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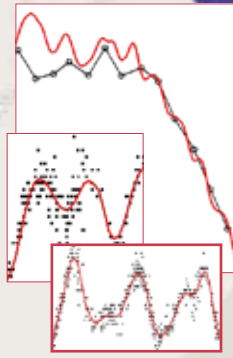
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ISSUE NO.43

JANUARY 2010

WWW.AAVSO.ORG

# AAVSO Newsletter



### LISTEN UP!

#### RESTLESS UNIVERSE

THE AAVSO PODCAST

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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

ARNE A. HENDEN

Welcome to 2010! I'm happy to reach this milestone, as it means all of my CCD image filenames, which are named with yymmdd, now have a "1" as the first digit rather than a "0", and iraf likes them better (yes, I know that I will have a Y2.5K problem). I bet you each have a different reason why, or why not, to like the beginning of a new year....

I think that we can look back on 2009 with some justifiable pride. Over a million observations were submitted to the database; 20-odd campaigns for professional researchers were initiated; dozens of papers using AAVSO data were published. With the new charts and improved sequences, the quality of submitted data is getting better and more useful to the professional. Citizen Sky, the biggest educational project the AAVSO has ever attempted, is successfully bringing in a new audience to variable star observing. Surveys are starting, and we're working hard to become involved in them to give some fun projects for our observers, at the same time providing the survey groups some much needed follow-up observations. Spitzer and Swift researchers have asked us for ground-based monitoring; VERITAS, VLA, Magellan and other ground-based facilities are also looking for our data.

Things keep improving for observer support. The re-invigorated Sequence Team is using Sara's great SeqPlot program, and making substantial headway in creating quality sequences for those

fields with CHET error reports, all of the LPV legacy stars, all of the RR Lyr legacy stars, new novae, etc. It is amazing to me how fast sequences can be created with SeqPlot, uploaded to the Variable Star comparison Database, and then be immediately available to the observers through the Variable Star Plotter. Instead of waiting days or weeks for a new nova field to have a good chart, we can generate one within minutes. Congratulations, Team!

We now permit the submission of observations for *any* Variable Star Index (VSX) star that has an AAVSO Unique ID (AUID). You no longer have the frustration of submitting an observation of a known SDSS cataclysmic variable and having it rejected since it was "not in the validation table." The validation table no longer exists!

The AAVSONet is really going smoothly. Currently, there are three general-purpose telescopes available to the membership (SRO, Wright28, Wright30), and two specialty telescopes that will accept a more limited set of proposals (BSM, APASS). More telescopes are on their way. Use of AAVSONet is a membership benefit—try out quality systems in a dark site! Maybe you are thinking of moving your telescope to some "farm" out West; here is a chance to see what improvement will result. As more telescopes join the network, more opportunity for long, dedicated observing runs will be available. For example, we've been working with Jim Bedient and student Benjamin Lane on an eclipsing binary

CONTINUED ON NEXT PAGE

## PRESIDENT'S MESSAGE

JAIME R. GARCIA

When I joined the AAVSO as a regular member in 1972, I never expected to be writing in the *Newsletter* as President. At that time, I was a very young student at La Plata University, involved in variable star observing since high school with fewer than 400 visual observations performed at my local astronomy club in Buenos Aires, the city in Argentina where I was born, and starting to do some work in photoelectric photometry at the University's observatory.

Before I joined the AAVSO I was an observer, so some of my observations had become part of the AAVSO International Database, but after some letter exchanges with Margaret Mayall, Clinton B. Ford, and Marvin Baldwin I felt the desire to be part of the effort by being a member. That time was a very difficult one, maybe the most in AAVSO history.

My personal commitment with variable star astronomy and spreading the word in Latin America let me get involved more and more with AAVSO, mainly interacting with Janet Mattei. Janet visited us in Argentina and Uruguay, giving rise to several interesting projects. At the end of the past century, I ran for Council after an invitation from Charles

CONTINUED ON NEXT PAGE

## FROM THE DIRECTOR'S DESK CONTINUED...

system, obtaining *BVR* light curves over multiple nights using Wright28. The results are very good, and Benjamin should have a good research project from these observations. Tom Krajci is doing a wonderful job of keeping three AAVSO telescopes (BSM, Wright28, Wright30) running from his site.

Speaking of the Bright Star Monitor and the AAVSO Photometric All-Sky Survey, both systems are up and running. BSM covers about 250 stars per night that are brighter than  $V=8$ , obtaining *B* and *V* measures. APASS is beginning its all-sky survey from Tom Smith's Dark Ridge Observatory, covering the celestial equator fields first and then moving north, completing the calibration of about 300 square degrees per photometric night. Both databases of observations should be available to the membership about the time that this newsletter is published.

Of course, everything is not "rosy." We've had computer problems this year that have slowed down data submission and plot generation at times. The poor economy means that we have to belt-tighten and change the way we operate, to provide as much observer support as we can, but more efficiently. My crystal ball says that things will improve in 2010, more surveys and researchers will need our data, and the AAVSO will stay on the forefront of variable-star research. We need all of you in order to make this happen! Thanks for your efforts over the past year, and I'm wishing everyone clear skies for 2010! ★

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## PRESIDENT'S MESSAGE CONTINUED...

Scovil, acting as a Nominating Committee member, encouraged me to take this challenging position.

During my first time on the Council, the AAVSO was very busy implementing the first GRB network, training observers, and creating new charts, with the increasing number of well-furnished backyard telescopes spreading all around the country and in some parts of the world.

However, things changed when Janet became sick, and after she passed away we were involved in hiring a new Director. That was a brand new experience for the Council and in the AAVSO's history, because we had never experienced a Director passing away during his/her duties. That was a very hard time....

Arne became our Director, and a new era started with his administration: we have a new headquarters, several robotic telescopes on line within a nice network, and an e-Journal published regularly, and many interesting opportunities for being involved in real science, as usual for you, our fellow observers and members.

In spite of the fact that we are going through a crisis in the world economy, we remain much excited. Our expectations are great!

We have brand new sections that need your help. We also need you experienced observers getting involved in mentoring new visual, PEP, and CCD observers and data miners.

During all this time, variable star astronomy has evolved a lot! Now we are able to make our measurements even if our skies are cloudy, using our AAVSONet telescopes or perhaps doing some data mining instead. By means of our agreement with Photometrica software, we are able to analyze the data collected with our telescopes. We can also peer into our International Database or even in any other set online without moving from our desk.

I am very glad to be the President of the AAVSO, the first coming from Latin America, after thirty-seven years of active membership and almost ten years serving in Council. I expect to be your voice inside Council. Please, let me know your opinions, impressions, and mainly your criticism. I strongly need that.

I am looking forward to see you at our upcoming Spring Meeting (which will be during the fall season in the Southern Hemisphere) in Argentina,

April 15–18, 2010. There you will have both amazing skies and good friends waiting to meet you in order to make our AAVSO a more global organization. ★

*Ed. note: the Spanish language text of Jaime's message can be found on the next page.*

## THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS

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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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## MENSAJE DEL PRESIDENTE

**JAIME R. GARCIA**

Cuando ingresé a AAVSO, como miembro regular, en 1972, nunca me imaginé escribiendo en la Newsletter como Presidente. En aquel tiempo, era un joven estudiante en la Universidad de La Plata, involucrado en la observación de las estrellas variables desde la secundaria con menos de 400 estimas visuales realizadas en el la asociación de astronomía en Buenos Aires, la ciudad donde nací, en la Argentina, y comenzando a realizar algún trabajo en fotometría fotoeléctrica en el observatorio de la Universidad.

Algunas de mis observaciones ya integraban la Base de Datos Internacional de AAVSO pero apenas como observador de AAVSO, hasta que, luego de un intercambio de correo con Margaret Mayall, Clinton B. Ford y Marvin Baldwin sentí el deseo de ser parte del esfuerzo de AAVSO siendo miembro. Aquellos eran tiempos difíciles, quizá los más duros en la historia de AAVSO.

Mi compromiso personal divulgando la astronomía de las estrellas variables en América Latina me permitió estar cada vez más involucrado con AAVSO, fundamentalmente interactuando con Janet Mattei. Janet nos visitó en Argentina y Uruguay dando lugar a varios proyectos interesantes. Hacia fines del siglo pasado, Chaz Scovil me invitó a participar como candidato en las elecciones para miembros del Consejo, cuando él formaba parte del Comité Denominador, animándome a enfrentar ese desafío.

Durante mis primeros tiempos en el Consejo, la AAVSO estaba muy ocupada implementando la primera red de observación de erupciones de rayos gamma (GRB), entrenando observadores y encarando nuevos proyectos de cartas a medida que aumentaba el número de telescopios del “fondo de casa” muy bien equipados, distribuyéndose en todo el país y en otras partes del mundo.

Sin embargo, la época bonanza terminó cuando Janet se enfermó y, luego de su fallecimiento, tuvimos que vernos envueltos en la búsqueda de un nuevo Director. Esa fue una experiencia completamente nueva no sólo para el Consejo, sino también para la historia de AAVSO, porque nunca habíamos experimentado que un Director falleciera en plena labor. Esos fueron tiempos muy duros...

Arne fue contratado como nuestro Director y comenzó una nueva era con su administración: tenemos una nueva sede, varios telescopios robóticos online amalgamados en una bella red, una revista científica electrónica, el e-JAAVSO, publicado regularmente, y muchos proyectos interesantes para involucrarnos en la ciencia real, como es usual para ustedes, nuestros estimados observadores y miembros.

A pesar que estamos atravesando una crisis en la economía mundial, estamos muy entusiasmados. ¡Nuestras expectativas son muy grandes!

Tenemos secciones nuevas que esperan vuestra participación y colaboración. También necesitamos que ustedes, observadores experimentados, se involucren como mentores de los nuevos observadores, tanto visuales, como con CCD o, inclusive, los “data miners”.

