AAVSO Meeting Abstracts

Number 1
June 2021

Abstracts of presentations made at meetings of
The American Association of Variable Star Observers

The American Association of Variable Star Observers
49 Bay State Road, Cambridge, MA 02138, USA

The Journal of the American Association of Variable Star Observers

The Board of the American Association of Variable Star Observers 2020–2021

ISSN 0000-0000 (print)
ISSN 0000-0000 (online)

AAVSO
Meeting Abstracts

Abstracts of presentations made at meetings of
The American Association
of Variable Star Observers

Number 1
June 2021

ISSN 0000-0000 (print)
ISSN 0000-0000 (online)

AAVSO
49 Bay State Road
Cambridge, MA 02138
USA

Publication Information

AAVSO Meeting Abstracts is usually published twice a year, June and December, and contains Abstracts of presentations (oral and poster) made at AAVSO meetings. The AAVSO usually holds two meetings per year, but if it holds fewer or more meetings in a year, the number of *AAVSO Meeting Abstracts* published in a year will vary accordingly.

The submission window for inclusion in *AAVSO Meeting Abstracts* is the same as the window for submission of Abstracts for an AAVSO meeting; it will therefore vary from issue to issue. Those interested in giving a presentation at an AAVSO meeting should monitor the Meetings page of the AAVSO website (https://www.aavso.org/aavso-meetings) for relevant announcements regarding instructions and deadlines.

An author may not specify in which issue an Abstract is to be published; Abstracts will be published in the issue appropriate to the meeting at which the presentation was given, except under extraordinary circumstances.

AAVSO, 49 Bay State Road, Cambridge, MA 02138, USA.

Telephone: 617-354-0484
email: aavso@aavso.org
website: https://www.aavso.org

AAVSO Meeting Abstracts
Number 1, June 2021

Abstracts of Papers and Posters Presented at the 109th Annual Meeting of the AAVSO, Held as an "Online Only" Event, November 13–15, 2020

Table of Contents continued on following pages

109th Annual Meeting Research Posters

Table of Contents continued on following pages

Abstracts of Presentations Made at the 109th Annual Meeting of the AAVSO, Held as an "Online Only" Event, November 13–15, 2020

Types of Period Changes of W Virginis Stars

Pradip Karmakar
MAA Durga Villa, Bhatrapally Road, Nabapally, Barasat, West Bengal, India; pradipkarmakar39@gmail.com

Horace A. Smith
Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824; smith@pa.msu.edu

Wayne Osborn
118 Eagle Pointe Drive, Unit C, Delevan, WI 53115; wayne.osborn@cmich.edu

Abstract There are still unsolved problems in understanding the evolution of type II Cepheids of the W Virginis class. Period changes of W Vir variables have the potential to provide insight into that evolution. We illustrate this by showing the observed period changes of three W Vir variables in globular clusters. V2 in M10 shows a long-term decrease in period. V3 in M10 shows a small period increase. Sometimes, as with V1 in M12, irregular period changes make it hard to determine the long-term trend of the period change.

Search for Variability in 30 Bright Metallic-line A Stars Observed by the TESS Spacecraft

Joyce A. Guzik
Los Alamos National Laboratory, MS T082, Los Alamos, NM 87547; joy@lanl.gov

Abstract As part of the NASA TESS Guest Investigator Cycle 2 program, we received 2-minute cadence light curves for bright main-sequence metallic-line A (Am) stars. The Am stars show significant underabundances of calcium and scandium, and enhanced abundances of titanium and iron-group elements compared to the solar abundances. Catanzaro *et al.* (2019) used high resolution spectroscopy + Gaia parallaxes to derive a set of uniformly reduced parameters for these stars, including log g, v sin i, effective temperature, luminosity, and element abundances. While these stars lie in or near the delta Scuti pulsation instability region in the H-R diagram, they are not expected to pulsate because the diffusive element settling and radiative levitation processes responsible for their peculiar abundances should have also drained helium from the layer in the envelope that drives delta Scuti pulsations. Of the 30 stars observed by TESS, we find four delta Sct stars, two of which may be δ Sct/γ Dor hybrids. Of the remaining stars, we find one previously known eclipsing binary, and 16 showing variability of unconfirmed origin. We will show example light curve analyses for a delta Scuti star, for one of the higher amplitude variables, and for the eclipsing binary. Follow-up observations combined with stellar modeling will be needed to understand the causes for the variability.

