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Annual Report

2023-24

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American Association of Variable Star Observers

Annual Report 2023-24

AAVSO Annual Report, 2023-2024

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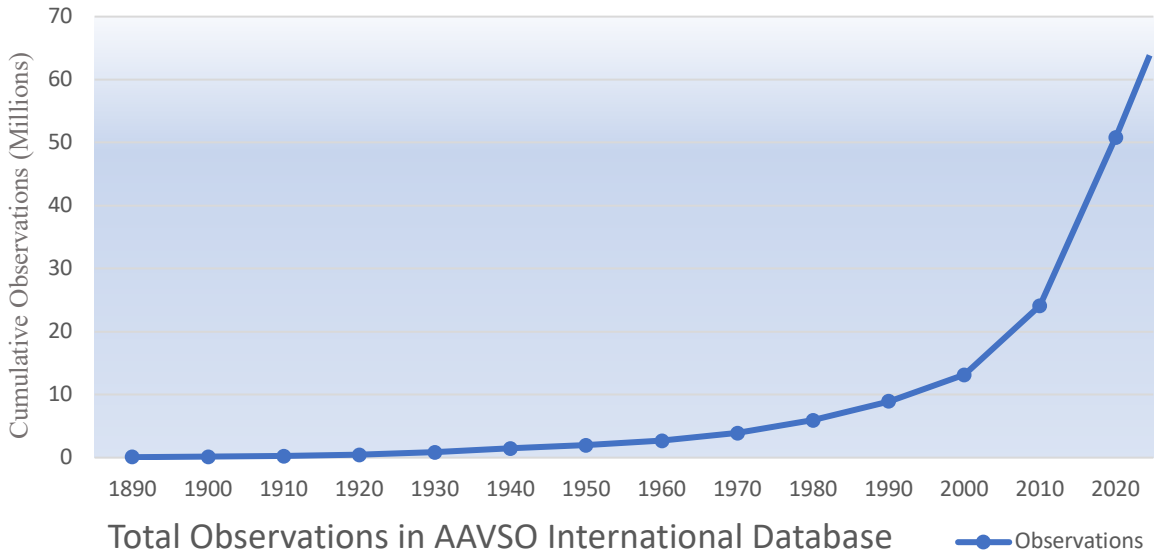
The American Association of Variable Star Observers

185 Alewife Brook Pkwy Ste 410
Cambridge, MA 02138-1104
United States

☏ +1 (617) 354-0484
@ aavso@aavso.org
🌐 www.aavso.org



About the AAVSO

The American Association of Variable Star Observers (AAVSO) is a science-focused 501(c)(3) non-profit organization headquartered in Cambridge, Massachusetts, U.S.A. Since its founding in 1911, the AAVSO and its members and observers from around the world have collaborated with the professional astronomical community to answer questions about stars and stellar evolution. Our mission is to enable anyone, anywhere, to participate in scientific discovery through variable star astronomy.

The AAVSO accomplishes this mission by establishing relationships between professional and amateur astronomers, delivering educational services, curating the world's largest database of variable star data, and publishing a peer-reviewed journal. In 2024, our engagement with researchers yielded 28 observing campaigns, and our educational programming reached approximately 10,000 individuals.

Most of our efforts involve curation of four databases, including a photometric database with more than 64 million observations, a variable star metadata database containing information on 2.3 million variable stars and counting, a spectroscopic database with some 14,700 spectra, and an exoplanet database showcasing about 8,100 exoplanet transits thus far. In addition, AAVSO-directed professional-amateur collaborations yielded 200 peer-reviewed publications.

AAVSO has a staff of eight individuals that are supported by nearly 200 volunteers. We thank our board members, committee members, observers, and educators. You are each a vital part of our organization's success.

Letter from **the President**

Thank you to every member of the AAVSO, every observer, and every donor. Each of you who has given their support this year can look ahead to a renewed, strengthened, and more scientifically productive organization. Today I'd like to fill you in on the goals and direction of our five-year strategic plan, a plan designed to build on our existing strengths and to enhance AAVSO's role in the astronomical community.

Since 1911, AAVSO observers have collected, archived, and freely given the fruits of our efforts to the scientific community. We have trained countless observers to make precise photometric observations, from the original visual estimations to the current generation of automated telescopes. We have pioneered photoelectric photometry, CCD and CMOS imaging, and now collect spectroscopic observations. Through AAVSOnet we give members without a telescope access to scheduled imaging time, and our tools and services – LCG, VSX, VSP, VPhot, and WebObs – facilitate every observer's participation in astronomical research.

