PHOTOMETRY
Differential Photometry

Overview

Differential Photometry is comparing the difference between a target star and a comparison star. This is most useful in Time Series observations.

The direct comparison of a target and comparison star in the same field of view eliminates all other observational variables leaving a direct, differential comparison. Example: light pollution.

IMPORTANT: This process does NOT derive an absolute magnitude measure, but instead provides differential/relative magnitude changes.

To accomplish this, we use Aperture Photometry. NOTE: If you have not viewed this lesson, pause and review it before proceeding here.

Key Elements:
- Understanding Aperture Photometry
- Understanding what a Comparison Star is
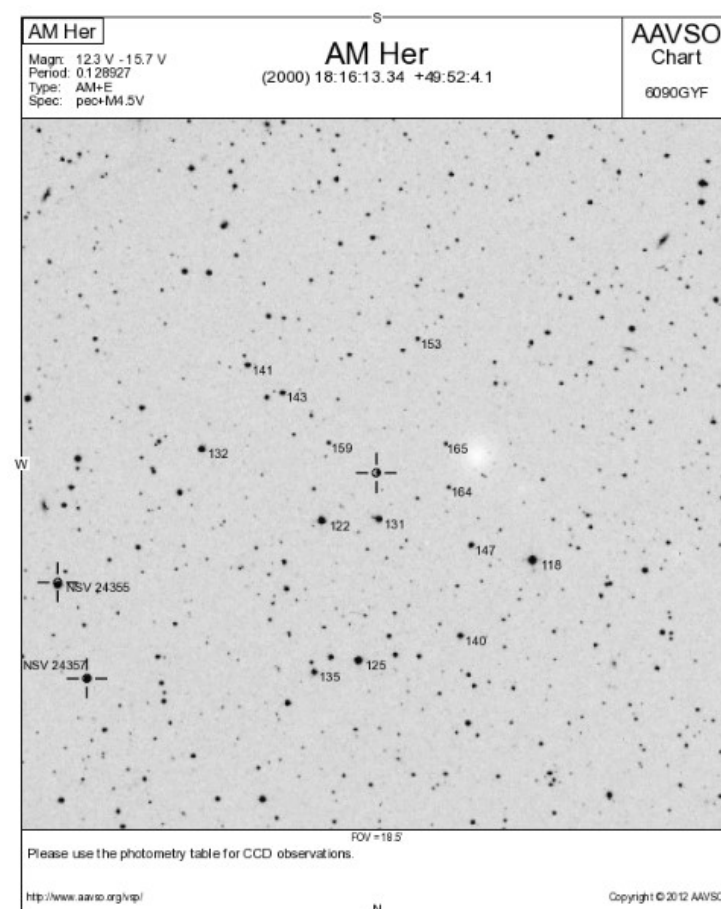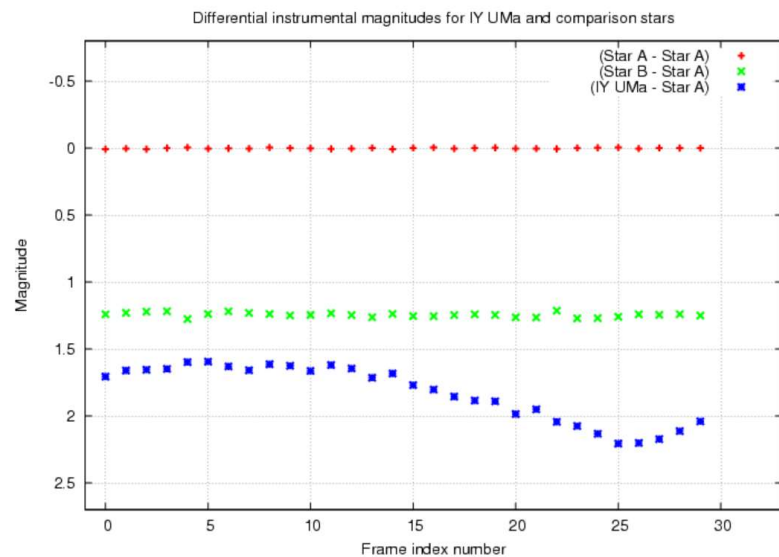- Stellar Magnitudes
- Image Calibration

Differential Photometry

Process

Differential Photometry uses Aperture Photometry to compare two types of stars:

- Target Star
- Comparison Star

The comparison reveals a relative pattern to the flux of each

Differential instrumental magnitudes for IY UMa and comparison stars

(Star A - Star A)
(Star B - Star A)
(IY UMa - Star A)

AM Her

Magn: 12.3 V - 15.7 V
Period: 0.128927
Type: AM+E
Spec: pec+M4.5V

AM Her
(2000) 18:16:13.34 +49:52:4.1

AAVSO Chart
6090GYF

Please use the photometry table for CCD observations.

