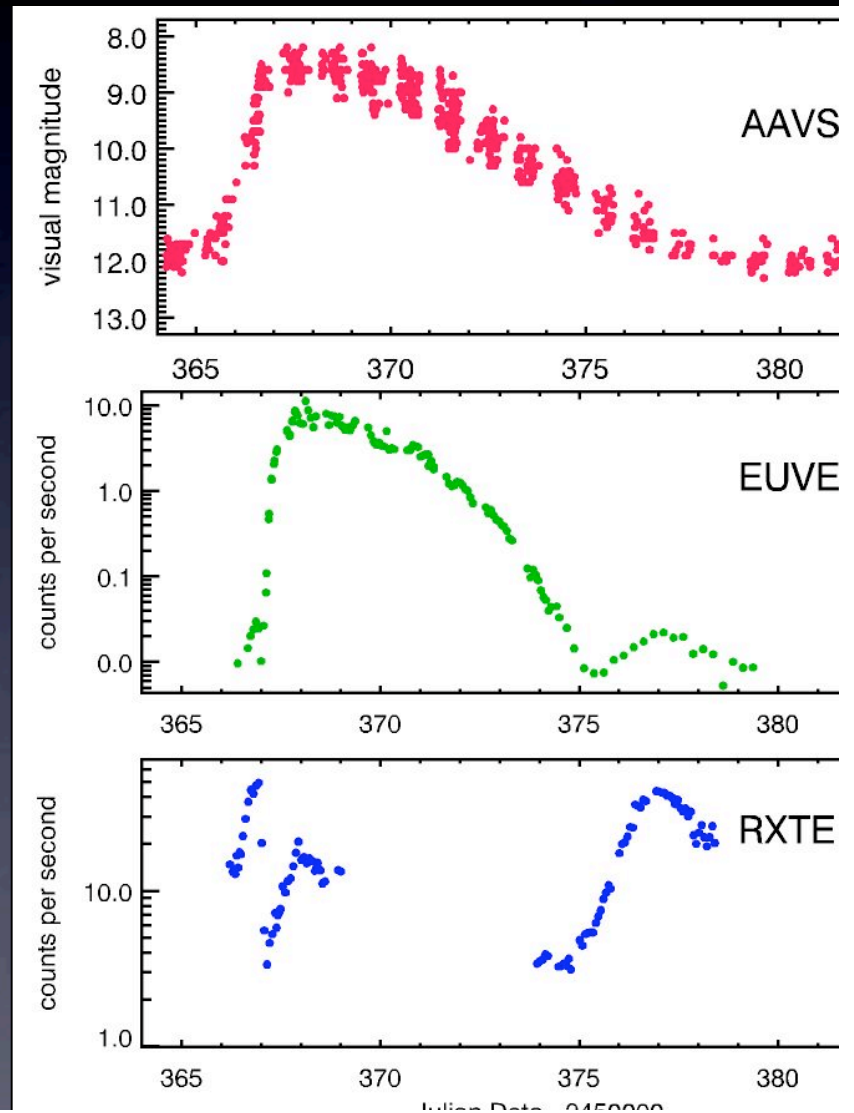
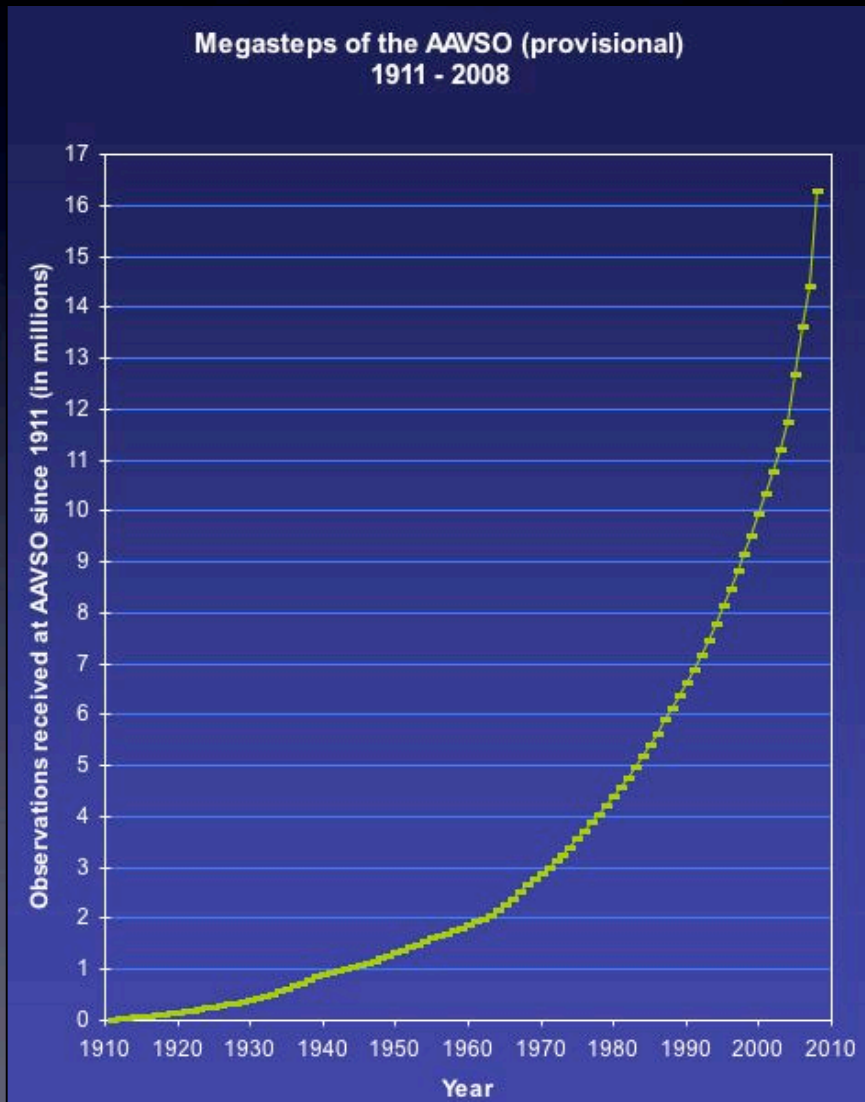