Durante todo este tiempo, la astronomía de las estrellas variables ha evolucionado muchísimo. Ahora, podemos hacer nuestras mediciones inclusive si el cielo está nublado, usando nuestros telescopios de AAVSONet o quizá haciendo minería de datos (data mining). Por medio de nuestro acuerdo con el software Photometrica, podemos analizar los datos obtenidos con nuestros telescopios. También podemos escudriñar nuestra Base de Datos Internacional o también en cualquier otra que esté online, sin movernos de nuestro escritorio.

Estoy muy contento de ser el Presidente de AAVSO, el primero proveniente de América Latina, luego de 37 años de ser un miembro activo y de casi 10 años siendo parte del Consejo. Espero ser vuestra voz dentro del Consejo. Por favor, permítanme conocer sus opiniones, impresiones y, principalmente, sus críticas. Realmente lo necesito.

Espero verlos en nuestra próxima Reunión de Primavera (que será en el otoño del hemisferio sur) en la Argentina, del 15 al 18 de abril de 2010. Allí los estarán esperando no sólo sorprendentes cielos sino también buenos amigos para conocerlos y para hacer de nuestra AAVSO una organización aún más global.

Jaime García  
30 de noviembre de 2009 ★

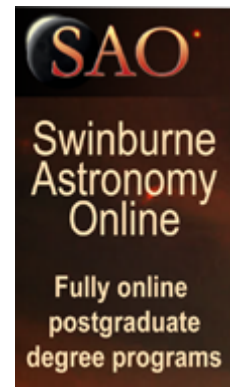
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## REPORTS FROM THE ANNUAL MEETING

### A PERSONAL VIEW OF THE AAVSO ANNUAL MEETING

DR. STEVE B. HOWELL  
NOAO, TUSCON, AZ

The AAVSO has always impressed me. When I was a young observer in Western Pennsylvania, the AAVSO, with its star charts, variable star literature, telescope making notes, and personal contact, was one of my favorite pastimes. Later, during college the AAVSO was again ready to help with more detailed information and suggestions as to variables in need of observation and what science was to be gained from the work. And during my professional career as an astronomer, the AAVSO has always been ready and willing to run campaigns and to put their members to work to gather observations highly related and critical to a Hubble or x-ray or large ground-based project.

At the 2009 annual meeting held recently in Newton, MA, the AAVSO once again surprised and impressed me. The meeting was a showroom of advanced thinking, technology, and project leadership in astronomical observing. The level of observational science being undertaken and the level of experience and instrumentation being employed was incredible. The base of information and detail the AAVSO has always

been known for remains but the advances in use of technical equipment and astronomical procedures are present as well. The organization is truly multifaceted, organized, and starting to provide enormous database information on a variety of large, astronomically precise and highly useful large observational programs.

The AAVSO meetings are always fun in terms of who you happen to talk to—members showing off their observatories and equipment (putting some professional equipment to shame), members telling of their “day job” but becoming highly effusive when they tell you of their night work, and members who work enthusiastically to inform and educate the public about astronomy. There is never a dull moment. This meeting also introduced me to the new AAVSO, the organization which has modernized itself, raised itself to a highly educated level, and moved into many new observational directions.

I have always had the greatest respect for the AAVSO and its members. They are the greatest observers I know and they have always been. Now they have earned my respect again in other ways. Director Arne Henden, long time friend and colleague, should be very proud of what he has accomplished with the organization, clearly the hard work and effort of many headquarters

### MEETING IMPRESSIONS

PATRICK McDONALD (MDP)  
TORONTO, ONTARIO, CANADA

Just as there are lifetime religious pilgrimages, every variable star observer should make an effort to attend at least one AAVSO Annual Meeting. I finally got around to it after almost three decades.

I confess that it was the prospect of my receiving an Observer Award certificate that added that extra push. Plus of course getting to see headquarters and meeting the people I’d communicated with over so many years. I couldn’t believe they still had some of my old report sheets on file. The excellent food didn’t hurt either. My vanity, however, was soon humbled when I saw how far our Calling has advanced over the years. AAVSO members now routinely carry out work that even professionals in major observatories could not have achieved twenty years ago. The CCD chip

has to a large extent eliminated the bias of the biological foibles of the human eye. We compass the passage of alien planets across their star’s brilliant faces. Perhaps most of all, the robotic telescopes seem poised to tally large numbers of observations, almost unbelievable in quality as well as quantity. Thanks to the far-reaching arm of the internet much of these data can be analyzed by amateurs thousands of miles away from the actual observatories.

Although this is excellent news for the science of variable observing, it has a shadow side. It seemed to me that the period of the visual telescopic observer’s major contribution is coming to an end as a result of all these innovations. Don’t get me wrong. I was glad to have made such a contribution when I did; they were exciting days. But the sun is setting on them. Perhaps we will find a niche for such observations in these new times. I certainly hope so. It is to the younger members, and/ or those proficient in the new

technologies, however, to continue the advances. I wish them well. As Captain Picard put it, “Let’s see what’s out there!” ★



Dr. Steve Howell

personnel and members alike. The AAVSO is a modern astronomical force which will remain an incredible resource for astronomical research but will also be a source of new and valuable unique research work provided by their own members to be placed alongside of the professionals. The boundary in these outdated terms is indeed fuzziest then ever. I look forward to many more years of continued work and collaboration with the AAVSO. ★



Patrick McDonald receives his Observer Award from the Director

# NEWS AND ANNOUNCEMENTS

## ANNUAL MEETING PHOTO GALLERY



*Shall we sing? Mike Saladyga, Ed Los, and Paul Valleli*



*Gamze Menali and Nejat Nurcan enjoying the open house at the AAVSO HQ*



*Haldun Menali, Mike Saladyga and Nejat Nurcan smiling for the camera!*



*Paper session—the attentive audience*



*Paper session—Gerry Samolyk*



*Annual meeting group*



*We are going to Argentina!*



*Arline and Elizabeth Waagen are enjoying the open house*



*Cheers! Nejat Nurcan and Matt Templeton*



*Jaime is taking over the presidency from Paula!*

## THE WILLIAM TYLER OLCOTT TANKARD

ELIZABETH O. WAAGEN (WEO)  
AAVSO HEADQUARTERS

Early this past summer we received a letter from a Mr. Phillip Cohen of Winston-Salem, North Carolina, telling us that he owned an engraved silver tankard (a drinking vessel or pitcher with an attached lid) that had belonged to William Tyler Olcott, and that he was selling it as part of reducing his possessions because he was terminally ill, and asking if the AAVSO might be interested in purchasing it. He enclosed two pictures of it showing the overall appearance and the detail of the engraving.

My immediate response to myself was, “the AAVSO should have that in its archives; it is a William Tyler Olcott piece that should come home.”

We had some discussion at Headquarters about the provenance of the piece—it was engraved “OT” and how did that make sense when Olcott’s initials were WTO? The piece was originally sold by Olcott’s niece Kathryn, who said she had received it from him (Olcott had no children). The woman who bought it had discussions later with Kathryn about the pitcher and her Uncle Tyler. Mr. Cohen bought it from her, so he was able to pass this information on to me in my discussion with him.

AAVSO Historian Tom Williams and AAVSO Archivist Mike Saladyga have been researching Olcott’s family as they write the history of the AAVSO. From them I learned that Olcott’s

mother’s family name was Tyler—she was Elizabeth Olivia Tyler Olcott and went by Olivia. Her mother, Olcott’s grandmother, was Olivia Tyler and she was a widow of substantial resources—in fact, it was her bequest to Olcott that freed him from financial worries and enabled him to pursue his interests, including variable stars and the AAVSO. It would be plausible for her to have had a silver tankard with her initials on it, and to have left it to her only grandson, whom she clearly loved. The piece dates from around 1870, which makes sense, time-wise.

The silver plated tankard is large—it would hold about two quarts—and is double-walled to provide insulation to keep the beverage cold or hot. It is decorated with a pattern of grapes and grapevines on the sides and the lid. The “OT” is in an Old English-type script and is on the front of the tankard, underneath the spout. The finish is perfect, as it was re-silvered in the 1990s and has been lovingly cared for.

Is it an astronomical item? Clearly not. However, I think it was likely a cherished possession of Olcott’s, and I very much liked the thought that it should be in the home of another of Olcott’s cherished possessions, the AAVSO. Also, I have always had an especially soft spot in my heart for William Tyler Olcott because of his obvious love



*The Olcott Tankard*

for the English language (something I share) and the beauty and elegance of his writing and poetry.

To celebrate my 30 years with the AAVSO I wanted to give something back to the organization that has given—and gives—me such joy, and this seemed perfect. I purchased the tankard from Mr. Cohen and told him of my plans, and he is delighted to know the future of his tankard, which he also loves.

So, it is with deep gratitude that I give this tankard from William Tyler Olcott to the AAVSO. ★

## IN MEMORIAM

MEMBERS, OBSERVERS, COLLEAGUES,  
AND FRIENDS OF THE AAVSO

**ROY HENRY GARSTANG**, AAVSO member since 1984, passed away November 1, 2009, at the age of 84. Roy was a professor of physics and astrophysics at the University of Colorado, Boulder, teaching with passion for 35 years and “retiring” in 1994. A member of the IAU, his research specialties included atomic physics, applications of astrophysics, and astronomical spectroscopy. He was an internationally recognized expert on light pollution.

**RICHARD E. WEND (WC)**, AAVSO member and observer since 1957, died October 25, 2009. In the 52 years Dick was a member of the AAVSO, he contributed 21,377 observations. He was an enthusiastic and steady observer, seldom missing a monthly report. Dick received the AAVSO Director’s Award in 2002 for his long observing record and his contributions to AAVSO special observing programs. Dick was also active in the Astronomical League, ALPO, and the Milwaukee and Racine Astronomical Societies, and served in the leadership of these organizations. Interested in the environment and education, Dick was an involved member of his community and a good friend to all.

## UPCOMING MEETINGS

*Spring 2010*—Valle Grande, Mendoza, Argentina, April 15–18, 2010. See details on next page.