We crafted the strategic plan as a year-long effort to define mandates, strategic issues, the external and internal environment, and implementation. From our current observers, we're recruiting small teams to conduct research at a professional level. Building on our special interest groups, we're encouraging focused "amateurs for the amateur" observing strategies. And for members who desire at-home participation, a plan to classify and analyze the vast store of VSX data. **Many members will simply continue their current established observing programs. A key activity is to step up our teaching and training so every member who wants the satisfaction of making a real contribution to science and to our common culture may do so. Because that's what we do: our work not only inspires us personally but gives inspiration to the next generation of astronomers and scientists.**

As a 501(c)3 charitable organization, AAVSO exists because we serve the larger world cultural community. Our staff and volunteers scan the astronomical literature, determine current astronomical problems, find gaps and holes that our observers can fill, then curate the data for accuracy and finally make the data available to the astronomical community and the public without restriction. **We could do none of this without your support. Your donations are vital in our planning. Your observations are crucial to our success. On behalf of the staff and the Board and officers of the Association, I wholeheartedly thank you for your continuing support.**

Sincerely,

Richard Berry

Richard Berry, President

Letter from the **Executive Director**

AAVSO is more than an organization; it is a global community of passionate individuals working together to advance our understanding of the universe. In 2024, our members, volunteers, and supporters contributed in countless ways—observing, mentoring, collaborating, and funding the work that fuels discovery. Thank you for being part of this journey and making this year such a success.

A Year of Achievement

This year, we met all of our primary goals and made substantial progress on our stretch goals. To strengthen AAVSO's place in modern astronomy, we engaged with leadership from major sky surveys, all of whom expressed interest in collaborating and emphasized the critical role of amateur astronomers in research. With surveys detecting more than 100,000 transient events each night, professional astronomers simply cannot keep up—they need our help. I believe this represents one of the most exciting ways in which AAVSO can grow.

We also established connections with the European Space Agency's PLATO mission and NASA's Habitable Worlds Observatory (HWO) program, laying the groundwork for future research projects launching in 2025 and beyond.

To enhance our technical infrastructure, we upgraded our authentication system for better third-party integration, migrated computing resources to a scalable platform, replaced the forums, and began transitioning our website to a modern framework. We also implemented new data quality controls, strengthening the reliability of photometric submissions based on recommendations from the Data Quality Task Force.

For our stretch goals, we initiated development of a smart telescope application, which is set to launch in mid-2025, and expanded our collaborations with professional research groups, particularly with CHARA, to further integrate AAVSO data into astronomical studies.

A Plan for the Future

One of our most important accomplishments in 2024 was developing a new strategic plan for 2025–2029. This plan focuses on five key areas:

- Shifting focus to high-science-value programs to maximize your scientific impact.
- Enhancing observer training so members can contribute meaningfully to modern scientific astronomy.

- Expanding membership engagement by highlighting the wide range of backgrounds, skills, and experiences in our community.
- Strengthening AAVSO's position within the astronomical community through greater professional engagement and outreach.
- Developing a robust technology infrastructure to meet the evolving demands of modern astronomy.

To achieve these goals, the Board and I have outlined 43 projects with 397 individual tasks to be executed over the next five years. Many of these initiatives rely on the dedication of our volunteers and supporters. Your involvement will be essential in shaping AAVSO's future, and we look forward to working together to bring this vision to life.

> We anticipate the Variable Star Index will expand from **2.2 million to 10 million known variable stars**, many of which have never been studied in detail.

Key Achievements & Impact

Membership & Engagement: AAVSO's membership remains strong at 1,200 members, with observer participation growing to approximately 1,300 active contributors. The most significant growth has been in the exoplanet community, mirroring trends seen in Exoplanet Watch and the professional community.

Scientific Contributions: This year, AAVSO's data, products, and service were cited in over 250 peer-reviewed publications. Most of these publications used resources in our databases which have grown substantially thanks to your efforts:

- Stellar Photometry (AID): 64.8 million observations, an 8.7% YOY growth.
- Stellar Spectroscopy (AVSpec): 14,700 spectra, a 15% YOY growth, making AVSpec the second largest amateur spectroscopy database, surpassing ARAS.
- Exoplanet Photometry: 8,100 transits recorded, a 63% YOY growth.
- Solar Observations: 181,000 observations, a 4% YOY growth.

In early 2025, we anticipate the Variable Star Index (VSX) will expand from 2.2 million to 10 million known variable stars, many of which have never been studied in detail. This growth presents an incredible opportunity—and a significant challenge. With so many new targets, we will need the dedication of our observers more than ever. Your contributions will be essential in ensuring these stars are properly observed, classified, and understood.

Education & Public Outreach

AAVSO continued to prioritize observer training and public engagement through structured programs. In 2024, we:

- Welcomed 35 new mentees into our mentorship program.
- Engaged 100 CHOICE participants in specialized training.
- Reached 10,000 attendees through our webinar series.

These programs equip both new and experienced observers with the skills needed to make meaningful scientific contributions.

Financial & Organizational Health

AAVSO remains financially stable, with the majority of our funding coming from our endowment, supplemented by donations and grants. However, with NSF grant success rates now below 15%, grants have become an increasingly uncertain funding source. As a result, the generosity of our donors and members will play an even greater role in sustaining and expanding our programs.

