CCD Views Vol. 3 No. 1

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS
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C C D V I E W S

February, 2002 Vol 3 No 1

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1. INTRODUCTION: QUITE A SKY

Sunday, January 27th was an interesting day. In one day a nova (N OPH 02), supernova (2002ao), and a GRB (020127) were discovered. Think about the majesty of it. Events that likely took place thousands of years ago, millions of years ago, and billions of years ago respectively all sent photons that converged with the Earth on the same day. Quite a way to look at the distance scale! For one event, mankind was in the stone ages, for another mankind was just an evolutionary option, for the earliest the Earth wasn't even around!

Then came January 28th and the discovery of SN2002ap followed by the weekend of February 2nd when V838 Mon decided to make a splash on the night sky. We're half expecting Las Vegas to begin taking bets on astronomical phenomenon.

Don't forget to get your applications for the 2nd High Energy Astrophysics Workshop in by March 15. Do it now before it gets lost in your INBOX!: http://www.aavso.org/meetings/heaapp.stm

Also, we are about to place the final order for CCD filters. If you need a filter please fill out the form in the last issue of CCD Views (http://www.aavso.org/ccdviews/ccdviewsvol2no4.shtml). It is vital that CCD observations be made with a proper filter.

Clear skies!

Aaron Price
AAVSO Technical Assistant

Gary Walker
Chairman, CCD Committee

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2. SN 2002ap Illustrated

Thanks to all the observers who have taken up the challenge to build a complete light curve of SN 2002ap. As of February 22, we have received 102 CCD observations. Special thanks to **UMB, MLF, VWA, WJL, CRI, RGY, HOU, COO, SBS, WJD, KZX, VWA, GBL, GKA, BVJ, MMN, KDA, PCH, and ZRE** for their observations.

At the URL below we have placed online a few light curves of the data to illustrate the observations. Remember that all this data is preliminary and our goal is to build a complete light curve, this means to follow it as it fades. This data is just as valuable because any "breaks" in the decay rate can have profound implications for the model of this object.

http://www.aavso.org/ccdviews/sn2002ap.shtml

Current results in the scientific community of SN 2002ap currently suggest that it is very similar to SN 1998bw, which is widely believed to be a Type Ib/c-pec a.k.a Hypernova. SN 1998bw has also been associated with GRB 980425, a peculiar GRB in its intensity and gamma ray peak. Data collected on Feb 11 suggest SN2002ap looked very similar to SN 1998bw 2 weeks after "explosion" (IAUC 7825) which implies that discovery of the supernova 12 days earlier was very close to its birth. The progenitor has been estimated to be around 40 times the mass of the sun (GCN 1240), close to the theoretical upper limit of star mass. It is well located far from the nucleus of M74 and so suffers very little dust extinction (GCN 1248) making observations of it even more valuable compared to regular supernovae due to this rare clean line of sight we have.

Please continue to observe SN 2002ap as much as possible using the AAVSO f-scale chart linked at the URL above. Everyone needs to be using the same chart. Much of the scatter in the light curve can be attributed to using earlier (or non) AAVSO charts. If you have submitted data with an earlier chart, feel free to recalibrate your photometry with the new chart and send us the new data. Just send a note to aaronp@aavso.org with the new data and telling us what data to replace. Also remember to SAVE YOUR IMAGES as the AAVSO will be asking for them soon.

Remember our goal for this object is to create an as accurate as possible lightcurve. We would like to use this to show the professional community what AAVSO CCD observers can do. This is also a terrific learning experience and - hey, believe it or not, it's quite fun to boot!

For the next issue of CCD Views we should have some serious results to publish. So please keep sending the data and stay tuned!

