British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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Photograph kindly taken by Liz Buczynski

"IF YOU HAPPEN TO BE PASSING MY DOOR!"

Denis Buczynski

Occasionally BAA members on holiday in Scotland, who are perhaps driving to Orkney, pass (on the A9) within 10 miles of my home and observatory at Portmahomack on the Tarbatness peninsula; sometimes they call in to see me.

I would like to extend an invite to any BAA or VSS member who would like to visit to do so. If you know ahead of time that you will be visiting the area, please contact me by e-mail < *buczynski8166@btinternet.com* >, or if it is at short notice, when you realise you are passing close to Portmahomack, it would be quicker and easier to contact me by phone: Tel: 01862 871187. Both my e-mail address and my telephone number are now on the back cover of the Circular.

(*continued opposite*)

FROM THE DIRECTOR

Roger Pickard

BAAVSS Section Meeting

I am very grateful to Tony Markham for writing up the notes for our last Section Meeting, held at the Humfrey Rooms on Saturday March 19th 2016. I hope you have all also had the chance to read the Speakers' talks as detailed on the website at: *http://www.britastro.org/vss/baavss_section_meeting_2016.htm.*

In his opening paragraph Tony mentions the outburst of V1028 Cygni, which I had attempted to observe, only to find I had actually observed V1928 Cygni! But as I had never observed either star before how did I find out which one I did observe?

The answer was in an amazing piece of software on the world-wide web at:
http://nova.astrometry.net/
All I had to do was upload one of the offending images, and within minutes the answer, giving the true coordinates of my image, was returned. Amazing.

Old Data Input

I thought it time to give an update to the request for assistance for old data input to the Database.

Whilst we still have some way to go, I am delighted to advise that following my previous request for assistance, which met with some success, the end is in sight! However, as long as we still have a few observers who only report their observations on paper, we will always need some helpers to transcribe them into digital format. But the great news is that the data I am now sending out to be transcribed is for the years 2013 onwards, and I anticipate that by the end of this year we will be up to date on current observations.

There are still some other outstanding observations from further back but they are few and far between and have mostly been held back as they are not so straightforward to enter. We also occasionally come across an old observers notebook, and these also need to be checked to see whether the observations contained have already been entered in the database.

But largely, it is a very promising picture, so many thanks to all those data inputters. In this respect I must particularly thank Clive Beech and our current Secretary, Bob Dryden who is doing an amazing job.

continued on page 4

On a recent visit here I was able to photograph another three Variable Star Section people posing in front of the **George Alcock Telescope**. They are right to left: **Dave Gavine**, **Storm Dunlop**, **Rhona Fraser** and myself **Denis Buczynski**.

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From the Director continued.

Spectroscopy

Hopefully, those of you who are even vaguely interested in spectroscopy have seen the details of the BAA Spectroscopy Initiative in the April Journal and in a posting in the Spectroscopy section of the BAA Forum.

The BAA are inviting members of at least two years standing to apply for a Ridley Grant of £400, which will cover 25% of the normal price of an Alpy 600 spectrograph. Add to this the fact that the manufacturers of the Alpy, Shelyak, are also offering a matching 25% discount on their list price to participants in this scheme, so in effect the equipment will be available to BAA members at half price.

The Ridley Grant conditions can be found on the BAA webpage at:

https://britastro.org/about-grants

along with a link to download the application form. Please note that a detailed description of the intended use of the equipment, and the names of the BAA Observing Section(s) to which results will be sent, should be supplied with the application form. We expect these spectrographs to be put to productive use!

The deadline for applications is 2016 June 30 so, if you are interested, do not delay.

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THE IAU TRANSIENT NAME SERVER AND SPECTROSCOPIC CONFIRMATION OF SUPERNOVA CANDIDATE AT2016bme

Robin Leadbeater

At the start of 2016 the IAU Transient Name Server (TNS)[1] became the official system for the reporting, confirming, and naming of potential supernovae. The TNS replaces the system run by Central Bureau for Astronomical Telegrams (CBAT) which had largely fallen into disuse, due to the number of discoveries made by automated survey systems which were not being reported through the official system. Of 3,468 probable supernovae reported through various channels in 2015 only 66 received official IAU names[2] .

The new system is fully automated and accepts reports from anyone registered on the system, amateur or professional. It does put the responsibility for accuracy firmly on the shoulders of the submitter, however, as there is no expert gatekeeper checking the validity of submissions. It appears to be significantly more complete than the old system, in that to date (23 May 2016) 2,357 of 2,795 potential supernovae were reported through TNS, of which 238 have been confirmed spectroscopically and given official names[2], though some survey teams have yet to adopt it fully.

