

# San Diego Astronomy Association

Celebrating Over 50 Years of Astronomical Outreach



February 2020

<https://www.sdaa.org/>  
A Non-Profit Educational Association  
P.O. Box 23215, San Diego, CA 92193-3215

## Program Meeting

### Next SDAA Business Meeting

February 11th at 7:00pm  
10070 Willow Creek Rd  
San Diego, CA 92131

### Next Program Meeting

February 19th at 7:00pm  
Mission Trails Regional Park  
Visitor and Interpretive Center  
1 Father Junipero Serra Trail

Date: February 19, 2020  
Speaker: Steven Levin  
Topic: Juno & the New Jupiter



Dr. Steven Levin is a Juno Project Scientist at the Jet Propulsion Laboratory. His research interests include:

Measurements of the spatial power spectrum, frequency spectrum, and polarization of the Cosmic Microwave Background Radiation.

Search for ExtraTerrestrial Intelligence (SETI) by surveying for narrow-band microwave emission.

Measurements of magnetic fields in pre-protostellar cold molecular cloud cores by observation of the Zeeman effect in CCS.

Modeling of the inner Jovian radiation belts based on analysis and observations of the associated synchrotron emission.

Juno is in 53-day polar orbits, observing Jupiter in order to understand the planet's gross size and structural properties, as well as measuring its atmospheric composition, temperature and deep wind profiles.

<https://www.youtube.com/watch?v=dDKv-TZZL8E>

## CONTENTS

February 2020, Vol LVIII, Issue 2

Published Monthly by the

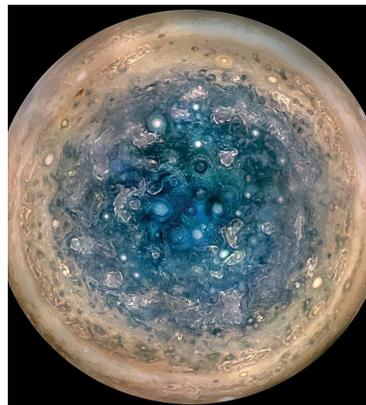
San Diego Astronomy Association

Incorporated in California in 1963

Program Meeting.....	1
January Minutes.....	2
Pixinsight Workshop.....	5
Solar Panel Help.....	5
SDAA Merchandise.....	5
Banquet Photos.....	6
Speckle Imaging.....	9
TDS Schedule.....	10
Winter DSO Imaging.....	11
ALCON 2020.....	14
SDAA Contacts.....	15
NASA Night Sky Notes....	16
Astronomy Cartoons.....	18

### Newsletter Deadline

The deadline to submit articles  
for publication is the  
**15th** of each month.



Southern Storms of Jupiter

[Link to Outreach Calendar](#)

<https://calendar.google.com/calendar/embed?src=g-calendar@sdaa.org&ctz=America/Los>



# San Diego Astronomy Association

## *San Diego Astronomy Association Board of Directors Meeting* *14 January 2020* – Unapproved and subject to revision

### 1. Call to Order

The meeting was called to order at 7:00pm with the following board members in attendance: Dave Wood, President; Steve Hallman, Vice President; Brian McFarland, Recording Secretary; Gene Burch, Treasurer; Bill Nguyen, Corresponding Secretary; Dave Decker, Director; Jeff Herman, Director; Mike Chasin, Director. Members/visitors in attendance: Melany Biendara, Hiro Hakozaiki, Dan Kiser, and Mary Todd.

### 2. Approval of Last Meeting Minutes

December meeting minutes were approved.

3. **Priority / Member Business** – Dennis Ritz made a presentation to the Board regarding solar power at TDS. As our monthly utility bill keeps increasing, Dennis provided documentation showing that we appear to be approaching the break-even point for installing solar panels. The Board approved Dennis's plan to seek two more volunteers to explore the feasibility of this and perform a cost-benefit analysis, and he will provide a note for the newsletter.

### 4. Treasurer's & Membership Report

- Report approved.
- Considering moving some funds around to maximize rate of return (only getting about 0.25% now).

### 5. Standard Reports

- a. Site Maintenance Report – Melany B will contact Anthony's Grading and Paving to get an estimate for erosion control at TDS. Anthony's did a good job on the Cruzan foundation and are familiar with our site.

- b. Observatory/Loaner Scope Report

Observatory: Both star parties canceled due to weather. Equipment remains excellent.

Loaner Scopes: Nothing to report. All is good.

- c. Private Pad Report

We currently have four pads available (three if you don't count #36) and five people on the waiting list (two are current pad holders waiting to upgrade). All of the people on the waiting list have passed on the pads currently available. It should be noted that three of the four pads available are along the south fence and it is getting increasingly difficult to lease those pads.

Pat Boyce gave up his interest in Pad #2 (Grady Boyce will now be the sole lessee) and is now leasing Pad #1.

Pad #29, a grandfathered pad, wanted to transfer the pad to another member directly. There seems to be some confusion as to how to proceed. Brian M will contact Mark S to clarify the club's long-standing procedure for how this is handled.

I haven't heard any more about Pad #14's plan to remove his current improvement and upgrade. The initial concept needed some additional details (like final dimensions).

#### **Pads Annual Usage Summary**

See attached for current usage summary and usage history since 2010. An X in the history indicates a year that the pad was not leased by the current lessee.

#### **Items of note:**

Almost 25% of the private pads had no usage in the last year.