Read the AAVSO GRB Discussion Group for more information, advice, and updates about this object.
http://mailman.McMaster.CA/mailman/listinfo/aavso-grb-list

References: IAUC 7811, 7816, 7817, 7820, 7821, 7822, 7825, 7826

GCN 1237, 1238, 1240, 1242, 1243, 1244, 1247, 1248

More info at: http://www.supernovae.net/sn2002/sn2002ap.html

(P/S: Many people have asked me who I bribed to get my initials on the hypernova, sorry but my confidentialty agreement with the AAVSO prevents me from revealing trade secrets. - Aaron)

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3. LIGHTCURVE OF AN ACTIVE V1028 CYG

Around the beginning of the new year Gary Billings (BGW) by chance caught V1028 Cyg in outburst. Braving the Canadian cold he got four days of good photometry and what appear to be clear superhumps. You can see the results at the URL below.

http://www.aavso.org/ccdviews/v1028-gwb.gif

Thanks to Gary for allowing us to share the data. If you have any lightcurves you are especially proud of, data, or other interesting results you'd like to share please feel free to contact aaronp@aavso.org.

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4. STARTING OUT IN CCD PHOTOMETRY PART TWO: FLAT FRAMES

By Keith Graham (GKA)

The following is the second installment in a series of contributions written by Keith Graham (GKA), who is in his 20th year as an AAVSO observer. The series will be continued in the next few issues of CCD Views and previous installments are in prior issues available at http://www.aavso.org/ccdviews/ .

Please note that all views here are views of the author. No specific makes or models of equipment are officially advocated by the AAVSO. The hardware mentioned in this article is here to illustrate issues that apply to all CCD equipment.

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Part Two: Flat Frames

Now that you have your equipment in order, it's time to use it. If you have done any CCD imaging, you are familiar with such terms as dark frame and flat field. Whereas most CCD users realize the importance of subtracting a dark frame from the raw image, some will shy away from taking a flat frame. I know I tried to weasel my way around them, and I hoped someone in the know would placate me by telling me I could easily get by without them in photometry.

NO SUCH LUCK.

Flat frames are essential. It took me hours of experimentation to figure out the best way for me to take flats that are conducive to good photometry. Different enthusiasts will give your their impressions as to the best way to take flats. Professional astronomers will have elaborate set ups with illumination at certain wavelengths. But we are amateurs, and we must do the best we can with what we have. There are advantages and disadvantages to the various methods, but I found that simplicity pays off.

I have an observatory, so I have set up a piece of white board that I bought at Menard's. I mounted this board on a wall and aim my scope at this board. I also bought a small halogen work lamp (25 watts) for illumination and set it up behind the scope and aimed at the board. The light from this lamp that makes its way through the telescope's optical train and lands ultimately on the CCD chip must be very evenly diffused. To achieve this, I made a diffusion screen from a piece of Styrofoam poster board and a sheet of milk plastic. I cannot tell you how much searching I did for that piece of milk plastic, but I found one by accident one day while accompanying my wife to her favorite quilt shop. Quilters use this stuff to make stencils and it is cheap. I paid $1.50 for a sheet large enough for my purposes. I cut a circle in the Styrofoam poster board large enough to fit snugly over the front end of the telescope, and I then mounted the milk plastic sheet over the hole. The end result is the light from the lamp is bounced from the white board on the observatory, diffusing it once. This diffused light must enter the scope through the milk plastic sheet causing it to further diffuse. This makes for a nice evenly dispersed light across the CCD chip. It is important that your scope is focused for a star, not for the board. I simply leave my camera on the scope and leave it in focus from the previous nights viewing.

I should mention that cleanliness is pretty important here. It is true that the flat will remove dust donuts and other imperfections in the optical path. But the fewer obstructions there are in the first place, the better. So if you have removed your camera from the scope, it might be a good idea to blow off any dust (using a squeeze bulb) from the camera chip cover, the v filter, and the focal reducer (if used).

Now, here is the important part. Does it matter how long you expose your flat?? You bet it does. I had read many opinions on CCD imaging which stated that the flat should be exposed to within 50%-75% saturation. For my ST6 with a full well ADU of about 65000, that would mean an average flat reading of between 32500 and 45000 ADU. I used this as my basis for my photometry flats, and found that I was not getting consistent readings in my photometric magnitude estimates. What I found was that this 50%-75% saturation might be good for "pretty picture" imaging, but it was too much for photometry. I learned from the photometry gurus that the flats ADUs should not be any more that 50% saturation. So I keep my flats to around 30000 ADU. With my setup, this means a 4.6 second exposure.

