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ISSUE NO. 76 APRIL 2018 WWW.AAVSO.ORG

AAVSO Newsletter

SINCE 1911...

The AAVSO is an international non-profit organization of variable star observers whose mission is: to observe and analyze variable stars; to collect and archive observations for worldwide access; and to forge strong collaborations and mentoring between amateurs and professionals that promote both scientific research and education on variable sources.

FROM THE DIRECTOR'S DESK

STELLA KAFKA

Acknowledging digitizers

Recently I had the opportunity to meet with prominent members of the Astronomical Society of Southern Africa. While discussing various aspects of variable star work at the AAVSO, I learned about a data digitization project which was completed in 2008, resulting in including in the AAVSO International Database (AID) more than 70,000 new observations acquired by Alexander W. Roberts, a prolific South African visual observer at the beginning of the 20th century. Those observations were methodically entered in our database by Dennis Cooper, Tim Cooper, and Brian Fraser (all from South Africa), enriching 99 southern variable star light curves with unique data. The southern sky is not as well studied, so those precious observations may be the only records of the behavior of those stars at the time.

It is not unusual to encounter data presented in an old scientific manuscript with no connection to a database. Since digital/searchable databases started emerging at the end of the last century, thousands of data sets are essentially lost under the weight of thousands of publications that emerge daily. Data tables also exist in observer paper logs and in observatory archives, and they are not used simply because access to them is limited and/or we don't know about their existence. Yet, those data can uniquely reveal the behavior of a variable star or they can place all modern light curves in perspective, leading to interesting scientific discoveries.

More than three decades ago, Janet Mattei recognized the value of such data sets. She also recognized that the earlier AAVSO light curves were likely to stay hidden (and lost) if they remained in their original form of paper and punchcard records in the AAVSO archives. She was already familiar with light curve tables buried in the pages of *Annals of the Harvard College Observatory*. Therefore, she initiated a digitization program at the AAVSO, a program that became possible because of the commitment of volunteers. So far, more than 125,000 historical variable star observations have been entered in our database from the *Harvard Annals*. And, although nowadays data are being submitted online, we still try to collect and digitize observations that are otherwise lost in their original observers' notebooks (e.g., the Eggen card project) or exist only in old manuscripts. Many volunteers have contributed to this project over the years;

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PRESIDENT'S MESSAGE

KRISTINE LARSEN

On March 14, famed physicist Stephen Hawking released his last breath into the very same cosmos that he had studied for over five decades. Most of you know that he is famous for his work on the properties of black holes, especially tiny primordial black holes that he predicted were created in the early universe and should be seen going out with a bang (literally a shower of gamma rays) today. Stellar-sized black holes that are the corpses of once-giant stars, and the gargantuan supermassive black holes found at the centers of spiral galaxies like our Milky Way, are also associated with variable light output, primarily in the X-ray part of the spectrum. Black hole systems have much in common with cataclysmic variable stars, and it was the variable light output of the accretion disk engines fueled by black holes and their messy eating habits that led to the discovery of objects such as BL Lac and SS 433. Both objects can be found in the AAVSO's International Variable Star Index (VSX) along with data in

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The *AAVSO Newsletter* is published in January, April, July, and October. Items of general interest to be considered for the *Newsletter* should be sent to eowaagen@aavso.org. Photo in this issue courtesy of Tom Calderwood.

Membership in the AAVSO is open to anyone who is interested in variable stars and in contributing to the support of valuable research. Members include professional astronomers, amateur astronomers, researchers, educators, students, and those who love variable star astronomy.

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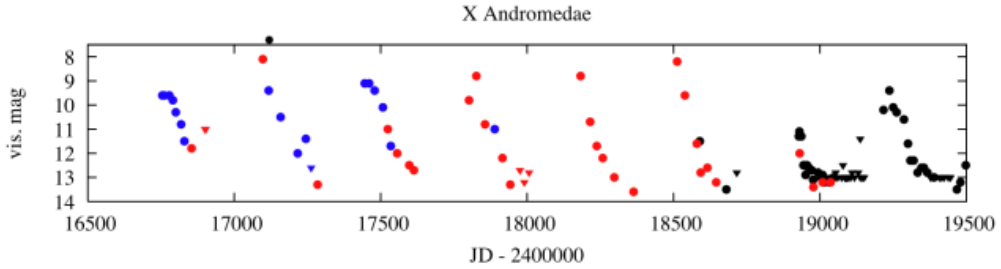

Light curve of X And, Jan. 1904–Apr. 1912. Black points are data that were already present in the AAVSO archives; red and blue points are visual observations by Leon Campbell and Annie Jump Cannon, respectively, digitized from Harvard Annals Volume 63.

the latest addition to the team is Mr. Noah Goldman, who spent last summer at HQ before joining the undergraduate degree program at the University of Massachusetts Amherst.

Data digitization is not as glamorous a job as acquiring new observations. It is a tedious data entry task, aiming to supplement a light curve with data that exist only in some sort of paper form. It requires hours of careful recording of information, and a lot of patience and persistence. It requires understanding of data quality and careful investigation of the errors associated with the relevant photometry. It is a job that seems never-ending, as there is an overabundance of such paper-based records. This type of detective work is also essential: those data sets are usually the only accounts of a star's behavior at certain time periods, and they place all modern data in a unique perspective. It is similar to our need to know our history to understand our present: we need to have as much information on the past behavior of variable stars to understand their present trends and assess processes that drive those variations....