# Using the AAVSO International Database

A. Price 97th AAVSO Annual Meeting  
October 16-19, Nantucket, MA



# Vital Statistics

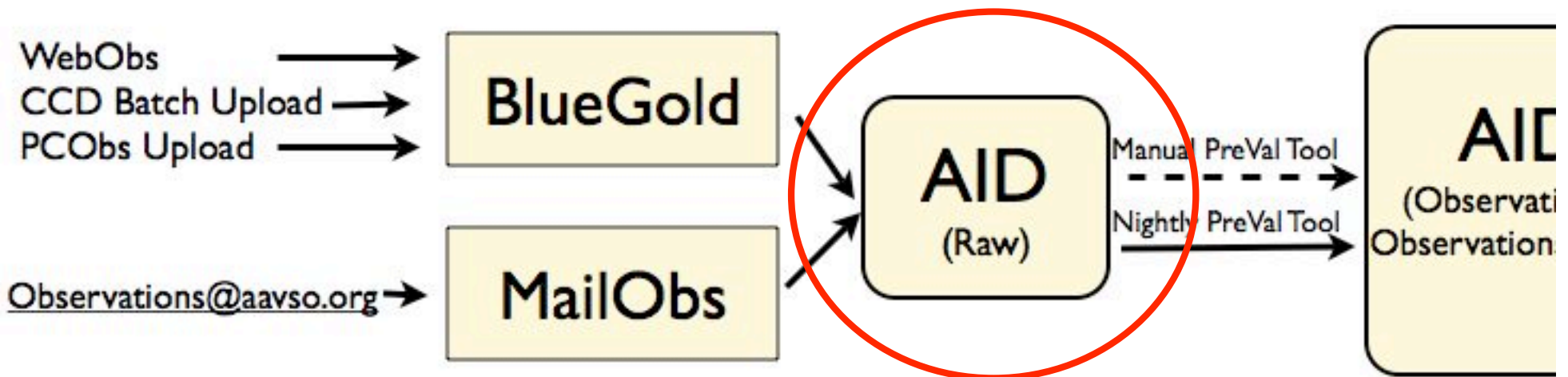
- 15,287,135 obs as of Oct. 14, 2008 at 04:13UT
- Oldest obs: July 19, 1894 at 18:18 UT
- 77% visual, 23% CCD, .003% other
- MySQL 5.0.27
- 3.6 GB
- Backups: 1 mirror\*, 7 daily snapshots, off-site weekly, archived monthly, far-off site annually
- BAA has archived copy as part of mutual archive agreement
- Paper ledgers to IBM punch cards in 1967
- Migration from punch cards to magnetic tape began in 1973 and ended in 1981
- In-house CPM system for data entry onto 8" disks began in 1981 (some in-house processing begins)
- Conversion from CPM 8" to IBM 5.25" disks in 1987
- Transfer for 4.5 million obs database from CfA storage to AAVSO HQ in 1989-1990



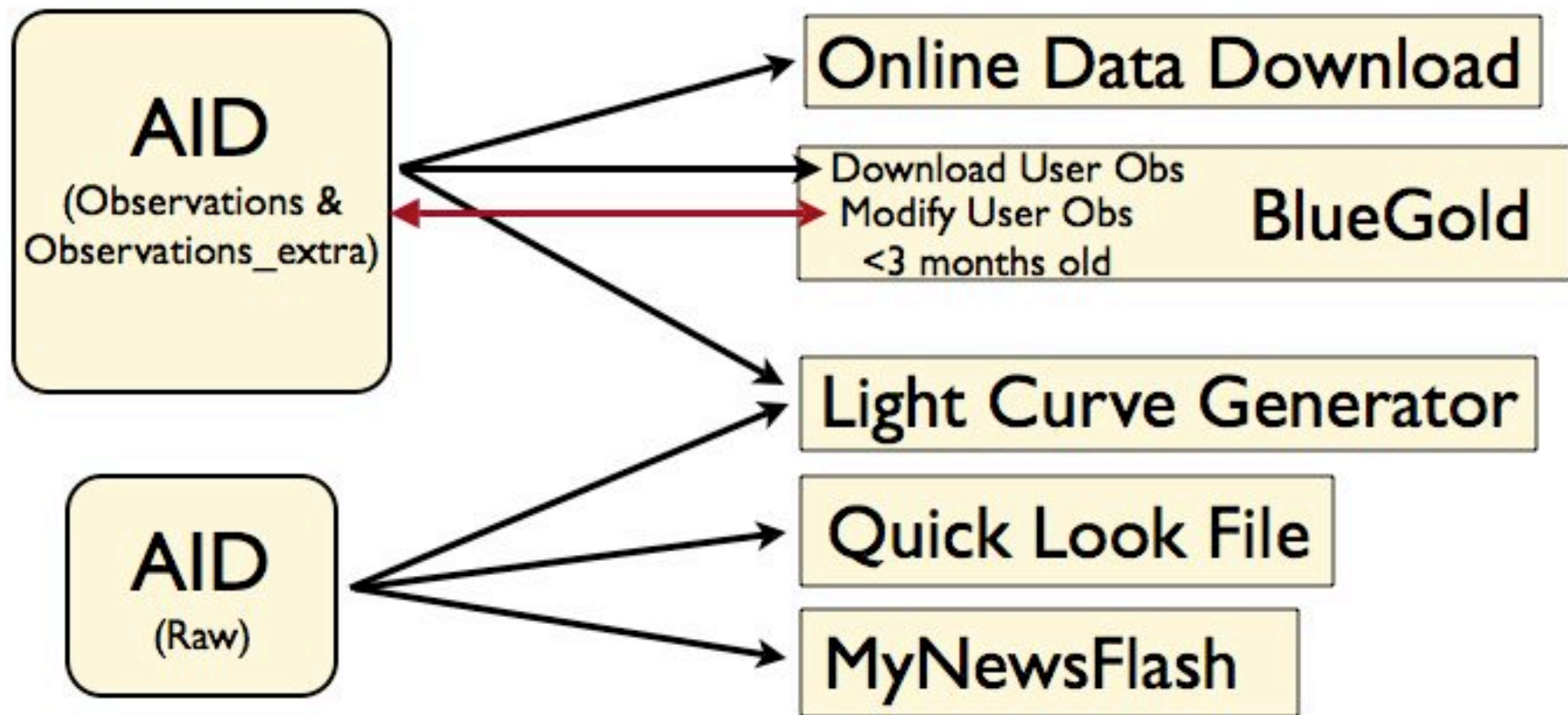
\* Details  
JAAVSO  
papers in I  
(Hill) and I  
(Waage)

# Incoming Data Pipeline

Going away soon...

