February 2020

February Meeting Details

DATE: Tuesday, February 11th
MEETING TIME: 7:00 PM
PLACE: La Posada Recreation Center

MEETING SCHEDULE:
- 7:00 Meeting Intro and Welcome
- 7:10 Organizational Announcements
- 7:30 Featured Presentation
- ~8:15 Club Activities/Business
- ~8:30 Door Prizes Drawing?
- ~8:45 Outside Activities/Snack at Denny's

Join us after the meeting at the local Denny’s restaurant for a snack, dessert, or whatever so we can get to know each other better and talk more astronomy.

February Presentation

WHO: Cassandra Lejoly
TITLE: Researching Comets: The Forgotten Dust Particles

ABSTRACT: Cometary research often focuses on understanding what type of gases are sublimating from the surfaces of comets; my work as a PhD Candidate at the Lunar and Planetary Laboratory focuses instead on what the gas tends to drag with it when it leaves the nucleus. Specifically, what type of dust particles does it bring along for the ride. This talk will take you through a brief history of cometary research, all the way through the history of my cometary research, leaving you knowing a lot more about how little we actually know.

ABOUT THE SPEAKER: Cassandra Lejoly is a graduate student at the Lunar & Planetary Laboratory and she is currently in charge of the LPL Graduate Student Outreach group at the University of Arizona. She has a B.S. in Astronomy and Mathematics, 2014, from the University of Arizona and a M.S. in Applied Physics, 2016, from Northern Arizona University.

Next Member Star Parties

DATE: Thursday, February 20th
TIME: 5:30 PM Setup
PLACE: Canoa Preserve Park

DATE: Thursday, March 26th
TIME: 6:00 PM Setup
PLACE: Canoa Preserve Park

DATE: Thursday, April 23rd
TIME: 6:45 PM Setup
PLACE: Canoa Preserve Park

To get directions and up-to-date information on the status of a star party in case a weather issue develops.

If you have a telescope that you don’t know how to use, or are looking to buy a telescope and want to compare different telescopes, join us at a star party and we can give you some help.
Greetings everyone,

We had another good club star party in January and again it was not very well attended. We had only four people show up. The night was outstanding. I got a chance to try out my new 5” refractor. Take advantage of this great site. There is room for a lot of people.

We had two public start parties scheduled for last month. One was at Tumacocori (the annual “go blind looking at the full Moon night” event). That went well. There was not a real big public crowd there. The second was at Historic Canoa Ranch. The initial weather forecast was not good. But in looking at the water vapor satellite image, a nice break was developing, so we went ahead with it. The first hour was not good. The only object we could see was Venus as that was extremely bright and you could see it through the light cloud cover. But at about 7pm, the skies began to open, not totally but enough to view some objects. There was a great crowd there so we were able to make them happy. We have three publics scheduled for February plus a joint solar one with TAAA. Please help out. We need club member participation at these public events else we will have to discontinue our support of them.

John Dwyer, President SAS

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**UPCOMING EVENTS**

<table>
<thead>
<tr>
<th>NEXT MEETING</th>
<th>PRESIDENT’S NOTES</th>
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<tbody>
<tr>
<td><strong>DATE:</strong> March 10th</td>
<td>Greetings everyone,</td>
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<tr>
<td><strong>TIME:</strong> 7:00 P.M.</td>
<td>We had another good club star party in</td>
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<tr>
<td><strong>SPEAKER:</strong> TBD</td>
<td>January and again it was not very well attended.</td>
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<td><strong>TITLE:</strong> TBD</td>
<td>We had only four people show up. The night was</td>
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**PUBLIC STAR PARTIES**

| DATE: February 21st | We had another good club star party in |
| TIME: 6:00 PM Setup | January and again it was not very well attended. |
| PLACE: Historic Canoa Ranch | We had only four people show up. The night was |

| DATE: February 22nd | outstanding. I got a chance to try out my new 5” |
| TIME: 6:00 PM Setup | refractor. Take advantage of this great site. |
| PLACE: Tumacocori National Historical Park | There is room for a lot of people. |

| DATE: March 20th | We had two public start parties scheduled |
| TIME: 6:30 PM Setup | for last month. One was at Tumacocori (the |
| PLACE: Historic Canoa Ranch | annual “go blind looking at the full Moon night” |

| DATE: March 24th | event). That went well. There was not a real big |
| TIME: 6:00 PM Setup | public crowd there. The second was at Historic |
| PLACE: Tumacocori National Historical Park | Canoa Ranch. The initial weather forecast was |

