



An update on the CHARA - AAVSO Collaboration

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Outline

- About the AAVSO
- Observing capabilities
- How to request data
- Data usage guidelines
- Year one results
- Other things of interest



The American Association of Variable Star Observers (AAVSO)



The mission of the AAVSO is “to enable anyone, anywhere, to participate in scientific discovery through variable star astronomy”

We achieve this mission through pro-am collaboration, strategic partnerships, educational activities, and data stewardship.



AAVSO by the numbers

Key Numbers

- Started in 1911
- **1,200 members**
- **800 observers**
- **200 volunteers**
- 6 staff + 3 contractors
- \$1M/year budget

Education and Public Outreach

- **Webinars reached 9,500 people**
- **8 CHOICE courses** with an average of 125 participants annually
- **7 Observing Manuals in 13 languages**
- **Mentoring Program**

Contributions to Science

- Data used in **380 publications/year (263 peer-reviewed!)**
- Photometry database (**59M observations**)
- Curated variable star metadata (**2.3M**)
- Spectra (**12k observations**)
- Exoplanet Transits (**4.5k**)
- Sunspot Counts (**250k**)
- Peer-reviewed Journal - JAAVSO

Other Activities

- Annual variable star meeting
- Proceedings
- Workshops



Characteristics of AAVSO participants

Come from different backgrounds

- High school to retired career professionals
- All interested in astronomy
- All want to contribute to science

Have a range of capabilities:

- Need education, training, and guidance (10%)
- Work with professional astronomers (80%)
- Conduct independent research (2-10%)

Utilize vastly different instruments

- Detectors: Eyes to CCD/CMOS cameras
- Optics: None to meter class telescopes.
- Tools: Robotic telescopes, photometers, spectrographs, speckle cameras, software.



2023 Annual Meeting - Credit Bob Stephens



Visual Observing
Roger Kalh



0.8 m telescope
Mario Motta



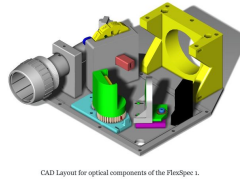
Home built solar scope
Santanu Basu



Amateur astronomers are *extremely* capable

SAS 2023 Proceedings

- DIY FlexSpec1 Spectrograph
- Speckle interferometry (Mt. Wilson)
- Exoplanet light curve modeling
- DART impact monitoring
- Ammonia characterization on Jupiter



BAV Magazine Spectroscopy

- Spectropolarimetry with a home-built, 3D-printed instrument

JAAVSO 51.2 (peer reviewed)

- Exoplanet transit modeling
- RS Cra - reclassification, not an EA binary
- Times of minimum for hundreds of EBs

JAAVSO 51.1 (peer reviewed)

- Exoplanet transit modeling
- Photometry + spectroscopy of flare stars.

Research from today's amateur astronomers is comparable to that of professionals from 1990-2010.
Low cost hardware and open-source software facilitates their research.

