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## Partial Solar Eclipse of 23 October 2014



*Former TAAA President John Kalas photographed the partial solar eclipse of October 23, 2014 from his backyard in Tucson. This photo taken at maximum eclipse, 3:54pm Tucson time, shows just under 40% of the Sun's disk being covered by the Moon. Unlike this summer's total solar eclipse, the October 2014 eclipse was not total in any part of the world. However, the sun did sport a fabulous sunspot group designated AR 12192. Ten Earths would fit across this sunspot group! This group produced ten flares of various intensities before it left the solar disk. In 2017, solar activity is considerably lower, so large sunspots are not going to be seen on the disk during this summer's solar eclipse.*

*John took 46 photos of the October 2014 eclipse start-to-finish, the last which caught the sun just as it was dropping behind the neighbor's rooftop. John used a Canon EOS 60Da DSLR mounted to his 130mm Astro-Physics refractor with a Thousand Oaks glass white-light solar filter. The camera settings were ISO 125 and 1/1000 sec exposure. Of course, John plans to photograph this summer's eclipse. Used by permission. © 2017 John Kalas*

## Take Note!

- ◆ Remembering Forrest Holly
- ◆ Chiricahua Astronomy Complex Report
- ◆ TAAA Outreach Report
- ◆ Volunteer Recognition
- ◆ Girl Scout Astronomy Clubs
- ◆ Planetary Nebulae
- ◆ Lunatic's Corner
- ◆ Objects in Cygnus
- ◆ David Levy's Skyward
- ◆ Space Place - 2017 Total Solar Eclipse



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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#### Publishing Guidelines

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#### Contacting the TAAA

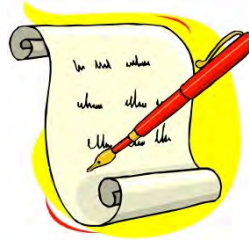
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## From Our President



Hello TAAA Members,

I hope this finds you all well and enjoying the summer months. I know that this is one of my favorite seasons for observing, with the summer constellations coming into great viewing positions. So, please enjoy the warm nights and dark, clear (well, till Monsoon) Arizona skies! A lot has been happening with the TAAA in 2017, as we continue our journey to "

If you missed the dedication of the Reynolds-Mitchell Observatory on May 20, consider making the trip to our Chiricahua Astronomy Complex (CAC) to look through the TAAA's gem, our 40" Dobsonian scope. Chief Telescope Operator Carter Smith is putting together a team of folks that will have the scope running smoothly for your viewing pleasure. I know I heard lots of oohs and aahs at the dedication ceremony, when nearly 90 TAAA members and guests came to CAC to check out our newest addition to the excellent complex. Many thanks to Bob Reynolds for his generous donations that made the Reynolds-Mitchell Observatory possible!

At the May 5 General Meeting, TAAA kicked off our "Gateway to the Galaxy" fund raising campaign. We intend to raise a total of \$450,000 to complete the following additions to CAC: The Night Sky Observatory, which will be a Large Roll Off Roof design with four telescopes, including a 9" refractor; The Night Sky Learning Center, which will boast a classroom, kitchen and 7 bedrooms; and a building for Sleeping Quarters, hosting 5 bedrooms for 10 guests. To date, we have raised \$170,000 of our goal and the Fundraising Committee continues to make great progress. In the latest exciting news, the TAAA Board of Directors has authorized the Strategic Planning Group (SPG) to accept bids for construction of the Night Sky Observatory.

As you can see, a lot is going on with TAAA, with more planned. There are currently some key TAAA positions either open or coming open soon. We launched the Nominations, Volunteers, and Resources Committee (NVRC) last year to help us with just this sort of need, so please responsive to any requests coming from the NVRC and let any NVRC or BOD member know of your willingness to serve.

I will end on a note of sadness. Forrest Holly, a very active TAAA volunteer member, passed away in May. Forrest had been helping with our TAAA membership efforts and served on several committees. Please join me in extending Condolences to his wife Joyce. You will be missed Forrest!

*Ben Bailey*

## **Members' News**

### *Chiricahua Astronomy Complex Open House - May 20, 2017*

Text by Jim Knoll; Photos by Susan Knoll (unless designated), CAC Fundraising (school-star-party[at]tucsonastronomy.org)

Clear dark skies and beautiful temperatures. You could not ask for a better evening for an Open House at the Tucson Amateur Astronomy Association Chiricahua Astronomy Complex (CAC). Almost 90 members and guests attended (a record). TAAA rented a bus to bring 42 down from Tucson and another 46 drove in personal vehicles.



**John Kalas recaps the development of our Chiricahua Astronomy Complex.**

John Kalas presented a recap of the history of CAC and how this beautiful complex got started. Then Ed Foley talked to the group about the future of CAC and building a Large Roll-Off-Roof Observatory with four telescopes; a Multipurpose Building with classroom, kitchen, and sleeping rooms; and another facility of sleeping rooms. Finally, we had the dedication ceremony for the 40" Dobsonian Reynolds-Mitchell Observatory (RMO). Tim Hunter gave a little history of the club, then turned the mic over to Robert Reynolds, who talked about how he got interested in astronomy and why the observatory is called Reynolds-Mitchell Observatory. Mitchell was a key figure in Bob's past and the person who inspired him to get into astronomy. We are grateful to Bob

for becoming a member of TAAA, and for choosing CAC as recipient of the Observatory, affording us all an opportunity to observe through such a fantastic telescope.

The remainder of the evening was spent gazing through telescopes under some amazingly dark skies. In addition to the fantastic views through the 40" Dob, we had the 14" Celestron in the other Roll-Off Roof Observatory open.



**Long time member Tim Hunter tells of our history.**



**The skies look promising for the dedication of the Reynolds-Mitchell 40" telescope.**

There were about 10 other member telescopes set up for viewing from the various observing pads. What a wonderful evening of camaraderie, socializing, and observing. This was such a success, we hope to make it an annual event. In the meantime, go to CAC and observe on your own or as part of the monthly CAC weekends!!



Photo by Charles Coffey

**Jean Reynolds cuts the ribbon as husband Bob looks on. Later, they are pictured inside the warm room of the Reynolds-Mitchell Observatory. The**

**40" telescope is picture below and right with Bob in the left image and Telescope Operator Carter Smith at right.**





## **Members' News**

### *The Continuing Vision for the TAAA Dark Site*

Text by Ed Foley, TAAA Treasurer, CAC Fundraising Committee (treasurer[at]tucsonastronomy.org)

TAAA's Gateway to the Galaxy Capital Campaign is off to a great start in 2017. Our organization is raising money for the next stage of improvements to the TAAA owned dark site, the Chiricahua Astronomy Complex (CAC) in Pearce, Arizona. To use this extraordinary site for outreach and to inspire tomorrow's members, we need to expand our facilities. A Large Roll-Off Roof Observatory will house four telescopes of varying types to give members and guests a chance to see, use and compare various instruments. A Multipurpose Building will include a meeting room where we can host outreach sessions or plan an evening's observing, more restrooms. Best of all, its seven sleeping rooms will give our members a chance to rest comfortably after a long night of observing.

To increase the awareness of these efforts among the membership and potential donors, the Fundraising Committee sponsored two events in May. A reception and presentation was held during the May 5th General Meeting, explaining what we are planning for the site. Preliminary floor plan designs for the Multipurpose Building with the additional sleeping rooms were introduced. Then on May 20th the TAAA hosted 90 members and guests at the CAC observing site. This gathering was held

to celebrate the commissioning of the new 40" Reynolds-Mitchell Observatory, and to further share our future plans for the site.

We are making good progress toward our \$450,000 capital campaign goal. Gifts and pledges now total more than \$165,000. This includes both gifts from members and our first foundation grant. We have now raised more than enough money to fund the first building, the Large Roll-Off Roof Observatory. Plans for this observatory have been drafted, and we will soon be seeking contractor bids to begin construction.

