

Before Getting Started...

V12 Tutorial: Fixed Formatting

Forced "U.S.-centric" settings

Ini (text) files are used; mixing formats can cause problems.

- Time separator ':' colon (also used as RA/Dec separator)
RA: 12:45:22.6 Dec: +05:32:57.9 UT: 04:52:30 (leading zeros/24-hour)
- Date separator '-' dash Date order yyyy-mm-dd
May 12, 2023: 2023-05-12 (leading zeros)
- Decimal point '.' period
Value = -0.45587 (leading zero for $|x| < 1.0$, no thousands grouping)
- Millimeters for focal lengths; meters for apertures (30 cm = 0.30 m)

MPO v12 Tutorial

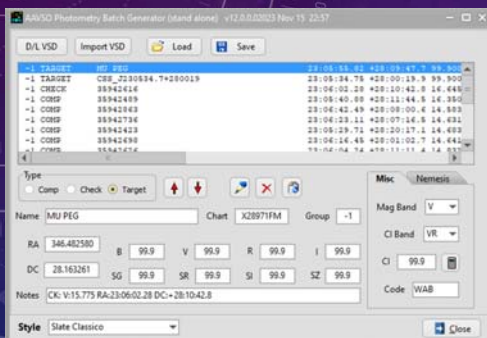
Variable Star Multi-image Photometry

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V12 Tutorial: Multi-image Variable Star Photometry Must See Videos

Variable Star Batch Reference Files

Variable Star Configuration



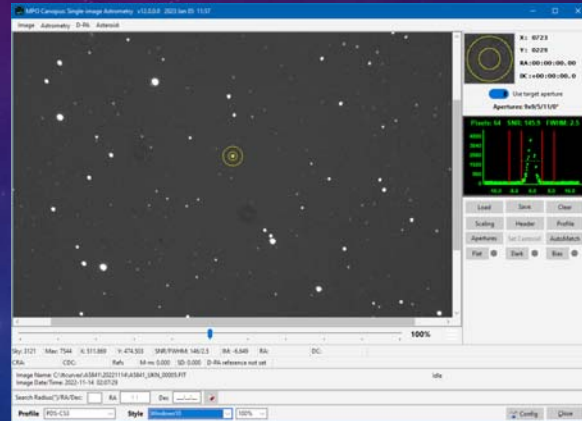
MPO YouTube channel <https://youtube.com/@8734Warner>

V12 Tutorial: Multi-image Variable Star Photometry

ImageForm: View Me Next!

ImageForm.mp4

- Used in all image measuring programs.
- “Sticky” image scaling and zoom.
- Set flat, dark, bias frames.
- Set aperture sizes and shapes.
- Automatch image.
- Supports only FITS images.



MPO YouTube channel <https://youtube.com/@8734Warner>

In the Offing

V12 Tutorial: Multi-image Variable Star Photometry What's Lies Ahead

Steps: from images to data

- Confirm Configuration (Profile).
- Review Images (optional).
- Set up work parameters.
- Open (automatch) Image1.
- Locate and select comp stars.
- Create and review a session.
- Measure Images.

Lightcurve analysis a period search in a separate tutorial.



Concentrate on the Process

V12 Tutorial: Multi-image Variable Star Photometry

Working with the Example Images

Concentrate on the Process

- Exact duplication of results may be unlikely.
 - For example, the point is not which stars are initially selected for comp stars, but how to select which stars will be used.
 - Very similar results are "good enough."
"Perfect" is the enemy of "good enough."

Assumed Paths

- "MPOV12" = MPO v12 Root directory, e.g.,
`MPOV12 = C:\MPOV12`
`MPOV12EX = C:\MPOV12\Examples\Canopus\VarStar\`

V12 Tutorial: Multi-image Variable Star Photometry

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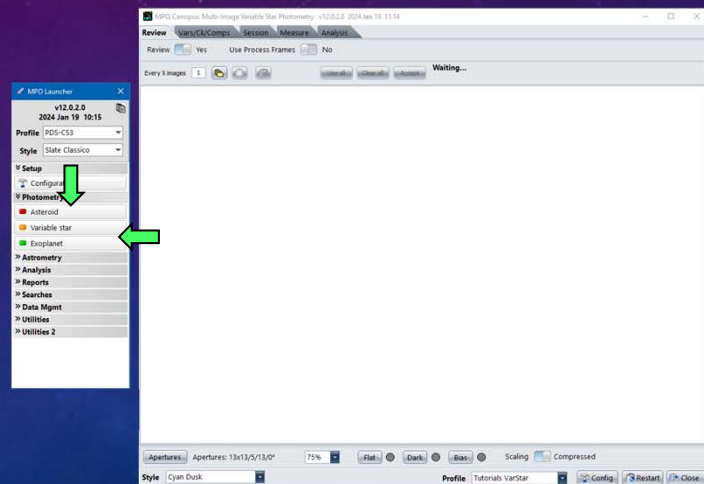
Assumed Paths

- "MPOV12" = MPO v12 Root directory, e.g.,
`MPOV12 = C:\MPOV12`
`MPOV12EX = C:\MPOV12\Examples\Canopus\VarStar\`

Configuration Setup

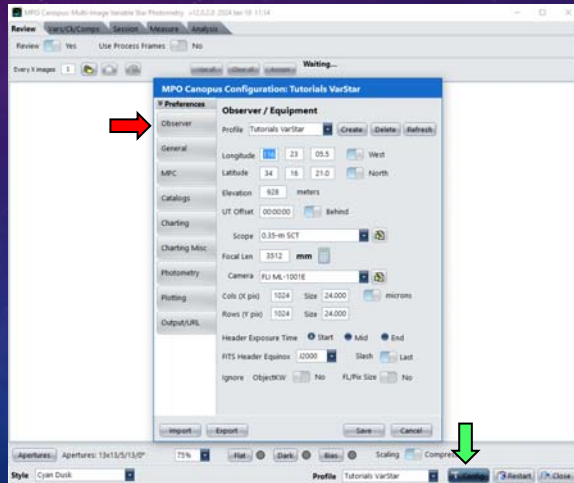
V12 Tutorial: Multi-image Variable Star Photometry Open Program

- Open MPO Launcher.
- Click <Photometry> tab.
- Click <Variable star>.
- Wait for program to appear.



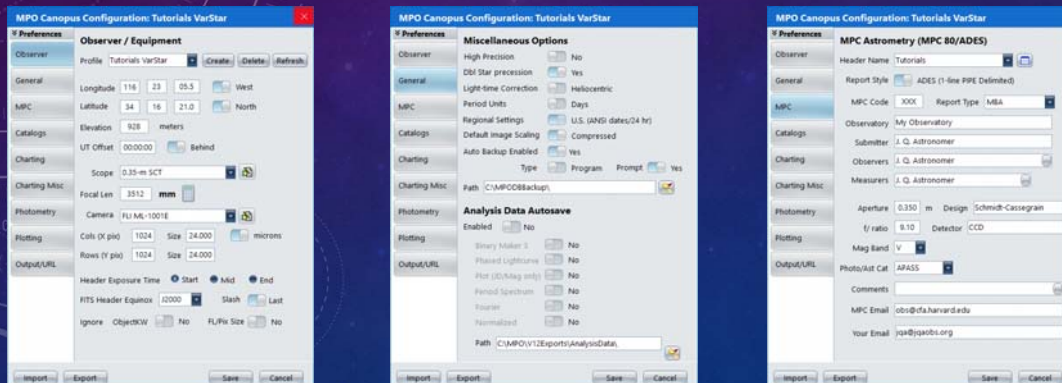
V12 Tutorial: Multi-image Variable Star Photometry Open Configuration

- Click <Config>.
- Wait for Configuration form to appear.
- If necessary, click on <Observer> in the panel on the left side of the form.



V12 Tutorial: Multi-image Variable Star Photometry Duplicate the Entries Shown Here

*The settings are valid only for the tutorials.
You must create a separate profile that matches your setup and images.*



V12 Tutorial: Multi-image Variable Star Photometry

Duplicate the Entries Shown Here

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You must create a separate profile that matches your setup and images.

The image displays three screenshots of the MPO Canopus Configuration: Tutorials VarStar dialog box, showing the Preferences, Chart Drawing Options, and Charting Miscellaneous tabs.

- Preferences:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - MPOSOC: No, MPC: No, Priority: 3
 - CMC15: No, MPC: No, Priority: 3
 - ATLAS2: Use, MPC: Yes, Priority: 2
 - UCAC4: No, MPC: Yes, Priority: 4
 - APASS: Use, MPC: No, Priority: 1
- Chart Drawing Options:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - Draw Dates: No
 - Draw Messier: Yes
 - Draw DSO: Yes
 - DSO Labels: Yes
 - Bin Magnitudes: No
 - Fill Stars: Yes
 - Reverse E/W: Yes
 - Reverse N/S: Yes
 - User Stars: Plot Stars: Yes, Use for Astrometry: Yes, Show Labels: No, Star Color: yellow
 - LONEOS Stars: Plot Stars: No, Use for Astrometry: No, Show Labels: No, Star Color: yellow
- Charting Miscellaneous:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - Maximum Scale Diff: 1.0
 - Max Match Angle Diff: 95
 - Chart Rotation (° CW): 0
 - Automatch Star Count: 20
 - Asteroid Table: Import

V12 Tutorial: Multi-image Variable Star Photometry

Duplicate Entries Shown

The settings are valid only for the tutorials.
You must create a separate profile that matches your setup and images.

The image displays three screenshots of the MPO Canopus Configuration: Tutorials VarStar dialog box, showing the Photometry Defaults, Plotting Options, and MPO Output Directories tabs.

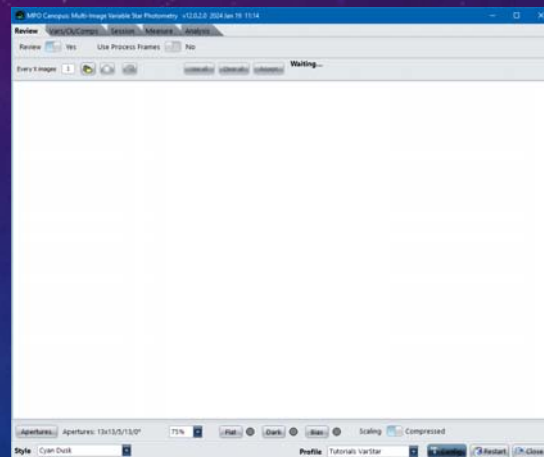
- Photometry Defaults:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - Default Filter: C
 - Default ADU/ISO Filter: CV
 - AJUSO Obs Code: 0001
 - Default Mag Band: V
 - Default Color Index: VR
 - Dark: [Field]
 - Bias: [Field]
 - Flat: [Field]
 - Clear process frame if blank: No
 - Photometry Magnitudes: Method: Derived, Clipping: 0.5, Saturation %: 90, Ignore: No, Max MIR Std Dev: 0.03, Min Comps SNR: 10, Camera eADU: 2.3
- Plotting Options:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - Method: Absolute
 - Differential ZP: Fixed, Mag: 0.0
 - Plot Symbol Size: 5
 - Dots Only: No
 - Monochrome: No
 - Header: Show, Footer: Show
 - TopRight Axis: Hide, Phase Angle: Hide
 - Force ON Phase: Yes, Method: Max-Row
 - Normalized Plot: Hide, Gantt Plot: Hide
 - MPS Style: Yes, Cycles: 1.1
 - Plot Sizes: Plots: Custom, W: 1024, H: 673; Spectrum: Custom, W: 1024, H: 676
- MPO Output Directories:** Shows settings for Observer, General, MPC, Catalogs, Charting, Charting Misc, Photometry, Flotting, and Output/URL. Key settings include:
 - Plots: C:\MPO\V12\Exports\Plots
 - Exports: C:\MPO\V12\Exports\Exports
 - Charts: C:\MPO\V12\Exports\Charts
 - Useful Web Sites: Lists various astronomical resources and links.

