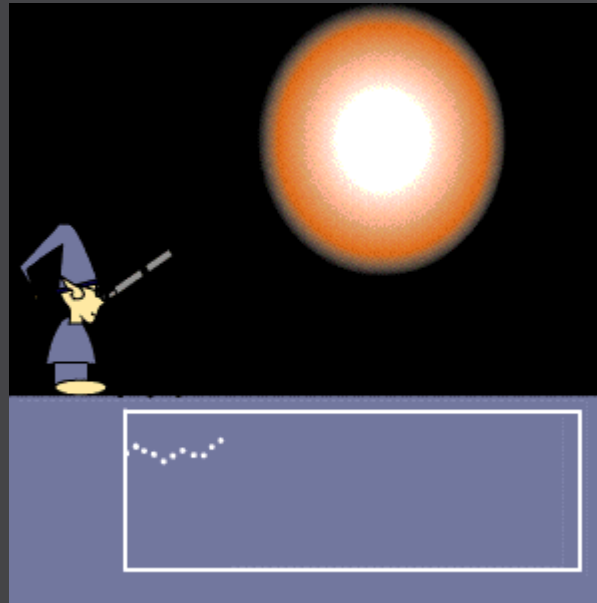


# HAT-P-10b / WASP -11b

## Data processing comparison

Maxim



Muniwin

Rigonda, Elena, Rita, Edgaras, Šarūnas

2016, Molėtai

# Contents

- Information about equipment
- Information about our object
  - Known data
- Processing the data
- Comparison of the data



# Information about equipment

Parameters of instrument:

- Diameter 1.65 m.
- Cassegrain F/12
- Scale 10 mm=1.75'
  - Focal reducer F/3.3
  - FOV 8x8'

Focal length 5.4

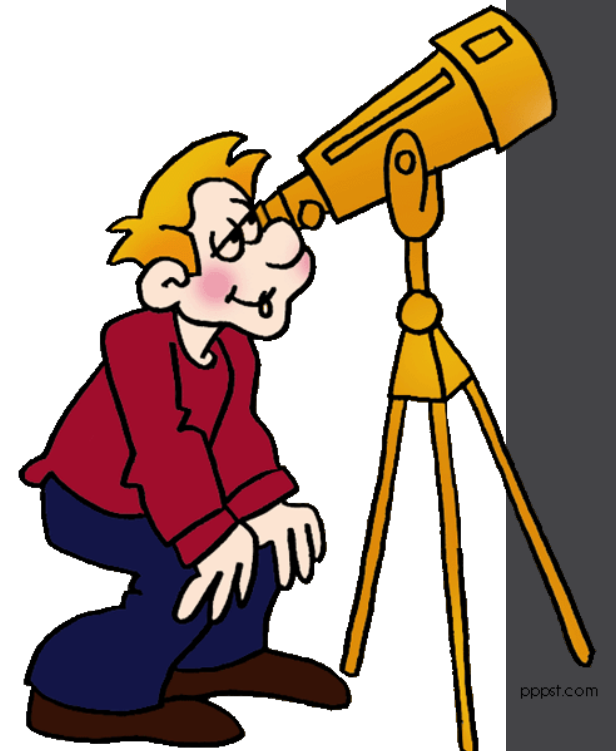
CCD camera Apogee Alta U47

Pixel size 13  $\mu$  m

1024x1024 (13.3 x 13.3 mm)



© VU Teorinės fizikos ir astronomijos institutas

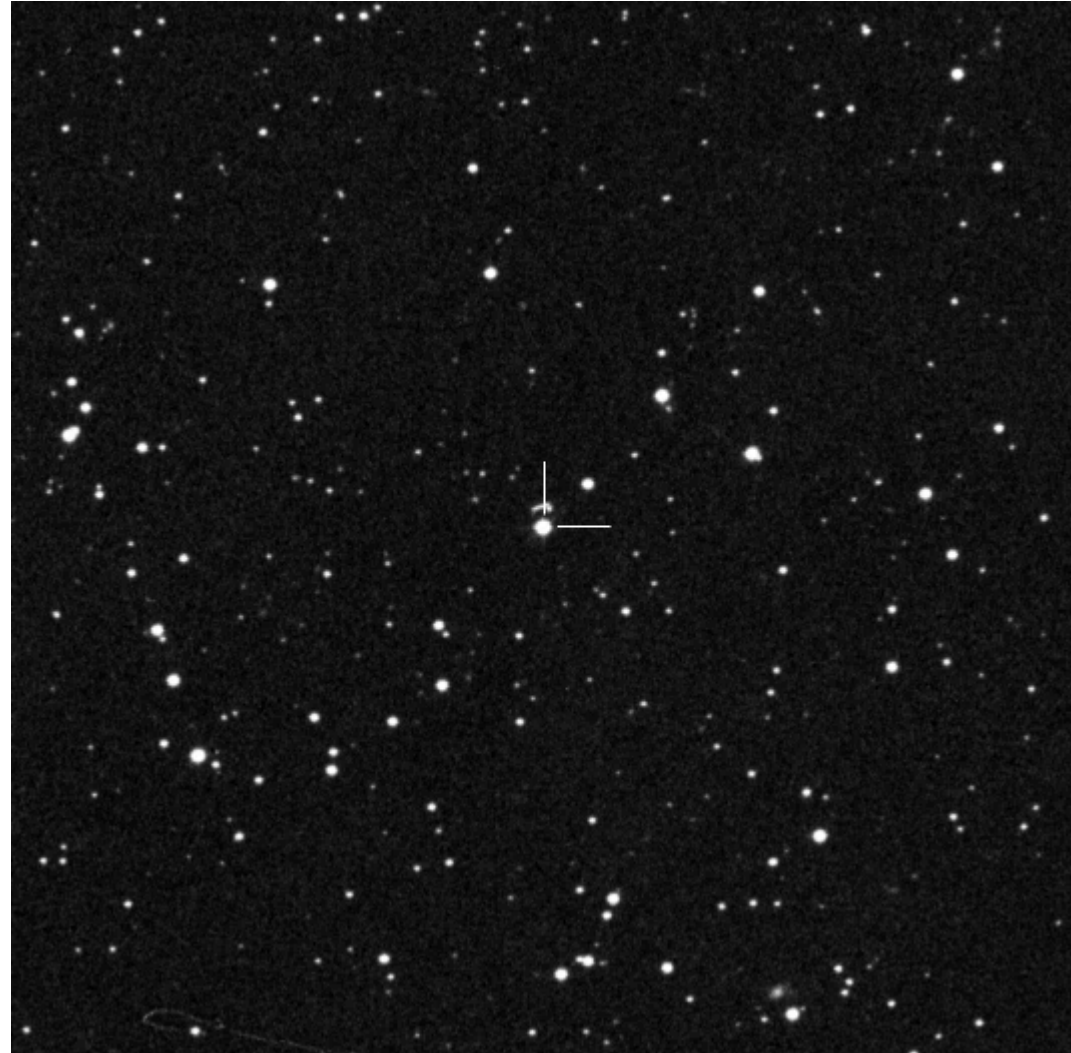


pppst.com

# HAT-P-10b/WASP -11b

Our data

- Discovered in **2008**
- V(Mag) – **11.89**
- Depth – **0.0254** (*0.0298*)
- Duration – **159 min.** (*156.8 min.*)
- Period – **3.722 d.**
  
- Observed with Moletai telescope (165cm.)