Our next interim goal is to raise enough funds for the Multipurpose Building. The fundraising committee has been busy drafting requests for grants from companies and foundations that have previously supported science and technology learning in Southern Arizona. To date, fifteen grants have been submitted by the committee to potential donors. Grant deadlines are spread throughout the year and the committee expects to have completed more than 40 requests before the end of 2017. The committee has also spoken to many TAAA members about supporting the campaign. The committee has already received many generous gifts this year, but we still need your help to complete this stage of building a world-class amateur observing site.

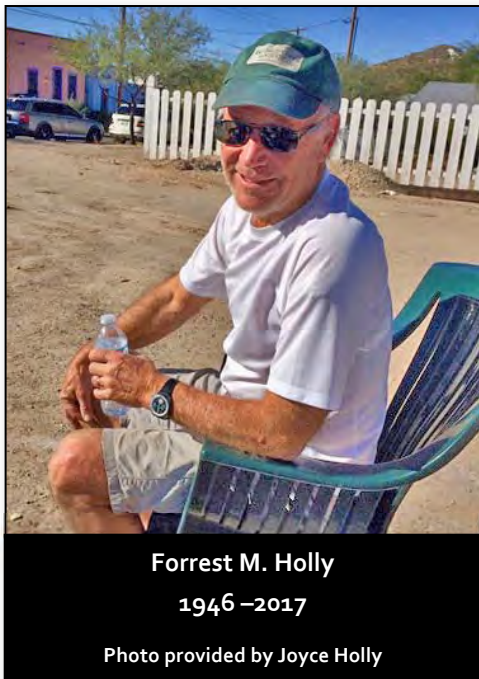


**A model of the Multipurpose Building which will include seven sleeping rooms.**

## **Members' News**

### *Remembering a Friend—Forrest M. Holly*

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



It is with great sadness that we announce that TAAA Member, Forrest Holly, passed away on May 22, 2017 at the age of 71. Forrest was a wonderful person with a great personality. He and his wife, Joyce, joined the TAAA in December 2012. Forrest and Joyce were avid observers who visited the CAC Site often. They worked together to achieve the Astronomical League observing awards for Double Stars and Messier objects. Forrest was most recently working on the challenging Herschel 400 award. He supported the club by volunteering as Membership Assistant working on member retention. Forrest also was a member of the CAC Strategic Planning Group and the Large Roll-off Roof Observatory working group where his engineering skills were invaluable.

Forrest graduated from Stanford University in 1968, earned a Masters degree from the University of Washington and received a PhD from Colorado State University. Forrest was professor emeritus of civil and environmental engineering at the University of Iowa. He retired from the University of Iowa in 2003. Forrest was an avid pilot and flight instructor. He is survived by his wife, Joyce, and his son, Lance. He will be missed.

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to do!*



*Web app  
available*

***Can you count stars? Yes? You can do this!***  
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***Sept 12—21***

***October 11—20***

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## *We thank our supporters*



# ★ Community Involvement & Outreach

## TAAA's Impact on Astronomy Awareness in Tucson—2017

Text and Photo by Jim Knoll, Volunteer Coordinator ([school-star-party\[at\]tucsonastronomy.org](mailto:school-star-party[at]tucsonastronomy.org))

School has started for the 2017-2018 academic year and the second half of our Outreach Program is again underway. Here are the results from the first half of 2017. Our program includes telescope observing and hands-on projects. Without the help of our astronomers who bring telescopes and our Astronomy Guides doing astronomy activities, our program would not be the success that it is.

TAAA Community Outreach Summary Audience (Jan-Dec 2017)				
Month	Events	Audience		Estimated Attendance
		Schools	Other	
Jan	10	6	4	1,015
Feb	11	8	3	1,965
Mar	17	9	8	4,635
Apr	11	4	7	1,135
May	12	7	5	1,120
Jun	3	0	3	700
<b>Totals</b>	<b>64</b>	<b>34</b>	<b>30</b>	<b>10,570</b>

TAAA Community Outreach Summary Volunteers (Jan-Dec 2017)					
Month	Outreach Hours	Astronomers		Astro Guides	NSN Toolkits
		Number	Hours		
Jan	25.5	43	116.0	2	2
Feb	31.5	37	106.0	0	0
Mar	60.5	56	275.5	13	10
Apr	42.0	48	196.0	9	5
May	37.5	41	134.5	2	1
Jun	18.5	10	74.0	4	4
<b>Totals</b>	<b>216</b>	<b>235</b>	<b>902</b>	<b>30</b>	<b>22</b>



Brothers Ethan and Brady take turns looking through Jim Knoll's telescope at Agua Caliente Park. Telescopes were also provided for the Cox Innovator's Night at the Tucson Convention Center.

### Thank You!

For supporting our outreach program!

#### Quarterly Reports

**January - March 2017:** This is normally the busiest quarter of the year and I want to thank all our volunteers that stepped up and met this challenge head on. In addition to the upsurge of school star parties, coinciding with the time when they teach astronomy and astronomy related topics in the classroom, we also had several public star parties including our quarterly event at Catalina State Park & another at Oracle State Park, monthly events at each of our two Pima County supported parks, and the Tucson Festival of Books. We attempted our annual Tucson Star Party at Pima Community College, but was weather cancelled. I want to congratulate all volunteers for a successful school and non-profit star party program.

**April - June 2017:** TAAA supported 54 school events during the school year, about 50% of our total events. We had 50 TAAA members volunteer their time and talents, which is an awesome amount for a club our size. There is still plenty of opportunity for members to jump into the school & non-profit star party scene. We would love to have your help. I want to take one more opportunity to thank all the generous volunteers that supported the Star Party program this past year. We could not do this level of outreach without such great volunteer support. Thank You!!



# Community Involvement & Outreach

## Starry Messengers SIG In Action

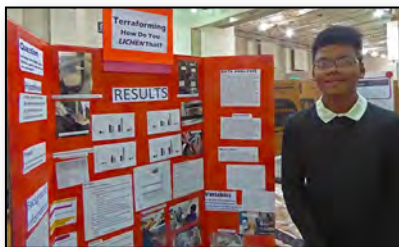
Text and Photo by Terri Lappin, SMSIG Chair (smsig[at]tucsonastronomy.org)

The TAAA Starry Messengers SIG has been very busy this year with outreach events. In addition to the regular events held at schools, three major events took place this spring: the Southern Arizona Regional Science and Engineering Fair, the Tucson Festival of Books, the TAAA Astronomy Festival celebrating Astronomy Day.

This year, the TAAA awarded three students for their astronomy themed science fair projects. These were:

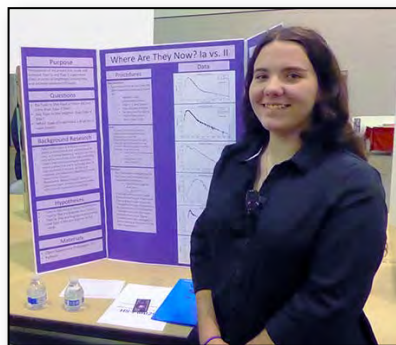
- ◆ Thomas Corder, a fourth grader at Sycamore Elementary School, for his project titled "My Mars Habitat". Thomas studied which materials would keep a Mars habitat from cooling down too fast.

- ◆ Brian Amador, an eighth grader at La Cima Middle School, for his project titled "Terraforming for Mars: How Do You Lichen That?"



That?" Brian simulated the Martian environment using simulated soil and carbon dioxide rich atmosphere where he attempted to grow various types of lichen. His results were rather interesting! He found that Pendant lichen did grow (by weight) in the Martian environment. His control sample didn't do so well in the Tucson environment – but it's not native to Tucson. He wants to continue this research using a wet algae which would be similar to the lichen used in his project.