*Spring 2011*—Boston, Massachusetts, Joint meeting with the American Astronomical Society, May 21–26, 2011

## THE 98TH AAVSO ANNUAL MEETING ARCHIVE AND HIGHLIGHTS

Access the full archive and highlights of the AAVSO’s 98th Annual Meeting, held in Newton, Mass., now online at: <http://www.aavso.org/aavso/meetings/archivefall09.shtml>. Included are: selected presentations from the scientific paper session; the Director’s Report; list of awards presented; and a photo gallery.

## LETTER FROM AN OBSERVER

Dear Fellow Members and Observers,

My name is Ibrahim Merhebi, but you can call me Bob. A year has passed since I first got to know about and became a member of the AAVSO. Although I've been a member for a whole year, I've only submitted a couple of observations (on epsilon Aurigae and beta Persei). Nevertheless, I've been enjoying the reading and getting to know more about the AAVSO, its publications, and tools. Upon the suggestion of AAVSO's Mike Simonsen, I am taking this opportunity to introduce myself to you.

It all started when I was 15 (I am currently 21). At that time, an interest in physics and astronomy began to build gradually through my reading. This very soon turned into a passion. At the age of 16, with a bunch of university students whom I met, we started what is now called the Lebanese Astronomy Group – LAG. This is the first group in Lebanon to unite individuals and clubs that have an interest in astronomy. The LAG has been arranging events and popularizing astronomy all across Lebanon ever since that time. Even though I was the youngest, and the only school student among the group, I was treated like I was a university student as they were.

Since the earliest days of my astronomy journey, I knew that I had to learn the sky and its constellations, so that was the first thing I did. It wasn't easy to start with no support. The LAG did not exist yet and I knew nobody who could help me learn astronomy. But I still managed to learn lots of what I should know. I am quite happy that I chose the right path at that time, otherwise

I would have to wait longer to use the 12×50 binoculars I bought a couple of years ago. It would have definitely been much harder if I had to start after graduating from school. My free time has been shrinking ever since, due to the fact that I am pursuing my other related passion, Physics at the Lebanese International University—LIU. That's right, I am studying Physics!

With only my binoculars I started to build a closer relationship with the sky. I discovered the beauty of what gems the universe offers, which anyone can see if they are looking in the right direction under the right conditions. I do not own a telescope yet, no dealers exist in Lebanon, but I have often borrowed a telescope from friends or colleagues. Over the years I tried several telescopes of almost every kind, from the smallest to the largest in Lebanon (a 16") and a handmade one as well. I currently operate a non-motorized 12" SCT that I borrowed from Majdi Saad, a friend of mine who has an interest in astronomy as well. He is the Editor-in-Chief of the only Arab scientific magazine, *Science and World*. The magazine was founded in 1999, and is currently concentrating on the development of school age students by introducing them to cutting-edge science through the magazine.

Although I enjoy observing, astrophotography, outreach activities, and attracting new people to astronomy, I have become more and more interested in being part of the science, especially now that I am a physics student.

I tried meteor observing, and although it is interesting with surprises now and then, I soon found it to be too time-consuming on a personal level, and one needs others to accompany him

on long nights in open and remote places in Lebanon. Then I came across the AAVSO, or was it the AAVSO that came across me? I became interested in becoming part of this community and I'm thankful I did. I feel that my observations are not just something I do for enjoyment, but that I am helping professionals related in one way or another to my passion and field of study. Moreover, I was very excited to learn that I was the first Lebanese member of the AAVSO. I hope to become the first Lebanese pioneer in variable star observing.

A few weeks prior to my joining the AAVSO I launched my own personal website—[www.astrobob.tk](http://www.astrobob.tk). December 24th will be its one-year anniversary. These pages are a personal initiative to "Publicize. Educate. Enhance...Lebanese Amateur Astronomy." This is my online Astrobob group's slogan. I do this by helping beginners and amateurs (even clubs) just like myself get to know the necessary information regarding his or her interest. I try to help guide them in the direction best suited to each, something I didn't have when I started.

As a final word, I would like to take the chance to deeply thank the AAVSO and all of its members for letting me be part of this. I would also like to dedicate a special thanks to AAVSO's Vice President, Mike Simonsen, and long-time variable star observer Robert Fidrich for their help and sincere kindness. I really thank you for this chance.

Sincerely Yours,

Ibrahim (Bob) Merhebi  
Lebanese International University—LIU  
Beirut, Lebanon ★

## THE 99<sup>TH</sup> AAVSO SPRING MEETING

We are very happy to invite our members, observers, and friends to the 99th Spring Meeting of the AAVSO. This meeting will be held in Mendoza, Argentina, April 15–18, 2010, at the Valle Grande Hotel and Resort, which is close to San Rafael City in the southern region of Mendoza province.

This special Spring Meeting of the AAVSO will take place, for the very first time, in South America, under dark southern skies. If you have always dreamed of seeing the glorious southern skies, here is your opportunity! The meeting will give both newcomers and longtime attendees the opportunity to share ideas, experiences, and tips on variable star observing. At the end of the Meeting, you will also have the opportunity to

visit the world's largest cosmic ray facility, the Pierre Auger Observatory, in Malargüe.

Special meeting events include: a Thursday evening small concert and dinner; three workshops on hot topics of variable star astronomy, observations each night, scientific paper sessions, invited talks, and a special closing banquet on Saturday evening.

April is a beautiful time to visit Mendoza province in Argentina, which is a desert with two important oases: one in the northern region and one in the southern. San Rafael is in the southern oasis and is a beautiful area for sightseeing with many mountains, lakes, cave paintings, and vineyards/wineries. The city has also many interesting museums and other attractions. Bring your families and stay a few extra days to soak in the sights! We hope to see you there!

### Spring Meeting — dates to remember

March 15	Early meeting registration deadline Deadline for abstract submission
March 31	Deadline for reserving guest rooms at the Hotel and Resort Valle Grande
April 15	General meeting begins!

Note: registration materials, schedules, and additional information (including prices and links) are available on the AAVSO website. If you would like a paper copy of the registration materials mailed to you, please call the AAVSO at 617-354-0484. ★

## VOLUNTEER SUPERSTARS

### MIKE SIMONSEN (SXN) IMLAY CITY, MICHIGAN

Members contribute to AAVSO in a lot of ways. Supporting the organization financially is not the only thing you can do to help AAVSO with its mission. We have dozens of volunteers working on important projects, such as The International Variable Star Index (VSX), charts and sequences, and the chart plotter (VSP). Others train observers through the Mentor Program, or do outreach through the Speakers Bureau and Writers Bureau.

A lot of this activity goes on behind the scenes, so I'd like to pull back the curtain and introduce you to some of the volunteers doing all this work. There isn't room to mention them all, but here are some of the exceptional examples, our "volunteer superstars."

**Tom Bretl, Plymouth, MN.** In addition to being an active contributing observer, Tom has been creating new sequences, revising old sequences, and addressing chart errors reported to the Chart Error Tracking Tool (CHET) at an amazing rate. He is responsible for at least 75% of all the new chart updates since July 2009.

**Tim Crawford, Arch Cape, OR.** Tim has been our most active and productive mentor in the mentor program. He has helped a dozen new CCD observers learn how to do everything from point their telescopes to flat fielding to reducing time series data. He has even helped teach the coordinator of the mentor program a thing or two! He has a seemingly unlimited amount of patience and always tells his students, "there is no such thing as a stupid question." Tim is also a member of the charts and sequences team.

Tim and Tom are also members of the AAVSO Speakers Bureau, volunteering to drive hours from home to give talks to scout troops, star parties, and astronomy clubs for free.

**Ken Mogul, Newnan, GA.** Ken came to the AAVSO through the mentor program. Physically unable to go out and observe, we eventually got him a mentor, Bill Dillon, and time on Global Rent-A Scope (GRAS). Ken began observing variables with robotic telescopes in his first year of observing. Now he has become a mentor to other new robotic telescope users and was a presenter in the recent Photometrica workshop in Newton,

MA, teaching others how to use Photometrica, the new AAVSO photometry software available soon as a member benefit. He has also helped select articles for the AAVSO Writers Bureau blog, an important time-intensive activity.

**John Blackwell, Exeter, NH.** John is an astronomy educator and director of the Phillips Exeter Academy Grainger Observatory. His experience with CCDs, software, observatory controls, and a vast array of telescopes has proven invaluable to the mentor program. John has taken on students along the east coast and in the Midwest, and is the mentor I send other educators to when they are looking for help.

We recently introduced John to an educator needing help at Radford University in southwest Virginia. Radford U. has a 14.5-inch RCOS telescope with a SBIG STL-11000 camera, run with TheSky6 and MaximDL. John, who is familiar with the telescope and software, is helping them by teaching the instructor the ins and outs of CCD photometry, particularly taking good flats, a challenge they were struggling with.

**Christopher Watson, San Diego, CA.** I first came to know Chris through working on the chart team. He developed an online tool for keeping track of all the charts we were preparing and checking which eventually evolved into CHET, the Chart Error Tracking Tool. He also designed the interface for the Variable Star Plotter (VSP), which many of you use on a regular basis, as well as the interface for the administrative tool for the Variable Star Database (VSD), which I now use on a regular basis to perform updates to the comparison star data that VSP plots charts with.

Chris wrote the program that produces the cataclysmic variable section *CV Circular*. This program searches the AAVSO database every Monday morning and organizes a document of all the activity reported on every CV in the database that is emailed to a list of subscribers. This and the VSD admin tool are examples of processes that run totally behind the scenes, but are vital to making things work at AAVSO.

Chris' greatest contribution has to be the development of the International Variable Star Index (VSX). Originally designed to be a repository for variable star information, kind of a *GCVS* on steroids, this tool has become the central engine driving several processes within the AAVSO now. The chart plotter, light curve

generator, quick look files, WebObs, Zapper, and data download programs all query VSX before they can perform their tasks. As if all this and a family and career weren't enough, Watson now serves on the AAVSO Council, too!

**Sebastian Otero, Buenos Aires, Argentina.** Sebastian is well known for his near photometric visual observations and is a prolific observer of southern hemisphere binocular and naked eye variables. He has mentored observers in Mexico, South America, the Philippines, New Zealand, and Australia.

Even more remarkable is the substantial time and talent he has invested in moderating submissions to VSX and updating the VSX database. He was recently given the AAVSO Director's Award for his contributions in this area.

