

# ★ ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

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# 01. SFAA PRESIDENT'S NOTE | HARVEST MOON

With the arrival of September, many northern hemisphere cultures turned their attention to harvesting what they had planted in the Spring. They would refer to the full Moon from this time period with names like the Corn or Barley Moon, to signify the most important crop of the season. The name Harvest Moon just serves as a reminder that it's time to harvest all, regardless of the kind of crop or produce.

September is also a time to start ready for the coming New Year, and at SFAA, this is a time to start planning next year's event calendar. It is also time to start thinking about board elections. We have a small number of vacant board positions coming up, and I would like to invite our members to inquire about what's involved if you are all curious about what the board does. Perhaps it will interest you more than you can imagine. It will also give you an opportunity to affect the direction of the club and the type of activities we plan for public outreach and for our members.

Even if you are not interested in joining the board, SFAA has volunteering opportunities that are fun and rewarding. Getting the public excited about science and astronomy in particular is a worthwhile endeavor. You get to inspire children and adults alike about the wonders of the universe. And among the easiest astronomy activity there is, is observing the Moon.

While the Moon is very prominent through all of September, International Observe the Moon Night is on October 5<sup>th</sup> this year. So, if you didn't get a chance to study the Moon this month, you can join the rest of the world in this great activity next month. Come join us on Mount Tam that night for our public star party!

Clear skies,

**P.J. Cabrera**  
President, SFAA

## SFAA BOARD OFFICERS AND DIRECTORS

<b>President</b>	P.J. Cabrera	<a href="mailto:president@sfaa-astronomy.org">president@sfaa-astronomy.org</a>
<b>Vice President</b>	Liz Triggs	<a href="mailto:vice-president@sfaa-astronomy.org">vice-president@sfaa-astronomy.org</a>
<b>Treasurer</b>	Scott Miller	<a href="mailto:treasurer@sfaa-astronomy.org">treasurer@sfaa-astronomy.org</a>
<b>Secretary</b>	Bill Kircher	<a href="mailto:secretary@sfaa-astronomy.org">secretary@sfaa-astronomy.org</a>
<b>Directors</b>	Matthew Jones, Brian Kruse, Jessica Miller, Will Silberman, Douglas Smith, and Kate Cabrera	

### \* \* \* Note: SFAA Membership Process \* \* \*

Current SFAA members can create a login account to the SFAA website to edit personal profile information, view membership status, and renew membership. Members will need the email address that was used to join SFAA as the login username, and members will need to create a password the first time they login.

An auto-renewal process is also available to make annual renewals easier and effortless.

The process to join SFAA will also change slightly with new members prompted for their personal profile information in addition to payment details.

## 02. SFAA & BAY AREA ASTRONOMY EVENTS



### SEPTEMBER 2019 – DECEMBER 2019

Details: <http://www.sfaa-astronomy.org/events>

**Wednesday, September 18, 7:30 pm – 9:15 pm**  
Meeting and Lecture, [Randall Museum](#)

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**Saturday, September 28, 6:30 pm – 2:00 am**  
[Mt. Tam](#) Members Night (arrive BEFORE sunset)

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**Saturday, October 5, 6:30 pm – 10:00 pm**  
[Mt. Tam](#) Public Star Party (arrive BEFORE sunset)

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**Sunday, October 6, 7:00 pm – 10:30 pm**  
City Star Party, [Pier 17](#) Embarcadero (by Exploratorium)

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**Wednesday, October 16, 7:30 pm – 9:15 pm**  
Meeting and Lecture, [Randall Museum](#)

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**Saturday, October 26, 6:30 pm – 2:00 am**  
[Mt. Tam](#) Members Night (arrive BEFORE sunset)

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**Thursday, November 7, 7:00 pm – 10:00 pm**  
City Star Party, [Lands End at Point Lobos](#) in San Francisco

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**Monday, November 11, 7:00 pm – 10:00 pm**  
SFAA Board Meeting, Location TBD

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**Wednesday, November 20, 7:30 pm – 9:15 pm**  
Meeting and Lecture, [Randall Museum](#)

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**Saturday, November 23, 6:30 pm – 2:00 am**  
[Mt. Tam](#) Members Night (arrive BEFORE sunset)

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**Saturday, December 7, 7:00 pm – 10:00 pm**  
City Star Party, [Presidio at Parade Grounds](#) in San Francisco

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**Wednesday, December 18, 7:30 pm – 9:15 pm**  
Meeting and Lecture, [Randall Museum](#)

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**Saturday, December 28, 6:30 pm – 2:00 am**  
[Mt. Tam](#) Members Night (arrive BEFORE sunset)

### GET LIVE HELP WITH YOUR TELESCOPE!

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Are you a new telescope owner?