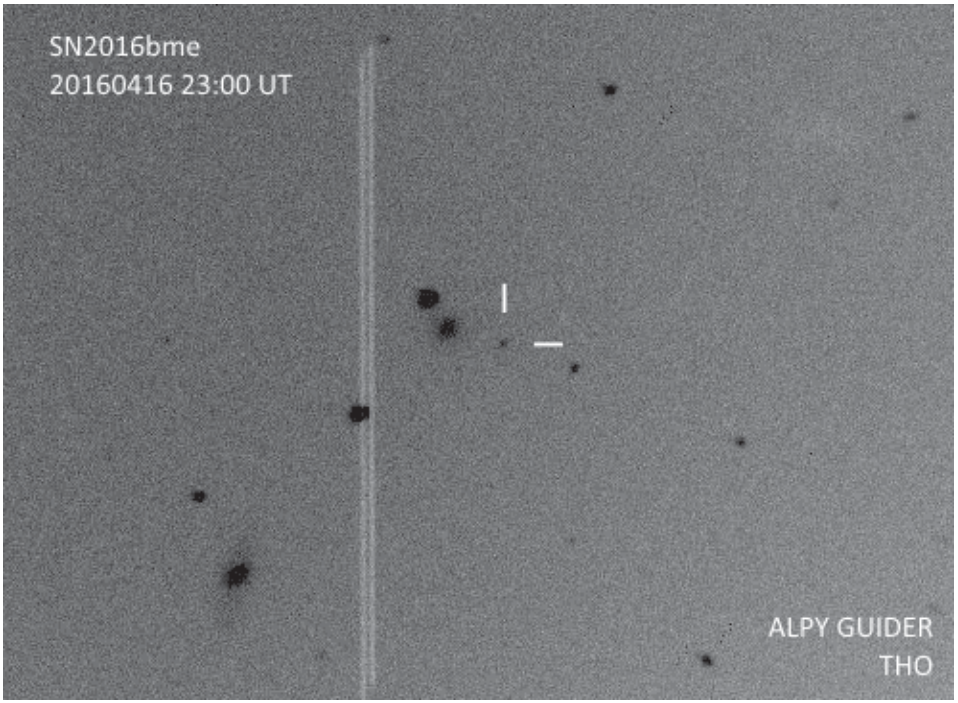


Figure 1: SN2016bme as it appeared in the spectrograph guider (the vertical line is the spectrograph slit where the target is positioned during spectrum acquisition)

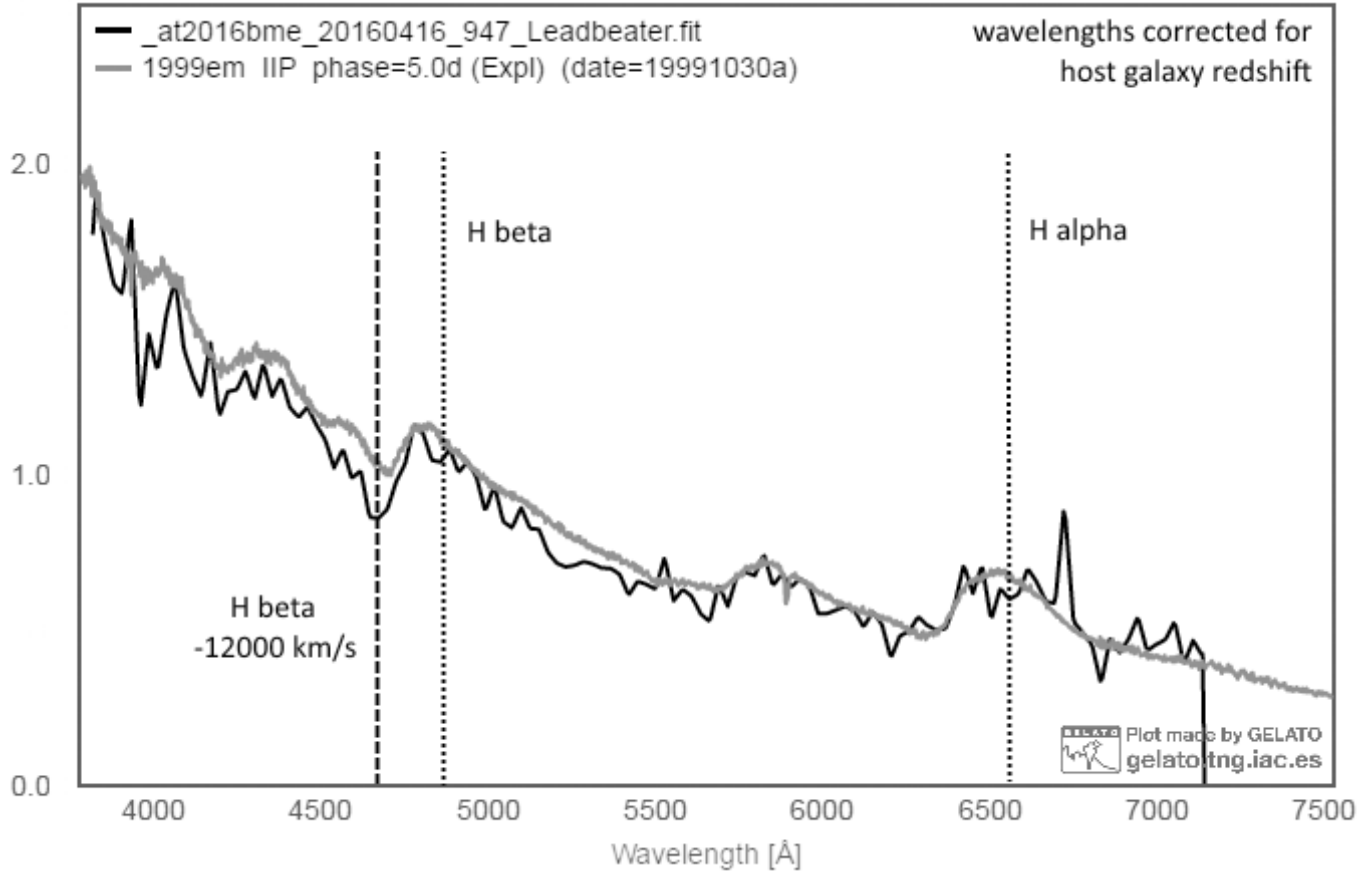
On 13th April 2016 Constantine Emmanouilidi of the amateur Greek Supernova Survey Team (GSST)[3] reported via TNS the discovery of a potential supernova in UGC 4671, designated AT2016bme[4]. At magnitude 16.5, it was potentially within range of my ALPY spectrograph which has been modified specifically for generating very low resolution spectra (R ~130) for supernova identification[5]. I also noticed a report of another object (AT2016bmf), in the same galaxy field, on the same day. Checking the images, it became clear to me that the Greek team had made an error in the submitted coordinates. I contacted them, and logged a comment in TNS pointing out the duplication, and the two reports were subsequently combined in TNS. (Fortunately for the Greek team their report was the earlier so they were confirmed as the discoverer !)