One pad in six of the leased pads has not met the minimum for the last four years.

Seven of the 11 grandfathered pads did not meet the minimum (two are in the process of giving up their pads). Some have been chronically underused for the better part of a decade (one hasn't met the minimum once in 10 years).

Dave W will contact Mark S about the updated pad development rules.

One member wants to install a radio telescope, and Dave W and Mark S will coordinate to try and get that person to take a south fence pad site.



# San Diego Astronomy Association

d. Program Meetings Report

**2020 Program Meeting Guest Speaker List – MTRP Auditorium Has Been Reserved For Dates Below**

19Feb - TBD

18Mar - Nick Galitzk - Simons Observatory (CMB)

15Apr - TBD

20May - TBD

17Jun - TBD

15Jul - TBD

19Aug - TBD

16Sept - TBD

21Oct - TBD // Nominating Com. Elect.

18Nov - TBD // Board, President, and Vice President Elect.

Backup Speaker - Steve Hallman; Gravity Wave Astronomy

May be able to secure Blaine Baggett of JPL for our summer fundraiser.

Dave W suggested that remote video has been a successful option to increase speaker commitments.

e. AISIG Report – First AISIG meeting scheduled for January 23rd. February’s meeting will be a “deep dive” into TARO.

f. Newsletter Report – Andrea continues to do stellar work.

g. Website Report

1. All of the banquet donations (a good long list) have been added to the banquet web page.

2. The webmaster would like to get information about upcoming programs as soon as it is available.

h. Social Media Report – No report.

i. Outreach Report

December was a real challenge because of weather cancellations of school and public events, which of course led to many attempts to reschedule. We were lucky to complete 3 of the 11 events on calendar for the month.

**Totals for December:**

Totals for Month:	Events Completed	3.0
	Events Cancelled	8.0
	Public Attendance	40.0
	Private Attendance	140.0
	Total Attendance	180.0
	Mem Support:	12.0
Average:	Mem/Event:	4.0

**Year to Date since January 1**

Completed Events since January 1:	118.0
Cancelled Events since January 1:	37.0
Events Scheduled since January 1:	155.0
Public Attendees since Jan 1:	8258.0
Private Attendees since Jan 1:	4896.0
Total Attendees since Jan 1:	13154.0



# San Diego Astronomy Association

As seen above in the totals since January 1, 2019, we shared the sky with about **13,154** San Diegans. This is up from our 2018, total of 9,613. The difference is in the number of events completed with **96** in 2018, and **118** in 2019. The increase in “events completed” is mostly due to our efforts to rescue weather challenged school events by moving indoors to conduct “Hands On” astronomy and role-playing exercises. This has been very effective with students in grades 3-5.

Our total attendance in 2019, was also bolstered by several high attendance public events including Julian Starfest, Mt. Helix Park, Lunar Eclipse at Balboa, the addition of events at Dixon Lake, the addition of events at Lake Morena, and consistent high attendance at Stars in the Park and Oakoasis. All of our public events in 2019, enjoyed good support from members and guests.

The Summer program was challenged by our loss of the Paso Picacho Campground to an SDGE project staging area. Ben Grunbaum pursued other options and secured sites at Green Valley Campground and Lake Morena. We hope to have access to the Paso Picacho Campground again in 2020.

We continue to operate without effective North County and South County Coordinators. This requires Dennis Ammann and myself to essentially double our efforts to provide service to these areas. Fortunately, we continue to enjoy the strong support of Kin Searcy for the San Diego County and Mission Trails events, Ben Grunbaum for the Summer mountain events, Ed Rumsey for the TDS Public events, and Dennis Ammann for KQ Ranch.

Our plans for 2020, begin with a re-write of the “Outreach” page on the website, including development of a more efficient protocol for requesting and managing school and other private events.

Our greatest challenge is still the minimal support from SDAA members for school events. These are characterized by their weekday schedule, early evening time frame, extensive driving time in rush hour traffic, and the short span of attention associated with elementary school students. Those that support school events continue to do so because of the excitement and success experienced with pre-pubescent children. We are always looking for members interested in supporting these and any of our other outreach efforts.

- j. TARO Report – Operational.
- k. Merchandise Report – Gene B purchased more shirts and hats.
- l. Cruzen Report
  - 1. Need to drill the Cassegrain mount’s top plate to accommodate the OTA rings. Last step in getting this thing mounted.
  - 2. Bill N working on an operating manual.
  - 3. There are numerous Astronomical League projects that might be of interest to users of the observatory.
- m. Astronomical League Report.
  - 1. 37 SDAA members in the A.L.
  - 2. ALCON 2020 is 15 to 18 July in Albuquerque.
  - 3. A.L. now has a webmaster so Mary submitted SDAA President change from Mike C to Dave W.
- n. JSE – Scheduled for 13 to 16 August, and the committee will commence after the banquet.

## 6. Old Business

- a. Banquet Update
  - 1. Caterer paid.
  - 2. Great list of raffle and auction items.
  - 3. Gene will put out a call for volunteers to help with check in, raffle tickets, etc.
- b. Electrical Upgrade – The trenches are all filled and the next step is to install the panel and the meter enclosure on the power pole.
- c. Other old business – None.