A Robert Frost Moment

V12 Tutorial: Multi-image Variable Star Photometry Two Paths Diverge, then Converge

The Two Paths Forward

- With or without a batch reference file.
- *"When you get to a fork in the road, take it."*
- **To the Crossroads.**
 - Select and accept images.
 - Click <Accept> on Review tab.
 - Click <Load> to automatch Image 1.
 - Set the Measuring Run values (SNR, Saturation, etc.).
 - Set <Source> to "Batch."
 - Click <Comps> to display BRF editor.



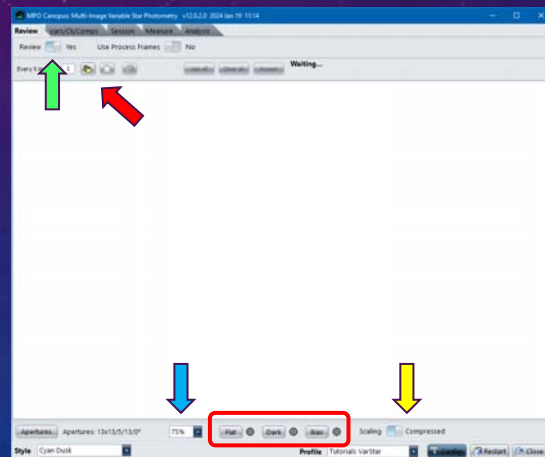
Reviewing/Selecting Images

V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Reviewing images is optional.

Whether or not reviewing, you must take certain steps.

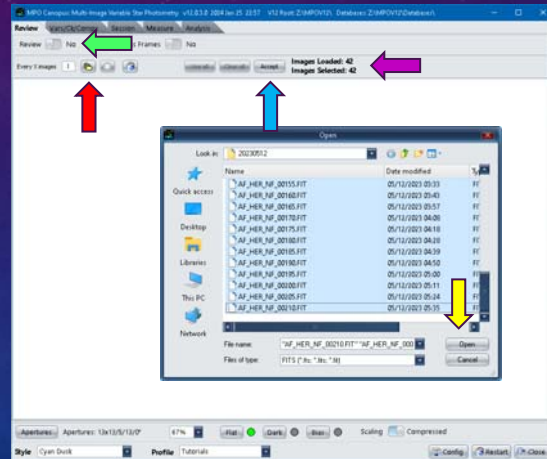
- Set <Review> to "Yes" or "No."
- Load process frames (optional).
- Set image sizing to show all or most of each image.
- Set <Scaling> to "Normal" or "Compressed."
- Select the images to be measured.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Not Reviewing Images

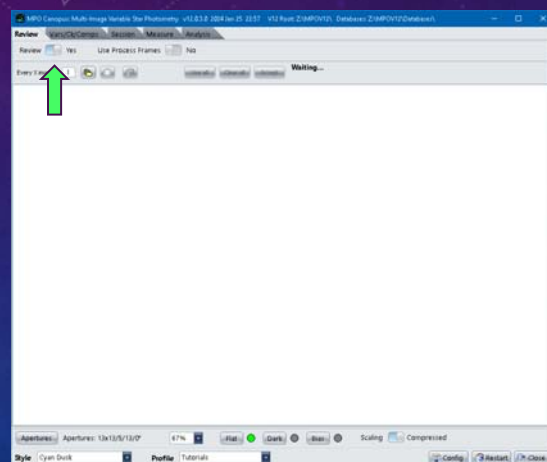
- Set <Review> to "No."
- "Every X Images" value is ignored.
- Click <Folders> to display a file open dialog.
- Select all images to be measured.
- Click <Open> on dialog.
- The label at far right shows "Loaded" and "Selected" counts. They should be the same.
- Click <Accept> to go the next tab.
- Fast forward on tutorial to "Measuring Run Setup."



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Review: Yes

- Yes
Create and display thumbnails of each selected image.
- No
Load selected images without review.
Paths, not full images, are saved in memory.

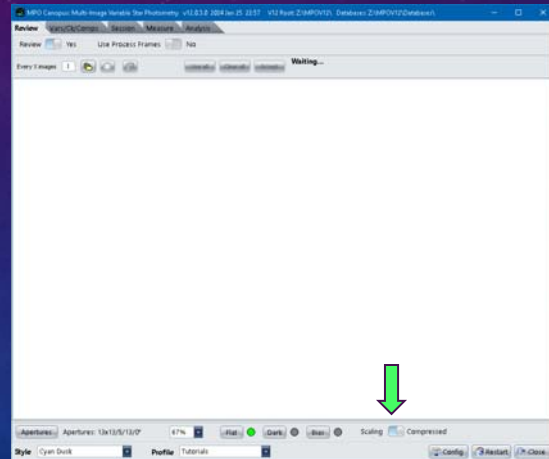


V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Scaling: **Compressed**

- **Normal**
Applies v10 "Normal" standard deviation display image scaling.
Good if no bright object dominates
- **Compressed**
Applies v10 "Compressed" standard deviation display image scaling.
Better for showing faint stars and targets

Applies to all images from here on.

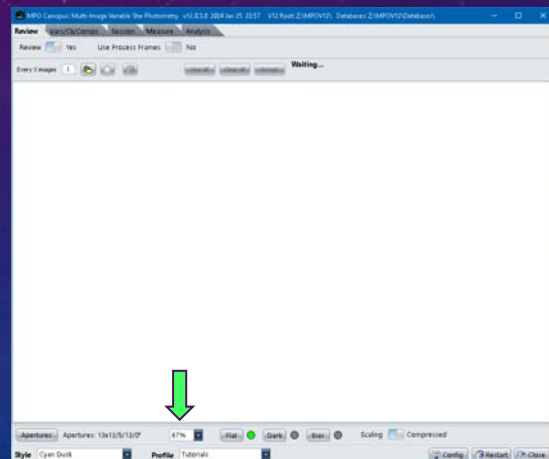


V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Image Size Scaling: **67% (or 75%)**

- Default value for all images from here on.
- Can be reset or overridden at any time.

Set the value based on row/column pixel counts of the image and display monitor resolution.

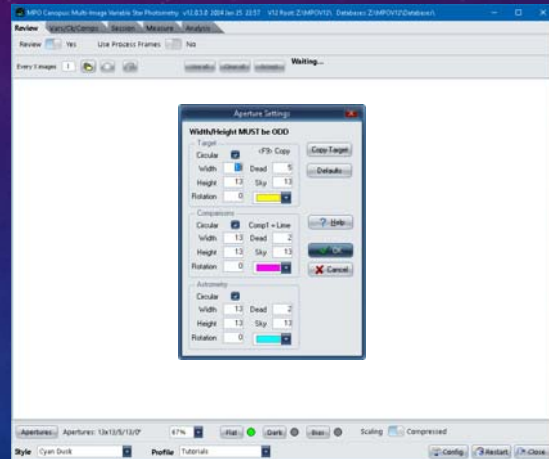


V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Measuring Apertures

- Inner Width/Height
 - Dead Zone
 - Sky annulus width
 - Rotation
 - Color
- Target: 13/13/5/13/0 Yellow
 - Comps: 13/13/2/13/0 Fuchsia
 - Astrometry: 13/13/2/13/0 Aqua

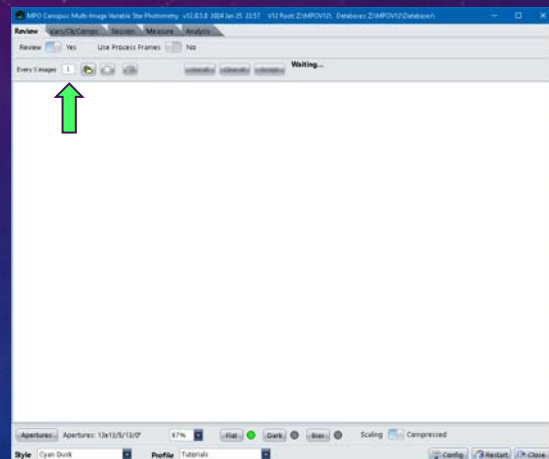
Colors are suggested but can be changed to suit your preferences.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Every X images: 1

- Must be > 0.
- If > 1, then a subset of images is loaded.
- X = 3, selecting images 1 – 99, Images 1, 4, 7, ... 99 are selected.
- Use > 1 only if subset is useful.



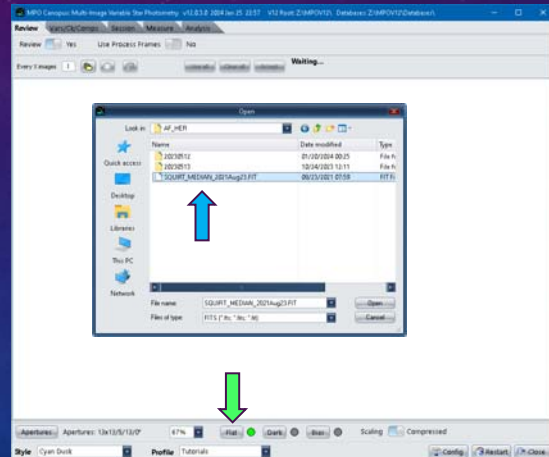
V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Load Flat Frame

- Click <Flat>, select "Load"
- Navigate to
MPOEX\AF_HER
- Select **SQUIRT_MEDIAN_2021Aug23.FIT**

"LED" Colors (all frames)

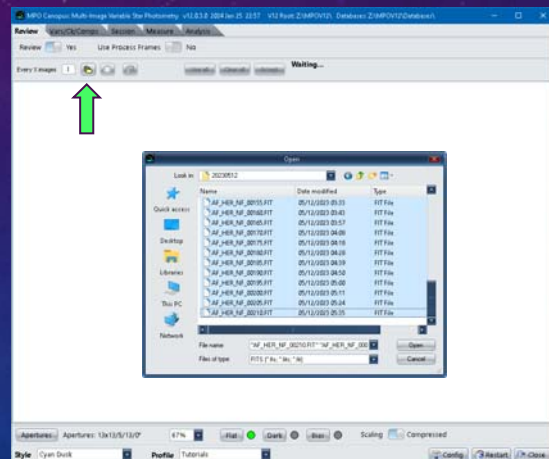
- Gray: No frame loaded.
- Green: Frame loaded and used.
- Red: Frame loaded, *not* used.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Select Images

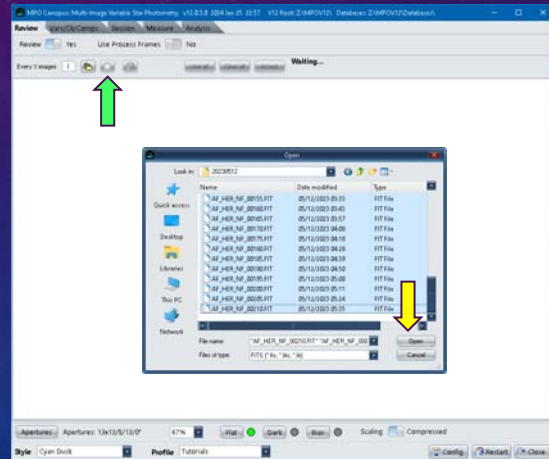
- Click <Files>
- Navigate to
MPOEX\AF_HER\20230512
- Select *all* images
- Generally, select the first and last image to be measured *and all those in-between just as if assuming Every X = 1.*
- The program "does the math" to create the subset.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Load Selected Images

- Click <Open>.
- Message to right of <Accept> reports progress, e.g., "20 of 42."
- Click now highlighted <X> to stop loading. Images loaded to the point are displayed.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Don't Like Subset

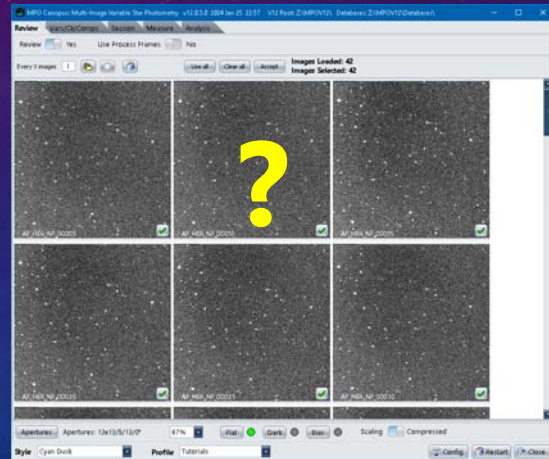
- Click <Trash Can> to clear all images.
- Select new set of images by clicking <Files> again.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Look for "Bad Images"

- Scroll down list to look for images that shouldn't be measured.
- Look for trailing, satellites/planes going through the field, clouds, etc.

