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NGC 4631—The Whale Galaxy



TAAA member Mike Mulcahy photographed NGC 4631, aka The Whale Galaxy, from Sabino Canyon using a Celestron 9.25-inch, f/10 Schmidt Cassegrain. His equipment includes a SBIG ST8300M camera, Baader filters, 50mm guidescope with a Loadstar guide camera all on an AP900 mount. The exposure totals 10.7 hours (L:310 R:120 G:110 B:100, all in 10 minute subs, binned 1x1). To capture the image, he used Maxim DL, Focusmax, SkyX, and CCDAutopilot. To process the image, he used CCDStack and Photoshop with various plugins. © Mike Mulcahy. Used by permission.

Taken from Wikipedia: NGC 4631 (also cataloged as Caldwell 32) is an edge-on spiral galaxy in the constellation Canes Venatici. This galaxy's slightly distorted wedge shape gives it the appearance of a herring or a whale, hence its nickname.

The galaxy contains a central starburst, which is a region of intense star formation. The strong star formation is evident in the emission from ionized hydrogen and interstellar dust heated by the stars formed in the starburst. The most massive stars that form in star formation regions only burn hydrogen gas through fusion for a short period of time, after which they explode as supernovae. So many supernovae have exploded in the center of NGC 4631 that they are blowing gas out of the plane of the galaxy. This superwind can be seen in X-rays and in spectral line emission. The gas from this superwind has produced a giant, diffuse corona of hot, X-ray emitting gas around the whole galaxy.

Take Note!

- ◆ Grand Canyon Star Party Preliminary Report
- ◆ Chiricahua Astronomy Complex Update
- ◆ Reach for the Stars Program
- ◆ Outreach Reports
- ◆ RTMC Astronomy Expo Report
- ◆ UA LPL Summer Science Saturday - July 18



Our mission is to provide opportunities for members and the public to share the joy and excitement of astronomy through observing, education and fun. We fulfill this by providing Astronomy Services to schools, church groups, scout troops, and convention organizers. We support many organizations in the Tucson area that are involved in Science, Technology, Engineering and Mathematics (STEM) programs. Our members enjoy observing the night sky under the dark skies that our observing sites offer. We are an all-volunteer, tax-exempt, non-profit, 501(c)(3) organization.

Frequency

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taaa-newsletter[at]tucsonastronomy.org.

Submissions should be in the form of a text or Microsoft Word compatible file. Photos and artwork are encouraged. Please send these as separate attachments with resolution of at least 200 dpi (higher is preferred). Submissions are retained by the editor unless prior arrangements have been made. Copyrighted materials will not be accepted unless permission to use is clearly stated. We will not publish slanderous or libelous material. All copyrights retained by Tucson Amateur Astronomy Association, Inc. or the original author.

Contacting the TAAA

Editor: taaa-newsletter[at]tucsonastronomy.org

TAAA Board of Directors:

taaabod[at]tucsonastronomy.org

www.tucsonastronomy.org

520-792-6414

PO Box 41254, Tucson AZ 85717



From Our President

As I begin my term as President of the TAAA, I would like to take a moment to thank Bob Gilroy for his past two years of service as President. Bob has worked tirelessly to improve TAAA in all areas and has had great success moving forward on many fronts. Under Bob's guidance many worthy projects were continued and new ones started. We are all very fortunate to have Bob's talents available to the TAAA, and I hope he'll be a very active Past President.

I would also like to recognize another valued club member, Terri Lappin, on receiving the prestigious Clifford W. Holmes Award at this year's Riverside Telescope Makers Conference Astronomy Expo. This award recognizes a "Major Contribution to Popularizing Astronomy" and Terri joins past recipients such as: Clyde Tombaugh, John Dobson, along with our own David Levy and Dean Ketelsen. On behalf of the TAAA, I would like to extend a huge, "Way to Go Terri!!"

I look forward to serving each of you as we move forward with the TAAA Mission to provide opportunities for members and the community to learn about and share the joy and excitement of Astronomy through observing, education and fun. To that end, the TAAA Leaders recently held a Strategy Meeting which examined our current mission and core processes, analyzed TAAA strengths and weaknesses, and then focused on some activities that will help us achieve our mission.

The four core processes that were selected to concentrate on over the next year are: Public Outreach, Member Development, Social Activities, and Education. Our Leaders have set multiple objectives for each of these core processes. An example of each of the objectives we are pursuing includes increasing Public Outreach by looking to engage a more youthful audience through partnering with at least two new youth organizations a year. We plan to advance Member Development by having each Special Interest Group (SIG) develop at least two additional mentors a year. In the area of Social Activities, we plan to have at least two BBQs per year for members at our Chiricahua Astronomy Complex site. For Education, we will review the TAAA "Introduction to the Fundamentals of Astronomy" classes by September 2015 with a potential to rework the curriculum.

I am deeply humbled by the opportunity to serve the TAAA and invite you to join me as we move into the future. I would like to remind all members that many opportunities exist within the TAAA to help us achieve our goals. Please feel free to contact myself or any TAAA Leader if you can offer your talents and time to the Association. Together we can make this the best Astronomy Association ever.

Ben Bailey



From Our (Past) President

As of June 1, 2015, I am now officially "Past President". I found being president a challenging, but rewarding experience. During my tenure I have tried to set the tone for understanding and cooperation. We have always had many volunteers doing many things and I thank all those volunteers for their dedication and hard work. The board of directors has been diligently working to ensure that we move forward in an efficient and effective way to fulfill our mission.

(Continued on page 3)

Past President's Message (Continued from page 2)

Some of the initiatives we have instituted:

- TAAA Hosted Astronomy Events – Since our establishment over 60 years ago, we have participated in many astronomy events. As Jim Knoll explained at our May general meeting, we participate in a lot of public and private outreach programs. Over the years our involvement in the Grand Canyon Star Party on the South Rim has grown and matured. In collaboration and cooperation with the National Park Service we get volunteer astronomers and attract visitors from all over the world. Complimenting these marvelous activities, we have set a goal of increasing outreach efforts to engage more of our community. We will attempt to host at least two major astronomy events every year (Spring & Autumn) that are open to the public. Under the effective leadership of Terri Lappin we have had two successful events at Brandi Fenton Park. They take the form of an all day and evening star party, hands on demonstrations and telescope instruction sessions – and include other non-profit organizations.
- Recording our General Meetings – In my comments in our Spring Newsletter, I mentioned that we were testing live streaming our meetings. We weren't able to achieve this, but we do have the ability to record the meetings to make them available online shortly thereafter. We officially started recording our meetings on May 1st. Both the Introductory and the Main Presentations are ready (in podcast format). They are large files and we are working to determine the best way to make them available...stay tuned.

- Website changes - Member benefits are available through the website. You'll need to login into take advantage of them. If you don't have log-in credentials (or you forgot them), please let me know – we will get you set up.
 - We have had a live chatroom on our website for member's use. You can have a group chat or a private one.
 - We have carpooling capabilities – check out TAAA Conjunctions. If you need a ride to any of our events, please sign up. And/or if you can be a driver, please sign up.
 - Signing up for Astronomy Magazine (or renewing your subscription) at the reduced "Astronomy Club Rate" is now easier – just click on the Astronomy Magazine link. Hopefully, we will have a link for Sky & Telescope Magazine shortly.

I want to thank all of you for supporting, encouraging, and advising me over the last several years. It made my job a lot easier. I know you will extend the same courtesies to Ben Bailey as he assumes the presidency. He is qualified, capable and has the drive and determination to move us forward.