So, through this newsletter piece, I would like to acknowledge and thank all the volunteers who have contributed variable star and solar data to the AID through our digitizer project. Thanks to their hard work, those light curve points are now taken into account for further analysis by the community. I would like to thank Dennis Cooper, Tim Cooper, and Brian Fraser; those who worked on the AAVSO Eggen card project examining and indexing 108,000 cards with photometric observations (https://www.aavso.org/aavso-eggen-card-project; led by George Silvis); those who continuously dig through the Harvard Annals and other publications and digitize the relevant data (https://www.aavso.org/digitization-aavso-data-published-harvard-annals); and all those who work behind the scenes, contributing to the AID by meticulously entering information that would otherwise be lost to obscurity—all those whose diligent and careful data entries lead to covering significant gaps in stellar light curves, revealing hidden behaviors of variable stars.

Sincere thanks to all!

Best wishes—clear skies,

Stella.

Ed. note: the Spanish language versions of the Director's and President's messages can be found on pages 4 and 5.

PRESIDENT'S MESSAGE
CONTINUED...

the AAVSO International Database taken by AAVSO observers.

Given the fact that these complex systems emit light over a range of wavelengths, and observations over the entire electromagnetic spectrum are therefore necessary to correctly model and understand them, the AAVSO's army of observers is called upon to submit optical wavelength observations of black hole systems in coordination with observations with X-ray or other wavelength satellites.

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PRESIDENT'S MESSAGE
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For example, in 2015 the black hole binary system V404 Cygni increased its activity, and AAVSO observers answered the call to submit detailed optical wavelength observations to researchers. Four of these observers, William (Bill) Stein, Michael Richmond, William (Bill) Goff, and Lewis M. Cook, were subsequently co-authors on a paper published in the prestigious journal Nature. V404 Cygni has continued to interest astronomers since then (as described in *AAVSO Alert Notices*), and AAVSO observers have likewise continued to step up to the plate and provide the high quality optical wavelength data that they are famous for.

William Tyler Olcott could not have imagined that the AAVSO would contribute to our understanding of black holes when the organization was founded in 1911, because Einstein's General Theory of Relativity and Karl Schwarzschild's application of it to black holes were several years in the future. But Olcott knew that variable stars would always fascinate astronomers, and that the AAVSO would continue to play an important role in our understanding of these fickle, flickering celestial fireflies. It is truer than ever that every observation matters, regardless of object, wavelength, or instrument. Photons teach us about both the future and the past or our universe, and allow us to test the most esoteric theoretical models that physicists like Hawking can throw our way. Hawking's life story has reached its end, but the implications of his mind-bending mathematics live on. Perhaps your observation will be the one to help astronomers make that next leap in understanding, or demonstrate the incompleteness of a model, or even challenge our preconceptions of the universe. Hawking encouraged us to "Remember to look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the universe exist. Be curious." Remember this sage advice, my friends, as you observe the universe on the next clear night.

AAVSO MEETINGS

Next meeting

107th Spring Meeting: July 6–8, 2018, AAVSO-British Astronomical Association (BAA), University of Warwick, Coventry, England (2018 Spring Meeting)
https://www.britastro.org/node/10727

An **updated schedule with speakers** and information about accommodations and location is linked to on the AAVSO meetings page
https://www.aavso.org/aavso-meetings

All slots for oral presentations have been filled, but there is still plenty of room for poster presentations. Please visit the link on the AAVSO meetings page for information about poster presentations.

Upcoming meeting

107th Annual Meeting: November 15–17, 2018, Lowell Observatory, Flagstaff, Arizona (2018 Annual Meeting)
https://www.aavso.org/aavso-meetings

NEW! Lowell Observatory Tour—November 18, 2018

On Sunday, November 18, following the AAVSO Annual meeting in Flagstaff, Lowell Observatory will provide a private tour for AAVSO meeting participants and their families. There is no charge for the tour. Lowell is planning to do telescope viewing through their Clark Telescope and give a Pluto Telescope Dome tour. The tour is expected to start at 5:00pm and end at 10:00 p.m.

Sunset is at 5:19 p.m., so they plan to hold the Pluto tour at 5:00 p.m. and then proceed with telescope viewing at 6:00 p.m.

The schedule will be as follows:

5:00–6:00 p.m. Pluto Telescope Dome Tour
6:00–10:00 p.m. Pluto Telescope Dome Open House
6:00–10:00 p.m. Telescope viewing through the Clark telescope

If you would like to take the tour you will be able to select it as an option on your Annual Meeting registration when it becomes available online later this summer. The hotel has extended the room meeting rate to include Sunday night. Lowell Observatory would like to know in advance of our meeting how many people will participate in the tour, so please be sure to mark your registration accordingly!

Most recent meeting

106th Annual Meeting: November 2–4, 2017, Vanderbilt University, Nashville, Tennessee (2017 Annual Meeting)
https://www.aavso.org/vanderbilt-meeting-page

The group photo from the AAVSO meeting may be viewed on the AAVSO website:
https://www.aavso.org/group-photographs#2010s

Missed the 2017 Annual Membership meeting? Now you can watch it here:
https://www.aavso.org/aavso-membership-meeting-november-4th-2017

Ed. note: following are the Spanish language texts of the Director's and President's messages.