Under the leadership of Development Director, Whitney Armentor, our fundraising efforts have strengthened donor engagement and increased support for key initiatives. Looking ahead, our community's continued commitment will be essential to ensuring AAVSO thrives in the years to come, and we look forward to introducing new ways for you to support the AAVSO in the coming year.

Looking Ahead

AAVSO's impact is made possible by its community of observers, researchers, and supporters. Your dedication fuels discoveries, advances scientific knowledge, and ensures that AAVSO remains a global leader in variable star research.

As we celebrate this year's successes, I encourage you to remain engaged—whether by submitting observations, mentoring new members, or supporting AAVSO's initiatives. Your contributions continue to drive the future of astronomy.

Thank you for being part of this extraordinary journey.

Brian Kloppenborg, Executive Director



Your Donations at Work

Collaboration with professional researchers
The AAVSO Executive Director and staff spend a considerable amount of time interacting with the professional astronomical community to find projects that are both scientifically interesting and well matched to the capabilities of our members. As a result of these efforts, AAVSO products, services, or data were used in more than 250 peer-reviewed publications in 2024. We also issued 28 Observing Campaigns, and provided hundreds of objects for our members to observe.

Maintenance of databases and archives
Thanks to your contributions, the AAVSO maintains two of the world's largest databases on variable stars. The AAVSO International Database (AID) houses over 64.8 million observations of variable stars submitted by individuals since 1891. Likewise, our Variable Star Index (VSX) is the world's most comprehensive database of variable star metadata, with information on more than 2.2 million stars.

Outreach and education
Donations allow the AAVSO to provide outreach and education to observers worldwide:

a. We presented 16 webinars in Spanish and English. These webinars saw more than 1,900 attendances on Zoom and approximately 10,000 unique views on YouTube.
b. Our Annual Meeting and science conference enabled 100 in-person and 43 online attendees to learn about the most recent research in variable star astronomy. We look forward to seeing you in person this November for our Annual Meeting in Portland, Oregon.

The AAVSO is recognized around the world as a significant contributor to variable star research. **None of this would be possible without our community of observers, members, and donors.**

Your support **is making a galactic difference in variable star research**

To donate to the future of observational astronomy, visit aavso.org/donate-now

AAVSO by the numbers

343
Publications
263 Peer-Reviewed

AAVSO by the numbers

1,180
Members

AAVSO by the numbers

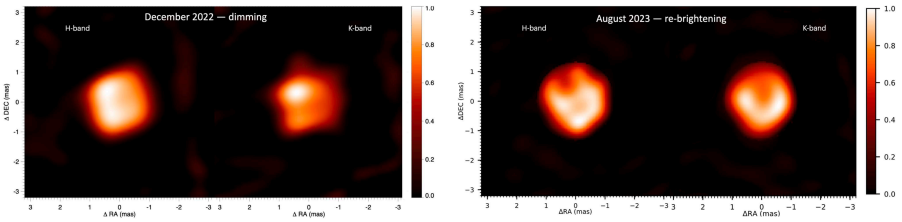
1,339
Active Observers

AAVSO by the numbers

9 CHOICE
Courses
114 Attendees

Highlighted Contributions to Science

The AAVSO has contributed to several projects in 2024. Below is a small sample of the interesting results featuring contributions of AAVSO observers.



Above: Four images of RW Cep that were obtained from the CHARA Array observations conducted on 2022 December 23 (left panel) and 2023 August 4 (right) in the H- and K-band wavelengths. Courtesy N. Anugu.

RW Cephei Flares Up

A research paper authored by a team led by Narsireddy Anugu, a staff scientist at Georgia State University's CHARA Array, cited the long-time recordkeeping of AAVSO observers. The observations were fundamental in distinguishing regular pulsations from more significant darkening events, like its Great Dimming in 2022. One observer cited—Wolfgang Vollmann—began observing RW Cep through serendipitous circumstances. He writes, "I observed W Cephei (triggered by an AAVSO request) and noted that RW Cephei was also on my DSLR images, so I decided to measure it too! I was very proud to be on their latest paper just doing what all variable star observers did for many decades—measuring stars to help understand them."

