

# Transit follow-up from the Montsec Observatory

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## Transit follow-up step-by-step

1. Proposal submission (we skipped that part!)



## Transit follow-up step-by-step

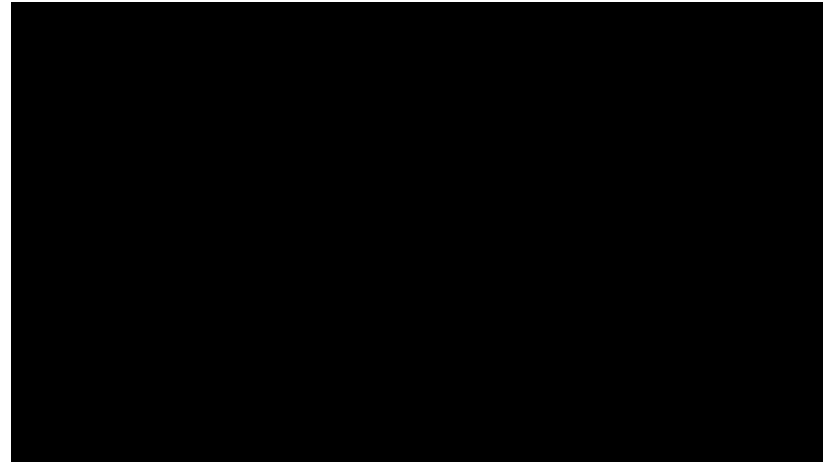
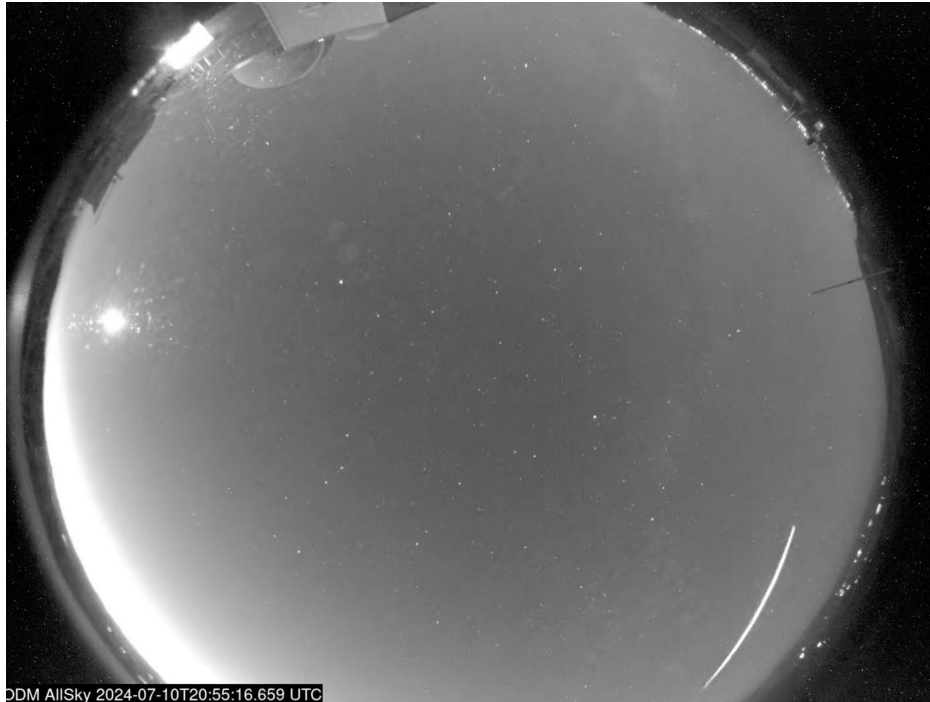
1. Proposal submission (we skipped that part!)
2. Go to observe the transit, but also...



## Transit follow-up step-by-step

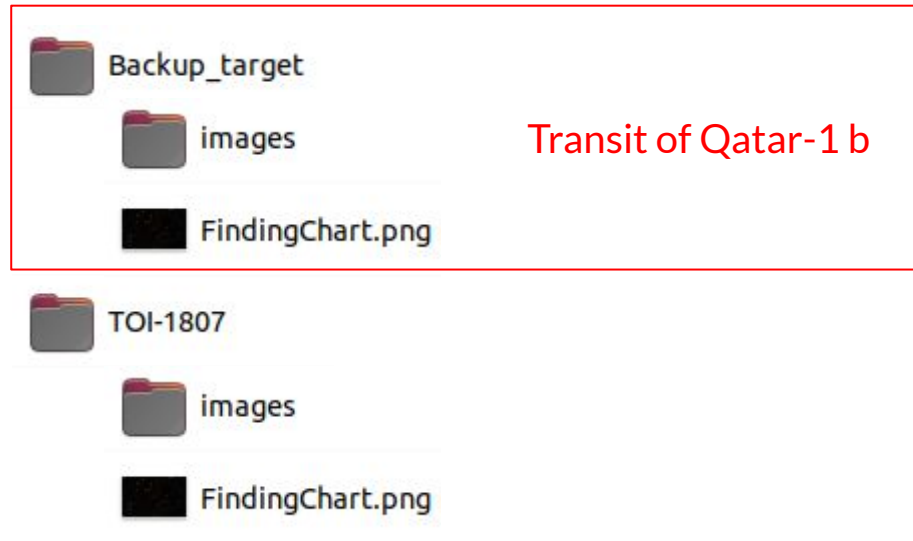
1. Proposal submission (we skipped that part!)
2. Go to observe the transit, but also...

