ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 67, No. 07 – November 2019

IN THIS ISSUE

01. SFAA PRESIDENT'S NOTE | NOVEMBER WOES

We have had a great couple of warm weeks at the start of November, but it seems Fall weather has finally arrived in the San Francisco Bay Area. The sky is overcast more often, and it get colder and darker earlier in the day.

With the cooler and more humid weather, our thoughts turn introspective and start thinking about plans for next Spring and Summer. And at SFAA, we have to start working on the composition of the board of directors for 2020.

We have a shortage of 5 Directors this season, and we need our members' help in filling those spots. Besides the 4 Officers (President, Vice-President, Treasurer, and Secretary), the Directors are required to reach quorum at board meetings. Without enough board members present at a meeting, we cannot conduct business or approve any motions. Without quorum we can't plan more Observatory trips or camping under the stars at Yosemite or at Robert Ferguson Observatory. We can't plan a schedule of star parties and can't get permits for Mount Tam, the Presidio or Land's End. We can't book the Randall for more lectures, as these require the board to approve the booking and pay for the venue.

To put it in stark terms, without a full SFAA board, there is no SFAA.

If you or anyone you know would like to get involved in running these activities, would you kindly take a look at the article regarding the board elections? Being a board director does not take much time out of each month, and like anything worthwhile, you get more out of it than you put in.

Help us keep SFAA running by joining the board and helping organize another year full of activities to engage the public in astronomy.

Clear skies,
P.J. Cabrera
President, SFAA

SFAA BOARD OFFICERS AND DIRECTORS		
President	P.J. Cabrera	president@sfaa-astronomy.org
Vice President	Liz Triggs	vice-president@sfaa-astronomy.org
Treasurer	Scott Miller	treasurer@sfaa-astronomy.org
Secretary	Bill Kircher	secretary@sfaa-astronomy.org
Directors	Matthew Jones, Tom Kellogg, Brian Kruse, Jessica Miller, Will Silberman, Douglas Smith, and Kate Cabrera	

02. SFAA & BAY AREA ASTRONOMY EVENTS

NOVEMBER 2019 – DECEMBER 2019

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

Monday, November 18, 7:00 pm – 8:30 pm
SFAA Board Meeting, Presidio Public Library

Wednesday, November 20, 7:30 pm – 9:15 pm
Meeting and Lecture, Randall Museum

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

Saturday, December 7, 7:00 pm – 10:00 pm
City Star Party, Presidio at Parade Grounds in San Francisco

Wednesday, December 18, 7:30 pm – 9:15 pm
Meeting and Lecture, Randall Museum

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.

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 for about one hour. The first meeting of the year is a half-day 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. 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.

One of the great benefits of joining the Board is that you can help to launch programs or projects that you are interested in, such as more field trips, creating an astrophotography sub-group, etc. If you have been participating in club activities and you have time and energy to commit to helping direct the club's affairs, please consider running for the Board.

We are specifically looking for 5 new Directors. Of our currently serving Directors, two are running as Officers next year, and three are not able serve on the board any longer.

We will accept nominations until the evening of November 20th. At that time the ballots will be prepared, and we will email a link to an online ballot, which you can fill out at any time until December 18th. If you would rather use paper ballots, we will have paper ballots at the December 18th lecture. The votes will be counted that evening and new board will be announced.

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.

04. SFAA VOLUNTEER OPPORTUNITIES

VOLUNTEER OPPORTUNITIES

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

Star Party Volunteers ▪ City Star Parties ▪ Mt. Tam Star Parties	Will Silberman (volunteer@sfaa-astronomy.org)
Snack Volunteers	Linda Mahan (speakerchair@sfaa-astronomy.org)
Marketing Volunteers	PJ Cabrera (president@sfaa-astronomy.org)
Above the Fog Volunteers	PJ Cabrera (president@sfaa-astronomy.org)

Star Party Volunteers

SFAA hosts 2 to 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.

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 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.

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.