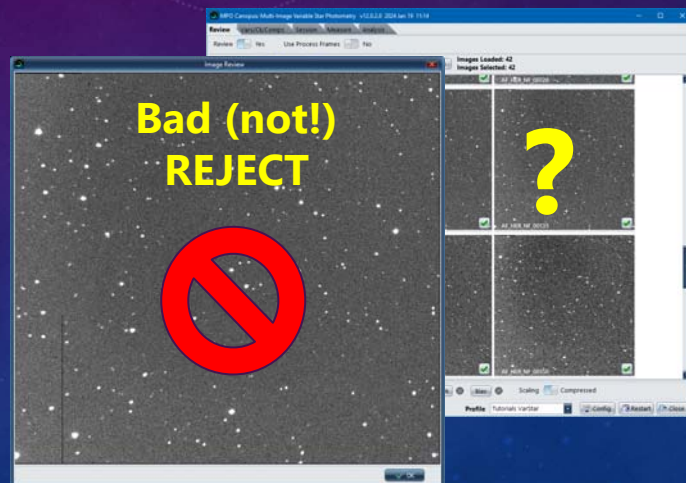


V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Look for "Bad Images"

- Double-click on an image in the list to show a larger version.
- Image is trailed. Rejected!
- Click <Close>.

*All the images in the set are good.
This is for illustrative purposes only.*



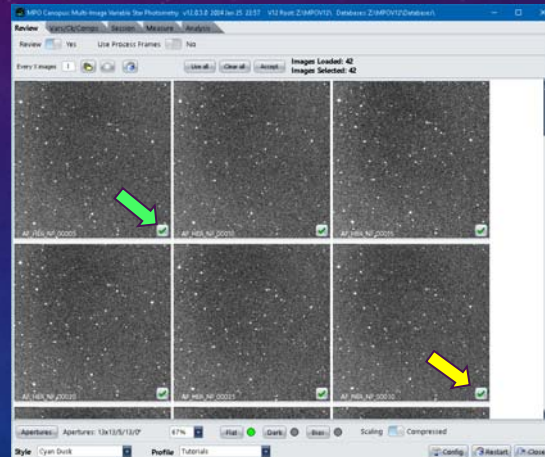
V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Selecting "Bad Images"

- Click on green <Check> in first image to be excluded.
- Ctrl+Shift+Click on green <Check> in last image to be excluded.
- The checks become a red 'X'

Restore Checks

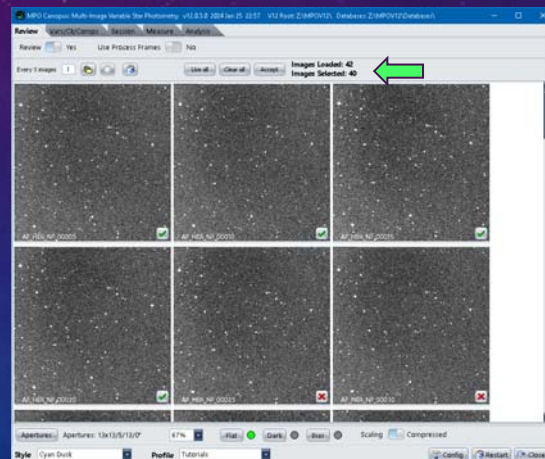
- Click the red X on an image (single or first in a range) to revert to a green check mark.
- For a contiguous range, Shift+Click on the last image in the range.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Rejecting "Bad Images"

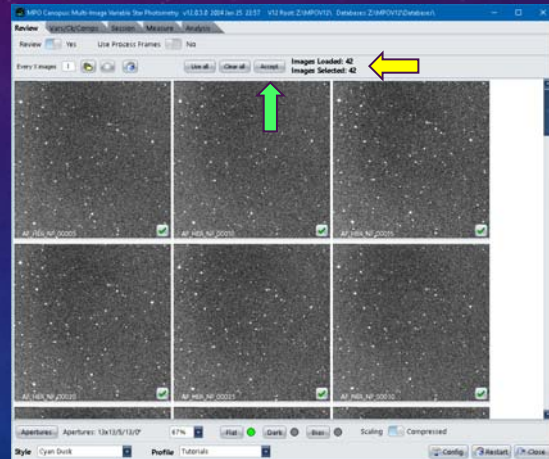
- To extend a contiguous range of images, Ctrl+Shift+Click on the "new last" image to be excluded.
- To exclude another image after the contiguous range, click on <Check>.
- Ctrl+Shift+Click on an image further down the list to create a new contiguous set.
- Note that the "Images Selected" numbers change as you select and deselect images.



V12 Tutorial: Multi-image Variable Star Photometry Reviewing and Selecting Images

Accept the Selected Images

- The example set for 2023 May 12 has no bad images. The Loaded and Selected counts should be 42.
- Click <Accept> to process the list and move to the Image 1 page.

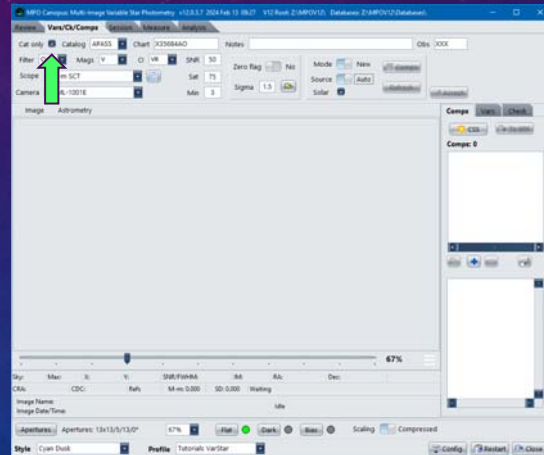


Preliminary Setup

V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Cat Only: **Checked**

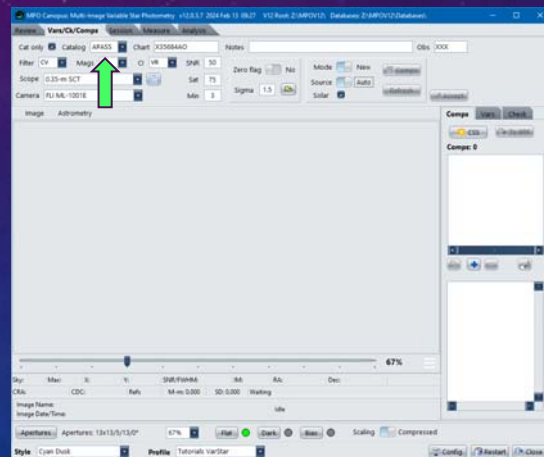
- **Checked**
Only stars from the selected catalog are used to generate the underlying star chart.
 - **Unchecked**
Stars from all catalogs being used can be used for plotting, up maximum of 75.
- Order of catalog processing set by Priority in the configuration.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Catalog: **APASS (DR-9)**

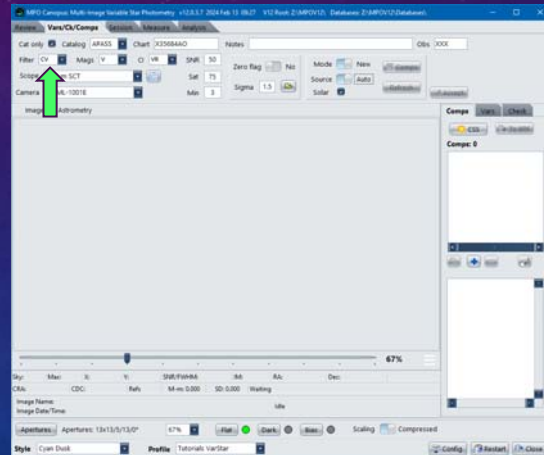
- Priority 1 in configuration.
- Has well-calibrated V magnitudes.
- ATLAS2 has V magnitudes but errors are generally ± 0.05 mag, worse for extremely blue/red stars.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Filter: **CV** (Clear using V mags)

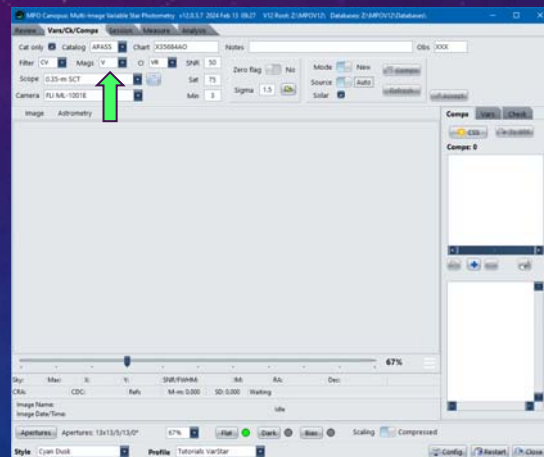
- Choose the filter used.
- Independent of the magnitude band of the comps, e.g., there are no "Clear" magnitudes in the catalogs.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Mags: **V**

- The magband of the magnitudes in the catalogs.
- Independent of filter used.
- Sloan vs. Pan-STARRS
 - *Sloan*
SG-SZ. Sloan (SDSS) photometric system.
CMC-15, UCAC4, APASS.
 - *Pan-STARRS*
PG-PZ. Pan-STARRS photometric system.
ATLAS2.
- *Not the Same! Systematic offsets.*

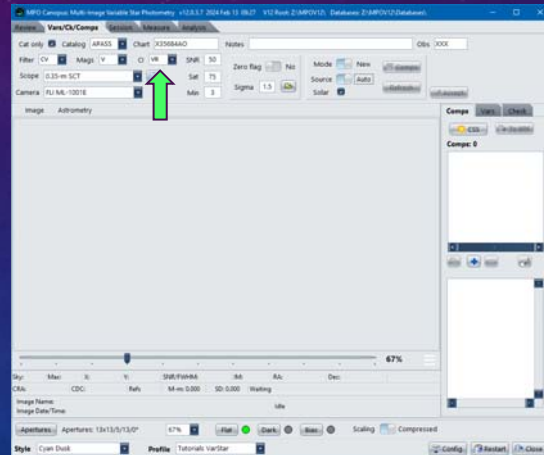


V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

CI: VR (V-R)

- For historical purposes, e.g., if transforms applied to the data later on.
- Default choice.
- Better: B-V since native to APASS.
- If using filter, select a band that includes the filter.
- If using multiple filters, select the band that includes two of the filters.

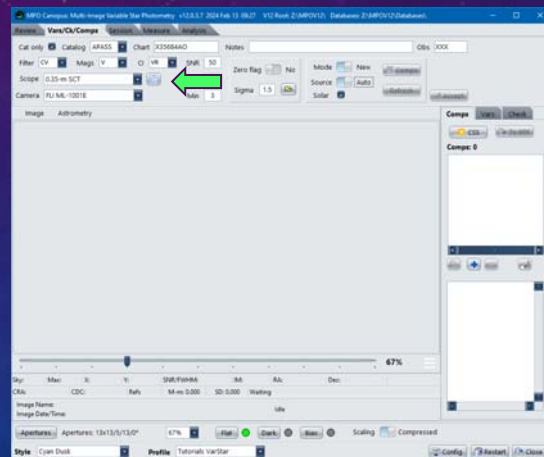
Measurements are stored as raw data. Any corrections are applied only during analysis.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Scope and Camera

- If none available, click button to right of Scope field to display equipment form to edit the dropdown lists.
- Actual scope was 0.30-m SCT.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

SNR: 50

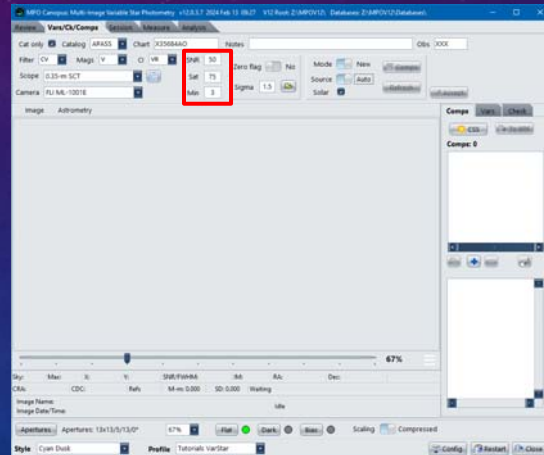
- Minimum SNR of any auto-selected comp star.