Despite a gibbous moon, I was able to record a spectrum on 16th April. Figure 1 shows an image of the supernova as it appeared in the spectrograph guider.

The spectrum showed a blue continuum with broad emission lines at the Balmer H-alpha and H-beta wavelengths, corrected for the redshift of the host galaxy. The H-beta line also showed signs of a blue shifted absorption (P cygni profile shape), from which an estimated velocity for the ejected material could be measured (~12,000 km/s). These features are characteristic of a type II (core collapse) supernova. The GELATO on line classification system[6] was also used to confirm the object as a young type II supernova

Text continues page 7.

Figure 2: Spectrum of sn2016bme (black) overlaid on best fit reference spectrum (grey)



(probably IIP). The spectrum and the best match from GELATO are shown in Figure 2 (on opposite page).

On receipt of the submission of my spectrum and classification report, TNS automatically allocated an official IAU supernova identification (SN2016bme) and generated on line certificates for the discovery and confirmation.

This may possibly be the first supernova candidate to be officially confirmed spectroscopically by an amateur. If so, it is perhaps particularly fitting that the discovery of the supernovea itself was also made by an amateur team!

References

1. *https://wis-tns.weizmann.ac.il*
2. *www.rochesterastronomy.org*
3. *www.amateur-astronomy.gr*
4. *https://wis-tns.weizmann.ac.il/object/2016bme*
5. *www.threehillsobservatory.co.uk/astro/spectroscopy_20.htm*
6. *https://gelato.tng.iac.es*

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SU LYNCIS - A NEW SYMBIOTIC VARIABLE

David Boyd

The red giant star SU Lyn is listed in Simbad as a semi-regular pulsating variable. It has recently been identified in a paper by Mukai et al.[1] as a new symbiotic star. They say:

"The X-ray spectrum, the optical to UV spectrum, and the rapid UV variability of SU Lyn are all consistent with our interpretation that it is a symbiotic star containing an accreting white dwarf."

It is powered by accretion onto the white dwarf, rather than shell-burning, resulting in weak optical emission lines and the previous failure to identify it as a symbiotic variable. They suggest that the weak emission line signature of accretion-powered symbiotic variables may mean there are many more similar to SU Lyn yet to be discovered.

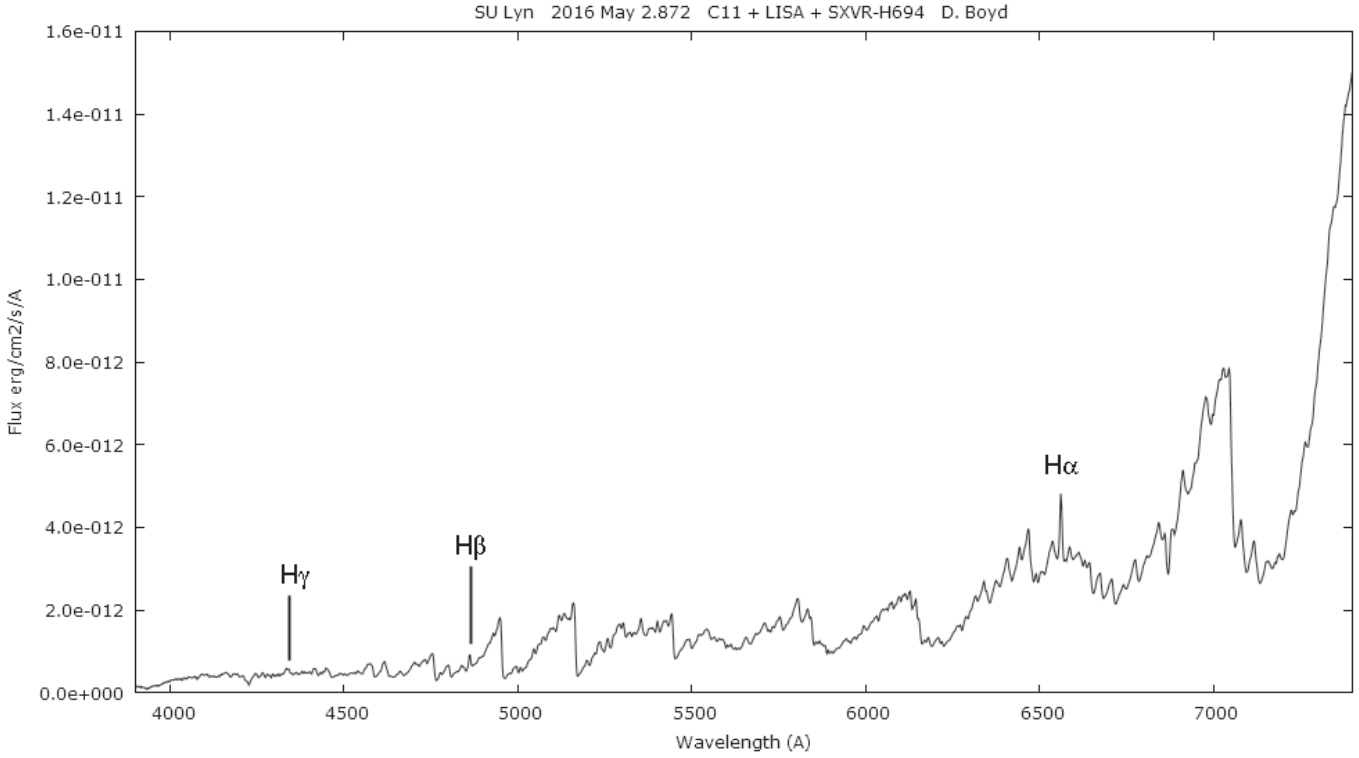
I recorded the flux calibrated spectrum of SU Lyn shown in Figure 1 (page 8) on 2nd May, and concurrently measured its V magnitude as 8.62 and B-V colour index as 1.97. With no correction for reddening the spectral type is close to M6III, consistent with M5.8III assigned in the paper. It has a weak Hα emission line, and just detectable Hβ and Hγ emission.