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

05. SFAA LECTURE SERIES | NOVEMBER 20, 2019

CELESTIAL MAPPING AND THE AMATEUR ASTRONOMER

NICK KANAS, MD, PROFESSOR EMERITUS, UCSF

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

Nick Kanas has been a member of the SFAA since 1977, serving as a Board member in the early 1980s. He is a Fellow of the Royal Astronomical Society (London). He has collected antiquarian celestial maps for over 40 years and has given talks on celestial cartography to amateur and professional groups. He has published articles on celestial cartography in magazines and journals, and has written two celestial map-related books: Solar System Maps: From Antiquity to the Space Age, and Star Maps: History, Artistry, and Cartography (now in its third edition). As a UCSF Professor of Psychiatry, he was a NASA-funded Principal Investigator studying psychosocial issues involving astronauts and cosmonauts in space. He is the co-author of the textbook Space Psychology and Psychiatry and more recently the author of Humans in Space: The Psychological Hurdles. Both books received Life Science Book Awards from the International Academy of Astronautics. He also has published three science fiction novels: The New Martians, The Protos Mandate, and The Caloris Network, and currently is working on a screenplay.

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 3RD WEDNESDAY OF EACH MONTH

06. UPCOMING SFAA LECTURES 2019

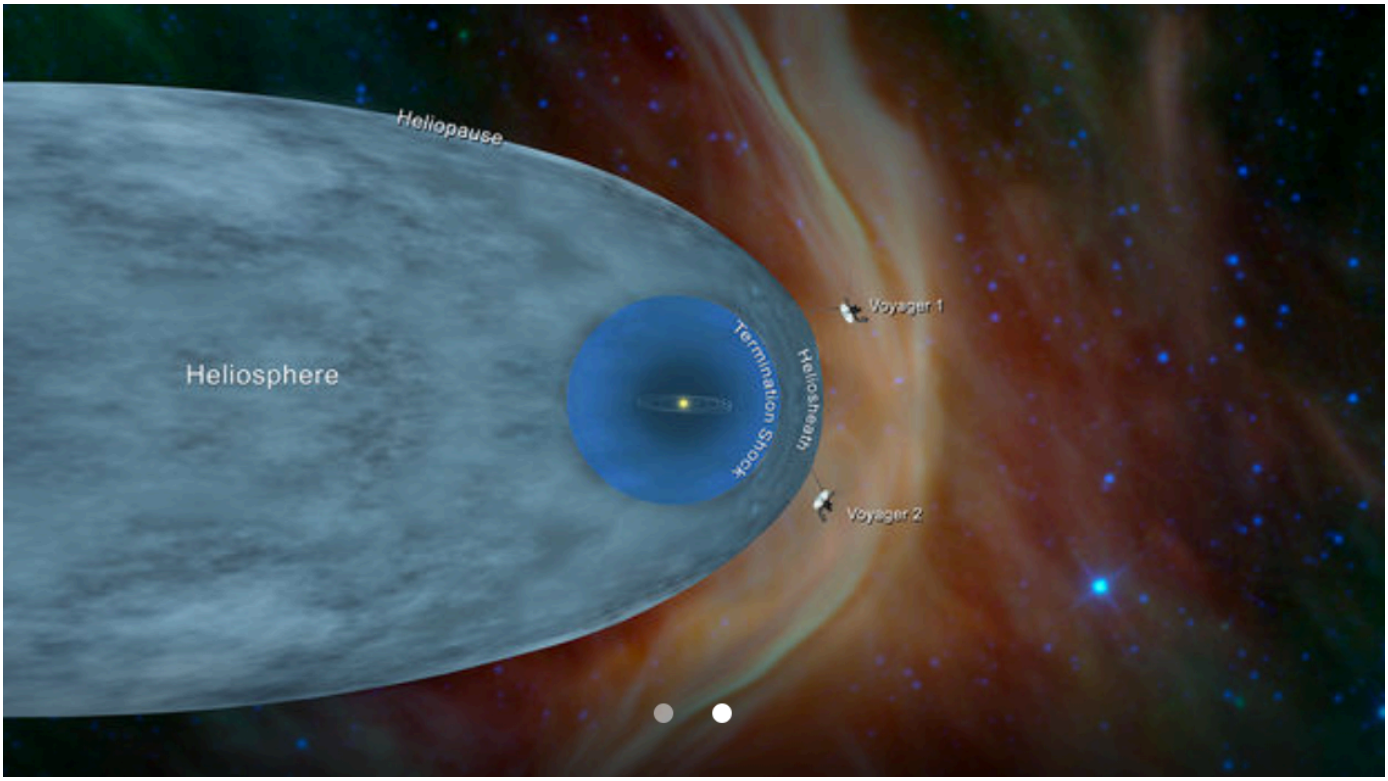
DECEMBER 18TH | KEVIN BUNDY, UCO LICK, UC SANTA CRUZ