MENSAJE DEL DIRECTOR

STELLA KAFKA

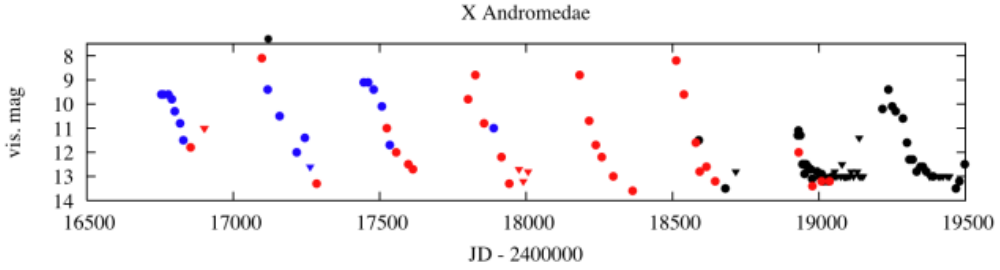
Reconociendo a los digitalizadores

Recientemente tuve la oportunidad de encontrarme con miembros destacados de la Astronomical Society of Southern Africa. Al tiempo que conversamos sobre varios aspectos del trabajo de la AAVSO en estrellas variables, me enteré de un proyecto de digitalización que se completó en 2008 y que dio como resultado incluir en la Base de Datos Internacional de AAVSO (AID) más de 70.000 observaciones realizadas por Alexander W. Roberts, un prolífico observador visual sudafricano de los comienzos del siglo XX. Esas observaciones fueron ingresadas metódicamente en nuestra base de datos por Dennis Cooper, Tim Cooper y Brian Fraser (todos de Sudáfrica), enriqueciendo las curvas de luz de 99 estrellas variables del sur con datos únicos. El cielo sureño no está tan bien estudiado, por lo que esas preciadas observaciones pueden ser los únicos registros del comportamiento de esas estrellas en aquel momento.

No es raro encontrar datos presentados en un antiguo manuscrito científico sin ninguna conexión a alguna base de datos. Desde que las bases de datos digitales/consultables comenzaron a aparecer a finales del siglo pasado, miles de esos datos están esencialmente perdidos en medio de las miles de publicaciones que emergen día a día. También existen tablas de datos en registros en papel de observadores y en archivos de observatorios y no se usan simplemente porque el acceso a los mismos es limitado y/o no conocemos su existencia. Sin embargo, esos datos pueden ser los únicos en revelar el comportamiento de una estrella variable o pueden poner las curvas de luz modernas en perspectiva, dando lugar a interesantes descubrimientos científicos.

Hace más de tres décadas, Janet Mattei reconoció el valor de estos datos. También reconoció que las curvas de luz más antiguas de AAVSO probablemente quedarían ocultas (y perdidas) si permanecían en su forma original de papel y tarjetas perforadas en los archivos de la asociación. Ella ya estaba familiarizada con las tablas de curvas de luz enterradas en las páginas del *Annals of the Harvard College Observatory*. Por lo tanto, inició un programa de digitalización en la AAVSO, un programa que fue posible gracias al compromiso de voluntarios. Hasta ahora, más de 125.000 observaciones históricas de estrellas variables se han incluído en nuestra base de datos provenientes de los *Harvard Annals*. Y, aunque hoy en día los datos se envían en línea, aun intentamos recolectar y digitalizar observaciones que de otra manera quedan perdidas en los apuntes originales de los observadores (por ej. el proyecto de tarjetas de Eggen) o existen sólo en viejos manuscritos. Varios voluntarios han contribuído con este proyecto a lo largo de los años; el último que se sumó al equipo es el Sr. Noah Goldman, que pasó el último verano en HQ antes de unirse al programa de licenciatura de la Universidad de Massachusetts Amherst.

La digitalización de datos no es un trabajo tan glamoroso como realizar nuevas observaciones. Es una tarea tediosa de ingreso de datos con el objetivo de complementar una curva de luz con observaciones que existen sólo en alguna forma de papel. Requiere horas de registro cuidadoso de información y un montón de paciencia y persistencia. Requiere entendimiento de la calidad de los datos e investigación minuciosa de los errores asociados con la fotometría que se encuentra. Es un trabajo que parece no tener fin, ya que hay una cantidad inmensa de esos registros en papel. Esta clase de trabajo detectivesco es también esencial: esos datos son generalmente las únicas pruebas del comportamiento de una estrella durante ciertos períodos de tiempo y ponen las curvas de luz modernas en una única perspectiva. Es similar a nuestra necesidad de conocer nuestra historia para comprender nuestro presente: necesitamos tener la mayor cantidad de información posible acerca del comportamiento pasado de las estrellas variables para entender sus tendencias presentes y evaluar los procesos que dan lugar a esas variaciones....



Los puntos negros son datos que ya estaban presentes en los archivos de AAVSO; los puntos rojos y azules son observaciones de Leon Campbell y Annie Jump Cannon, respectivamente, digitalizadas del Harvard Annals *Volume 63.*

Así que, por medio de este artículo en el newsletter, me gustaría agradecer a todos los voluntarios que han contribuído con datos de estrellas variables y solares a la AID a través de nuestro proyecto de digitalización. Gracias a su duro trabajo, esos puntos en las curvas de luz ahora son tenidos en cuenta para un mejor análisis por parte de la comunidad. Quiero agradecer a Dennis Cooper, Tim Cooper y Brian Fraser; a aquellos que trabajaron en el proyecto de tarjetas de Eggen de AAVSO examinando e indexando 108.000 tarjetas con observaciones fotométricas (https://www.aavso.org/aavso-eggen-card-project) liderados por George Silvis; a aquellos que continuamente revisan los Harvard Annals y otras publicaciones y digitalizan los datos que son relevantes (https://www.aavso.org/digitization-aavso-data-published-harvard-annals) y a todos aquellos que trabajan detrás de escena contribuyendo a la AID al ingresar meticulosamente información que de otra manera se perdería en la oscuridad, todos aquellos cuyas cuidadosas y diligentes contribuciones digitales de datos llevan a cubrir vacíos significativos en curvas de luz estelares, revelando comportamientos ocultos de estrellas variables.