This article was originally posted on the ARAS Spectroscopy Forum:
http://www.spectro-aras.com/forum/]

References

1. *http://arxiv.org/abs/1604.08483v1*

Figure 1: Flux-calibrated spectrum of the symbiotic star SU Lyn recorded with a LISA spectrograph on a C11 scope.



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THE VARIABLE STAR SECTION MEETING AT NORTHAMPTON, 19TH MARCH, 2016

TONY MARKHAM

Morning Session

VSS Director Roger Pickard welcomed everyone to the meeting and mentioned several recent cases of interesting variable star activity. This included the outburst of V1028 Cygni, which he had attempted to observe. However, although he instructed his telescope to make a series of observations of this star, he discovered the following morning that he had made a typing error and it had actually observed V1928 Cygni !

David Boyd gave an overview of 15 years' data for DW UMa, an eclipsing nova-like cataclysmic variable, collected by the Center for Backyard Astrophysics consortium (CBA). The DW UMa system has an orbital period of 3.28 hours, and is comprised of a low mass main sequence star that is losing material to a white dwarf via an accretion disc. This disc has a wide rim that usually hides the white dwarf from our view. The white dwarf is believed to have a mass of around 0.77 solar masses and to be Earth-sized. The main sequence secondary star is around 0.30 solar masses. The two stars are separated by just over 1 AU. The accretion disc is around 0.64 solar radii in size. DW UMa is normally around magnitude 14.2 but shows occasional low states when it can fade to around 18th magnitude. Plotting annual average O-C values for eclipse times is suggestive of a sinusoidal variation with a period of 13.6 years. This variation could be related to a postulated third body of around 10 Jupiter masses in the system, or alternatively it could be due to a magnetic cycle in the main sequence star (Applegate effect). More data will be required to determine which explanation is correct.

In 1999, DW UMa was in its low luminosity state, but it brightened over the next few years. In more recent years, the main brightness changes have been during eclipses, although there are also smaller out-of-eclipse variations. Analysis of these variations shows the presence of apsidal and nodal precession of the accretion disc, as well as positive and negative superhumps. Analysis of the eclipse parameters (skew, depth, full width at half depth) indicates that all three vary over time. This may be due to the disk being tilted and slowly precessing. During the 1999 low state, the eclipses were narrow and steep sided. This is believed to be due to the accretion stream having shut off (possibly due to a cool star-spot at the inner Lagrange point) and no accretion disc being present. Assuming that this explanation is correct then the accretion disc itself must be of magnitude 14.2 in the high state; the white dwarf (usually hidden, but visible during low state) must be of magnitude 17.8, and the main sequence secondary must be of magnitude 19.9. Thus, when we observe DW UMa in its normal high state, virtually all the light we see must come from the accretion disc.

Des Loughney reported on his observations of the star V1061 Tauri, an eclipsing binary with an amplitude of less than half a magnitude. Stars with such small amplitudes have not previously been studied by the VSS but the development of DSLR photometry now makes it feasible for the Section to study them. His first challenge was to select suitable comparison stars based on their similar magnitudes, similar B-V values, and closeness to the variable. The variability of V1061 Tau was discovered in 1990. The primary eclipse is 0.4 magnitude deep and secondary eclipse is 0.3 magnitude deep. The latest (Krakow) period is 1.3852288 days, but is from 13 years ago.

Des uses a Canon 550D DSLR with a 200mm lens, taking a sequence of twenty 4 second exposures at ISO 800, f3.2, and then stacking the images in AIP4WIN. He finds that his biggest source of error arises from scintillation during windy Edinburgh nights. For reference, when observing rho Cas, his standard deviations have ranged from 0.007 to 0.065 magnitude, averaging 0.032 magnitude . Although V1061 Tau is catalogued as a beta Lyrae type (EB) star, Des finds that the light curve is much more like that of W UMa. There has been some uncertainty as to whether eclipses are total. His observations of 2016 Feb 10 indicated that the secondary eclipse is total. However, total eclipses in systems of closely matched stars should be around 0.75 magnitude deep, rather than 0.3-0.4 magnitude. One possible explanation for this discrepancy would be the inclusion of light from a third unresolved star in the system. Des recommends that more observers follow this star.
The slides from this presentation can be viewed via:

http://www.britastro.org/vss/V1061Tau.pdf

Dr John Southworth (Keele) featured a historical perspective in his talk "Eclipsing Binaries - the Royal Road". In 1783, John Goodricke had suggested that a dark body was responsible for the periodic fades of Algol but it was not until 1890 that Vogel showed it to be a spectroscopic binary, and not until 1910 that Stebbins showed it to have a detectable secondary eclipse. Stebbins had in 1891 showed that beta Aurigae was a doubled-lined spectroscopic binary and had determined the radius of each star.

Although a paper on Light Curve Modelling had been published by Russell as early as 1912, there was little further progress until computers were brought into use in the 1960s and 1970s. Wilson and Devinney published a definitive paper in 1971, and more recently, the PHOEBE system became available in 2005. Many observers find the JKTEBOP system easier to use, see

http://www.astro.keele.ac.uk/jkt/codes/jktebop.html

From the light curve, it is possible to derive the orbital period, eccentricity, inclination and relative sizes of the stars. Spectra provide radial velocity information and hence the mass ratio. Further analysis provides information regarding the surface density and mean density and, subject to some assumptions, temperature and luminosity information. Given that both stars in the system should be of the same age, these results can be used to test theoretical stellar models. This work has been used to interpret Kepler data and, once the eclipse related variations have been subtracted, useful insights have been provided into the behaviour of red giants, delta Scuti pulsators, gamma Doradus stars and very low mass stars in binary systems.