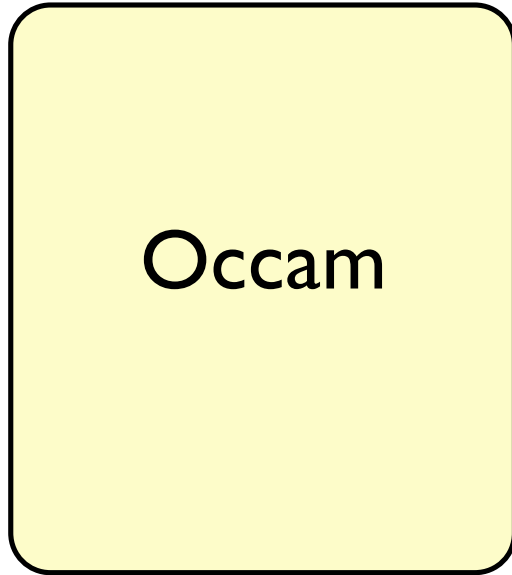


# Outgoing Data Pipeline

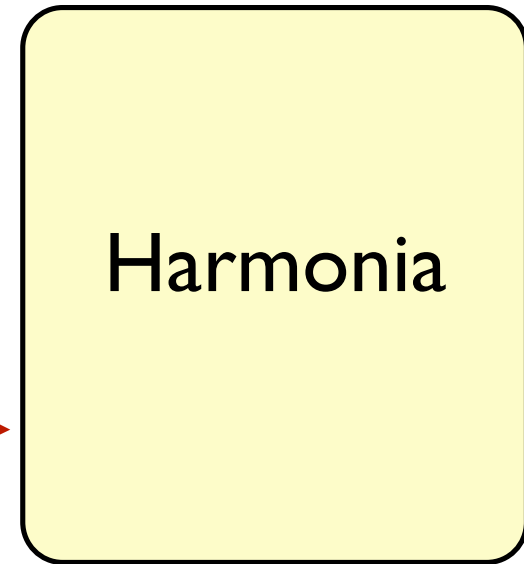


# The Near Future

Incoming



Outgoing



# Light curve generator

Arne sez “V is V is V...”

Object Name, Designation or AUJD: V CAP

Ex: SS CYG

Plot last: 2000 days.

Or Start Date:

In JD or mm/dd/yyyy

End Date: 2454684.1452

In JD or mm/dd/yyyy

(takes a few seconds - please wait)

**Highlight Your Own Observations**

Observer Initials:

Show List of Observers

Enable Background Grid

Point Size

Width  Height

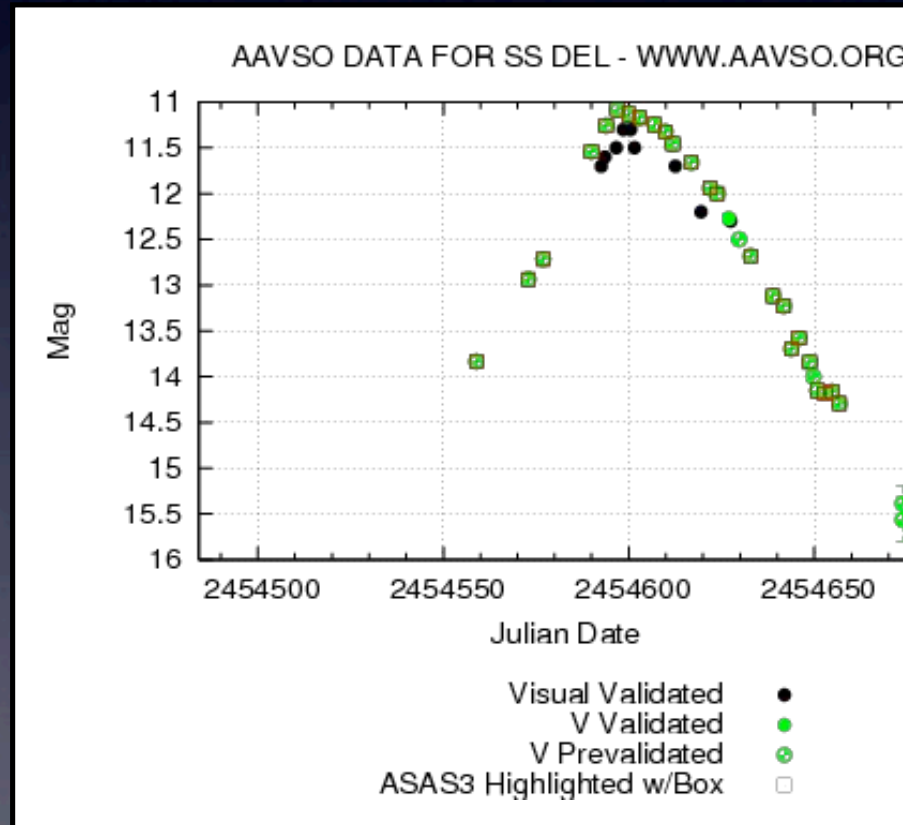
Force Vertical Axis:  to  Mag.

Draw V-band mean curve with  day bins.

[Click here to clear your settings for this interface.](#)

Show only this [data](#):

- Visual
- U
- B
- V
- R
- I
- J
- H
- Unknown
- Fainter Than
- Discrepant
- Unvalidated

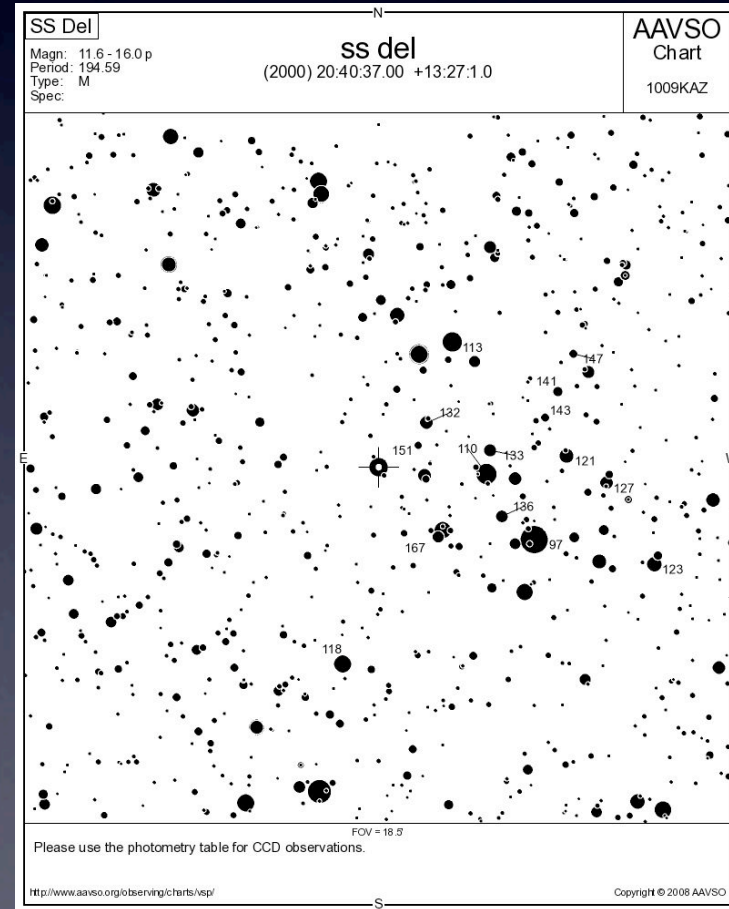
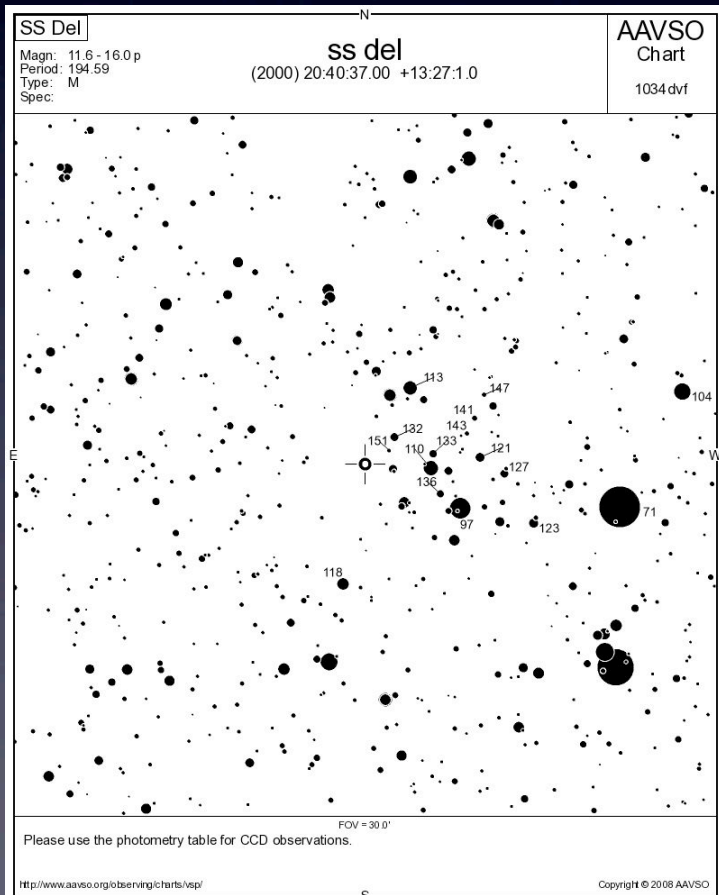