**Patrick Wils, Hever, Belgium.** Another Director's Award recipient, Patrick has been instrumental in importing large datasets of variables into VSX and has devoted hundreds of hours of his time to approving submissions and guiding contributors through the submission process.

Without Patrick Wils and Sebastian Otero the International Variable Star Index would be years behind where it is today. Without Chris Watson it wouldn't even exist.

Today the AAVSO has a spacious headquarters, an impressive database, a humongous website, and a multi-million dollar endowment, but the most important asset is, and always has been, the members and observers of the organization. It is my privilege and honor to know and work with so many of you. ★

## THE AAVSO WALTER A. FEIBELMAN SUITE

As a reminder, the Feibelman Suite is available to guests who are in the Boston/Cambridge area to perform an AAVSO-related task, that is,



the purpose of their visit is to do something for or related to the AAVSO. For details about the suite or making a reservation, please visit <http://www.aavso.org/news/feibelman.shtml>.

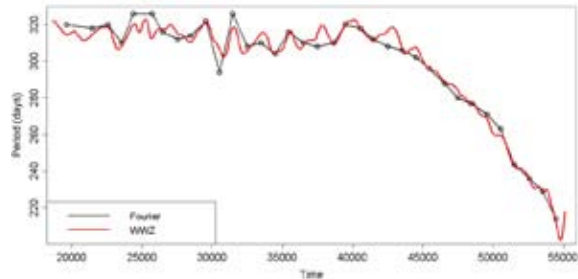


# T UMi: FROM MIRA TO ???

GRANT FOSTER PORTLAND, MAINE

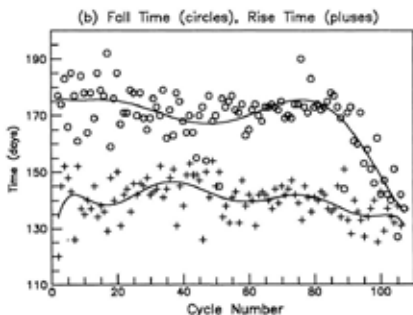
For over a century, astronomers (mostly amateurs) have kept vigilant watch over T Ursae Minoris. During most of that time, T UMi showed regular repeating cycles of brightening and dimming with amplitude exceeding 5 magnitudes, well over the limit of 2.5 magnitudes which is required for a variable to be classified Mira-type. Like snowflakes, no two cycles were exactly alike, each was visibly different from the others, again just like Mira-type variables. Its period of variability was long, about 310 days, right in the middle of the range for Mira-type variables (most have periods from 200 to 600 days, although some are longer and some shorter). It had continued its reliable-but-not-too-regular fluctuations as long as we'd been watching. In short, T UMi didn't just fit the definition of a Mira-type variable, it was a textbook case—an archetype—of the Mira class.

Around 1970 things began to change, when the period of variation began to decrease. At first the change could have been just the random, cycle-to-cycle fluctuations that Mira-type variables show all the time; after all, one or even several cycles in a row with shorter-than-average period is nothing unusual. But not only did the shortened periods persist, they kept getting shorter, until the period of T UMi was consistently lower than had been observed before. By 1980 there was no longer any doubt that the period wasn't just fluctuating as all Mira periods do, it was evolving, shortening to unprecedented values.

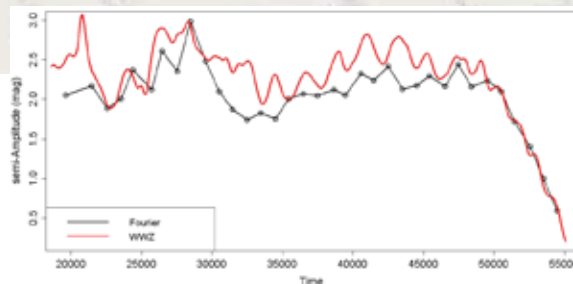


Plot showing the decline in period of variation of T UMi

Not only was T UMi showing a period decrease, the shape of its cycles was changing. T UMi had always shown a more rapid rise to maximum brightness, followed by a slower decline to minimum, but the decline started happening much faster while the time required to rise only changed a little. What had been consistently a steep rise and more shallow fall was now turning into a more symmetric cycle, with rise and fall taking about the same time.



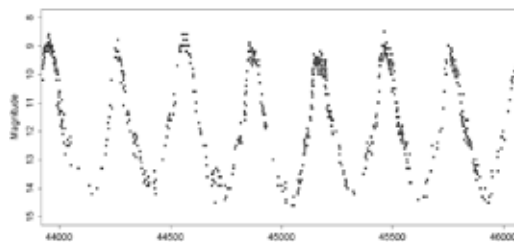
Plot showing change in fall and rise time of T UMi



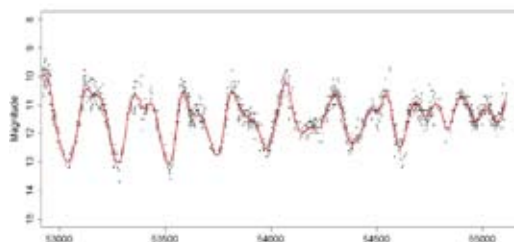
Plot showing decrease in amplitude of T UMi

While the period decrease continued, around 1995 the amplitude of T UMi also began to decrease. Again, at first a few smaller-than-average cycles might have been just ordinary fluctuations, but the amplitude decrease not only persisted, it plunged further, until by 1998 there was no doubt that the amplitude of T UMi, like its period, wasn't just fluctuating as all Mira amplitudes do, it, too, was evolving.

By definition, Mira-type variables have amplitude of at least 2.5 magnitudes. But for about the last 5 years, the amplitude of T UMi has been below that limit—so it no longer fits the definition of a Mira-type variable. Both its period and its amplitude continue to decrease, showing no signs of stabilizing. For the last few years, even the shape of its cycles is unrecognizable; T UMi no longer shows the simple up-and-down variation it maintained for nearly a century, it now shows humps and bumps, multiple peaks and valleys, with definite signs that it's fluctuating with more than one period at the same time. What was once a textbook Mira-type variable, a "poster child" of the category, no longer acts like a Mira-type at all. Its amplitude is too small, its cycle shape is too convoluted, and it shows multiperiodic behavior not typical for the class. But for the class of SR, or semiregular variables, the behavior of T UMi fits to a "T."



T UMi light curve from May 1979 to October 1984



T UMi light curve from December 2003 to June 2009

## FLASHY BEHAVIOR

Mira-type variables are highly evolved, having exhausted much of their hydrogen, a star's primary fuel during its main-sequence lifetime. In fact, these giant stars have a core which is depleted in both hydrogen and helium, so very little nuclear energy production takes place in the core. Instead, the core is surrounded by shells; most of the energy production takes place in a hydrogen-burning shell, which surrounds a helium-rich shell, which surrounds the carbon/oxygen-rich core.

CONTINUED ON PAGE 15



## EYEPIECE VIEWS

CONDUCTED BY GAMZE MENALI (MGQ) AAVSO HEADQUARTERS

Greetings All,

Best wishes for the year ahead and always!

It is hard to believe we are in 2010! A new year, new beginnings...

We have been with our readers since July 2001 and as always; we express our deepest gratitude for reading and contributing to our publication/section. Our articles are both educational and fun to read which is what we think is making our publication worthwhile to read. Mike Simonsen generously contributed several wonderful pieces and we have a fascinating article by David Levy.

We hope you will enjoy our first issue of 2010 as much as we enjoyed working on it.

We wish you a wonderful year ahead with the best dark, clear skies.

Thanks and good observing!

*Gamze Menali*

## Avoiding Bias: Simonsen's Rules for Variable Star Observing

MIKE SIMONSEN (SXN)  
IMLAY CITY, MICHIGAN

There has been some recent discussion on the Citizen Sky website about looking at the light curve or checking the Quick-Look file data of a star you are observing. The main concern revolves around observers having too much information, or a preconceived notion, before making an observation. We call this bias. The term “biased” is used to describe an action, judgment, or other outcome influenced by a prejudged perspective. In variable star observing, or any scientific investigation, bias is a bad thing.

Half the fun of variable star observing for me is precisely the fact that I don't know what my favorite variable star is doing at any given moment for sure. It's why I climb out of bed in the middle of the night in the winter to go observe them. I can't wait to see what they are up to. If I already knew, or thought I knew, there would be no reason to lose sleep.

So the first part of my advice is simple: don't look at the light curve or recent data on a variable star you plan to observe before you observe it. You risk biasing your observation, and you're missing out on the fun. The science is usually the reason people start doing this, and the fun they discover along the way is why they keep doing it for years and years. To risk either is, well...stupid!

By all means, when you are done, and have reported your observation, go look at how it compares to other observers' data and see where it fits in the light curve. This is valuable feedback, you're probably going to be quite happy with your result, and you can be proud of your contribution to science for the night.

If your observation looks different from other observers', don't worry too much about that either. Don't assume the other guy is a better, more

experienced, more correct observer than you, even if he used a CCD or the Binford 9000 photometry device. He could be a half-blind, one-eyed village idiot for all you know. The other guy or gal might not even have been looking at the same star you were.

I was taught some basic rules for observing (a very long time ago) when I started out. These rules have been passed down from generation to generation, so they are not specifically mine, or necessarily original, but we shall hereby refer to them as “Simonsen's Rules for Variable Star Observing.”

**Rule #1** Be sure you are measuring the right star. Always be very conscientious when identifying the variable. There is nothing more useless than an observation of the wrong star!

**Rule #2** Report exactly what you see, not what you think you should be seeing...period.

**Rule #3** Bias is your enemy; avoid it. (see rule #2)

This may be difficult for some people, so here are some tips for overcoming your preconceived notions.

If you see the observations of some other observer(s) beforehand:

1. Assume they are lying to deceive you!
2. Know they are bad observers, so their opinion is worthless!
3. They could be, and probably are, completely crazy. How many variable star observers have you met? I rest my case.