¡Un agradecimiento sincero a todos!

Con los mejores deseos—cielos claros,

Stella.

MENSAJE DEL PRESIDENTE

KRISTINE LARSEN

El 14 de marzo, el famoso físico Stephen Hawking exaló su último aliento al mismo cosmos que había estudiado durante más de cinco décadas. La mayoría de ustedes sabe que es famoso por su trabajo sobre las propiedades de los agujeros negros, especialmente los pequeños agujeros negros primordiales que él predijo que fueron creados en el universo temprano y que deberían verse hoy como una explosión (literalmente una lluvia de rayos gamma). Los agujeros negros de tamaño estelar que son los cadáveres de estrellas alguna vez gigantes y los gigantescos agujeros negros supermasivos que se encuentran en los centros de galaxias espirales como nuestra Vía Láctea, también están asociados con un flujo de luz variable, principalmente en la porción de rayos X del espectro. Los sistemas de agujeros negros tienen mucho en común con las estrellas variables cataclísmicas y fue el flujo de luz variable de los motores de disco de acreción alimentados por agujeros negros y sus hábitos alimenticios sucios lo que condujo al descubrimiento de objetos como BL Lac y SS 433. Ambos objetos se pueden encontrar en el Índice de estrellas variables internacionales (VSX) de AAVSO, junto con los datos observados en la base de datos internacional de AAVSO, tomados por los observadores de AAVSO.

Dado que estos sistemas complejos emiten luz en un amplio rango de longitudes de onda y que para modelarlos y comprenderlos correctamente son necesarias observaciones en todo el espectro electromagnético, el ejército de observadores de AAVSO debe presentar observaciones de longitud de onda óptica de los sistemas de agujeros negros en coordinación con observaciones de satélites en rayos X u otros longitudes de onda diferentes. Por ejemplo, en 2015, el sistema binario de agujeros negros V404 Cygni aumentó su actividad y los observadores de AAVSO respondieron a la llamada para enviar a los investigadores observaciones detalladas en longitud de onda óptica. Cuatro de estos observadores, William (Bill) Stein, Michael Richmond, William (Bill) Goff y Lewis M. Cook, fueron posteriormente coautores de un artículo publicado en la prestigiosa revista Nature. Desde entonces, V404 Cygni mantiene interesandos a los astrónomos (como se describe en las alertas de AAVSO, AAVSO Alert Notices), y los observadores de AAVSO también continuaron avanzando y proporcionando los datos de alta calidad en la longitud de onda óptica por los que son famosos.

William Tyler Olcott no pudo haber imaginado que la AAVSO contribuiría a nuestra comprensión de los agujeros negros cuando se fundó la organización en 1911, porque la Teoría de la Relatividad General de Einstein y su aplicación por parte de Karl Schwarzschild a los agujeros negros demoraron varios años en el futuro. Pero Olcott sabía que las estrellas variables siempre fascinarían a los astrónomos y que la AAVSO continuaría desempeñando un papel importante en nuestra comprensión de estas luciérnagas celestes inestables y titilantes. Es más cierto que nunca que cada observación importa, independientemente del objeto, la longitud de onda o el instrumento. Los fotones nos enseñan tanto sobre el futuro como el pasado de nuestro universo y nos permiten probar los modelos teóricos más esotéricos que físicos como Hawking pueden arrojarnos. La historia de la vida de Hawking ha llegado a su fin, pero las implicaciones de sus matemáticas alucinantes siguen vigentes.

Tal vez su observación sea la que ayude a los astrónomos a dar el siguiente salto en la comprensión o demuestre lo incompleto de un modelo o, incluso, desafíe nuestras ideas preconcebidas sobre el universo. Hawking nos animó: "Recurda mirar a las estrellas y no a los pies. Intenta darle sentido a lo que ves y preguntarte sobre lo que hace que el universo exista. Sé curioso." Recuerden este sabio consejo, mis amigos, mientras observan el universo en la próxima noche despejada.

IN MEMORIAM

MEMBERS, OBSERVERS, COLLEAGUES, AND FRIENDS OF THE AAVSO

No deaths among AAVSO members, observers, friends, and colleagues have been reported this quarter.

Stephen Hawking

However, we do note the passing of the singular **Dr. Stephen Hawking** with respect and gratitude for his enormous contributions to our understanding of the universe and our own field of variable star astronomy, and for the many life lessons he taught.

A NOTE ON THE TRANSLATIONS

We are grateful to Sebastián Otero and Jaime García for providing, respectively, the Spanish language versions of the Director's and President's messages. We hope that readers of the Newsletter *will enjoy this feature.*

OBSERVER'S CORNER

Note: This column will include advice on observing practices and tips for observing for visual, DSLR, PEP, and CCD observers.