Simultaneous Photometry on VSX Variables and TESS Exoplanet Candidates

Madelyn Madsen
madsenma@mnstate.edu

Abstract As a continuation of our software development as part of the TESS ground-based follow-up network, we have been able to produce the data products necessary for a TESS submission. Currently we are able to produce a photometry measurement table, light curve, seeing profile, a field of labeled apertures, and corresponding measurement files. We have made one successful submission to TESS, and we are now working on streamlining the analysis process for other submissions. We are also able to measure the photometry of variable stars in the field and have observed a possible new variable in the field we submitted to TESS.

The Quick and the Deadtime

Gregory Sivakoff
University of Alberta, Edmonton AB, Canada; sivakoff@ualberta.ca

Abstract In an ideal world, we could image sizescales as small as the distance between the Earth and the Moon. However, even the highest resolution astronomical imaging facililities, like the Event Horizon Telescope, could only do so out to distances less than 100 parsecs (326 light-years) from Earth. However, since light travels from the Earth to the Moon in about 1.3 seconds, rapid variability can probe small distances across the entire Universe—if your source is bright enough and you have a good setup. I will discuss recent rapid-variability results from relativistic jets launched by stellar-mass black holes that are feasting on the envelope of nearby stars. These results demonstrate the power (and pitfalls) of rapid variability (milliseconds to minutes). I will also discuss some of the equipment that astronomers are using to make such measurements—especially CMOS/sCMOS detectors whose useful features include minimized deadtime due to quick readout, low readout noise, and windowing.

Characterizing the O'Connell Effect in Kepler Eclipsing Binaries

Matthew Knote
Department of Aerospace, Physics, and Space Sciences, Florida Institute of Technology, 150 West University Boulevard, Melbourne, FL 32901; mknote2015@my.fit.edu

Abstract The O'Connell effect—the presence of unequal maxima in eclipsing binary light curves—is a poorly understood phenomenon that has been recognized for over a century. Several

ideas have been proposed to explain it, including chromospheric spots, effects of mass transfer, or circumstellar material, but the exact cause of the effect nevertheless remains unresolved. The Kepler mission observed nearly 3,000 eclipsing binaries, of which my analysis shows that over 200 show a significant O'Connell effect. Our goal is to analyze and characterize this sample of systems as a prelude to future projects looking to determine the physical cause of the phenomenon. I now present the results we have obtained thus far, such as a correlation between the O'Connell effect size and eclipse depth. I will also discuss some interesting classes of systems we have discovered, including systems with considerable temporal variation and systems with asymmetric minima that warrant further observations.

Disk Instabilities Caused the 2018 Outburst of AG Draconis

Helena M. Richie
University of Pittsburgh; helenarichie@pitt.edu

Abstract The symbiotic binary AG Draconis (AG Dra) has a well-established outburst behavior based on an extensive observational history. Usually the system undergoes a 9- to 15-year period of quiescence with a constant average energy emitted, during which the system's orbital period of ~ 550 d can be seen at shorter wavelengths (particularly in the U band), as well as a shorter period of ~ 355 d thought to be due to pulsations of the cool component. After a quiescent period, the marker of an active period is usually a major (cool) outburst of up to V = 8.4 mag, followed by a series of minor (hot) outbursts repeating at a period of approximately 1 year. However, in 2016 April after a 9-year period of quiescence, AG Dra exhibited unusual behavior: it began an active phase with a minor outburst followed by two more minor outbursts repeating at an interval of ~ 1 year. We present R-band observations of AG Dra's 2018 April minor outburst and an analysis of the outburst mechanism, and report on the system's activity levels following the time of its next expected outburst. By considering the brightening and cooling times, the scale of the outburst, and its temperature evolution, we have determined that this outburst was of disk instability in nature.