The near future will see further exploitation of the Kepler data; the Kepler EB catalogue contains 2878 objects. The BRITE satellites will study systems brighter than magnitude 5.5. NASA's Transiting Exoplanet Survey Satellite (TESS) is scheduled to be launched in 2017. Gaia will provide good parallaxes, but photometry is limited and so it will not provide detailed light curves. ESA's PLATO will provide long duration monitoring of bright stars. It is expected to find 50 000-100 000 EBs and to deliver long term light curves. Possible projects for amateurs include using eclipse timings to provide information about apsidal motions, and monitoring for light-time effects in triple star systems. A copy of John Southworth's slides can be viewed at:

http://www.britastro.org/vss/southworth.pdf

Afternoon Session

Simon Hodgkin (Cambridge) gave an overview of "Transient Astrometry with the Gaia satellite". This relates to the detection of objects exhibiting short-lived brightness variability. There are many categories of such objects, including Novae (largely understood), Luminous Supernovae (observed, but not understood) and Fallback Supernovae (theoretical, but not yet observed). During the 1980s, most transient objects found were identified by amateurs. Professional astronomers only started to regularly look for these objects during the 1990s.

Gaia, launched on 2013 Dec 19, has a limiting magnitude of around 20.7 and covers the whole sky, scanning 1230 square degrees (approx 2.5% of the sky) per day. There are other surveys which carry out more frequent checks, but these only monitor small areas of the sky. Gaia has two telescopes which point in directions 106.5 degrees apart, perpendicular to its slowly precessing spin axis. Each field is revisited approximately every 30 days. The field of view is 0.7degree x 0.7 degree. In addition to the positional information recorded for each star, a low resolution spectrum and a radial velocity measurement are also captured. The target is to make around 225 billion astrometric measurements covering around 2 billion stars.

Processing at Cambridge starts around a day after the observations have been made, with the results being available 1-2 days after the observations. Hence detection reports will not be as immediate as those from SWIFT. The primary aim of the analysis is to detect objects that are new or changed compared with what was seen in earlier runs. Prioritisation means that EBs will be left for later study but RCBs will be followed up immediately. In the first year, 297 runs "ingested" 16 billion possible transients and 52 million alert candidates which were filtered down to 273 published alerts, from which it was possibly to classify the nature of 108, including 74 supernovae. Aggressive filtering of 100 000 -1 000 000 alert candidates per day reduces the number of candidates needing to be classified by the human eyeball to a few hundred. This is currently generating around 1 published alert per day (the mission target is 10 per day). Simon illustrated the results to date by describing several discoveries, including GAIA14aae, only the third known eclipsing AM CVn star (18th magnitude, period 49.71 minutes).
The GAIA Alerts Interface can be found at
gsaweb.ast.cam.ac.uk/alerts

The data release schedule will see object positions and G magnitudes published in October 2016, followed by light curves and radial velocities in later years. Everything should have been released by 2022. An Educational Outreach Project can be found at
gaia.ac.uk

Schools will be encouraged to carry out photometric follow up on alerts using robotic telescopes. A copy of Simon's slides can be seen at
http://www.britastro.org/vss/hodgkin_baavss.pdf

Andy Wilson gave a review of the current status of the BAA VSS database. This now includes 2,739,651 observations, by 943 observers, of 2,707 stars. Of the observations, 2,000,234 are visual, 732,052 are CCD, 5,621 are DSLR and 1,744 are photographic. 72 user accounts have been set up, but only 32 have been used to submit observations (do observers need more guidance?). Observations, including corrections to previously transmitted data, are submitted quarterly to the AAVSO. Andy also illustrated the statis-

tics by showing how observer and observation numbers had fluctuated over the years, and by listing the leading observers in the various categories. Future plans include: the generation of phase plots for EBs, adding PEP data, recalculation using the latest comparison star magnitudes, and improving the data entry process. Andy's slides can be viewed at:

http://www.britastro.org/vss/BAAVSS_2016March_AndyWilson_Database.pdf

Chris Jones provided an update on the ICCE programme. This programme came into being after Mike Collins had imaged many interesting variable objects during the 1990s, some of which were new discoveries, and some of which had incorrect catalogue information. Some of these variables are still not listed in VSX. The ICCE project's aims include the provision of charts, the resolution of identification uncertainties and the correcting of variability classifications.

Chris then reviewed the current situation for the stars currently on the list. One star with identification issues had been V720 Cas: there were three stars close together at the catalogued position. It is believed that the variable has now been correctly identified. In addition, it seems likely that a second of the three stars is an eclipsing variable. V720 Cas is most likely a Mira variable (range 11.0 - <15.8), whereas it has been listed in VSX as a semi-regular with range 9.6-12.5.

In the case of V1717 Aql, BAA monitoring has shown that the GCVS had identified the wrong star of a close pair as the variable. Stars TAV 0559 +06, TAV 1933 +53 and NSV 16874 have poor sequences; their comparison star magnitudes were taken from the unreliable True Visual Magnitude Star Atlas. Other stars needing better sequences are Q1992/076, NSV 13806, NSV 25835 and NSV 14687. For V1258 Tau (NSV 2249), the BAA observations suggest a period half of that listed in VSX. Another star, CC Cam, has been shown to be a Mira with a period of 246 days and will probably now be dropped. An apparent sudden change in the behaviour of NSV 25186 from 2015 onwards needs to be investigated.

Looking forward, help from CCD observers would be useful in using photometry to set up sequences and for the observation of low amplitude and very red variables. Visual observers can also check sequences. Help would also be welcome with analyses, the provision of feedback and with the preparation of papers. A copy of the slides from this presentation can be viewed at:
http://www.britastro.org/vss/ICCE update 2016.pdf

Late Afternoon session

Gary Poyner's presentation "A Telescopic variable star hop around the Arrow", highlighted several interesting variables in the Sagitta region.