Sat: 75%

- Maximum percent of largest value allowed by ADU (or bit-depth of image), e.g., 16-bit = 65,535.

Min: 3

- Minimum number of comp stars. Does not include check star.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

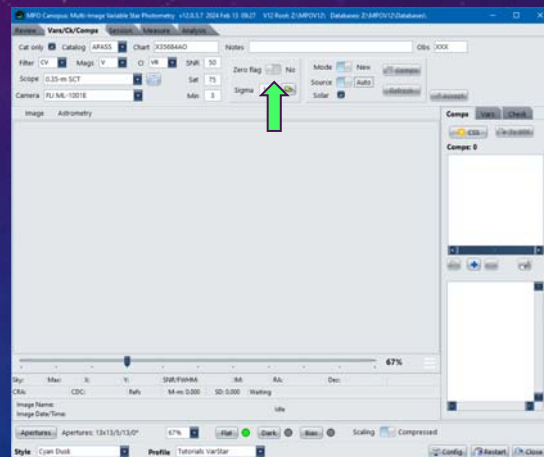
Zero Flag: No

Yes

- Only stars with SExtractor flag = 0 are inspected.
- Good if dense area (bright star, globular cluster or galaxy off to side).

No

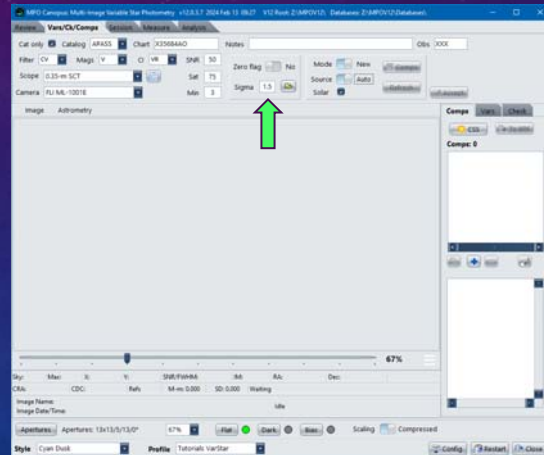
- Flag value is ignored.
- Could include saturated, blended, or other "errors" that may give false instrumental vs. catalog magnitudes.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Sigma: 1.5

- From SExtractor (EXTRACT.EXE)
- Sets a lower "above the noise" level.
- Default: 1.0 – 2.0.
- Range: 0.1 – 3.0.
- Time to automatch to sigma value.
- Larger number (≥ 1.0)
 - Fewer stars, fewer false hits, may not find very faint target.
- Smaller number (< 1.0)
 - More star, more false hits, better chance of finding very faint target.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

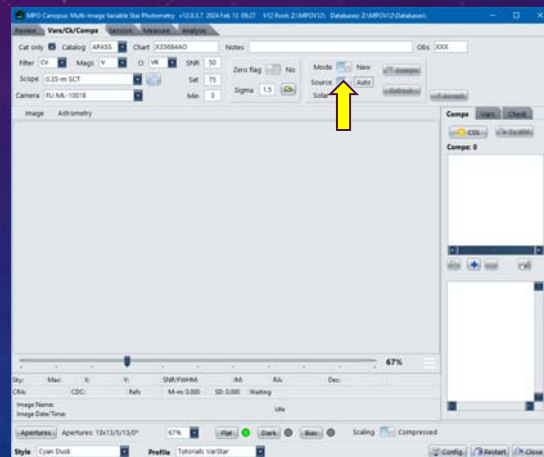
Mode: New

New

- Create a new session after selecting comps and setting target(s) and check.
- Source (comp selection) is either Auto or Batch.

Edit

- Edit existing session.
- Source setting is ignored.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

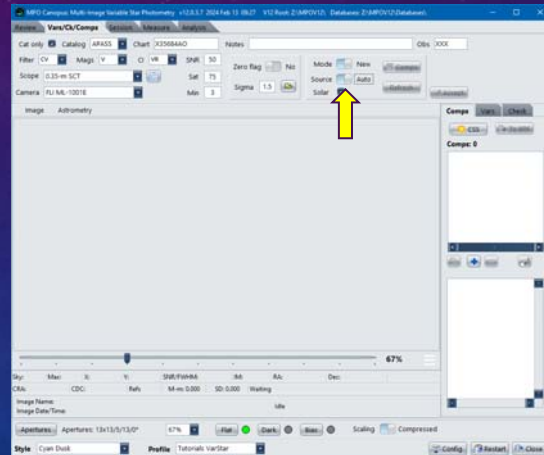
Source: **Auto**

Auto

- MPO Canopus selects up to 15 comp stars.
- Set can be edited.
- Target(s) and check set manually.
- Final setup can be save to BRF.

Batch

- Existing batch reference file is loaded or one is created on-the-fly and then loaded.
- If insufficient number of comps, more can be added manually.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

Solar: **Checked**

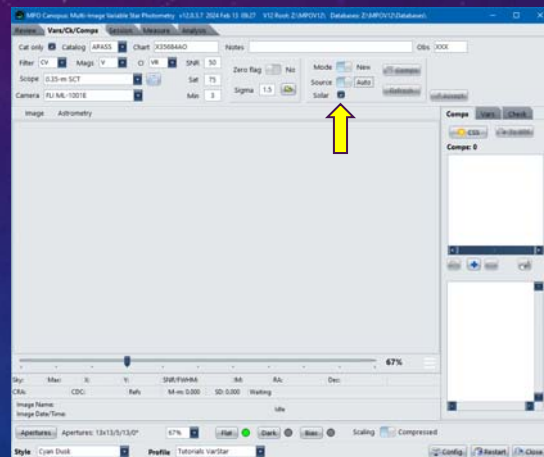
Checked

- Comps initially restricted to solar color, i.e., $B-V = 0.45 - 0.95$.
- *Tend* not to be variable.

Unchecked

- Initial selection not restricted by color index.
- Good for deep blue or red targets.

After initial selection, swap color index limitation by setting box to opposite state.



Selecting Comp Stars (Auto)

The Fork in the Road

V12 Tutorial: Multi-image Variable Star Photometry

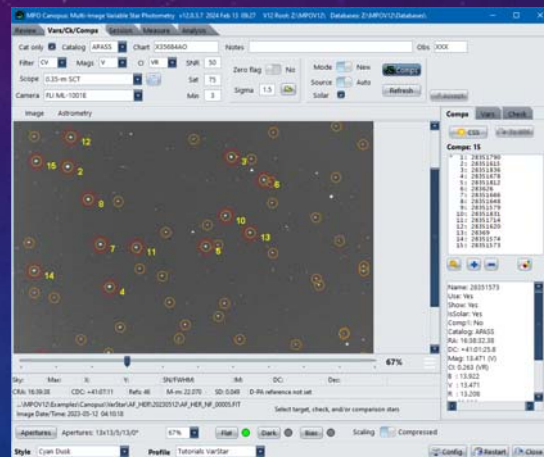
Selecting Comps

Skipping Ahead

- If a batch reference file is in hand, skip to the "Selecting Comp Stars (Batch)" chapter.

The Long Way Home

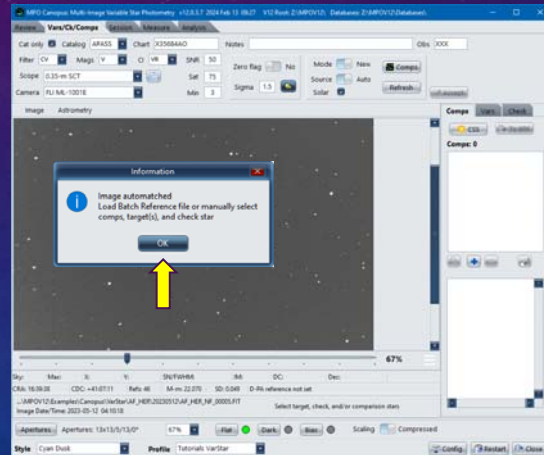
- A query on the AAVSO site on AF HER found no comps. However, it did find some more potential variable star targets.
- And away we go...



V12 Tutorial: Multi-image Variable Star Photometry Load Image1

- Click <Load>.
- Uses the first image in the selected images.
- Wait while image is automatched.
- Message appears if matched.
- Click <OK> on message box.

Required even if using editing existing session.



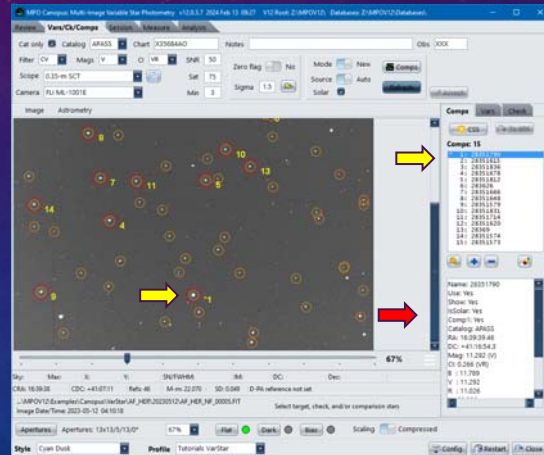
V12 Tutorial: Multi-image Variable Star Photometry Selecting Comps

- Click <Comps>.
- Wait until comp star selections are made.
- Selections are shown on image and in comps list in the Comps tab on the right.

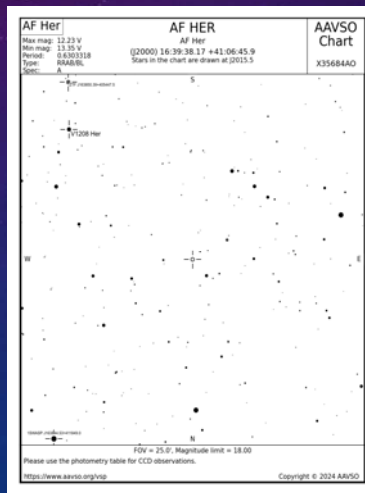
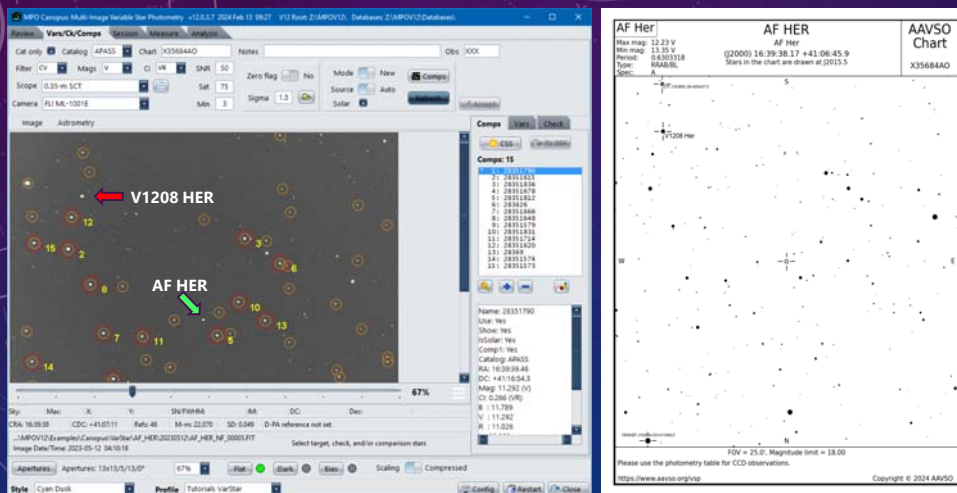


V12 Tutorial: Multi-image Variable Star Photometry Review Comps Selection

- Make sure that no comps are the target(s).
- Check Comp 1
 - Is it too bright?
 - Does it have a close companion?
- Check Other Comps for same reasons.