Remember, through understanding, cooperation, enthusiasm and dedication we can accomplish great things.

Bob Gilroy



Early Reports from the Canyon

(Adapted from the TAAA Forum)

Email from TAAA Member, Karen Liptak:

Although I'm a member of TAAA, I attended the last two nights of this year's Grand Canyon Star Party as a visitor, part of a tour group that started in Flagstaff and also visited Lowell Observatory and Meteor Crater. I'd heard about the Grand Canyon Star Party for years, but did not realize what a big and wonderful event it is. Much applause to everyone who helps make it a reality. The crowds were huge and people got so much out of the night. Others on my tour raved about it. I got to hear Jim O'Connor and Mary Turner do their sky walks, and the sky came alive for me as never before thanks to their talks, the dark skies, and everyone who participated. The park and sky...perfect combo!

Reply from Jim O'Connor, South Rim Coordinator, Grand Canyon Star Party

Thank you, Karen. It was a whole lot of fun to see you there at the solar setup, then that night for my walk around the stars.

It's the volunteers, and the ever-increasing support from the National Park Service. They make it work. We had volunteers from Pennsylvania, Massachusetts, Wisconsin, Florida, and Texas as well as Phoenix, Prescott, Kingman, Flagstaff, Utah, and other locales in addition to the TAAA volunteer group, a minimum of three years in a row for all, some more than 20 years. We've had the Grand Canyon National Park Superintendent Dave Ueberauga kick it off two of the last four years, and the Deputy Superintendent the other two. The Grand Canyon Association took part on the first night and several others. Not just a bunch of astro-fanatics dropping down scopes and showing eye candy in the dark. Nineteen years of hard work by Dean Ketelsen laid the foundation for the best outreach in the world.

Getting better every year.

Read more GCSP news on the Ketelsen's Blog
<http://www.theketelsens.blogspot.com/>

TAAA Program - Our CAC Observing Site

Chiricahua Astronomy Complex Update

Text and Photos by John Kalas, CAC Director (cac-director[at]tucsonastronomy.org)

The Strategic Planning Group has been quite busy in the last few months. Meetings took place to discuss future development at the site. On January 24th, members interested in having observatories at the site gathered to start the process of developing plans for that project. More recently, members met to discuss the possibility of adding a multi-use facility for sleeping, socializing and training. Working groups were established at these meetings to pursue development of potential specifications and designs for the facilities. A previously organized working group has been reviewing features desired for a large roll-off roof observatory. These efforts are helping to formulate the future of the site.

A welcome improvement to the astronomy complex, the Ramada, was completed on May 20th. This 20'x30' structure provides much needed shade for the site as well as a picnic area. The first of four picnic tables has been installed. A small donated gas grill will be transferred to the site in the near future. With a generous donation, a larger stainless steel gas grill will soon be purchased and delivered to the site in the near future. The ramada and grills will offer members the ability to prepare their own meals at the site and will allow the club to host "star-b-cues" much like those at Kitt Peak National Observatory. Three more picnic tables are needed to complete the ramada facility. If interested in sponsoring a picnic table, or part of one, please contact John Kalas at cac-director[at]tucsonastronomy.org.

With the ramada construction finished, our attention is now focused on Phase 4, the Member Pads Area. The building permit application will be



Much needed shade is provided by the new ramada for a picnic table. As additional donations are made, more tables will be added.

submitted to the Cochise County Permit Dept. in early June. Once the permit is approved, the construction will begin for nine concrete telescope observing pads each with electricity and a parking space in a newly developed area just east of the Amphitheater. Nine individual members have donated the funds required to construct the telescope pads and they will each have exclusive rights to the use of their respective pads. Further expansion of the Member Pads Area will be undertaken as other members show interest in having their own pads.



The new 20' by 30' ramada provides a place for gathering at the Chiricahua Astronomy Complex. BBQ grills will soon appear, making this a fantastic place for eating and socializing before a night of observing. Note the red bricks of the Recognition Patio on one side of the ramada.



Recent additions to the site include the third steel storage container for storing member and club equipment. The container was delivered and installed on April 21st and is shown on the left in this photo.



Involving Young People The Mission of Reach for the Stars

Text by Bill Lofquist (mal3[at]tucsonastronomy.org)
and Jim Knoll (school-star-party[at]tucsonastronomy.org)

Throughout its sixty plus years of promoting astronomy, the Tucson Amateur Astronomy Association (TAAA) has put an emphasis on reaching out to young people in order to engage them and encourage their interest in astronomy. It does this primarily through star parties for schools and various nonprofit youth groups and organizations. These efforts reach thousands of young people each year and are supported by volunteer hours by many TAAA members. These members provide their own transportation and equipment to make these learning events possible.

In the same way, each year TAAA members support many public events for people of all ages.

Generally speaking these efforts have provided *Brief Exposure*, the first level of learning. The *Reach for the Stars* program is designed to build on this long history of outreach by providing young people opportunities to experience astronomy through a more sustained exposure, mentoring, and even providing them with an opportunity to teach others.

A Challenge to TAAA and Its Members

As has been mentioned many times, TAAA is "graying" and not attracting younger members. Since our club mission emphasizes the importance of education about astronomy, this has a built-in challenge for us to develop new ways to reach out and engage both young adults and, especially, teens and youth.

It is important that we consider this challenge in a serious and focused manner. First, if we are to attract young people to what we have to offer, **we need to meet them where they are**, rather than expect them to come to us. They are not coming to us on a routine basis.

Second, it is important that **we look to outside resources**. To improve our chance of success, we can partner with youth organizations which aids us in our need to meet young people in their own surroundings.

Third, this means **meeting** those organizations where they are and looking for *mission congruity*. A major emphasis today, Science, Technology, Engineering, and Math (STEM), has the potential for providing a meeting place for a variety of organizations that have a youth constituency and are interested in education. Obviously, this would include schools, and we already work with many of them at the *Brief Exposure* level. We have progressed beyond that level, in a limited way, helping establish astronomy clubs at area schools for a more sustained level of involvement. While we need to continue to interest schools at

this level, we are finding definite limitations to what the schools can do. Working with schools at the elementary level is somewhat easy, but it is more challenging at the middle and high school levels where competing activities result in fewer requests.

Schools are under tremendous pressure from decreased funding and outside expectations that make testing the be-all and end-all. This makes the job of teachers and administrators more difficult, and many claim that it makes education and learning less achievable. So it is understandable that it is difficult to engage the schools at the more advanced learning levels.



REACH FOR THE STARS

A program to engage young people in learning about astronomy and teaching other young people about astronomy. Its purpose is to make it possible for any young person in the Tucson area interested in learning about astronomy to do so at the highest possible level.

At the April 18th TAAA strategic planning session, a lot of emphasis was placed on our outreach efforts as was the need for us to become more effective in our efforts to engage young people. Two goals were set to move forward. First is to Target Youth Audience – Partner with youth organizations to engage young people in TAAA/Astronomy. Second is to add two organizations by the end of fiscal year 2016 to our program. The two of us (Jim Knoll and Bill Lofquist) were charged with the responsibility to be the champions for this effort. Jim is the Coordinator of the School/Nonprofit Star Party Program for TAAA, Bill (the previously Coordinator) has had a long-standing interest in this matter. A number of other TAAA members are strong advocates for more involvement with young people and are currently involved in other specific activities. There will be opportunities for members to support those efforts.