If the bias is some personal belief, based on your own preconceived notion, realize that:

1. You are lying to yourself! (and now you are talking to yourself...hmm)
2. You are a bad observer (you should know!) and your opinion is worthless.
3. You are obviously schizophrenic – you are in fact crazy!

**Rule #4** We never know for certain what a variable star will do from moment to moment. Therefore, you can never be certain what your star is doing at any given moment, that's why we do this. This can be added to the reasons bias should be avoided.

**Rule #5** Make every observation as if you are the only one looking at your star at this moment. You may not have to pretend. The number of variable star observers worldwide is so small this is often the case. You are special; don't forget that.

**Rule #6** Have fun.

For astronomers, the universe is our laboratory. It's beautiful, mysterious, impressive, awe-inspiring, and humbling, and it's ours. Enjoy it. ★

## TWINKLE, TWINKLE, QUASI-STAR

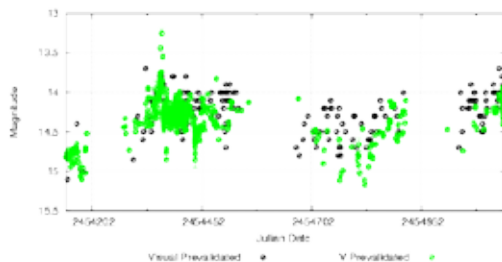
MIKE SIMONSEN (SXN)  
IMLAY CITY, MICHIGAN

“Twinkle, twinkle quasi-star  
Biggest puzzle from afar  
How unlike the other ones  
Brighter than a billion suns  
Twinkle, twinkle, quasi-star  
How I wonder what you are.”

—“*Quasar*” by George Gamow, 1964

The AAVSO recently announced a special observing campaign on several blazars, including the unusual variable object 3C 66A. So, what the devil is 3C 66A, and what is a blazar?

In the 1960s advances in radio and x-ray astronomy opened our eyes to new classes of objects we’d never even imagined before. Some of these early discoveries were radio sources we believed were associated with stellar objects. The *Third Cambridge Catalogue of Radio Sources* (3C) is an astronomical catalogue of celestial radio sources. It was published by the Radio Astronomy Group of the University of Cambridge in 1959. Entries in this catalogue use the prefix “3C” followed by a space, then the sequential discovery number, such as “3C 48.” In the case of 3C 66A there are two sources very close together in the sky, so they are given an additional letter suffix, resulting in the names 3C 66A and 3C 66B.



Recent light curve of 3C 66A

3C 66A was one of these radio stars. As hints of their true nature began to unfold, astronomers began calling them Quasi Stellar Radio Sources, which was eventually shortened to “quasars.” The spectrum of 3C 278 taken during an occultation by the moon finally revealed that these radio stars were actually galaxies. Even more remarkably, these were the most distant galaxies known, billions of light years away.

Like quasars, blazars appear star-like optically. They emit energy in radio wavelengths as well as all other wavelengths up to gamma-rays. Due to their variability in optical and other wavelengths, these objects have all come to be known as Active Galactic Nuclei, or AGNs. Blazars are the most variable of all the AGNs and can change in brightness by up to a factor of 100 in a few months. BL Lacertae is the prototype of this class, and as you can guess by the name was first thought to be a variable star.

The engines that power these active galaxies are believed to be supermassive black holes residing in the nucleus of the galaxy. These super compact objects can possess the mass and gravitational pull of a million to a few billion Suns. Surrounding the massive central region is an accretion disk. Beyond that is a doughnut-shaped torus of dust and gas extending out another couple of light-years which glows in the infrared.

## EYEPIECE VIEWS

Due to the physics of accretion disks, the inner disk rotates more quickly than the outer portions. The inner parts near the black hole are spinning so rapidly and are so hot that very high-energy wavelengths are generated. Gas and dust spiral in towards their eventual doom, like water circling a giant cosmic drain. A massive amount of energy is emitted when matter accretes onto the black hole via the accretion disk, and vast amounts of gravitational energy are released as the matter gets sucked down the drain and disappears from the universe.

In some AGNs, radio jets are produced which protrude perpendicularly from the disk, spewing energetic particles at nearly the speed of light. Our point of view relative to these jets is what distinguishes the different types of AGN.

Looking at the jet straight on, right down the barrel of the beast, we see blazars and quasars. However, if the jet is not pointed in our direction, the dusty disk of the galaxy lies in our line of sight, and we see what are called Seyfert galaxies.



Looking down the barrel

NASA/Goddard Space Flight Center Conceptual Image

So the answer to our initial question, what is 3C 66A? It is an active galactic nucleus, a quasar, a blazar, and a variable source of radiation in optical and other wavelengths, powered by a supermassive black hole in a galaxy billions of light years away.

Why has the AAVSO asked observers to monitor this crazy cosmic catastrophe?

Observations have been requested by Dr. Markus Boettcher, from Ohio University, in a study he and his colleagues are making of several blazars. These AGNs are being intermittently monitored by VERITAS (the Very Energetic Radiation Imaging Telescope Array System), a four-telescope collection designed to detect sources of very high-energy (VHE) gamma-rays. If a VHE gamma-ray outburst is detected by VERITAS, target-of-opportunity observations with the Newton X-ray Multi-Mirror (XMM) telescope will be triggered.

CONTINUED ON NEXT PAGE



The VERITAS array

VERITAS (Very Energetic Radiation Imaging Telescope Array System) [http://veritas.sao.arizona.edu/component/option,com\\_frontpage/Itemid,1/](http://veritas.sao.arizona.edu/component/option,com_frontpage/Itemid,1/)

## SOME MUSINGS ON VARIABLE STARS

## EYEPIECE VIEWS

DAVID LEVY (LVY)  
VAIL, ARIZONA

In the spring of 1966, Isabel K. Williamson announced a new program in observing variable stars. As Director of Observational Activities of the Montreal Centre of the Royal Astronomical Society of Canada, Miss Williamson often had good ideas like that. During the summer that followed I added stars like  $\gamma$  Herculis, X Herculis, and RR Coronae Borealis to my observing list.

Not long after that, the AAVSO began publishing my name in its list of non-member observers, something I liked to call “the AAVSO’s list of observers who were too lazy to join.” Not wanting that reputation, I promptly joined the AAVSO and quickly added other stars to my program. For a number of years during the late 1970s and early 1980s, I was concentrating on the rapidly varying stars in M42, making more than 10,000 observations of them during the 1980 fiscal year. But as the years went by, my primary observing



David Levy at his telescope

activity, visual comet hunting, began to take more and more of my time. By 1990, with 6 visual finds to my credit, I decided to let my observing friendship with the variables lapse. But not completely: I kept a single system, a cataclysmic variable named TV Corvi, under observation, first visually, later using CCD, and have kept it up ever

since. I have observed almost every outburst since the first one I detected on March 23, 1990.

In these modern times, I understand that the AAVSO is emphasizing electronic imaging and observations over visual. Although I understand this, and am in fact a part of it, I feel that some of the magic that visual observations provide has been lost. Where are the observers who, like Leslie Peltier, memorized and used the comparison sequences of hundreds of variables? A few years ago, in 2003, my wife Wendee and I hosted an observing session during the AAVSO

spring meeting in Tucson. When I happened to open up my collection of old blueprint charts, the group excitedly gathered around to look at them, study them, relish them. They couldn’t get to them fast enough! Yes, they are antiques, from a time long gone, but they show that the magic is still there. May it never die. ★

SIMONSEN: QUASI-STAR  
CONTINUED...

Since VERITAS is not regularly monitoring the targets, optical monitoring by observers on the ground is crucial to alert the VERITAS collaboration if any one of the blazars on their list enters a high state of activity. AAVSO observers will essentially act as fire spotters, and if we see smoke, professional astronomers will turn the big guns on these blazing beasts. Details of the campaign and the list of targets can be found in *AAVSO Alert Notice 353*.

I have observed 3C 66A for years, partly because it is a variable object, but also because it is remarkable as the most distant thing I can actually see in my 12-inch telescope. Now I have an even better reason to watch it closely in the coming months. My observations, from my humble back yard observatory, could trigger target of opportunity observations of the XMM Newton satellite. You have to admit, that’s cool. ★

DOUBLE DIPPING—WINTER  
Variable Stars Near Deep Sky Treats

MIKE SIMONSEN (SXN) IMLAY CITY, MICHIGAN

Just to refresh your memory, double dipping is taking in a few deep sky objects while still making variable star observations. Now that winter has arrived, we have a whole new set of deep sky wonders to distract us from our variables. Fortunately, there are plenty of variables within a short star hop of many of your favorite nebulae and clusters. So if you have visitors braving the cold who want to see faint fuzzies, you can still sneak in some variable star observing.



M33

In the last newsletter we left off our double dipping at M33 in Triangulum. Picking up where we left off, we can jump easily from M33 to three of my favorite cataclysmic variables. First, about 2.5 degrees NW of M33 is TY Psc. TY Psc is a UGSU that can get as bright as 11.7V during a superoutburst, but most CV enthusiasts

know the field for the distinctive little four-star asterism due south. This grouping provides a convenient mix of magnitudes to use when the star in outburst.

TW Tri is closer to M33, about 1.4 degrees NE of the galaxy. This CV lies in a rather barren part of the sky. It erupts about once a month,

making it rewarding to follow its activity. TW Tri is suspected of being a Z Cam type CV, but standstills will have to be verified by CCD observers, since they will probably occur around 15<sup>th</sup> magnitude or fainter.

While you pretend to hunt for M33 you can zoom over about 1 degree SE of the galaxy and land on the field of TX Tri. Not a particularly active star, I can’t tell you why I still enjoy chasing after it.

CONTINUED ON NEXT PAGE

**SIMONSEN: DOUBLE DIPPING  
CONTINUED...**

Maybe it's because not many of us do. Now scoot back over to M33 and let your guests pretend they can actually see spiral structure in the eyepiece.

Then grab a pair of binoculars and show them the Double Cluster (NGC 869 and 884) in Perseus. RS Per is a red semiregular variable right smack in the middle of the eastern cluster NGC 884. It varies from about 7.8 to 10V, so most of the time it can be seen in binoculars. You don't have to let anyone know you are making a variable star observation while taking in the beauty of the Double Cluster.