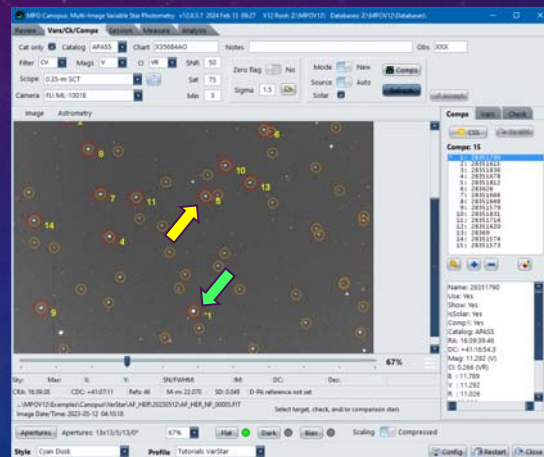
V12 Tutorial: Multi-image Variable Star Photometry Confirm Comps vs. Known Variables



Editing the Comps List

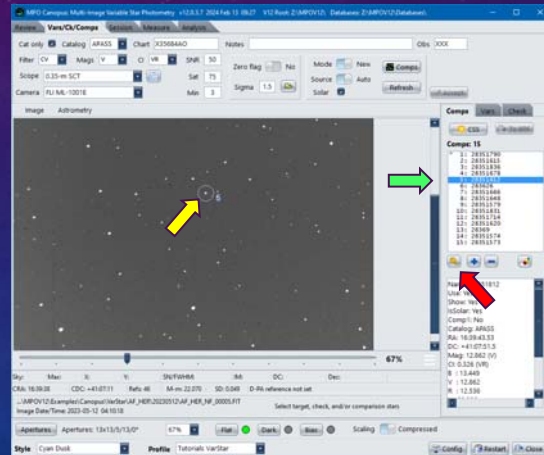
V12 Tutorial: Multi-image Variable Star Photometry Resetting a Comp

- Comp 1 is too close to the edge.
- Look for a good replacement.
 - Similar to AF Her mag.



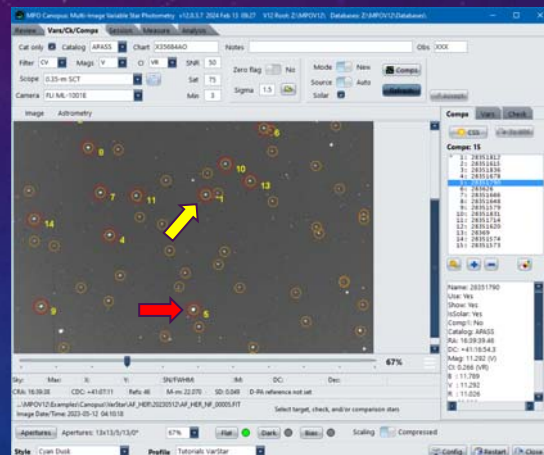
V12 Tutorial: Multi-image Variable Star Photometry Resetting a Comp: Swapping Places

- **Comp List Full**
 - Click on the **Comp1** replacement in the list.
 - Click **<key>** under the list to swap with **Comp 1**.



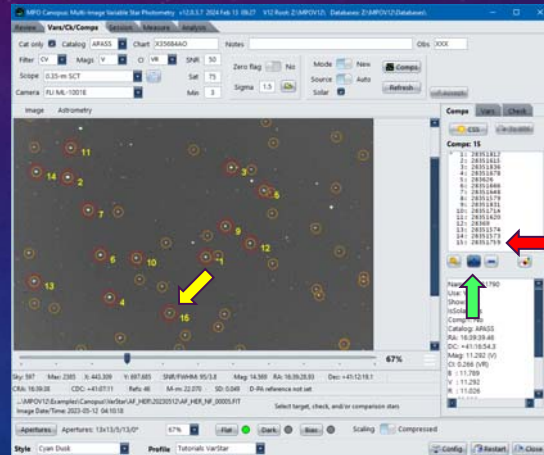
V12 Tutorial: Multi-image Variable Star Photometry Resetting a Comp: Swapping Places

- **Comp List Full**
 - **New Comp 1**
 - Since original **Comp 1** was not good
 - Click on it in the list
 - Click **<minus>** under the list.



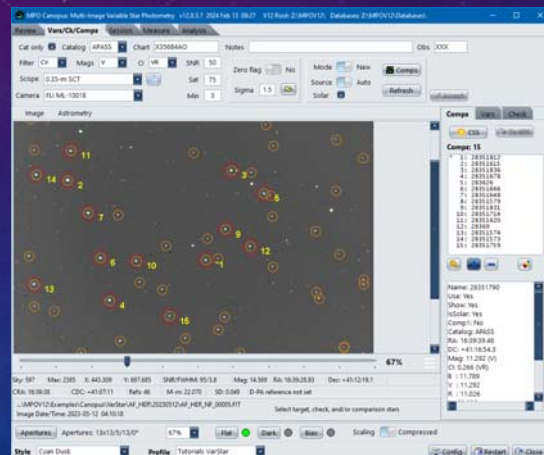
V12 Tutorial: Multi-image Variable Star Photometry Resetting a Comp: Using a New Comp

- **Comp List Full**
 - Click on **Comp 1** in the list.
 - Click **<minus>** under the list.
 - Ignore warning about no **Comp 1**.
- **Comp List < 15 stars**
 - Click a circled star on image for new **Comp 1**.
 - Click **<plus>** under list.
 - Star is added to list.
 - Swap with current **Comp 1**.
 - Do not delete old **Comp 1** if it's still good.



V12 Tutorial: Multi-image Variable Star Photometry Add Until You're Done

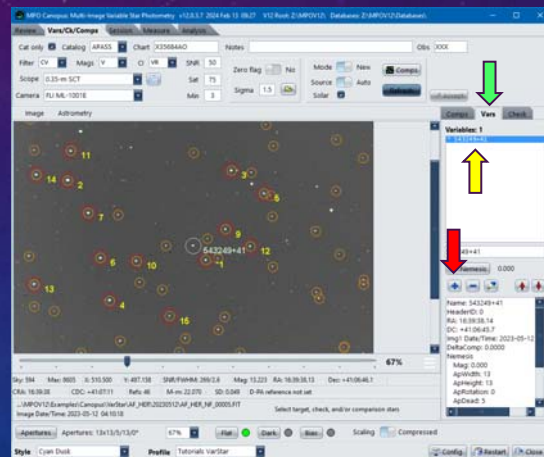
- **Continue editing list**
 - Delete "bad" comps.
 - Add more circled stars.
 - Orange are solar-color
 - Cyan are not solar-color, but still meet other comp criteria.
 - Get as many comps as possible, up to limit of 15 comps.
- **Do not click <Accept>!**



Setting Target(s)

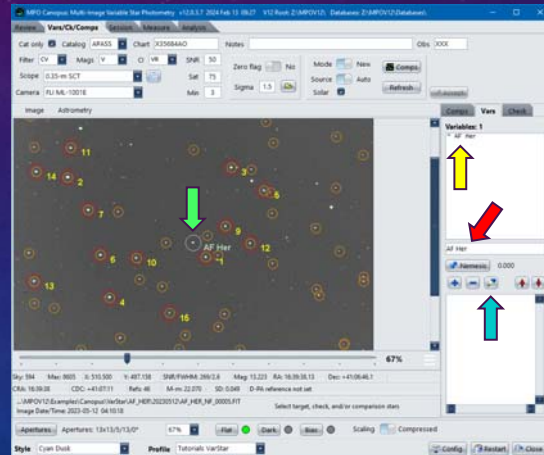
V12 Tutorial: Multi-image Variable Star Photometry Setting the Primary Target

- Click on Vars tab.
- Click on AF Her in the image.
- Click <plus> button on that tab.
- The variable is added to the list.
- It has a catalog name, not AF Her.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Primary Target

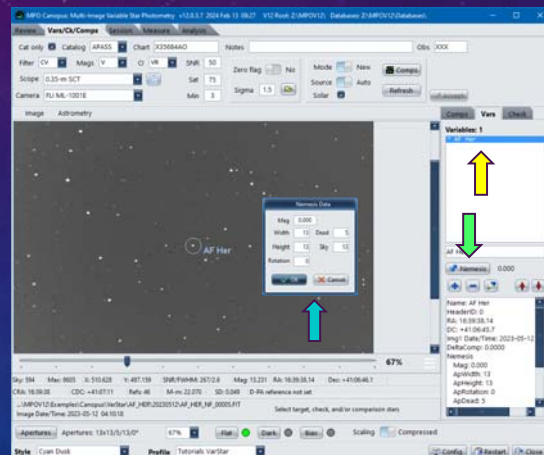
- Click on the star in the Vars list.
- The star is surrounded by a “sky blue” circle.
- Enter “AF Her” in the entry field just below the list.
- Click <pencil> below the list.
- The star is renamed on the image and list.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Primary Target Nemesis

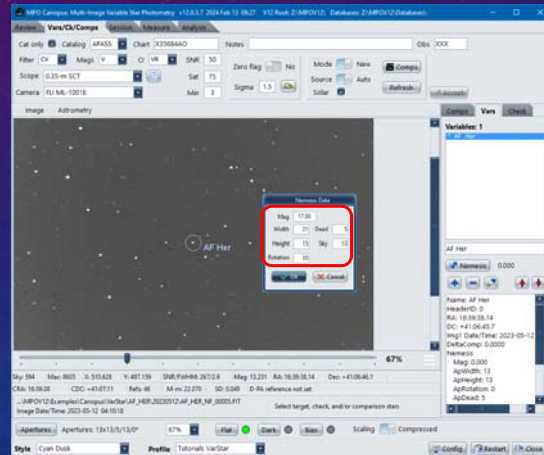
- What is “Nemesis?”
 - A close companion that cannot be excluded when measuring the target.
- The Solution?
 - Measure both stars and subtract the effect of the nemesis star on the total measured magnitude.

MPO Nemesis code is based on a formula in “Astronomical Algorithms” by Jean Meeus.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Primary Target Nemesis

- Assume a 17.00 mag close companion.
- Click on target in list.
- Click <Nemesis>.
- Enter apertures that will safely contain target *and* companion.
- Click <OK> on apertures form.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Primary Target Nemesis

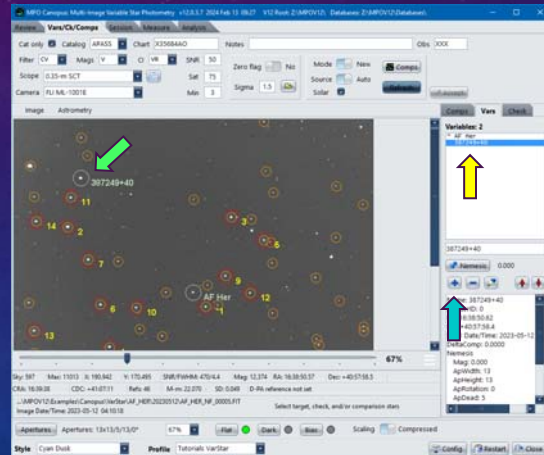
- The information in the list at bottom shows updated Nemesis settings.
- Click <Refresh> to redisplay numbers comps and target.
- Click <pencil> *only if* you want to clear Nemesis data.
 - Click <Refresh>
 - Click on target in list to confirm Nemesis data are gone.