# Size comparison



Jupiter



HAT-P-10b / WASP -11b

# A New Radius for the 1.5 Saturn Mass Transiting Exoplanet HAT-P-10/WASP-11b

Louis J. Scuderi, Laird M. Close, Jason A. Dittmann and Peter C. Stephenson



0:04 / 11:28

YouTube video player interface showing a play button, volume icon, settings gear, YouTube logo, and a full-screen icon.

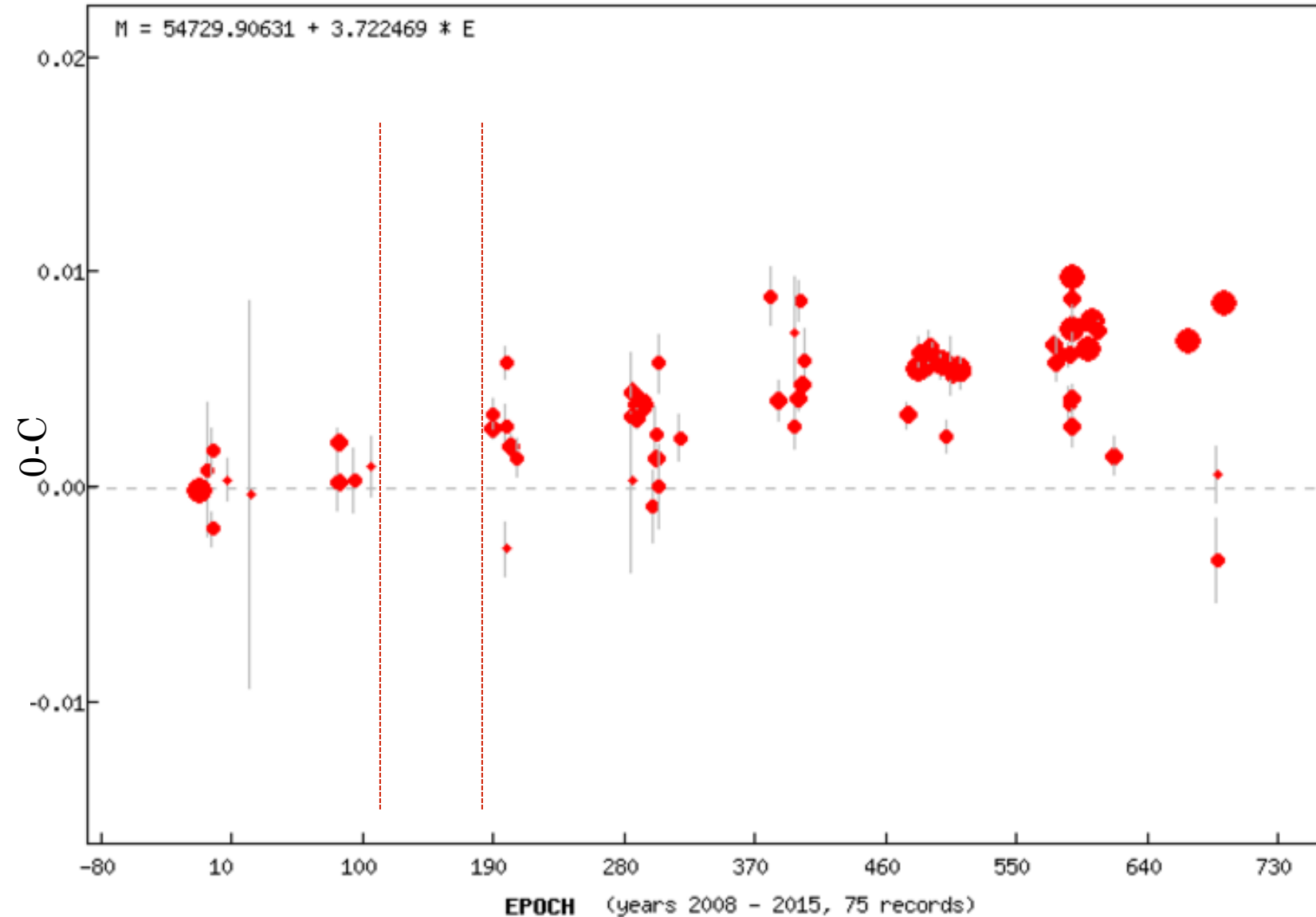
# Known data

# observed data minus calculated data

HAT-P-10/WASP-11 b

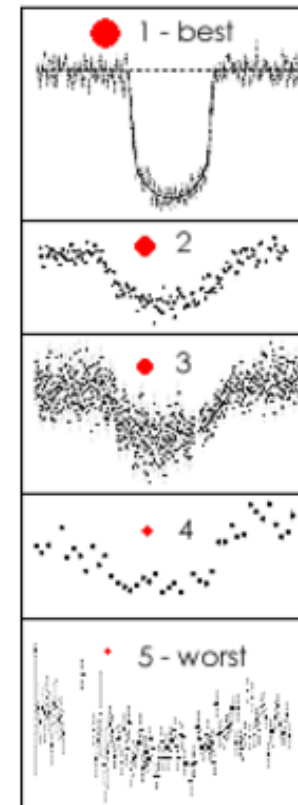
Exoplanet Transit Database: O-C vs EPOCH