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 3RD WEDNESDAY OF EACH MONTH

Voyager 2 Illuminates Boundary of Interstellar Space



This artist's concept shows the locations of NASA's Voyager 1 and Voyager 2 spacecraft relative to the heliosphere, or the protective bubble of particles and magnetic fields created by our Sun. Both Voyagers are now outside the heliosphere, in a region known as interstellar space, or the space between stars.
Credit: NASA/JPL-Caltech

One year ago, on Nov. 5, 2018, NASA's Voyager 2 became only the second spacecraft in history to leave the heliosphere - the protective bubble of particles and magnetic fields created by our Sun. At a distance of about 11 billion miles (18 billion kilometers) from Earth - well beyond the orbit of Pluto - Voyager 2 had entered interstellar space, or the region between stars. Today, five new research papers in the journal Nature Astronomy describe what scientists observed during and since Voyager 2's historic crossing.

Each paper details the findings from one of Voyager 2's five operating science instruments: a magnetic field sensor, two instruments to detect energetic particles in different energy ranges and two instruments for studying plasma (a gas composed of charged particles). Taken together, the findings help paint a picture of this cosmic shoreline, where the environment created by our Sun ends and the vast ocean of interstellar space begins.

The Sun's heliosphere is like a ship sailing through interstellar space. Both the heliosphere and interstellar space are filled with plasma, a gas that has had some of its atoms stripped of their electrons. The plasma inside the heliosphere is hot and sparse, while the plasma in interstellar space is colder and denser. The space between stars also contains cosmic rays, or particles accelerated by exploding stars. Voyager 1 discovered that the heliosphere protects Earth and the other planets from more than 70% of that radiation.

When Voyager 2 exited the heliosphere last year, scientists announced that its two energetic particle detectors noticed dramatic changes: The rate of heliospheric particles detected by the instruments

plummeted, while the rate of cosmic rays (which typically have higher energies than the heliospheric particles) increased dramatically and remained high. The changes confirmed that the probe had entered a new region of space.

Before Voyager 1 reached the edge of the heliosphere in 2012, scientists didn't know exactly how far this boundary was from the Sun. The two probes exited the heliosphere at different locations and also at different times in the constantly repeating, approximately 11-year solar cycle, over the course of which the Sun goes through a period of high and low activity. Scientists expected that the edge of the heliosphere, called the heliopause, can move as the Sun's activity changes, sort of like a lung expanding and contracting with breath. This was consistent with the fact that the two probes encountered the heliopause at different distances from the Sun.

The new papers now confirm that Voyager 2 is not yet in undisturbed interstellar space: Like its twin, Voyager 1, Voyager 2 appears to be in a perturbed transitional region just beyond the heliosphere.

"The Voyager probes are showing us how our Sun interacts with the stuff that fills most of the space between stars in the Milky Way galaxy," said Ed Stone, project scientist for Voyager and a professor of physics at Caltech. "Without this new data from Voyager 2, we wouldn't know if what we were seeing with Voyager 1 was characteristic of the entire heliosphere or specific just to the location and time when it crossed."

