be very surprised."

Similar to Voyager 1 and 2's historic observations, New Horizons also is on a path toward potential discoveries in the Kuiper Belt, which is a disc-shaped region of icy objects past the orbit of Neptune, and other unexplored realms of the outer solar system and beyond.

"No country except the United States has the demonstrated capability to explore so far away," said Stern. "The U.S. has led the exploration of the planets and space to a degree no other nation has, and continues to do so with New Horizons. We're incredibly proud that New Horizons represents the nation again as NASA breaks records with its newest, farthest and very capable planetary exploration spacecraft."

Credits:

Production editor: Dr. Tony Phillips | Credit: Science@NASA

To view the Neptune images taken by New Horizons and learn more about the mission, visit: http://www.nasa.gov/newhorizons

For more information about the Voyager spacecraft, visit: http://www.nasa.gov/voyager
August 26, 2014:
The European Space Agency’s Rosetta mission has chosen five candidate landing sites on comet 67P/Churyumov-Gerasimenko for its Philae lander. Philae’s descent to the comet’s nucleus, scheduled for this November, will be the first such landing ever attempted.

"This is the first time landing sites on a comet have been considered," said Stephan Ulamec, Philae Lander Manager at the German Aerospace Center, Cologne, Germany. "The candidate sites that we want to follow up for further analysis are thought to be technically feasible on the basis of a preliminary analysis of flight dynamics and other key issues – for example, they all provide at least six hours of daylight per comet rotation and offer some flat terrain. Of course, every site has the potential for unique scientific discoveries."

For each possible zone, important questions must be asked: Will the lander be able to maintain regular communications with Rosetta? How common are surface hazards such as large boulders, deep crevasses or steep slopes? Is there sufficient illumination for scientific operations and enough sunlight to recharge the lander’s batteries beyond its initial 64-hour lifetime without causing overheating?

The potential landing sites were assigned a letter from an original pre-selection of 10 possible sites, which does not signify any ranking. Three sites (B, I and J) are located on the smaller of the two lobes of the comet and two sites (A and C) are located on the larger lobe.

"The process of selecting a landing site is extremely complex and dynamic; as we get closer to the comet, we will see more and more details, which will influence the final decision on where and when we can land," said Fred Jansen, Rosetta’s mission manager from the European Space Agency’s Science and Technology Centre in Noordwijk, The Netherlands. "We had to complete our preliminary analysis on candidate sites very quickly after arriving at the comet, and now we have just a few more weeks to determine the primary site. The clock is ticking and we now have to meet the challenge to pick the best possible landing site."

This annotated image depicts four of the five potential landing sites for Rosetta’s Philae lander. Image credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM Click for Full Image and Caption.

The selection of a primary landing site. A fully detailed strategy for the landing operations at the selected site will be developed, along with a backup.

The landing of Philae is expected to take place in mid-November when the comet is about 280 million miles (450 million kilometers) from the sun. This will be before activity on the comet reaches levels that might jeopardize the safe and accurate deployment of Philae to the comet’s surface, and before surface material is modified by this cometary activity.

Rosetta is an international mission spearheaded by the European Space Agency with support and instruments provided by NASA.

For more information on the U.S. instruments aboard Rosetta, visit: http://rosetta.jpl.nasa.gov. The ESA’s Rosetta home page is at http://www.esa.int/rosetta.

Credits:
Production editor: Dr. Tony Phillips | Credit: Science@NASA

Rosetta is an ESA mission with contributions from its member states and NASA. Rosetta’s Philae lander is provided by a consortium led by the German Aerospace Center, Cologne; Max Planck Institute for Solar System Research, Gottingen; French National Space Agency, Paris; and the Italian Space Agency, Rome. NASA’s Jet Propulsion Laboratory in Pasadena, California, a division of the California Institute of Technology, manages the U.S. participation in the Rosetta mission for NASA’s Science Mission Directorate in Washington.
SAWIN OBSERVATORY REMINDER AND DAS LOANER TELESCOPES AND EQUIPMENT

The DAS owns and maintains The Sawin Observatory on the grounds of the Mt. Cuba Astronomical Observatory. The Sawin Observatory houses the club’s equatorially mounted 12.5” reflecting telescope. The Sawin is also currently home base for our 17.5” Coulter Odyssey 2 Dobsonian telescope, which is currently being upgraded to better quality optics.

DAS members can obtain a key for access to the Sawin Observatory by being checked out on these telescopes and the use of the observatory. Naturally, all DAS members are invited to look through these telescopes during our Member Star Parties (MSPs) at the Sawin. DAS members who are interested in becoming key holders of the Sawin Observatory should contact Greg Lee to receive training in the use of the facility and the telescopes.

We are currently working to improve the 17.5” Dob by improving all of the factors that affect image quality, including the optics themselves, the mirror support cell, and ventilation.

LOANER TELESCOPES and EQUIPMENT

80 mm Celestron Refractor (on loan from Bill McKibben)

The club currently has on loan from our Secretary, Bill McKibben, an 80 mm Celestron Refractor with a Nextar GOTO mount. As soon as we can pair this up with an eyepiece set, we’d like to put this out on loan to members to see if they find it useful as a loaner telescope. Contact Bill McKibben if you would like to give this scope a try.