# Quick Look (File)

Displaying 40 observations received since 2453870 from 11 observer(s).

[\(New Search\)](#)

Name	JD	Calendar Date	Mag.	Band	Comment Codes	Observer	Comparison Star 1 (CName)	Comparison Star 2 (KName)	Chart(s)	Uncertainty	Transformed	Comments
SS DEL	2454749.00774	OCT 09.5077	<a href="#">15.3</a>	V		NLX	110		<a href="#">1034dvf</a>	0.13	N	
SS DEL	2454746.655676	OCT 07.1557	<a href="#">15.214</a>	V		SRIC	151	136	<a href="#">1034DMP</a>	0.023	N	
SS DEL	2454746.652094	OCT 07.1521	<a href="#">15.256</a>	V		SRIC	151	136	<a href="#">1034DMP</a>	0.026	N	
SS DEL	2454746.648512	OCT 07.1485	<a href="#">15.215</a>	V		SRIC	151	136	<a href="#">1034DMP</a>	0.028	N	
SS DEL	2454745.1774	OCT 05.6774	<a href="#">15.57</a>	V	BU	HMH	000-BCS-657	000-BCS-648	08010	0.02	N	Limits of detection with t
SS DEL	2454743.39028	OCT 03.8903	<a href="#">&lt;14.3</a>	Vis.		ACO	143		AAVSO		N	chart questioned
SS DEL	2454739.29097	SEP 29.7910	<a href="#">15.913</a>	V	BU	HMH	000-BCS-652	000-BCS-648	080101	0.024	Y	limits of detection with th
SS DEL	2454738.3958	SEP 28.8958	<a href="#">10.8</a>	Vis.		TST01	102-6		AAVSO 080110		N	beyond sequence



# Validation List

- AUID, Designation, “Name”, Aliases
- 44,146 stars & 1,499 aliases as of Oct. 14 at 5:39UT
- Greek and nonstandard name consolidation projects
- Properties kept in VSX
- Add stars through VSX and then submitting an obs (preferred), WebObs or e-mail aavso@aavso.org
- Any proven variable accepted
- Exceptions can be made for good cause

000-BDM-465	<a href="#">AU CrA</a>	-	<a href="#">light curve</a>
000-BDB-509	<a href="#">AU CRB</a>	1609+32	<a href="#">light curve</a>
000-BDN-230	<a href="#">AU Cru</a>	-	<a href="#">light curve</a>
000-BCV-013	<a href="#">AU CVN</a>	1305+32	<a href="#">light curve</a>
000-BCL-291	<a href="#">AU CYG</a>	2014+34	<a href="#">light curve</a>
000-BDQ-081	<a href="#">AU Del</a>	-	<a href="#">light curve</a>
000-BDQ-320	<a href="#">AU Dor</a>	-	<a href="#">light curve</a>
000-BDQ-346	<a href="#">AU Dra</a>	-	<a href="#">light curve</a>
000-BBG-760	<a href="#">AU ERI</a>	0412-25	<a href="#">light curve</a>
000-BCV-933	<a href="#">AU GEM</a>	0739+31	<a href="#">light curve</a>
000-BDR-031	<a href="#">AU Gru</a>	-	<a href="#">light curve</a>
000-BCV-995	<a href="#">AU HER</a>	1753+29	<a href="#">light curve</a>
000-BDR-976	<a href="#">AU Hya</a>	-	<a href="#">light curve</a>
000-BDS-313	<a href="#">AU Hyi</a>	-	<a href="#">light curve</a>
000-BDS-415	<a href="#">AU Ind</a>	-	<a href="#">light curve</a>
000-BDS-487	<a href="#">AU Lac</a>	-	<a href="#">light curve</a>

The screenshot shows the VSX website interface. At the top, there is a search bar and navigation links: Search, Submit, Register, Log In, and Account. Below this, the date and time are shown as 15 Oct 2008 04:37:35 UTC, and a welcome message for a guest user. The main content area is titled "Detail Sheet" and contains a table of star properties for 000-BDQ-346. The table includes fields for Name, AAVSO UID, Const., J2000.0 coordinates, B1950.0 coordinates, Other names, Var. type, Spec. type, Mag. range, Discoverer, Study ref., Chart ref., Epoch, Outburst, Period, Rise dur., and Remarks. The "Name" field is highlighted in green and contains "AU Dra". A red arrow points from the "light curve" link in the table on the left to the "AU Dra" entry in the "Name" field of the detail sheet.

Detail Sheet	
Name	AU Dra
AAVSO UID	000-BDQ-346
Const.	Dra
J2000.0	17 35 21.30 +68 38 19.0 (263.83875 +68.63901)
B1950.0	17 35 37.60 +68 40 05.0
Other names (Internal only)	- (Not logged in)
Var. type	EASD:
Spec. type	-
Mag. range	12.3 - 13.1 p
Discoverer	-
Study ref.	V.P.Zasewitch, Astron. Zh. N173, 1956.
Chart ref.	E.Geyer, R.Köppenbahn, W.Strohmeier, KVS NG, 1955.
Epoch	10 Jun 1956 (HJD 2435635.3070)
Outburst	-
Period	0.51514
Rise dur.	-
Remarks (Original)	-



# Data Download

Name,  
designation  
or AUID

All, JD or  
mm/dd/yyyy

Danger, Will  
Robinson!