To make a long story short, I found that taking flats is really no pain at all. Once I got a system going, it became a snap. Now, the first thing I do when I set up and get the camera thermally stabilized is take a flat. Now here again, there are different schools of thought. Some say you should take many flats and average them. Others say 1 flat is sufficient. I have tried both ways, and I have found that I can get by with one flat for the evening. I have found my results to be rather consistent with the observations of others and are repeatable. Both of these checks tell me that my data is reliable.

Another way to take flats is with a light box. They are quite easy to make, and can be used in the field if you do not have an observatory. I will not go into their construction here, but you can find them on the web sites of other CCD enthusiasts. In fact, if you

ask on the MAPUG (http://www.mapug.com/) or SBIG users list (http://www.sbig.com/sbwhtmls/sbiglist.html), the people there are very helpful in offering their plans on their own websites.

So, in summary, while the taking of flat frames might seem impossible (or just a royal pain) at the outset, they are worth your effort to perfecting them. Once you find a method that works for you, stick with it. In your photometry, you want to do things the same way each time so your results are consistent. The only reason to change what you are doing is if you find you can do it better a different way that will give you better results. But keep your exposures of flats to below 50% saturation of your CCD chip.

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5. HIGH PRECISION CCD PHOTOMETRY WORKSHOP MP3s AND POWERPOINT PRESENTATIONS

Audio from Arne Henden's workshop held at the 90th AAVSO Annual Meeting last November has been placed online at the AAVSO web site along with the slide show that went along with the presentation. They can be downloaded in MP3 and PowerPoint format, respectively, at the URL below.

http://www.aavso.org/meetings/fall01sounds.shtml

Many thanks to Arne Henden (USNO) for both holding the workshop and allowing us to place this material online.

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6. A CAUTIONARY TALE OF PEP TO CCD TRANSITION
By Dan Kaiser (KDA), AAVSO President

This is aimed at the amateur. For the purpose of this discussion my definition of an amateur will be one who supplies his own equipment. My point is that when an amateur thinks of upgrading his/her equipment to PEP or CCD, they must not only consider the program stars they wish to observe, ie the limiting magnitude of the pep/CCD equipment is capable of reaching, but assure themselves that the remaining hardware is up to the job. I will use my experience as an example.

Photoelectric photometers generally have 1mm apertures. Your mount is required to keep the target star inside the aperture during an integration. Generally 10 seconds. In 1991 my mount/drive had a total periodic error of 20 arc seconds, or +/- 10 seconds. My telescope focal length gave a field of view of 30 arc seconds for the 1mm photometer aperture. What that meant is that most of the time the target star would stay in the 1mm aperture. It would occasionally wander out and that particular integration would have to be discarded. Not a show stopper. If the error had been larger it could have been a show stopper.

But then I decided I wanted to observe stars much fainter than my pep equipment was capable of doing. In 1995 a CCD was purchased. Now instead of a keeping the target star in a 30 second fov, the CCD required I keep the target on a few pixels covering 1/5 that or about 6 arc seconds. True the +/-10 arc second error was such I could integrate

for about 30 seconds and thus go fainter then the photometer, due to the incredible sensitivity of the CCD. But for the cost of the upgrade the gain in limiting magnitude was disappointing.

(Yes I know one can stack several 30 second images and sort of get the same quality and longer integration. However for photometry that is not recommended.)

So the solution was to track more accurately. This could be done by either a better drive or guiding, or both. First I tried guiding. A second CCD as an auto-guider on a guide scope. This improved the tracking tremendously. I was able to track for 120 seconds. However I also learned that the drive had a nasty spike in it. The auto-guider could not keep up with the error in the spike and so integrations were done during the part of the 4 minute worm cycle that did not contain the spike.

In 1996 the drive was upgraded to an 11 5/16" from a 7 1/2". This was another great improvement allowing 120 second _unguided_ images. With the auto-guider a target could be followed for much longer. However differential flexure between the imaging and the guiding scopes raised it's ugly head. Continual tweaking of the hardware reduced the problem, but it always remained.