(Continued on page 6)

Involving Young People (Continued from page 5)

Reach for the Stars Astronomy Clubs

Knowledge about Astronomy and Observational Skills

The primary emphasis of *Reach for the Stars* is on learning how to observe the skies with the naked eye, with binoculars and with a telescope and building knowledge about astronomy and the universe. This can take place through the formation of *Reach for the Stars Astronomy Clubs* or through individual learning. Young people who participate in *Reach for the Stars* can join and become student members of the TAAA, though this is not required.

Participants in *Reach for the Stars* are encouraged to undertake a systematic and disciplined approach to their learning about astronomy. Club Notebooks allow the participant to undertake an observing program, recording when and where they were observed, what instrument was used, the viewing conditions; making a drawing of the object and its surrounding stars; and making other notes about the experience. Certificates will be given to each participant to recognize their learning accomplishments. Developing these skills will prepare each participant to locate a variety of objects in the sky and to help other young people and adults develop their astronomy skills. Use of the *Astronomical League* observing programs will provide structure for club members' learning.

A *Reach for the Stars Astronomy Club* is for young people who have a genuine desire to deepen their understanding of astronomy and sharpen their observing skills. Volunteer amateur astronomers will be available to provide mentoring and encouragement to the participants. Clubs are limited to a small number of participants so each person can have an intensive learning experience. Regular observing sessions will help to maintain a good pace of learning. Skills and knowledge will be enhanced as participants teach others what they know. Participants who have their own telescopes can also participate in TAAA star parties as volunteer amateur astronomers.

Participants in each *Reach for the Stars Astronomy Club* will determine their own rules, the scheduling of meetings and planning their activities. When accompanied by a TAAA volunteer, Clubs will be able to use the TAAA observing sites at TIMPA west of the Tucson Mountains and at the Chiricahua Astronomy Complex (CAC) in Cochise County.

First Steps Underway

As of this writing a couple first steps are getting under way. We have made contact with two youth-serving organizations to discuss the idea of *Reach for the Stars Astronomy Clubs*. They are Big Brothers Big Sisters of Tucson and the Boys and Girls Clubs of Southern Arizona.

Initial conversations are very encouraging. Such a partnership will provide educational, STEM-type learning opportunities for their youth participants. With some redeployment of TAAA volunteer time, we will be able to provide more sustained experiences (See *Level 4*) for both the young people and TAAA members.

These conversations will be unfolding over the summer months, with a view to implementing the plans in the fall. TAAA members with an interest in these efforts are encouraged to join the discussions.

We invite observations and suggestions from one and all to help us further shape the ideas presented in this article. We plan to present this in greater detail during the November 2015 Introductory Presentation to solicit membership feedback. The benefits that can accrue to TAAA are many as we become more deeply relevant to younger people.

A Concept of Levels of Learning about Astronomy

- Level 1 - Brief Exposure
- Level 2 - Sustained Exposure
- Level 3 - Sustained Exposure with Mentoring
- Level 4 - Sustained Exposure with Mentoring and an Opportunity to Teach Others

We thank our supporters



Star Guy Brian V Deis
www.mrstarguy.com



Community Involvement & Outreach

BASIS School Students Enjoy CAC Experience

Text and Photos by Mike Magras (mike@sargamites.net)

It was a success! That's the feedback received from the students who attended this year's two-night BASIS School Astronomy Program hosted by the TAAA at our Chiricahua Astronomy Complex. Fourteen students participated in this year's event. About half were 8th graders and the rest were high school juniors and one sophomore. In addition to Hannah Sugarman, the sponsoring physics teacher, two of the student's fathers participated and three TAAA members supported the program: Kevin Koski from Kingman, Jim Heasley, and Mike Magras.

The group set out from the BASIS Tucson North at River & Craycroft about 9am and arrived at the CAC site about two hours later. After campsite set-up and lunch, the students learned how to open the observatory. The roll-off roof was a hit with every student insisting on cranking it open or closed, some exclaiming they wished their bedrooms had the same capability!

We proceeded to demonstrate that astronomy can be done during the daytime. Using the accuracy of the Astro-Physics mount and the Celestron 14-inch telescope, the students observed Venus and learned about its phases, viewed lunar craters, mountains and lava plains, and the cloud structure on Jupiter. Kevin Koski set up his H-alpha scope and the kids were treated to views of solar prominences, loops, spikes and other phenomena. In the evening most of the kids and adults spotted Venus with their naked eyes. Some students even spotted Jupiter while the sun was still up!

After the hungry kids consumed a pasta and salad dinner, they enjoyed more observing including Saturn, M13, the Ring Nebula, the Moon and many other objects. These technically-minded students quickly mastered the basic operation of the Astro-Physics mount and drove the Celestron 14 to many of the objects. They also practiced identifying constellations with their planispheres and used those skills to find deep sky objects with the Dobsonian telescopes that were set up for their use. Finally, they got a kick out of photographing Saturn and M57 with a DSLR at the Celestron 14's prime focus, ending with a shot of a star field that may have contained Pluto.

After a late get-up on day two, everyone headed up to the Chiricahua National Monument for a ranger-led interpretive walk, followed by a 3.3 mile round-trip hike to the grottoes, cool crevices between tall rocks in whose shade lunch was enjoyed, and then thru Echo Canyon. Weather was perfect with some high clouds that mitigated the sun during our walk. The clouds were cooperative by clearing at sunset.

That evening, Kevin Koski had some students rolling with laughter at his funny and informative celestial stories while giving them hands-on



instruction in pointing his beautiful 16-inch Dobsonian. Meanwhile, another group was at the Celestron 14 watching the shadow of Io overtake the shadow of Ganymede in a race across the face of Jupiter—all as the Great Red Spot looked on. It was quite a sight and an amazing opportunity to witness solar system geometry at work, concepts these intelligent kids readily absorbed and quickly comprehended.

Later that evening, some students, one father, and a teacher took turns photographing targets of their choice, adding DSLR operation to their repertoire of newly acquired astronomical skills. The session ended with another photo of the suspected Pluto field for comparison to the previous one to see if, in deed, we had imaged Pluto which would appear to jump between the two images.

Over the course of the two-days, the new CAC ramada and picnic table proved to be godsend. It was great to have reliable shade that did not blow away in the gusty winds and dust devils! The ramada was the focal point of our group activities, meals, recreation and just hanging out.

As the program was winding down, a couple students expressed how lucky the TAAA is to have such a wonderful facility for astronomy. To hear this from an interested adult is a complement, but from these young people it is a testament to the potential for TAAA to use this site for the education and enjoyment of many more people of all ages.

