News from the Society for Astronomical Sciences

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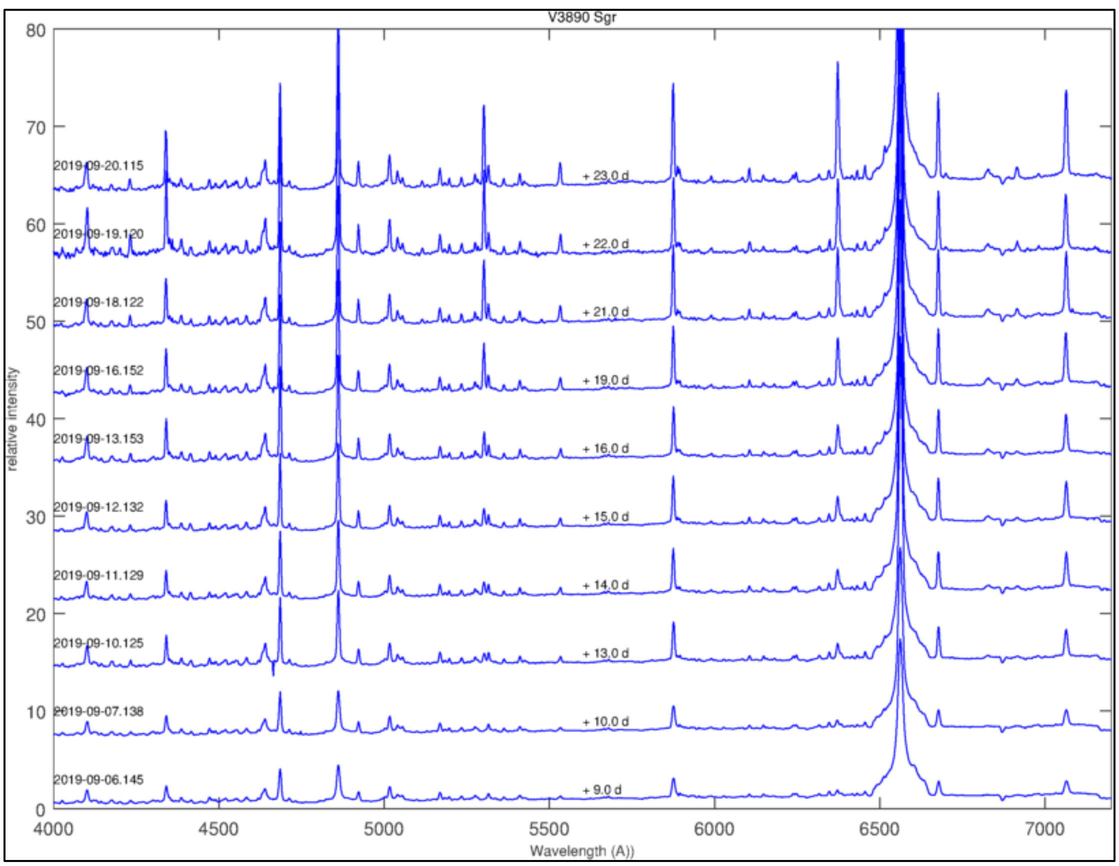
On-Line Video Discussion: *Remote & Automated Observing*

In order to facilitate detailed discussions on particular topics of interest to our members, we are going to try sponsoring some on-line discussion groups. The goal is to help our members share experiences, teach and learn from each other. The on-line format will let you dig as deeply into the topic as the participants feel is useful.

The first discussion topic will be **"Remote or Automated Observing"**. The first video session will be on November 7, 2019 at 18:00 UT = 10AM PST. The series on this topic will probably span 10-12 weekly sessions; but the end point will be up to the participants.

If you would like to participate in this discussion series, please contact Jerry Foote (jfoote@infowest.com). You will be sent a code that will allow you to join the on-line video session. For logistical reasons, we'll probably limit this to 12 participants, on a first- come first-served basis.