**CLUB EQUIPMENT FOR LOAN OUT**

**TELESCOPES:**

- 2 - 8” Celestron Schmidt Cassegrain telescopes
- 1 – 4” Refractor telescope
- 1 – 1” Refractor telescope

*Note: Instruction may be required for some telescopes. Contact one of the club officers for information and availability.*

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**CLUB BOOK/CD/DVD LOAN LIBRARY**

**BOOKS:**

The following books are available for check out:

1. *Guide to the Stars (16")* by David H. Levy
3. *Touring the Universe: A Practical Guide to Exploring the Cosmos through 2017* by Ken Graun (2 copies)

*Please see the club treasurer or secretary for availability. Our thanks to Ken Graun for his generous donations.*

**CDs/DVDs:**

We have “Understanding the Universe: An Introduction to Astronomy”. This is a 16 DVD set of 96 lectures (30 min per lecture) by Dr Alex Filippenko of UC Berkeley and CalTech. This is a nontechnical introductory college-level course on astronomy. More information about this course can be found at [http://www.teach12.com/ttcx/coursedesclong2.aspx?cid=1810](http://www.teach12.com/ttcx/coursedesclong2.aspx?cid=1810). Please see the club treasurer at the next meeting for availability.
THE FEBRUARY SKY

Jupiter is now visible in the morning sky, rising about 2 hours before the Sun. Saturn, now also in the morning sky, rising about 1.5 hours before the Sun. Venus is still the primary evening sky object. It will be at mag -4+ all month. It is about 70% illuminated now and still rather small as it is on the other side of the Sun from us. Mercury, now in the evening sky for most of the month, will reach greatest eastern elongation (18°) from the Sun and is well positioned for our viewing. Mars is still low in the eastern morning sky rising about 3 hours before the Sun. Uranus, in Aries, is in the southwest evening sky at sunset, setting around 11pm. Neptune, located in Aquarius in the evening sky, will be basically two close to the Sun for viewing as it reaches conjunction with the Sun early next month.

There is still only one comet that is currently visible. Comet C/2017 T2 (PanSTARRS) is currently around 9th magnitude. It passed through the Double Cluster late in January and will be moving towards Cassiopeia as the month goes on. It is not an easy target as it is rather faint and small. It is predicted to reach 8th magnitude next summer. It will be well positioned for Northern Hemisphere observers up to that time.

There will be an occultation of Mars by the Moon on the morning of the 18th between 4:30am and 5:30am. Also keep a look out in the evening for the Zodiacal Light this month and next in the two weeks after the full Moon.

WANT TO VIEW SATELLITES?

To find out information on when you can view satellites, such as the International Space Station (ISS), or satellite related events, such as Iridium Flares, go to www.heavens-above.com. Under "Configuration", use “select from map" to enter your specific location (precision can make a difference for Iridium Flares), and choose what satellite’s information you want to view. Also, information on comets, planets, and other objects are available.

FEBRUARY MOON/SUN TIMES

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<th>M-Phase</th>
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<th>Star Party</th>
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(S)=Solar

WANT CURRENT COMET INFORMATION?

If you want information on current observable comets, go to “The Weekly Information about Bright Comets” site at http://www.aerith.net/comet/weekly/current.html. Comets are listed in brightest to least bright order. Remember, to see a comet without any optical aid, it must be approximately 4th magnitude or brighter. With binoculars, the comet would most likely need to be at least 8th magnitude. Comets below 11th magnitude might be difficult to pick up with other than a large aperture telescope. Visibility can also depend on how diffuse the comet is.
THE STARGAZER’S CORNER: Betelgeuse and the Crab Nebula: Stellar Death and Rebirth

What happens when a star dies? Stargazers are paying close attention to the red giant star Betelgeuse since it recently dimmed in brightness, causing speculation that it may soon end in a brilliant supernova. While it likely won’t explode quite yet, we can preview its fate by observing the nearby Crab Nebula.