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FOV = 18.5'

Process Overview

To produce a differential magnitude for an image use the following steps:

1. Determine the "instrumental magnitude" of the variable star and a set of comparison stars of roughly similar brightness in the image using software.
2. Average the instrumental magnitudes of the comparison stars for that image.
3. Subtract the average comparison star instrumental magnitude, determined in step 2, from the variable star's instrumental magnitude, the result is the differential magnitude for the variable star for that image.

As long as the measurement errors are not too large, you should see some systematic variation of the differential magnitude of the variable star.

Best Practices

The following are guides for best results for Differential Photometry:

- Ensure each image is already corrected/reduced: Darks, Flats, Bias
- Selecting the correct aperture for the target and comparison stars
- Use multiple comparison stars with magnitudes similar to the target
- Comparison stars should NOT be variable
- All stars, comparison and target should be in the same field of view

AAVSO Chart — AM Her
Magn: 12.3 V - 15.7 V
Period: 0.128927
Type: AM+E
Spec: pec+M4.5V
(2000) 18:16:13.34 +49:52:4.1
6090GYF

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Differential Photometry

Results

Once Differential Photometry is performed, via software, you will achieve:

- A table of measurements
- Time stamp for each measurement (received from the FITS header)
- Change in flux of the target relative to the comparison stars
- Associated errors
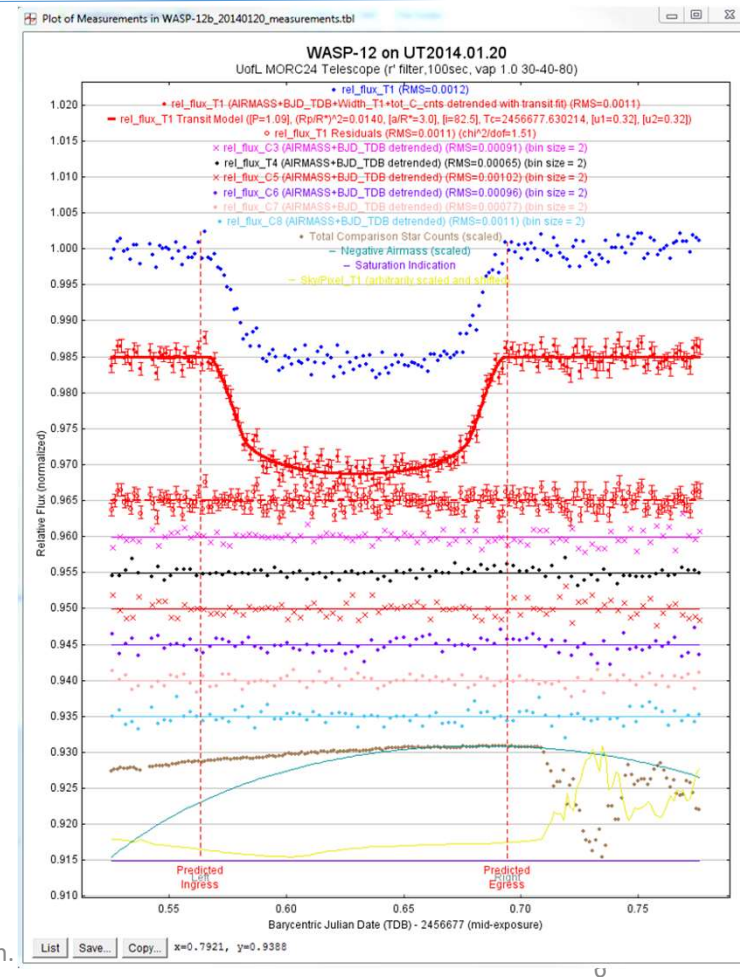
Summary

Differential Photometry is the comparison of a non-variable comparison star against a target star suspected to be variable.

The advantages of this process are: Errors introduced by a variable atmosphere are minimized as it affects all stars in the image at the same time

Questions?