Almost 1 degree due west is UV Per. This UGSU gets to 11<sup>th</sup> magnitude in outburst, but outbursts are few and far between. You may have to wait a year or two for the next one. Fortunately, UV Per lies in an interesting double string of stars, making this field a pleasure to take in while hunting for an outburst.

TZ Per, an active UGZ, 1.3 degrees NW of the double cluster, is another fun, active star you might want to sneak in before the guests get antsy. With outbursts every other week or so, it's bright more often than not, so it's often visible in an eight or ten-inch telescope.

M76 is known as the Little Dumbbell Nebula because of its resemblance to M27 in Vulpecula. It also makes a fine place to star hop from to get to KT Per. Slew one degree SW of the faintest Messier object until you find an almost perfect little baseball diamond of 12<sup>th</sup> and 13<sup>th</sup> magnitude stars. KT Per is another fine, active CV that gets as bright as 11<sup>th</sup> magnitude in outburst.

On the sky, the Pleiades have always looked to me like they belong to Perseus instead of Taurus. Following the long arm of stars that is the southern part of Perseus, (alpha, delta, nu, epsilon, ksi, then zeta) out to its natural conclusion, you run smack into the Pleiades. This well-known cluster is great in binoculars, small telescopes, and large apertures. Even better yet, just about every star you can see is a known or suspected variable. Take your pick.



*Pleiades*—NASA/ESA/  
AURA/Caltech

While we're in Taurus, slide farther south to the Hyades. Just west of Aldebaran is a bright double star consisting of theta 1 and theta 2 Tau. In the same medium power field of view is W Tau, a semiregular variable that ranges from 8.2 to 13.0V with a period of approximately 165 days.

The Eskimo Nebula (NGC 2392), in Gemini, is a bright, round planetary nebula that has a fairly remarkable green color to it. Not many deep sky objects exhibit any color at all through modest scopes, but this one always looks green to me. The central star is fairly easy to see, compared to many planetary nebulae. I've seen some rings, dark lanes, and other features in this planetary on very good nights in the 12-inch, but it takes averted vision and lots of patience to eke out any detail at all. I'd rather be hunting down a few more variables! R, S, T, and U Gem are all within a few degrees of this deep sky favorite. S and T Gem form an equilateral triangle about 1.5 degrees on a side with kappa Gem. Kappa Gem and NGC 2392 form a triangle with U Gem, kappa being about 3.2 degrees north and the Eskimo being about 6 degrees to the west. You can probably get all of them in the FOV of your finder scope. R Gem is a little harder to find, lying a little less than half way from NGC 2392 to epsilon Gem. 6<sup>th</sup> magnitude 44 Gem is a good sign post for finding R Gem, which lies about 28 arc minutes east.

If your guests have endured the cold night air up to now with you wandering off and doing variable star estimates in between, you can reward

them with the "piece de resistance" of the winter sky, the Orion Nebula, M42. By all means, do take in this glorious sight. I don't think anyone ever really gets tired of looking at it. Be happy in the knowledge that a mere 1.6 degrees NW of the center of this mammoth nebula, S Ori, a very interesting Mira that often exhibits a hump in the ascending branch of its light curve, is waiting for you to stop by for a visit. Varying from 7<sup>th</sup> to 14<sup>th</sup> magnitude with a longish period of 415 days, this variable can supply you with a lot of entertaining observing sessions. Plotting the strange behavior of this star on the light curve generator can be fun, too. What's up with the hump? I don't know, and I don't think anyone else does either. Imagine that, a mystery that could potentially be solved utilizing amateur data!



*Orion Nebula*—NASA/ESA

When the snow begins to melt, and temperatures start to moderate, the wide, empty portion of the spring night sky will have swung around. The Milky Way hugs the horizon all the way round the sky and anywhere you glance up you're looking away from the galaxy and out into deep space. We'll zig-zag through the 'Realm of the Galaxies' in the spring sky, looking for a few more variable stars in between. ★



*Field around UV Per*—The Digitized Sky Survey copyright © 1994, Association of Universities for Research in Astronomy, Inc.

## OBSERVING CAMPAIGNS UPDATE

**MATTHEW TEMPLETON AAVSO CAMPAIGN COORDINATOR**

It is time again for a summary of the AAVSO's Observing Campaigns. As of the writing of this report (November 2009), we are currently running thirteen campaigns on various projects, on topics ranging from flare stars to blazars and everything in between. There are projects for observers with a range of equipment and time constraints, so please stop by the Observing Campaign website to find out more:

<http://www.aavso.org/new/campaigns.shtml>

Here, I'll provide a brief summary on just a few of the many observing campaigns of 2009:

The AAVSO is currently running several long-term campaigns, both for specific research proposals as well as for data collection. We recently launched a long-term monitoring campaign on behalf of Dr. Stella Kafka, who is looking for evidence of long-term stellar cycles in magnetically active stars, similar to the 22-year solar cycle. In November we released a list of stars being targeted, and we are now in the process of adding and updating sequences for these stars. We'll also be adding recent images of these fields for objects with large proper motions. We've also issued updated *AAVSO Special Notices* on behalf of Dr. Gordon Sarty (U. Saskatchewan), who continues his large project to study high-mass X-ray binaries. This project is notable not only for the amount of photometry collected, but also for the direct participation of AAVSO observers in conducting spectroscopy at major facilities.

The AAVSO continues to solicit photometry of a number of blazars on behalf of Dr. Markus Boettcher (U. Ohio). Of particular note currently is the bright blazar 3C 66A, which has been active for several weeks and is currently being targeted for ground-based high-energy observations by the VERITAS telescope in Arizona to search for correlations between the optical and gamma-ray emission (the latter detected at the ground by the Cerenkov light flashes generated when gamma-rays impact the Earth's atmosphere). This is an ongoing project, and we will be working with Dr. Boettcher to make best use of the excellent light curves being generated by our High Energy Network observers. You can learn more about this project in *AAVSO Alert Notice 411*, and you can learn more about blazars and the AAVSO High Energy Network on the recently-updated

Network page on our website: <http://www.aavso.org/observing/programs/hen/>

Two major events and two (thus-far) non-events are the subject of major campaigns as well. First, if we were going to have a Variable Star of the Year, it would probably be epsilon Aurigae, which entered its first eclipse in 27 years back in August and September of this year. The AAVSO continues to participate in a major observation and education project—Citizen Sky—to monitor epsilon Aurigae through the end of this eclipse, and all AAVSO observers are encouraged to participate. The “weirdest” event of the year might go to the recent decline to minimum and subsequent activity of the usually-bright variable TT Ari. This cataclysmic variable is both a novalike with a large accretion rate as well as a VY Sculptoris star, in which accretion stops altogether, sending the star into a deep minimum of around 16.5. While the decline to minimum was a rare and exciting event in and of itself, its subsequent oscillations of two or more magnitudes has kept observers busy and theorists scratching their heads. Some very interesting astrophysics are going to come from TT Ari's current activity, so please contribute observations if you have the equipment to make deep observations.

We began monitoring the star V1412 Aquilae in February 2009 for Dr. Arlo Landolt. This suspected eclipser may be an example of a white dwarf being orbited by a brown dwarf or an exoplanet. Potential eclipses were observed in 1985 and 1988, but have not been detected since during sporadic monitoring. In August, Michel Bonnardeau posted the results of his Monte Carlo simulations of potential periods, and gave several potential eclipse dates that might detect the eclipse and yield the exact period. Possible dates for eclipses in 2010 include January 5 (JD 2455202), February 25 (2455253), and September 15 (2455455). Eclipses are expected to last less than an hour, but should be deep—three magnitudes or more. Occasional monitoring of this star by a large number of observers will provide good coverage. If you see the star fainter than you expect, please report it right away via WebObs.

Finally, the major “non-event” of 2009 was the non-outburst of the recurrent nova U Sco. AAVSO observers have continued to monitor

this extremely fast nova for the past two years, obtaining deep twilight observations very close to solar conjunction. U Sco had its most recent conjunction in late November 2009, and AAVSO observers around the world are encouraged to pick this star up again as soon as possible when it emerges into morning twilight in late December and early January 2010. The hope is that a rapid detection of a U Sco outburst will occur within a few minutes to an hour of the nova onset, enabling Dr. Bradley Schaefer to set in motion observations with a number of ground- and space-based observatories. Rapid, multiwavelength observations during the nova outburst will hopefully shed light on the physics of recurrent novae, and on U Sco in particular.

Finally there were several concluded campaigns during 2009, of which I'll mention two.

AAVSO HQ requested observations of the suspected black hole binary BG Gem on behalf of Dr. Mark Reynolds (U. Michigan) during the first few months of 2009. The resulting light curve, with over 1,500 observations by 17 observers, is excellent. Observers submitted a number of multi-filter observations along with single-filter photometry. The light curves are remarkably tight, with the major difficulty being the mixture of data where BG Gem and the nearby non-variable stars aren't split, a problem that's relatively straightforward to deal with. According to Dr. Reynolds, the AAVSO data were used to generate a new ephemeris for BG Gem. This ephemeris will be used during upcoming spectroscopic observations in 2010. However, the data themselves will be useful in photometric studies of this star, and the color information that can be extracted from the *BVRI* light curves will provide some interesting astrophysical information of its own. Visit the AAVSO light curve generator and data download pages to see for yourself!

A major support campaign we ran in August and September of 2009 helped with the commissioning of a new instrument on board the Hubble Space Telescope. The AAVSO was contacted by Ed Smith of the Space Telescope Science Institute (STScI) to request monitoring of the bright symbiotic star AG Draconis. The new instrument—the Cosmic Origins Spectrograph—could only obtain ultraviolet calibration data of AG Dra when it was *not* in outburst. AAVSO observers supplied a timely stream of observations of this source, both visual and CCD, and the mission planners

CONTINUED ON NEXT PAGE

## PHOTOELECTRIC PHOTOMETRY IN 2009

MATTHEW TEMPLETON AAVSO HEADQUARTERS

The AAVSO Photoelectric Photometry (PEP) program had a fantastic year in 2009, with new observers joining the program and more contributions by our long-term PEP observers. For the fiscal year, 940 PEP observations were submitted through the PEPObs utility of WebObs, and an additional 1178 observations were submitted as reduced magnitudes, for a total of 2,118 observations. This is an increase of over 60 percent over FY 2008's total of 1,317 observations! The total also includes 333 PEP-IR observations made in the J and H bands of the infrared.