## 7. New Business

- a. New SDAA Board of Directors for 2020

President	Dave Wood	Director Alpha	Pat Boyce
VP	Steve Hallman	Director Beta	Mike Chasin
Treasurer	Melany Biendara	Director Gamma	Dave Decker
Recording	Gene Burch	Director Delta	Hiro Hakozaki
Corresponding	Bill Nguyen		



# San Diego Astronomy Association

The three Board members listed on the SDAA bank accounts (and with account access) will be Melany Biendara, Gene Burch, and Dave Wood.

- b. Property Tax Redemption Form – In the works.
- c. Spring Cleanup – Scheduled for 18 April.
- d. Call for new business – Summer fundraising social event tentatively scheduled for July 25 on the rooftop of the Natural History museum.

## *Pixinsight Workshop*

What better way to start the new year than to improve your image processing skills? SDAA is proud to have partnered with noted astroimagers Warren Keller and Ron Brecher to host a Pixinsight workshop. This two day advanced workshop will be in San Diego May 2-3. As a perk to the SDAA members, if you register before March 1st you will receive a \$50 discount. To ensure the best learning experience the class size is limited to so register soon. <https://www.ip4ap.com/Workshops/May-2020-San-Diego-California-Advanced-Workshop>

## *Solar Panel Help Wanted*

The SDAA Board is looking for a couple of members with solar panel grid tie experience to evaluate renewable electricity at our aptly named Tierra Del Sol observing site. With the new north power drop, there is space for solar panels in a ground frame near the new pole. There are many options for panels, vendors, installers and contracts. As a non-profit, the SDAA will need a contract with installation to benefit from renewable tax incentives. If you have experience installing grid tie solar panels, and a bit of time, please send a brief summary of your experience to [sandiegoastronomyassociation@gmail.com](mailto:sandiegoastronomyassociation@gmail.com).

## *SDAA Merchandise*

SDAA Merchandise is a great way to support our club! We've just re-stocked and have a good selection of sweatshirts, T-shirts, polo shirts and hats in most sizes. Here's a link to our online store: [SDAA - SDAA Store](#)