Community Involvement & Outreach

Dreary Day Brightened by Stellar Evolution Toolkit

Text by Jim O'Connor (gcsp[at]tucsonastronomy.org); adapted from TAAA Forum message

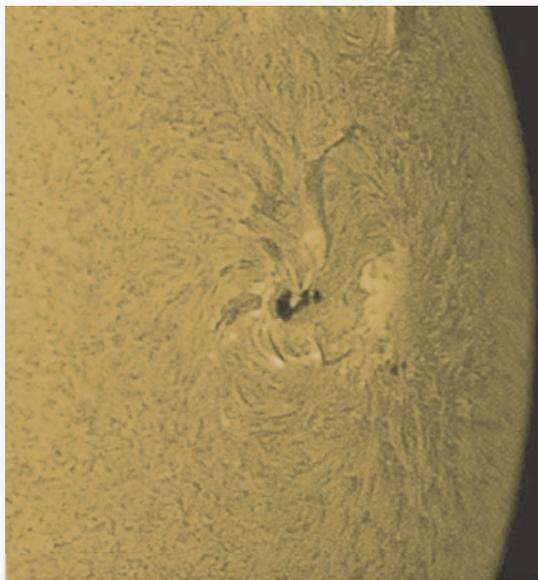
The Tucson Amateur Astronomy Association supported a solar event at the Boys and Girls Club of Tucson. Ron Brewster and Jim O'Connor, along with Jim's Stephen, were to observe the sun, Susan O'Connor was doing an indoor Night Sky Network Toolkit demo featuring Stellar Evolution with grandson Andrew. One problem, there was no sun to be seen in the sky. Rather than cancel the event, Jim decided to help his wife with the indoor activity. Here's his report:

She (Susan) set up the Stellar Evolution materials, as well as the big Sun banner, and I added the poster set I use at the scope. As solar star parties go, it was a loss but as an SMSIG activity, I can't imagine a better one. Gretl, our sponsor, had a room for us and it allowed us to execute the mission very well.

It was a fantastic event. The kids were broken into two groups; first the younger ones, then the older group. They were all very sharp, even the youngest participated fully in the lesson transfer. Lots of hands-on, and great questions. The young staff member with them, Enrique, has a special gift with guiding and managing each group's trip through the education, despite the broad difference in ages. It was a huge advantage over the usual "drive by" kind of extended event we have, to have a captive audience that could receive the whole lesson in a contained package. To exit the room with a treat from Enrique, they had to ask a relevant question about what they had seen and participated in. It turned out that a small bag of chips is a great motivator to pay attention and get engaged, even down to the seven year olds!



Night Sky Network's Black Hole demonstrator is used to explain the curvature of space around a mass. We use it to explain small masses can gathered into larger ones, ultimately achieving enough massive stars. Photo provided by the Night Sky Network.



Detail of the Our Star, the Sun banner showing magnetic field lines around a sunspot. Courtesy of NASA.

The guests got the full Stellar Evolution story, and spent quite a bit of time with the hands on demos of the stellar accretion and black hole demonstrators. At the Sun banner, we were able to have good discussions of the magnetic nature of solar phenomenology, with the older group really understanding the examples of the normal behavior and the active sun discussions, asking some great questions regarding dark matter influences as well as taking in my discussion of the Earth's environmental effects due to solar activity, and the protection provided by the atmosphere and the magnetic field to practical questions like the UV effects on health.

Enrique was a great asset, understanding and grasping the science although his true avocation is poetry. One of the sharpest young people I've ever met, and devoted to being a mentor for the young people. Although his primary interest is in the humanities, he really grasped the scientific achievements since the development of general and special relativity, and we had some great discussions about responsible interactions among humanism, religion and science. A great mind is coming along!

All in all, a very uplifting event on a dreary day.

★ Featured Article

Full Moon Transforms View of the Night Sky

Text by Wayne Johnson (aka Mr. Galaxy) (mrgalaxy[at]juno.com)

Editor's Note: This originally appear on the TAAA Forum and appears with Wayne Johnson's permission, with minor editing for clarity.



I think I'm photon-deprived! We have several people in the TAAA whose writings are far superior to mine and I enjoy their observations (of the sky or life in general) very much. Dean Ketelsen is smart in that he does his commentaries via a blog site so that he can be

astronomical or not as the case may be. I enjoy Julian Grajewski's observations because they prove that you do not need massive equipment to enjoy the heavens. Of course, I empathize with Jim O'Connor, moving his 200 lbs of equipment from one location to another. When the weather cooperates I move my big telescope around wheelbarrow-style. Jim's equipment is high-tech at its best, mine is low-tech but comparatively large and my big scope doesn't leave the yard. High-tech (digital setting circles, etc.) is great as long as you don't totally rely on it. It is easy to get lost in the sky and will become very frustrating if don't have a basic understanding of where you want to be, kind of like depending on GPS to get you somewhere. It will do most of the work for you but not all of it!

It always seems the skies are clearest and the weather nicest especially on full moon nights like tonight (on June 1st). Because it was so pleasant I went outside to enjoy the respite from the heat of the day and see what the sky had to offer. It's always a pleasant surprise and usually not what you expected at all. Note, I didn't take out my telescope or even binoculars. It was early evening and the most obvious object in the sky was the full moon rising in the east with Saturn a few degrees away. Venus and Jupiter were obvious toward the west. A few of the brightest stars in the sky were noticeable. It was what I imagine an urban sky (such as Tucson's) would be, so a scenario that probably 90% of our membership would encounter (and enjoy!).

One of the things you should notice with the planets since they are bright is that they form a line (or band) on the sky. If you start with Venus then go east through Jupiter then all the way across the sky to the Moon and Saturn you have traced an imaginary line on the sky called the "ecliptic" (i.e., the part of the sky where the Sun appears to travel). Ecliptic comes from the word "eclipse" and is the part of the sky where solar and lunar eclipses can occur. The planets mostly travel along this line (and the moon oscillates about 5 degrees above and below the ecliptic, which is why eclipses only occur a few times a year) and there

are at least a couple bright stars that are also obvious along that path. Tonight I was able to see Regulus and Spica, the brightest stars in Leo and Virgo, respectively, on the way from Jupiter to Saturn. Regulus lies about a degree north of the ecliptic and Spica is a couple degrees south of this line. Many years ago a group of us in southern California saw a spectacular grazing occultation (where the moon's rough edge just passes in front of a star) of Spica where we saw the star appear to blink on and off nearly a dozen times.

One curious observation tonight involved a couple of the brightest stars in the sky. I was looking north at Polaris at around 8pm (this time will be slightly different from night to night) and noticed that there were two bright stars at nearly the same altitude and each about the same distance from the North Star, one in the northeast and the other in the northwest. They turned out to be Capella, the brightest star in Auriga (setting in the west) and Vega in the constellation Lyra (rising in the east). I never realized the positional relationship of these two stars with respect to Polaris so that was an interesting revelation for me. Even if you don't have any instruments, go out and enjoy the night sky while the weather is pleasant and the skies are clear. The night before we had an exquisite sunset which is always a treat here in the southwest.

Classifieds

Fantastic Items Here!

New Item! For Sale: Celestron NexStar 8SE Like NEW condition includes: Celestron 40mm, Celestron 25mm, Vixen 9mm, Orion Polarizer Filter, Celestron CN16 GPS, Telrad Red Dot, Celestron Power Tank, AC Power Supply, Recon-X 3-Fliter Flashlight, all books and the original paperwork and shipping cartons. \$1050 Located in Oro Valley. Call Bob at 520-219-3262

Price Reduced! For Sale: Tele Vue Radian 10mm eyepiece \$95. Meade "Super Wide Angle" 24.5mm eyepiece \$95. Meade Nebula Filter \$50. Celestron HD Wedge adapter for Astrophotography with select older Celestron telescopes, i.e. Ultima 2000, etc. \$95. Call Jim at 520-744-3858 or 520-401-6769

Price Reduced! For Sale: Orion EQ-1 Mount w/EQ-1M Motor Drive & Hand Controller. Suitable for small scopes and DSLR astrophotography. As new, partially assembled. Manuals included. \$95. Call Jim at 520-744-3858 or 520-401-6769.