Fireball from the Gulf of Lion to Narbonne!



## Transit follow-up step-by-step

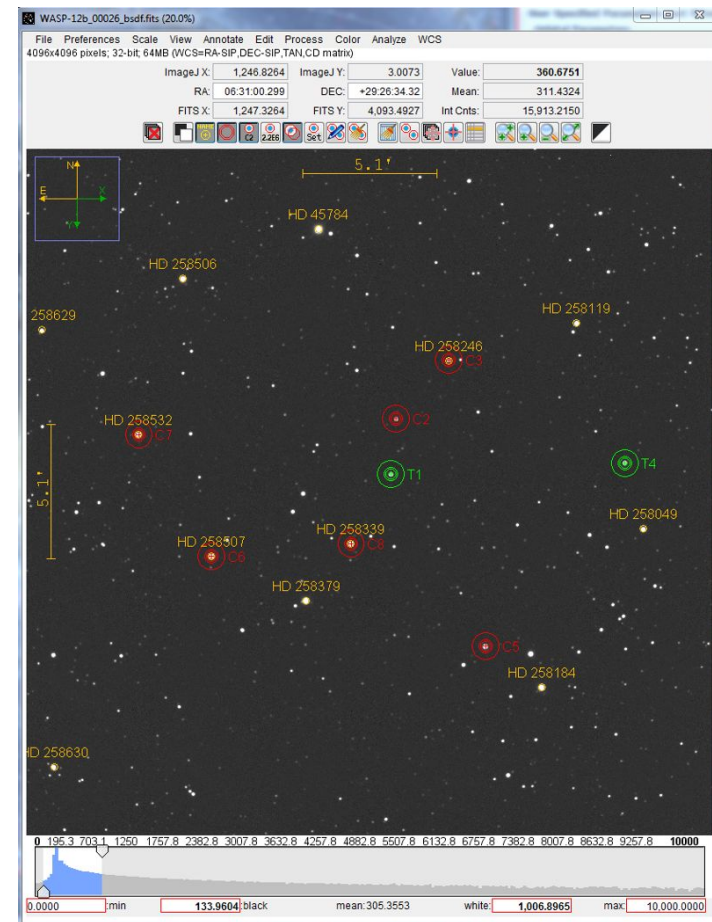
1. Proposal submission (we skipped that part!)
2. Go to observe the transit, but also...
3. Reduce the data



## AstroimageJ

- Software to analyse images and obtain the photometry
  - Image pre-processing:
    - bias, dark subtraction, flat fielding...
  - Multi-aperture differential photometry
  - Light-curve detrending


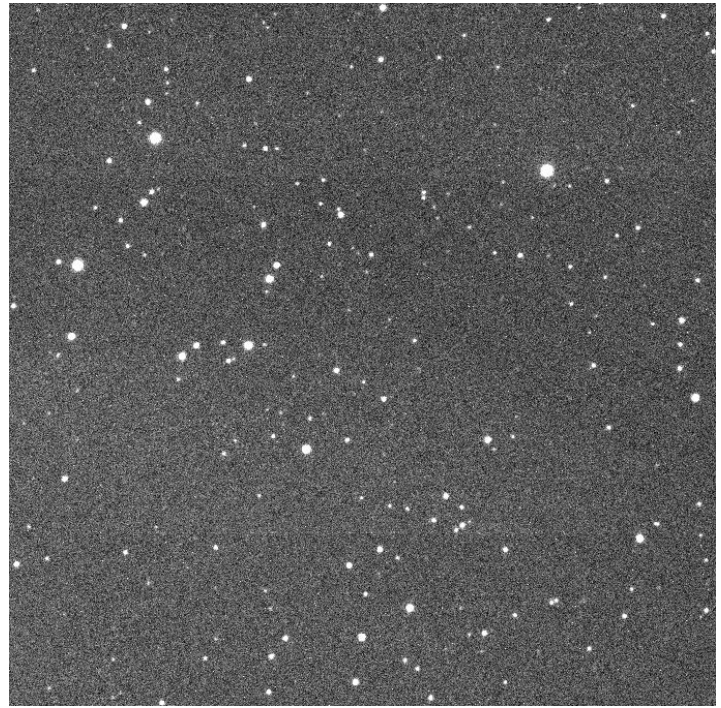
<https://www.astro.louisville.edu/software/astroimagej/>





## TJO data

- TJO data from a transiting planet
  - Finding chart of the star
  - 260 images (4.4 GB)



7th Institute of Space Sciences Summer School:  
Multiwavelength Approach to Exoplanets

2-11 July 2024  
7th IISCC, Conferencia del verano  
Madrid, España  
https://icee.csic.es/icee/summer2024

Institute of Space Sciences CSIC ICEE

2-11 julio 2024  
Institute of Space Sciences  
Europe/Madrid time zone

7th Institute of Space Sciences Summer School

Vista general  
Lecturers  
Venue  
Cronograma  
Important Dates  
Registration  
School Fee  
Accommodation  
School Poster  
Contact us  
summerschool2024@icee...