$$M = 54729.90631 + 3.722469 * E$$



data quality indicator

- 1 - best
- 2
- 3
- 4
- 5 - worst

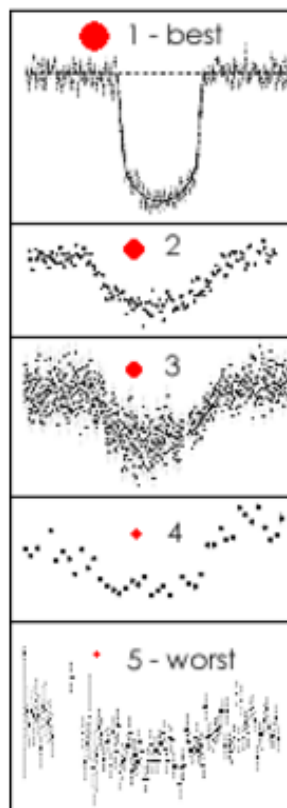
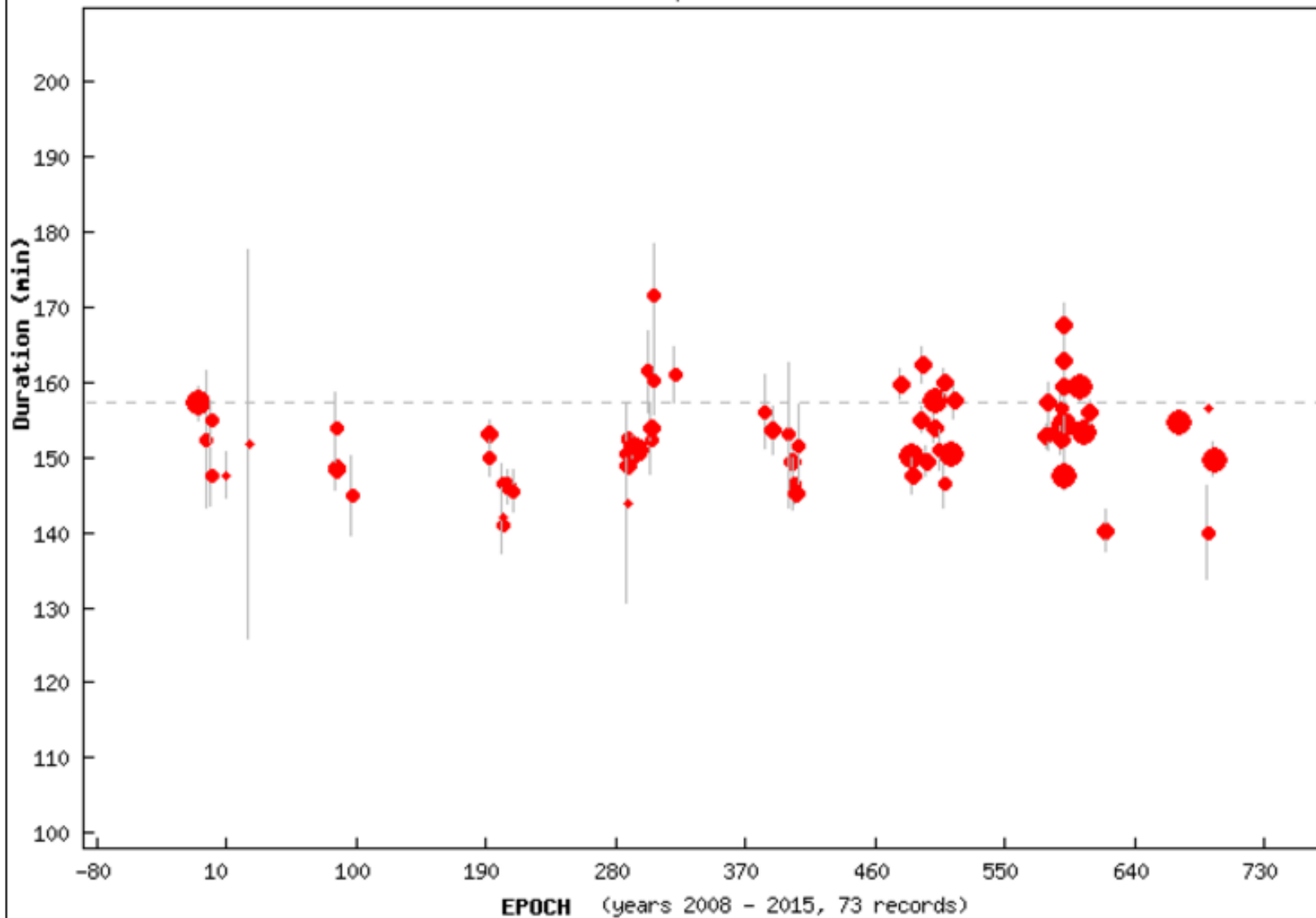




# Transit duration

HAT-P-10/WASP-11 b

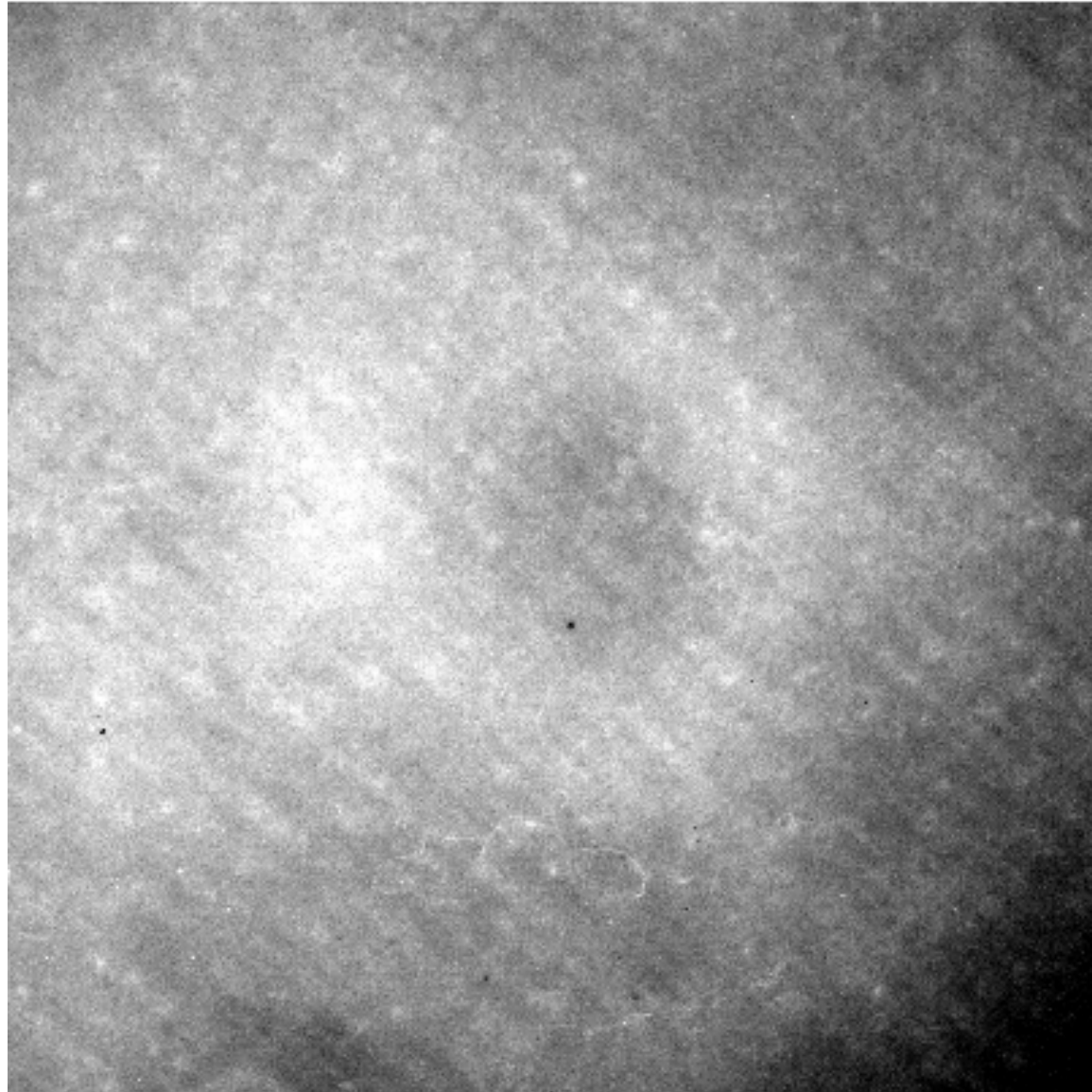
Exoplanet Transit Database: Transit-Duration vs EPOCH