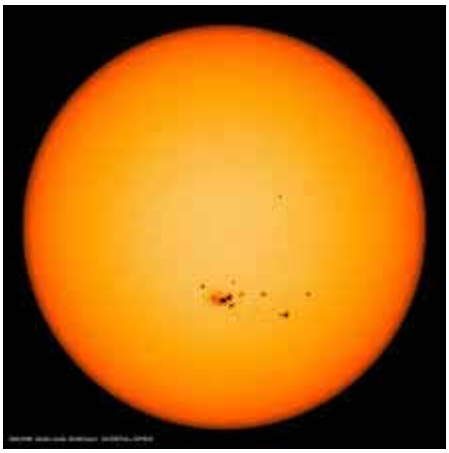
Observing Our Closest Star

JESSICA JOHNSON (UNIVERSITY OF NEW MEXICO)

I first started solar observing five years ago under the guidance of Dr. Kristine Larsen. I instantly fell in love with it and have been hooked ever since. Solar observing for me has become my primary observational astronomy outlet, especially since I am the farthest thing from a night owl. So I actively encourage anyone who wants to be involved in observational astronomy but needs a full 8 hours of sleep at night to observe our closest star!

SAFETY! SAFETY! SAFETY!

Solar observing is fun and exciting but can be incredibly dangerous. The golden rule of solar observing is safety; we all value our eyesight and thus it is crucial to take the correct precautions before viewing the sun. The first thing I do before observing the sun is check my solar filter for any holes, defects, or issues with the filter. If it is fine and ready to use, then with the aperture pointed away from the sun (you can never be too careful!) I will place the filter onto the scope. There are two types of material that the filters are made out of, mylar and metal-on-glass. I have used and like both kinds so it is up to you and whichever you feel most comfortable using. Moral of the story; take no chances, you only get two eyes!!



Patience is a Virtue!

In first learning how to solar observe patience is necessary. One of the most challenging tasks that comes with solar observing involves figuring out how to differentiate different groups of sunspots. This is a visual task that takes time to learn; even now after several years of observing I sometimes struggle with it. My advice is to look for common orientations of the sunspots. Sunspots within different groups quite often are aligned similarly (parallel to the sun's equator) and groups are often separated by a few degrees. However, if you are uncertain, record all of your observations and leave a question mark over the groups that you are unsure of. Watch the group evolve over the course of a few days and as it changes it may become more obvious which spots belong to which group.

Solar observers are quite unlike other observers. We record one observation of one star per day (if you are lucky enough to not live in a frequently cloudy place) whereas nighttime observers can view numerous stars throughout the night leading to many observations logged for a single viewing session. Your observations may come in slowly, but they will come!

No spots is still important data!

Honestly, one of the most frustrating things about solar observing can be the days when there are no sunspots to observe. Especially since, as mentioned above, solar observers can only submit one observation a day. This was something I struggled with as I was learning to observe during the transition from solar maximum to solar minimum. I was "sunspot spoiled" and was frustrated for some time once the sun quieted until I realized the importance of there being no sunspots. It is easy to forget that even though there are no sunspots to record that day it is an important observation, as it tells us valuable information about the sun's behavior. Since it is our closest star shouldn't we want to know as much as we can about it? Keep this in mind and it will get you through those quiet solar days!!

Food for Thought!

- observing conditions. You will need this information to submit your observations later.
- Draw a sketch of the spots you saw on each day you observed. I even go ahead and label the different groups I observed. I have found it helps me to keep track of my observations. I also can follow a particular group of sunspots over the course of its lifetime, and drawing it is a great way to see that evolution.
- Have Fun! This data collection is not time consuming and should be a great addition to your daily activities!

I wish you clear skies and happy observing!

Note: The AAVSO Solar Observing Guide *is available in six languages—English, Spanish, French, German, Italian, and Portuguese. It may be downloaded from* https://www.aavso.org/solar-observing-guide.

"MANAGING" THE AAVSO LPV PROGRAM, AND OTHERS

JOHN R. PERCY (UNIVERSITY OF TORONTO, EDITOR: JAAVSO)

In the January 2018 *AAVSO Newsletter*, Andrew Pearce, using data provided by Elizabeth Waagen, published a very interesting survey on AAVSO visual and non-visual observations of LPVs—Mira stars, semiregulars, and irregulars. He divided these into Legacy Program stars, and other stars, and calculated the total number of visual and non-visual observations, per year, over the past decade. He found that the number of visual observations of the 155 Legacy stars consistently averaged about 375 per year whereas, for the approximately 1,600 other stars, the number averaged about 33.

On the LPV Section website, I posted a page (1) on "Why Observe LPVs?" In short: LPVs are very complex variables; there is much more to learn than just the average period and amplitude. The periods wander; the amplitudes vary; some stars are multiperiodic; and many have an unexplained "long secondary period." I also posted a page (2) listing 51 LPVs which were especially complex or unusual, and especially worthy of observation. I am delighted to hear that observations of the 155 Legacy stars are dense and sustained. These 375 observations per year are necessary to understand these stars in all their complexity. Your observations of LPVs are useful, not just for astrophysical analysis of the stars, but to detect unusual stellar behavior, to assist astronomers in scheduling variable star observing programs, to correlate with data obtained by other techniques (such as spectroscopy) or at other wavelengths, and for educational projects. Thank you, AAVSO observers, for your valuable work!