Beware rogue  
commas...

Recommended

NVO XML  
Format

**Star:**  [Star names](#)

**Start Date:**  **Stop Date:**   
(All or JD or mm/dd/yyyy)

**First Name:**  **Last Name:**

**E-mail:**  [Privacy policy](#)

**Country**

**Affiliation (optional)**

**Which best describes you?**

**How do you plan to use the data?**

**Do you want [discrepant](#) data included?**  No  Yes

**Which format would you like the data in?**

Comma Delimited  
 Tab Delimited  
 Space Delimited (*not* column-delimited)  
 [VOTable](#)

**Comments & questions:**

# More fields were added over time as we expanded the database

```
2439764.7,<14.5,,,Visual,FD,,,,,No,,G,,,,ss del
2439766.7,<14.3,,,Visual,FD,,,,,No,,G,,,,ss del
2439778.5,<13.2,,,Visual,LS,,,,,No,,G,,,,ss del
2439786.5,14.8,,,Visual,LS,,,,,No,,G,,,,ss del
```

```
2452452.465,11.6,,,Visual,SJZ,M,113S,118,PE1997, MOON:,No,,G,118,,,ss del
2452455.4118,11.5,,,Visual,DPA,,11.3 11.8,,PE0597,,No,,G,,,,ss del
2452460.4479,11.6,,,Visual,KKI,,113W,118,PD1997,,No,,G,118,,,ss del
2452461.481,11.7,,,Visual,SJZ,,113S,118,PE1997,,No,,G,118,,,ss del
```

```
2454650.79910,14.149,0.061,,V,ASAS3,,000-BCS-651,000-BCS-655,1009QAL,SUBMITTED BY DKS,No,,P,000-BCS-655,,11.33
2454652.84554,14.183,0.043,,V,ASAS3,,000-BCS-651,000-BCS-655,1009QAL,SUBMITTED BY DKS,No,,P,000-BCS-655,,11.28
2454654.77611,14.161,0.057,,V,ASAS3,,000-BCS-651,000-BCS-655,1009QAL,SUBMITTED BY DKS,No,,P,000-BCS-655,,11.26
2454656.76039,14.292,0.043,,V,ASAS3,,000-BCS-651,000-BCS-655,1009QAL,SUBMITTED BY DKS,No,,P,000-BCS-655,,11.27
2454662.7188,<14.2,,,Visual,SXN,,142,,030712,,No,,P,,,,ss del
```

# Format

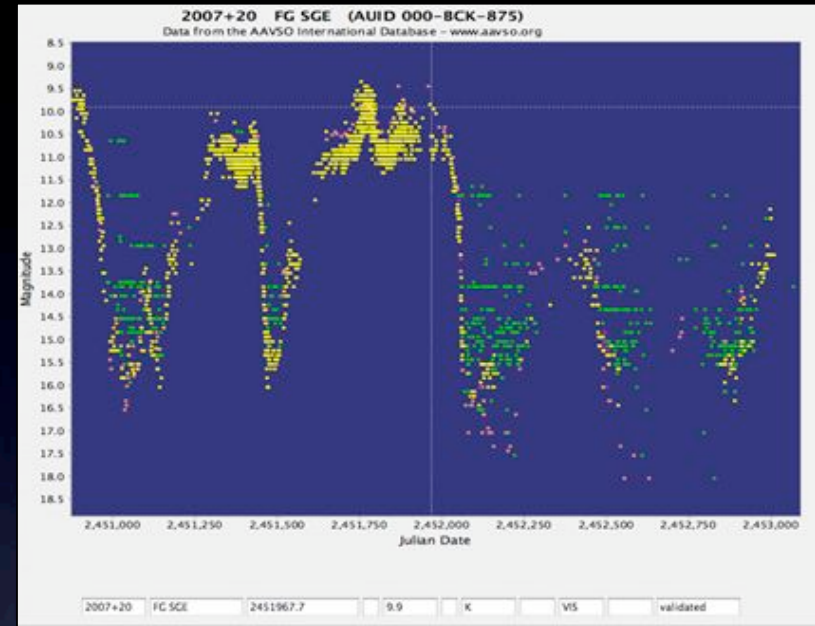
1. **JD:** The [Julian Date](#) of the observation.
2. **Magnitude:** The magnitude estimate of the observation. A < sign means it was a null observation "fainter than" the magnitude given. A : (colon) means the observer was uncertain about the estimate.
3. **Uncertainty:** Uncertainty (error) of the observation as submitted by the observer
4. **HQ Uncertainty:** Uncertainty (error) of the observation as determined by AAVSO HQ
5. **Band:** [Bandpass](#) of the observation
6. **Observer Code:** This is a unique ID assigned to each observer.
7. **Comment Code:** Comment codes submitted by the observer. A list of codes is [here](#).
8. **Comp Star 1:** The comparison star(s) used to make the visual estimate. If photometric, this is the comparison (C) star ID.
9. **Comp Star 2:** The comparison star(s) used to make the visual estimate. If photometric, this is the check (K) star ID.
10. **Charts:** The charts used to find the field and locate the comparison stars and their values. As of July, 2008 new charts were issued with a Chart ID format of XXXXY where XXXX is a number and Y can be any combination of letters. You can visit our [Variable Star Plotter](#) and type in that Chart ID to see the exact chart the observer used to make that observation. For Chart IDs that are not in that format, contact AAVSO HQ and we can e-mail you a copy of the chart used in the observation.
11. **Comments:** Comments on the observation, usually from the observer
12. **Transform:** If transformation coefficients were applied to the observation then this will be "Yes".
13. **Airmass:** The airmass of the observation.
14. **Validation Flag:** This flag describes the level of [validation](#) of the observation. **G** means the observation has passed our validation tests. **D** means that during the validation phase it was flagged discrepant and should be used with extreme caution. **P** means it has only undergone pre-validation, meaning it was checked for typos and data input errors only. No flag means it has not been validated at all and should be used with caution.
15. **Cmag:** Supplied magnitude of the comparison star
16. **Kmag:** Measured magnitude of the check star
17. **HJD:** Heliocentric Julian Date
18. **Name:** Name of the star

# Bandpasses

- **Vis.:** Visual observations
- **U:** Johnson U band
- **V:** Johnson V band (a.k.a. "photometric V")
- **B:** Johnson B band
- **R:** R band, usually Cousins R (Rc)
- **I:** I band, usually Cousins I (Ic)
- **Sloan Z:** Z band from SDSS set (Iz)
- **CV:** Unfiltered with a V zeropoint Block
- **CR:** Unfiltered with a Red zeropoint
- **J:** J band (NIR 1.2micron)
- **H:** H band (NIR 1.6micron)
- **K:** K band (NIR 2.2micron)
- **N/A:** Unknown
- Rare/old filters:
- **RGB-Blue:** Blue filter from the RGB set (144 obs)
- **RGB-Green:** Green filter from the RGB set (3,801 obs)
- **RGB-Red:** Red filter from the RGB set (522 obs)
- **Orange:** Orange color filter (1,359 obs)
- **Yellow:** Yellow color filter (482 obs)
- Always expanding...