Scope: Remote observing can range from operating a backyard observatory from your house, to operating an observatory thousands of miles distance with or without on-site help. We will attempt to cover all aspects of taking



V3890 Sgr was detected in outburst on August 27. Here is a sequence of spectra taken with a LISA spectrograph, showing the evolution of this recurrent Nova, starting at the bottom spectrum taken 9 days after the outburst was announced, through the top spectrum at 23 days after the outburst. Note the changing shape of the prominent H-Balmer lines, and the strengthening of a variety of metal lines during this period. [Courtesy of François Teyssier and Forrest Sims].

scientifically useful observations from a remote sight.

This will be a "group-led" discussion. We hope to cover topics such as:

- Observatory hardware: Observatory roof/dome control, weather sensors, power backup, communications, environment control, computers and security.
- Telescope control: Commercial software packages such as ACP, The SkyX, Prism, and IDLE.
- Data acquisition software: All of the above and including MaximDL, PHD2 guiding, DS9 and other specialized acquisition and display software.
- Observing plans: On-Line resources, actual remote observing sessions.

Each session is expected to run 60 minutes. Some of the sessions may led by some of the product vendors. One or two may be pre-recorded videos of actual observing runs. Ideally, the Group participants will range from active remote observers to individuals just getting started – or just wondering about – remote or automated observing.

The discussion Moderator will be Tom Smith. The SAS Representative will be Jerry Foote.

The agenda for the first session will be:

1. Introduction of participants
2. Remote observing definitions
3. Observatory hardware
    - Roof/Dome control
    - Power backup
    - Communications
    - Computer
4. Set agenda/topics for next session.

We will hold these discussions using the on-line tool Zoom (https://zoom.us/). This tool is free to single party users. SAS will pay the group fees. Each participant will need a free Zoom account, and a computer with video camera and microphone (headset mic's work best).

Please contact Jerry Foote to be added to the list of participants (jfoote@infowest.com). We look forward to a productive discussion!

Planning for SAS-2020

Mark your calendars: the SAS-2020 will be June11-12-13, 2020 in Ontario, California, at the Ontario Gateway Hotel (same venue as this year).

The hotel remodel is progressing. By next year, we will be in the new guest rooms and the lobby and restaurant remodel should be finished.

Start thinking now about the project and results that you'll present at SAS-2020!

The Call for Abstracts is below. Registration will open in January, 2020.

Call for Abstracts

Papers are solicited on all aspects of astronomical science that are (or can be) pursued by observations with small telescopes (less than 1-meter aperture). We encourage presentation of work which follows the Scientific Method, including clear hypotheses, reproducible experiments, and results. Examples of work presented in the past are:

- Observations, data, and analysis of variable stars, eclipsing binary stars, double stars and stellar systems
- Observations, data, and analysis of asteroids and other solar system objects; and exoplanets
- Progress, status, and planning for upcoming observing campaigns such as the TESS follow-up initiative.
- Instrumentation/hardware and techniques (including software) for photometry, astrometry, spectroscopy, polarimetry, and fast-cadence observations (e.g. occultations)
- Investigations of atmospheric effects, light-propagation and scattering, light pollution monitoring.

All abstract submissions will be reviewed by a panel of experienced amateurs and professionals who will provide helpful feedback to authors and decide which submissions to schedule as part of the symposium as either presentations or posters.

Reminders for SAS Members ...

Membership Renewal: Even if you can't attend the annual Symposium, we value your support of the Society for Astronomical Sciences, and your interest in small-telescope science.

As an SAS member, you can request a bound copy of the Proceedings (free), even if you cannot register or attend the Symposium.

Symposium Proceedings: Published proceedings from all recent Symposia are freely available in PDF format at the PUBLICATIONS tab of the SAS website (www.SocAstroSci.org).

Symposium Videos: If you missed a recent Symposium, you can watch many of the presentation videos on the SAS website at the PUBLICATIONS tab.

Keeping in Touch: The SAS Yahoo group ("SocAstroSci") is a good way to keep in touch with the members and participants.

Kudos, Criticisms, or fresh Ideas? If you have any questions or ideas for the Symposium, ideas for Workshops or Technical topics that you would like to see, or comments on any other subjects related to the Symposium, please share them with the Program Committee at program@SocAstroSci.org.