Using Bespoke 18-inch Newtonian and R = 3000 Spectrometer for High-Precision Observations

John Menke
22500 Old Hundred Road, Barnesville, MD 20838; John@menkescientific.com

Abstract It is quite possible to make high-precision spectroscopic measurements using rather modest (home-built) equipment. This paper describes a multi-year research effort on AZ Cas, a binary eclipsing variable with a 9-year period that has giant red and blue components. The next eclipse is in 2022 when previous observations show that we can expect substantial stellar interactions between the components. There are limited data on the system, including substantial uncertainty of the doppler shifts involved. Preliminary results give hope that doppler shifts can be measured to better than 0.1 Å (about 10 km/s) even with a spectrometer resolution of about 2 Å.

Morning Star: The Search for and Discovery of the Stars of Bethlehem According to the Gospel of Matthew

Rev. Kenneth Beckmann
3704 Derby Ridge Drive, Columbia, MO 65202; kcb@whatajoyfulcelebration.com

Abstract For more than two thousand years, the Star of Bethlehem has remained an enigma in the light of biblical scholarship and astronomical research. In 1984, the late Dr. Dorrit Hoffleit wrote an article in the Journal of the AAVSO, Volume 13, Number 1, entitled, "The Christmas Star, Novae and Pulsars." This article described Carolyn Murphy-Beehler's discovery of an ancient Christian star map of the Star of Bethlehem in the catacomb of Priscilla at Rome. Recently, I have discovered four clues and two keys that demonstrate that the Star on the star map in the catacomb and the Star in Matthew's Gospel may be one and the same Star. In this paper, I will demonstrate how two observations, one at the Star's rising and the other the Star at Midheaven, provide an indisputable argument that the Star of 5 BCE (the Star on the star map in the catacomb) accurately describes the Star Matthew speaks about in his gospel.

Automating a Small Urban College Observatory

Donald Smith
Deshawn Reid
Guilford College, 5800 West Friendly Avenue, Greensboro, NC 27410; dsmith4@guilford.edu, reid26856@gmail.com

Abstract We will report on our efforts to automate the operation and data processing of the 16-inch RCOS optical telescope at the Guilford College J. Donald Cline Observatory in Greesboro, North Carolina. We will briefly describe the hardware and software that comprise the instrument, and we will outline the Python scripts we have written to automate the observing schedule at night and the data reduction the next day. The final product is an ever-growing database of timestamped photometric measurements, from which can be easily extracted light curves for analysis. This fall, we have been carrying out our first oberving campaign on several variable stars indentified throught the AAVSO Target Tool as needing further observations. We will present our preliminary light curves and discuss the precision of the analysis, including the effects of the local light pollution conditions.

Researching Eclipsing Binaries "Down Under": Illustrating the Methods and Results of Variable Stars South

Thomas J. Richards
P.O. Box 323, Kangaroo Ground, VIC 3097, Australia; tomprettyhill@gmail.com

Abstract Southern skies teem with variables but there are relatively few research-oriented amateur astronomers to study them, so a centralized funded research organization is not realistic. Instead, Variable Stars Sourth (RASNZ) provides a very successful, virtual non-localized base for scattered southern variable star researchers to collaborate in a project-oriented manner without central services. This presentation illustrates that distributed but collaborative enterprise—rather different from the AAVSO model—by describing the very active work of the VSS's Southern Eclipsing Binaries Project. It shows how each observer carries out their own data analysis on their light curves, and how cloud collaboration is used to automatically combine their analyses and derive further results from them. The presentation also shows with examples how those data are used by observers as the basis for more advanced research where again, individuals collaborate rather than using a central service. The approach has proved to be very productive over the seven years of the project.