Or perhaps you could use some help with alignment, collimation, or other adjustments?

Like playing guitar or dancing the tango, learning to operate a telescope can, with great effort, be learned on your own.

However, it's much easier and more enjoyable to learn hands-on with experienced individuals.

Bring your telescope to a Star Party – we'll be happy to help!

### BAY AREA ASTRONOMY EVENTS

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Long-time SFAA member, Kenneth Lum, assembles and reports a list of Bay Area Astronomy events. Check the following link for information and additional events:  
<https://groups.yahoo.com/neo/groups/bayastro/info>

## 03. SFAA 2020 BOARD OF DIRECTORS ELECTION

The SFAA elects Directors and Officers every December for the upcoming calendar year. The Directors and Officers constitute the Board of Directors, which is the SFAA's governing body.

The Board is responsible for:

- maintaining the membership roster;
- managing SFAA funds;
- organizing and publicizing events and activities;
- coordinating member volunteers; and
- communicating on the SFAA's behalf with the broader community.

Fortunately, the club has a stable cash flow and adequate reserves. Members' dues fund all SFAA-sponsored activities; unlike many non-profit organizations, SFAA Board members don't have to fundraise.

Board meetings are scheduled once a month. The first meeting of the year is a day-long retreat to plan for the year ahead. The remaining meetings take place during the evening on weekdays. Typically, the board convenes two online and one in-person meeting each quarter.

Any current member of the SFAA is eligible to run for the Board. Some of our current board members are not eligible to serve another term, so we need new people to run and fill vacant seats. We're interested in fresh ideas and perspectives to enhance the events and communications the SFAA offers to members and to the broader public. If you have been participating in SFAA activities and you have the time and energy to commit to helping direct the club's affairs, please consider running for the Board.

The responsibilities of SFAA Officers and Directors are described in greater detail in the Bylaws page on the SFAA website: <http://www.sfaa-astronomy.org/sfaa-bylaws/>.

If you are interested in running for a Board seat, if you have questions, or if you would like to nominate another member, please contact PJ Cabrera at [president@sfaa-astronomy.org](mailto:president@sfaa-astronomy.org).

# 04. SFAA VOLUNTEER OPPORTUNITIES

## VOLUNTEER OPPORTUNITIES

Contact: Will Silberman ([volunteer@sfaa-astronomy.org](mailto:volunteer@sfaa-astronomy.org))

### Star Party Volunteers

- City Star Parties Will Silberman ([volunteer@sfaa-astronomy.org](mailto:volunteer@sfaa-astronomy.org))
- Mt. Tam Star Parties

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**Snack Volunteers** Linda Mahan ([speakerchair@sfaa-astronomy.org](mailto:speakerchair@sfaa-astronomy.org))

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**Marketing Volunteers** PJ Cabrera ([president@sfaa-astronomy.org](mailto:president@sfaa-astronomy.org))

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**Above the Fog Volunteers** PJ Cabrera ([president@sfaa-astronomy.org](mailto:president@sfaa-astronomy.org))

### Star Party Volunteers

SFAA hosts 2-3 star parties every month throughout the year, including City Star Parties in San Francisco and observation nights on Mount Tamalpais. Between April and October, in partnership with Mt. Tam State Park, the Friends of Mt. Tam, and Wonderfest, SFAA provides telescope observing as part of a public monthly astronomy program. As a result, we need **experienced SFAA members to serve as volunteers for each of these events**. If you've been to a few star parties, you're familiar with the procedures, and you're able to commit to attending these events, **we can use your help!**

Volunteers are responsible for: checking weather forecasts prior to scheduled events, coordinating with other volunteers, providing cancellation notice due to inclement weather or dangerous conditions (e.g. forest fires). Volunteers are expected to arrive to events early, welcome and orient members, and hold a brief huddle for all telescope operators to review procedures and answer questions.