6” Orion Dobsonian Telescope

We have a 6” Orion Sky-Quest XT6 Dobsonian reflector, complete with eyepiece set, available for loan to members. You can keep the telescope out on loan for a month or more. However, we use this telescope heavily for outreach star parties at the Woodside Farm Creamery, so if you have it on loan from April through October you may be asked to bring it out to one or more of these events.

Meade 8” LX-10 Telescope

We also have an 8” Meade LX-10 Schmidt Cassegrain Telescope (SCT) available for loan. If you have any thoughts about buying a telescope, especially an SCT, you are strongly advised to take this one out on loan so you can learn the advantages and disadvantages of this design.

Barlowed Laser Collimator Toolset

Also available for loan to DAS members is Howie Glatter’s version of the Barlowed Laser Collimator. This is actually made up of a set of three very nice tools: 1) a 1.25” Glatter laser collimator (which is useful on its own for collimating the secondary mirror); 2) a 1.25” “TuBlug”, which converts the straight beam laser collimator into a “Barlowed” laser collimator, complete with a target screen that’s visible from the back end of your Newtonian telescope; and 3) an Orion 2” to 1.25” centering adapter for use with 2” focusers.

Along with the center donut or triangle on your Newtonian primary mirror, a Barlowed laser collimator is a very accurate and incredibly easy way to collimate your Newtonian or Dobsonian telescope. It may sound complicated, but using the Barlowed laser collimator is incredibly quick and easy compared to earlier generations of collimation tools. As one person noted “It’s one of the handiest and most useful tools the club has ever offered for loan to the membership!”

Obviously, no one DAS member can keep these collimation tools out on loan forever, but borrowing this set of tools is a great way to become familiar with the new “Barlowed Laser Collimator” approach to collimation without having to buy the tool set sight unseen.

If you’re interested in borrowing any of the club’s loaner telescopes or other items, please contact Bill Hanagan, Jeff Lawrence, or Greg Lee at one of our monthly meetings.

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DAS FORUM / E-MAIL SITE ON YAHOO

Don Shedrick

This is a restricted e-mail service for use by DAS members for DAS purposes. To use this site, go to http://groups.yahoo.com; search for Delaware Astronomical Society; and click on the link that comes up. To join, you must have a Yahoo ID and password; if you don’t, you can register at this time by following Yahoo’s instructions. You will then be allowed to “Join the group” upon clicking in that box. You must then register for the DAS group and add your profile by clicking on “add new profile” and completing the form.

When adding or editing your profile, you will need to enter your actual name in the “Real Name” box so you can be identified as a DAS member so Don Shedrick can approve your application to join the DAS group, and everyone will know to whom they are communicating.

Finally, specify your desired email address for delivery of messages. Note: You may choose to not have your name and email address displayed to any-one other than DAS members who are members of the Yahoo DAS email group.

For more detailed instructions, go to the DAS website under DAS Resource Links.
Comet Jacques

This 2 hour time lapse was taken Monday night (8/26) showing the comet moving across the sky in Cassiopeia. Thin clouds created some hazy gradients, but you can get a sense for how fast this guy is moving in these shots taken at 5 minute intervals. The moving version can be seen at http://www.starwatcher.org/cindex.html

The Night Sky Network is doing a new survey of amateur astronomers located in the United States. We are attempting to understand the landscape of educational outreach performed by astronomy clubs and assess the needs of the amateur astronomy community for the next 5 years. We want to hear your voice!

Please let us know what your needs are and how we can better help you and your clubs by taking our survey, located here: http://bit.ly/2014astrosurvey

HTTP://NightSky.JPL.NASA.Gov/

The NASA Night Sky Network is managed by the Astronomical Society of the Pacific.

The ASP is a 501c3 nonprofit organization that advances science literacy through astronomy.

Your contribution is tax-deductible as provided by law.
On How to Get Started in Astro-Photography  Bill Hanagan

You can get started in astrophotography with your current camera mounted on a tripod by taking wide field photographs of meteor showers, conjunctions, constellations, and star trails. Mounting your camera “piggyback” on a motorized telescope that tracks the movement of the stars allows you to photograph a few more subjects, mostly large and bright nebulas and comets. At this level, some smaller subjects may benefit from the use of a telephoto lens. As you move to progressively fainter and smaller subjects, the demands on your equipment will grow considerably. However, as you improve your equipment, the number of subjects that you can photograph will also increase exponentially.

Joining the AP SIG is a great way to learn what equipment you’ll need to photograph the subjects that interest you and to find out what specific equipment works well (or doesn’t work) before you spend your money.
INFORMATION ON DAS MEMBERSHIPS AND MAGAZINE SUBSCRIPTIONS

DAS MEMBERSHIP
· DAS membership dues are $30.00 per year and due on November 1 for all members.
· There is no need to renew membership until the treasurer contacts you during the membership renewal drive starting in mid-October.
· New members joining at various times of the year may be eligible for a prorated dues amount.
  - $20 when joining March-May
  - $10 when joining June-August
  - $30 for joining September-October through November 1 of the following year.