Sesión

Hands-on session

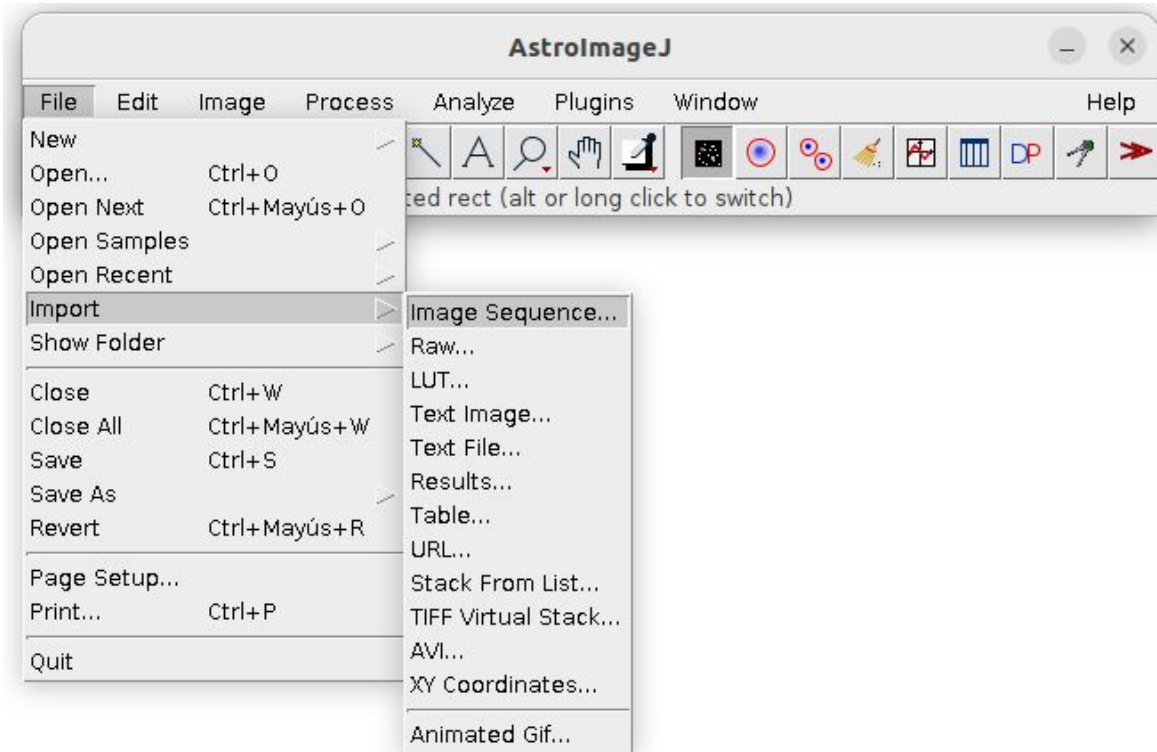
3 jul. 2024 14:30  
Institute of Space Sciences

Materiales de la presentación

- Hands\_on\_ALMA\_Morata
- Hands\_on\_Machine\_Learning\_Blanco
- Hands\_on\_Machine\_Learning\_Blanco.pdf
- Hands\_on\_Morales\_Juliet.zip
- Hands\_on\_Planetary\_magnetic\_field\_measurements\_Elias.pdf
- Hands\_on\_Spectroscopy\_Marina\_Lafarga
- Hands\_on\_Transmission\_Spectroscopy\_Gascon
- Hands\_on\_Transmission\_Spectroscopy\_Gascon.pdf
- Hands\_on\_Transmission\_Spectroscopy\_Gascon.zip
- Hands\_on\_Trifonov\_Exostriker.pdf

## Photometry with AstroimageJ

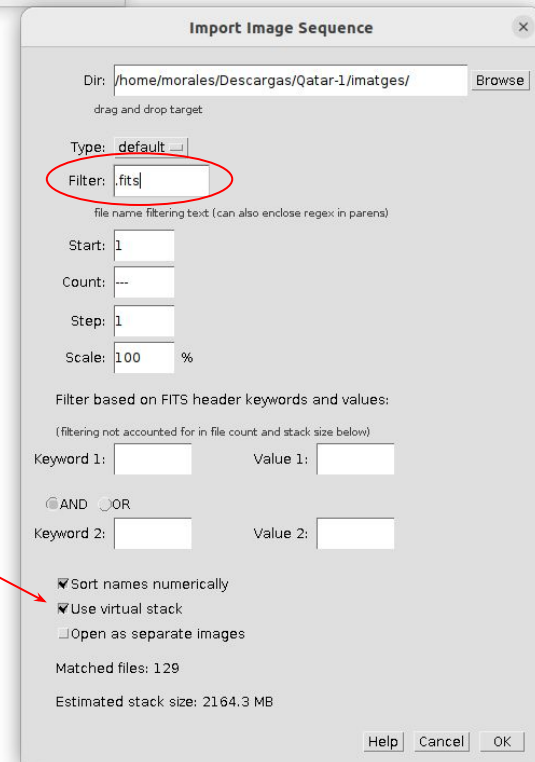
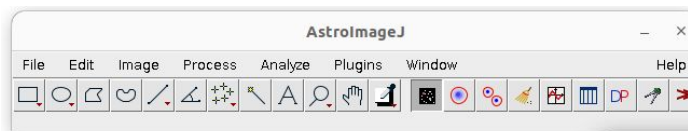
- Load the sequence of images  
→ File → Import → Image Sequence