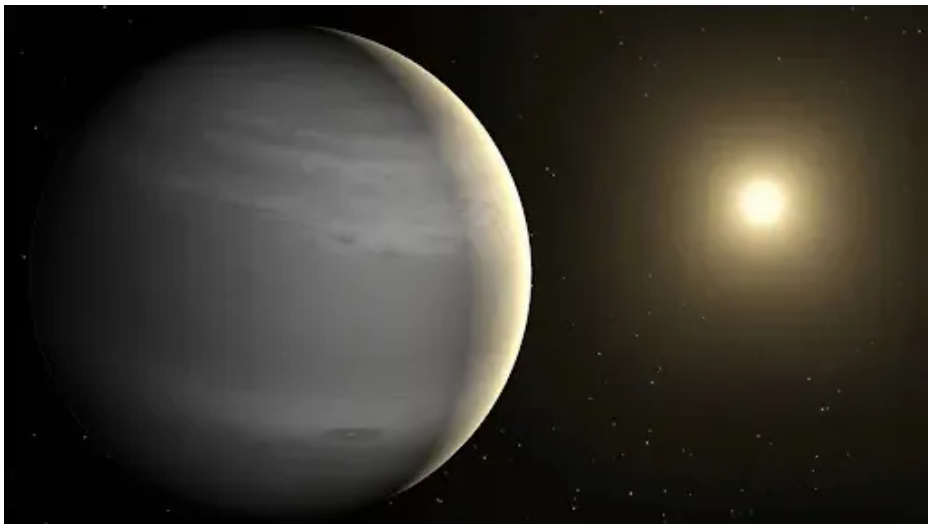

GOTO065054+593624: a peculiar dwarf nova identified in real time via Kilonova Seekers

Probing a Super-Outburst: GOTO065054+593624

Its name may be long, but this nova's story is worth the extra characters. It was initially discovered during a dramatic super-outburst by citizen scientists within the Kilonova Seekers project.

However, its true impact was determined in the aftermath. Regular follow-up observations, carried out largely by dedicated AAVSO observers, began to immediately probe its behavior. Their observations provided critical data on how the superhump period evolves throughout the outburst, offering valuable insights into the conditions within the accretion disk and enabling key tests of theoretical models.

GOTO065054+593624 is a shining example of how citizen scientists and professional researchers can work together to push the boundaries of astrophysical understanding.



Above: An artist's rendition of WASP-77 A b, a gas giant exoplanet that orbits a G-type star. Courtesy NASA Exoplanet Catalog.

WASP-77 A b: A Stellar Example of Professional and Citizen Science Collaboration

Over the past several years the AAVSO has worked in collaboration with the Exoplanet Watch team to involve citizen scientists in observing and submitting to the AAVSO Exoplanet Database. In the case of WASP-77 A b this resulted in more than 30 observations which achieved remarkable results. When combined with TESS and radial velocity measurements this data were able to present an exceptionally complete picture of this exoplanetary system presented in a paper led by researcher Frederico Noguer.

AAVSO by the numbers

16 Webinars

2,185 on Zoom

10K YouTube Views

AAVSO by the numbers

65 million

Observations in AAVSO International Database

AAVSO by the numbers

8,100

Exoplanet Transits Observed

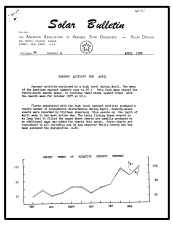
AAVSO by the numbers

14,600

Spectra

Spectroscopic DBs

Most impressively, the transit time precision improved by a factor of 2.3 compared to using TESS data alone. This achievement highlights the transformative role of AAVSO and other citizen science contributions in advancing exoplanet research. WASP-77 A b now stands as a testament to the power of collaboration between professionals and citizen scientists.


Solar Bulletin

Exploration of the Sunspot Archives

In a groundbreaking effort to preserve and advance solar physics research, Brad Schaefer is spearheading a project to recover, compile, and publish an unprecedented archive of sunspot counts spanning 80 years, from 1944 to 2024 for the AAVSO Solar Database. This monumental endeavor, slated for release in a data paper in *The Astrophysical Journal* and as an online resource on the AAVSO website, will consolidate over half a million observations into a definitive long-term record.

Unlike the Zurich/Brussels counts, the AAVSO data benefit from contributions by multiple observers, averaging out individual variations to provide a superior dataset. This archive will also enable the calibration of a robust long-term sunspot index, addressing critical gaps in understanding solar activity and its climate impacts over decades.

The project involves recovering data from AAVSO archives, personal observer logbooks, and collaborations with other solar organizations like SILSO. Among the highlights are data from renowned observers, including Hisako Koyama, Herbert Luft, Thomas Cragg, and David Levy, whose meticulous records span decades and provide vital calibration anchors. Efforts are ongoing to fill remaining gaps through outreach to observers, institutions, and historical archives.

Once complete, this database promises to be an invaluable tool for researchers worldwide, providing new insights into solar activity and its influence on our planet.

A New Milestone for AVSpec!

With over 15,500 unique observations, AVSpec—the AAVSO's spectroscopy database—has achieved an incredible milestone, becoming the second-largest amateur spectroscopy database in the world. Launched in 2019, AVSpec has grown rapidly thanks to contributions from more than 85 dedicated observers.

And the future looks even brighter. The advent of 3D-printable spectrographs like LOWSPEC is making high-quality spectroscopic observations more accessible and affordable than ever, promising to expand this thriving database even further.

To leverage this growing trove of data, a major focus in the coming year will be to launch new, engaging projects. Stay tuned—exciting opportunities are just around the corner!