- ◆ Gabriele Clarke, a senior at the UA Sky School, for her project titled "Where are They Now? Ia vs II". We awarded Gabriele last year for a supernova project. She continued this research with this year's project.



Using data found in the Open Supernova Catalog she studied the behavior of the light curve of both Supernova Type Ia and Type II over time and wavelength.



**Brian O'Connell developed a method to explain the possibility for "solar eclipses" to occur around stars that have planets.**

and adults in making nearly 300 pinhole solar projectors in preparation for this summer's solar eclipse. Several members set up solar telescopes and others helped answer questions about astronomy and the TAAA. We estimated about 3300 interactions took place between the public and TAAA members over the two days.

Now in it's fourth year, the TAAA Astronomy Festival was held on Astronomy Day, April 29th. We had several activities for young people as well as telescopes for observing both the sun and night sky objects. This year we were joined by representatives from the UA SkyCenter, OSIRIS-REx, and the Tucson L5 Space Society. Door prizes were provided by Stellar Vision, David Levy's Sharing the Sky Foundation, and the TAAA. About 200 people attended the event which was advertised through Facebook and in the Arizona Daily Star Caliente.

## SMSIG OUTREACH

### Schools and Events

Mesa Verde Elementary  
International Wildlife Museum  
Rattlesnake Ridge Elementary  
Sunrise Drive Elementary  
UA ScienceCity  
Innovators Night  
Astronomy Festival  
Tucson Hebrew Academy  
Lehman Academy  
Esmond Station  
Borman Elementary (DMAFB)  
Spacefest

### Toolkits and Activities

Space Rocks  
Our Magnetic Sun  
Shadows and Silhouettes  
Life in the Universe  
Exploring the Solar System  
Solar Projectors

The TAAA's exhibit at the Tucson Festival of Books was in the UA ScienceCity. Over the weekend event, TAAA volunteers assisted kids



## Community Involvement & Outreach

### TAAA Awards, Recognitions, and Certificates

Provide by Mae Smith, TAAA Vice-President (vice-president[at]tucsonastronomy.org)

Several TAAA leaders recognized volunteers at the June and July General Meetings.

Night Sky Network certificates and pins for use of Night Sky Network Toolkits, presented by Terri Lappin:

Susan O'Connor  
Jim O'Connor  
Karen Liptak  
Brian O'Connell  
Jim Knoll  
Ruth Gomez  
Mae Smith  
Mary Turner  
Terri Lappin

Certificates given to those who supported school and non-profit star parties, presented by Jim Knoll (Number indicates volunteer hours):

Kevin Bays	19.5
Don Beaman	3.0
<b>Bryan Betcher</b>	<b>78.5</b>
Peter Bibbo	13.0
Greg Bohemier	3.0
Ron Brewster	24.5
<b>Don Cain</b>	<b>88.0</b>
Bill Clarke	3.0
Pat Droll	3.0
Vern Dunlap	5.5
John Dwyer	8.0
Edward Eastburn	8.5
Richie Falk	3.0
<b>Stephen Ferris</b>	<b>52.0</b>
Bob Gilroy	4.0
Gus Gomez	16.5
Rob Halberg	8.0
Paula Harper	4.0
George Hatfield	3.0
Chuck Hendricks	42.0
Ron Henke	12.0
Gerry Hodge	30.0
Don Holder	4.0
Ralph Jensen	18.0
Lyle Johnsen	14.5
Connor Justice	4.5

John Kalas	3.0
Irene Kitzman	9.5
Allen Klus	11.0
<b>Jim Knoll</b>	<b>176.0</b>
<b>Susan Knoll</b>	<b>69.5</b>
Keith Kumm	4.0
Terri Lappin	16.0
Karen Liptak	27.0
Bill Lofquist	38.5
Rich Loper	4.0
John McGee	5.0
JD Metzger	8.5
Elaine Miller	8.5
Jim Miller	8.5
Brian O'Connell	12.0
<b>Jim O'Connor</b>	<b>191.0</b>
Susan O'Connor	40.0
<b>Paul Ross</b>	<b>81.0</b>
<b>Byron Skinner</b>	<b>68.0</b>
Sam Sollenberger	7.0
Joe Statkevics	16.5
<b>Bernie Stinger</b>	<b>77.5</b>
Howard Weatherhead	18.0
Robert Whilliams	10.0
Paul Williamson	13.0
Robert Wilson	27.0
<b>Bill Yohey</b>	<b>67.5</b>

Certificates for years of voluntary assistance and support of the Apparel Program, presented by Mae Smith:

Pati Dunlop  
Susan O'Connor  
Carter-Thaxton Smith

Certificates for service on the Grand Canyon Star Party 2017 T-Shirt Committee, presented by Mae Smith:

Chuck Hendricks  
Dean Ketelsen  
John Mead  
Susan O'Connor  
Carter-Thaxton Smith



Certificates for serving on the Handbook Working Group, presented by Mae Smith:

Sheila Conrad  
John Kalas  
Jim Knoll  
Terri Lappin  
J.D. Metzger  
Susan O'Connor

Certificates for representing TAAA in writing astronomy modules for the National Boy Scout STEM Program, presented by Mae Smith:

Carter-Thaxton Smith  
Wayne Thomas

Certificates for volunteer service at Astronomy Service star parties, presented by Bill Lofquist:

Ben Bailey  
Hunter Bailey  
Ralph Jensen  
John Kalas  
JD Metzger  
Jim O'Connor  
Tom Rolfsmeyer  
Carter-Thaxton Smith  
Michael Turner  
John Mead  
Jim Knoll

(Continued on page 9)



# **Community Involvement & Outreach**

## *Girl Scouts Reach for the Stars Program*

Text and Photos by Terri Lappin, SMSIG Founder (smsig[at]tucsonastronomy.org)

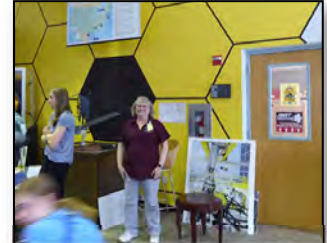
The TAAA Starry Messenger SIG has partnered with the Southern Arizona Council of the Girl Scouts to develop astronomy clubs for the girls. Terri Lappin, our SMSIG founder, attended the week-long training program at Goddard Space Flight Center along with adult volunteer Rachel Buck and Girl Scouts Sophia of Tucson and Garvey of Yuma. Over the next two years, astronomy clubs will be developed in Tucson and Yuma.



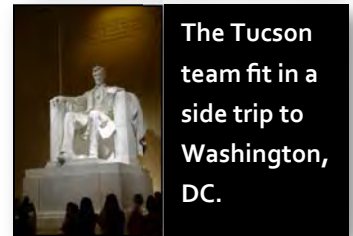
**Modeling a solar eclipse.**  
Left to right: Rachel,  
Garvey, and Sophia.