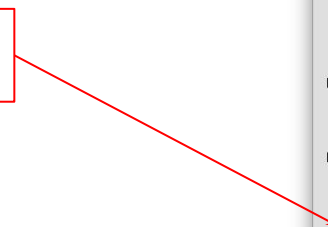


## Photometry with AstroimageJ

- Load the sequence of images
  - File → Import → Image Sequence
  - Indicate some filter to select images (".fits")

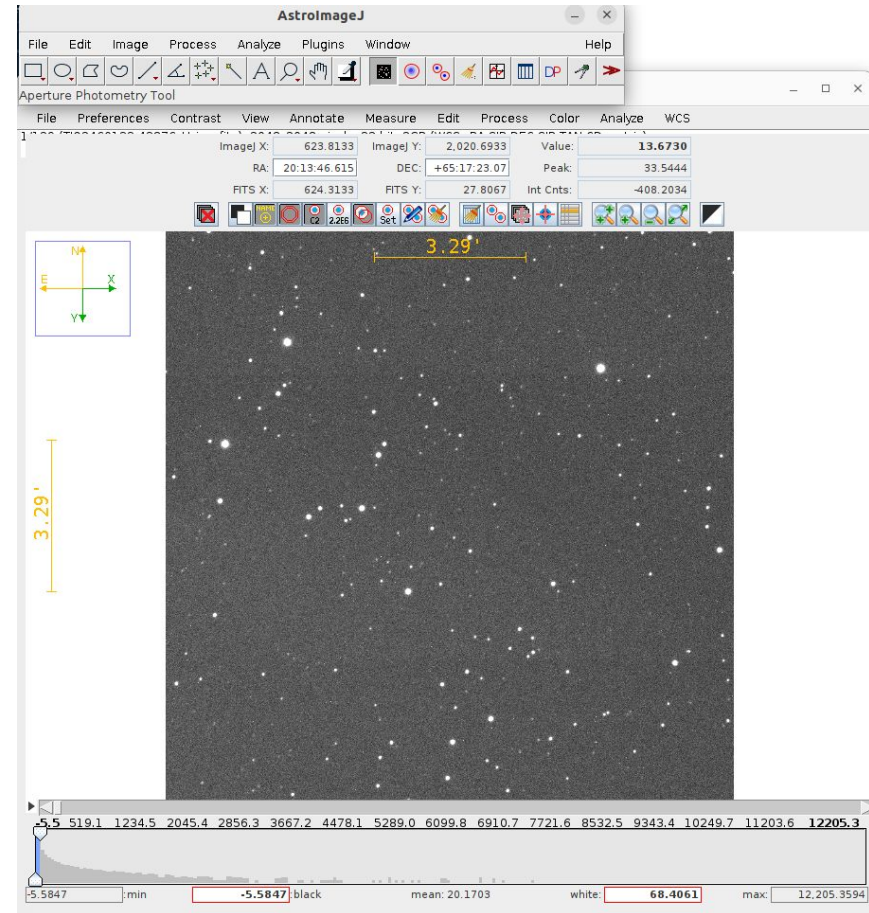


Process images  
one by one



## Photometry with AstroimageJ

- Load the sequence of images
  - File → Import → Image Sequence
  - Indicate some filter to select images (".fits")
  - The first image will be opened