Measuring the Masses of White Dwarfs with X-rays: A NuSTAR Legacy Survey

Aarran Shaw
University of Alberta, Canada; aarrans@unr.edu

Abstract Magnetic cataclysmic variables are binary systems consisting of a white dwarf accreting matter from a normal, Sun-like star. The magnetic field of the white dwarf is strong enough to disrupt the accretion flow, forcing material along the magnetic field lines on to the poles of the dense star, where it forms an extremely hot shock just above its surface. The temperature of this shock is directly related to the white dwarf mass, and can be measured by studying the hard X-ray spectrum. This method is complimentary to optical radial velocity measurements, which depend on the (often not very well-known) binary inclination. With the 2012 launch of NASA's NuSTAR X-ray telescope, the hard X-ray spectrum has become much more accessible to astronomers. We present here the results from a NuSTAR Legacy survey of 19 magnetic cataclysmic variables, measuring their spectra and deriving the masses of their white dwarfs. We present the mass distribution and draw comparison with the masses of other classes of white dwarfs, commenting on the consequences our results may have on theories of accretion and novae in CVs.

Building Connection through Community-Based Astronomy

Todd Duncan
Erika Dunning
Pacific University, Department of Physics, 2043 College Way, Forest Grove, OR 97116; tduncan@pacificu.edu, dunn6387@pacificu.edu

Abstract Looking at the night sky can help us feel more connected to our fellow humans—perhaps because it reminds us that what we have in common is far greater than our differences. In addition, the process of doing astronomy research can help us feel more connected to the larger universe. This presentation will summarize what we've learned by combining the two: bringing astronomy research (in the form of variable star photometry) out into public spaces to invite conversation and participation from anyone who happens to walk by our portable observatory.

New Observations of the SX Phe Star XX Cygni

Richard Berry
Nolan Sottoway
Sol McClain
Address correspondence to: R. Berry, 22614 North Santiam Highway, Lyons, OR 87358; rberry@wvi.com

Abstract We report 20+ new times of maximum light of the short period pulsator XX Cygni measured during the August 2020 Pine Mountain Observatory "Virtual Astronomy Camp" for high-school students. Observations were made at a cadence of 10 seconds, producing dense light curves. We determined each time of maximum by fitting ~250 data points near the peak with a six-order polynomial. Assuming a constant period for the star, the standard error from the ephemeris is 0.00025 day = 22 seconds. We saw no evidence for early or late time-of-max during our observing campaign.

Discoveries of Variable Stars by Amateur Astronomers Using Data Mining on the Example of Eclipsing Binary Romanov V20

Filipp Romanov
Pobedy Street, House 3, Flat 30, Yuzhno-Morskoy, Nakhodka, Primorsky Krai, Russian Federation 692954; filipp.romanov.27.04.1997@gmail.com

Abstract I report my discovery of a high-amplitude Algol-type eclipsing variable star in the constellation Centaurus which was registered in the AAVSO's Variable Star Index (VSX) on December 3, 2018 under the name of Romanov V20. I describe the process of my analysis of data from VizieR catalogues to select this star as a candidate for searching for variability and to check if the variability of the star was known before. I inform how I used photometry data from several sky surveys to find variability, and how I researched these data in the software

VStar for light curve analysis and for period search. I explain about registering variable stars in VSX, and about my requesting from the AAVSO a chart with comparison star magnitudes and about my follow-up observations of the main eclipse of this sufficiently bright star with a remote telescope in Australia. I produce photometric measurements of Romanov V20 from these images and compare them with data from sky surveys, and using this variable star as an example, I show that amateur astronomers can make astronomical discoveries and can conduct scientific research even without astronomical equipment, regardless of geographic location. Beisides this variable star, I am currently the discoverer of 70 other variable stars, which have also been registered in VSX since January 2016.