ASTRONOMICAL LEAGUE MEMBERSHIP
· The DAS offers an optional membership in the Astronomical League (AL) at a discounted rate.
· AL membership dues are $7.50 per year and are due on June 1 for all members.
· The AL does not offer any prorated discounts for new memberships starting mid-year.

SKY & TELESCOPE MAGAZINE
· The DAS offers subscriptions to Sky & Telescope at a discounted rate of $32.95 per year.
· Subscriptions to S&T will be processed by the club for the first subscription year only.
· The publisher should then send renewal notices directly to the subscriber at the club rate of $32.95.
· You may receive renewal offers for amounts other than $32.95. If so, check to see if they are special offers and how close you are to your renewal date.
· Your subscription expiration date should be displayed on the mailing label on your magazine.
· If you are within 3 months of your renewal date and still have not received the correct renewal notice, please contact the publisher and tell them you should receive the member rate.

ASTRONOMY MAGAZINE
· The DAS offers subscriptions to Astronomy magazine at a discounted rate of $34.00 per year.
· Subscriptions to Astronomy will be processed by the club for the first subscription year only.
· Your subscription expiration date should be displayed on the mailing label on your magazine.
· Renewals can be handled by all club members on the Astronomy.com website using the following steps:
  a. go to www.astronomy.com
  b. select the ‘customer service’ link in the upper right corner
  c. select the ‘renew your subscriptions’ link
  d. enter your customer number (found on the mailing label), postal code, and the renewal code of ‘RCLUB040’ and click ‘continue’
  e. follow the remaining steps from there.

NEW MEMBERSHIP FORM
· Please review the membership and magazine information above carefully.
· PLEASE fill out the membership form below completely.

- NEW MEMBERSHIP FORM

Please be sure to review the Membership and Magazine information above carefully.

Please make checks payable to DAS and forward to:
Jeff Lawrence, Treasurer, 815 Leeds Lane, Newark, DE 19711

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Name_________________________________________________Email Adress________________________________
Street Address_________________________________________________Phone Number________________________
City___________________________________________________________State______Zip___________________________
Notes_________________________________________________________________________________________________

For questions or concerns, contact Jeff Lawrence, DAS Treasurer at (302) 668-8277 or jef.law76@gmail.com
DAS CONTACTS  Please call any of us with your concerns!

Board members:

**Officers:**
President: Greg Lee -- 302-762-5358 or greglee288@gmail.com,

Vice-President: Rob Lancaster -- also, Program Chair & Future Web Site Development -- RLancaste@gmail.com

Secretary: Bill McKibben, Secretary billmck21921@comcast.net

Treasurer: Jeff Lawrence jef.law76@gmail.com; (302) 668-8277 also Sky & Telescope & Astronomy magazine issues

**Board members at Large:**
Terry Lisansky terry@terry.cx

Glenn Bentley -- 610-869-0706 or gbentley@chesco.org

Bill Hanagan -- 302-239-0949 or hanaganw@verizon.net, also Astronomical Photography Special Interest Group; Amateur Telescope Making Special Interest Group; By-Laws; Observatory and Equipment Improvements

**Standing Chairs:**
Publications: Joe Neuberger -- 302-723-2734 or JRNeuberger@gmail.com, also, FOCUS Newsletter article/photo contributions

Observing: Fred DeLucia -- 609-410-8943 or fredworld@verizon.net, also, Elections Chair and Awards Chair

Education: Mike Cimorosi - mgcimorosi@verizon.net

Observatory: Open Position (contact Pres. Greg Lee with questions)

Library: Maria Lavalle and Sue Bebon

**Other Chairs:**
Web Site Maintenance and Operation: Daniel Chester-- chester@udel.edu

**SEE PRECEDING PAGE FOR NEW MEMBERSHIP FORM**

If you have questions, call any of the member representatives listed. Otherwise, just check the appropriate boxes and complete the form on the preceding page. Print it or cut it off and send it with your check to Jeff Lawrencet his address on the form. The magazine prices are group rates to DAS members.

If you’re just joining us for the first time, THANK YOU VERY MUCH, and WELCOME to the DAS! It’s GREAT to have you with us!

DAS CONTACTS  Please call any of us with your concerns!

**FOCUS editor**  Joe Neuberger

**The Last Word...**

I hope all of the members had an enjoyable summer, and got to squeeze in a bunch of astronomical activities into your busy summer schedules.

We, as a club, have an exciting year ahead with a new president in Greg Lee and vice-president in Rob Lancaster. Bill McKibben remains secretary and Jeff Lawrence remains treasurer after all the votes were counted in May’s DAS elections.

There’s plenty happening on the equipment front with the completion of the 17.5” mirror renovation, and decisions about to be finalized on a strategy for getting the DAS’ equipment updated so that members can participate more widely in the many different facets of modern astronomy from observing through astro-photography.

So get ready for an exciting year ahead for the DAS!!