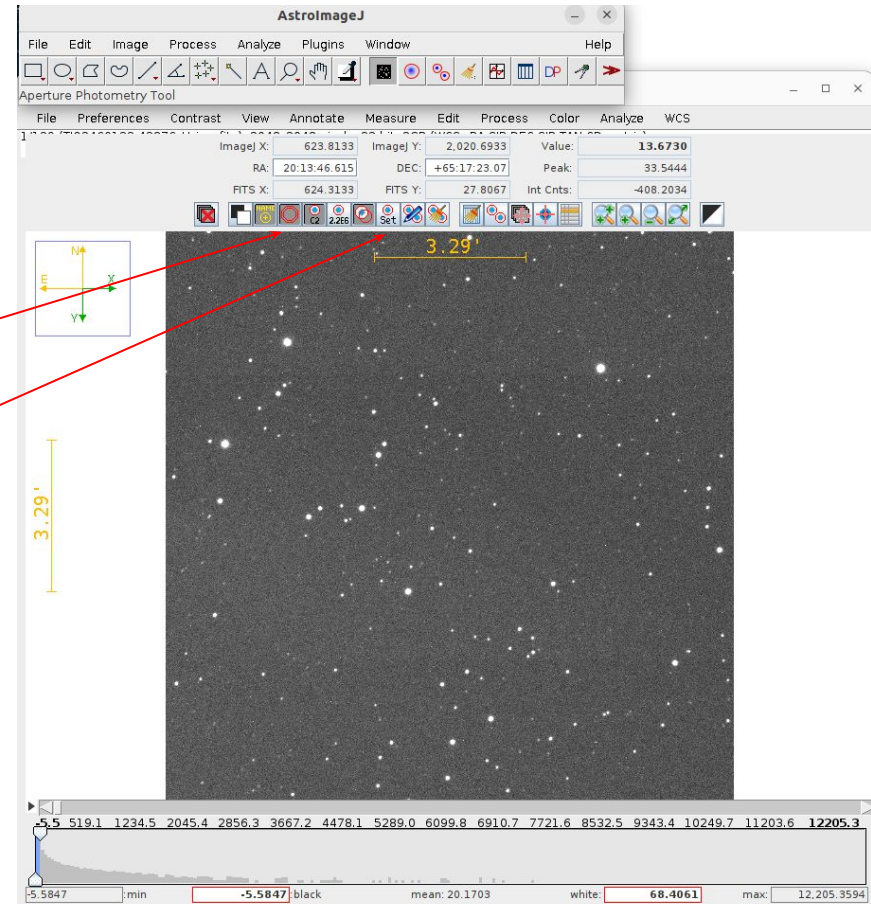


## Photometry with AstroimageJ

- Aperture photometry  
→ Define the aperture settings

Center aperture  
on the star

Set apertures  
properties



## Photometry with AstroimageJ

- Aperture photometry
  - Define the aperture settings
  - Set the apertures

The screenshot shows the AstroimageJ interface. The 'Aperture Photometry Settings' dialog box is open, displaying various configuration options for aperture photometry. The main image window shows a star field with a selected star and its measured intensity.

**Aperture Photometry Settings**

- Radius of object aperture: 15.000
- Inner radius of background annulus: 20.000
- Outer radius of background annulus: 30.000
- Use variable aperture (Multi-Aperture only)
- FWHM factor (set to 0.00 for radial profile mode): 1
- Radial profile mode normalized flux cutoff: 0.010 (0 < cutoff < 1 ; default = 0.010)
- Centroid apertures
  - Use Howell centroid method
  - Fit background to plane
  - Remove stars from backgrnd
  - Mark removed pixels
- Use exact partial pixel accounting in source apertures (if deselected, only pixels having centers inside the aperture radius are counted)
- Prompt to enter ref star absolute mag (required if target star absolute mag is desired)
- List the following FITS keyword decimal values in measurements table:
  - Keywords (comma separated): ID\_S0BS,JD\_UTC,HJD\_UTC,BJD\_TDB,AIRMASS,ALT\_OBJ,CCD-TEMP,EXPTIME,RAOBJ2K,DECOBJ2K
  - CCD gain: 1.000000 [e-/count]
  - CCD readout noise: 0.000000 [e-]
  - CCD dark current per sec: 0.000000 [e-/pix/sec]
  - or - FITS keyword for dark current per exposure [e-/pix]:
  - Saturation warning ('Saturated' in table) (red border in Ref Star Panel)...
    - ... for levels higher than: 55000
  - Linearity warning (yellow border in Ref Star Panel)...
    - ... for levels higher than: 30000

**Image Window (imatges (V) (29.3%))**

ImageJ X:	548.7200	ImageJ Y:	2,048.0000	Value:	NaN
RA:	20:13:50.950	DEC:	+65:17:32.73	Peak:	32.8193
Y:	0.5000	Int Cnts:	-30.7581		

The main image window shows a star field with a selected star. The measured intensity is 3.29. The bottom status bar shows coordinates: 0 6099.8 6910.7 7721.6 8532.5 9343.4 10249.7 11203.6 12205.3