**About 45 adults and Girl Scouts attended the training at Goddard Space Flight Center. Here, they making "telescopic observations" of a newly found "planet" (ball of Playdough). The exercise ends with a space mission to "sample" the planet.**



**Terri stands in front of a full scale painting of the James Webb Space Telescope mirrors.**



**The Tucson team fit in a side trip to Washington, DC.**

(Continued from page 8)

**Certificates for assistance with the AFSIG, presented by Dennis McMacken:**

Ben Bailey  
Bob Gilroy  
Paul Anderson  
Cathy Anderson  
Bill Yohey  
J. D. Metzger  
Gus Gomez  
Ruth Gomez  
Peter Laylin  
Sara Liberty-Laylin  
Stephen Ferris  
Joe Grisillo  
Bill Clarke  
Jim Schrode

**Certificates for assistance with TIMPA, presented by Dennis McMacken:**

Stephen Ferris  
Bill Yohey  
Gus Gomez  
Jim O'Connor  
Wally Rogers

**Certificates for serving on the Strategic Planning Group, presented by Bill Lofquist:**

Ed Foley  
Joe Jakoby  
Ron Probst  
Conrad Stolarski  
Wally Rogers  
John Kalas  
John Mead  
Bob Reynolds

Mae Smith  
Carter-Thaxton Smith

**Certificates for assistance with Introduction to the Fundamentals of Astronomy Class, presented by Dennis McMacken:**

J.D. Metzger  
Bob Gilroy  
Ben Bailey  
Paul Anderson  
Cathy Anderson  
Bill Clarke  
Hunter Bailey  
Bill Yohey  
Steve Marten  
Stephen Ferris  
Jim Schrode  
Jim O'Conner

# **Observing and Imaging**

## Planetary Nebulae of the Quarter – Spring 2017

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

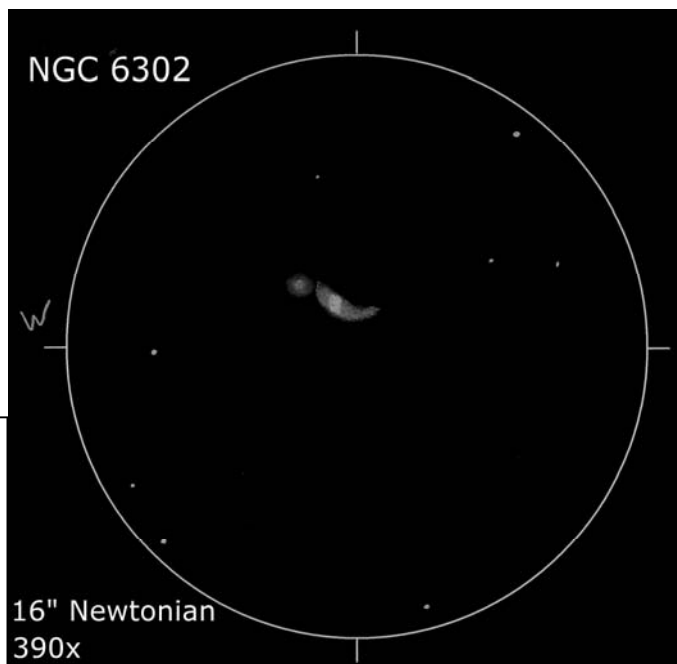
Planetary nebulae (PN) are fascinating objects which come in numerous forms or appearances. Besides the well-known grand four Messiers (M27, M57, M76 and M97), there are hundreds more to explore. This article suggests two PNs, a pretty bright and easy-to-observe one, and a harder one for the more ambitious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

The spring sky is not really cluttered with planetary nebulae. However, in each and every single spring night there are beautiful gems that can be found – you just have to wait long enough. This applies to this season's bright PN, NGC 6302. This object is probably better known as the Butterfly Nebula or Bug Nebula. The history of its discovery is a little diffuse. Some sources claim that James Dunlop discovered this nebula in 1826, others state E.E. Barnard as the discoverer. Whoever it was, he found a real showpiece.

Have a look at images of this PN. It is easy to understand where the nicknames originate from. The Hubble images strongly remind me of a butterfly, while my own observation logs rather resemble a bug. The central star is hidden by dense dust clouds, but it is known that it is one of the hottest known in our galaxy, exceeding 200,000 Kelvin.

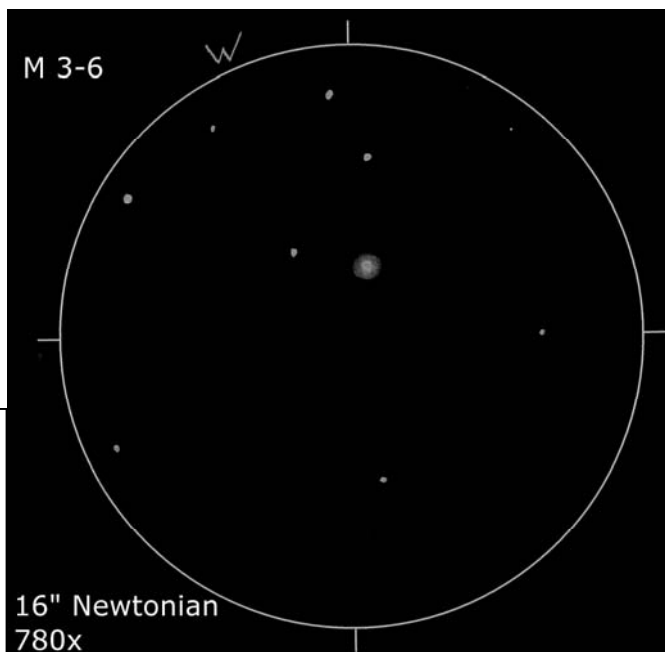
I observed the Bug Nebula in May 2012 from the Grand Canyon South Rim with a 16" Dobsonian telescope and noted: Reminds me of a spiral galaxy, quite bright and pretty big, very bright center, two arms streaking to E and W, bright knot in the W-arm, faint notch in the east coming from the south, no central star seen, beautiful object; fst 6m5; 390x

**NGC 6302**  
RA: 17h 13.7min  
Dec: -37° 6'  
Constellation: Scorpius  
Brightness: 12m8  
Central star: (21m)  
Size: 1.2 x 0.5 arcmin  
Distance: 2000 ly



You do not have to stay up late if you want to observe this season's hard object PK 254+5.1. It is located in the faint southern constellation Pyxis. It was first described by James D. Wray in his 1966 PhD thesis. Due to its small size, lots of magnification and therefore a large aperture will be needed if you want to discern the small disk. That said, a four inch telescope equipped with a UHC-filter will suffice to identify this object. So, it actually is not that hard to see. I observed M3-6 in May 2012 from Kitt Peak and noted: Blinked and identified using an [OIII]-filter at 195x, small disk, [OIII]- and UHC-filters help improve visibility but do not reveal more details, center is brighter, inner shape cannot be identified, circular outer shape, quite bright, no central star (the used 16" telescope should have revealed the central star easily, so the brighter center might actually be the central star itself blurred by the seeing); fst 6m4, 780x

**PK 254+5.1 (=M3-6)**  
RA: 8h 40.7min  
Dec: -32°23'  
Constellation: Pyxis  
Brightness: 11m0  
Central star: 13m9  
Size: 19 arcsec  
Distance: no data



# **Observing and Imaging**

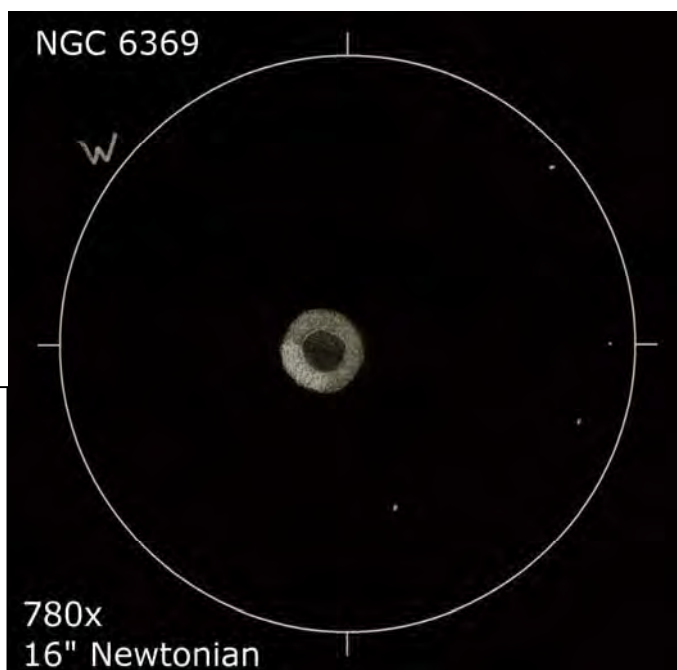
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Text and Drawings by Christian Weis (weis[at]astroweis.de)

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.