Betelgeuse, despite its recent dimming, is still easy to find as the red-hued shoulder star of Orion. A known variable star, Betelgeuse usually competes for the position of the brightest star in Orion with brilliant blue-white Rigel, but recently its brightness has faded to below that of nearby Aldebaran, in Taurus. Betelgeuse is a young star, estimated to be a few million years old, but due to its giant size it leads a fast and furious life. This massive star, known as a supergiant, exhausted the hydrogen fuel in its core and began to fuse helium instead, which caused the outer layers of the star to cool and swell dramatically in size. Betelgeuse is one of the only stars for which we have any kind of detailed surface observations due to its huge size – somewhere between the diameter of the orbits of Mars and Jupiter - and relatively close distance of about 642 light-years. Betelgeuse is also a "runaway star," with its remarkable speed possibly triggered by merging with a smaller companion star. If that is the case, Betelgeuse may actually have millions of years left! So, Betelgeuse may not explode soon after all; or it might explode tomorrow! We have much more to learn about this intriguing star.

The Crab Nebula (M1) is relatively close to Betelgeuse in the sky, in the nearby constellation of Taurus. Its ghostly, spidery gas clouds result from a massive explosion; a supernova observed by astronomers in 1054! A backyard telescope allows you to see some details, but only advanced telescopes reveal the rapidly spinning neutron star found in its center: the last stellar remnant from that cataclysmic event. These gas clouds were created during the giant star’s violent demise and expand ever outward to enrich the universe with heavy elements like silicon, iron, and nickel. These element-rich clouds are like a cosmic fertilizer, making rocky planets like our own Earth possible. Supernova also send out powerful shock waves that help trigger star formation. In fact, if it wasn’t for a long-ago supernova, our solar system - along with all of us - wouldn’t exist! You can learn much more about the Crab Nebula and its neutron star in a new video from NASA’s Universe of Learning, created from observations by the Great Observatories of Hubble, Chandra, and Spitzer: bit.ly/ CrabNebulaVisual

Our last three articles covered the life cycle of stars from observing two neighboring constellations: Orion and Taurus! Our stargazing took us to the "baby stars" found in the stellar nursery of the Orion Nebula, onwards to the teenage stars of the Pleiades and young adult stars of the Hyades, and ended with dying Betelgeuse and the stellar corpse of the Crab Nebula. Want to know more about the life cycle of stars? Explore stellar evolution with “The Lives of Stars” activity and handout: bit.ly/starlifeanddeath.

Compliments: David Prosper of the NASA Night Sky Network
SONORAN STARRY NIGHTS

S.A.S CLUB OFFICERS

<table>
<thead>
<tr>
<th>OFFICE/POSITION</th>
<th>NAME</th>
<th>PHONE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chairman of the Board</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>President</td>
<td>John Dwyer</td>
<td>(520) 393-3680</td>
</tr>
<tr>
<td>Secretary</td>
<td>Michael Moraghan</td>
<td>(520) 399-3352</td>
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<td>Star party Coordinator</td>
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<tr>
<td>Newsletter Editor</td>
<td>John Christensen</td>
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<td>Joe Castor</td>
<td>(620) 584-4454</td>
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<td>ALCOR*</td>
<td>Burley Packwood</td>
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</tr>
<tr>
<td>NSN** Representative</td>
<td>Duane Johnson</td>
<td>(520) 303-6920</td>
</tr>
<tr>
<td>Past President Emeritus</td>
<td>Dan F. Case</td>
<td>(520) 207-6833</td>
</tr>
</tbody>
</table>

* Astronomical League Coordinator
** Night Sky Network

WHY JOIN SAS

1. SAS Family Membership Fee is only $15.00 per year.
2. SAS monthly newsletter “The Sonoran Starry Nights.”
3. Top-quality astronomy lectures by local astronomers!
4. SAS Discount for Astronomy Magazine $34.00 for 1yr or $60.00 for 2 yr renewed through our treasurer.
5. SAS Discount subscription rate for Sky & Telescope Magazine $32.95 for 1-year self-renewed.
7. SAS T-Shirts for sale for $10.00—M, L, XL.
8. Member of International Dark-sky Association (IDA) and The Astronomical League.
9. SAS Discount for Astronomy 2020 Calendar $10.00
10. SAS monthly Member Star Parties.
11. SAS Telescope and astronomy book loan programs.
12. SAS outreach to astronomy education in schools.
13. SAS fellowship with other amateur astronomers!