My concern is with the other stars, which number over a thousand. In the past few years, my students and I have analyzed data on hundreds of SR/L stars which had a few hundred observations in total, and had not been fully analyzed (see "Why Observe LPVs?" for references). Percy & Terziev (2011 JAAVSO 39, 1–9) listed a handful of stars, out of 125, which should continue to be observed, and a large number which could reasonably be dropped from the program. Most appear to be irregular, but that may be because of the limited and inadequate number of observations. I am now working through a list of about 150 more SR/L stars, kindly provided by Elizabeth Waagen, with only 150–250 observations in total. For some of them, it is possible to estimate the average period and visual amplitude—but nothing more. For the rest, the results are inconclusive, and likely to remain so. In other words, the thousands of observations of these hundreds of stars are essentially wasted.

Pearce also noted that most of the non-visual observations were of non-Legacy stars. I will not comment on this, but those stars presumably include many dozen small-amplitude red variables in the PEP program, and which are certainly worthy of observation.

In the past, when I have suggested that stars should be dropped from the program, either because they were sparsely observed and/or appeared constant, the response has been "but the stars might do something interesting in the future". This is highly unlikely.

One helpful innovation is the new AAVSO Target Tool (3), which enables observers to select from the LPV list, and ensure that no star is left unobserved.

I suspect that other AAVSO observing programs are faced with the same dilemma: how can you balance observer autonomy with the desire to maximize scientific impact? Obvious answers are through communication and education. Hence this *Newsletter*. Thank you, Elizabeth Waagen, for making it both useful and interesting.

(1) https://www.aavso.org/content/why-observe-lpvs
(2) https://www.aavso.org/sites/default/files/images/The Percy List_1.pdf
(3) https://www.aavso.org/aavso-target-tool

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LPV SECTION UPDATE

ANDREW PEARCE, ADMINISTRATOR

The *AAVSO Bulletin: Predicted Dates of Maxima and Minima of Long Period Variables* is a long-running publication of the AAVSO. It gives predictions of dates of maxima and minima for hundreds of long period variables (Miras and semiregulars) in the AAVSO program, and is intended to be an observing guide and planning tool for all observers of LPV stars, amateur and professional alike. The currently published *Bulletin* for January 2018 through February 2019 is *Bulletin 81* and can be found at https://www.aavso.org/aavso-bulletin-81-2018.

We would especially encourage observers to focus on those stars as listed which are more in need of observations such that we can maintain continuous and robust light curves.

For those observers wishing to following some of the more unusual LPVs and Pulsating Red Giants (PRGs), then we'd recommend you consult John Percy's list which is found on the LPV Section web site (AAVSO LPV Section File Downloads page https://www.aavso.org/lpv-section-file-downloads—the file is titled "The Percy List.pdf"). We are focusing on many of these unusual stars in the :LPV of the Month" articles.

Observers are reminded of the multi-year campaign to follow the Z And / Mira star, R Aqr, which is continuing for the next few years. R Aqr shows not only a Mira pulsation but also complex eclipse behavior as the two stars interact. The period of Mira variation is approximately 387 days and the eclipse period is approximately 44 years, with the next one due around 2022. Further information is contained in the *AAVSO Alert Notice 535* (https://www.aavso.org/aavso-alert-notice-535). R Aqr is currently in conjunction with the Sun, however, early morning observations will be especially valuable in the coming months.

Another point of difference between non-visual and visual observations is that non-visual observations for stars not in the Legacy Program far outweigh those within the Program. On average, LPV Program star observations make up only 16% of the total number of observations compared to 52% for visual observations. Furthermore, the observations per Legacy Program star average at around 58 per star compared to an average of 35 observations per non-Legacy Program star. The large difference noted in the visual observations is not reflected for non-visual observations.

The graphs below plot the total number of stars followed with observations averaging less than 10 per year. This is an arbitrary number, however, it's not clear whether this is enough data points to be able to construct meaningful light curves with this sort of quantity.

The results show that on average, 42% of the total number of LPVs and SRs followed by visual observers have recorded 10 or less observations per year. It is also noted that on average, 40% of the total number of LPVs and SRs followed by non-visual observers have recorded 10 or less observations per year, which is almost identical to the situation with visual observers.

The analysis has thrown up some interesting insights which are summarized below:

- The number of visual observations and the coverage of the LPV Legacy Program stars has remained essentially constant over the last 10 years.
- Visual observers, on average, have provided a significant focus on the LPV Legacy Program stars compared to non-Program stars which is very encouraging.
- The number of non-visual observations has varied more than for visual observations on an annual basis and the coverage of LPV Program Legacy stars is significantly less than for visual observations.
- For both types of observations a significant fraction (40%) of the stars observed have less than 10 observations per year. There may be an argument to encourage observers to stop following these poorly observed stars and focus more on others which have more well defined light curves or where gaps can be plugged in these light curves.

We hope that this analysis can generate some discussion amongst LPV observers as to the most effective way of appropriate coverage of LPVs. We would invite any comments.

If anyone has any ideas as to the types of activities the LPV Section should consider adopting or interesting stars that should be more widely publicized, we'd be especially glad to hear from you!