"New Stars" in Scorpio and Vulpecula

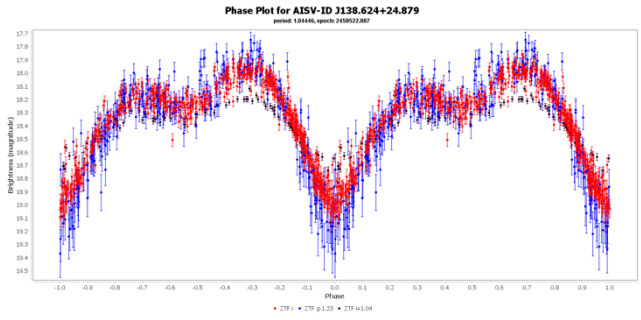
In their scrutiny of the night sky, variable star observers may find themselves discovering entirely "new stars." AAVSO observers found not one, but two novae this past year. The first, V1723 Sco, was discovered by Andrew Pearce, adding another notch to his impressive total (he appears in the prior Annual Report). V615 Vul was discovered on 2024 July 29.832 UT at magnitude 11.2 by AAVSO observer Kirill Sokolovsky, along with S. Korotkiy, N. Potapov, and S. Ostapenko, part of the "New Milky Way" survey from Nizhnii Arkhyz, Karachay-Cherkessia, Russia.

VSX Highlights

Despite automated surveys like Gaia and ATLAS dominating sky surveyance and publishing millions of new variable stars, the AAVSO still saw a 46% increase in submissions of new objects to VSX when compared to the previous three years. Most of these discoveries have come from an active group of members of the Variable Star Search Program at Xingming Observatory in Xinjiang, China.

We want to highlight the work of Shuming Wang, an amateur astronomer and college student. Wang discovered three of the most interesting stars submitted to VSX this year, ones that are not easy to classify and will be good objects for follow-up observations to understand their true nature.

VSSP J005847.46+562749.9 is a typically constant star that underwent a deep fading event with several brightenings and fadings, and a total duration of 347 days. It might be a disc-occultation system like V1400 Cen. Gaia classified it as an O-type star, but that spectral type seems unlikely.



AISV-ID J138.624+24.879, an object that, despite having a spectral type of M1e, shows periodic variations, and is not a good candidate for a BY Draconis rotational red dwarf variable, due to its very large amplitude. It is likely a cataclysmic variable but with a particularly strange light curve and a long period of 1.04 days.

AISV-ID J107.240-17.465 has a normal F-type spectrum and shows a very slow sinusoidal change in magnitude over several years. It appears periodic, but the period is too long to be determined for now.

Shuming's work is a good example of hard work, and we encourage the next generation of astronomers to follow his steps!

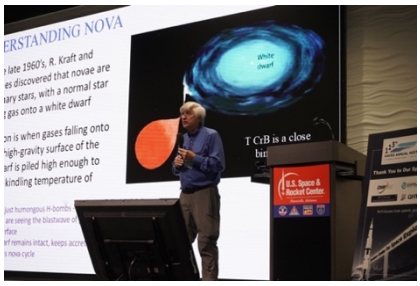
Left: A full-size mockup of a Saturn V rocket provides an imposing backdrop to the US Space & Rocket Center. *Right:* Annual Meeting attendees await the opening keynote, given by NASA's Dr. John Blevins.

AAVSO Events

AAVSO 113th Annual Meeting

On November 8, more than 100 people gathered in Huntsville, Alabama, to attend the Annual Meeting. Nearly 20% of the attendees were students, the highest ratio ever recorded. They gathered in the U.S. Space & Rocket Center, a venue that, with its displays of hardware from the past, present, and future of human spaceflight, won rave reviews.

The meeting opened with a reception in the imposing Saturn V Hall. Chief engineer Dr. John Blevins spoke about **the role of NASA's Space Launch System in helping return astronauts to the Moon** through the Artemis campaign.

Annual Meeting keynotes. *Left:* John Blevins discusses a SLS, a launch vehicle helping return astronauts to the Moon. *Middle:* Brad Schaefer presented on the ever-popular T CrB. *Right:* Sukanya Chakrabarti delves into her team's observational strategy to directly measure Galactic accelerations.

On Saturday, in-person attendees were joined by almost 60 users via a Zoom simulcast. After a brief welcome and housekeeping remarks, the programming began with the Landolt Lecture. Dr. Brad Schaefer delivered an entertaining presentation on **the recurrent nova T Corona Borealis**, reviewing the star's eruptions, highlighting some of the data submitted by AAVSO observers, and pondering what might be learned from the next eruption.