For Mt. Tam events, volunteers are tasked with:

- members night: ensuring every vehicle belongs to an SFAA member and has a parking pass; at the end of the night, volunteers make sure members understand how to lock the gate on the way out; and
- public astronomy program: coordinating with Friends of Mt. Tam volunteers to manage visitor parking.

Volunteers receive an e-mail once a month to coordinate on upcoming star parties. If you're interested in volunteering, or if you have questions, please contact Will Silberman at [volunteer@sfaa-astronomy.org](mailto:volunteer@sfaa-astronomy.org).

### Snack Volunteers

SFAA needs volunteers to bring light refreshments to our monthly meetings and lectures at the Presidio Officers Club, on the **third Tuesday of each month**. Refreshments create a welcoming atmosphere for members and guests. Volunteers can donate snacks or provide receipts for expense reimbursement.

If you're interested in bringing refreshments, please send an e-mail to Linda Mahan at [speakerchair@sfaa-astronomy.org](mailto:speakerchair@sfaa-astronomy.org) and indicate which month(s) you can help with and what you'd like to bring.

### Marketing Volunteers

SFAA needs volunteers to help post SFAA event updates to groups such as SFGate, SF FunCheap, Eventful, Bay Area Science, etc. If you're interested in marketing opportunities, please send an e-mail to PJ Cabrera at [president@sfaa-astronomy.org](mailto:president@sfaa-astronomy.org).

### Above the Fog Volunteers

SFAA distributes a monthly newsletter, *Above the Fog*. Volunteers are asked to submit an occasional article, astrophoto, and/or to serve as a member of the editorial team. If you're interested in contributing to these monthly newsletters, please send an e-mail to PJ Cabrera at [president@sfaa-astronomy.org](mailto:president@sfaa-astronomy.org).

**On behalf of the board of directors and your fellow SFAA members, thank you for your willingness to help out!**

## 05. SFAA STAR PARTY ETIQUETTE | SFAA BOARD OF DIRECTORS

This set of etiquette guidelines is designed to ensure harmonious interactions between SFAA members and others at various star party observing events as well as following established regulations of observing venues. The first section outlines general etiquette guidelines that should be followed at any event regardless of location. Etiquette for specific locations is listed later in this document. By following these simple guidelines that acknowledge responsible and courteous behavior between members and the public and among members, these exceptional opportunities will be enhanced for everyone.

Please keep in mind that the public views any member of the SFAA as a representative of the SFAA and your behavior toward the public will be taken as officially sanctioned by and indicative of our organization. Consider that you are more than an individual with a telescope: you are perceived by the general public to be knowledgeable on astronomy, experienced in explaining matters with which the public is not familiar, and even though the term amateur is in our name, you are seen to be something of a mature professional in handling people and addressing their questions however stated. Also keep in mind that any member of the public that you may interact with may also be a future member of the SFAA and/or in the case of children and young adults, a future astronomer who may be influenced by their experience with you.

### 1. General Etiquette Guidelines

#### 1.1. Designated Area

Please observe and follow venue established rules for observing areas including parking and arrival and departure times.

#### 1.2. Arrival and Departure

Plan to arrive at least a half hour before sunset. This will allow plenty of time to set up while it is still light, allow your eyes to gradually become dark-adapted and get acquainted with your observing neighbors. If you arrive after dark the headlights of your vehicle will disrupt everyone's night vision which can take up to a half hour to regain. Use red lights. Ideally use a dim red light, letting your eyes dark adapt. If using a bright red light, especially a headlamp while breaking down equipment, do not point the light directly towards another observer, and be mindful of pointing it towards shiny materials where it might reflect towards another observer.

Upon departure please use every consideration regarding your vehicle's white lights, exterior and interior, so as to not disrupt others' night vision.