The brightness variations of RZ Vul were discovered as long ago as 1906, but it was then largely ignored for the next 60 years. IBVS 135, in 1966, suggested that it was possibly a U Gem or nova-like star, whereas IBVS 1371, in 1977, listed it as a RVB star and Schaefer, in 1987, classified it as a RCB star. VSX now lists the star as a RVB variable with a range of 11.7 - 15.0V and a period of 85 days. Gary started observing it in around 1990 using a TA chart. Since 1999, it has been showing a number of deep minima which seem to be getting progressively deeper. AAVSO observations of the star go back to 1964 but show

no minima during the earlier decades. A nearby magnitude 15.3 star has the potential to affect the reliability of observations during these deep minima.

FG Sagittae has sometimes been described as a "chameleon star". It was around 9th magnitude for many years, but a fade to magnitude 14 occurred in 1993, and it has remained active ever since. By 2007, it had faded to magnitude 17. It is now around magnitude 19 and so is a target for CCDs or large telescopes. It is a post asymptotic giant branch (AGB) star, whose spectrum has changed from B to K over the past century.

V Sagittae is a close binary system that also shows eclipses. It has a magnitude range of 8.6-13.8V and a period of around 320 days. It also shows three-magnitude flares, plus variations over timescales of days. It is likely that mass transfer to a white dwarf component is involved. The visual amplitude has been decreasing in recent years. The 12.5-hour orbital period also appears to be decreasing. In addition, the depth of the eclipses seems to be variable, ranging from 0.5 magnitude to 1.5 magnitudes.

PU Vul is a symbiotic nova. Kuwano observed it at magnitude 9.0p on 1979 April 5, and it was subsequently reported that Honda had imaged it at magnitude 10.0p on 1978 Aug 21. It remained bright until 1989-90, but steadily faded after that. Its overall range has been 8.7-16.6p. The system has an orbital period of 13.5 years. It shows eclipses whose depth have been decreasing in line with the fade of the overall brightness of the system. The PU Vul system most likely includes a white dwarf, a nebula and a red giant.

V339 Del (Nova Del 2013) had been classified as type NA: a fast classical nova. Beryllium and Lithium were both detected in the spectrum during the outburst: this was a first (theory had predicted that Beryllium would be created in novae and then decay to Lithium).
The slides from Gary's presentation can be viewed at:

http://www.britastro.org/vss/Gary BAAVSS 2016.pdf

John Toone's talk was titled "America's First Variable Star". He introduced his talk by highlighting the fact that variable star observers in the USA seemed unaware that T Leonis (a dwarf nova) was the first variable star discovered from their country. Indeed, over the decades, the star that has been recognized as the first variable discovered from the USA has fluctuated back and forth. Although listings from 1862-1908 quoted T Leonis, subsequent listings quoted T Orionis (jointly with NV Orionis from 1936 onwards). Although T Leonis was eventually reinstated, an added complication is that the star was renamed as QZ Vir in 2006!
T Leonis was first sighted by C H F Peters in 1862 while he was observing the asteroid Clytia from Hamilton College Observatory in New York. He noted the presence of this extra star in late April whilst the American civil war was raging. It remained bright into early May, but then faded from view. He saw it again however, on May 10-11 before it then finally faded away. These changes fit in with the idea that Peters saw a superoutburst and rebrightening, making it the first such event observed for a type UGSU variable.

Peters had been born in Denmark, but moved to the US in 1854. He subsequently discovered two comets, 48 asteroids and 16 variable stars, all by visual means. He was however also a controversial figure who fell out with several leading US astronomers, and this seems to have contributed to his legacy being overlooked in subsequently written historical accounts, especially those originating from Harvard College Observatory.

Cannon and Pickering at Harvard wrote in 1907 that "T Leo is probably not variable" and followed this up in 1909 stating that "T Leo is constant". However, as John highlighted, Harvard's own plates just prior to 1909 do actually show T Leonis in outburst on several occasions! With T Leonis discounted post 1909, the status of "first US-discovered variable star" transferred to T Orionis, which had been discovered by Bond at Harvard in 1863. With the variability of T Leonis discounted, no attempt was made, when constellation boundaries were fixed in the late 1920s, to ensure that it was included within the boundary of Leo.

Eventually, however, the variability of T Leonis was rediscovered, and from 1957 onwards, outburst observations and spectra gradually led to its classification as a dwarf novae of type UGSU. A final twist is that, with T Leonis having been ignored when the constellation boundaries were drawn up, it was renamed as QZ Vir in the 78th Name List in 2006.

John concluded by questioning why T Leonis was renamed, because there was no issue with the name before 2006 and the error was in the constellation boundary, not the variable star designation. John also said that Peters' legacy ought to be re-appraised as he was quite possibly the finest visual observer that the USA had produced.
For a copy of John's slides, go to:
www.britastro.org/vss/BAA VSS 2016 Americas First VS [Compatibility Mode].pdf

In the final talk of the day, **Shaun Albrighton** described possible future plans for the Binocular Programme, and highlighted some recent interesting results. Over the years, more stars have been dropped from the programme than have been added. Shaun would like to add more candidates, by extending the limits to fainter magnitudes accessible by larger binoculars, and by adding variables discovered by Hipparcos.

Looking at period analyses using "vstar" for current programme stars, Sean reported that for U Mon this reveals periods 2388 days and 45.71 days: the latter is actually half of the actual period of this RVB variable. For RW Boo, the GCVS lists a period of 209 days. He noted that Tony Markham had recently flagged that RW Boo seems to currently be varying with a somewhat longer period and that minima have become particularly deep. Shaun's analysis revealed that the deep minima seem to occur at intervals of 410 days, while an analysis of all observations from just the last few years suggests a period of 332 days, thus illustrating the complexity that can occur in semi-regular variables.