113th AAVSO ANNUAL MEETING
U.S. Space & Rocket Center | Nov. 8–10, 2024

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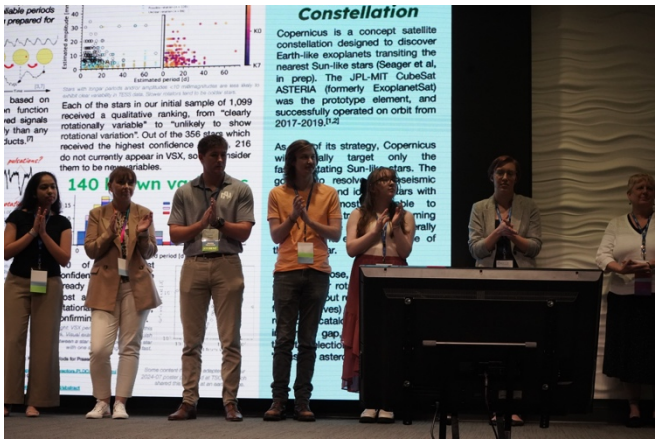

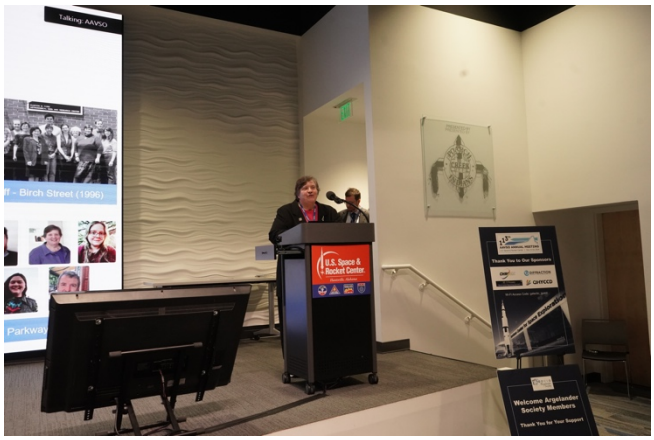

> The meeting was well coordinated, the venue excellent, hotel was good, and **the content and sessions excellent!**

Following the keynote, 20-minute sessions covered the spectrum of topics of interest to variable star aficionados, including exoplanets, pulsating stars, education and outreach, and observing techniques. The poster hall featured 14 poster papers, with contributions from across the country (and Poland). The Argelander Society Members' banquet rounded out the day's activities.

Sunday began with the Membership Meeting and various reports, followed by the presentation of awards—including recognition of Elizabeth O. Waagen's 45 years of service to the AAVSO. Following lunch, Dr. Sukanya Chakrabarti (University of Alabama) presented "The Precision Frontier of Dark Matter Constraints from Direct Acceleration Measurements." Between presentations, in-person attendees read poster papers, networked, and browsed the tables of DC-3 Dreams, Diffraction Limited, Chroma Technology, and QHYCCD tables. We thank these sponsors for their support. The Annual Meeting concluded with the traditional Closing Banquet, held in the Saturn V Hall.

Testimonials

It is a pleasure to inform you that in my recently published paper "TESS light curves of cataclysmic variables. IV. A synoptic view of eclipsing old novae and nova-like variables" (ApJS, 273, 6), **I used a considerable amount of data retrieved from the AAVSO International Database**. I thank you for maintaining this valuable research asset.

Albert Bruch
Laboratório Nacional de Astrofísica
Brazil

Joining AAVSO has been **one of my best decisions I made in my life** when it comes to doing research work.

Charles Galdies

Thank you for this recognition and for sharing the Observer Award certificate with me. **It's an incredible honor** to be acknowledged by the AAVSO, an organization I deeply admire.

Susan Delaney

I'm proud to offer a modest contribution to AAVSO, whose work in support of astrophysics **cannot be praised enough**.

Fulvio Tabacco

Thank you for the award, **it will be framed and take pride of place on the wall** . . .

Aengus O'Fearghail

Webinars

AAVSO hosted 16 webinars in 2024, attracting more than 4,000 registrations, 2,000 attendees and 10,000 YouTube views. covering a diverse range of astronomical topics.

The final webinar in La Ciencia del Cielo para Principiantes (The Science of Heaven for Beginners) series, Ciencia Ciudadana (Citizen Science) ran in January. Funds were provided by the National Science Foundation (grant number NSF-2212883).

Additionally, there were five sessions that fell into the how-to category: Introductory Photometry; Introductory Spectroscopy; Photometry: Filters and Transformations; Introduction to Exoplanet Observing; and Things I Thought I'd Never See.

> The presentation was excellent—clear and really interesting.

Interspersed were five science sessions: Asteroseismology: Golden Opportunities for Astrophysics; Cataclysmic Variables; A Campaign to Monitor Supernovae Progenitors; An Overview of Exoplanet Watch; and Mapping Wide Binaries using Pulsation Timing Variations.

In June, Section leaders presented webinars on the AAVSO sections: Solar, Eclipsing Binaries, and Long-Period Variables; Exoplanets, Young Stellar Objects, and Instrumentation & Equipment; CVs, AAVSOnet, and SPPs; and Spectroscopy, HEN, and PEP.