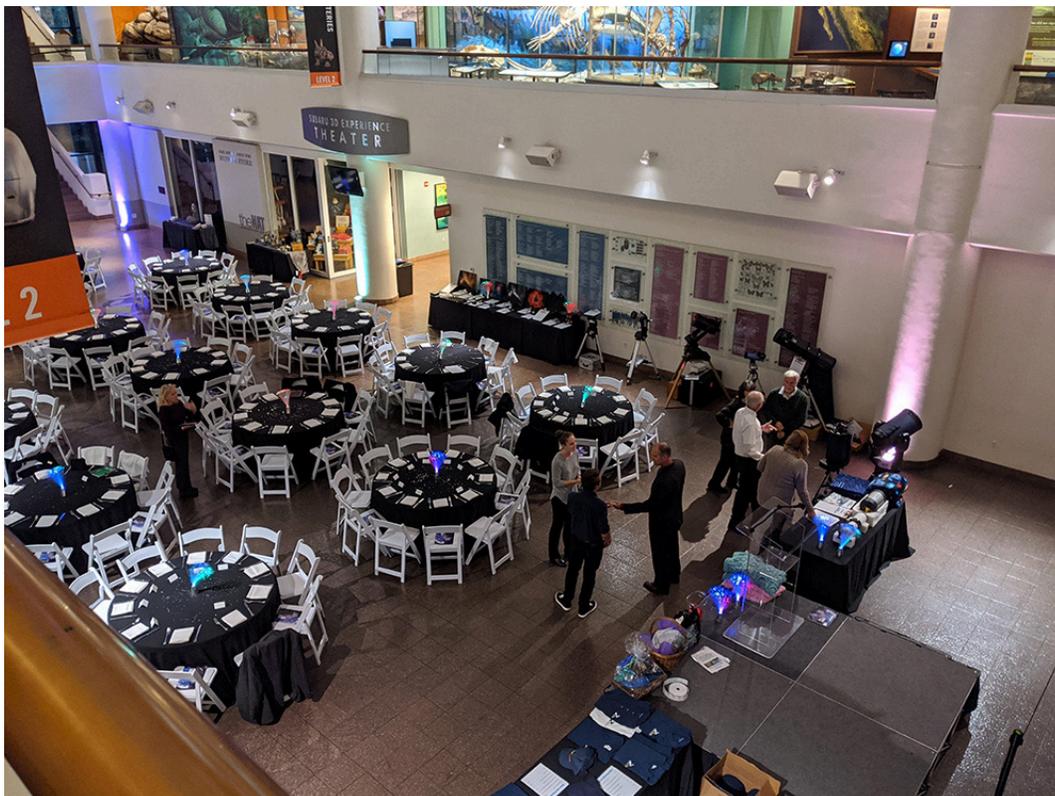




# San Diego Astronomy Association

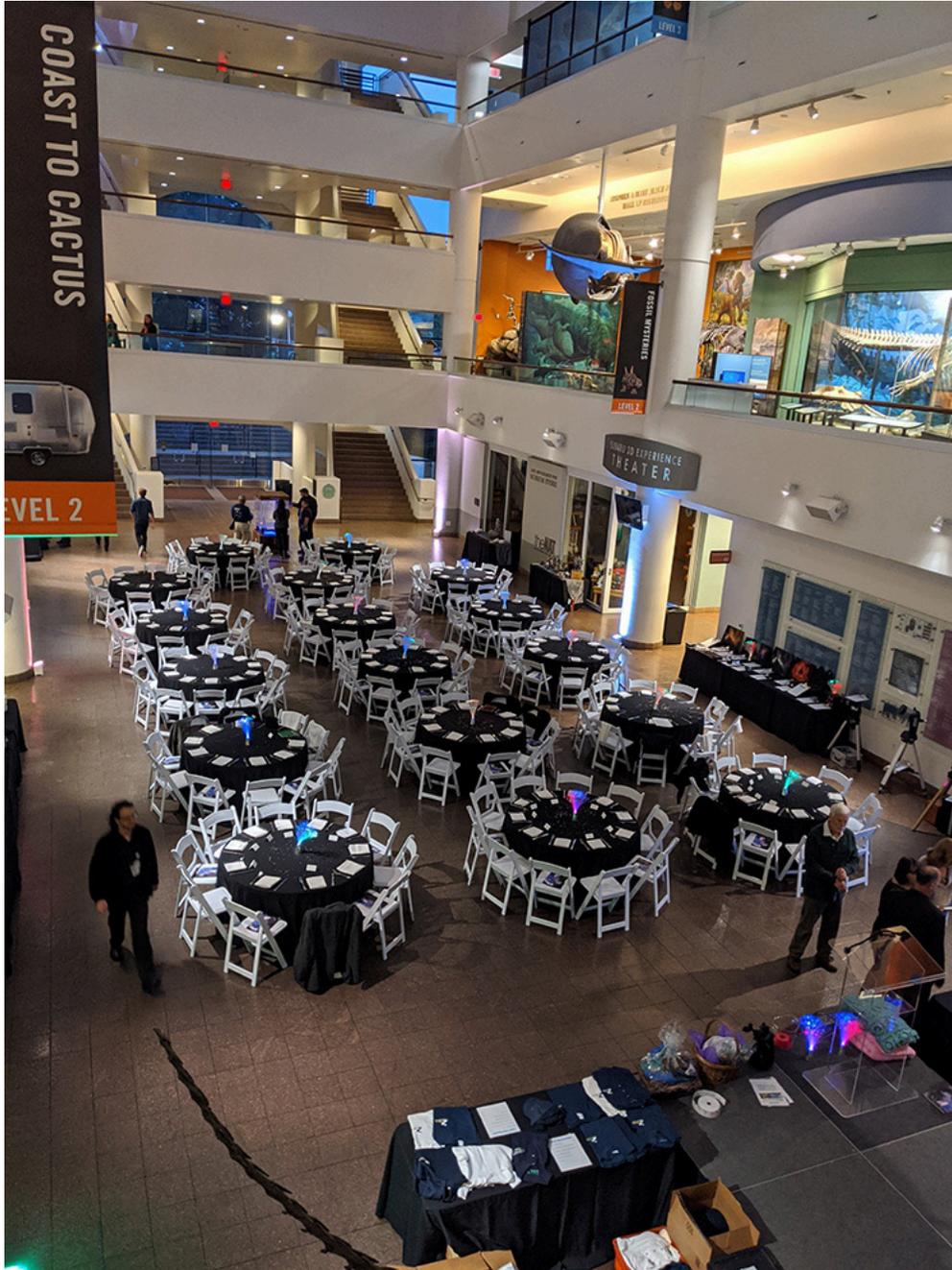
## *Photos from Annual Banquet at the Natural History Museum*