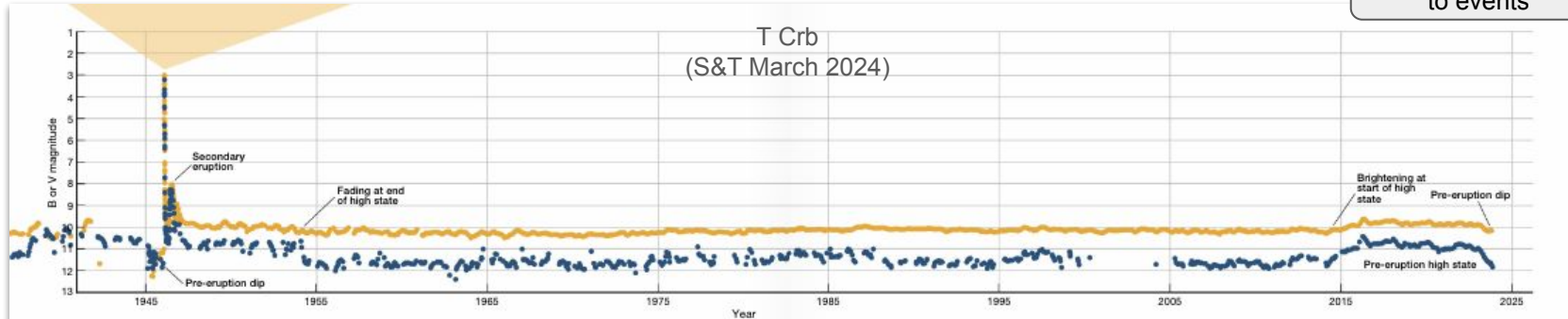
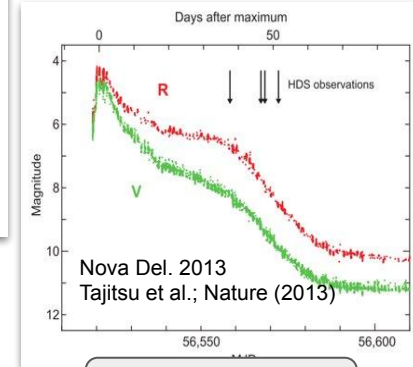
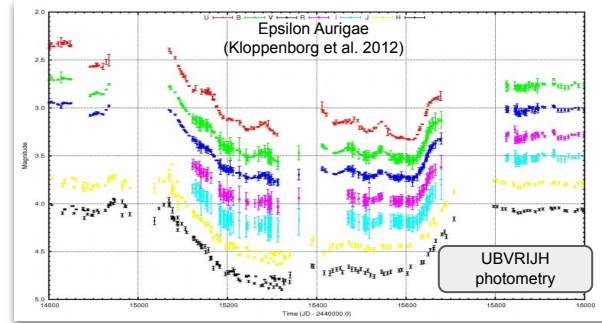
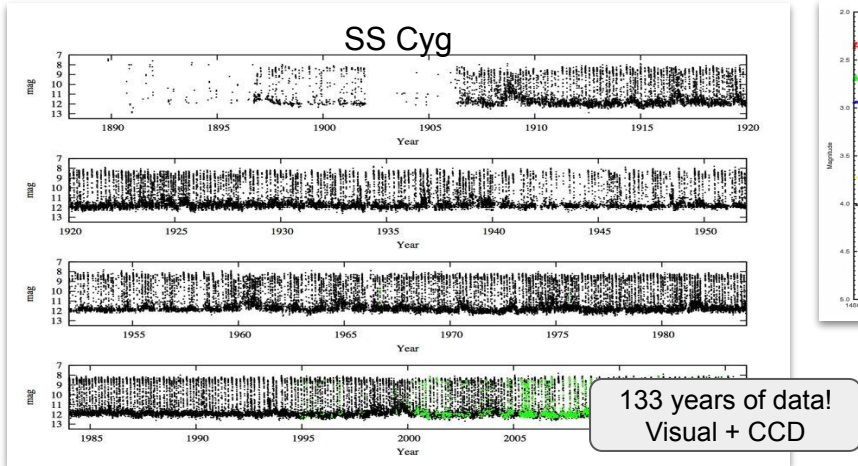


Photometric Capabilities

| Instrument | Filters | Range [magnitudes] | Precision [magnitude] | Commonality of resource | Principal Geographic Coverage | Notes |
|------------|--------------------------|---------------------------|-----------------------|-------------------------|-------------------------------|------------------------|
| Visual | Eye | 0 - 16+ | 0.100 - 0.200 | Abundant | Worldwide | |
| CCD/CMOS | Johnson Cousins UBVRI | 2 - 19+ | 0.010 - 0.050 | Abundant | Worldwide | U filter very uncommon |
| CCD/CMOS | Sloan ugriz | 2 - 19+ | 0.010 - 0.050 | Rare | Worldwide | Mostly on AAVSONet |
| PEP | Johnson Cousins UBVRI | U: -1 - 7 BVRI: -1 - 8 | 0.005 - 0.010 | Rare | North America, Europe | |
| PEP | Optec JH | -4 - 4 | 0.010 - 0.020 | Very Rare | North America, Australia | Fewer than 15 exist |