Wait! There's V1208 HER, too!



V12 Tutorial: Multi-image Variable Star Photometry Setting Additional Targets

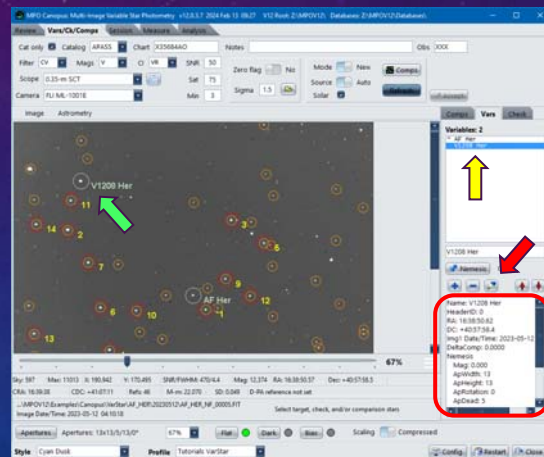
- Click on V1208 HER on image.
- Click <Add> on the Vars tab.
- It is added with a star catalog name or "Selected-#" (# is a number).
 - "Selected-#" is a star not in the chosen catalog but found during image extraction.



V12 Tutorial: Multi-image Variable Star Photometry Setting Additional Targets

- Enter "V1208 HER" in the edit field below the vars list.
- Click <pencil>.
- Star is in list with proper name and marked in image.
- A nemesis star can be set for each variable.
 - The nemesis magnitude and apertures settings are for the selected variable only and do not have to be the same as for any other nemesis definition.
- Repeat steps for other additional targets.

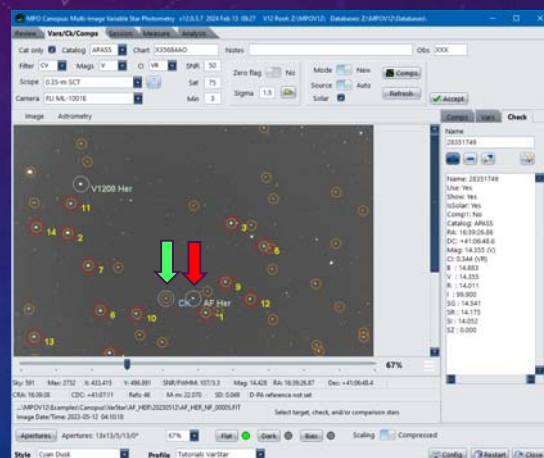
Almost there!



Setting the Check Star

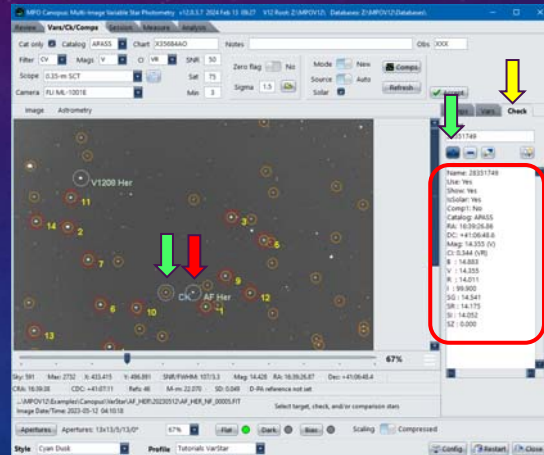
V12 Tutorial: Multi-image Variable Star Photometry Setting the Check Star

- Check Star is “alternate target”.
- Used to verify that none of the comps stars is also a variable.
- Only one and must not be variable.
- Should be similar in magnitude to primary target or a good compromise among all targets.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Check Star

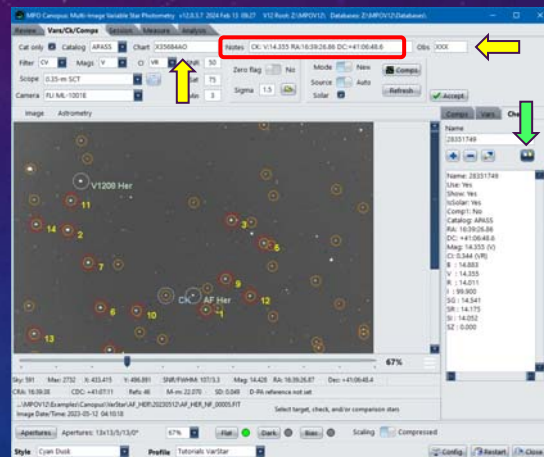
- Click on Check tab.
- Click on proposed Check Star in the image.
- Click <Add>.
- It appears in the check list and shows as "CK" on the image.



V12 Tutorial: Multi-image Variable Star Photometry Setting the Remaining (Required) Data

- Click <transfer> to the right of <pencil>.
 - Copies Name, RA/Dec, and mag to <Notes>.
- Enter "X35684AO" in <Chart>.
 - Chart ID of downloaded finder chart.
- Enter "XXX" in <Obs>.
 - Observer code assigned by AAVSO.
- Review comps, vars, and check lists.

Do not click <Accept>.



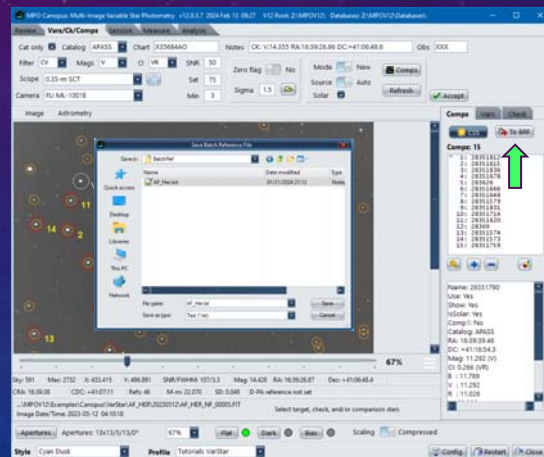
Save Batch Reference File

V12 Tutorial: Multi-image Variable Star Photometry Complete Setup and Save to Batch Reference File.

- Return to Comps tab.
- Click <To BRF>.
- Select path and enter a file name in the file save dialog form.
- Click <Save> on the dialog form.
- A confirmation message appears showing full path name of the saved BRF.

Hint

The installation creates \MPOV12\AAVSO directory. Save to there or in a subdirectory of it, e.g. \MPOV12\AAVSO\BatchRef\



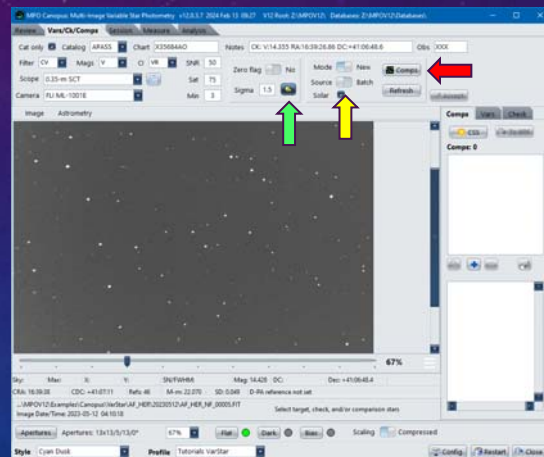
Selecting Comp Stars (Batch)

The Same, but Different, Fork in the Road

V12 Tutorial: Multi-image Variable Star Photometry

Quick and Easy

- Use Existing Batch Reference File
 - Select and accept images.
 - Click <Accept> on Review tab.
 - Click <Load> to automatch Image 1.
 - Set the Preliminary values (SNR, Saturation, etc.).
 - Set <Source> to "Batch."
 - Click <Comps> to display BRF editor.

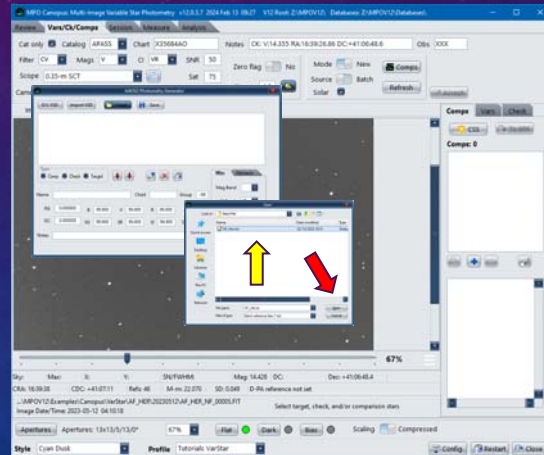


V12 Tutorial: Multi-image Variable Star Photometry Quick and Easy

- Click <Load> on BRF editor to display a file open dialog.
- Locate and select the BRF text file.
- Click <Open> on the file open dialog.

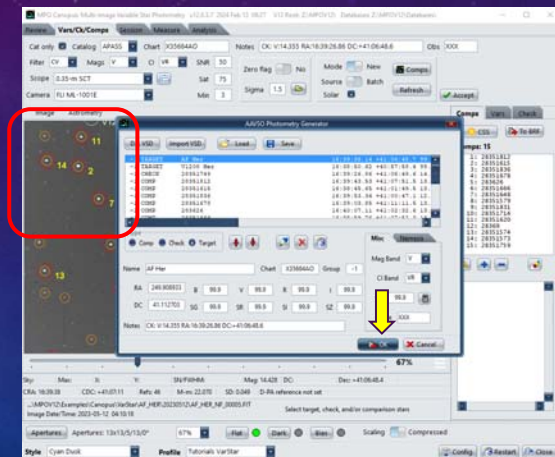
The BRF can be version 12 or legacy version 10.

- A v10 file may need some “tweaking” after being loaded. Once it’s ready, save it in the editor, which converts the data to a v12 BRF.



V12 Tutorial: Multi-image Variable Star Photometry Quick and Easy

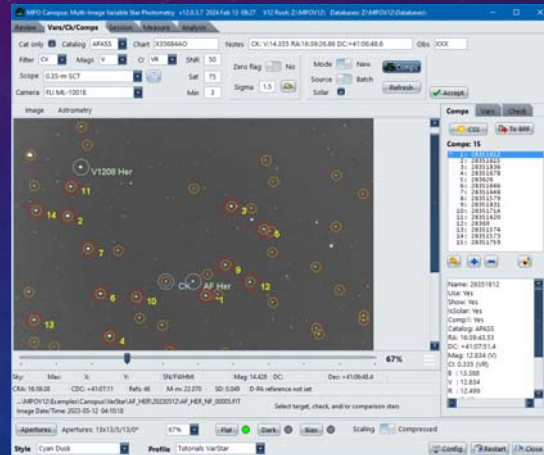
- All potential comps are auto-selected.
- The items in the BRF are loaded into an internal list (a second or two).
- When done, the comps, variables, and check star show on the image and in the list.
- Remember to click <Save> if any changes were made or the file that was loaded was version 10.
- Click <OK> on BRF editor.



V12 Tutorial: Multi-image Variable Star Photometry Quick and Easy

- Confirm all data were transferred.