The rather unimpressive constellation Ophiuchus is a real deep-sky eldorado. Most might know the "serpent-bearer" for its Messier globulars (seven out of 29 are located within Ophiuchus – more than in any other constellation, except for Sagittarius that also is host of seven Messier globulars). But there is a lot more to see. The PN list Rev 6DS, which was compiled by Kent Wallace and Doug Snyder lists 97 planetary nebulae within Ophiuchus. Truly a remarkable amount! One of the quite spectacular PNs is NGC 6369, which currently is less than two degrees from Saturn. NGC 6369 was discovered by William Herschel in 1784 and is also called the Little Ghost. Shining with an apparent magnitude of 11m5, even telescopes as small as 4 inches should be able to show this object. Of course, bigger telescopes are needed in order to reveal its inherent beauty. I observed NGC 6369 in May 2012 at the Grand Canyon south rim and noted: significant ring-structure, at low magnification (76x) already seen as area, beautiful at higher powers, northern ring-segment brighter than the rest, center brighter than sky background, no CS, very nice object; 780x, fst 6m5 (Sag)

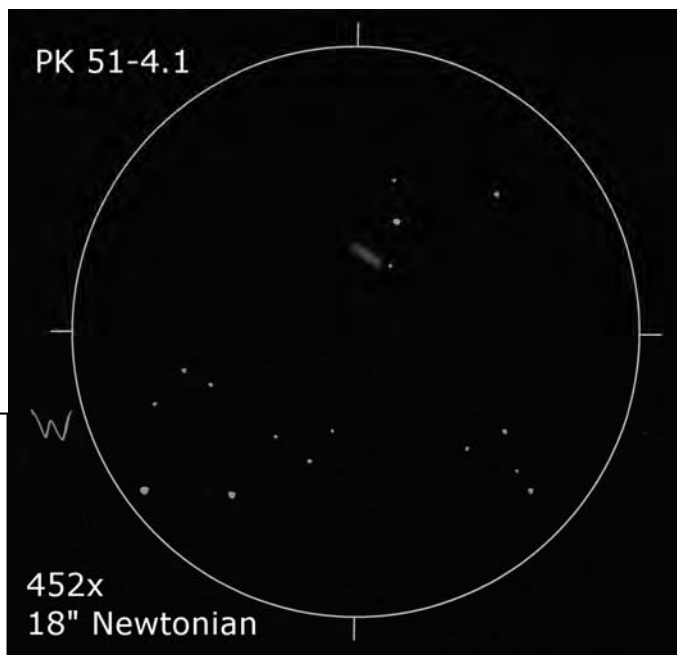
**NGC 6369**  
 RA: 17h 29.3min  
 Dec: -23° 46'  
 Constellation:  
 Ophiuchus  
 Brightness: 11m5  
 Central star: 16m0  
 Size: 0.5 arcmin  
 Distance: 3900 ly



PK 51-4.1 is a peculiar PN located in Aquila. It is also known as Peimbert-Costero 22 (PC 22) who compiled a list in 1961, but was discovered by the Russian astronomer Apriamashvili in 1959. It is a multi-polar PN having several lobes. It was categorized to be a so-called starfish planetary nebula by Labin et al. in beginning of 2017. Starfish PNs are objects that show the same morphological characteristics, which are an equatorial waist or ring and fast lobes with approximately the same sizes that therefore have been emerged at the same time (cf. Labin et al.: Catching a Grown-Up Starfish Planetary Nebula: I. Morpho-Kinematical study of PC 22; you can find the very interesting pdf online).

I was quite thrilled when I first saw this object with my 18" Dobsonian in September 2014. Even though it is not particularly bright, I could see the conspicuous elongation of PC 22. Kent Wallace saw this object with an 8" telescope, so you might want to give it a try – almost regardless of the size of your telescope.

**PK 51-4.1 (=PC22)**  
 RA: 19h 42.0min  
 Dec: 13°51'  
 Constellation: Aquila  
 Brightness: 14m4  
 Central star: 18m1  
 Size: 20 arcsec  
 Distance: 15,000 ly



My notes were: Nice PN that can be found and identified easily using a UHC-filter at 94x, good response to [OIII], very interesting appearance, elongated object with a star directly to its north,

averted vision improves visibility and a filter (UHC or [OIII]) makes the nebula look bigger; 452x, fst 6m8 (Lyr)

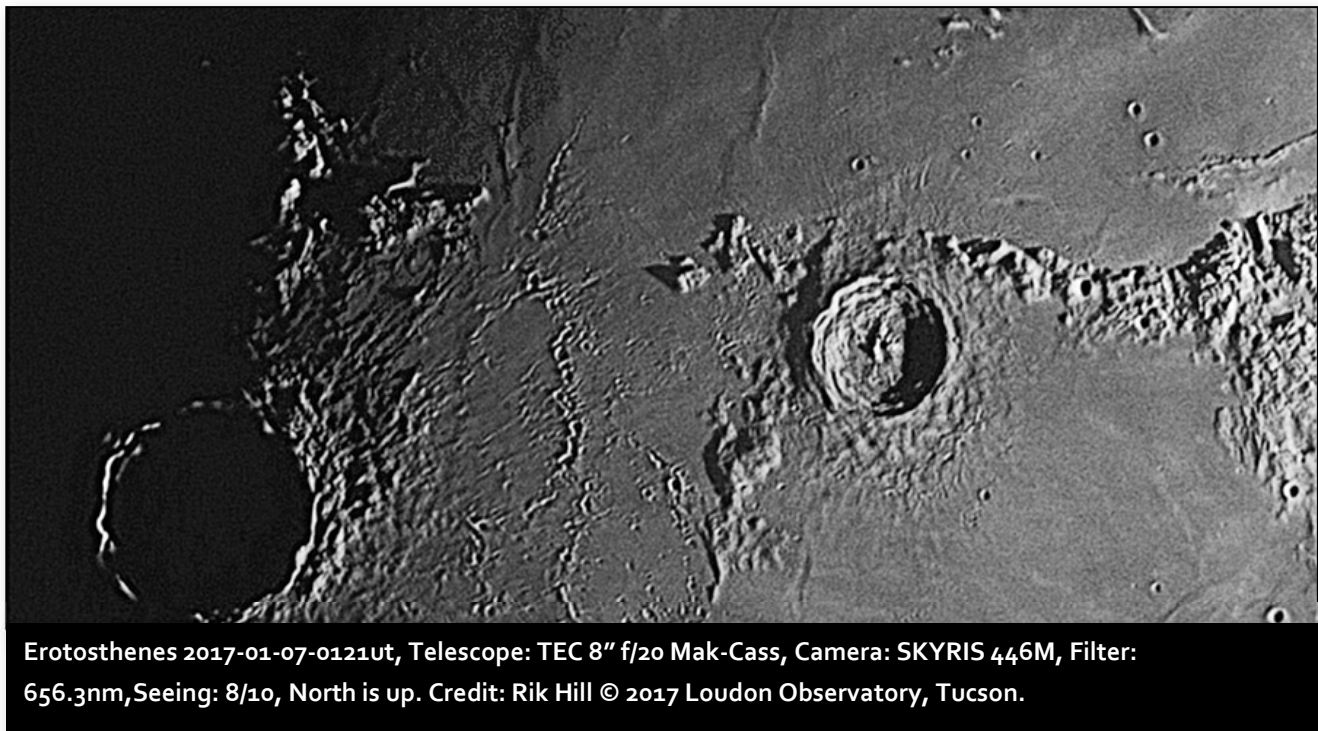


# **Observing and Imaging**

## *Lunartic's Corner*

Text by Rik Hill (rhill[at]jpl.arizona.edu)

### *In the shadow of a giant*



It must be a rough life for any features near Copernicus. To be lost in the shadow of the 95km giant means you will always be overlooked. Such is the case of Eratosthenes, a 60km crater that would shine on its own in lesser environs. From the wonderfully terraced walls to the splendid crisscrossed pattern in the hummocky terrain of the ejecta blanket, it's a sight to behold. Beyond the immediate thick ejecta are radial streaks of a thinner layer of ejected material spreading into Sinus Aestuum below and Mare Imbrium above. To the right of Eratosthenes is the curve of peaks that is the tail end of the Montes Apenninus. At the far right end of the curve is Mons Wolff with deep valleys on its flanks.