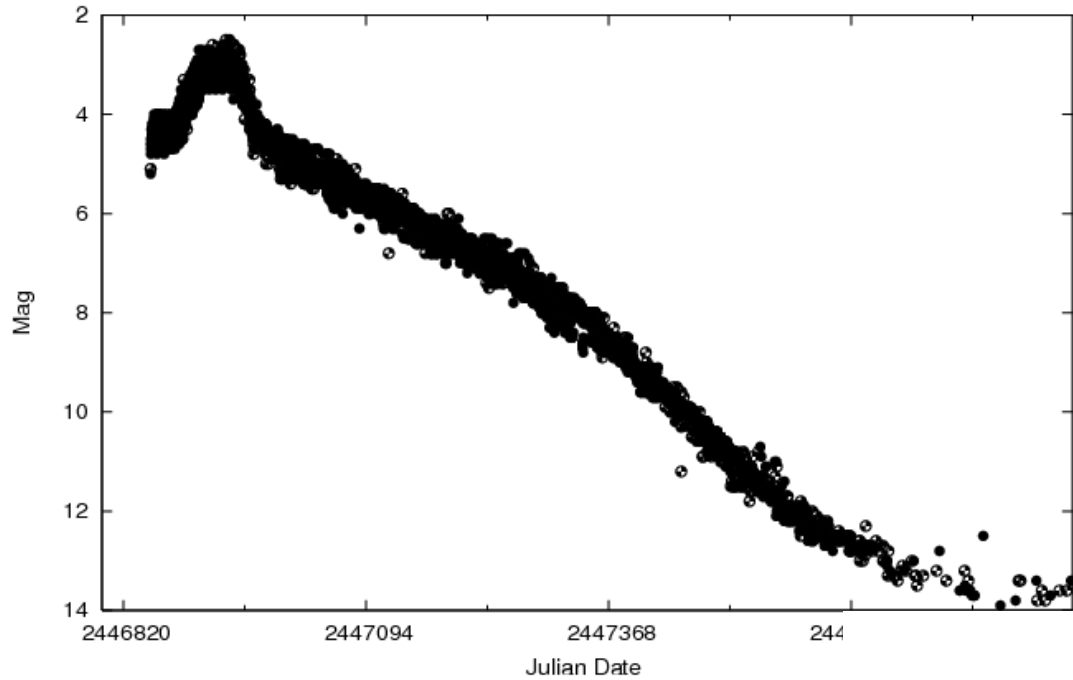
# Validation Flag

- Two types of validation: full and pre
- **G** means the observation has passed our validation tests.
- **D** means that during the validation phase it was flagged discrepant and should be used with extreme caution.
- **P** means it has only undergone pre-validation, meaning it was checked for typos and data input errors only.
- No flag means it has not been validated at all and should be used with caution.
- Details in
- Malatesta et al., (2005) JAAVSO ,Volume 34, 1.
- Supervalidation



Help us!

AAVSO DATA FOR SN 1987A - WWW.AAVSO.ORG

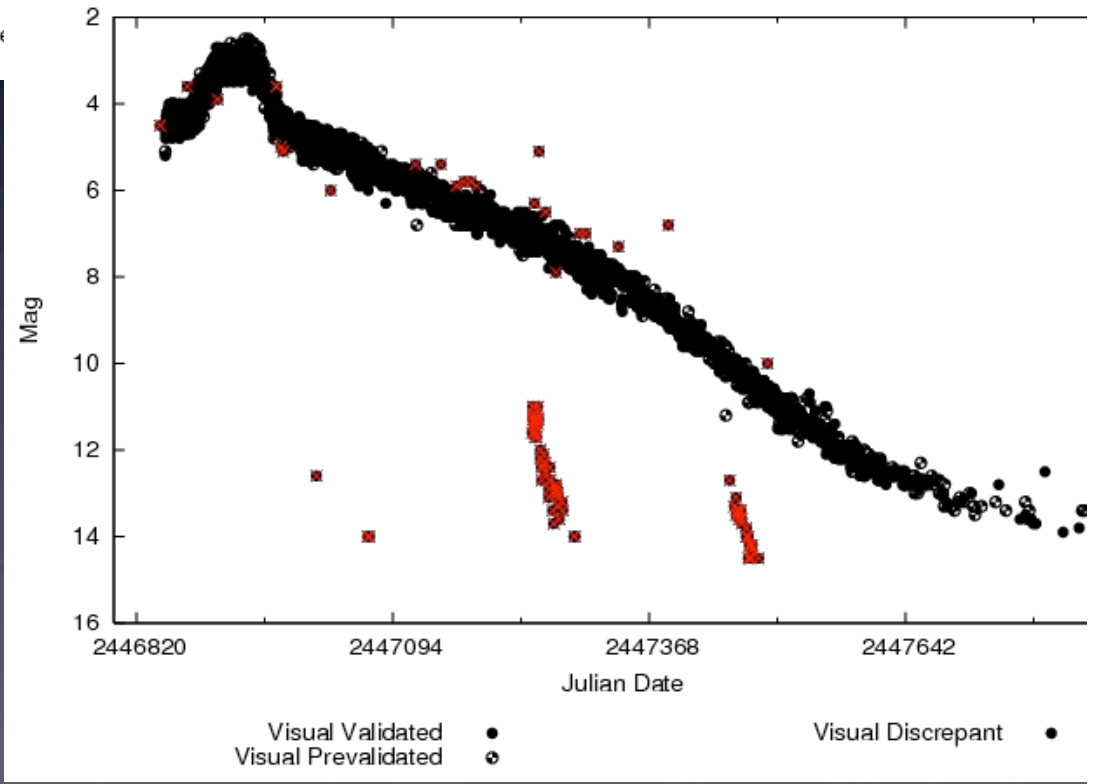


Validated

AAVSO DATA FOR SN 1987A - WWW.AAVSO.ORG

Visual Validated ● Visual Prevalidated ○

Validated +  
Discrepant



Visual Validated ● Visual Prevalidated ○ Visual Discrepant ■

# Dear Colleague

## Dear Colleague,

The AAVSO International Database is a precious resource for the science of variable star astronomy, and we hope your research will benefit greatly from the use of these data. The amateur and professional astronomers who have contributed data to the AAVSO over the last century did so hoping to make a positive contribution to variable star research, and it is our goal to facilitate the use of these data by the astronomical community. AAVSO data are and always will be provided **free of charge** upon request, as a service to the scientific community.