Provided by Dave Wood



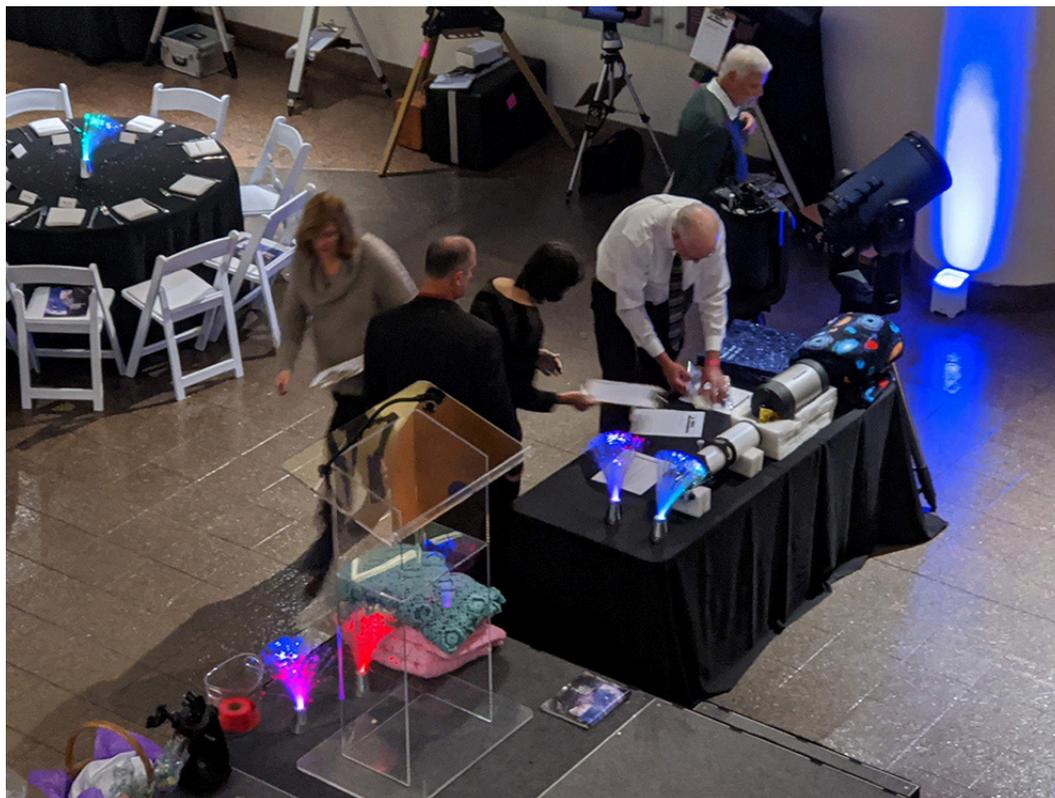


# San Diego Astronomy Association





# San Diego Astronomy Association





# San Diego Astronomy Association

## *Speckle Imaging for Double Star Measurement*

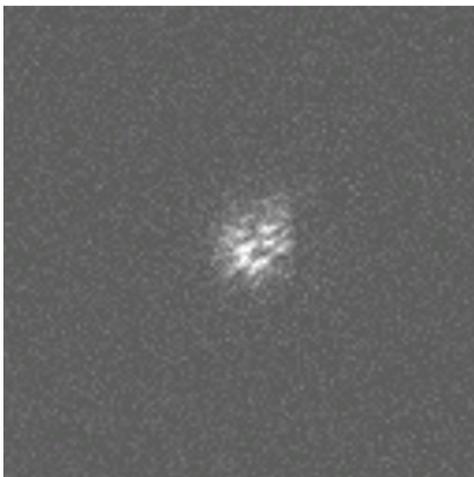
Many, if not most, of the stars in our galaxy are members of binary or multi star systems. The interaction between stars in these systems lets us determine their mass and better understand other astrophysical properties of the stars. The closer together the stars are, the more interesting the interactions become. To understand these systems, the position of the stars relative to one another (their separation and angle) must be measured. Doing this over time yields the star's orbits. The relative motion of double star systems is an active area of research open to citizen scientists.

When the stars are close together, measuring this accurately from standard images becomes difficult. Normally when two stars are very close or are of very different brightness, they cannot be resolved, and their separation distance and angle cannot be determined. Our atmosphere usually limits this optical measurement of double star positions. The atmospheric blurring that prevents measurement is a very dynamic effect. It is caused by the motion of turbulent cells in the air resulting in optical refraction of the light from the stars. These cells and the resulting light refraction change very rapidly.

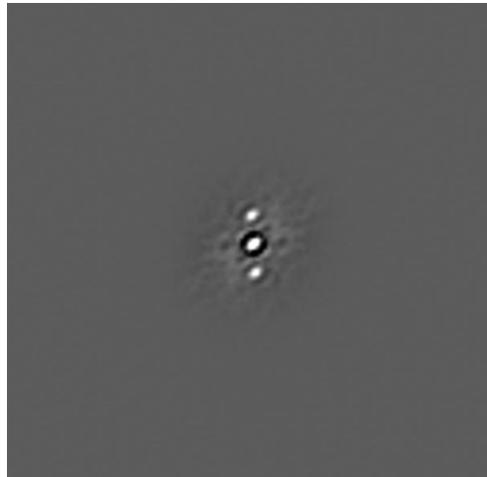
Normally when we take pictures of stars, we make the exposure long enough to get good signal to noise but not saturate the detector. This lets the turbulence cells change during exposure and blurs the image. But if we take very short exposures, we can freeze the atmospheric turbulence in time and get an image that isn't blurred but is still distorted by the turbulence at that one time. A large number of images taken with short exposures can then be used to accurately estimate the stars separation and angle.

One way to do this is called Lucky Imaging. In Lucky Imaging, a large number of images are searched to find ones with low distortion. These images are stacked to yield a good signal to noise image that reveals the star separation and angle.

Another way is called Speckle Imaging. Speckle Imaging uses a bit of math called the Fourier transform. A Fourier transform converts an image into a new image that represents the spatial frequency magnitudes and phases which, when combined, recreates the original image. In speckle processing a large number of short exposure images are Fourier transformed, aligned, and then combined into a single image. When the magnitude of that image is inverse Fourier transformed, the result is the image's autocorrelation function. The autocorrelation function very accurately tells at what positions in the image bright points (like stars) occur. With two stars in the image, this reveals their separation and angle. The two figures show the distortion pattern from a short exposure image and the autocorrelation image resulting from speckle processing a number of images. In the autocorrelation image the separation between the two bright spots and the central bright spot is the separation of the two stars. A line through the three bright spots tells the orientation (angle) of the stars.



Short Exposure Speckle Image



Autocorrelation Image

This kind of image analysis is not difficult to do with a small telescope and a CMOS or video camera to take the short exposure images. A Barlow lens is also needed to get a plate scale fine enough to resolve the image distortion patterns. Software is available to do the analysis without deciphering all the math. There are a few of us at SDAA interested in this technique. If you want to get involved, let Scott Dixon or Pat Boyce know.