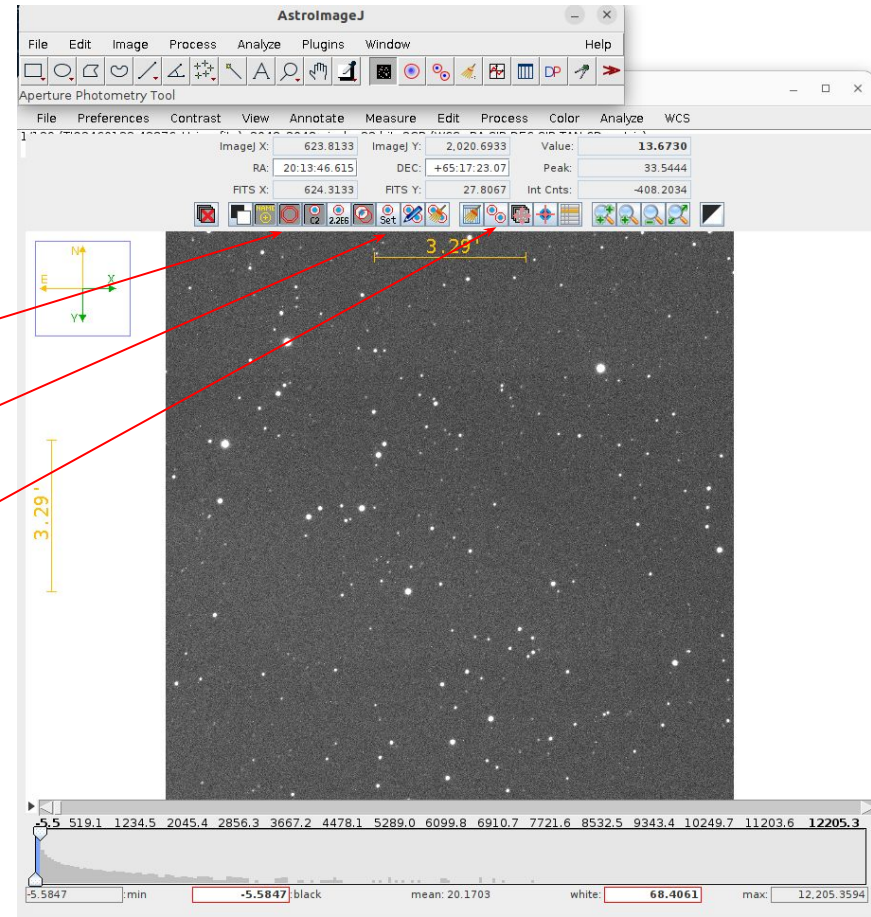
## Photometry with AstroimageJ

- Aperture photometry
  - Define the aperture settings
  - Set the apertures
  - Select your target and reference stars