Small Telescope Science in the News

Here are some interesting notes that have appeared in the literature over the past few months, showing the science that is facilitated by small-telescope photometry and spectroscopy.

Colours of the flickering source of Mira (R. Zumanov, et al)

During the photometry-lunch discussion at SAS-2018, a question was asked about the appropriate observing cadence for long-period variable stars. Somebody offered the "textbook" answer, that goes, roughly, "if the characteristic time scale of the brightness variation is T hours (or days), then you should strive to observe about every T/10 hours (or days)..." The implication was that, if the period of your target variable is about a year, then making an observation every month is sufficient; and every week is more than sufficient.

Then, someone else mentioned that there have been reports that Mira-type variables do surprising things, especially near minimum light. If true, then (a) devoting some telescope+CCD time to them is a good idea (most of them are too faint for visual observers, at minimum brightness), and (b) a much more rapid cadence of observations might be appropriate. But no one offered a suggestion as to how frequently observation/data should be gathered for these stars. Well, now here is a paper that offers a tantalizing suggestion (get the pre-print at https://arxiv.org/abs/1903.03782v2).

The authors did time-series photometry of Mira on three nights when it was near minimum brightness in 2018. Their runs were about two hours long, with typical cadence of about 1-1.5 minutes between CCD exposures. They observed "flickering" of up to ≈ 0.1 magnitude, with characteristic time scale of less than a half-hour. Their suspicion is that the flickering has something to do with Mira's white-dwarf companion ingesting the red-giant's stellar wind.

My suspicion is that this is pretty compelling evidence that it would be worthwhile for some of us to do long-duration time-series photometry runs on Mira and other long-period variables, to get a closer look at what's going on. We may not want to restrict ourselves to minimum light, either.

The authors of this study cycled between B- and V-band filters in order to make estimates of the color of the "flickering" source, and we should probably follow their example.

Stellar Evolution in Real Time: Models Consistent with the Direct Observation of a Thermal Pulse in T Ursae Minoris

by László Molnár, et al (The Astrophysical Journal, 879:62 (14pp), 2019 July 1)

The textbook says that stars on the Asymptotic Giant Branch should evolve rapidly, as changes occur in their internal structure and energy-generation mechanisms. One of the predicted phenomena is a "Helium flash" caused by unstable burning in the Helium-fusion shell within the star. These events are expected to cause several observable effects: chemical abundance changes in the photosphere (as material is "dredged up" by restructuring of the internal structure of the star); changes in the pulsation cycle (if the star happens to be a pulsator) – in particular, the pulsation period is expected to decrease and the surface luminosity to decrease at the onset of the Helium flash.

The authors of this paper used the 110-year record of AAVSO (visual) observations of T UMi, to provide compelling evidence that the amplitude of its pulsations began dropping in ≈2000, and at the present time the pulsation amplitude is significantly smaller than it was a decade ago ($\Delta V \approx 1$ mag now, versus ≈4 magnitudes a decade ago). The average luminosity appears to have been decreasing by about 0.5% to1% per year. The period of the pulsations began shortening in about 1975 – 1980.

The authors combine this observational history with models of the Helium-flash, and extrapolate into the near future. The most sensitive test of the models is continued monitoring of the pulsation period and amplitude. Depending on the mass of T UMi, the shortening of the pulsation period should stop and then re-lengthen, possibly as soon as 10 years from now (if $M_* = 2.8\ M_{Sun}$); or a hundred years from now (if $M_* < 1.8 M_{Sun}$).

This report encourages observers to maintain visual (and CCD) monitoring of T UMi, so that the data will continue to accumulate for future analysis of these changes (to decide if we are indeed seeing a Helium flash, or if something else is going on). The authors don't specifically call for spectra, but it's hard to imagine that an ongoing record of the star's spectral changes wouldn't be useful. At Vmag≈ 11 (and presumably a red color), the target is well within the range of ALPY and LISA spectrographs on backyard-scale telescopes.

Evaluation of scientific CMOS sensors for sky survey applications

by S. Karpov, et al (accepted to *Astronomische Nachrichte*n, pre-print at https://arxiv.org/abs/1909.00729.)