Star "Crawling" with Astronomical Binoculars

William Wink
1356 Butter Churn Road, Middletown, PA 17057; williamwink@yahoo.com

Abstract I discuss a technique to use small FOV astronomical binoculars to identify and observe variable stars using a DSLR and astrometry. Pictures of equipment are included as well as an example of an observation.

GW Lib and V386 Ser: CVs Containing Accreting, Pulsating White Dwarfs

Paul Szkody
Department of Astronomy, University of Washington, Box 351580, Seattle, WA 98195; Szkody@uw.edu

Abstract There are now 18 cataclysmic variables in which the white dwarf is known to be pulsating. This provides a unique opportunity to monitor the interior of the white dwarf when a dwarf nova outburst occurs and heats the white dwarf. Theory predicts the pulsations should stop when the white dearf moves out of its instability strip, and then resume at shorter pulsation periods which gradually grow as the white dwarf cools back to quiescence. We have tested this theory with optical and UV data on GW Lib and V386 Ser and find strange behavior in GW Lib while V386 Ser appears to follow the theory so far. AAVSO data contributed to both these projects and we encourage further monitoring until these systems return to quiescence.

109th Annual Meeting Research Posters

The Blazar BL Lacertae: 2018-2020 V-, R-, and I-Band CCD Photometry

Manny Rosales
Christina Singh
Wyatt Carbonell
Leslie F. Brown
Connecticut College, Physics and Astronomy Department, New London, CT; lfbro@conncoll.edu

Gary Walker
114 Cove Road, West Dennis, MA 02670; bailyhill14@gmail.com

Abstract We observed the gamma-ray loud AGN BL Lacertae (BL Lac; R.A. $22^h\ 02^m\ 43.290^s$, Dec. +42° 16' 39.98" J2000; z = 0.0691) in the V, R, and I optical bands between July 2018 and September 2020 using the Walker telescope located at Sierra Remote Observatories. This source was active at these wavelengths during this time, and since August 2020 has been in a historically bright state. We present our three-year V, R, and I band light curves for BL Lac and compare its optical variations with this AGN's gamma-ray behavior as observed by NASA's Fermi-LAT.

Differential Photometry of Eclipsing Binary System V798 Her in Globular Cluster NGC 6341

Khola Anees
Department of Space Science, Institute of Space Technology, Pakistan

Shaukat Naaman Goderya
Tarleton State University, 137 Shadow Creek Lane, Aledo, TX 76008; sngoderya@gmail.com

Fazeel Mahmood Khan
Institute of Space Technology, Pakistan

Abstract We present the photometric study of an eclipsing binary star, V798 Her, in the globular cluster NGC 6341. The observations were obtained in Johnson B, V, and R filters using an 0.8-m Tarleton telescope and a CCD photometer. The observed light curves after the determination of light elements show that V798 Her is a W UMa contact binary system with a period of 0.2951110 day. Wilson Devinney Mathematical Model (2017 version) was used for the analysis and for obtaining the photometric solution of V798 Her.

Establishing a New ToM (Time of Minimum) for the Primary Eclipse of the Binary System WZ Ophiuchi

Mike Miller
221 Bluestem Drive, Georgetown, TX 78633; mikerph1951@gmail.com

Abstract In my research of Neglected Binary Stars I discovered that there was very little current data on the binary star WZ Oph. The Binary Star Database, AAVSO, Mt. Suhora Astronomical Observatory and the BRND Regional Network of Observers (Chez Astronomical Society) revealed the most recent observations of WZ Oph occurred in the mid 1990's. For this reason I concluded that it would be a challenging project for summer of 2018 to attempt to establish a new ToM(time of minima) for the primary eclipse of WZ Oph. The ToM for WZ Oph using my photometry data and Peranso software was determined to be 2458312.72315 JD heliocentric.