★ Featured Article

Riverside Telescope Making Conference and Astronomy Expo – Think about it for 2016

Text by Terri Lappin (terrilappin[at]tucsonastronomy.org) Photos by Terri Lappin and Gary Rosenbaum

It was about 1980 when I attended my first "RTMC". In the intervening years, I've probably attended about 20 of these annual gatherings of amateur astronomers and telescope makers. Just as astronomy has changed, so has RTMC. One change is the addition of "Astronomy Expo" to the name as it covers more than telescope making. Gone are the truckloads of equipment from Meade and Celestron at ridiculously low prices. As a beginner back in the 1980's, I relished in the ability to outfit my observing kit with all the doodads a well-equipped observer needed...an 8x50 finder for \$10 or a Lumicon UHC filter for \$20 – all equipment I still use. This year, several vendors had advertised "show" pricing – good deals, but not what I would call ridiculously low prices. I did find a pair of 8x21 binoculars for \$20 – just what I need for those times when I see an unusual bird while driving around Tucson.

What has never changed over the years is the enthusiasm shown by amateur astronomers. We tend to be a friendly bunch sharing experiences – observing stories, mostly. We laugh at the funny stories and shake our heads because we exactly understand the other person's experience. And, we've made a new friend.

So, while RTMC has changed in some ways, it's remained the same in the most significant way. It's a place to meet fellow amateurs to talk shop.

RTMC stands for Riverside Telescope Makers Conference. The conference is held over Memorial Day weekend in the San Bernardino Mountains of Southern California at the Camp Oakes YMCA just a few miles from Big Bear, CA. You have your choice of on-site camping or staying in town. I don't care much for camping anymore, so we get a hotel in Big Bear. Good thing, too, because temps this year got below freezing in the early mornings, with a brisk wind making it feel even colder.

RTMC Astronomy Expo has always been family oriented. Admission fees are kept low with special pricing for families. There's lots of things for the non-astronomer to do - a



The Meeting Hall and nearby swimming pool.



Telescope Making lives on at RTMC. At top left is Jerry Logan (Los Angeles) is an accomplished telescope maker and machinist. He enters a scope every year. Top right is TAAA member Bill Wheeler with a 10" telescope he made. At lower left is Dennis Young's (Sedona, AZ) 12" f/17 portable refractor. Dennis gave a presentation about this telescope.

swimming pool, canoes on the lake, archery, bike and hiking trails, wall climbing, and catch/release fishing. This year they added a Zip Line (\$10 per ride). For young astronomers, maybe attending their first RTMC Astronomy Expo, there are special activities on both Saturday and Sunday about the solar system.



Receiving the Clifford W Holmes Award for outreach efforts.

This year's trip was unexpected. We don't go every year and Gary and I had already decided to skip this year. But then I got word that the RTMC Board of Directors had decided to award me with their most honored

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RTMC Astronomy Expo (Continued from page 10)

Clifford W. Holmes Award for my outreach work. So, a quick zip across the desert was in order. A few other Tucsonans made the trip, too. We ran into Paul and Cathy Anderson (attending their first RTMC Astronomy Expo), Bill Clark, and Bill Wheeler. Teresa Plymate, former TAAA Treasurer and now a RTMC board member living in Big Bear, was also there. Unfortunately, due to a family emergency, Claude Plymate wasn't able to attend this year. Sorry if I forgot any other Tucsonans we saw or those we didn't see.



The food line; burgers, chicken, hotdogs and brats.

We arrived on Friday afternoon and had a pleasant dinner in Big Bear at the Old Country Inn. Saturday morning, we headed over to Camp Oakes. The swap meet was in progress. (If you aren't aware,

telescope makers love to scavenge through each other's stuff looking for that one item they need.) The swap meet runs both Saturday and Sunday mornings, but Saturday morning is the best time to peruse the offerings. This is where I found some eyepieces and a Barlow for my grand-nephew who has a budding interest in astronomy – I was then on a mission to find him a telescope.

RTMC, founded in 1969, was originally all about telescope making. There's still that element to the conference. Nearly every time we're there, we see someone working on a mirror and someone else cutting up wood for a quickly assembled Dobsonian telescope. This year was no different. RTMC Astronomy Expo continues to present telescope merit awards for home crafted telescopes and other astronomy items. In years past, thirty or more telescopes entered the contest. This year there were 6 or 7 entries. I was pleased to see a young teenage girl receive a merit award for the telescope she built. It brought back memories of the two telescope mirrors I completed so many years ago. Another merit award went to TAAA member Bill Wheeler for a telescope he built. Telescope making is still alive!



Some of the astrophotography contest images

A few years ago the RTMC Astronomy Expo started holding an astrophotography contest. There's usually about a dozen photos submitted in different categories. If you're an astrophotographer and attend RTMC Astronomy Expo next year, you should consider entering a

print. Conference attendees vote on their favorite image in each of the five categories.

Presentations are given in the big meeting hall both Saturday and Sunday. Gary and I attended an interesting presentation about Nightscape Photography. The presentation organizers make sure there's a good mix between beginner level and more advanced level subjects covering observing, astrophotography, and telescope making. Workshops, both beginner and advanced, are also held. More in-depth workshops require an extra fee.

In addition to the already mentioned swap meet, several vendors set up shop for the weekend. On the main field this year, there was a large tent for vendors. This is where I found the binoculars I purchased. There was



an old Criterion 6" scope for \$50 – a bit outdated for my grand-nephew, and a small telescope on a go-to mount – not much bigger than what he already has. I left without a telescope for him.

Oceanside Photo & Telescope's exhibit with special pricing on eyepieces and other telescope accessories.



We visited the Tele-Vue representative and found that he was selling a gizmo called a SnapZoom. It's designed to align a cell phone to an eyepiece. We bought one (\$70, show price) with the promise that it will fit the new larger cell phones. I want it for outreach purposes, so people can take home a souvenir from our public star parties.

There is an evening program on both Saturday and Sunday. Although the conference begins on Thursday, the official formal opening is on Saturday evening. Since it's held over Memorial Day, they start with a local Boy Scout troop presenting the colors and we recite the Pledge of



The Saturday evening presentation.

Allegiance. It's a reminder of what the weekend is really about. Telescope merit awards, astrophoto awards, and other awards are presented Saturday night. This year, I

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★ Featured Article

No Surprise! Earth's Strongest Gravity Lies Atop The Highest Mountains

By Dr. Ethan Siegel

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Put more mass beneath your feet and feel the downward acceleration due to gravity increase.

Newton's law of universal gravitation may have been superseded by Einstein's, but it still describes the gravitational force and acceleration here on Earth to remarkable precision. The acceleration you experience is directly proportional to the amount of mass you "see," but inversely proportional to the distance from you to that mass squared.

The denser the mass beneath your feet, the stronger the gravitational force, and when you are closer to such a mass, the force is even greater. At higher elevations or even higher altitudes, you'd expect your gravitational force to drop as you move farther from Earth's center. You'd probably also expect that downward acceleration to be greater if you stood atop a large mountain than if you flew tens of thousands of feet above a flat ocean, with nothing but ultra-light air and liquid water beneath you for all those miles. In fact this is true, but not just due to the mountain's extra mass!