For AF Cyg, the light curve suggests that a secondary period is present in addition to the 94-day period revealed by the analysis of BAA data. In the case of X Oph, the light curve seems more reminiscent of a semi-regular rather than a Mira variable. However, as John Toone pointed out, this is because the observed range is constrained by the presence of a magnitude 8.4 star very close to the variable, and hence we do not see the true minimum brightness of X Oph. For CE Lyn, the BAA analysis reveals semi-regular variations with a period of 529 days (VSX lists no period). The observed range of 7.7-8.6 is somewhat larger than the 7.20-7.66Hp found by Hipparcos. For V UMi, the BAA analysis indicates a period of 73 days, in line with that listed by VSX, but also hints of a 760-day period.

Shaun's slides, which include analyses for additional stars, can be viewed at:

www.britastro.org/vss/BAAVSS Binocular Section.pdf

ECLIPSING BINARY NEWS - JUNE 2016

DES LOUGHNEY

YY Geminorum

This interesting system about which much has been written is a challenge to observe although it is not faint.

It is a sextuplet system, otherwise known as Castor C. Castor, in Gemini. Castor A and Castor B which largely make up the star that we see are both binaries. About 1.2 minutes of arc from Castor AB is Castor C. YY Gem or Castor C is made up of two red dwarfs with masses averaging 0.61 of the sun. These dwarfs are only 3.9 solar diameters apart and orbit each other every 19.54 hours.

The out of eclipse magnitude of the system is 8.91V. The primary and secondary minimum is around 9.6V. The system is classified as an EA/DM+UV. The UV category is unusual and seems to mean that both stars in the system are subject to light variations due to either star spots or flares.

According to Wikipedia some athorities believe that that the variations of YY Gem are solely to do with flares or star spots and it is not an eclipsing binary.

A recent paper (1) suggests that the primary cause of variation is eclipses though flares occur. The interaction between flares and eclipse makes the system worth studying if you have the means to separate YY Gem from Castor AB.

Mass Photometry of a Globular Cluster

A recent draft paper 'Many new variable stars discovered in the core of the globular cluster NGC 6715 (M54) with EMCCD observations' illustrates a methodology of detecting variable stars. Using the methodology 1405 stars in the core were measured and 67 new variables detected (30 RR Lyrae, 21 long period irregular, 3 semi regular, 1W Virginis and one eclipsing binary). Data miners can access the photometric measurements at the Strasbourg Astronomical Data Centre.

It is perhaps surprising that only one new eclipsing binary was discovered as it is assumed that up to half of all stars occur in binary systems. Maybe there is a reason why there are not so many EBs in the core of a globular cluster.

An intriguing image is reproduced within the draft paper, of a finder chart for globular cluster NGC 6715. It can be found by opening the pdf found on the website *"arxiv.org/abs/1605.06141"* (reference (2)). All known variables and new discoveries have been labelled with their V numbers; known variables and new variables have different symbols for different groups and surveys. Details can be found on the pdf.

Zeta Andromedae

Zeta And is a fairly bright star with a magnitude of around 4. It is the subject of an article recently published in Nature (3). Zeta And was once classifed as an eclipsing binary of the Beta Lyrae class (EB/GS/RS) with a period of 17.77 days and a variation between 3.92

and 4.14.

Krakow no longer classifies it as an eclipsing binary (though it is a binary) and the GCVS states that it is a ELL/RS variable. In other words the small periodic variation (of only 0.22 magnitude) is solely due the ellipsoidal nature of the components. Wikipedia still states that it is an EB eclipsing binary.

The Nature article describes how astronomers were able to directly image star spots on the surface of Zeta And (a 16 solar mass giant).
"In order to image its surface during one of its 18-day rotations, Dr. Roettenbacher and co-authors used a method called interferometry, where the light of physically separate telescopes is combined in order to create the resolving power of a 330-m telescope."

References

(1) MNRAS 2015, Vol 446, pp 4205 - 4219, ' A Multi Wavelength Study of the M dwarf binary YY Geminorum' by CJ Butler et al.
(2) < *arxiv.org/abs/1605.06141* >
(3) "No Sun-like dynamo on the active star Zeta Andromedae from starspot asymmetry", Nature 553 217 -220 (12 May 2016).

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IBVS 6145 – 6175

Janet Simpson

6145 HIP10680/HIP10679: a visual binary in the beta Pictoris association with the fastest rotating member. (Messina, Hentunen, & Zambelli, 2015)
6146 AO Psc time keeping. (Bonnardeau, & Michel, 2015)
6147 A new contact eclipsing binary in the field of KOI 1152. (Safsten, et al, 2015)
6148 Study of Pulsation Spectrum of Mass-accreting Component of Algol-type system VV UMa. (Gunsriwiwat, & Mkrtichian, 2015)
6149 BAV-Results of observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. (HUBSCHER, & Lehmann, 2015)
6150 Photometry of High-Amplitude Delta Scuti Stars in 2014. (Wils, Hambsch, et al, 2015)
6151 The 81st Name-List of Variable Stars. Part I - RA 00h to 17h30. (Kazarovets, et al, 2015)
6152 BAV-Results of observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. (HUBSCHER, Joachim, 2015)
6153 110 minima timings of eclipsing binaries. (Petropoulou, et al, 2015)
6154 OAN-TNT Results of Observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. (Pena, Renteria, et al; students from the Latin American School of Observational Astronomy ESAOBELA 12, 14 and 15 as well as the students from the Advanced Observational Courses 12, 13, 14 and 15 at Facultad de Ciencias, UNAM. 2015)