The last people at the event should sweep the area with their flashlights to see if anyone accidentally dropped something important. If you find anything left behind, contact the club President the next day and then bring the item with you to the next meeting to be reunited with its owner.

#### 1.3. Parking Your Vehicle

A good idea is to back your vehicle in at the start of the evening so that when you leave, you can pull straight out and thereby minimize disruption and the dreaded headlights destruction of everyone's night vision. It will also make unloading and loading your equipment much easier.

#### 1.4. Preserving Night Vision

Don't use white lights! Use red light. If for some reason you must use a white light, kindly inform your neighbors and give them a chance to close camera shutters and eyes. Each person should have a red flashlight for use at the site. It is easy to modify a regular flashlight by covering the lens with a red filter of various materials -automobile brake light repair tape works very well.

#### 1.5. Workable Space between Observers

As you set up your telescope, be sure to put it at least several yards away from your closest neighbor. Many people need room for star chart tables, chairs, power supplies, cables, etc.. If members of the public are present, there may be long lines for a view at the eyepiece of everyone's telescope so having plenty of workable space between telescopes will be particularly important.

## 1.6. Laser Pointers

Please be extremely cautious when using a laser pointer or to align your telescope. Keep laser pointers upward and not horizontal. A misdirected beam of laser light can blind by causing retina damage. When showing constellations or objects in the sky make sure to keep the beam away from any aircraft as the range of the laser is far more than you may realize.

## 1.7. Smoking

While attending observing events where smoking is permitted please smoke downwind of other observers or smoke far away from the observing area. It is far easier for a smoker to re-locate him or herself, than it is for an observer to pick up equipment to re-locate in order to avoid the smoke. If you are smoking, please ask folks nearby if your smoke is bothering them. If you are a non-smoker and/or are bothered by someone's smoke, don't be afraid to ask the smoker to re-locate. If smoking is not permitted be considerate enough to strictly observe the local rules. **Note: smoking is not permitted in Mount Tamalpais except at established campgrounds, i.e. Bootjack and Pantoll Campgrounds only.**

## 1.8. Music

Please respect everyone's observing concentration and enjoy your music via headphones. What is music to your ears may be obnoxious and distracting noise to others. If you do wish to play music or the radio out loud, check first with the entire observing group, and be prepared to turn it off if it becomes annoying to someone. Some people want to escape to the mountains to escape the drone of the city, to enjoy some peace and quiet.

## 1.9. Children

If you do bring a child, make sure that he/she acts responsibly so as to not disturb or irritate observing neighbors. Do not allow them to run about the observing area as it is not a playground. Children should always be supervised to ensure they do not run into or trip over astronomical gear, hurting themselves and/or others. Close supervision of children will help ensure you do not wind up paying to replace some expensive equipment or deal with personal injury.

## 1.10. Pets

For events where dogs are permitted, keep them away from equipment. For the sake of your dog, please also keep leashes short as they are difficult to see in the dark and folks may accidentally get caught up walking through the leash. **Note: dogs are only allowed if they are leashed on paved roads in Mount Tamalpais before sunset. Dogs are not allowed after the park is closed. Dogs are not allowed, leashed or unleashed, on trails and wooded areas, as they are carriers of lethal diseases for wildlife.**

## 1.11. Ask before Touching

Never touch anyone else's equipment without permission and never touch any glass optical surface. Some astronomers may be adjusting their equipment or doing delicate astrophotography. But, don't be afraid to ask if you can view what they are observing or any questions you may have about their equipment. On the other hand, observers should be accommodating to other astronomer's or members of the public inquiries - a warm welcome and thoughtful responses to questions may stimulate a lifelong curiosity and enthusiasm toward astronomy. Also, please keep food and drinks away from equipment.

## 1.12. No Litter

Do not litter. Everything you bring to the event you must take with you when you leave. It may be helpful to bring your own trash bag to properly store your waste to dispose of at home.

## 1.13. Emergencies

Any emergency, such as a medical condition, should be immediately reported via 911 and subsequently to the SFAA event leader or designated authority.

## 1.14. Local Rules and Regulations

Honor facility rules. At any SFAA event, abide by the rules established for the location. For example, smoking, alcohol, or pets may be prohibited. Not following the facility rules puts us at risk for not being able to use the location in the future.