Earth is built like a layer-cake, with the less dense atmosphere, ocean, and crust floating atop the denser mantle, which in turn floats atop the outer and inner cores of our planet. An iceberg's buoyancy is enough to lift only about one tenth of it above the sea, with the other nine tenths below the surface. Similarly, each and every mountain range has a corresponding "invisible mountain" that dips deep into the mantle. Beneath the ocean floor, Earth's crust might be only three to six miles thick, but it can exceed 40 miles in thickness around major mountain ranges like the Himalayas and the Andes. It's where one of Earth's tectonic plates subducts beneath another that we see the largest

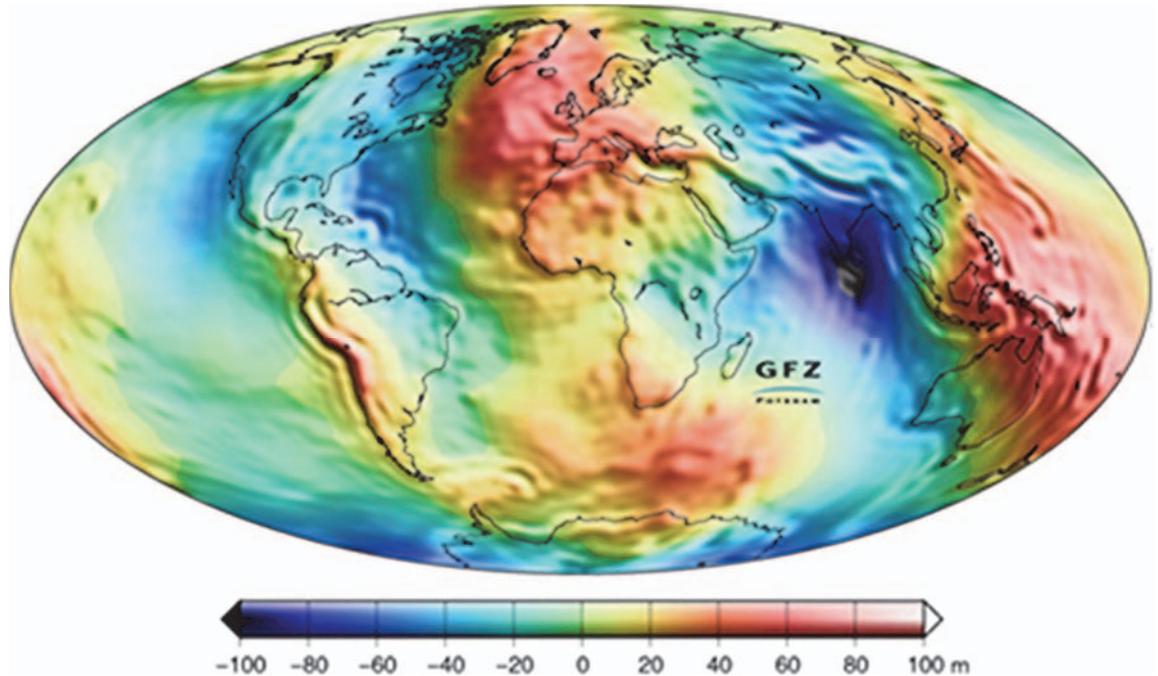


Image credit: NASA / GRACE mission / Christoph Reigber, et al. (2005): An Earth gravity field model complete to degree and order 150 from GRACE: EIGEN-GRACE02S, Journal of Geodynamics 39(1),1–10. Reds indicate greater gravitational anomalies; blues are smaller ones

gravitational anomalies: another confirmation of the theory of continental drift.

A combination of instruments aboard NASA's Gravity Recovery and Climate Experiment (GRACE) satellites, including the SuperSTAR accelerometer, the K-band ranging system and the onboard GPS receiver, have enabled the construction of the most accurate map of Earth's gravitational field ever: to accelerations of nanometers per second squared. While the mountaintops may be farther from Earth's center than any other point, the extra mass of the mountains and their roots – minus the mass of the displaced mantle – accounts for the true gravitational accelerations we actually see. It's only by the grace of these satellites that we can measure this to such accuracy and confirm what was first conjectured in the 1800s: that the full layer-cake structure of Earth must be accounted for to explain the gravity we experience on our world!

Observing and Imaging

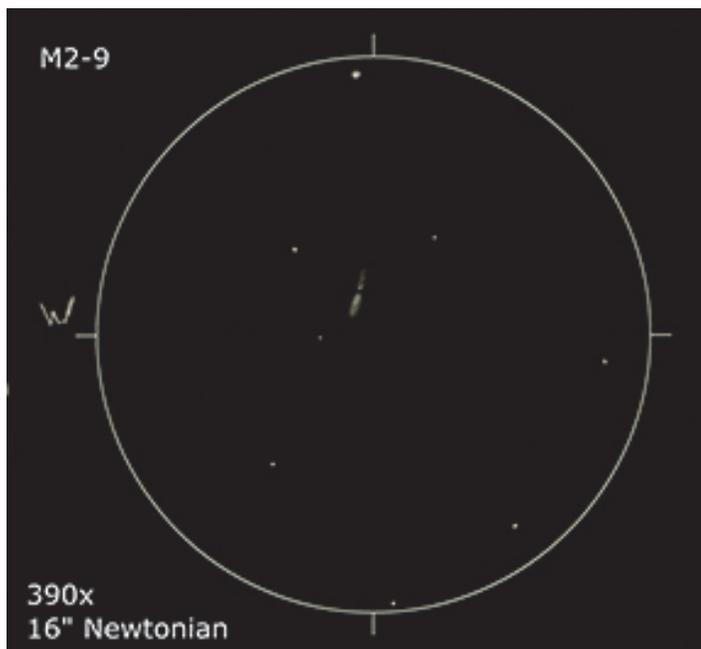
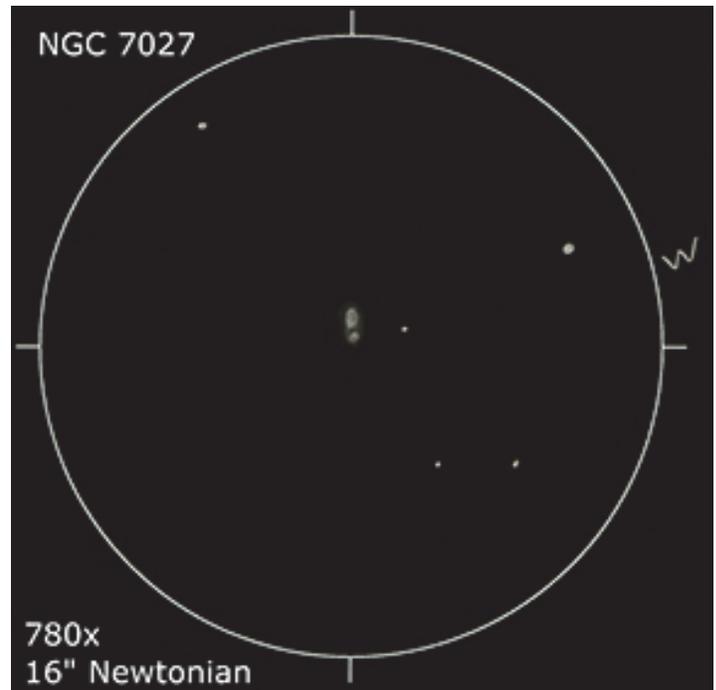
Planetary Nebulae of the Quarter – Summer 2015

Text and Drawings by Christian Weis (weis[at]astroweis.de)

Planetary nebulae (PN) are fascinating objects which come in numerous forms or appearances. Besides the well-known grand four Messiers (M27, M57, M76 and M97), there are hundreds more to explore. This article suggests two PNs, a pretty bright and easy-to-observe one, and a harder one for the more ambitious observer who is equipped with a bigger scope.