PEP SECTION UPDATE

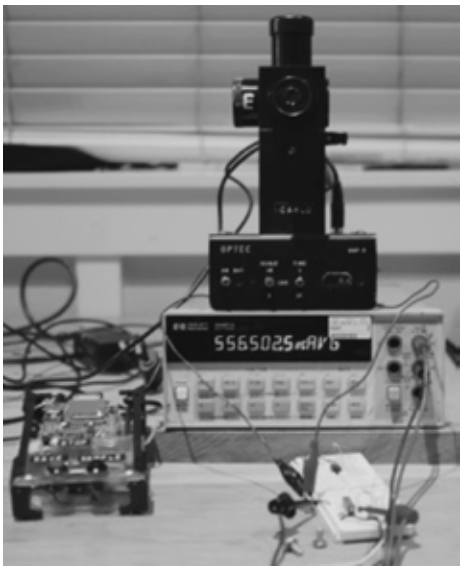
TOM CALDERWOOD, AAVSO PEP SECTION LEADER

James Kay has stepped down as leader of the AAVSO PEP Section. Jim served as section leader since 2015, and we thank him very much for all his good work.

My Counts Floweth Over

Most users of the SSP3 photometer rely on the built-in display to record their counts. The panel counter of an SSP3 goes up to 9999, but, here, the Generation 1 model, with a simple counter, offers an advantage over Generation 2 (with the microcontroller). When Gen. 2 exceeds 9999, the controller flashes "OVER" in the display, and you have no idea what the actual count was. But Gen. 1 turns on a separate LED to indicate overflow, and displays the correct low-order 4 decimal digits of the count. Just add 10,000 to reconstruct the true count. This doubles your dynamic range. If you log data through the computer interface on a Gen. 2 photometer, the counts overflow at 65536. If your star is bright enough to drive the counts past that point, simply add 65536. I once saw a presentation by a fellow who didn't realize his Gen. 2 counts had wrapped around - his magnitudes were, of course, absurd.

I recently had the opportunity to test the linearity of my Gen. 1 SSP3 (see photo). This was done by applying test voltages directly to the voltage-to-frequency converter, which is the weak link in the signal processing chain. The circuitry performed very well out to a count rate of 14kHz, which translates to 140,000 counts in 10 seconds (I use an Arduino computer to capture the analog output pulses). This was at gains 1 and 10. Gain 100 was a different story: it did not perform well, and I do not recommend using it. The greatest deviation from perfect linearity occured at the low end of the frequency range, and this brings up a point about the "offset" value we use. I keep my photometer offset quite low, but for stars that generate counts only in the hundreds (in ten seconds), this is probably a mistake. The linearity table illustrates the problem at gain 10, which is where we do most of our work. The deviation from linear is shown at two different offsets: 15Hz and 40Hz, corresponding to 150 and 400 "dark" counts at ten seconds. "Net Hz" is the dark-subtracted star signal over a range of about 200-1100 counts. One can see that the linearity is dramatically worse at 15Hz (a 0.5% error corresponds to 5 mmag). I will write up my testing in more detail for an upcoming version of the PEP manual.



15 Hz offset net Hz	% error	40 Hz offset net Hz	% error
20	–0.55%	21	–0.12%
39	–0.50%	35	–0.12%
52	–0.36%	53	–0.11%
64	–0.26%	64	0.11%
80	–0.23%	80	0.09%
97	0.14%	98	0.07%
114	0.09%	117	0.04%

EXOPLANET OBSERVING SECTION UPDATE

DENNIS M. CONTI, EXOPLANET SECTION LEADER

TESS (Transiting Exoplanet Survey Satellite) is now scheduled for launch in April of this year.

There will be two categories of exoplanet observations that will be needed to support the TESS program and the AAVSO is actively working to support each category.

The first category includes observations in support of the TESS Followup Program (TFOP) Subgroup 1 (SG1). The primary role of TFOP SG1 is to help distinguish exoplanet false positives from true exoplanet transits. This process will be the first in the TESS pipeline to help confirm an exoplanet candidate and will consist of ground-based photometric time-series analysis of candidate exoplanets identified by the TESS science team. Members of TFOP SG1 are approved by the head of the subgroup and will have demonstrated the ability to conduct high quality exoplanet observations. However, a member of TFOP SG1 can also "sponsor" associate members who can submit their own observations in support of this crucial TESS pipeline step. With a few of us AAVSO members now part of TFOP SG1, I will be putting out guidelines before the launch of TESS as to how other AAVSO members can qualify to contribute as "associates" in TFOP SG1.

The second category of TESS program participation will be open to the general observing community. In this program, an observer will be free to upload their observation of a TESS candidate to the ExoFOP-TESS database. This category of observational data is more intended to help refine the ephemerides of TESS exoplanet candidates as opposed to helping identify false positives.

In support of both the TESS program and exoplanet observing skills in general, the third AAVSO Exoplanet Observing CHOICE course has completed. There have now been over 125 participants who have taken one of these three courses.

Finally, much progress has been made on the AAVSO Exoplanet Database. The intent of this database is to store long-term, exoplanet observational data for future exoplanet research needs. Much thanks to George Silvis and Phil Manno for their help in getting this database going. An announcement will take place when the database is ready for use.

OBSERVING CAMPAIGNS UPDATE

The detailed report on observing campaigns and novae discoveries given in earlier issues of the *AAVSO Newsletter* has been discontinued. Observers may read about the observing campaigns underway and recent novae via the list below of the *AAVSO Alert Notices* issued for these targets. (Also included are two *AAVSO Special Notices* for which no related *Alert Notice* was issued.) Links to *AAVSO Special Notices* associated with an *Alert Notice* may be found by clicking on the *Alert Notice* link.

Also, the stars which are targets of observing campaigns are given in the Alerts/Campaigns list of the AAVSO Target Tool.