Photometry database examples



Spectroscopic Capabilities

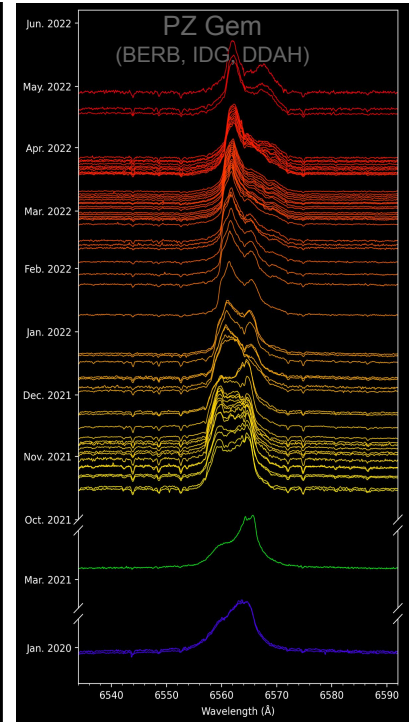
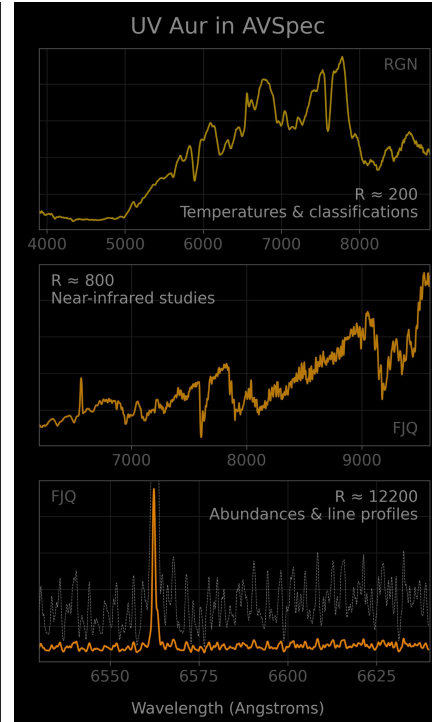
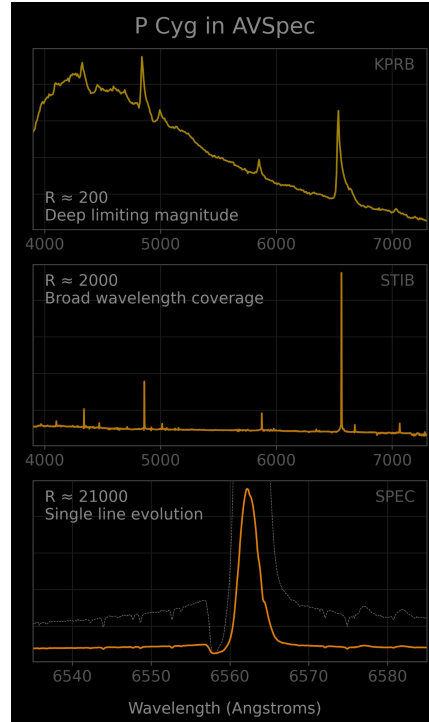
| Instrument | Type | Mag Limit | Resolution | Wavelengths [Angstroms] | Spectral Range [Angstroms] | Commonality of Resource | Principle Geographic Coverage | Notes |
|-------------------|--------------------|-----------|-----------------|-------------------------|----------------------------|-------------------------|-------------------------------|---|
| SA100/200 | Widefield Slitless | V = 10-14 | 100-200 | 3600-10,000 | Full | Common | Worldwide | Includes zero order. Stars can overlap. |
| Alpy 600 | Slit | V = 10-14 | 600-1000 | 3700-7500 | Full | Common | North America, Europe | |
| LISA, LOWSPEC | Slit | V = 10-14 | 1000-4000 | 4000-7000 | 2000-3000 | Common | North America, Europe | |
| eShel | Echelle | V = 6-8 | 10,000 | 4500-7000 | Full | Very Rare | North America, Europe | |
| LHIRES III | Slit | V = 6-8 | 10,000 - 20,000 | 4000-7000 | 251-155 | Common | North America, Europe | |
| Shelyak Whoppshel | Echelle | V= 9 | 30,000 | 3920-7500 | Full | Very Rare | North America, Europe | Fewer than 10 exist |



Spectroscopic Database - AVSpec

Quality Control

- Every spectrum inspected by AAVSO
- Feedback provided to improve results



How to request AAVSO observing time

From the CHARA (internal) proposal form

- Check the box!

If you get CHARA time

- AAVSO will send you an email with instructions.
- Fill out the form and send it back.

Otherwise

- Visit <https://www.aavso.org/observing-campaigns>
- Email the proposal form to the address below

Starting in April we'll have a web application for this process.