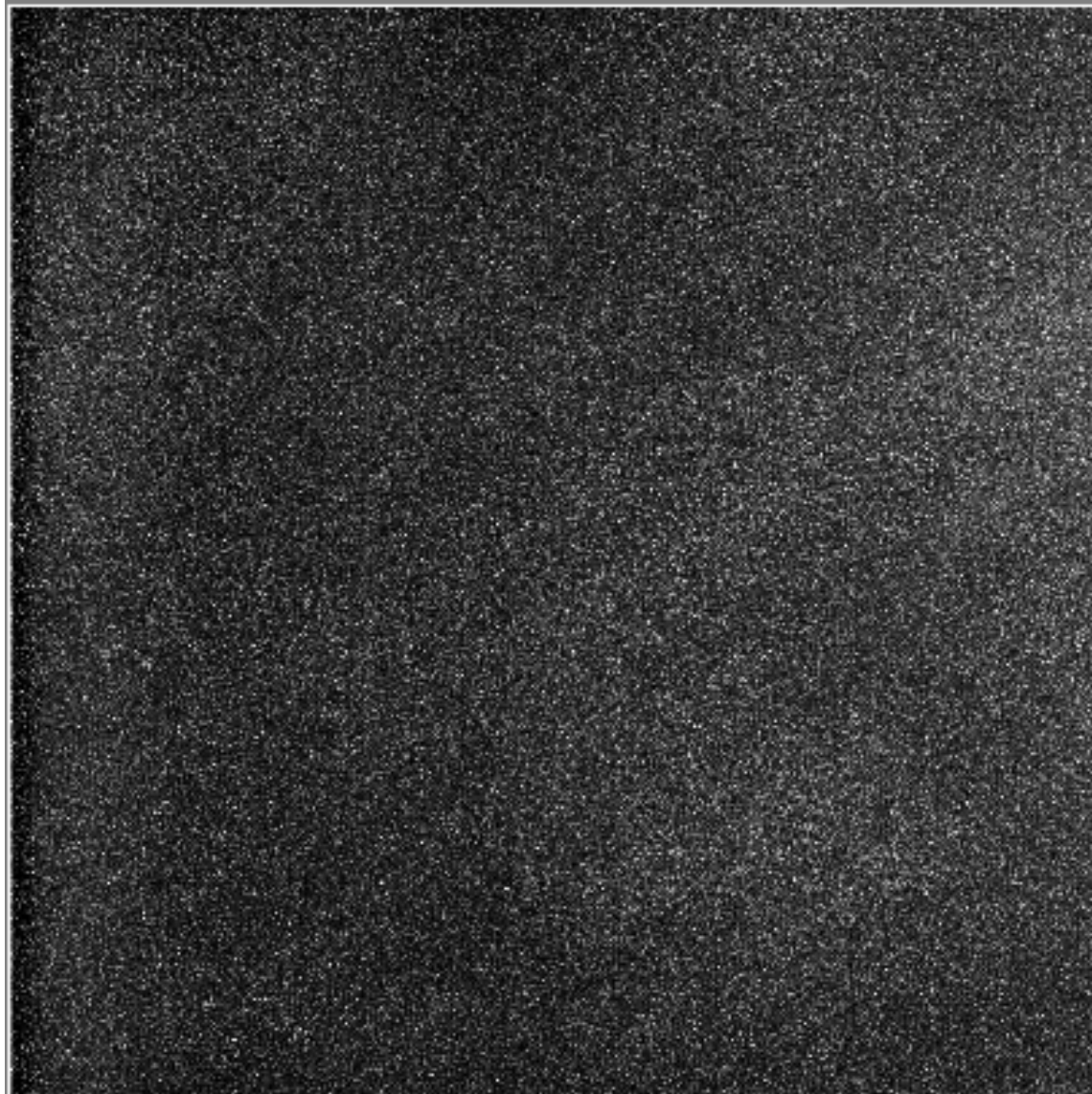
# Frames

- 826 light frames
- 16 flat frames
- 24 dark frames
- 20 bias frames

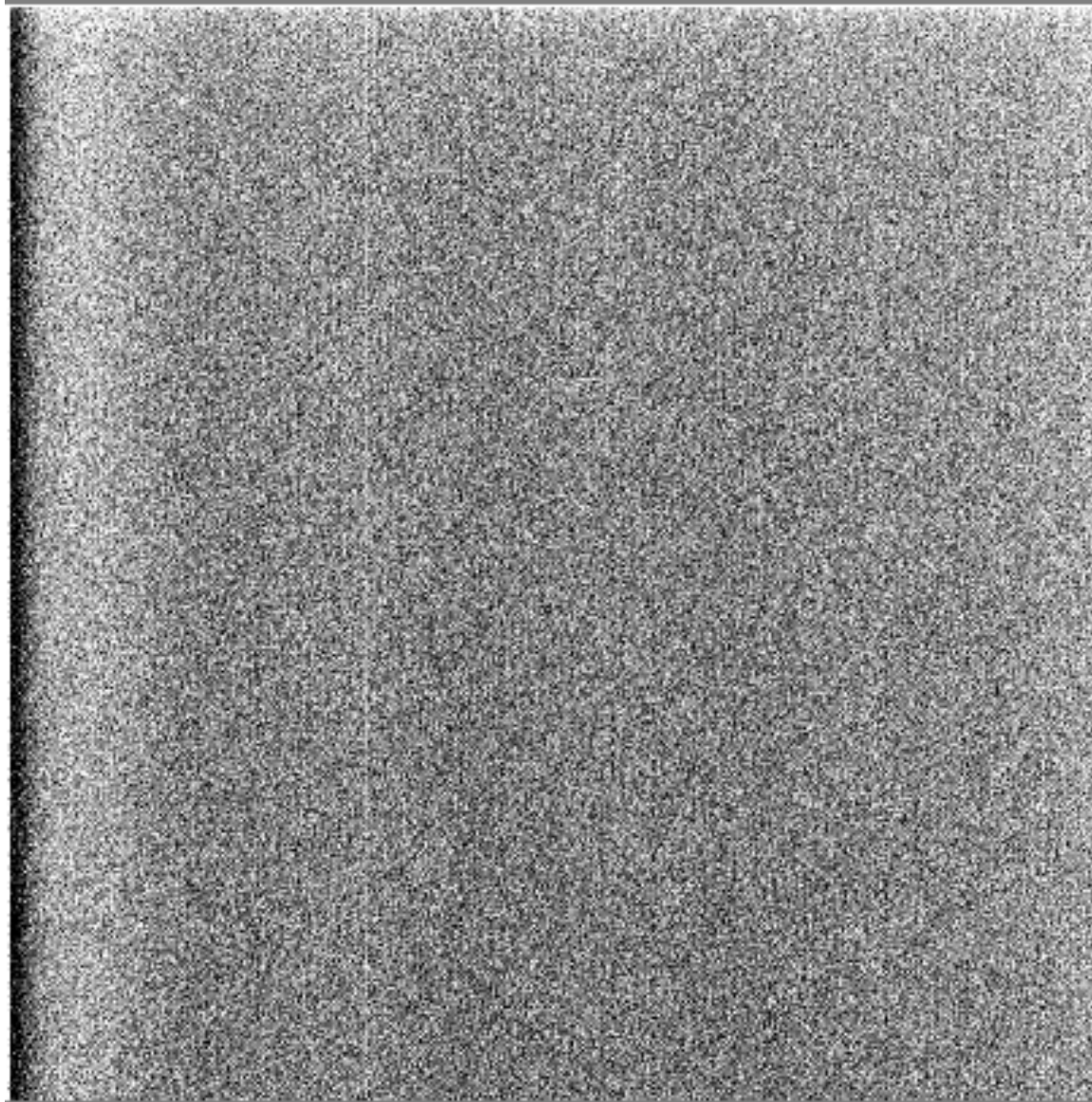
# Master Flat Frame



# Master Dark Frame



# Master Bias Frame



Frame #	Date and time (UTC)	Exposure	Filter	Stars	Status
★ 1	2015-08-22 21:40:55	10.000	None	76	Photometry OK (76 stars found)
★ 2	2015-08-22 21:41:08	10.000	None	67	Photometry OK (67 stars found)
★ 3	2015-08-22 21:41:21	10.000	None	89	Photometry OK (89 stars found)
★ 4	2015-08-22 21:41:34	10.000	None	74	Photometry OK (74 stars found)
★ 5	2015-08-22 21:41:47	10.000	None	73	Photometry OK (73 stars found)
★ 6	2015-08-22 21:42:07	10.000	None	63	Photometry OK (63 stars found)
★ 7	2015-08-22 21:42:20	10.000	None	71	Photometry OK (71 stars found)
★ 8	2015-08-22 21:42:33	10.000	None	67	Photometry OK (67 stars found)
★ 9	2015-08-22 21:42:46	10.000	None	67	Photometry OK (67 stars found)
★ 10	2015-08-22 21:42:59	10.000	None	70	Photometry OK (70 stars found)
★ 11	2015-08-22 21:43:12	10.000	None	72	Photometry OK (72 stars found)
★ 12	2015-08-22 21:43:24	10.000	None	68	Photometry OK (68 stars found)
★ 13	2015-08-22 21:43:37	10.000	None	85	Photometry OK (85 stars found)
★ 14	2015-08-22 21:43:50	10.000	None	79	Photometry OK (79 stars found)
★ 15	2015-08-22 21:44:03	10.000	None	59	Photometry OK (59 stars found)