Space is colorful. You can, for instance, observe the Blue Flash nebula (NGC 6905) in Delphinus, the Red Rectangle nebula (HD 44179) in Monoceros or the green rectangle NGC 7027 in Cygnus, the object discussed now. NGC 7027 was discovered by Edouard Stephan in 1878. With 9m6 (other data in literature quotes 8m5) it is quite a bright object. This is very helpful since one has to magnify a lot – the green rectangle (or the magic carpet nebula as it is sometimes called) is pretty small in size. I am confident in saying that it is easy to recognize the rectangular shape even with smaller telescopes. If you have a medium-sized or even a large aperture, there is more to see than just the outer shape. I observed NGC 7027 quite a while ago in November 2010 at Kitt Peak with a 16" Dobsonian and noted: Pretty small but definitely non-stellar at 76x, 780x: South brighter and bigger, separation is unsymmetrical, no central star, wedge-shaped to the N, the green color of the nebula is obvious, appears a little bigger when using [OIII]; 780x, fst 6m3

<p>NGC 7027 RA: 21h 7.0min Dec: 42° 14' Constellation: Cygnus Brightness: 9m6 Central star: 16m5 Size: 18 x 10 arcsec Distance: 3600 ly</p>



Minkowski 2-9 (M2-9) is a faint planetary nebula that attracts attention by the fact that it has two PK designations: PK 10+18.1 and PK 10+18.2. It is probably better known by its informal name, the Butterfly Nebula. This object was discovered in 1947 by Rudolph Minkowski and is well worth a try. It is really peculiar: as the two PK-designations already suggest, one can see a two-part nebula which is split in its center. If you have a telescope of some 12 inches or even more, try it. The Butterfly is really captivating! I observed M 2-9 in May 2012 at the Grand Canyon South Rim with a 16" Dobsonian and noted: Longish using averted vision, guessed the right "star" to be the PN at 76x, two-part, relatively weak, northern part a little brighter, kind of challenging; 390x, fst 6m5

<p>PK 10+18.1/2 (M2-9) RA: 17h 5.6min Dec: -10°8' Constellation: Ophiuchus Brightness: 14m6 Central star: 15m6 Size: 20 arcsec Distance: 2100 ly</p>
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★ Observing and Imaging

Constellation of the Season: Hercules - The Strongman

Text and artwork provided by Chris Lancaster

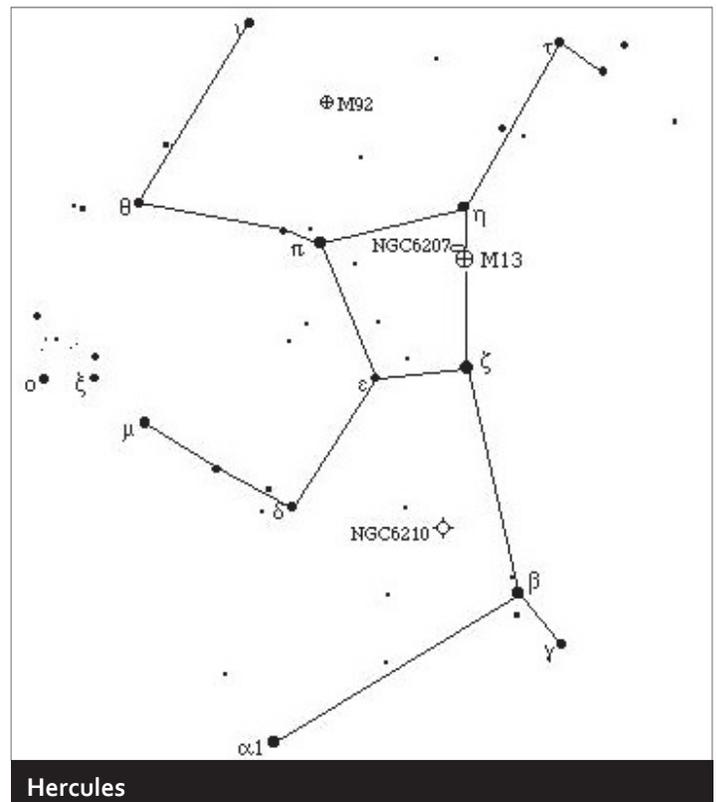
The Constellation of the Season was written by Chris Lancaster and is the basis of his book, "Under Dark Skies - A Guide to the Constellations, Trafford Publishing (<http://bookstore.trafford.com/Products/SKU-000158114/Under-Dark-Skies.aspx>). While the information was accurate at the time of the original writing, the reader should be aware that the sky does change over time. In particular, separation and position angles of double stars may have increased or decreased. This article is presented as originally written. Consult current observing resources for correct separations and position angles. ©2008 Used by permission.

From Greek myth we get the elaborate story of Hercules, who was the son of Zeus and a mortal princess. Hera, the wife of Zeus, in her jealousy sent serpents to kill the infant Hercules, but his strength was immediately displayed when he strangled the snakes. When that didn't work, Hera managed to send him away to become a servant to King Eurystheus. There he grew up to be stronger than any mortal man. In order to be released from the servitude of the king, he was commanded to complete the Twelve Labors, including slaying many terrifying creatures such as the Nemean Lion (which became Leo) and a several headed monster called Hydra (also placed in the sky).

The demise of Hercules came after he had won the affection of Deianeira, a beautiful maiden. When Nessus, a fearsome centaur, kidnapped Deianeira, Hercules [shot] him with an arrow. Nessus gave Deianeira a drop of his blood and deceived her by saying that Hercules would be forever in love with her if he ever came in contact with it. But when Hercules wore a tunic that Deianeira had dotted with the blood, his flesh began to burn away. As a result of this blunder, Deianeira's emotional anguish and Hercules physical pain led them to both kill themselves. Zeus put Hercules in the sky for all the world to see and remember the mighty hero.

Hercules is still low in the sky after dark during the middle parts of May and reaches the meridian just after midnight. He poses in a kneeling position to the west of the bright star Vega in the constellation of Lyra. The most recognizable part of Hercules is the quadrilateral of stars that form the "keystone" figure. The other stars of Hercules forming his limbs splay out from this keystone and are in the range of 2nd, 3rd, and 4th magnitude.

Hercules is home to one of the best deep sky objects visible from this hemisphere, the great Hercules globular cluster M13. When Charles Messier discovered it in 1764, he described it as "a nebula which I am sure contains no star," which gives you an idea about the kind of instruments he had at his disposal in his day. It will rise to within about 4 degrees from the zenith and will appear as a diffuse spot of magnitude 5.9 to the naked eye on nights of exceptional darkness and clarity. A small telescope of about 4 inches will show this spot as a large ball with a few of the brighter stars coming into view. Eight inches or more of aperture will make this globular cluster bloom into a dense explosion of hundreds of stars while the other hundreds of thousands fill in the



spaces in between with a dense glow spreading across 16' of the sky. A prolonged gaze at M13 will be a treat for your imagination as geometrical patterns of stars will come in and out of view. Besides the brightness of M13, the other aspect that makes this object a joy to view is how easy it is to find. Simply look 2.5 degrees south of Eta Herculis, the 3.5 magnitude star marking the northwest corner of the Keystone asterism. If you wish to use your setting circles or a go-to scope, M13's location is RA 16h 42m 53s Dec +38d 55' 20".