Pushing Through Plasma

The two Voyager spacecraft have now confirmed that the plasma in local interstellar space is significantly denser than the plasma inside the heliosphere, as scientists expected. Voyager 2 has now also measured the temperature of the plasma in nearby interstellar space and confirmed it is colder than the plasma inside the heliosphere.

In 2012, Voyager 1 observed a slightly higher-than-expected plasma density just outside the heliosphere, indicating that the plasma is being somewhat compressed. Voyager 2 observed that the plasma outside the heliosphere is slightly warmer than expected, which could also indicate it is being compressed. (The plasma outside is still colder than the plasma inside.) Voyager 2 also observed a slight increase in plasma density just before it exited the heliosphere, indicating that the plasma is compressed around the inside edge of the bubble. But scientists don't yet fully understand what is causing the compression on either side.

Leaking Particles

If the heliosphere is like a ship sailing through interstellar space, it appears the hull is somewhat leaky. One of Voyager's particle instruments showed that a trickle of particles from inside the heliosphere is slipping through the boundary and into interstellar space. Voyager 1 exited close to the very "front" of the heliosphere, relative to the bubble's movement through space. Voyager 2, on the other hand, is located closer to the flank, and this region appears to be more porous than the region where Voyager 1 is located.

Magnetic Field Mystery

An observation by Voyager 2's magnetic field instrument confirms a surprising result from Voyager 1: The magnetic field in the region just beyond the heliopause is parallel to the magnetic field inside the heliosphere. With Voyager 1, scientists had only one sample of these magnetic fields and couldn't say for sure whether the apparent alignment was characteristic of the entire exterior region or just a coincidence. Voyager 2's magnetometer observations confirm the Voyager 1 finding and indicate that the two fields align, according to Stone.

The Voyager probes launched in 1977, and both flew by Jupiter and Saturn. Voyager 2 changed course at Saturn in order to fly by Uranus and Neptune, performing the only close flybys of those planets in history. The Voyager probes completed their Grand Tour of the planets and began their Interstellar Mission to reach the heliopause in 1989. Voyager 1, the faster of the two probes, is currently over 13.6 billion miles (22 billion kilometers) from the Sun, while Voyager 2 is 11.3 billion miles (18.2 billion kilometers) from the Sun. It takes light about 16.5 hours to travel from Voyager 2 to Earth. By comparison, light traveling from the Sun takes about eight minutes to reach Earth.

More information about Voyager is available at the following site: https://voyager.jpl.nasa.gov/