Observing Campaign Manager
Elizabeth Waagen
eowaagen@aavso.org

Request for Observing Time at the CHARA Array
For the Period
August 1 – December 21, 2023
Type only within boxed areas immediately after hyphens

| | |
|--------------------------|---|
| P.I. Name/e-mail - | PhD Research? – yes/no (circle choice) |
| Co-P.I. Names - | |
| Observing Participants - | AAVSO data? – yes/no (circle choice) |
| Proposal Title - | |
| | Is this a new or continuing project? – new / continuing (circle choice) |
| Abstract - | |

Summary of Requested Observing Run(s)

| Run | No. of Nights | Optimal Dates | Acceptable Dates | Beam Combiner | Filter / Spectral Mode | Telescopes |
|-----|---------------|---------------|------------------|---------------|------------------------|------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

Unacceptable Observing Dates (for non-astronomical reasons) -

1

2023B – Submission Deadline: 2023 March 31, midnight EDT – Submit to proposals@chara-array.org



AAVSO Data Usage Guidelines

1. Include the following in your acknowledgements:

"We acknowledge the use of data from the AAVSO International Database in this research. We express our gratitude to the worldwide network of observers who made these data possible."

2. In AAS journals, use "AAVSO" as a facility keyword.

3. Please consider adding observers as co-authors on your paper.

- a. Drop Elizabeth Waagen an email to get observer contact information: ewaagen@aavso.org



Data Usage Guidelines:
<https://www.aavso.org/data-usage-guidelines>

Collaboration year one results

CHARA 2023B proposals

- 5 approved CHARA proposals w/ box checked
- 1 CHARA PI responded to our emails
- 2 additional CHARA-related proposals

CHARA 2024A proposals

- 4 approved CHARA proposals w/ box checked
- 3 CHARA PIs responded!
- 1 program already running!

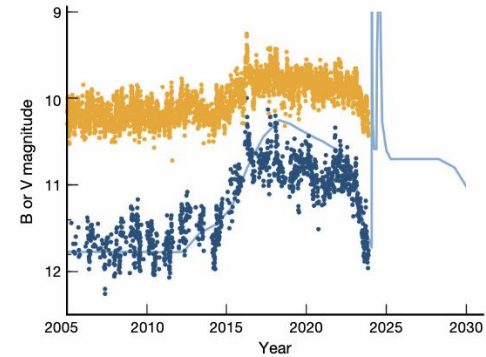
Data Acquired

- Sig Gem
 - BVRI photometry during 8-day TESS run
 - 166 points obtained, 1 observer
- ARMADA
 - BVR photometry on 75 non-variable stars
 - 53 / 75 observed
- T CrB
 - 1 photometry point every 12 minutes on average

Sig Gem - AAVSO

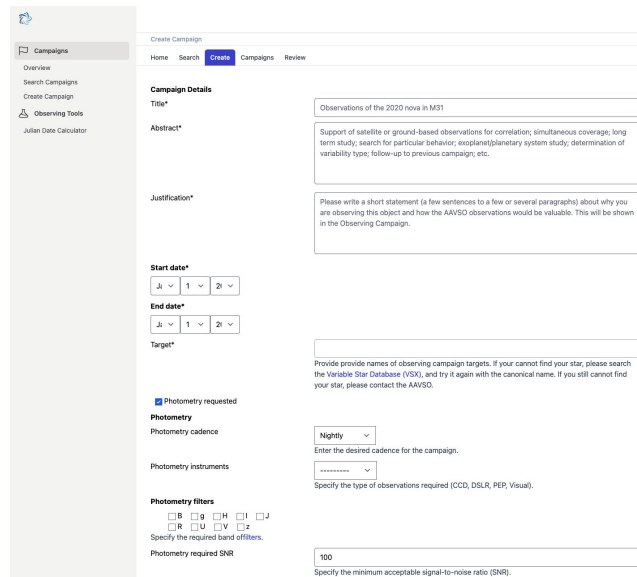


T CrB - S&T March 2024



Lessons Learned

- AAVSO wasn't set up for survey programs
 - Testing a new engagement method using AAVSONet
- Poor response from PIs
 - Can CHARA share object lists? No.
 - Simplified AAVSO proposal process
 - Created a new app for campaigns (see right). Ready for 2024B.
- Poor uptake by observers
 - Testing new campaign promotional methods (blog posts, social media announcements, direct email)
 - Creating new project-focused observing programs
 - Adding objects to AAVSONet as a backup
- Communication and oversight
 - New application reminds staff to check in on campaigns regularly
 - Instituted monthly status reviews



The screenshot shows the 'Create Campaign' web interface. On the left is a navigation sidebar with options: Campaigns (selected), Overview, Search Campaigns, Create Campaign, Observing Tools, and Julian Date Calculator. The main content area is titled 'Create Campaign' and has tabs for Home, Search, Create (active), Campaigns, and Review. The 'Campaign Details' section includes:

- Title***: A text input field containing 'Observations of the 2020 nova in M31'.
- Abstract***: A text area containing 'Support of satellite or ground-based observations for correlation; simultaneous coverage; long term study; search for particular behavior; explanation; planetary system study; determination of variability type; follow-up to previous campaign; etc.'
- Justification***: A text area with a placeholder: 'Please write a short statement (a few sentences to a few or several paragraphs) about why you are observing this object and how the AAVSO observations would be valuable. This will be shown in the Observing Campaign.'
- Start date***: A date selector showing 'Jul 1 2024'.
- End date***: A date selector showing 'Jul 1 2024'.
- Target***: A text area with a placeholder: 'Provide names of observing campaign targets. If you cannot find your star, please search the Variable Star Database (VSD), and try it again with the canonical name. If you still cannot find your star, please contact the AAVSO.'
- Photometry requested**: A checked checkbox.
- Photometry**: A section with 'Photometry cadence' set to 'Nightly' and a text input for 'Enter the desired cadence for the campaign.' Below it, 'Photometry instruments' is set to '.....'.
- Photometry filters**: A section with checkboxes for 'B', 'g', 'H', 'I', 'J', 'R', 'U', 'V', 'z'. Below it, a text input for 'Specify the required band filters.' is empty.
- Photometry required SNR**: A text input field containing '100'.



Stellar metadata: Variable Star Index (VSX)

Search VSX ?

Special searches > Go

Select a Special search above, or enter information in the fields below, then click Search.

Name
Examples: SS Cyg, V456 Sgr, NSV 1009
%And, ASAS %+%, Mis V%
Search by AUJID also available

> Capture coordinates for object to Position field

Const.

Filters search results by boundaries of selected constellation

Position
Examples: 21 42 42.8 +43 35 10
07:04:04 -03:50:51
118.77187 +22.00139

Size Radius Box size

Mag. at maximum between and

Mag. at minimum between and

Period between d and d

Epoch between HJD and HJD

Rise dur. between % and %

Nova year between and

Variability type

Examples: M, DCEP, EA%

Spectral type

Examples: K, Mfs, pec(%)

Stellar Association

Campaign or Program > View details

Observations in the AAVSO International Database

Catalog Color between and

Include Variables Suspects Non-variables Not checked

Order by Descending

Click [Less](#) to hide extended search options.

The International Variable Star Index

Current Time: 20 Jan 2023 22:17:33 UTC Welcome, Guest. You are not logged in.

Latest Details ?

Log in to retrieve additional aliases from SIMBAD.

Name **eps Aur**

AAVSO UID 000-BCT-905 (33572 observations)

Constellation Auriga > Sequence

J2000.0 05 01 58.13 +43 49 23.9 (75.49221 +43.82331) > Search nearby

B1950.0 04 58 22.53 +43 45 05.4

Proper motion: RA: -0.86 +/- 1.38 mas/yr Dec: -2.66 +/- 0.75 mas/yr Source: F. Van Leeuwen, 2007

Galactic coord. 162.788 +1.179

Other names (Internal only) Please note that aliases shown in grey link to obsolete records.

| | | |
|------------------------------|------------------------------|------------------------------|
| 7 Aur | AKSO 0454443 | ADS 3605 A |
| ASASSN-V J050159.29+435345.9 | ASASSN-V J050200.51+435101.9 | ASASSN-V J050202.42+434720.2 |
| BD+43 1166 | HD 31964 | HP 23416 |
| HR 1605 | IRC +40709 | RAFGL 6705 |
| SAO 39955 | | |

(Not logged in) > Add name

Variability type EA/GS ?

Spectral type A8:V-F2:ep+BV ?

Mag. range 2.92 - 3.83 V ?

Discoverer --

Epoch 04 Jun 1956 (HJD 2435629) > Ephemeris

Outburst --

Period 3892 d (27.08 y)

Rise/clipse dur. 8% (113 weeks)

Remarks ?

Some references may be clicked to view in new window. Roll over index number to view submission details.

1 GCVS V8 A/B 14.0m, 21°, 224deg, d = 0.0377 Survey of the physical properties of the system **ID. Struve, PASP 68, 27, 1956, K.O. Weig, AAS Conf 48, 221, 1955, H.A. Abt, ApJ 126, 138, 1957, I.M. Kopylov, P.N. Kuznetsovskiy, in: Kosmich. Astron., Obs. 29, 251, 1963, M. Hack, Mem. SAI 32, FA, 1961=Milano-Merate Contr. N185, 1962, Kh. Abto, Tartu Publ 45, 294, 1977.** The spectrum probably varies even outside eclipses. The eclipses are probably due to a disk of gas and dust surrounding the hot companion. The brightness has physical fluctuations with the amplitude up to 0.25m and the cycle about 110d (C.M. Kuffer, ApJ 76, 1, 1932) which hinder revealing the possible Mm II. Similar cycle was discovered also in the fluctuations of V1.