The Nominating Committee hosted Meet the Candidates in our FY25 Board Election.

The AAVSO Argelander Society

Named for Friedrich Argelander, considered "the father of variable star astronomy," The Argelander Society offers membership benefits to individuals who have given a certain level of substantial financial support to the AAVSO over many years. Once a benefactor has donated a cumulative total of $35,000 to the AAVSO, they are eligible for a lifetime membership in the organization, free registration to Annual Meetings, invitations to special events, special awards, and tokens of the association's appreciation.

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Theodore H. N. Wales
Gary Walker
Thomas R. Williams

Above: Friedrich Wilhelm August Argelander (1799–1875). Photograph courtesy of the Mary Lea Shane Archives of the Lick Observatory, University of California-Santa Cruz

Friedrich Argelander was the first astronomer to begin careful study of variable stars. Argelander is probably best known for the Bonner Durchmusterung, the largest and most comprehensive of the pre-photographic star catalogs. He began mapping the exact positions of the stars in the northern sky in 1852, a monumental task before the use of photographic plates. When finally completed in 1863, it listed the positions of 324,198 stars down to 9th magnitude.

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> I am grateful for the opportunity to **contribute** to the **science of variable stars**.
>
> AAVSO Member

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> I am so happy and grateful to be a member!
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Treasurer's Reports

October 1, 2023, to September 30, 2024

Robert D. Stephens, Treasurer, AAVSO, 185 Alewife Brook Parkway, Suite 410, Cambridge, MA 02138, U.S.A.

AAVSO Statement of Financial Position

September 30, 2024

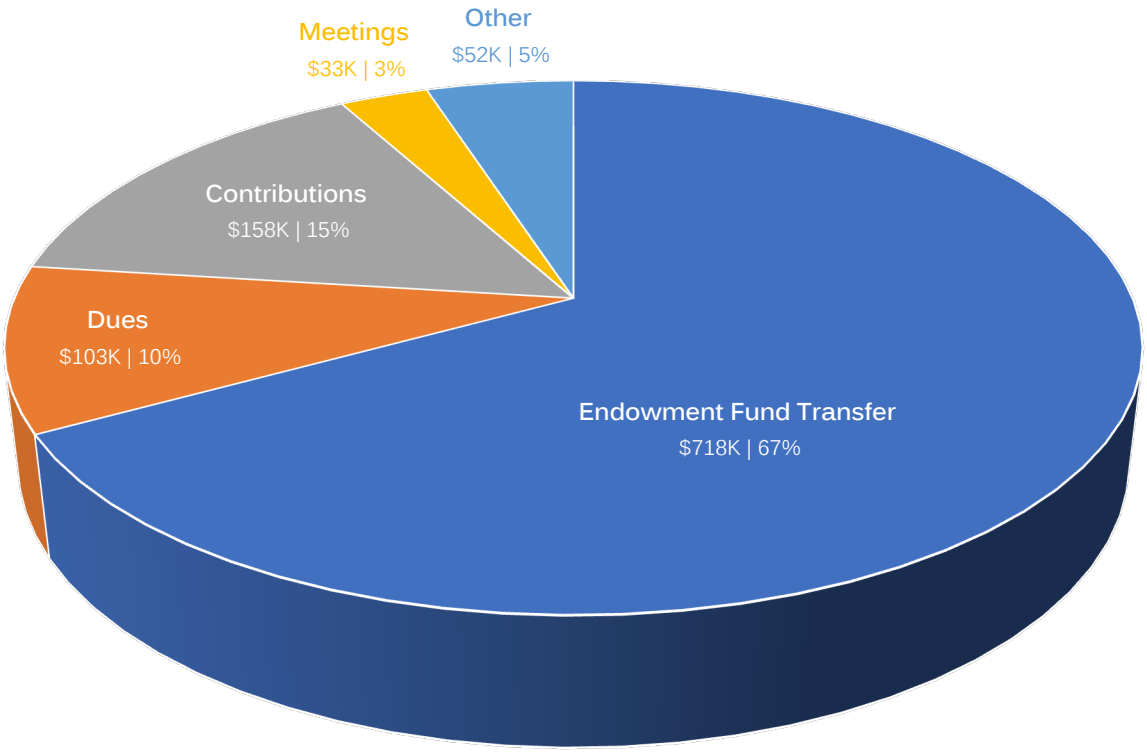
Assets		
Cash	$	410,970
Prepaid expenses		22,234
Investments		18,405,948
Operating lease right-of-use assets, net		205,710
Property and equipment, net		21,685
Security deposit		13,000
Total Assets	$	19,079,547
Liabilities and Net Assets		
Liabilities		
Accounts payable and accrued expenses	$	91,422
Prepaid membership dues and meetings		81,537
Operating lease liability		213,039
Total Liabilities		385,998
Net Assets		
Without donor restrictions		15,083,675
With donor restrictions		3,609,874
Total Net Assets		18,693,549
Total Liabilities & Net Assets	$	19,079,547