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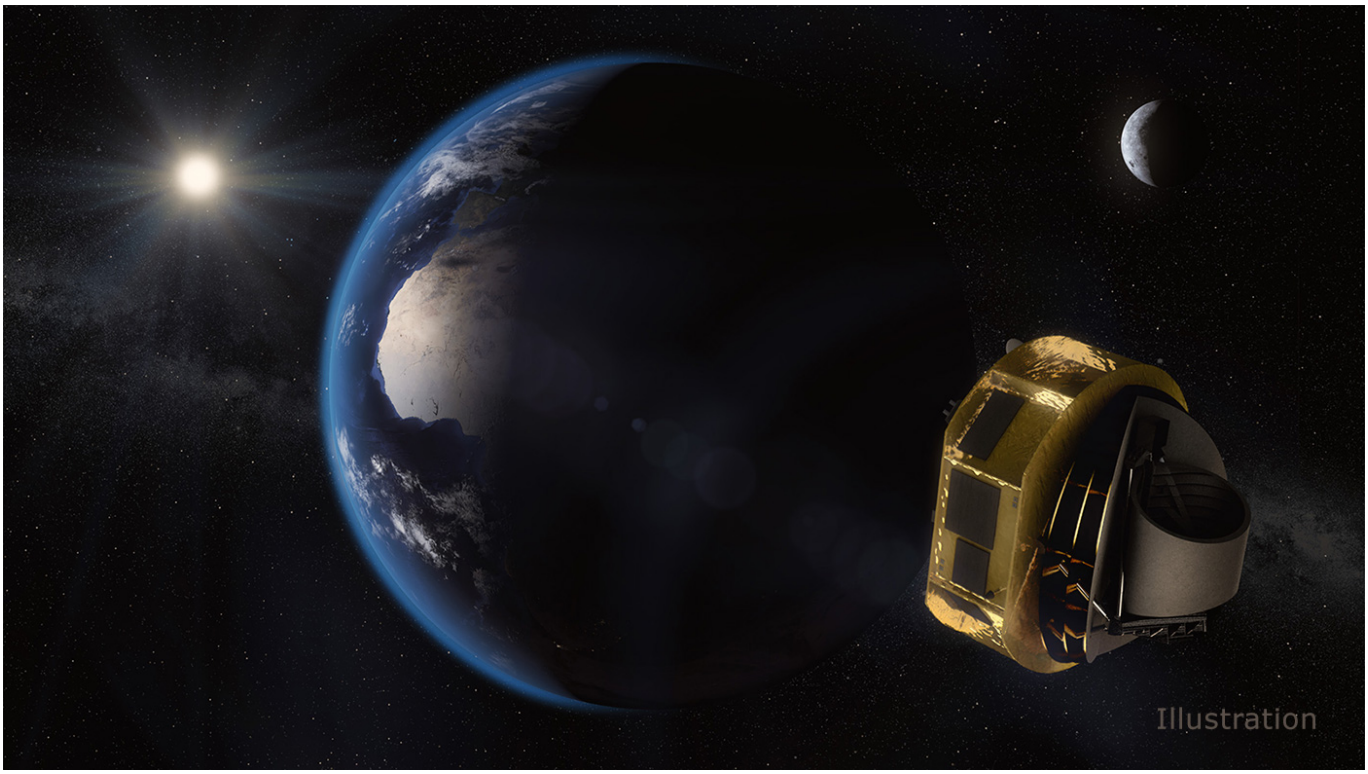
NASA Instrument to Probe Planet Clouds on European Mission



This artist's concept shows the European Space Agency's ARIEL spacecraft on its way to Lagrange Point 2 (L2) - a gravitationally stable, Sun-centric orbit - where it will be shielded from the Sun and have a clear view of the sky. NASA's JPL will manage the mission's CASE instrument.
Credit: ESA/STFC RAL Space/UCL/Europlanet-Science Office

NASA will contribute an instrument to a European space mission that will explore the atmospheres of hundreds of planets orbiting stars beyond our Sun, or exoplanets, for the first time.

The instrument, called the Contribution to ARIEL Spectroscopy of Exoplanets, or CASE, adds scientific capabilities to ESA's (the European Space Agency's) Atmospheric Remote-sensing Infrared Exoplanet Large-survey, or ARIEL, mission.

The ARIEL spacecraft with CASE on board is expected to launch in 2028. CASE will be managed by NASA's Jet Propulsion Laboratory in Pasadena, California, with JPL astrophysicist Mark Swain as the principal investigator.

"I am thrilled that NASA will partner with ESA in this historic mission to push the envelope in our understanding of what the atmospheres of exoplanets are made of, and how these planets form and evolve," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate in Washington. "The more information we have about exoplanets, the closer we get to understanding the origins of our solar system and advancing our search for Earth-like planets elsewhere."

So far, scientists have found more than 4,000 confirmed exoplanets in the Milky Way. NASA's retired Kepler space telescope and active Transiting Exoplanet Survey Satellite (TESS) are two observatories that have contributed to this count. These telescopes have discovered planets by observing brightness of a star's light dimming as a planet crosses its face, an event called a "transit." ARIEL, carrying CASE, will take planet-hunting through transits one step further, by delving deeper into planets already known to exist.