Our only requirements for the use of AAVSO data are simple:

First, please acknowledge the use of any and all AAVSO data used in publications with the [appropriate acknowledgements](#) we have provided on our webpage. If the data form the basis of your research, we ask that a representative of the AAVSO be included as an author; in exchange we will assist you in the analysis and interpretation of these data at a level appropriate for a coauthor.

Second, if you use our data in a publication, please let us know! We are thrilled to see the work of our observer community in print, and our observers are equally thrilled to see their work put to good use. The AAVSO has created the [AAVSO In Print](#) page for just this purpose. It shows the observers that their work is paying off, it showcases your hard work in using and analyzing AAVSO data, and it proves to the astronomical research community that the AAVSO continues to be a relevant and valuable resource for variable star astronomy. If your paper is accepted, in press, or published in a magazine, journal, or conference proceedings, please email us at [aavso@aavso.org](mailto:aavso@aavso.org) with the paper title, the authors, the year of publication, and the journal and reference information. If the paper appears on the [arXiv.org preprint server](#), please include the URL for the abstract page.

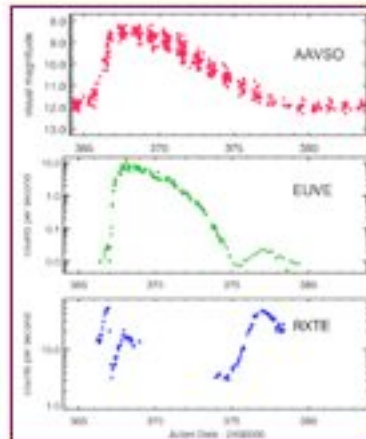
We are very pleased to provide you with whatever data we have of interest to you. If our data prove valuable to your research, please let us know!

Sincerely,

Dr. Arne A. Henden, Director  
American Association of Variable Star Observers



AAVSO Director Arne Henden with the [AstroCam](#) at USNO Flagstaff, AZ

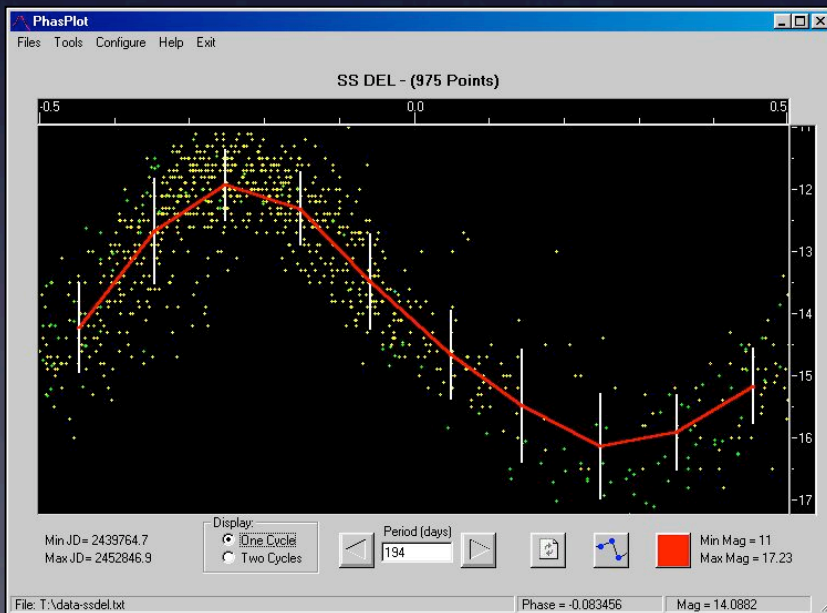
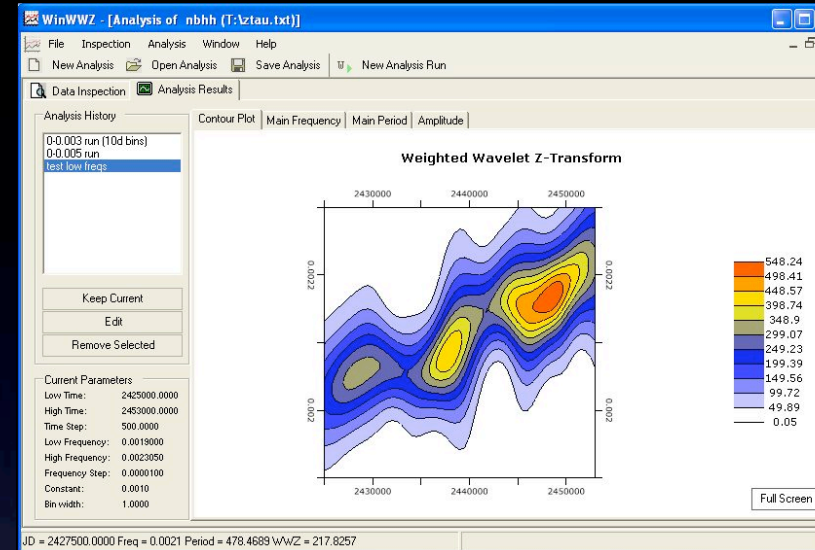


Click image to see [complete figure](#). The October 1996 narrow outburst of SS Cyg captured in three wavelengths. For more information about the SS Cyg collaboration, visit [RXTE's Greatest Hits](#) and [ELVE Science Highlights](#). Figure adapted from Wheatley et al. (2003).

- Authorship guidelines
- Let us know so we can promote your project and inform our members
- Not included, but important *you have some, please toss so **MONEY** our way!*

# Analysis Software

- WWZ by Foster/Klingenberg
- MagPlot by Labbey
- PhasPlot by Labbey
- TS by Foster
- VStar\* by Foster/HOA team
- Peranso\*, commercial by Vanmunster
- Volunteers needed





# Analysis Tutorials

## Time-Series Analysis of Astronomical Data by Dr. Matthew Templeton, AAVSO (Copyright 2003, AAVSO. All rights reserved.)

You may download the PowerPoint file of this presentation by clicking [here](#).

The full version of this paper appears in the Journal of the AAVSO, volume 32, number 1, page 41.

### SLIDE 1 -TITLE

In this short paper, I'll give a very brief overview of time series analysis. Time-series analysis is performed on astronomical data, and what I will also suggest different kinds of analysis for different kinds of objects. I will also suggest resources that you might find useful in your own work.

*Our web site is full of  
them!*

*Templeton, JAAVSO Volume 32, 2004*

### **Time-Series Analysis of Variable Star Data**

**Matthew Templeton**

*AAVSO, 25 Birch Street, Cambridge, MA 02138*

*Based on a workshop session at the 92nd Spring Meeting of the AAVSO, April 2003; revised August 2004*

**Abstract** Time-series analysis is a rich field of mathematical and statistical analysis, in which physical understanding of a time-varying system can be gained through the analysis of time-series measurements. There are several different techniques of time-series analysis that can be usefully applied to variable star data sets. Some of these techniques are particularly useful for data found in the AAVSO International Database. In this paper, I give a broad overview of time-series analysis techniques useful for variable star data, along with some practical suggestions for the application of different techniques to different types of variables. I include elementary discussions of traditional Fourier methods, along with wavelet and autocorrelation analysis.