We've talked quite a bit at recent SAS Symposia about the operating principles, performance, and characterization of sCMOS ("scientific CMOS") sensors for astronomical use, and how they differ from CCD imagers. Here is a report on the characterization of a new product – the Andor Marana sCMOS camera – with an eye to using it for a wide-field astronomical survey instrument.

The "bottom line" is that the authors conclude that this is a fine candidate for their application. It has wonderfully low read noise, excellent uniformity, and low dark current. They also identify a few special ways that the sCMOS device differs from the CCDs that many of us are used to. These differences include the way it achieves 16-bit dynamic range, the statistics of dark-current, and the presence of on-board processing.

Most of the CCDs that we use for photometry and spectroscopy provide 16-bit A/D output, and generally excellent linearity. This sCMOS provides 16-bit output, but it accomplishes that by using two separate amplifiers ("low-gain" and "high gain") each with11-bit digitization. The two outputs are combined to achieve the same effect as 16-bit digitization. The authors find that this approach works, but that the photon transfer curve does have "hiccup" about 1500 ADU, where the processing transitions from the low-gain to the high-gain amplifier. Nevertheless, the overall linearity of the sensor is very good (non-linearity < 3%) up to about 50% of the full-well signal.

If we examine the histogram of dark-current on a single pixel of our CCD, we expect to see a Gaussian distribution. The sCMOS camera has an additional unusual phenomenon in which an individual pixel may jump (randomly and rapidly) between "low", "normal" and "high" dark current states. The authors call this "Random Telegraph Signal". The good news is that the effect is small – less than 10 ADU – but it does mean that the dark-frame statistics are different from what we are used to with CCDs.

We are all used to seeing a scattering of defective pixels on our CCDs, and standard image-processing routines can mask those if desired. In contrast, the Andor Marana camera has an internal "blemish masking" routine that identifies defective pixels (high dark current or excess read-noise) and replaces their signal with the average of the 8 nearest neighbors. The good news is that only about .02% of the pixels are masked in this way. The bad news is that this on-board processing alters the statistics of the dark frames, and might adversely affect some science goals.

This isn't the only "on board" processing that is done by the camera. There is a gradient of dark current (from bottom to top of the image), and also some amplifier glow (at the left and right sides of the image – neither of which is surprising nor significant issues. However, the camera has an on-board algorithm that attempts to correct for these effects, and the authors discovered that the algorithm seems to over-correct for the amplifier glow. They were able to get an undocumented Software Development Kit from Andor, to disable this "Anti-Glow technology".

There is quite a bit to learn about these new devices, and this article will be a useful educational resource as we see them move into the marketplace.

VV Cephei update – 2019-09-20

Ernst Pollman has just reported a model of the VV Cep system, that is a nice match to the spectroscopy reported since the beginning of the eclipse. In the model, the modulation of H-alpha equivalent width and the modulation of V/R ratio of the H-alpha line are explained by a precessing accretion disk. See his report at

https://astrospectroscopy.de/.cm4all/uproc.php/0/conclusion_2019-09-20.pdf?_=16d49fcdb38&cdp=a

and a neat animation of the disk precession at

https://astrospectroscopy.de/.cm4all/uproc.php/0/disk%20axis%20precession.WMV?_=16d4a0562d0&cdp=a

Spectra taken by SAS members James Foster and Al Stiewing contributed to this result. Well done!

2019 Symposium Sponsors

The Society for Astronomical Sciences thanks our Sponsors for their participation and financial support. Without them, our Symposium would not be possible. We encourage you to consider their fine products for your astronomical needs.

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The Society for Astronomical Sciences welcomes everyone interested in small telescope astronomical research. Our mission is to foster amateurs' participation in research projects as an aspect of their astronomical hobby, facilitate professional-amateur collaborations, and disseminate new results and methods. The Membership fee is $25.00 per year.

As a member, you receive:
• Discounted registration fee for the annual Symposium.
• A copy of the published proceedings on request each year, even if you do not attend the Symposium.

Membership application is available at the MEMBERSHIP page of the SAS web site: http://www.SocAstroSci.org.

The SAS is a 501(c)(3) non-profit educational organization.

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