6155 The 81st Name-List of Variable Stars.Part II - RA (Kazarovets, et al, 2015)
6156 The Long-term Binary System VV Cep (Pollmann, Bennett, & Hopkins, 2016)
6157 BAV-Results of observations - Photoelectric Minima of Selected Eclipsing Binaries. (HUBSCHER, Joachim, 2016)
6158 106 minima timings of eclipsing binaries, (Karampotsiou, et al, 2016)
6159 VARIABLES IN THE GLOBULAR CLUSTER M12 (NGC 6218), (KINMAN, T. D., 2016)
6160 Two new Blazhko stars: XZ UMi and VX Scl. (Skarka, et al, 2016)
6161 Constraining Solar/Stellar Activity and Magnetically-Driven Variability. (Fabbian, & Simoniello, 2016)
6162 Photometric evolution of the 2016 outburst of recurrent Nova LMC 1968: the first three weeks. (Munari, et al, 2016)
6163 Multiperiodic variability of the pulsating star GSC 0476-1362. (GAZEAS, & ILIOPOULOS, 2016)
6164 CCD Minima for Selected Eclipsing Binaries in 2015. (Nelson, Robert H. 2016)
6165 107 minima timings of eclipsing binaries. (Tzouganatos, et al, 2016)
6166 Using APASS Standards to Transform CCD Observations: Application to New and Old Observations of MT Cam. (Terrell, Gross, & Cooney, 2016)
6167 Minima Times of Selected Eclipsing Binaries. (Parimucha, et al, 2016)
6168 BG CMi time keeping. (Bonnardeau, Michel, 2016)
6169 Monitoring the Radial Velocity of HeI 6678 of gamma Cas. (Pollmann, Ernst, 2016)
6170 Historic light curve of V890 Cas. (NESCI, R., 2016)
6171 The AD binary in the multiple system eta Mus. (BLACKFORD, BUTLAND, & BUDDING, 2016)
6172 Long-term Radial velocity Monitoring of the HeI 6678 line of zeta Tauri (Pollmann, Ernst, 2016)
6173 Spotted stars as Cepheid impostors observed with K2. (Vida, Plachy, et al, 2016)
6174 Confirmation of the magnetic nature of the delta Scuti star HD 21190 (HUBRIG, & SCHOLLER, 2016)
6175 Metal-rich or misclassified? The case of four RR Lyrae stars. (Molnar, et al, 2016)

The Information Bulletin on Variable Stars (IBVS) can be accessed through the WWW in HTML format at the following URL…. *http://www.konkoly.hu/IBVS/IBVS.html*

BINOCULAR PROGRAMME

SHAUN ALBRIGHTON

The various priority levels of the Binocular Programme can now be found on the VSS web site at: ***http://www.britastro.org/vss/bin_prog_priority_191013.htm*** or for a full listing in constellation order at: ***http://www.britastro.org/vss/chartcat_binoc.htm***

These listings can be viewed in Circulars 157 - 160, and can be obtained in paper format from Shaun Albrighton and Roger Pickard (Contact details under Director and Binocular Secretary on back page of the Circular).

ECLIPSING BINARY PREDICTIONS – WHERE TO FIND THEM

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The publication of Eclipsing Binary Predictions is now discontinued in the VSS Circular. Predictions for RZ Cas, Beta Per and Lambda Tau can still be found in the BAA Handbook. Predictions, completed on a monthly basis, are available on the BAA VSS website at: ***http://www.britastro.org/vss/dpredict.html***

If readers require paper copies of the predictions please contact me.

The best source for predictions for Eclipsing Binaries is the Mt. Suhora Astronomical Observatory, Cracow Pedagogical University website (known as the Krakow website)at: ***http://www.as.up.krakow.pl/o-c/index.php3***

Click on 'Constellation List', choose your constellation and then choose your system.

A webpage will then appear with lots of useful information regarding the system. In the section entitled 'Light Elements' there is a link entitled 'current minima and phase'. When you click on this link, in the example of Beta Lyrae, you get predictions of primary and secondary eclipses for a period of three months. For systems with very short periods such as RZ Cas the predictions are for one week. For a system such as SW Cyg, with a period of around 4.57 days, the predictions are for a month.

The Krakow website does not tell you how much of an eclipse will be observable at a particular time of the year at your latitude and longitude. However, it has some useful literature references for each system, although they may not necessarily be up to date. Nor are references to the 'Information Bulletin on Variable Stars' included, but these can be found at: ***http://www.konkoly.hu/IBVS/IBVS.html***

Although the Krakow website lists the depth of eclipses it does not list the actual V magnitudes at maximum and minimum. For an indication of these magnitudes you will need to visit the 'General Catalogue of Variable Stars' website at: ***http://www.sai.msu.su/groups/cluster/gcvs/gcvs/***

Click on 'GCVS Query Form', type in a designation such as SW Cyg, and click on 'Search'. The resulting information displayed shows that maximum is 9.24V, primary minimum 11.83V, and secondary minimum 9.30V. These magnitudes, however, may have been determined some time ago.

The GCVS website gives SW Cyg a period of 4.57313411 days but the Krakow website lists the period of SW Cyg as 4.572986 days. The latter is more likely to list the most up to date period. It must always be borne in mind that small changes in a period can result in significant changes in the times of minima if the period was determined a few years ago.

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* ***** *

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Charts are downloadable from the VSS web pages at
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If you would like to prepare an article for consideration for publication in a Variable Star Section Circular, please read the *Notes for Authors*, published on the web pages at:
http://www.britastro.org/vss/circs.htm; reproduced in full in VSSC132 p 22, or contact the editor (details on back cover) for a pdf copy of the guidelines.

If you are unsure if the material is of a suitable level or content, then please contact the editor for advice.

The **deadline for contributions** to the next issue of VSSC (number 169) will be 7th Aug 2016. All articles should be sent to the editor (details are given on the back of this issue).

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