## AAVSO: Grant Foster Online Chat Transcript

My favorite is "TS" -- it's a **time series** analysis program. It does very sophisticated Fourier analysis (the CLEANEST method), and also does polynomial ...

[www.aavso.org/aavso/foster.html](http://www.aavso.org/aavso/foster.html)

### Grant Foster

30 minutes

"Long-Term Light Curves of Cepheid Variables" ( [video](#), [ppt](#) )

We have analyzed the light curves of 65 Cepheid variables, using visual data from the American Association of Variable Star Observers (AAVSO). We find that Cepheid pulsations are not nearly so constant as is often believed; half of our well-observed sample show episodes of period change, in addition to long-term period evolution. We derive the Fourier decomposition coefficients for the sample, and present mean light curves for the best-observed stars. We also find that the light curve shape is usually well approximated by a "bent sawtooth" wave, which can account for the coefficients of the Fourier series.

### Wednesday, March 23

Workshop: [Intro to Using AAVSO Data Analysis Tools](#) Grant Foster

Talk: **The Sun in High Energy** Mitzi Adams

Talk: **Polars** Steve Howell

Talk: **VERITAS & AGN Light Curves** Geza Gyuk

Workshop: **Intro to Using X-ray Data Analysis Tools** Sandeep Patel

Town Hall Style Discussion all speakers as panelists

### Method #1: world's best

- Eye + Brain: Look at the data!
- Plot  $x$  as a function of  $t$ : Explore!
- Scientific name:

*Visual Inspection*

- World's best – but not infallible

# 2005 HEA Data Analysis Workshop

## Time Series Analysis of Amateur Observations: Various Methods and Some Results

Ivan L. Andronov

*Astronomical Observatory, Odessa State University, Ukraine (now Astronomical Observatory, Odessa National University, T. G. Shevchenko Park, Odessa 65014 Ukraine)*

*Present affiliation: Odessa National Maritime University, Mechnikova St. 34, Odessa 65029 Ukraine*

**Abstract** Algorithms and programs are described which allow **time series** analysis of periodic, multi-periodic, quasi-periodic, and aperiodic signals of an arbitrary nature with equidistant and non-equidistant arguments. The methods are applied to the observations of semiregular, dwarf nova, eclipsing, and Mira-type stars.

*Foster, JAAVSO Volume 24, 1996*

## DATA REDUCTION BY AVERAGING

Grant Foster

AAVSO  
25 Birch Street  
Cambridge, MA 02138

*Presented at the AAVSO Annual Meeting, October 28, 1995*

### Abstract

In many cases, a time series with very many observations can, by averaging over an appropriate time span, be reduced to a manageable number of data points with very little loss of information. I investigate the errors inherent in this process.

## WAVELET ANALYSIS OF SMALL-AMPLITUDE PULSATING RED GIANTS

John R. Percy

Ryan Kastrukoff

Erindale Campus, and  
Department of Astronomy  
University of Toronto  
Mississauga, ON L5L 1C6  
Canada

*Presented at the 90th Spring Meeting of the AAVSO, May 5, 2001*

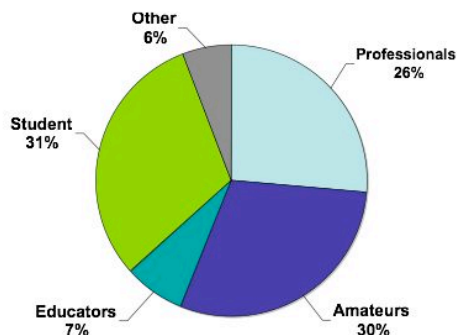
### Abstract

We have investigated the usefulness of wavelet analysis for studying the changing period and amplitude of small-amplitude pulsating giants. Specifically, we have applied it to EU Del, W Boo, and SX. With care, this method can provide useful information about variability with amplitudes between 0.2 and one magnitude, especially if in conjunction with light curves, Fourier analysis, and autocorrelation analysis.

# Enjoy your data... everyone else is!

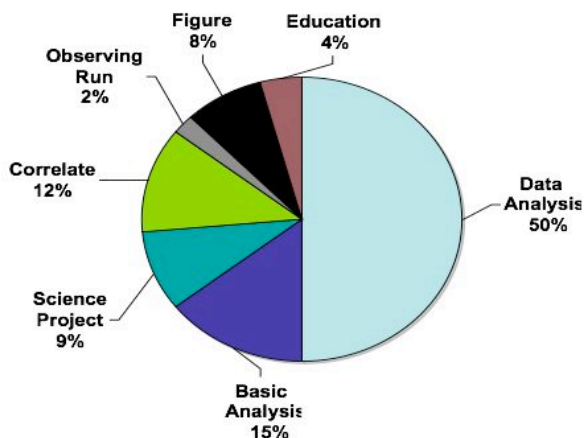
## 4,248 Online Data Requests

Who is downloading the data?



## 4,248 Online Data Requests

How is the data being used?



2008

- J. Shears, C. Lloyd, D. Boyd, S. Brady, I. Miller, R. Pickard, 2008, [Outburst characteristics of the dwarf nova V452 Cassiopeiae](#), Accepted for publication in the *Journal of Astronomical Association*.
- A. Golovin, Y. Kuznyetsova, M. Andreev, 2008, [High-Resolution Spectroscopy of Long-Periodic Eclipsing Binary Epsilon Aurigae](#), *Odessa Astronomical Publications* 20, p. 55.
- M. Zhao, D. Gies, J.D. Monnier et al., 2008, [First Resolved Images of the Eclipsing Interacting Binary Beta Lyrae](#), Accepted by *ApJL*.
- C. Papadaki, H.M.J. Boffin and D. Steeghs, 2008, [IP Pegasi in outburst: Echelle spectroscopy & Modulation Doppler Tomography](#), *Journal of Astronomical Data* (submitted)
- Izumi Hachisu, Mariko Kato, and Angelo Cassatella, 2008, [A Universal Decline of Classical Novae. III. GQ Mus 1983](#), accepted to *The Astrophysical Journal*
- A.V.Halevin and A.A.Henden, 2008, [Eclipse mapping of RW Tri in the low luminosity state](#), *MNRAS* (submitted)
- A. Olech, M. Wisniewski, K. Zloczewski et al., 2008, [Curious Variables Experiment \(CURVE\). RZ LMi - the most active SU UMa star](#), accepted to *Acta Astronomica*
- C. Papadaki, H.M.J. Boffin, V. Stanishev et al., 2008, [Photometric study of selected cataclysmic variables II. Time-series photometry of nine systems](#), *Journal of Astronomical Data* (submitted)
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