During the year, we added several stars to the PEP program, including the Cepheids delta Cep and Polaris, the high-mass X-ray binary V884 Sco, beta Cep, and the pulsating red giants V2105 Oph and khi Peg. Along with these have come campaigns on several of these stars as well as the luminous blue variable P Cyg, and epsilon Aurigae, which began its once-in-27 years eclipse during August of this year.

### FOSTER: T UMI CONTINUED...

The helium shell is not generally hot enough to support much helium burning. But as the star ages the helium shell slowly gets hotter, until it crosses a "tipping point" at which furious helium burning is triggered. This event is referred to as a helium shell flash. The flash produces a prodigious amount of energy, which causes the surrounding hydrogen-burning shell to expand and cool, which switches off hydrogen burning; for a brief time the main energy source is helium burning.

The shell flash changes the luminosity (energy output) of the star, as well as its period of pulsation, and can lead to exaggerated mass loss. For a brief time (in astronomical terms) the star will show strong evolution of its period and amplitude, as well as its luminosity and mass loss. Eventually it settles back to normal, meaning its previous Mira-like behavior (if that can be called "normal"). Many thousands of years later, it's likely to experience another helium shell flash, again leading to temporary changes in its pulsation and exaggerated mass loss. This may culminate in a flash with truly dramatic mass loss, which can signal the death of the star (or at least the end of the giant phase of its life).

An exciting new development has been the addition of archival data sets from a few observers and observing groups during the past year. These included: archival *UBV* photometry of epsilon Aurigae by Jeff Hopkins; archival *UBV* photometry of southern Miras and other stars by the Auckland Photometric Observers Group (headed by Stan Walker); archival *UBV* photometry of several RV Tauri stars from the 1950s by Frank Kameny; and as of today (November 25), over 5,500 photoelectric *UBVRI* observations of southern Miras by Leopoldo Celis, digitized by Brian Skiff of the Lowell Observatory. Not including the Celis data which were added today, more than 13,000 photoelectric observations were added to the AAVSO International Database during 2009!

Photoelectric data are highly prized by researchers. These data are fully calibrated and transformed, and are some of the highest-precision and highest-accuracy data in the AAVSO archives. Furthermore, photoelectric observers are capable

of observing the brightest stars in the sky with much greater ease than imaging systems, providing important data on these sorely neglected variables. Photoelectric photometry is painstaking and precise work. A single magnitude may take nearly half an hour to obtain, with multiple measures taken of the variable, comparison star, and sky to create a single data point. But the resulting light curves are remarkable and are well worth the effort put into making them.

Is T UMi showing us the aftermath of a helium shell flash? That's certainly the leading theory of its behavior, but is by no means certain. Certain aspects of its behavior, most notably fluctuating with two different periods simultaneously, were not predicted by the shell-flash theory. And, the present behavior of T UMi so strongly resembles that of the semiregular variables that other theories may be needed. A lot depends on what this fascinating star does in the next few decades, and to determine that with sufficient precision we need continued monitoring.

Professional observatory campaigns are poorly suited to the kind of relentless vigil which has told us so much about T UMi, and which will answer the burning questions about its immediate future. Only the efforts of a multitude of observers over many years—the kind of effort for which amateurs are famous—can yield those answers, on which depends whether the success or failure of our current theoretical understanding. As Sztatmary et al. (2003, *Astronomy and Astrophysics*, **398**, 277) suggest, "Visual data are crucial for prompt detection of period stabilization or even period increase. The latter would be the final argument confirming the concept of the He-shell flash. However, if the period will turn to a constant value and remains there for a considerable time then the

whole theory should be revised. In that case T UMi shall shed new light on a peculiar mode switching phenomenon not well understood." ★

I'd like to take this opportunity to thank all of our photoelectric observers for their hard work over the past year—thank you for making this a successful year for the AAVSO Photoelectric Photometry program!

PEP Observers for FY 2009 (provisional totals): Brian McCandless (589 observations), David Williams (390), Nick Stoikidis (199), Jeff Hopkins (165), Gianni Galli (132), Charles Calia (113), Thomas Rutherford (105), Glen Ward (84), Henri Van Bommel (83), Jim Fox (68), Adrian Ormsby (64), Robert Crumrine (38), James Wood (37), Hans Nielsen (33), Thomas Pears (14), Erik Hoeg (3), and Wayne Clark (1). ★

### TEMPLETON: CAMPAIGNS UPDATE CONTINUED...

gave the spectroscopic observations their approval on September 7 and 8. This was a major project that would have been much harder to schedule without the assistance of the AAVSO community, and your efforts played an important role in getting this new instrument calibrated and made available to the astronomical world in a timely manner.

The AAVSO observer community has a huge role to play in variable star astronomy, and the data you provide are often the only source of data researchers may have access to. We're doing our best to link the AAVSO community to the best and most productive projects. We'll continue to solicit research projects that AAVSO observers can contribute to and be acknowledged for their efforts. If you have any comments or questions about AAVSO Observing Campaigns, please contact me at [matthewt@aaavso.org](mailto:matthewt@aaavso.org).

Clear skies! ★

## WHY OBSERVE Z CAM STARS?

F. A. RINGWALD CALIFORNIA STATE UNIVERSITY

**W**hy would anyone be interested in observing Z Cam stars?

The Z Cam stars are a subclass of dwarf novae. Dwarf novae are a subclass of cataclysmic variables (CVs). In addition to the normal outbursts that dwarf novae show, the Z Cam stars have standstills. During these standstills, they remain for months or even years at a brightness of about one magnitude fainter than at outburst maximum.

Dwarf novae are natural laboratories for accretion disk physics. Accretion disks are common throughout the Universe. They occur any time both gravity and angular momentum act on matter in space, which is almost always. (Angular momentum can be thought of as the amount of rotational motion a body has: it is what keeps a spinning object spinning.) All stars are thought to form in accretion disks. This is why the planets in the Solar System are all nearly in the same plane: they formed by gravity in what was once the Sun's accretion disk, called "The Solar Nebula." That most stars are in binary systems is probably because the angular momentum throws gas into a preferred plane, where it forms into another star. Accretion disks make us aware of some of the more fascinating objects in the Universe, such as neutron stars and black holes, since without matter falling into it, a black hole is invisible. Supermassive black holes are thought to reside in the centers of all galaxies, and explain the complex behavior of active galaxies and quasars. Since galaxies rotate, it is hard to escape the conclusion that their central engines are fed by accretion disks.

A problem with studying star formation, neutron stars, black holes, and active galaxies is that all these objects are complex, hard to observe, or so bizarre that they defy comprehension—and often all three. This is why dwarf novae are useful: they teach us the basic physics that must govern these more exotic systems. Dwarf novae do this because they vary on human timescales of minutes to decades, not centuries to millennia. CVs also often eclipse, so their basic geometry is well understood—insofar as it isn't, precisely—but then the geometry of protostars and quasars is often not understood at all.

Nearly all CVs, dwarf novae included, consist of a K–M dwarf that orbits a white dwarf close enough that it spills gas onto the white dwarf. Because of the sideways motion of the orbit, the gas stream does not fall onto the white dwarf directly, but settles into orbit around it. This resulting ring spreads out into a disk, which settles onto the white dwarf. Two book-length reviews of cataclysmic variables are *Cataclysmic Variable Stars* by Brian Warner (1995) and *Cataclysmic Variable Stars: How and Why They Vary* by Coel Hellier (2001). Coel Hellier's book was written specifically for undergraduates and amateur astronomers: the first chapter describes how to make useful observations of CVs.

Aside from dwarf novae, the two other general classes of CVs are the classical novae and the nova-like variables. Classical novae have nuclear-powered eruptions, of amplitude 10–15 magnitudes or more. These usually occur only once in many centuries, and often last for years. Nova eruptions are caused by the buildup of gas on the surface of the white dwarf: eventually, the mass, pressure, and temperature build up and the gas detonates in a thermonuclear runaway. Nova-like variables do not have eruptions or outbursts, but do have spectra that resemble those of classical novae many years after an eruption. Many nova-like variables have spectra that resemble those of dwarf novae in outburst: these nova-likes might therefore be thought of as dwarf novae that are stuck in outburst all the time.

Dwarf novae normally have outbursts of 2–5 magnitudes' amplitude and days-to-weeks' duration. These outbursts occur only quasi-periodically: it not easy to guess in advance when they will occur. There is no substitute, therefore, for regular monitoring. Observations of eclipsing dwarf novae show that their outbursts occur in the disks. Unlike classical nova eruptions, they are not nuclear-powered. They are powered by gravity, by the luminosity of a large amount of gas heating up as it falls into the strong gravity field of the white dwarf.

In 1974, Yoji Osaki (Tokyo) presented the theory that dwarf nova outbursts are caused by thermal instabilities in the disk. In this picture, gas accumulates in the disk until it heats up and becomes viscous. It therefore avalanches in

toward the white dwarf, heating up even more and causing an outburst. We now have good evidence that dwarf nova outbursts are indeed caused by thermal instabilities: the accretion disk radii in eclipsing cataclysmic variables grow and shrink to the sizes predicted by disk instability theory (Harrop-Allin and Warner 1996).

With a high enough mass-transfer rate into the disk, the disk can resemble a dwarf nova stuck in outburst all the time. This is what nova-like variables are thought to be. If the flow is just at the critical rate that separates the dwarf novae from the nova-like variables, the disk may settle into a standstill. Standstills are the defining characteristic of the Z Cam stars.