CLUB DUES

Dues (family or individual) are $15 annually, payable each year in the month you initially joined the club. You will receive a reminder in the monthly newsletter e-mail of your due date. You can either pay at the club meeting or mail it to the club’s address (S.A.S., P.O. Box 1081, Green Valley, AZ, 85622).

SAS WEB SITE

If you want to keep up-to-date with club activities, such as star parties, etc., check out our website at: sonoraastronomicalsociety.org

SAS STATISTICS & FINANCES

Lifetime Members: 0
Individual & Family Members: 163
Total Membership: 163

Bank Balance as of End of Dec: $2626.20
Deposits / (W/Ds): $307.00/($3.00)
Bank Balance as of End of Jan: $2930.20

February 2020

Volume XII Issue 6
Are you interested in Astrophotography or are you currently involved in imaging the skies? Please plan to join our monthly meeting of the Sonoran Desert Astro Imagers group. Our meetings focus on improving our skills, helping each other, workshops, and field trips. Please send your Name and E-mail address to my address below and we’ll include you in the emailing notices of monthly meetings; “the when and where meeting notice.” Do you have any questions? If so, call me (Larry Phillips) at (520) 777-8027 or email to llp41astro@cox.net.

Clear Skies! Larry Phillips

SAS IS A MEMBER OF THE ASTRONOMICAL LEAGUE

Since SAS is a member of the Astronomical League, any SAS member may join the Astronomical League for a nominal fee of $7.50. What are the advantages to you of joining the AL?

1. You can receive various observing awards by joining an “observing club” and observing the required number of objects. There are all levels of clubs from beginner to advanced, viewing constellations to deep-sky objects and using either your naked eyes, binoculars, or a telescope. Contact our ALCOR rep Burley Packwood for details.

2. You can get a 10% discount on books purchased through the AL Book Service.

3. You will receive the AL’s quarterly “Reflector” magazine which keeps you up to date on all the AL activities.

More info at www.astroleague.org

SAS IS A MEMBER OF IDA

SAS is proud to be a member of the International Dark-Sky Association, supporting the reduction in light pollution around the U.S. and the world.

More info at www.darksky.org

SAS NON-PROFIT STATUS

The Sonora Astronomical Society is a 501 (c) (3) nonprofit charitable organization! SAS has a CERTIFICATE OF GOOD STANDING from the State of Arizona Corporation Commission for 2009-2011!

MAGAZINE SUBSCRIPTIONS

To order or renew your Sky and Telescope Magazine at the Club Rate, you can go directly to www.skyandtelescope.com/clubspecial

To order or renew Astronomy Magazine, see the Treasurer.

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EQUIPMENT FOR SALE

One of our club members (John Verderame) is offering a service to sell equipment. Here is John’s info:

“If you have astronomy equipment sitting around collecting dust, or just want to get some cash for your equipment, please contact me! I sometimes buy equipment outright for cash, or if you would like me to help you sell something larger or more expensive, I can do that for a small commission. This is the only way I get new or better equipment, and I did it for the Prescott Astronomy Club too. I sell mainly on Cloudy Nights and eBay, but also sometimes Craig’s List, and have all positive feedback (I go by my actual name on Cloudy Nights if you wish to check me out).

Please call (I don’t do texting) 307-250-2728 or email me at: astroitalian@gmail.com.

Thanks! John Verderame

1. **Celestron 11” Nexstar GPS (Go-To) Telescope.**

   Includes:
   * Alt-Azimuth Mount
   * 1 Eyepiece
   * Landing Pad
   * Feather Touch Focuser
   * Vibration Pads
   * Asking $1400

   Contact Lyle Kolze at (608) 346-5957 or lkolze@yahoo.com

2. **Orion Skyquest xt10i For Sale.**

   includes:

   The telescope is an Orion Skyquest xt10i which has a computer that can locate 14000 items in the sky. It is assembled and the mirror and scope have been checked. It comes with a carrying case. It’s never been used. I decided that another telescope would be better suited for me. Original price was $900. Asking $850 which includes the carrying case, a $120 value. I live in Green Valley.

   Contact Ed Matte at EdMatte@msn.com

3. **Orion XT8 Plus Dob.**

   If you are interested in this scope, contact Robert Shropshire at rshropshire1@aol.com for more information.