## **2. Mt. Tamalpais State Park & Rock Springs Parking Lot**

### **2.1. Designated Area**

Our Special Use Permit (S.U.P.) is specific to the Rock Springs parking lot located at the intersection of Ridgecrest Boulevard and Pantoll Road. For public star parties our area of telescope set-up is the western half of the parking lot defined approximately by the wooden Rock Springs parking lot sign on the east, to the end of the lot on the west. On public nights the Friends of Mt. Tam will set up safety cones to help identify our area of operation. For members only parties we have access to the entire lot but typically set up in the same area as the public nights.

On either public or members only nights, upon arrival you must display your current year California State Parks (C.S.P.) Parking Pass on the dashboard of your vehicle. This pass distinguishes you from the public attendees as a current member of the SFAA and covered under our S.U.P. By not displaying the permit you may be subject to a fine by Park Rangers for unauthorized presence in the Park after closing hours.

### **2.2. Arrival and Departure**

Plan to arrive at Rock Springs at least a half hour before sunset. This will allow plenty of time to set up while it is still light, allow your eyes to gradually become dark-adapted and get acquainted with your observing neighbors.

Shortly before sunset, the contact people for the event will call a group huddle to introduce new members, discuss any important announcements, and explain the departing procedures. If you are new to a Mount Tamalpais star party, please let your contact people know, as there is important information to be shared.

After 10 pm, the only exit available is through the Pantoll gate, as all other Mount Tamalpais gates will be closed. The Pantoll gate has a combination lock for SFAA members to let themselves out. Communicate with your observing neighbors to find out if they are going to leave soon, and try to leave in groups so as to maintain the integrity of the gate lock combination; allow efficient and safe departures; give individual attendees the ability to allow plenty of take-down time for their equipment; ensure that no one is left behind a locked gate to which combination they do not know! The first car in the group can unlock the gate and let the other vehicles through. Please lock the gate once all vehicles are through.

Do not let anyone in as you leave. Besides the park rangers, only SFAA members are allowed inside the park and they should have arrived before sunset, so a late arrival is no excuse, even if they display a valid parking pass.

Upon departure please use every consideration regarding your vehicle's white lights, exterior and interior, so as to not disrupt others' night vision.

### **2.3. Smoking**

Our S.U.P. stipulates no smoking. This stems from the safety issue of fire danger – we are in a heavily wooded and dry grassy park. In addition, it can be quite irritating to other observers and to the public, so the SFAA supports this rule and any member who lights up will be advised to put it out.

### **2.4. Pets**

Our S.U.P. stipulates that dogs will not be permitted in the park after closing hours, which occurs at sunset.

### **2.5. Emergencies**

All emergencies that occur shall be reported via landline telephone to Park Dispatch at: 1-866-227-4181 or 911. **Note: If using a cell phone, do not dial 911 – dial 415-472-0911 for fast response.**

Feel free to contact any board member if you have any questions or doubts about these guidelines.



## 06. SFAA LECTURE SERIES | SEPTEMBER 18, 2019

### EXOPLANETS ACROSS THE SKY: THE VIEW FROM TESS ANN MARIE CODY, NASA AMES & SETI INSTITUTE



The Transiting Exoplanet Survey Satellite (TESS) is a NASA space mission that is tasked with tracking the brightness variations of stars across nearly the entire 360 degree expanse of the sky, in its two year planned mission. In operation for the past year, it has already made numerous new discoveries, including comets, supernovae, and exoplanets. TESS is finding small, rocky planets around stars that are bright enough to view with binoculars, or even the naked eye. These are prime targets for future studies of exoplanetary composition and atmospheres. In this talk I will present some of the many TESS discoveries to date and discuss ongoing efforts to conduct follow-up studies from the ground.

Ann Marie Cody is an astronomer at the NASA Ames Research Center, where she is on the research staff for the NASA Kepler and K2 missions. She is also a project investigator at the SETI Institute. Prior to these positions, she conducted research as an Ames postdoctoral fellow and at the California Institute of Technology, her PhD institution. In addition, she holds degrees from Harvard University and the University of Cambridge. Dr. Cody has been involved with a number of space telescope missions, which she has used to conduct high-precision measurements of the brightness of stars at optical and infrared wavelengths. Her research focuses on young variable stars and their planet-forming dust disks.