Statement of Activities and Changes in Net Assets

Year Ending September 30, 2024

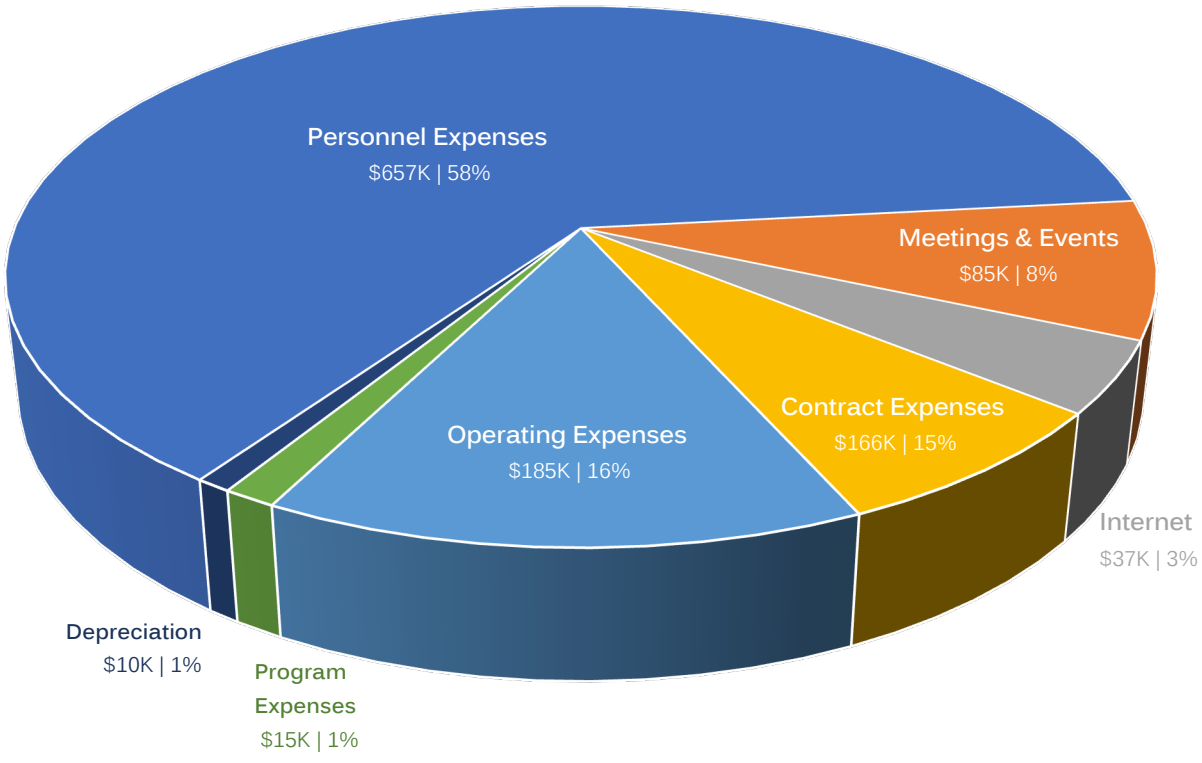
Changes in net assets without donor restrictions:		
Revenues, support, and other gains		
Contributions and grants	$	195,825
In-kind contributions		12,944
Membership dues and fees		103,352
Meetings, courses and other fees		38,153
Sales of publications and related material		6,988
Dividends and interest, net		407,640
Unrealized (depreciation) appreciation on investments		4,207,687
Realized gains on sale of investments		(834,704)
Total Revenues, support, and other gains		**4,137,885**
Expenses		
Program Services		747,363
General and administrative		357,572
Fundraising		65,368
Total Expenses		1,170,303
Increase (Decrease) in Unrestricted Net Assets	$	2,967,582
Changes in Net Assets With Donor Restrictions		
Contributions and grants		
Dividends and interest, net		5,875
Unrealized (depreciation) appreciation on investments		69,965
Realized gains on sale of investments		(14,692)
Expenses		(3,186)
Increase in Temporarily Restricted Net Assets		57,962
Increase (Decrease) in Net Assets		3,025,544
Net Assets – Beginning of year		15,668,005
Net Assets – End of year	$	18,693,549

AAVSO Revenues Used in Operations | FY23-24



Above: Revenues by type used to fund AAVSO operations. The Endowment Fund transfer is the sustainable draw from the Endowment Fund. *Below:* Expenditures of the AAVSO by type.

AAVSO Expenses | FY23-24



The American Association of Variable Star Observers

185 Alewife Brook Pkwy Ste 410
Cambridge, MA 02138-1104
United States

Telephone: +1 (617) 354-0484
Email: aavso@aavso.org
Website: www.aavso.org