Identification of Bimodal Period and Long Secondary Period Carbon Red Giants Misclassified as "Miscellaneous" in VSX

Kristine Larsen
Geological Sciences Department, Central Connecticut State University; Larsen@ccsu.edu

Abstract In a 2015 *JAAVSO* paper, Percy and Huang applied VStar analysis software to AAVSO visual observations of known carbon red giants in order to better determine the periodicities of these stars. In particular, they sought to separate false periodicities (due to alias and spurious periods) from truly biperiodic stars with two pulsation periods as well as long secondary period (LSP) stars. Previous work by this author and her students has determined that while pulsating red giants in general have sufficient irregularities and multiple periodicities to confound automated classification algorithms, for example those of ASAS (All-Sky Automated Survey) and ASAS-SN (All-Sky Automated Survey for Supernovae), VStar analysis can often identify improved periods and lead to the proper classification of these stars' variability type. This project, motivated by the work of Percy and Huang, is a preliminary analysis of 250 spectral class C red giants with V-band variability that are classified as MISC in VSX (Variable Star Index) on the basis of their MISC classification in the "ASAS Catalogue of Variable Stars" (Pojmański 2002, *Acta Astron.*, **52**, 397). The goal is to better determine their periodicities, and in particular to identify biperiodic and LSP carbon red giants in order to improve the accuracy of their VSX citations.

RU Camelopardalis: The Reluctant Cepheid Revisited

John R. Percy
Department of Astronomy and Astrophysics, and Dunlap Institute of Astronomy and Astrophysics, University of Toronto; john.percy@utoronto.ca

Abstract Skilled amateur astronomers can still make significant contributions to variable star research, even in this age of massive automated sky surveys. Among other things, they can identify and/or observe stars with unusual properties or behavior. RU Cam, a 22-day carbon-rich Population II Cepheid (CW variable) is one such star. In 1965, Serge Demers and Don Fernie discovered that it had abruptly decreased in full amplitude from 1.0 to 0.1 magnitude. It was subsequently observed intensively until the 1990s, especially at the Konkoly Observatory, and this enabled theoretical discussions about the possible nature of the star's pulsation. The cause of the amplitude decrease was and still is not clear. Observations have been more sporadic since the 1990s. There is some AAVSO V photometry, and sparse AAVSO visual photometry from before the amplitude decrease to the present. More recently, RU Cam was observed by the "All-Sky Automated Survey for Supernovae" (ASAS-SN) from 2014 to 2018. In this paper, I analyze the ASAS-SN data and the AAVSO data for possible changes in the period and the amplitude. The period has remained more-or-less stable at 22 ± 1 days and, since 1965, the full amplitude has continued to vary from less than 0.1 to about 0.3 on a time scale of hundreds of days (tens of pulsation periods), reminiscent of the variability of red SR variables. An attempt to follow the period changes using the (O–C) method was unsuccessful because of the sparseness of the data. I therefore suggest that this star should be monitored systematically, preferably in UBV. It is well-placed for northern observers.

Using High Resolution Spectroscopy to Measure Cepheid Pulsation

Kevin Gurney
14A Gladstone Road, Sheffield, S10 3GT, United Kingdom; k.gurney@shef.ac.uk

Abstract Using a high-resolution spectrograph like the Lhires III (Shelyak Instruments) it is possible, in principle, to measure radial velocities of the order of 1 km/s (Leadbeater, "Pushing the Limits," AAVSO/BAA joint meeting, 2018). Thus, within these bounds, it should be feasible to measure radial velocities associated with Cepheid pulsation. However, extracting this component of the Doppler shift from a multiple system in which orbital components play a role is challenging; it requires information on the orbital ephemeris which, in turn, may require substantial observational and modelling effort. Fortunately, such information is available in a recent paper by Gallenne *et al.* 2018, *Astrophys. J.* for the target described here, V1334 Cyg. Here, I show how measurements of the wavelength of the Hα line of V1334 Cyg can be used, in conjunction with this published model, to determine a putative pulsation profile of this Cepheid variable, and validate it against AAVSO-derived photometry.