Center aperture  
on the star

Set apertures  
properties

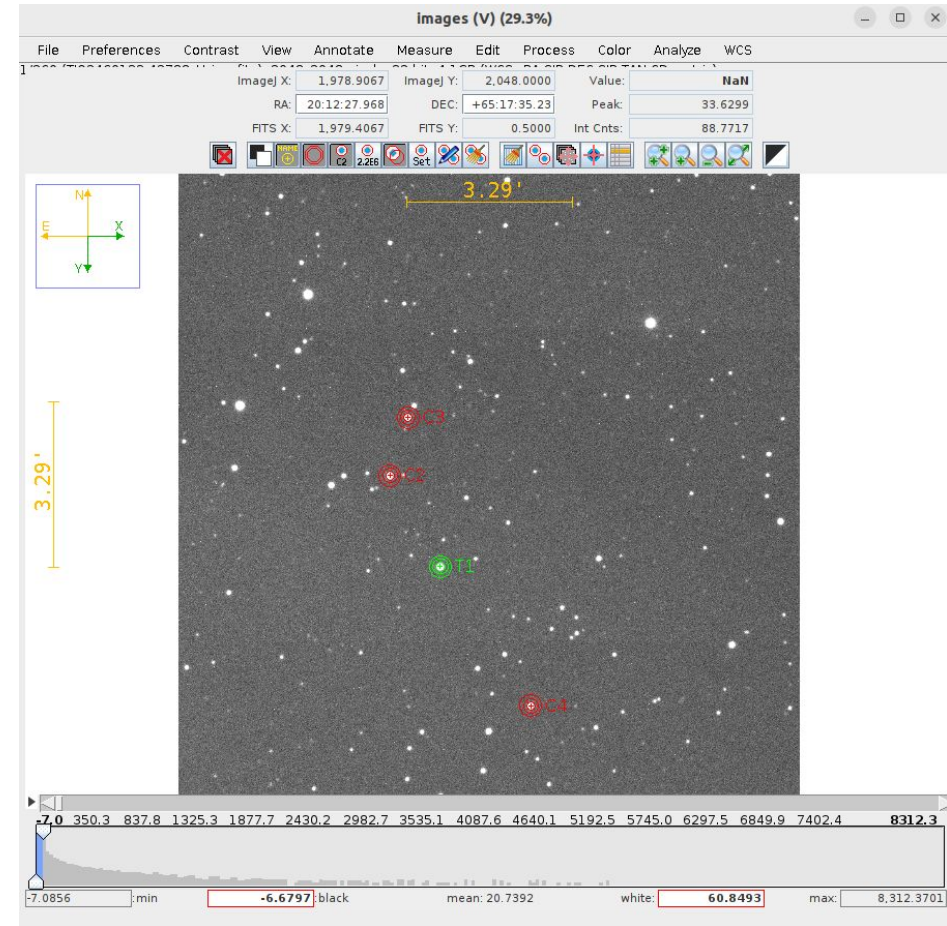
Identify target  
and comparisons





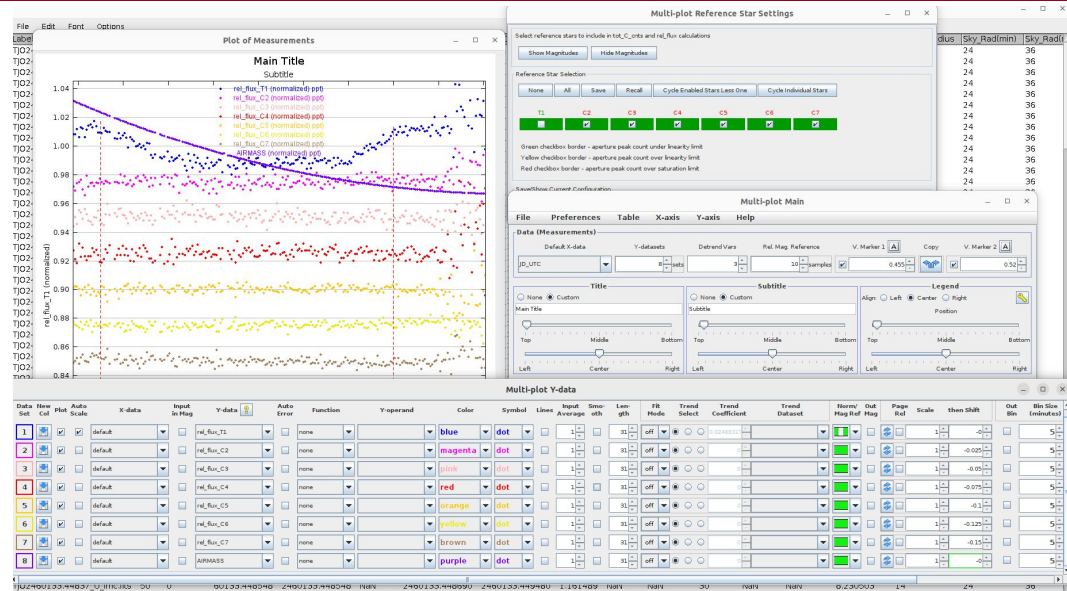
## Photometry with AstroimageJ

- Aperture photometry
  - Define the aperture settings
  - Set the apertures
  - Select your target and reference stars
  - Compute the photometry



## Photometry with AstroimageJ

- Aperture photometry
  - Define the aperture settings
  - Set the apertures
  - Select your target and reference stars
  - Compute the photometry



## Photometry with AstroimageJ

- Aperture photometry
  - Define the aperture settings
  - Set the apertures
  - Select your target and reference stars
  - Compute the photometry
  - Normalize your light curve

Create a new column

**Add new columns to table**

New column name (from X-data):

Add new column from Y-data

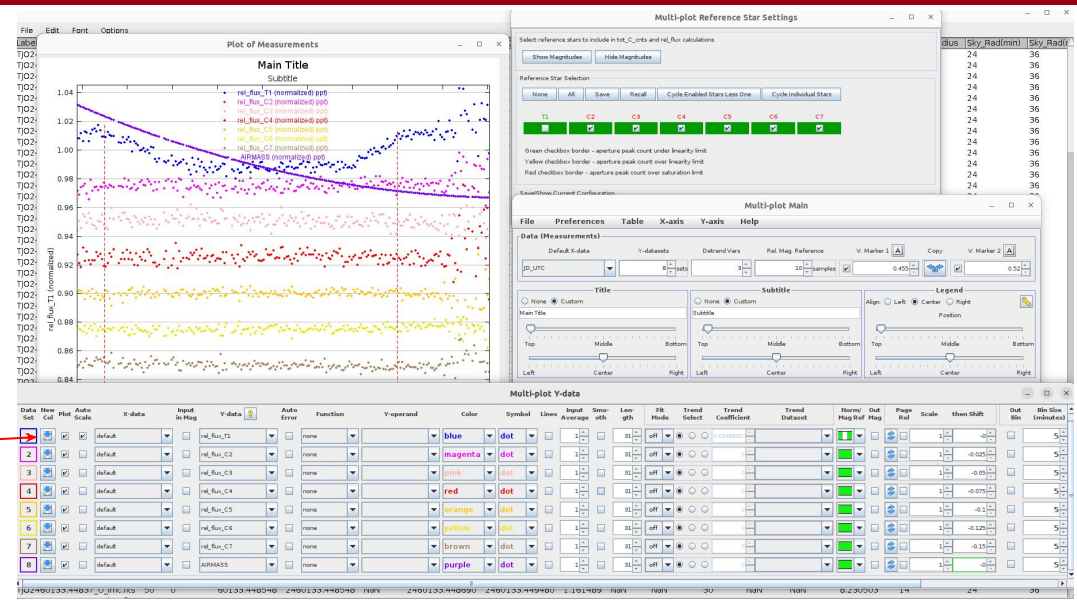
New column name (from Y-data):

Add new column from Y-error

New column name (from Y-error):