# San Diego Astronomy Association

## 2020 Star Party Schedule

Date	Hours	Type	Sunset	Twilight	Moonrise(set)	Illumination
2/15/2020	6:00 to 9:00 PM	Public	5:33 PM	6:56 PM	12:58 AM	54%
2/22/2020	6:00 to 9:00 PM	Member	5:39 PM	7:02 PM	6:44 AM	1%
3/14/2020	7:30 to 10:30 PM	Public	6:56 PM	8:18 PM	12:53 AM	70%
3/21/2020	8:00 to 11:00 PM	Member	7:01 PM	8:23 PM	6:18 AM	6%
4/11/2020	8:00 to 11:00 PM	Public	7:16 PM	8:41 PM	11:43 PM	84%
4/18/2020	8:30 to 11:30 PM	Member	7:21 PM	8:48 PM	4:51 AM	17%
5/16/2020	8:30 to 11:30 PM	Public	7:41 PM	9:17 PM	3:23 AM	31%
5/23/2020	8:30 to 11:30 PM	Member	7:46 PM	9:23 PM	(8:56 PM)	1%
6/13/2020	8:30 to 11:30 PM	Public	7:57 PM	9:39 PM	1:52 AM	47%
6/20/2020	8:30 to 11:30 PM	Member	7:59 PM	9:41 PM	5:59 AM	0%
7/11/2020	8:30 to 11:30 PM	Public	7:58 PM	9:37 PM	12:21 AM	64%
7/18/2020	8:30 to 11:30 PM	Member	7:55 PM	9:33 PM	4:42 AM	5%
8/8/2020	8:30 to 11:30 PM	Public	7:40 PM	9:11 PM	10:49 PM	79%
8/15/2020	8:30 to 11:30 PM	Member	7:32 PM	9:01 PM	3:25 AM	14%
9/12/2020	7:30 to 10:30 PM	Public	6:57 PM	8:21 PM	2:09 AM	28%
9/19/2020	7:30 to 10:30 PM	Member	6:48 PM	8:10 PM	(8:42 PM)	9%
10/10/2020	7:00 to 10:00 PM	Public	6:20 PM	7:42 PM	12:55 AM	44%
10/17/2020	7:00 to 10:00 PM	Member	6:12 PM	7:34 PM	(7:13 PM)	2%
11/7/2020	5:30 to 8:30 PM	Public	4:52 PM	6:16 PM	10:46 PM	61%
11/14/2020	5:30 to 8:30 PM	Member	4:47 PM	6:12 PM	6:48 AM	0%
12/5/2020	5:30 to 8:30 PM	Public	4:42 PM	6:09 PM	9:42 PM	76%
12/12/2020	5:30 to 8:30 PM	Member	4:43 PM	6:11 PM	5:34 AM	0%



# San Diego Astronomy Association

## *Winter DSO Imaging*

By Hunter Harling

The winter season brings with it one of the best times of the year for deep sky object imaging. With Orion over the eastern horizon, there are many deep-sky targets visible.



*Credit: Stellarium software*

Many winter targets are also excellent for narrowband imaging since we are looking towards the galaxy's spiral arms rich with hydrogen-alpha and oxygen III gas. Plenty of deep-sky objects can be found in Auriga constellation as well, such as the Flaming Star Nebula, Tadpole Nebula, and Spaghetti Nebula.



# San Diego Astronomy Association

Here is a stack of the Tadpole Nebula in H $\alpha$  and OIII:



*HOO narrowband image, 12 hours of exposure.*

There are also good opportunities for widefield imaging, particularly of Orion constellation. Betelgeuse has also dimmed over the past few months, so it will look smaller in widefield photographs now than it has in the past, giving us a unique opportunity to capture it at this state.



# San Diego Astronomy Association

Here is a widefield image of the winter constellations shown in the Stellarium clip above:



*Balanced Rock taken at Arches National Park*

At this time of year, venus can also be seen low on the western horizon at sunset:



*Venus and the moon taken at Arches National Park*



# San Diego Astronomy Association

ALCON 2020



Event date:

Wed Jul 15, 2020 (All day) to Sat Jul 18, 2020 (All day)

Location of event:

Embassy Suites Hotel  
1000 Woodward Place NE  
87102 Albuquerque , NM  
United States

See map: [Google Maps](#)

New Mexico US

The Astronomical League holds an annual national convention that provides an opportunity for amateur astronomers all over the country to gather together to learn and exchange ideas, techniques, and opinions on astronomy. The conventions provide professional astronomers an opportunity to address to attendees about their field of expertise. This allows amateurs to learn about the latest discoveries in astronomy directly from the astronomers making the discoveries. This year's Astronomical League Convention (ALCON) will be held in Albuquerque, New Mexico from 15 to 18 July 2020.

The ALCON starts on a Wednesday with an AL Council Meeting. The main conference is held on Thursday, Friday, and Saturday and features speakers and workshops. The conference ends with an awards banquet on Saturday. The speaking events are for those interested in astronomy from the beginner to the advanced amateur. Check the 2020 ALCON schedule for a list of speakers and their topics.

The 2020 ALCON will feature two special events, an evening presentation on 17 July by Apollo 17 Astronaut Harrison Schmitt and a tour of the Very Large Array (VLA) on 19 July. Evening field trips to observing sites will be available on 15, 16, and 17 July.

The ALCON 2020 website is available at <http://alcon2020.astroleague.org>. We hope to see you at the 2020 ALCON!