★ 16	2015-08-22 21:44:16	10.000	None	69	Photometry OK (69 stars found)
★ 17	2015-08-22 21:44:29	10.000	None	71	Photometry OK (71 stars found)
★ 18	2015-08-22 21:44:42	10.000	None	70	Photometry OK (70 stars found)
★ 19	2015-08-22 21:44:55	10.000	None	73	Photometry OK (73 stars found)
★ 20	2015-08-22 21:45:07	10.000	None	75	Photometry OK (75 stars found)
★ 21	2015-08-22 21:45:20	10.000	None	74	Photometry OK (74 stars found)
★ 22	2015-08-22 21:45:33	10.000	None	56	Photometry OK (56 stars found)
★ 23	2015-08-22 21:45:46	10.000	None	78	Photometry OK (78 stars found)
★ 24	2015-08-22 21:45:59	10.000	None	63	Photometry OK (63 stars found)
★ 25	2015-08-22 21:46:12	10.000	None	63	Photometry OK (63 stars found)
★ 26	2015-08-22 21:46:25	10.000	None	69	Photometry OK (69 stars found)
★ 27	2015-08-22 21:46:38	10.000	None	66	Photometry OK (66 stars found)
★ 28	2015-08-22 21:46:50	10.000	None	63	Photometry OK (63 stars found)
★ 29	2015-08-22 21:47:03	10.000	None	73	Photometry OK (73 stars found)
★ 30	2015-08-22 21:47:16	10.000	None	65	Photometry OK (65 stars found)

Muniwin

**Processing PHOTOMETRY**  
tmp00277.fts

Frame #269:  
79 stars found  
Frame #270:  
77 stars found  
Frame #271:  
76 stars found  
Frame #272:  
79 stars found  
Frame #273:  
78 stars found  
Frame #274:  
78 stars found  
Frame #275:  
75 stars found  
Frame #276:  
76 stars found  
Frame #277:

Cancel Pause

Choose stars

View

Image

Chart

Mixed

Selection

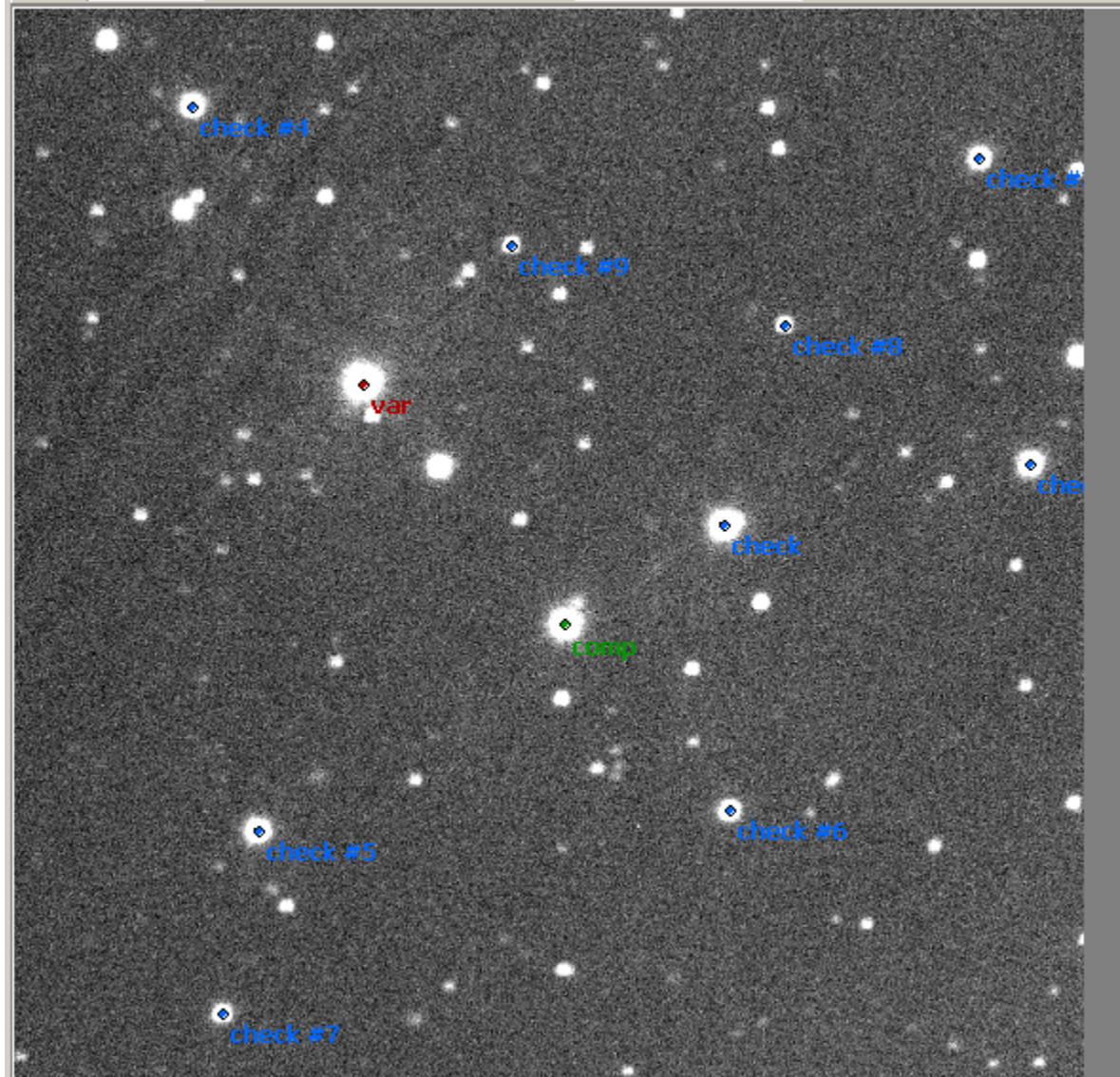
New selection



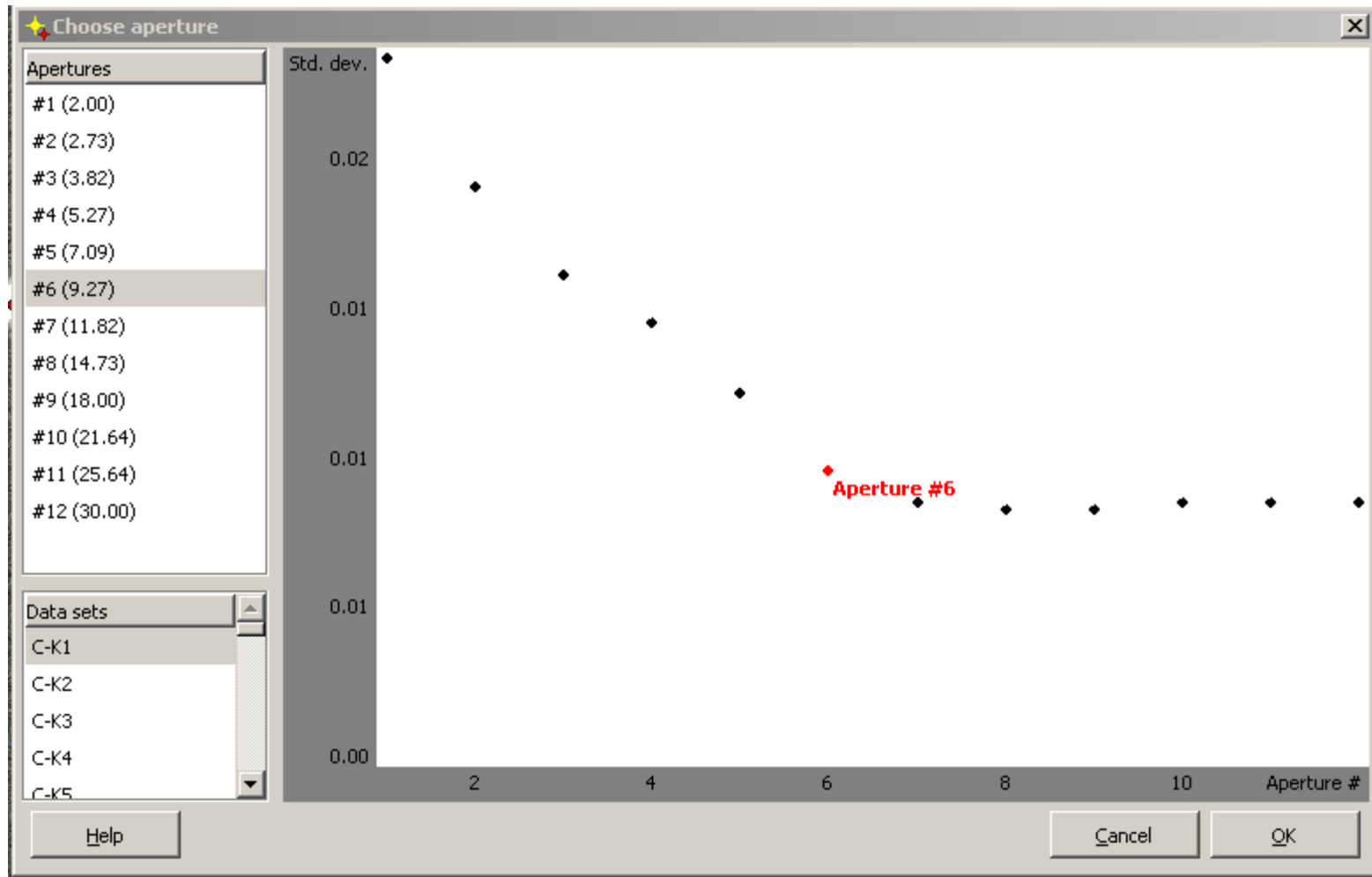
New

Save as...