To the left of Eratosthenes is the ghost crater Stadius splattered with secondary craters from the Copernicus impact that stretch to the upper edge of this image. Back in the early 1960s I had to work to see these pits in my 60mm Tasco refractor. It was not until I had my RV6 6" f/9 reflector that they were clear to me.

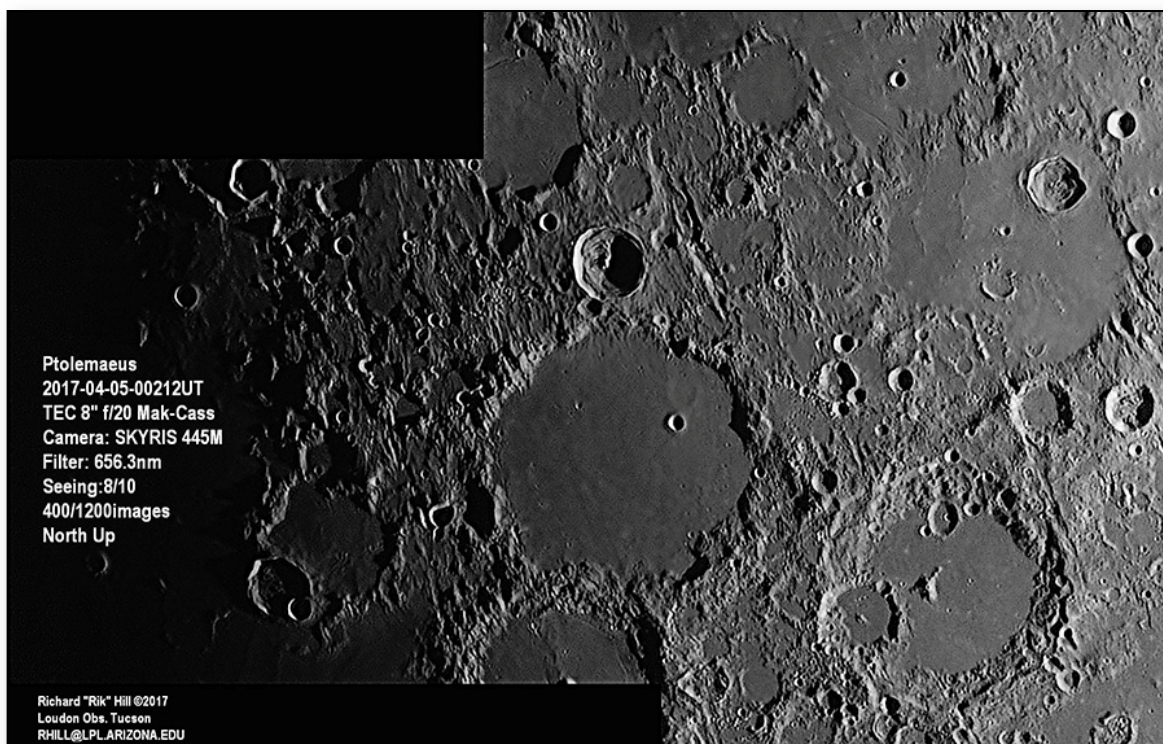
This montage was made from two images, each of which was a 500 frame stack from 1500 frame AVIs. They were combined in iMerge and further processed with GIMP and IrfanView.

# **Observing and Imaging**

## *Lunartic's Corner*

Text by Rik Hill (rhill[at]lpl.arizona.edu)

### *The Great Walled Plain*



Many of those who look at the moon for the first time do so around first quarter and the first thing they often notice is the great crater right in the middle. This, what we used to call a great walled plain, is the 158km diameter Ptolemaeus. I have heard people say they can see it naked eye when it is on the terminator. Sadly, I've not had that experience. This is an ancient crater, even by lunar measure. It may be as old as 4.5 billion years. It may seem hard to believe but to the right of Ptolemaeus is the crater Albategnius (139km) which is half a billion years younger. It looks older with all the later impact damage like the 46km crater Klein on its left wall. Up above Klein is another large walled plain, not so well defined as Ptolemaeus. This is Hipparchus (155km). It's about the same age as Ptolemaeus with the younger Horrocks (31km) near its northern wall.

On the floor of Ptolemaeus is a very stark young crater Ammonius that was a challenge to me with my little 2.4" telescope in the early 1960s. Back then it was called Lyot but the crater of that name now lies on the

lunar southeastern limb. Above Ptolemaeus is Herschel (43km), a clear deep crater, and further above that you can see most of another plain, Flammarion (77km), named for Camille Flammarion, who was the author of one of the first serious astronomy books (tomes) I ever had.

Before leaving, notice that the whole area is raked with deep, long, parallel scars from mountain-sized "rocks" that were ejected (probably during the Imbrium impact) and scoured the landscape. There's a particularly interesting one of these gashes just to the right of Herschel.

The three AVIs used in this montage were stacked using AVIstack2 and further processed with GIMP and IrfanView with final assembly done with iMerge.



# **Observing and Imaging**

## Constellation of the Season

Text and artwork provided by Chris Lancaster

### Cygnus - The Swan

There are many stories behind this constellation. One describes Cygnus as the Greek god Zeus after he disguised himself as a swan to seduce Leda, wife of a Spartan king. Another tells of Orpheus, a musician who was changed into a swan and lofted into the sky next to his harp (Lyra). And then there is the dramatic story of a young man called Cygnus who was the friend or brother of Phaethon, the son of Apollo. Phaethon borrowed the Sun chariot for a quick ride but soon lost control of the vehicle. To stop the chariot, Zeus was forced to kill Phaethon who fell into the river Eridanus. Cygnus frantically swam through the waters in an attempt to pull Phaethon back to shore for burial. Zeus was touched by the devotion Cygnus showed to his friend, so he turned Cygnus into a swan and gave him a permanent place in the heavens.

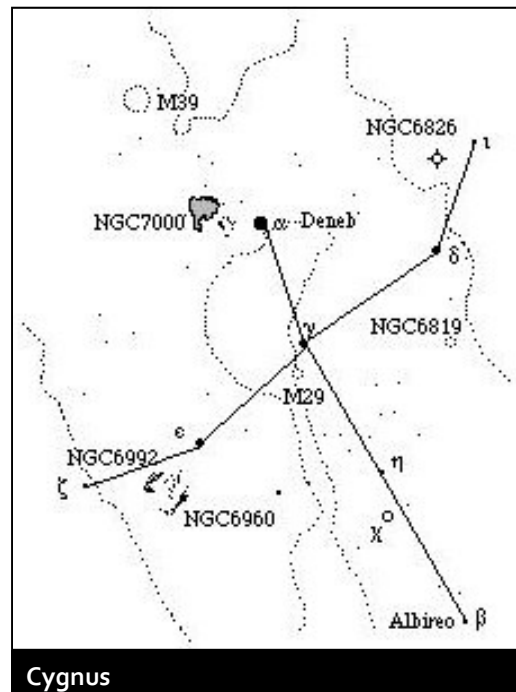
Near the northeast corner of the constellation is the star cluster M39. This is a very large, loose cluster of about 30 stars of magnitudes 7 to 10 spanning 32', or about the size of the moon at perigee. Its true appearance is best appreciated in binoculars, since in the telescope it becomes more of a random scattering of separate stars. It can be found 9.2d ENE of the 1.2 magnitude star Deneb (Alpha Cygni) or RA 21h 32.3' Dec +48d 26'. In M29 we find a much more compact cluster, and one which is almost lost in the surrounding star fields of the Milky Way. Look 1.8d SSE of Gamma Cygni for a tight group (7') of 10-15 stars of 8th and 9th magnitude forming a shape like two parentheses turned backwards--)(.