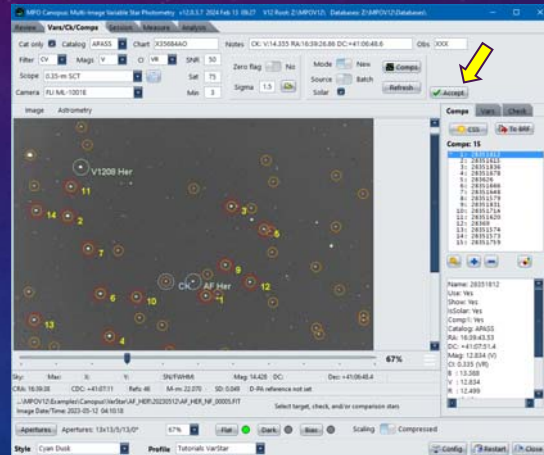
- <Chart>
- <Notes>
- <Obs>
- Comps tab
- Vars tab
- Check tab



Create/Verify Session

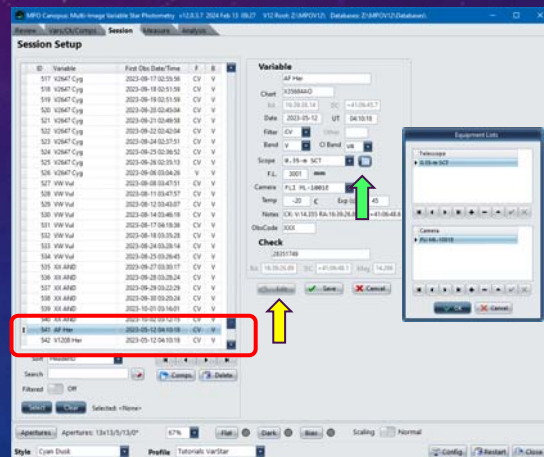
V12 Tutorial: Multi-image Variable Star Photometry Create Session

- Click <Accept>.
- Program creates and populates new session.
- Program changes to Session Setup tab when done.
- **Be Patient. 3-20 seconds to finish.**



V12 Tutorial: Multi-image Variable Star Photometry Verify Session

- Two sessions created.
- First session is "primary" target.
- Verify information for each session.
- To edit session data
 - Click <Edit> in Variable section.
 - Make changes.
 - Use button next to Scope to edit equipment lists.
 - Click <Save> or <Cancel>.
 - If you edit one, edit the other(s).
- **Make sure "primary" target session is highlighted (click on it).**
- Click on Measure tab (no <Accept>)



Measuring Run Setup

V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

TO: 30

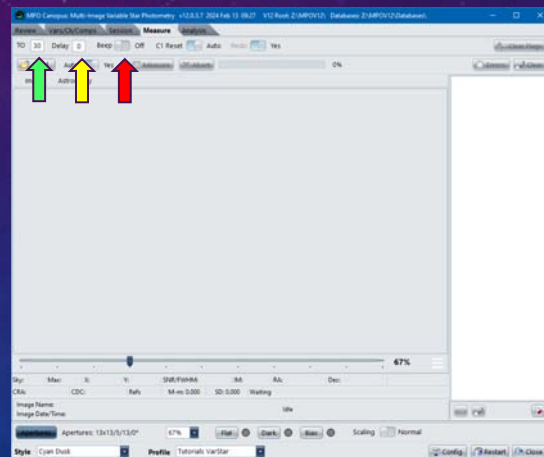
Number of seconds before automatch fails.

Delay: 0

Pause (seconds) between measuring an image and loading the next (0 ~ 1/6 second).

Beep: Off

Computer "beep" as an image is measured.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

C1Reset: Auto

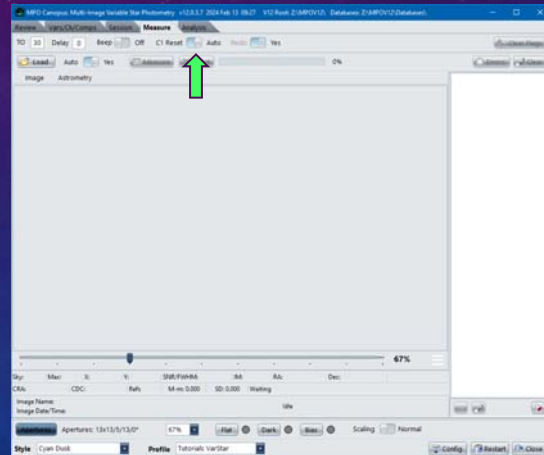
Auto

If Comp1 is lost, e.g., image shift, program does automatch to find it and continues if successful.

Manual

If Comp1 is lost, e.g., image shift,

- Program displays message to reset position.
- Last known position is indicated on image.
- Shift+Click on Comp1.
- Confirm or reject and try again.
- Program continues after accepting Comp1.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

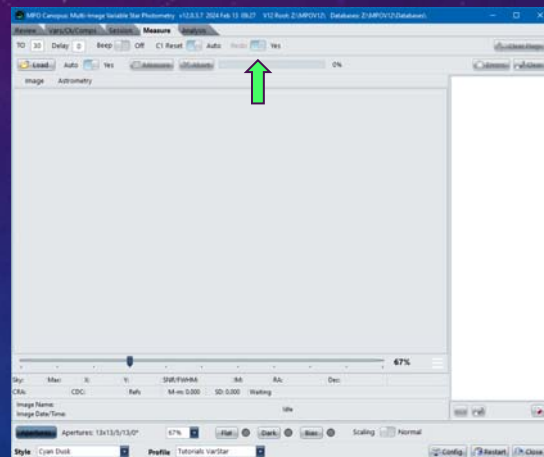
Redo: Yes

Yes

If a record that is ≤ 1.5 s of new record, the new record replaces the old.

No

If a record that is ≤ 1.5 s of new record, the new record is ignored, i.e., the original record remains.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Run Setup

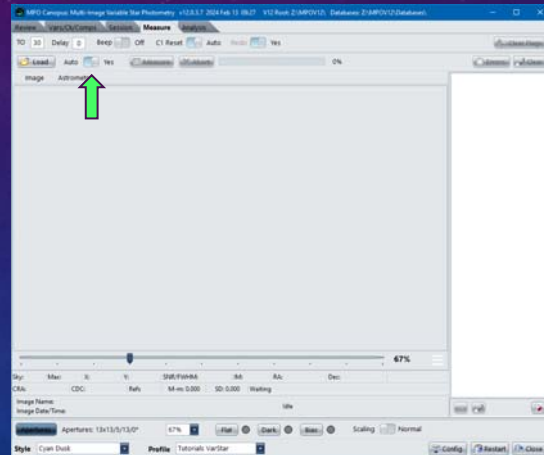
Auto: **Yes**

Yes

After an image is processed, the next one is automatically loaded after "Delay" seconds.

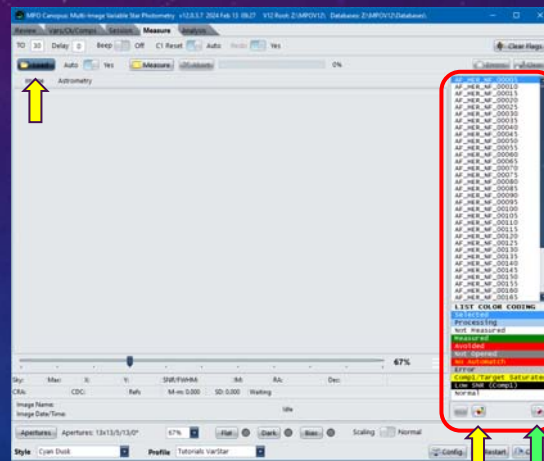
No

After image is processed, you must press <Enter> on the keyboard to load and measure the next image.



V12 Tutorial: Multi-image Variable Star Photometry Load Preselected Images

- Click <Load>.
- Preselected images info appear in measuring list. Actual images are loaded only when needed, i.e., when being measured or displayed.
- Click <pencil> to clear list.
- Click <flashlight> to toggle the measuring list color coding legend.
- As each image is handled, its name in the list is color-coded to show the result of the measurement attempt.



V12 Tutorial: Multi-image Variable Star Photometry Error Flags

- Log of measuring results is kept.
- Click <Clear Flags> if list has been processed, in full or partially, and some lines are color-coded. All lines are reset to "Not Measured" status.
- Click <Errors> to see the errors log after processing.
- Click <Clear> to clear the internal errors list and errors log.
- All three buttons are disabled during processing.



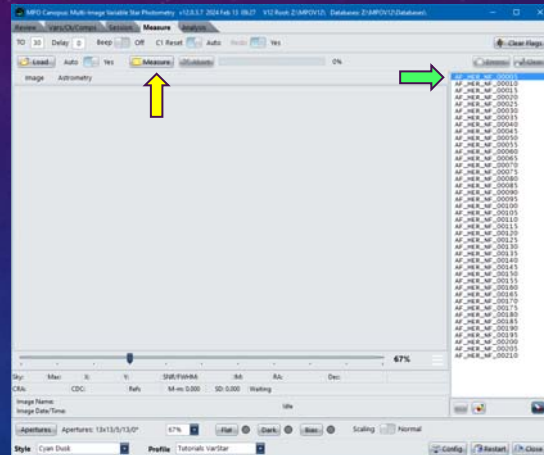
Measuring the Images

V12 Tutorial: Multi-image Variable Star Photometry Measuring Images

Measure the Images

- Double-click on first image in the list to display *but not measure* it.
- To Start, click <Measure>.

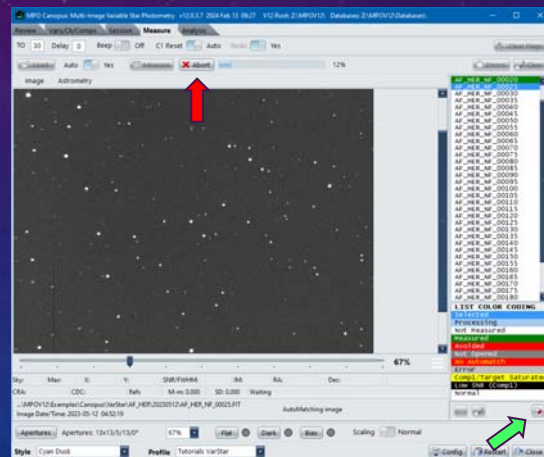
If the highlighted image is not first image in list when starting, a message asks to confirm starting at that image, from the top, or cancel measuring.



V12 Tutorial: Multi-image Variable Star Photometry Measuring Images 1

Measure the Images

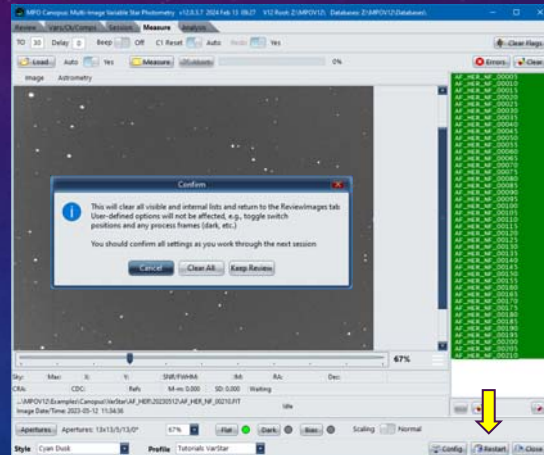
- Click <Abort> to stop processing.
- Use <flashlight> to toggle color coding legend.
- Be kind to the program and your CPU! Avoid do other things in this or other programs when measuring.
- **Don't click on the images list; at best, this can change which is the current and next image.**



V12 Tutorial: Multi-image Variable Star Photometry To Measure Additional Images

To Measure for a Different Session

- Click <Restart>. This a *must*.
- **Clear All**
Clears all internal lists and variables along with the selected images list from the Review page.
- **Keep Review**
Clears all internal lists and variables but keeps the selected images list from the Review page. Good if measuring more than one target in same set of images.