Current and ongoing observing campaigns

Date Name Subject

20180326 *Alert Notice 627*—Nova in Canis Major = N CMa 2018 = TCP J07134590-2112330
20180321 *Alert Notice 626*—Nova in Carina = ASASSN-18fv
20180321 *Alert Notice 625*—ASASSN-18ey = MAXI J1820+070 coverage needed for VLT and XMM
20180319 *Alert Notice 624*—Observations requested for MAXI J1820+070 = ASASSN-18ey
20180315 *Alert Notice 622*—N Oph 2018 No. 2 = TCP J17140253-2849233 = PNV J17140261-2849237
20180315 *Alert Notice 621*—Optical monitoring of NSV 24045 = HD 163296
20180306 *Alert Notice 619*—Nova Ophiuchi 2018 = PNV J17244011-2421463
20180305 *Alert Notice 618*—Monitoring SDSS J153817.35+512338.0 for HST observations
20180305 *Alert Notice 617*—Multiwavelength observations of YZ Cnc, SU UMa, and CR Boo outbursts
20180213 *Alert Notice 616*—Nova Sco 2018 No. 2 = PNV J16484962-4457032
20180131 *Alert Notice 613*—Nova Cir 2018 - PNV J13532700-6725110
20180131 *Alert Notice 612*—Nova Sco 2018 - PNV J17180658-3204279
20180126 *Alert Notice 611*—Flaring of Blazar 3C 279
20180115 *Alert Notice 609*—Nova Muscae 2018 - PNV J11261220-6531086
20171116 *Alert Notice 606*—Observing campaign on nova in Vela—ASASSN-17mt
20171017 *Alert Notice 602*—CE Tau observations requested to supplement BRITE-Constellation
20170906 *Alert Notice 598*—Intermediate polar FO Aqr fading and photometry needed now
20170816 *Alert Notice 593*—VV Cep eclipse monitoring requested
20170807 *Alert Notice 590*—V1117 Her observations requested
20170804 *Alert Notice 589*—R Aqr coverage needed for Chandra and HST observations
20170721 *Alert Notice 588*—Long-term CCD monitoring of ER UMa-type variable DDE 48 in Vulpecula
20170630 *Alert Notice 585*—Monitoring of Evryscope targets requested for follow-up
20170621 *Alert Notice 584*—Monitoring of PDS 110 requested to cover upcoming eclipse by exoplanet
20170616 *Alert Notice 583*—Photometry requested for Red Dots campaign
20170516 *Alert Notice 577*—SN 2017eaw in NGC 6946 (PSN J20344424+6011359)
20170428 *Alert Notice 575*—Monitoring of Swift J1357.2-0933 (CRTS J135716.8-093238) requested
20170425 *Alert Notice 574*—Monitoring of EPIC 204278916 requested
20170403 *Alert Notice 572*—AG Dra monitoring requested
20170316 *Alert Notice 571*—Observations Requested of Exoplanet Proxima Centauri b
20170131 *Alert Notice 566*—Beta Pic observations requested for BRITE-Constellation
20161028 *Alert Notice 561*—Nova in Sagittarius = ASASSN-16ma = PNV J18205200-2822100 [V5856 Sgr]
20161024 *Alert Notice 560*—TCP J18102829-2729590 = Nova in Sagittarius [V5855 Sgr]
20161004 *Alert Notice 556*—Monitoring of V2487 Oph requested
20160927 *Alert Notice 553*—Nova Lup 2016 = PNV J15290182-4449409 = ASASSN-16kt [V407 Lup]
20160803 *Alert Notice 546*—Campaign on V1687 Cyg (WR 140)
20160408 *Alert Notice 542*—Continuing observations requested for KIC 08462852
20170502 *Special Notice #429*—V694 Mon (MWC 560) spectroscopy requested
20160119 *Alert Notice 535*—R Aqr observing campaign
20160408 *Special Notice #415*—T CrB brighter and bluer—monitoring requested
20150618 *Alert Notice 520*—X-ray nova and LMXB V404 Cyg in rare outburst
20150415 *Alert Notice 518*—Observations of 2MASS J06593158-0405277 needed
20150324 *Alert Notice 514*—RW Aur monitoring requested
20150313 *Alert Notice 511*—Monitoring requested for developing planetary systems dust production study
20150305 *Alert Notice 510*—Observations of the symbiotic nova ASAS J174600-2321.3
20140917 *Alert Notice 504*—Epsilon Aur monitoring during predicted pulsation phase
20140806 *Alert Notice 503*—Request for regular monitoring of the symbiotic variable RT Cru
20140709 *Alert Notice 502*—EE Cep observations requested for upcoming eclipse
20120625 *Alert Notice 462*—Monitoring of J1407 for next extrasolar ring system transit
20120302 *Alert Notice 454*—Monitoring of CH Cyg requested for Chandra and HST observations
20110517 *Alert Notice 440*—PEP Observing Campaign on P Cygni
20070711 *Alert Notice 353*—Monitoring of Blazars requested for VERITAS/XMM TOO
20070406 *Alert Notice 348*—Observe HMXBs; monitor AR UMa; update on *Alert Notice* 345
20080502 *Alert Notice 377*—Request extended to observe HMXBs in support of radial velocity observations
20070813 *Alert Notice 354*—Extending Request to Observe HMXBs in Support of Radial Velocity Observations
20070813 *Alert Notice 355*—Correction to Subject Title of *Alert Notice 354*