(Not logged in) > Add remark

References ?

Click reference title/citation to view in new window. Roll over index number to view submission details.

1 T. Jayasinghe, K. Z. Stanek, C. Kochanek, et al., 2019 (in preparation) --

2 Kh. Abto, Tartu Publ. 39, 82, 1971. --

External Links ?

Links open in a new window. Not all links may be valid for this particular target.

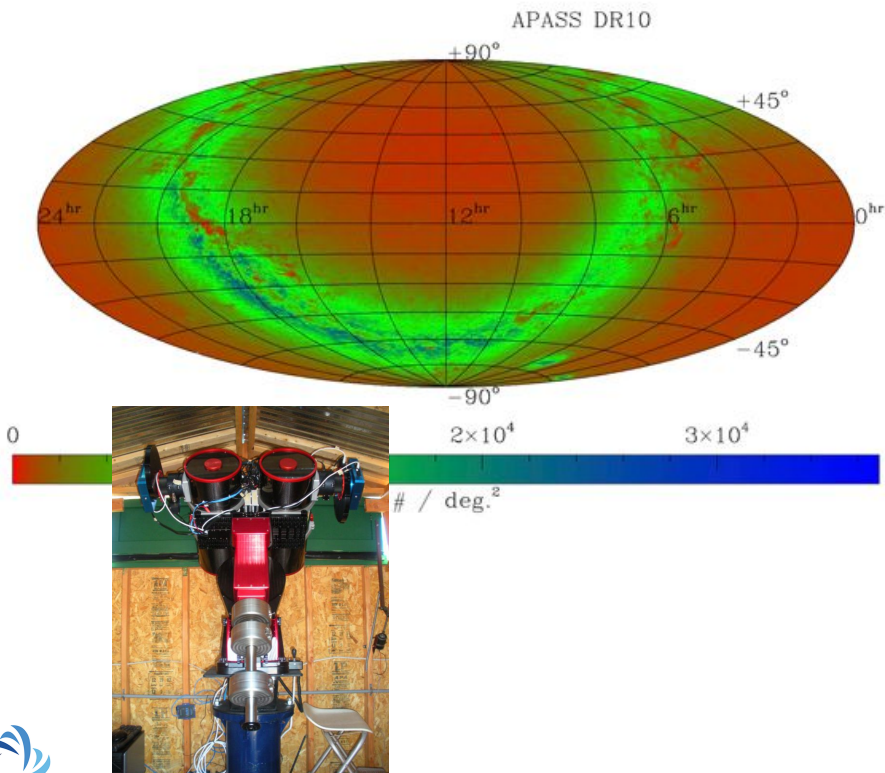
Location > Go Select a Location for more details.

Think of VSX as ADS for variable stars.

- 2.3 M entries (all known variables of > 1 milli-mag or more)
- Query by name, coordinates, min/max magnitude, period, variability type, spectral type, stellar associations, campaigns
- External Links point to 30 separate databases, including survey programs.

Visit aavso.org/vsx/

AAVSO Photometric All-Sky Survey (APASS)



About the survey:

- Bridges the gap between Tyco2 and SDSS
- Valid from 7 - 17th magnitudes
- Eight filters:
 - Johnson B, V
 - Sloan u', g', r', i', z', and Z
- Photometry on 128 million objects.
- 510,000 images taken as of DR10

Where can you get it?

- DR10 on AAVSO.org
- DR9 on VizieR and Virtual Observatory

Funded by Robert Martin Ayers Sciences Fund,
NSF AST 1412587, and the AAVSO endowment



Use our telescopes



- 8 robotic telescopes worldwide
 - 5 – Bright star monitors (7" apertures)
 - 3 - Faint star monitors (24" apertures)
 - Johnson-Cousins, Sloan, H-alpha filters
 - Spectrograph coming soon
- Time requested by proposal
- All proposals reviewed by TAC
- Data can be downloaded or sent to VPhot for processing.
- **Member-only benefit**



We are always open to adding additional telescopes to the network and have partnered with universities to do so. Contact us if you are interested!



AAVSO's 113th Annual Meeting

US Space and Rocket Center
Huntsville, AL
Nov. 8 - 10, 2024