Another compact cluster measuring about 5' is NGC6819. Sometimes nicknamed the Foxhead, this is a rich group of stars of magnitudes 11 to 15 sitting 7.8' west of Gamma Cygni (RA 19h 41.3' Dec +40d 11'). It assumes the shape of a square vase or, as the name might suggest, an animal's snout.

Deneb is worth special mention since it is one of the intrinsically brightest stars known, giving off 60,000 times the light of the sun. It shines at magnitude 1.2 from a distance of about 1,800 light years. If placed at the standard distance of 10 parsecs (32.6 light years), it would shine at magnitude -7 (its absolute magnitude), while the sun at Deneb's distance would be a 13.3 magnitude weakling.

Nearby is NGC7000 (3.2 degrees E of Deneb), also known as the North American nebula. In a dark sky it is visible in 50mm or larger binoculars. It covers a 120'x100' patch of the sky as a diffuse glowing cloud roughly outlining the shape of the North American continent.

Another well known nebula is the Veil Nebula. It is separated into two parts as NGC6992 to the east and NGC6960 to the west. In 8-inch and



larger scopes this complex mass of nebulosity, which is almost 180' in diameter, is fairly evident as wispy tangles of gasses 3d SSE of Epsilon Cygni. The brightest portion, NGC6992, is a 1 degree long arc south of a line connecting Epsilon and Zeta Cygni, while NGC6960 is dimmer but perhaps a little easier to find since it passes by the 4.2 magnitude star 52 Cygni. It is very much worth the effort to pan along the Veil's entire face to study the details of its structure.

Increase your power to go after a small planetary nebula about 80% of the distance from Deneb to Iota Cygni (RA 19h 45m Dec +50d 31'). Measuring a mere 2' in diameter, this 10th magnitude nebula is NGC6826. With sufficient magnification, it shows an obvious disc compared to neighboring stars.

Chi Cygni is a variable star of special interest due to its wide range of brightness. Watch for it to fade to 13th magnitude, then brighten by a factor of 3,000 to near 5th magnitude over a period of 407 days.

Even though most observers with more than just a few glimpses through a telescope are closely familiar with Beta Cygni, I would feel remiss if I didn't mention it. This is Albireo, one of the best double stars in the sky. Any telescope can split the pair which are 34" apart and will show a pale golden yellow primary of magnitude 3.1, and a magnitude 5.1 companion of a wonderfully rich blue color.

*The Constellation of the Season, written by Chris Lancaster, 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.*



## ★ Featured Article

### Skyward—June 2017

Text and Photos by David H. Levy, TAAA Past President



### *The Partial Phases of August's Eclipse*

*This Skyward article is provided by David H Levy. The Skyward series is featured in the community publication, The Vail Voice. Other editions of Skyward can be found at <http://jarnac.jarnac.org/>*

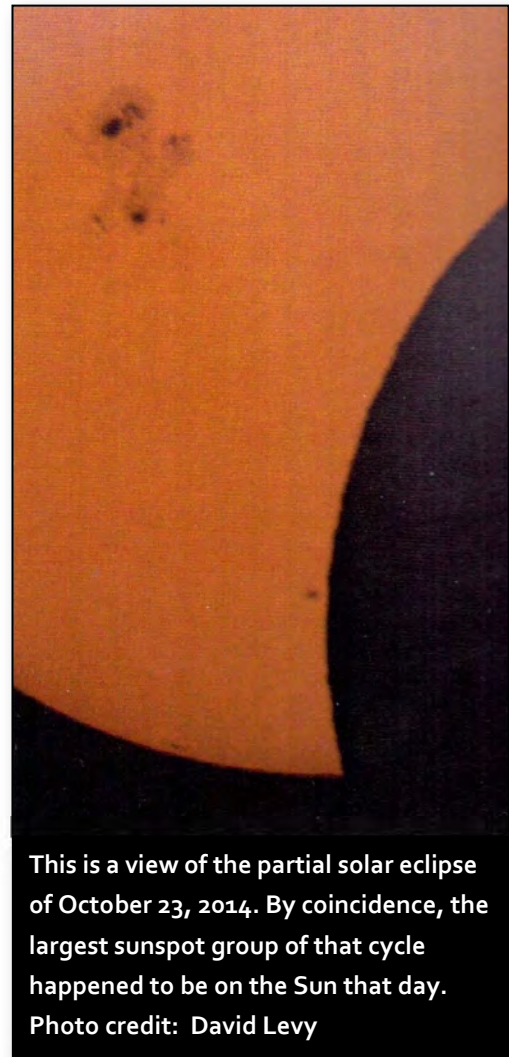
On August 21 this summer, the long shadow of the Moon will race across the United States, offering millions of people a look at the Sun's magnificent atmosphere, its corona. But for the millions more who do not make it to the narrow path of total eclipse, the Sun's light will still be partially cut off by the Moon. Everyone in the United States, and almost all of Canada, will see a partial eclipse that day. How much of the Sun will be covered by the Moon depends on where you live. Tucson, Arizona, to cite an example, will see a maximum eclipse of 58%.

A partial eclipse lacks the drama of a total eclipse, but it is well worth watching nevertheless. The beginning is subtle. The Moon's first bite is barely noticeable, appearing at first as a tiny flat area cutting into the edge of the Sun. Within a few minutes that "line" becomes curved as the Moon cuts into ever-larger regions of the Sun. As the eclipse progresses, more and more of the Sun gets cut off. Within an hour, half the Sun will be covered and our star will take on the appearance of a crescent.

By this time you need to pay close attention to the warnings about possible eye damage during a solar eclipse. Never look at the Sun without protection for your eyes. It is dangerous even when there is no eclipse. During an eclipse, the Sun's light is reduced, and you do want to gaze at it, but the dangerous UV is still there. (During the moment of total eclipse, and only then, is it perfectly safe to gaze at the Sun without protection for your eyes.) Most people have access to eclipse glasses fitted with strips of mylar plastic that offer excellent protection from the Sun's ultraviolet rays. If you do not have access to a pair, you can project the Sun's image through a pinhole onto a second sheet of paper or cardboard. But do not look through the pinhole. If you have a telescope, you can project the sun's image onto a piece of cardboard, a wall, or even the ground.

The closer you are to the path of totality, the thinner the crescent will get. If there is a tree nearby, try looking at the spaces between its leaves. You should be able to see dozens of crescent Suns, each one projected through a space between the leaves. Their appearance is really quite wonderful. If the eclipse gets deeper than 80%, the sky will begin to darken slightly and a general sense of quiet will start to descend across the land.

After maximum eclipse, the story reverses. The sky lightens up, the crescent gets much wider, and after another hour the Moon leaves the Sun and the eclipse is over.