The most detailed observational study of standstills has been for Z Cam itself. It used 51,086 observations made by the AAVSO between 1928 and 1995 (Oppenheimer, Kenyon, and Mattei 1998). Kent Honeycutt (Indiana University) and collaborators also published detailed studies of five other Z Cam stars (RX And, Z Cam, SY Cnc, AH Her, and HX Peg) in 1998. Their observations were done between 1990 and 1996 with RoboScope, an automated 16-inch telescope, as well as by the AAVSO in 1975–1996.

The outbursts of Z Cam stars are of special interest to observers because they are constantly doing something. They tend not to spend long periods between outbursts in a faint, quiescent state, the way some other dwarf novae do: most of the time, they are either on the rise to outburst or on the decline from outburst. Shafter, Cannizzo, and Waagen (2005) used AAVSO light curves to study the outbursts, aside from the standstills, in Z Cam stars. They found that Z Cam stars with longer orbital periods have longer outbursts. This may be since they have larger sizes: more heat is required to light up the disk during an outburst, but detailed models that explain this have not been done.

Even with the observations and analyses of recent years, we still know relatively little about standstills, not even the fundamental observational properties of how often they occur or how long they last. Oppenheimer, Kenyon, and Mattei (1998) found that the standstills of Z Cam could last between 9 days and 1020 days; Z Cam was in standstill almost continuously between 1977 and 1981. In contrast, HX Peg has much shorter standstills, about 30 to 90 days long, which recur yearly (Honeycutt et al. 2005). Standstills are not completely static: in their compilation of

CONTINUED ON NEXT PAGE



## RINGWALD: Z CAM STARS CONTINUED...

the statistics of dwarf nova outbursts published in 1984, Paula Szkody (Washington) and Janet Mattei (AAVSO) showed there can appear erratic flareups with amplitudes of several tenths of a magnitude.

I therefore encourage a study of these basic observational properties—the phenomenology—of Z Cam stars. Some effort has been made to explain standstills theoretically, but so far it is still sketchy and quite possibly wrong. More observations would of course greatly help.

The leading explanation for standstills was published by Friedrich Meyer and Emmi Meyer-Hofmeister (Max Planck Institut für Astrophysik, Munich) in 1983. It involves increased mass flow into the disk because of irradiation of the red dwarf. According to this theory, normal outbursts would trigger standstills in dwarf novae that happen to have average mass transfer rates just below the critical rate above which the disk would be too hot to have outbursts, as in nova-likes. An outburst would heat the side of the red dwarf that faces the white dwarf and accretion disk. This would puff up the red dwarf's atmosphere, causing the mass transfer rate into the disk to be higher. The atmosphere, or outer layers, of the mass-losing star would only have so much gas to give up, although, so the mass transfer would eventually reach an equilibrium rate and therefore stand still.

The standstills of Z Cam are observed to be triggered by normal outbursts (Oppenheimer, Kenyon, and Mattei 1998). It would be of interest to confirm whether all Z Cam stars do this, since this is an essential feature of most theoretical models. Another problem with the theory, which Emmi Meyer-Hofmeister and Hans Ritter (MPIA) discussed in 1993, is that the predicted mass transfer rate increase should last for the diffusion timescale of a red dwarf's atmosphere, about  $10^5$  years. This prediction is too long. Standstills are observed to last for a few years, and often much shorter.

Another idea is that standstills are ended by starspots. Starspots are similar to sunspots, but are on stars other than the Sun. Sunspots and starspots are areas on a star's surface that have strong magnetic fields: they push the gas on the surface of the star aside, like Moses parting the Red Sea. Because of this, inside a starspot the gas

pressure will be lower than the pressure of the gas surrounding it. This is why sunspots are dark: with a lower pressure comes a lower temperature.

Suppose a starspot were to move or form over the point on the mass-losing star from where the gas is spilling into the disk. It might choke off the flow of the gas from the star into the accretion disk. This idea has received much attention, both as an explanation for what ends starspots, and also as an explanation of why CVs of all types have erratic, unpredictable low states. I wonder whether it's true: plasmas and other hot gases are well known for the ability to escape confinement. It is therefore still unclear what stops a standstill.

Models are now sophisticated enough to explain why standstills are about a magnitude fainter than outburst maximum. It is because the disk is heated by the gas stream from the mass-losing star. Because of this extra source of heat, the critical mass transfer rate at which a standstill occurs is about 40% less than the mass transfer rate during outburst (Stehle, King, and Rudge 2001).

Somehow, a Z Cam star knows it will go into standstill some months before it actually does. The minima get brighter, the maxima get fainter, and the amplitudes of the outbursts get smaller. Is this from a heating wave spreading though the disk? If so, it's an important piece of accretion disk physics, since it would be essential for understanding mass flow and angular momentum transport through the disk. Since standstills occur on timescales of weeks to years, sustained observations by amateur astronomers will be exactly what is needed for improved understanding.

Two Z Cam stars have eclipses: EM Cyg and AY Psc. It would be particularly useful to monitor these stars, since theoretical models of standstills make specific predictions about how disk radius varies among quiescence, outburst, and standstill (see Buat-Ménard, Hameury, and Lasota 2001).

Indeed, extended campaigns by amateurs are still essential. Professional astronomers everywhere are finding it increasingly difficult to get funding. This encourages what's called “smash-and-grab” science: quick projects that promise large immediate scientific payoffs, but which tend to be conservative, unimaginative, and prone to missing out on serendipity. Long-term monitoring projects are especially unpopular among professionals these days—foolishly so, since there is so much to be learned from them. Observing standstills

in Z Cam stars is quite literally science that only amateurs can do—and I am very pleased to find people able and willing to do it!

### Further Reading

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## ORGANIZATION AFFILIATIONS IN THE AAVSO INTERNATIONAL DATABASE

ELIZABETH O. WAAGEN (WEO) AAVSO HEADQUARTERS

Five years ago the Variable Star Section of the Royal Astronomical Society of New Zealand (RASNZ) arranged with the AAVSO to add its entire database of variable star observations to the AAVSO International Database. While some of these observations were already in the AAVSO archives, having been sent directly by the observers, most were not (they are currently being added). It is important to acknowledge the source of the data added from the RASNZ database, identifying the source organization in the data themselves. This same consideration holds true for other databases being contributed to the AAVSO International Database, such as that of the Variable Star Section of the British Astronomical Association, which will be added in the near future. Another example of these databases is that of the French AFOEV, which sends data monthly from its observers for inclusion in the AAVSO archives.

We have added an Organization field to each observation in the AAVSO International Database to indicate the source of an observation. Every time an observation is downloaded, that Organization field will be included if the researcher so requests. We expect that most observations will have “AAVSO” as the Organization, meaning that the observation was submitted to the AAVSO with the AAVSO indicated or without any organization indicated.

We are extending the option of an Organization field to our individual observers. If you are a member of an organization and you want your

observations to indicate that they are from that organization, tell us (via Blue&Gold) and we will put it in the Organization field of each observation. At the end of this article are step-by-step instructions.

You do not have to indicate an organization on any of your observations—if you do not choose anything, the Organization field will say AAVSO, meaning that your data come through the AAVSO.

You may also decide to have some observations marked as AAVSO and some as another group—that is all right. For example, say you usually have AAVSO as your Organization, but you are making observations for a certain campaign that the Hungarian Astronomical Association (HAA) is running and you want your observations from that campaign linked to the HAA as the source. Before you upload your observations from that campaign, you would change your Primary Affiliation to HAA as the Organization. The code for HAA would appear in the Organization field of each of those observations.

We will begin using this Organization field on January 4, 2010. Every observation submitted from that date onward will have something in the Organization field. If you have questions, please don't hesitate to contact me ([eowaagen@aavso.org](mailto:eowaagen@aavso.org)). We look forward to continuing to receive your observations! ★

### INSTRUCTIONS ON CHOOSING AN ORGANIZATION TO BE PART OF EACH DATA RECORD

1. Log in to Blue&Gold ([www.aavso.org/bluegold](http://www.aavso.org/bluegold)).
2. Go to the “Update My Personal AAVSO Records” page.
3. Click on the “Primary Affiliation” drop-down menu.
4. Click on the organization. If you choose the blank line at the beginning of the list, you are choosing “no group.”
5. Click the “Update these fields in the Database” button at the bottom of the page.

## JULIAN DATE / MOON PHASE CALENDARS

2,450,000 plus the value given for each date

### DECEMBER 2009

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 5167	2 5168	3 5169	4 5170	5 5171
6 5172	7 5173	8 5174	9 5175	10 5176	11 5177	12 5178
13 5179	14 5180	15 5181	16 5182	17 5183	18 5184	19 5185
20 5186	21 5187	22 5188	23 5189	24 5190	25 5191	26 5192
27 5193	28 5194	29 5195	30 5196	31 5197		

### JANUARY 2010

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 5198	2 5199
3 5200	4 5201	5 5202	6 5203	7 5204	8 5205	9 5206
10 5207	11 5208	12 5209	13 5210	14 5211	15 5212	16 5213
17 5214	18 5215	19 5216	20 5217	21 5218	22 5219	23 5220
24 5221	25 5222	26 5223	27 5224	28 5225	29 5226	30 5227
31 5228						

### FEBRUARY 2010

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1 5229	2 5230	3 5231	4 5232	5 5233	6 5234
7 5235	8 5236	9 5237	10 5238	11 5239	12 5240	13 5241
14 5242	15 5243	16 5244	17 5245	18 5246	19 5247	20 5248
21 5249	22 5250	23 5251	24 5252	25 5253	26 5254	27 5255
28 5256						

Moon calendars courtesy StarDate online  
<http://stardate.org/nightsky/moon/>

## THE AAVSO AND 365 DAYS OF ASTRONOMY



A reminder that you can subscribe to both the 365 Days of Astronomy podcast and blog using the [available RSS feed](#) or via Apple's iTunes. 365 Days of Astronomy, that's what IYA 2009 is all about. We hope you'll tune in!

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Telephone \_\_\_\_\_ Fax \_\_\_\_\_ Email \_\_\_\_\_

Age \_\_\_\_\_ Birth Date \_\_\_\_\_ Vocation \_\_\_\_\_

Telescopic Equipment \_\_\_\_\_

Astronomical Experience(if any) \_\_\_\_\_

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