# San Diego Astronomy Association

## SDAA Contacts

### Club Officers and Directors

President	Dave Wood	<a href="mailto:President@sdaa.org">President@sdaa.org</a>	(858) 735-8808
Vice President	Steve Hallman	<a href="mailto:VicePresident@sdaa.org">VicePresident@sdaa.org</a>	
Recording Secretary	Gene Burch	<a href="mailto:Recording@sdaa.org">Recording@sdaa.org</a>	(858) 926-9610
Treasurer	Melany Biendara	<a href="mailto:Treasurer@sdaa.org">Treasurer@sdaa.org</a>	
Corresponding Secretary	Bill Nguyen	<a href="mailto:Corresponding@sdaa.org">Corresponding@sdaa.org</a>	(619) 751-6621
Director Alpha	Pat Boyce	<a href="mailto:DirectorAlpha@sdaa.org">DirectorAlpha@sdaa.org</a>	(619) 227-9614
Director Beta	Mike Chasin	<a href="mailto:DirectorBeta@sdaa.org">DirectorBeta@sdaa.org</a>	(858) 210-1454
Director Gamma	Dave Decker	<a href="mailto:DirectorGamma@sdaa.org">DirectorGamma@sdaa.org</a>	(619) 972-1003
Director Delta	Hiro Hakozaiki	<a href="mailto:DirectorDelta@sdaa.org">DirectorDelta@sdaa.org</a>	

### Committees

Site Maintenance	Bill Quackenbush	<a href="mailto:TDS@sdaa.org">TDS@sdaa.org</a>	(858) 395-1007
Observatory Director	Ed Rumsey	<a href="mailto:Observatory@sdaa.org">Observatory@sdaa.org</a>	(858) 722-3846
Private Pads	Mark Smith	<a href="mailto:Pads@sdaa.org">Pads@sdaa.org</a>	(858) 484-0540
Outreach	Dave Decker	<a href="mailto:Outreach@sdaa.org">Outreach@sdaa.org</a>	(619) 972-1003
N. County Star Parties	-Vacant-	<a href="mailto:NorthStarParty@sdaa.org">NorthStarParty@sdaa.org</a>	
S. County Star Parties	-Vacant-	<a href="mailto:SouthStarParty@sdaa.org">SouthStarParty@sdaa.org</a>	
E. County Star Parties	Dave Decker	<a href="mailto:EastStarParty@sdaa.org">EastStarParty@sdaa.org</a>	(619) 972-1003
Central County Star Parties	Dennis Ammann	<a href="mailto:CentralStarParty@sdaa.org">CentralStarParty@sdaa.org</a>	(619) 247-2457
Camp with the Stars	-Vacant-	<a href="mailto:CampWiththeStars@sdaa.org">CampWiththeStars@sdaa.org</a>	
K.Q. Ranch Coordinator	Dennis Ammann	<a href="mailto:KQ@sdaa.org">KQ@sdaa.org</a>	(619) 247-2457
Newsletter	Andrea Kuhl	<a href="mailto:Newsletter@sdaa.org">Newsletter@sdaa.org</a>	(858) 547-9887
New Member Mentor	Dan Kiser	<a href="mailto:Mentor@sdaa.org">Mentor@sdaa.org</a>	(858) 922-0592
Webmaster	Jeff Stevens	<a href="mailto:Webmaster@sdaa.org">Webmaster@sdaa.org</a>	(858) 566-2261
AI SIG	Scott Dixon	<a href="mailto:AI SIG@sdaa.org">AI SIG@sdaa.org</a>	(858) 673-9588
Site Acquisition	-Vacant-	<a href="mailto:SecondSite@sdaa.org">SecondSite@sdaa.org</a>	
Field Trips	-Vacant-	<a href="mailto:FieldTrips@sdaa.org">FieldTrips@sdaa.org</a>	
Grants/Fund Raising	-Vacant-	<a href="mailto:Grants@sdaa.org">Grants@sdaa.org</a>	
Julian StarFest	-Vacant-	<a href="mailto:info@julianstarfest.com">info@julianstarfest.com</a>	
Merchandising	-Vacant-	<a href="mailto:Merchandising@sdaa.org">Merchandising@sdaa.org</a>	
Publicity	Jeff Flynn	<a href="mailto:Publicity@sdaa.org">Publicity@sdaa.org</a>	(619) 806-6505
Loaner Scopes	Ed Rumsey	<a href="mailto:loanerscopes@sdaa.org">loanerscopes@sdaa.org</a>	(858) 722-3846
Governing Documents	TBD		
TDS Network	Dave Wood	<a href="mailto:TDSNet@sdaa.org">TDSNet@sdaa.org</a>	(858) 735-8808
Amateur Telescope Making	-Vacant-		
ALCOR (Astronomical League Correspondent) Mary Todd		<a href="mailto:ALCOR@sdaa.org">ALCOR@sdaa.org</a>	(858) 560-2052

#### SDAA Editorial Staff

Editor - Andrea Kuhl  
[newsletter@sdaa.org](mailto:newsletter@sdaa.org)

Assistant Editor: Craig Ewing

Have a great new piece of gear? Read an astronomy-related book that you think others should know about? How about a photograph of an SDAA Member in action? Or are you simply tired of seeing these Boxes in the Newsletter rather than something, well, interesting?

Join the campaign to rid the Newsletter of little boxes by sharing them with the membership. In return for your efforts, you will get your very own byline or photograph credit in addition to the undying gratitude of the Newsletter Editor. Just send your article or picture to [Newsletter@SDAA.Org](mailto:Newsletter@SDAA.Org).



# San Diego Astronomy Association

NASA Night Sky Notes

February 2020



**This article is distributed by NASA Night Sky Network**

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit [nightsky.jpl.nasa.gov](http://nightsky.jpl.nasa.gov) to find local clubs, events, and more!