ARIEL will be able to see the chemical fingerprints, or "spectra," of a planet's atmosphere in the light of its star. To do this, the spacecraft will observe starlight streaming through the atmospheres of planets as they pass in front their stars, as well as light emitted by the planets' atmospheres just before and after they disappear behind their stars. These fingerprints will allow scientists to study the compositions, temperatures, and chemical processes in the atmospheres of the planets ARIEL observes.

These chemical fingerprints of exoplanet atmospheres are extremely faint. Identifying them is a huge challenge for astronomers and requires a telescope to stare at individual stars for a long time. But many space observatories are multi-purpose and must split up their time among different kinds of scientific investigations. ARIEL will be the first spacecraft fully devoted to observing hundreds of exoplanet atmospheres, looking to identify their contents, temperatures and chemical processes. The addition of CASE, which will observe clouds and hazes, will provide a more comprehensive picture of the exoplanet atmospheres ARIEL observes.

So far, telescopes have only been able to carefully probe the atmospheres of a handful of exoplanets to determine their chemistries. ARIEL's much larger, more diverse sample will enable scientists to look at these worlds not just as individual exotic objects, but as a population, and discover new trends in their commonalities and differences.

The CASE instrument will be sensitive to light at near-infrared wavelengths, which is invisible to human eyes, as well as visible light. This complements ARIEL's other instrument, called an infrared spectrometer, which operates at longer wavelengths. CASE will specifically look at exoplanets' clouds and hazes - determining how common they are, as well how they influence the compositions and other properties of planetary atmospheres. CASE will also allow measurements of each planet's albedo, the amount of light the planet reflects.

The spacecraft will focus on exceptionally hot planets in our galaxy, with temperatures greater than 600 degrees Fahrenheit (320 degrees Celsius). Such planets are more likely to transit their star than planets orbiting farther out, and their short orbital periods provide more opportunities to observe transits in a given period of time. More transits give astronomers more data, allowing them to reveal the weak chemical fingerprint of a planet's atmosphere.

ARIEL's hot planet population will include gas giants like Jupiter, as well as smaller gaseous planets called mini-Neptunes and rocky worlds bigger than our planet called super-Earths. While these planets are too hot to host life as we know it, they will tell us a lot about how planets and planetary systems form and evolve. Additionally, the techniques and insights learned in studying exoplanets with ARIEL and CASE will be useful when scientists use future telescopes to look toward smaller, colder, rockier worlds with conditions that more closely resemble Earth's.

The CASE instrument consists of two detectors and associated electronics that contribute to ARIEL's guidance system. CASE takes advantage of the same detectors and electronics that NASA is contributing to ESA's Euclid mission, which will probe deep questions about the structure of the universe and its two biggest mystery components: dark matter and dark energy.

The ARIEL spacecraft with CASE on board will be in the same orbit as NASA's James Webb Space Telescope, which is expected to launch in 2021. Both will travel some 1 million miles (1.5 million kilometers) from Earth to a special point of gravitational stability called Lagrange Point 2. This location allows the spacecraft to circle the Sun along with the Earth, while using little fuel to maintain its orbit.

While Webb will also be capable of studying exoplanet atmospheres, and its instruments cover a similar range of light as ARIEL, Webb will target a smaller sample of exoplanets to study in greater detail. Because

Webb's time will be divided, shared with investigations into other aspects of the universe, it will deliver detailed knowledge about particular exoplanets rather than surveying hundreds. ARIEL will launch several years after Webb, so it will be able to capitalize on lessons learned from Webb in terms of planning observations and selecting which planets to study.

"This is an exciting time for exoplanet science as we look toward the next generation of space telescopes and instruments," said Paul Hertz, director of the astrophysics division at NASA Headquarters, Washington. "CASE adds to an exceptional set of technologies that will help us better understand our place in the galaxy."

CASE is an Astrophysics Explorers Mission of Opportunity, managed by JPL. The Astrophysics Explorers Program is managed by NASA's Goddard Space Flight Center in Greenbelt, Maryland, for the Science Mission Directorate at NASA Headquarters in Washington, DC.

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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.