The dazzling nature of M13 makes us forget that a galaxy lies less than half a degree from it. However, a large telescope is required due to its weak 12.2 magnitude glow. NGC6207 is very much overshadowed by M13, but presents a challenge for those who want to hunt it down. Look

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RTMC Astronomy Expo (Continued from page 11)

received the Clifford W Holmes Award. It was a wonderful honor to be recognized for my outreach efforts. Then come the door prizes! The door prize committee does a wonderful job getting donations from vendors. Gary was a lucky this year. He won two tickets for a half-night on the Mt Wilson 60-inch telescope. They're good to the kids, too, with age appropriate door prizes for them.

Saturday night, Chuck Claver from the Large Synoptic Survey Telescope (LSST) gave the keynote lecture. It was an excellent overall talk about the LSST. Chuck lives in Tucson so hopefully we'll have him give the same lecture at a TAAA meeting sometime soon.

Following the evening keynote lecture, most people head out to observe. A family oriented Tour of the Constellations and a more structured observing session is also offered. Usually an old sci-fi movie is shown in the meeting hall for those not wanting to observe. The site is over 7200

feet elevation, but a combination of being 100 miles from the ocean and Los Angeles means that the sky never gets very dark – at least by southern Arizona standards. Normally, we make sure to look through some of the scopes that win merit awards and then head back to our warm hotel room about midnight. This year, since we were heading back to Tucson the next day, we opted to not observe – plus it got very chilly soon after the sun went down.

On Sunday, the swap meet continues and presentations are given though to a smaller sized crowd. Sunday evening is a bit different since there are no awards, but they still have door prizes and a star party. The conference wraps up Monday morning.

I encourage others to plan a trip to southern California next year around the end of May and make sure you attend the RTMC Astronomy Expo.

Constellation of the Season (Continued from page 14)

27 arc minutes to the northeast of M13 for this small, oblong glow, or RA 16h 47m 59s Dec +36d 49' 59".

While M13 is an unquestionable visual treat, don't forget about Hercules' other great globular cluster, M92, which is only slightly smaller and dimmer than M13. If you draw a line from Eta to Iota Herculis, M92 is about 2/3 of the way between the two, or RA 17h 17m 6s Dec +43d 8' 00". Robert Burnham Jr in his famous Celestial Handbook indicates that M92 holds its own among the sky's other fantastic globular clusters by saying that "the view (of M92) in large instruments is stunning beyond words; the countless star images run together into a dazzling central blaze which is equaled by only a few of the globulars." M92 shines at magnitude 6.5 and spans an area of 11.2 arc minutes.

From these ostentatious objects we can also seek some of the other obscure things Hercules has to offer. Toward the south, a little less than 8 degrees from the "keystone", is the small planetary nebula NGC6210 (RA 16h 44m 30s Dec +23d 49' 00"). Boost the power for this tiny nebula which spans only about 12 arc seconds in diameter. But the small size coupled with its fairly bright 9th magnitude glow makes it fairly easy to spot.

Alpha Herculis, named Ras Algethi from the Arabic phrase which means "head of the kneeler", is a naked eye irregular variable star. Its brightness can be compared to nearby Delta Herculis which shines at magnitude 3.1. Alpha goes from that same magnitude down to about magnitude 3.9 over a period averaging about 90 days. It has a spectrum of M5 which gives it a reddish color.

Get all the Constellation articles in one book!

Under Dark Skies - A Guide to the Constellations

By Chris Lancaster

Available online for \$14.99 <http://bookstore.trafford.com/Products/SKU-000158114/Under-Dark-Skies.aspx>

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2015 Globe at Night Campaigns

July 7 - 16

October 3 - 12

August 5 - 14

November 2 - 11

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December 2 - 11

<http://www.globeatnight.org/>

Small Bodies of the Solar System Summer Science Saturday

July 18, 2015, 10:00am - 4:00pm

Kuiper Space Sciences

1629 E. University Blvd.

Every summer, the Space Imagery Center at the Lunar and Planetary Laboratory (LPL) hosts a community open house. These events feature lectures and displays about research at LPL. For the younger members of our community, the events feature plenty of hands-on activities.

Lectures—Kuiper Space Sciences Room 308

1:00p.m. Pluto and the Kuiper Belt in the Big Picture of the Solar System

Dr. Renu Malhotra (Professor, Lunar and Planetary Laboratory)

In the last two decades, planetary scientists discovered that Pluto has many siblings and that they are all part of a super-sized version of the asteroid belt—known as the Kuiper Belt—in the vast space beyond the zone of the giant planets. The New Horizons spacecraft is visiting Pluto in July and will subsequently visit another Kuiper belt object “PT1” (for Potentially Targetable KBO 1), giving us the first close-up look at these worlds in the coldest, darkest regions of the solar system. Professor Malhotra will review the recent discoveries and how they are revolutionizing our knowledge of the solar system.

2:00p.m. Dawn of the Dwarf Planet

Dr. Shane Byrne (Associate Professor, Lunar and Planetary Laboratory)

The Dawn Spacecraft is currently investigating the dwarf planet Ceres, after having successfully explored the nearby asteroid Vesta. These two diverse bodies have given us a glimpse into the very beginnings of the solar system when the building blocks of planets like the Earth were being assembled. Vesta had some of the earliest volcanoes, while the ice-rich Ceres likely had an ancient subsurface ocean. Dawn observations today are providing plenty of surprises, Dr. Byrne will discuss Dawn’s achievements to date and the ongoing exploration of Ceres.

3:00p.m. From 700,000 Asteroids to 1... Why OSIRIS-REx is Going to Asteroid Bennu

Carl Hergenrother (LPL Associate Staff Scientist)

In September of 2016, the OSIRIS-REx mission will launch on a seven-year mission to collect a sample of the near-Earth asteroid Bennu and return that sample to Earth in 2023. Over the past few decades, the number of known asteroids has exploded to nearly 700,000. LPL Staff Scientist Carl Hergenrother will explain why Bennu was selected as the target of the OSIRIS-REx mission.

Children’s Activities

- ◆ Mr. Nature’s Storytime @ 10:30 am, 11:30 am, 12:30 pm
- ◆ Santa Rita High School Theatre Department workshop @ 10:30am - Noon - An improvisational theatre experience around SciFi! It’s interactive, you get to meet other students around your age, and most importantly you get to have fun while maybe learning a thing or two about the great unknown!
- ◆ Lunar and Planetary Laboratory Graduate Students, Egg Drop Contest Starts at 10:15am, launch 11:15am
- ◆ UA Poetry Center, fun writing poetry with a science theme, 2:00 pm

Exhibits

- Dawn
- New Horizons
- OSIRIS-REx

For more information visit www.lpl.arizona.edu/sss

Ongoing activities

- 4-H Rockets
- L-5 Society
- Lunar and Planetary Laboratory Teaching Teams Program
- National Optical Astronomy Observatory (NOAO)
- OSIRIS-REx
- Pima Air and Space Museum
- Planetary Science Institute
- Tucson Amateur Astronomy Association (TAAA)

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Astronomy Fundamentals SIG	Dennis McMacken	520-638-8178	fundamentals[at]tucsonastronomy.org
Starry Messenger SIG	Terri Lappin	520-977-1290	smsig[at]tucsonastronomy.org
General Information	Chuck Hendricks	520-247-3815	taaa-info[at]tucsonastronomy.org