All is good, correct? Well I wanted to set the equipment on a eclipsing binary and let it gather data while I slept. After all I do have to work during the day so that I can pay for all this equipment and still afford to have food on the table. The differential flexure issue allowed following a target for a few hours before one of the stars of interest drifted out of the fov. So it required re-centering from time to time. Unattended all nighter's were out of the question.

So, the guiding CCD and the imaging CCD were sold to help finance a self guiding CCD. This has worked out very well. The self guiding CCD will stay on a target for as long as it is visible. In fact the only tracking errors are due to polar misalignment causing field rotation, which requires several hours before it is detectable, and then it is in the order of 2 arc seconds.

Sorry to be so long winded. But you do see my point? When thinking of upgrading to pep or CCD, remember it is not only the detector that requires consideration. If the ancillary equipment is inadequate you will be disappointed. (We have not discussed matching the photometer/CCD to the telescope, filters, acquisition and reduction software, etc, etc. Let's leave that for another time.)

I have forgotten who the speaker was at the first AAVSO CCD workshop who said, "Calculate the expense of all the required equipment, multiply that by 3, and that is what the final cost will be." He did not mention all the time it will require as well. I don't mean to sound negative or to discourage. I just want you to be realistic in your expectations. Once it all comes together the results are well worth the effort.

Dan Kaiser (KDA)
Current AAVSO President

(This article was adapted with permission from a post made to the

AAVSO Discussion Group. It was part of a larger discussion about the differences between PEP and CCD observing.)

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7. FU ORI: A FLICKERING SENSATION

A new e-scale CCD chart has been published for FU ORI. This chart uses a new CCDV sequence by Doug West and include V-Rc and Tycho B-V values.

FU ORI is the subject of the February, 2002 Variable Star of the Month written by Kerri Malatesta. FU ORI is normally around 9th magnitude but the AAVSO International Database shows flickering by as much as .03 mag. However, similar stars of the same type (of which FU ORI is the prototype) have sometimes shown variations of as much as .1 mag so you can never predict what you will find.

Observations in V and I are encouraged on a nightly basis. If flickering is detected, make an observation every 15 minutes and reduce your data as carefully as possible. Notify aavso@aavso.org after you have submitted the observations through the usual channels.

The complete VSOTM article and charts are available at the URLs below:

http://www.aavso.org/vstar/vsotm/
http://www.aavso.org/charts/catalog/ORI/FU_ORI/

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8. CCD OBSERVATIONS VIA ONLINE LIGHT CURVE GENERATOR

The AAVSO Online Light Curve Generator has recently been upgraded to distinguish between CCD observations and visual observations. CCD observations will show up as the symbol "x" on a light curve while visual observations continue to show up as an asterix (*). The color of the "x" provides the band the data was taken in: Green for V, Blue for B, Red for R, and orange for I. CCD "fainter than" observations are unaffected.

http://www.aavso.org/adata/curvegenerator.shtml

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9. LINUX CCD DRIVER SUPPORT

Many consumer CCDs are now supported under Linux. Below is a list of URLs where you can find drivers and software for various CCDs.

Linux Astronomy CCD Imaging
http://home.earthlink.net/~dschmenk

This site has kernel drivers for QuickCam, Audine, and the entire line of Starlight Xpress cameras, including support for the autoguider interface, new USB adapters and the TrueTech Custom Filter Wheel. It also includes patches to use Xephem for CCD control. The source code is available under the GNU license.

CCD Astronomy on Linux
http://www.dimensional.com/~ashe/ccd-astro.html

This site does pretty much the same for the SBIG ST7/8/5C/237 cameras, CFW filter wheels, and the AO7 adaptic optics unit. Source code is not available.

Linux Apogee Instruments CCD Camera Drivers
http://randomfactory.com/apogee-lfa.html
http://sourceforge.net/projects/apogee-driver/
This site has drivers, GUI, and a developer's kit for the Apogee line of cameras. The source code is available under the GNU license.

FLI Software Page
http://www.moronski.com/fli/
You can download a Finger Lakes Instruments Linux SDK from this page.

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10. CCD POINTS

We decided to go with both totals this time: CCD Points and raw number of observations submitted. However, I cutoff the total observation column at 100 CCD Points because it would be too easy to figure out the formula(e)! In the next issue we'll add a running point total.