#### **Randall Museum**

199 Museum Way, San Francisco, CA 94114

7:00 pm Doors Open & Light Refreshments | 7:30 pm Club Announcements | 7:45 pm Speaker

**SFAA'S GENERAL MEETINGS OCCUR ON THE 3<sup>RD</sup> WEDNESDAY OF EACH MONTH**

## 07. UPCOMING SFAA LECTURES 2019

OCTOBER 16<sup>TH</sup> | [BRIAN DAY, NASA AMES](#)

### Exploring Planetary Surfaces with NASA's Solar System Treks

Originally designed for mission planning and science, this technology has shown great benefits for public outreach. NASA's Solar System Treks have a suite of online, interactive visualization and analysis portals. This talk will showcase the capabilities of 7 portals where you can take a Trek to a number of planetary bodies; incl. the Moon, Mars, Ceres, Mercury and more.

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NOVEMBER 20<sup>TH</sup> | [DR NICK KANAS, PROFESSOR EMERITUS, UCSF](#)

### Celestial Mapping and the Amateur Astronomer

Discover how the history of celestial cartography has evolved into several pathways that have relevance for today's amateur astronomer. Professor Kanas will trace the history of ancient star mapping traditions, discuss the beautiful images of constellations pictured in early atlases, and explain how the use of the telescope influenced mapping, along with other significant developments that many amateur astronomers take for granted.

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DECEMBER 18<sup>TH</sup> | [KEVIN BUNDY, UCO LICK, UC SANTA CRUZ](#)

### Mapping the Lives and Deaths of 10,000 Nearby Galaxies with MaNGA

The SDSS-IV MaNGA survey is obtaining resolved spectroscopy for thousands of nearby galaxies, providing new insights on key questions regarding galaxy growth, the regulation of star formation, and its eventual suppression through "quenching." MaNGA maps the largest integral field survey of galaxies ever conducted.

### [Randall Museum](#)

199 Museum Way, San Francisco, CA 94114

7:00 pm Doors Open & Light Refreshments | 7:30 pm Club Announcements | 7:45 pm Speaker

[SFAA'S GENERAL MEETINGS OCCUR ON THE 3<sup>RD</sup> WEDNESDAY OF EACH MONTH](#)

## NASA Satellite Spots a Mystery That's Gone in a Flash



*This visible-light image of the Fireworks galaxy (NGC 6946) comes from the Digital Sky Survey, and is overlaid with data from NASA's NuSTAR observatory (in blue and green). Credit: NASA/JPL-Caltech*

Pops of bright blue and green in this image of the Fireworks galaxy (NGC 6946) show the locations of extremely bright sources of X-ray light captured by NASA's NuSTAR space observatory. Generated by some of the most energetic processes in the universe, these X-ray sources are rare compared to the many visible light sources in the background image. A new study, [published in the \*Astrophysical Journal\*](#), offers some possible explanations for the surprise appearance of the green source near the center of the galaxy, which came into view and disappeared in a matter of weeks.

The primary objective of the NuSTAR observations was to study the supernova - the explosion of a star much more massive than our Sun - that appears as a bright blue-green spot at upper right. These violent events can briefly produce enough visible light to outshine entire galaxies consisting of billions of stars. They also generate many of the chemical elements in our universe that are heavier than iron.

The green blob near the bottom of the galaxy wasn't visible during the first NuSTAR observation but was burning bright at the start of a second observation 10 days later. NASA's Chandra X-ray Observatory later observed that the source - known as an ultra-luminous X-ray source, or ULX - had disappeared just as quickly. The object has since been named ULX-4 because it is the fourth ULX identified in this galaxy. No visible light was detected with the X-ray source, a fact that most likely rules out the possibility that it is also a supernova.