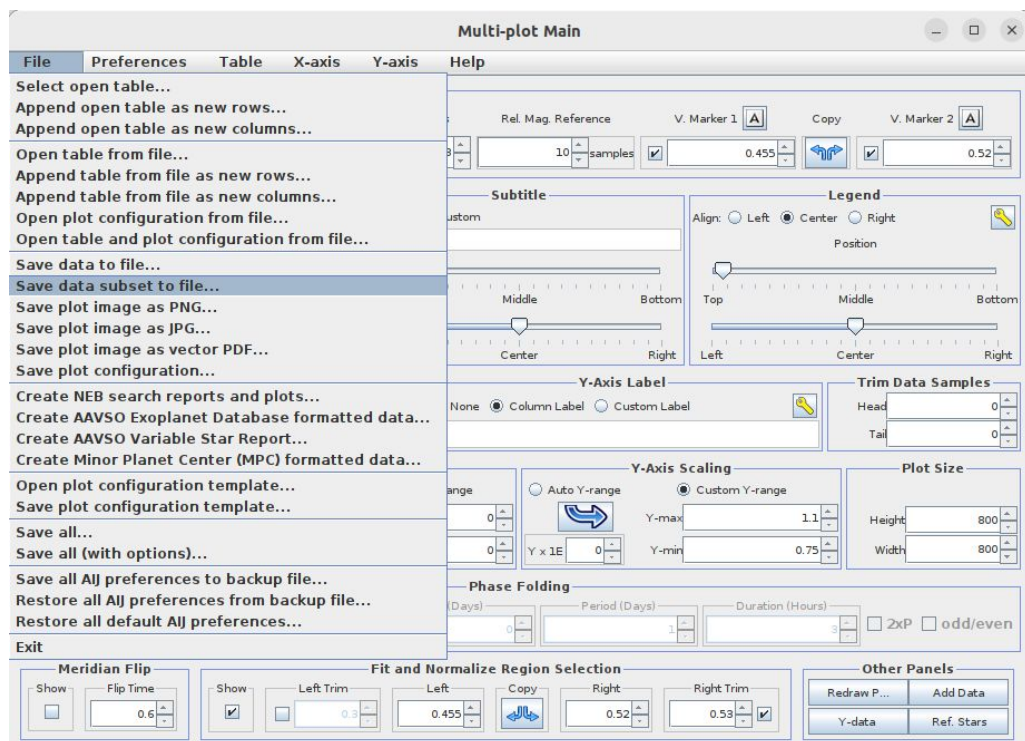
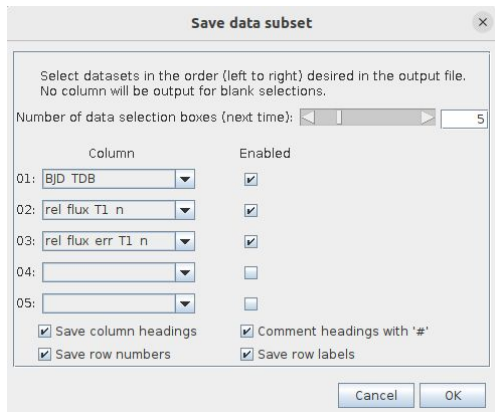
Remove Scale from Y-data and Y-error before saving  
 Remove Shift from Y-data before saving

\*\*\*New data column(s) will be added to the open table.\*\*\*  
 \*\*\*Save table to save new column(s) to disk.\*\*\*



## Photometry with AstroimageJ

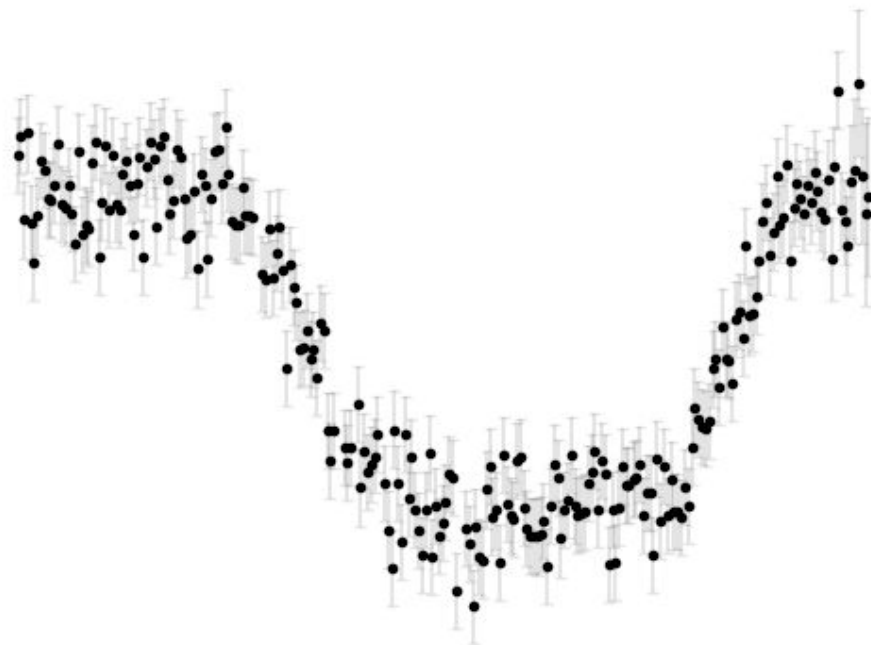
- Aperture photometry
  - Define the aperture settings
  - Set the apertures
  - Select your target and reference stars
  - Compute the photometry
  - Normalize your light curve
  - Save the light curve



## Photometry with AstroimageJ

- Transit fit: single transit, so we need some properties
  - The planetary system is Qatar-1
    - Qatar Exoplanet Survey (Alsubai et al. 2011)
  - Jupiter type planet around a K dwarf
  - Properties:
    - $P = 1.42$  days
    - $i = 84.08^\circ$
    - $a/R_\star = 6.25$
    - $R_p/R_\star = 0.146$

Try to adjust it with some of the fitting tools!





Thank you!