As always, remember that CCD Points are for *fun only* and serve no official AAVSO purpose and are not recorded anywhere other than CCD Views. In fact, I spend more time checking the locations of observers in the list than I do checking the point totals! :)

CCD Points includes data from Dec - Jan.

Pts	Obs	Observer		Location
3817	916	ARJ	ARNOLD, JAMES	AL, HUNTSVILLE
960	211	DRG	DIETHELM, ROGER	SWITZERLAND, RODERSDORF
549	154	WGR	WALKER, GARY	MA, SHERBORN
546	321	ZRE	ZISSELL, RONALD E.	MA, SOUTH HADLEY
541	471	BGW	BILLINGS, GARY W.	CANADA, CALGARY
313	26	MDW	MACDONALD II, WALTER J.	CANADA, OSHAWA ONT.
309	38	GKA	GRAHAM, KEITH A.	IL, MANHATTEN
291	46	NMI	NICHOLAS, MIKE	AZ, GLENDALE
220	66	SFK	SCHEDER, FRANK L.	MD, LEONARDTOWN
219	98	WJD	WEST, JERRY DOUG	KS, MULVANE
178	58	RSE	ROBINSON, STEPHEN E.	MD, ROCKVILLE
145	54	KDM	KLINGLESMITH, DANIEL A.	NM, SOCORRO
143	23	OAR	OKSANEN, ARTO	FINLAND, MUURAME
139	86	SYZ	SANCHEZ, CRISTINA	SPAIN, GIJON-ASTURIAS
129	18	PAH	PRICE, AARON (C.AARON)	MA, WATERTOWN
117	60	MTK	MICHALIK, TOM	VA, LYNCHBURG
104	17	HDU	HURDIS, DAVE	RI, NARRAGANSETT
69		COO	COOK, LEWIS M.	CA, CONCORD
62		MTM	MATTEI, MICHAEL	MA, LITTLETON
55		BJS	BEDIENT, JAMES R.	HI, HONOLULU
53		PMH	PHELPS, MATT	MA, ARLINGTON
46		RZD	RODRIGUEZ, DIEGO	SPAIN, VILLALBA,
42		RGY	RUBRIGHT, GARY	PA, LANCASTER
36		OCN	O'CONNOR, STEPHEN D.	CANADA, NORTH MONTREAL
35		WRX	WILLIAMS, ROGER	MI, KALAMAZOO
33		SDY	SCHARNHORST, DANNY	GERMANY, ERFURT
33		MLF	MONARD,LIBERT A.G.(BERTO)	SOUTH AFRICA, PRETORI
28		GBL	GARY, BRUCE L.	CA, SANTA BARBARA
23		LIW	LILLER, WILLIAM	CHILE, VINA DEL MAR
20		NLX	NELSON, PETER	AUSTRALIA, ELLINBANK,

18	CLF	COHEN, LOUIS	MA, CAMBRIDGE
14	UMB01	TITTLEY, ERIC	BALTIMORE, MD (UMBC)
12	CJI	COLOMA, JOSEP MARIA	SPAIN, BARCELONA
11	RGY	RUBRIGHT, GARY	PA, LANCASTER
10	LIW	LILLER, WILLIAM	CHILE, VINA DEL MAR
10	CML	CURE, MICHEL	CHILE, VALPARAISO

CCD Views is published bimonthly and when circumstances warrant via e-mail. An archive is available at http://www.aavso.org/ccdviews/ . Please send comments and suggestions to aaronp@aavso.org.

To receive CCD Views via e-mail send a message to majordomo@aavso.org with "subscribe ccdviews" in the body of the e-mail. To unsubscribe, place "unsubscribe ccdviews" in the e-mail.

The AAVSO has many free online publications including "Eyepiece Views", a similar newsletter intended for visual observers. To learn more and subscribe visit: http://www.aavso.org/mailinglists.stm

Good observing!

Aaron Price, AAVSO Technical Assistant (PAH)
Gary Walker, Chairman of the AAVSO CCD Committee (WGR)

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