"Ten days is a really short amount of time for such a bright object to appear," said Hannah Earnshaw, a postdoctoral researcher at Caltech in Pasadena, California, and lead author on the new study. "Usually with NuSTAR, we observe more gradual changes over time, and we don't often observe a source multiple times in quick succession. In this instance, we were fortunate to catch a source changing extremely quickly, which is very exciting."

## Possible Black Hole

The new study explores the possibility that the light came from a black hole consuming another object, such as a star. If an object gets too close to a black hole, gravity can pull that object apart, bringing the debris into a close orbit around the black hole. Material at the inner edge of this newly formed disk starts moving so fast that it heats up to millions of degrees and radiates X-rays. (The surface of the Sun, by comparison, is about 10,000 degrees Fahrenheit, or 5,500 degrees Celsius.)

Most ULXs are typically long-lived because they're created by a dense object, like a black hole, that "feeds" on the star for an extended period of time. Short-lived, or "transient," X-ray sources like ULX-4 are far more rare, so a single dramatic event - like a black hole quickly destroying a small star - might explain the observation.

However, ULX-4 might not be a one-off event, and the paper's authors explored other potential explanations for this object. One possibility: The source of ULX-4 could be a neutron star. Neutron stars are extremely dense objects formed from the explosion of a star that wasn't massive enough to form a black hole. With about the same mass as our Sun but packed into an object about the size of a large city, neutron stars can, like black holes, draw in material and create a fast-moving disk of debris. These can also generate slow-feeding ultra-luminous X-ray sources, although the X-ray light is produced through slightly different processes than in ULXs created by black holes.

Neutron stars generate magnetic fields so strong they can create "columns" that channel material down to the surface, generating powerful X-rays in the process. But if the neutron star spins especially fast, those magnetic fields can create a barrier, making it impossible for material to reach the star's surface.

"It would kind of be like trying to jump onto a carousel that's spinning at thousands of miles per hour," said Earnshaw.

The barrier effect would prevent the star from being a bright source of X-rays except for those times when the magnetic barrier might waver briefly, allowing material to slip through and fall onto the neutron star's surface. This could be another possible explanation for the sudden appearance and disappearance of ULX-4. If the same source were to light up again, it might support this hypothesis.

"This result is a step towards understanding some of the rarer and more extreme cases in which matter accretes onto black holes or neutron stars," Earnshaw said.

NuSTAR is a Small Explorer mission led by Caltech and managed by JPL for NASA's Science Mission Directorate in Washington. NuSTAR was developed in partnership with the Danish Technical University and the Italian Space Agency (ASI). The spacecraft was built by Orbital Sciences Corp. in Dulles, Virginia. NuSTAR's mission operations center is at the University of California Berkeley, and the official data archive is at NASA's High Energy Astrophysics Science Archive Research Center. ASI provides the mission's ground station and a mirror archive. Caltech manages JPL for NASA.

To read more about NASA's NuSTAR mission, go here: <https://www.nustar.caltech.edu/>

News & Media Contact

Calla Cofield

Jet Propulsion Laboratory, Pasadena, Calif.

626-808-2469

[calla.e.cofield@jpl.nasa.gov](mailto:calla.e.cofield@jpl.nasa.gov)

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### Application for New or Renewing Membership

1. Memberships, with dues payment, are for one year running from the member's join or renewal date.
2. New or renewal memberships sent in via USPS mail will have membership start date based on postmark date.
3. SFAA is a 501(c)(3) nonprofit organization. Membership dues are tax-deductible, as allowed by law.

**This application is for:**

- New**  
 **Renewing**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

E-mail: \_\_\_\_\_

Phone  
(optional): \_\_\_\_\_

- Membership Type:**     Individual - \$25.00     Family - \$30.00     Student - \$10.00  
 Supporting - \$75.00     Institutional - \$40.00

**(All dues tax-deductible as allowed by law)**

- Please mail me a Mount Tamalpais Parking Permit (1 per membership)**

**To complete the membership process:**

- A. Print and fill out this form
- B. Make check or money order payable to San Francisco Amateur Astronomers
- C. Mail this form and payment to:

**Treasurer, SFAA**  
**PO Box 15097**  
**San Francisco, CA 94115**

Both new and renewing members will receive a verifying email from the SFAA upon completion of the membership process.