4. **Celestron CPC 1100 Computerized Telescope.**

   includes:
   * Starbright XLT optical coating
   * GPS with SkyAlign for quick & easy alignment
   * 9x50 finder scope & Telrad finder
   * microfocuser
   * 2” star diagonal with Virtual View swivel adapter
   * 40 mm x 1.25” Celestron Plossl eyepiece
   * 13 mm x 1.25” TeleVue, Nagler IV eyepiece
   * 17 mm x 2” TeleVue, Nagler IV eyepiece
   * 2” 2x Barlow magnifier
   * hand control with 2 line LCD screen
   * sturdy tripod with 2” diameter steel legs
   * compatible with StarSense technology & WiFi
   * ergonomic carrying handles
   * 12 V cable & 120 V adapter
   * metal carrying case for accessories, manual, original packaging

   In excellent condition was $4400 new, asking $2850 obo

   Please contact Murray Croot, at (520) 372-2383 or mcroot@gmail.com for photos.
The Speaker: Pierre Christian, Ph.D., University of Arizona
Subject: Testing Einstein’s Gravity by Taking Photographs of Black Holes

One of the many things that John Dwyer does as SAS President is finding speakers for the monthly meetings (he would greatly appreciate some help with this). Pierre Christian, Ph.D., University of Arizona, spoke about “Testing Einstein’s Gravity by Taking Photographs of Black Holes”.

Pierre is a Steward Prize Fellow in theoretical and computational astrophysics and was a member of the worldwide team that took the first-ever image of a black hole in 2019. He divided his talk into three sections: What is a Black Hole; How to Photograph a Black Hole; and, Black Holes as Laboratories of Strong Gravity.

The most well tested and accurate theory of gravity is General Relativity. Gravity is not a force; it is a curvature in spacetime that effects even light. A black hole curves spacetime so much that not even light can escape. At its center is a singularity, a point of infinite density, a puncture in the fabric of spacetime. The singularity is surrounded by a membrane, the event horizon. Anything that enters the event horizon cannot escape. If you passed through the event horizon you would feel no change but if you turned around to leave you could not get out.

Pierre drew a stick figure of himself projecting two lights in opposite directions. The figure was standing on a horizontal line representing location with a vertical line projecting upward representing time. The distances the two light beams traveled over time were represented by two inclined lines forming a large V. The sides of the V represent the speed of light. The stick figure can't move faster than light so he cannot go beyond the edges of the V, referred to as the "causal future"; beyond the edges of the V is “the elsewhere”. If a black hole approached, its gravity would tip the V toward it until one edge falls within it and the light beam could not escape. In the black hole time and space switch places; the singularity is a moment in time. Within the event horizon there is no distance, all points are exactly the same amount of time away from the singularity.

A black hole cannot be seen, as light cannot escape. The gas and dust around it form an accretion disk, blocking our optical view of the dark spot. However, radio waves can penetrate the surrounding matter. To take the recent and only image of a black hole, astronomers combined data collected by radio telescopes around the world. In effect, the aperture of the Event Horizon Telescope, as the radio telescopes were collectively called, was as large as the Earth. As their target, astronomers selected the black hole within galaxy M87. The galaxy is 50 million light-years away and from that distance has a diameter of only tens of micron arcseconds. However, it has a very massive black hole that slows events through time dilation, so its image is not blurred by motion. An image of the Milky Way's black hole, a thousand times less massive, was not as clear.

Astrophysicists can model a black hole based on Einstein’s general relativity, with two other assumptions. This is called a Kerr-Newman black hole, “the black holes that we know and love”, as Pierre said. The two other assumptions are “no closed time loop, that is, no time travel”; and, “nature abhors a naked singularity”, that is one without an event horizon. Physics breaks down in a singularity, so without a shielding event horizon anything could happen, there would be no predictability. If the black holes in space are not Kerr-Newman black holes, general relativity is wrong, or there is time travel or indeterminism (nothing could be predicted).

Black holes can be used as evidence of general relativity. The model of an Einsteinian Kerr-Newman black hole is circular and general relativity predicted it could bend light. Gravitational lensing, the bending of light from an object behind a massive gravitational object, validates Einstein's prediction and general relativity. The way light is bent conforms with the Kerr-Newman model.

An audience member asked why the famous image taken by the Event Horizon Telescope makes the black hole appear lopsided. Pierre said that is because of Doppler Beaming. The black hole is spinning, so the light from the approaching edge of the accretion disk appears brighter, and light from the receding edge appears dimmer.

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