## **Betelgeuse and the Crab Nebula: Stellar Death and Rebirth**

**David Prosper**

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](http://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](http://bit.ly/starlifeanddeath) .

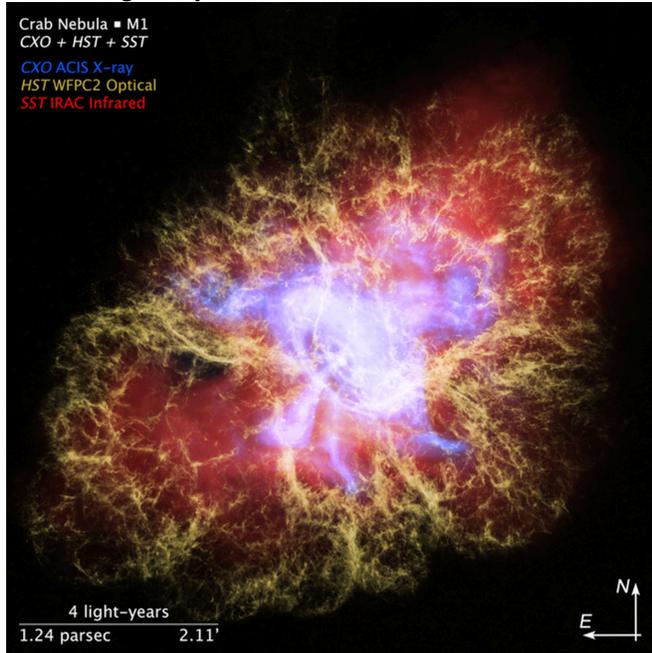
Check out NASA's most up to date observations of supernova and their remains at [nasa.gov](http://nasa.gov)



# San Diego Astronomy Association

NASA Night Sky Notes

February 2020



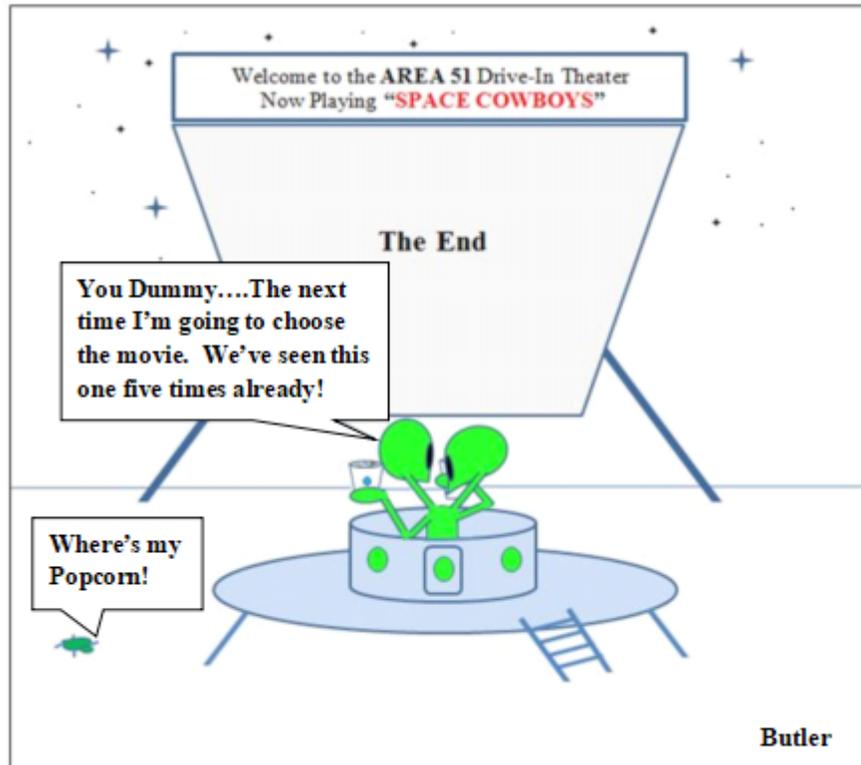
*This image of the Crab Nebula combines X-ray observations from Chandra, optical observations from Hubble, and infrared observations from Spitzer to reveal intricate detail. Notice how the violent energy radiates out from the rapidly spinning neutron star in the center of the nebula (also known as a pulsar) and heats up the surrounding gas. More about this incredible “pulsar wind nebula” can be found at [bit.ly/Crab3D](http://bit.ly/Crab3D). Credit: NASA, ESA, F. Summers, J. Olmsted, L. Hustak, J. DePasquale and G. Bacon (STScI), N. Wolk (CfA), and R. Hurt (Caltech/IPAC)*



*Spot Betelgeuse and the Crab Nebula after sunset! A telescope is needed to spot the ghostly Crab.*



# San Diego Astronomy Association



## MEMBERSHIP INFORMATION

Send dues and renewals to P.O. Box 23215, San Diego, CA 92193-3215. Include any renewal cards from Sky & Telescope or Astronomy magazine in which you wish to continue your subscription. The expiration date shown on your newsletter's mailing label is the only notice that your membership in SDAA will expire. Dues are \$60 for Contributing Memberships; \$35 for Basic Membership; \$60.00 for Private Pads; \$5 for each Family membership. In addition to the club dues the annual rates for magazines available at the club discount are: Sky & Telescope \$32.95 and Astronomy \$34. Make checks payable to S.D. Astronomy Assn. PLEASE DO NOT send renewals directly to Sky Publishing. They return them to us for processing.