**This is a view of the partial solar eclipse of October 23, 2014. By coincidence, the largest sunspot group of that cycle happened to be on the Sun that day.  
Photo credit: David Levy**

I know all these things because I have witnessed 90 eclipses since 1959, about 30 of which were either partial or the partial phases of total eclipses. An eclipse offers absolute proof that the Earth is moving through space around the Sun, that the Moon circles the Earth, and that because of a cosmic coincidence, the Moon and the Sun get in each other's way and that occasionally there is an eclipse. We are a part of this graceful movement. Eclipses teach us that we are a part of the solar system, and on August 21, throughout most of North America, we will get a first hand demonstration.

## ★ Featured Article

### Skyward—May 2017

Text and Photos by David H. Levy, TAAA Past President

#### *A country that respects its astronomical history*



*This Skyward article is provided by David H Levy. The Skyward series is featured in the community publication, The Vail Voice. Other editions of Skyward can be found at <http://jarnac.jarnac.org/>*

Brazil is a land that has an incredibly rich legacy in astronomy, and without a doubt the country respects that history. I learned that lesson a couple of hours after my flight landed in Rio de Janeiro to lecture at the Tenth Conference on Astronomy and Astronautics. Before heading off to the meeting venue in Campos dos Goytacazes, a city some two hundred kilometers north of Rio, Marcelo Souza insisted that we visit the Observatorio Nacional in Rio. We arrived at what first appeared to be an aging planetarium, but when we entered the front door we walked into an earlier time.

Brazil has a rich astronomical history, dating back to the middle 17th century when Portuguese sailors made landfall on what would one day be modern Brazil. They navigated using sextants, but when they arrived they later followed the developments in Europe and began setting up simple refractor telescopes with small lenses. In its earliest days, without a plethora of telescopes, the



**The Southern Cross as photographed from David's hotel at Campos dos Goytacazes.**

naked eye was the primary instrument used to appreciate, learn from, and most of all, enjoy the stars. In fact, while on my tour of this wonderful place, I gave two lectures to classes of young children. Each lecture consisted of a single sentence: "Always enjoy the stars."

Brazil's national observatory does encourage its visitors to enjoy the stars.. I was most impressed with what appeared to be a very long rounded wood box hanging innocently from the ceiling. But it wasn't a box. It was a gorgeous old tube that, once upon a time, supported a 32-cm diameter lens, which stands displayed in a case nearby. The telescope was intended to be used at this very observatory, but the complex already had a more traditional metal tubed refractor that the staff was happy with, and which miraculously is still in use today. This metal-tubed telescope is still used for public viewing nights every clear Wednesday and Saturday evening.

We can learn much from the National Observatory in Brazil, which takes its history quite seriously. These lovely telescopes were state of the art around the world, from about 1800 through 1930. By the late twentieth century the old refractors had been superseded by the great reflectors, which still do the best scientific observing. Currently the Hubble Space telescope, a giant 90-inch reflector built to use in space, enjoys the best pictorial definition of any telescope in the world. These old refractors Rio de Janeiro, however, still have life left in them. As long as there are young eyes and minds eager to peer through these telescopes, they could live forever.



**Sugarloaf Mountain at Rio de Janeiro.**

## ★ Featured Article

### *The 2017 Solar Eclipse Across America*

Text by Teagan Wall



*This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit [spaceplace.nasa.gov](http://spaceplace.nasa.gov) to explore space and Earth science!*

On August 21st, the sky will darken, the temperature will drop and all fifty United States will be able to see the Moon pass—at least partially—in front of the Sun. It's a solar eclipse!

A solar eclipse happens when the Moon passes between the Sun and Earth, casting its shadow on Earth. Sometimes the Moon only covers up part of the Sun. That is called a partial solar eclipse. When the Moon covers up the Sun completely, it's called a total solar eclipse. As our planet rotates, the Moon's shadow moves across Earth's surface. The path of the inner part of this shadow, where the Moon totally covers the Sun, is called the path of totality.

The path of totality on August 21 stretches from Oregon to South Carolina. If you happen to be in that path, you will be able to experience a total solar eclipse! If you're in any of the 50 United States during this time, you can see a partial solar eclipse.

No matter where you'll be for the eclipse, remember that SAFETY is very important. Never look at the Sun when any part of it is exposed, like during a partial eclipse! It can hurt your eyes very badly. If you want to view the eclipse, you can buy special eclipse glasses. Go the NASA 2017 Eclipse Safety website to learn more about what glasses to buy.

If you are in the path of the total eclipse, you may look directly at the eclipse only when the Moon has completely covered the Sun. This is called totality, and it lasts a very short time. You must be sure to put your eclipse glasses back on before the Sun peeks out from behind the Moon.

You won't be the only one watching this event! NASA scientists will use this eclipse to study our Sun. During a total solar eclipse, we can see the Sun's atmosphere, called the corona. Usually the Sun is so bright that we can't see the corona. However, when the Moon blocks out most of the Sun's light, we can get a glimpse of the corona.

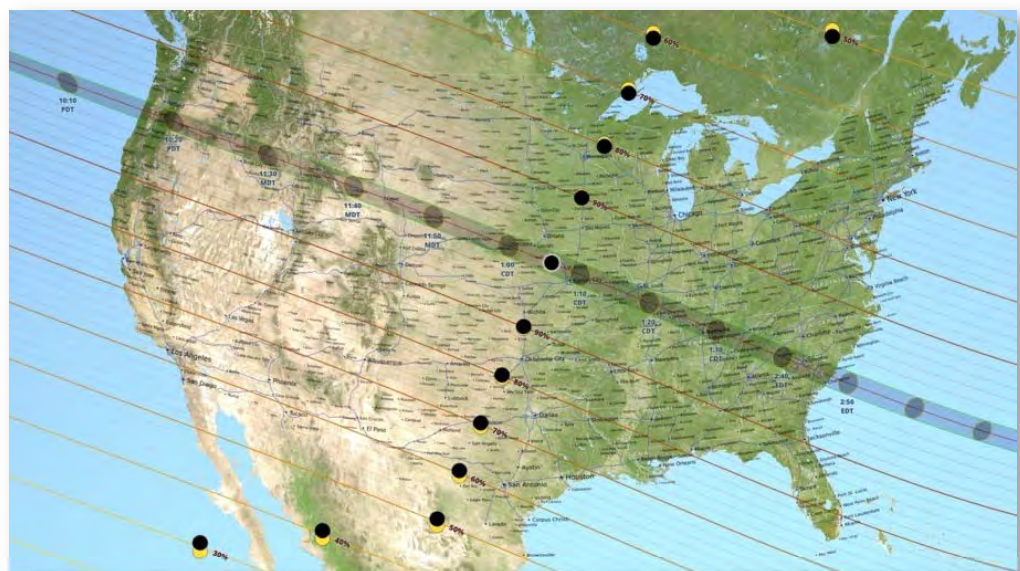
The surface of the Sun is about 10,000 degrees Fahrenheit, but the corona is much hotter. It's about 2 million degrees Fahrenheit! The eclipse gives NASA researchers the chance to learn more about why the corona is so hot. In fact, while the eclipse will only last about two to three minutes in one place, scientists have found a way to have more time to study it.

NASA will use two research jets to chase the eclipse as it crosses the country. The jets will fly very high, and spend seven minutes in the shadow of the Moon. Researchers are using jets to help look for small explosions on the Sun, called nanoflares. These nanoflares may help to explain the corona's extreme heat.

Whether you're watching with eclipse glasses from the ground, or in a NASA jet from the sky, the 2017 eclipse should be quite a show! It's a fun reminder of our place in the solar system, and how much we still have to learn.

To learn about what eclipse glasses to buy and other eclipse safety guidelines, visit: <https://eclipse2017.nasa.gov/safety>

To learn more about solar eclipses, check out this NASA Space Place video: <https://spaceplace.nasa.gov/eclipse-snap>



**A map of the United States showing the path of totality for the August 21, 2017 total solar eclipse. Image credit: NASA's Scientific Visualization Studio**



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