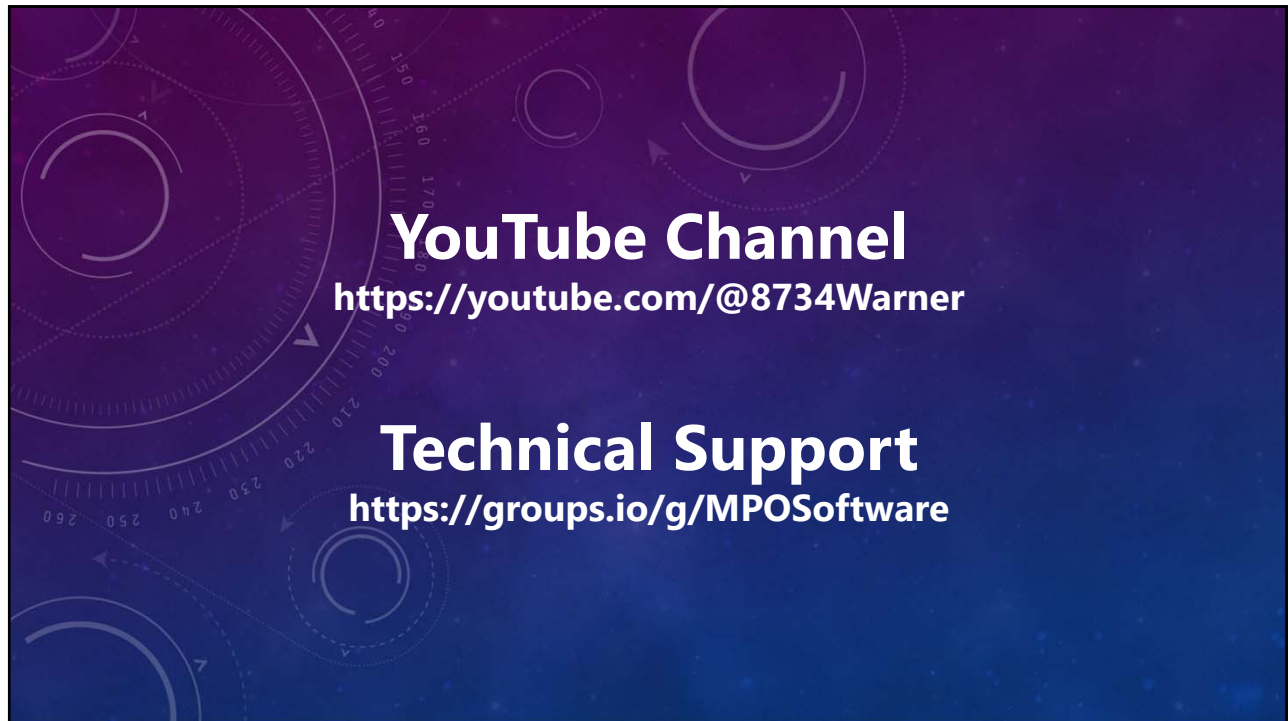


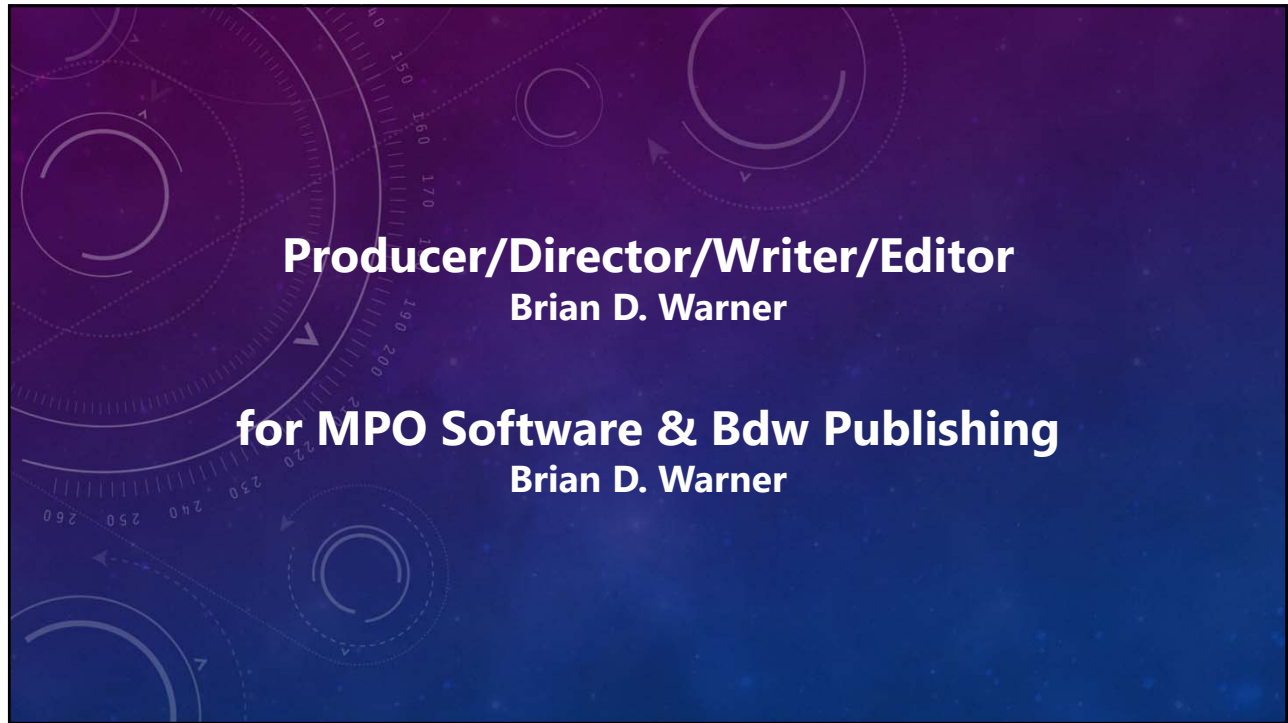
V12 Tutorial: Multi-image Variable Star Photometry Avoid Information Overload

Before Period Analysis

- Measure the examples AF HER images for 2023 May 13

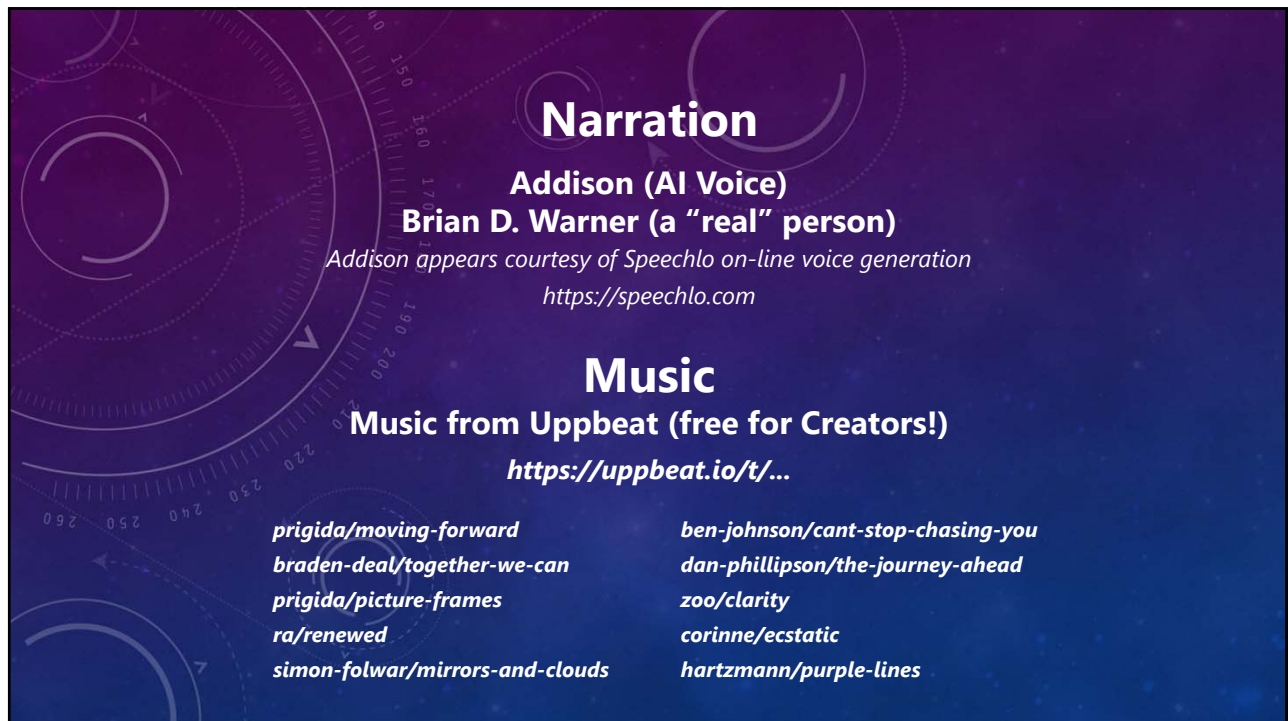
It's Time to Take a Break!





Producer/Director/Writer/Editor
Brian D. Warner

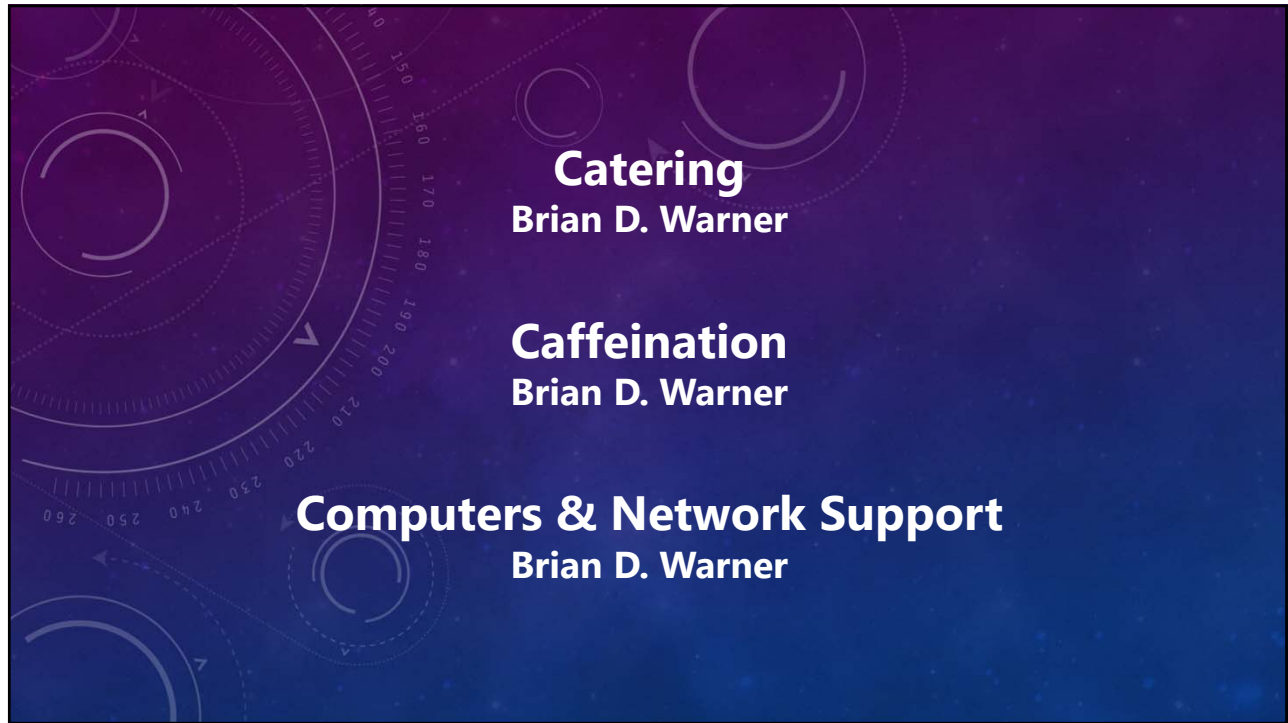
for MPO Software & Bdw Publishing
Brian D. Warner



Narration
Addison (AI Voice)
Brian D. Warner (a "real" person)
Addison appears courtesy of Speechlo on-line voice generation
<https://speechlo.com>

Music
Music from Uppbeat (free for Creators!)
<https://uppbeat.io/t/...>

<i>prigida/moving-forward</i>	<i>ben-johnson/cant-stop-chasing-you</i>
<i>braden-deal/together-we-can</i>	<i>dan-phillipson/the-journey-ahead</i>
<i>prigida/picture-frames</i>	<i>zoo/clarity</i>
<i>ra/renewed</i>	<i>corinne/ecstatic</i>
<i>simon-folwar/mirrors-and-clouds</i>	<i>hartzmann/purple-lines</i>



Catering
Brian D. Warner

Caffeination
Brian D. Warner

Computers & Network Support
Brian D. Warner



MPO v12 Tutorial

Variable Star Multi-image Photometry

No humans were harmed during the making of this production

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