Remove

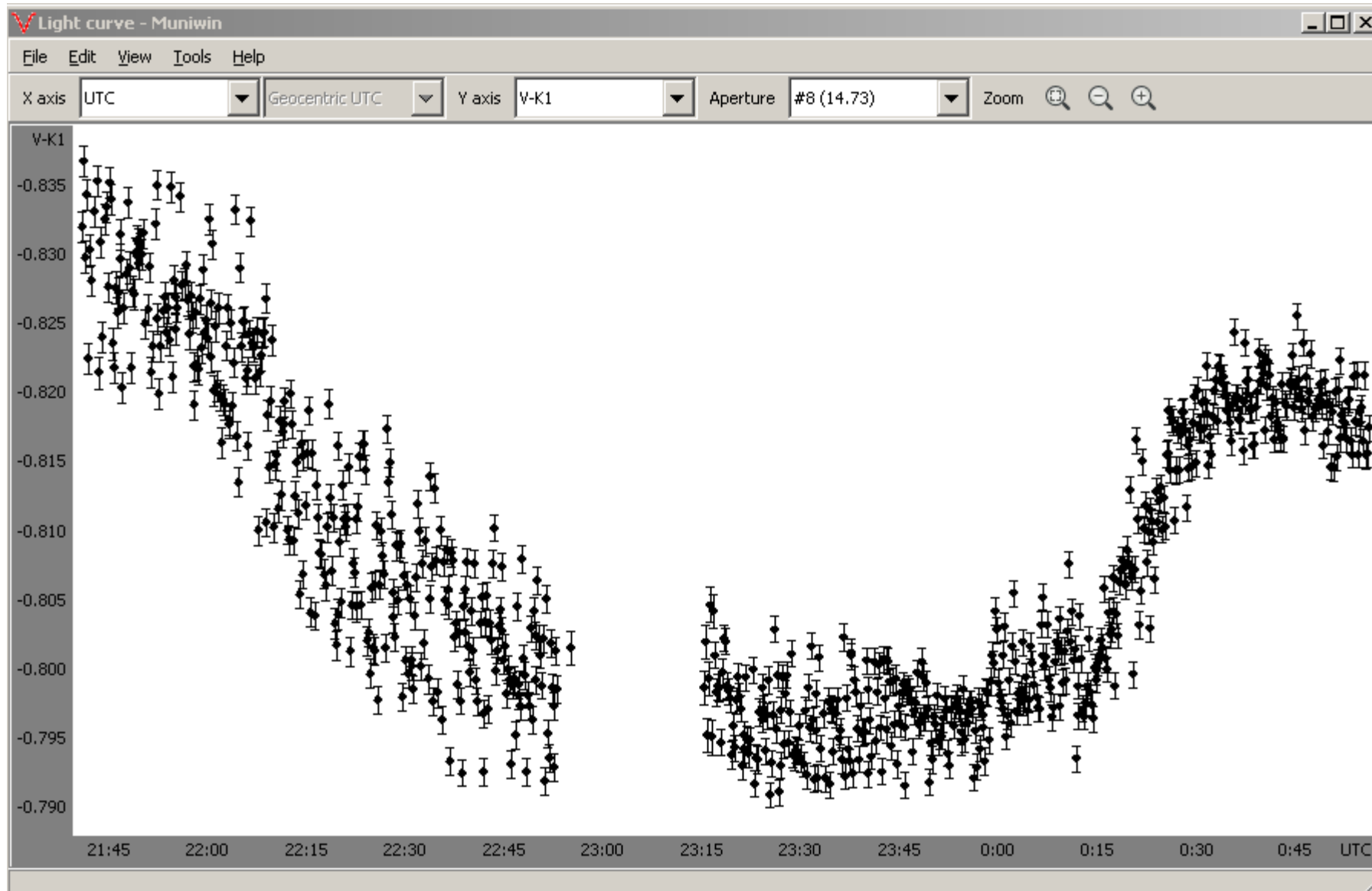


Help

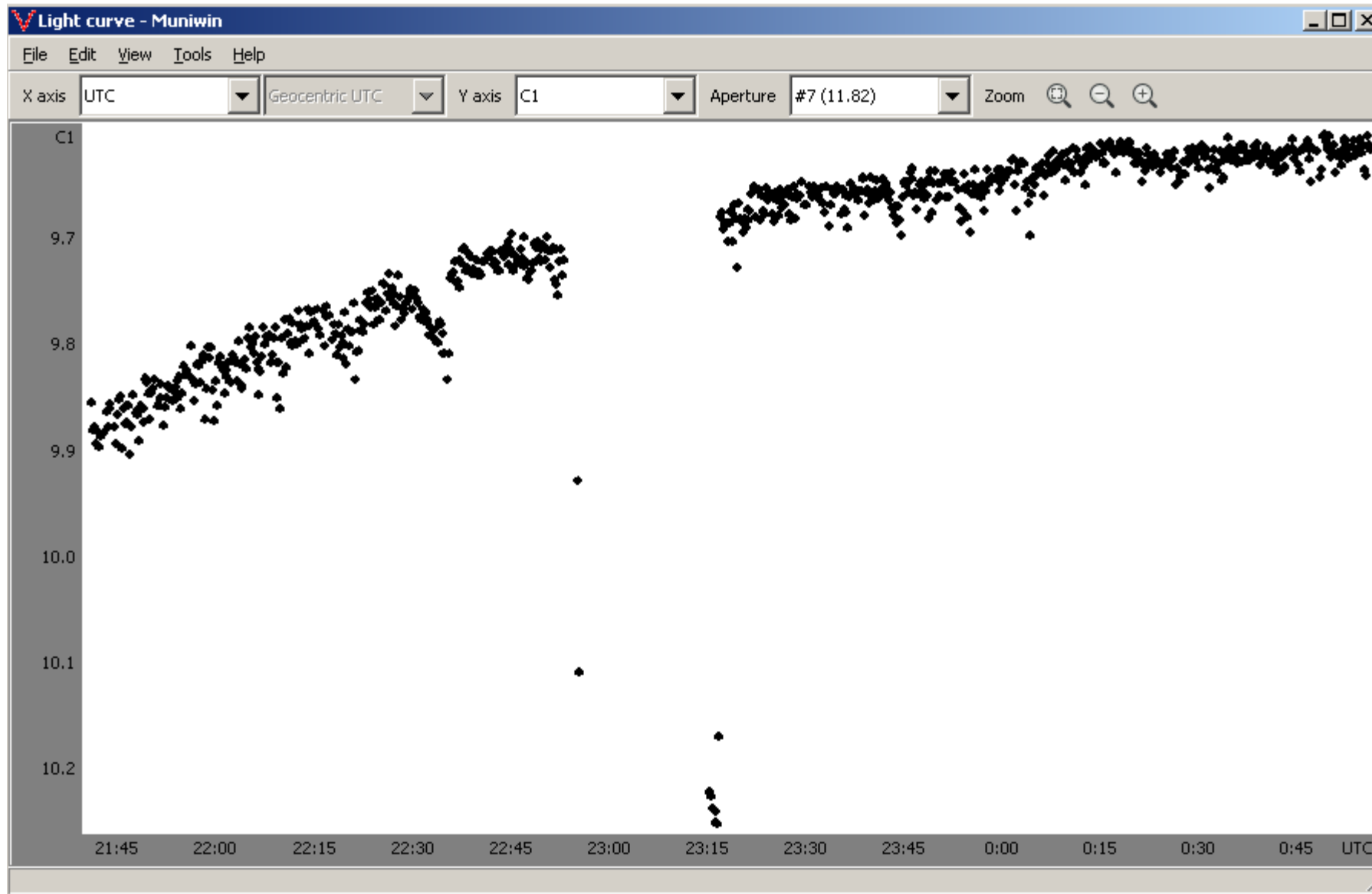


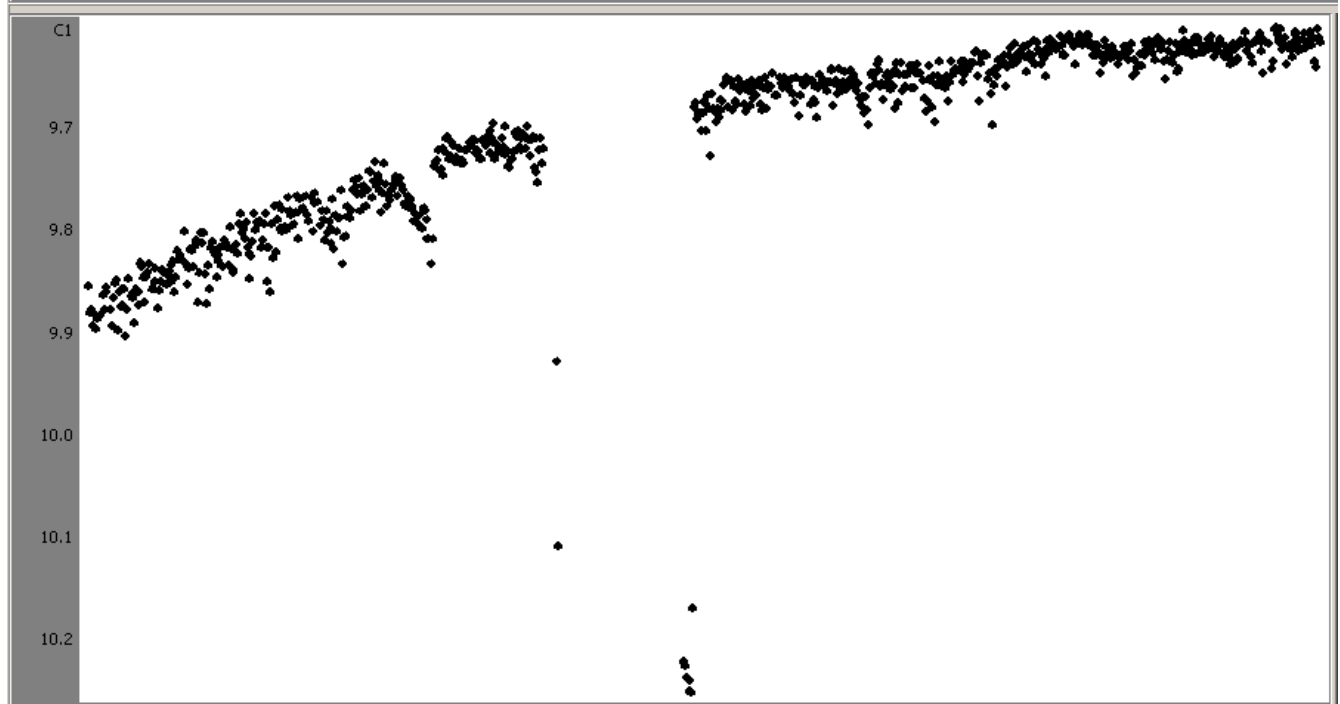
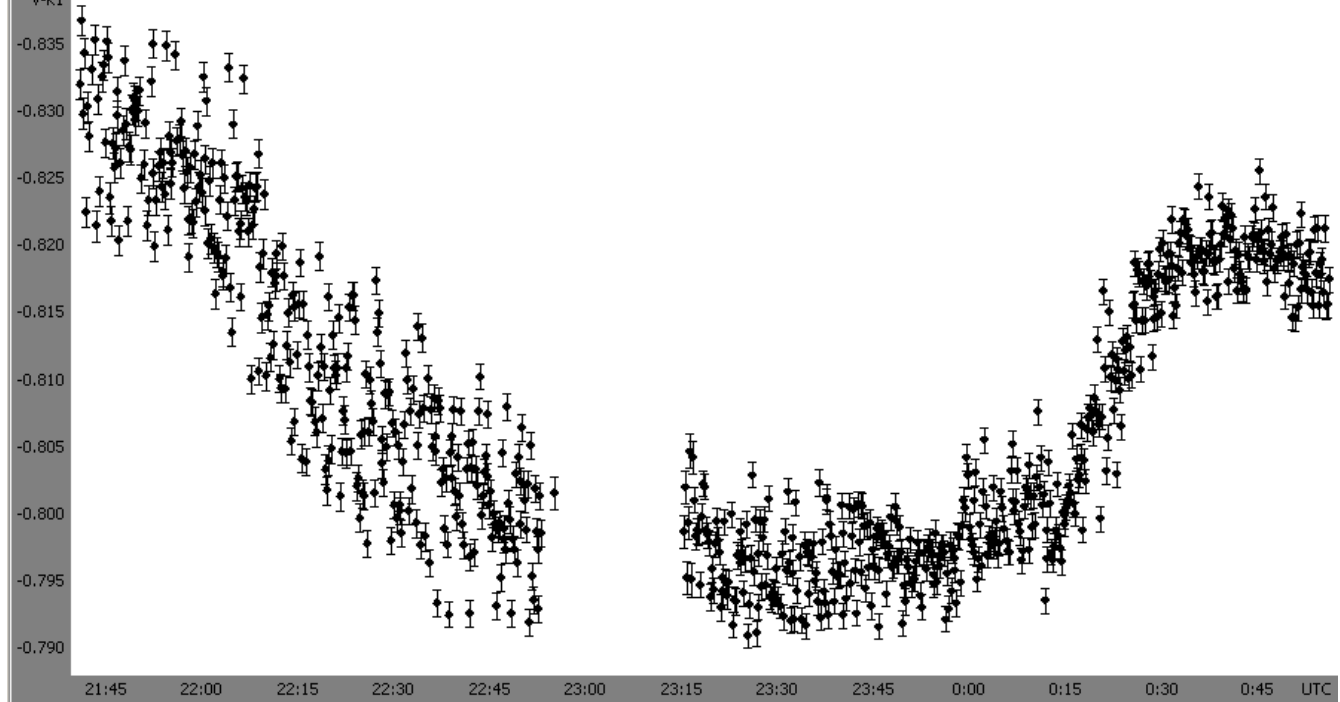


# Light Curve



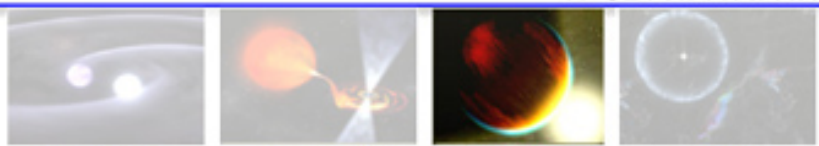
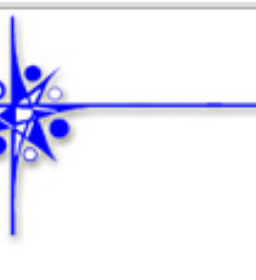
# RAW instrumental magnitudes





# <http://var2.astro.cz/ETD/index.php>

Variable Star and Exoplanet Section  
of Czech Astronomical Society



B.R.N.O. MEDUZA TRESKA HERO

Ar more informace isversu si postupit: [Přihlásit](#)

Vertéjas Ne ▼

own transits:

... complete ... worldwide ... continuously growing ...

## ETD Exoplanet Transit Database

<http://var.astro.cz/ETD>

### ETD - Exoplanet Transit Database

[Observers community](#) | [How to contribute to ETD](#) | [Model-fit your data](#) | [Transit predictions](#) | [KEPLER Transit predictions](#) | [KEPLER Candidates](#)

ETD is here to supply quickly and easily the **list of all ever observed transits of transiting exoplanets** to observers and researchers.

Our database administrators are periodically checking for new transits - both in literature and in on-line internet sources. Each transit is stored with complete citations, link to the paper / on-line source URL.

For each exoplanet, there is available graphical output of relations:

- transit **TIMINGS vs. EPOCH**
- transit **DURATION vs. EPOCH**
- transit **DEPTH vs. EPOCH** and
- **list of available transits.**

## ETD - Exoplanet Transit Database

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[Observers community](#) | [How to contribute to ETD](#) | [Model-fit your data](#) | [Transit predictions](#) | [KEPLER Transit predictions](#) | [KEPLER Candidates](#)

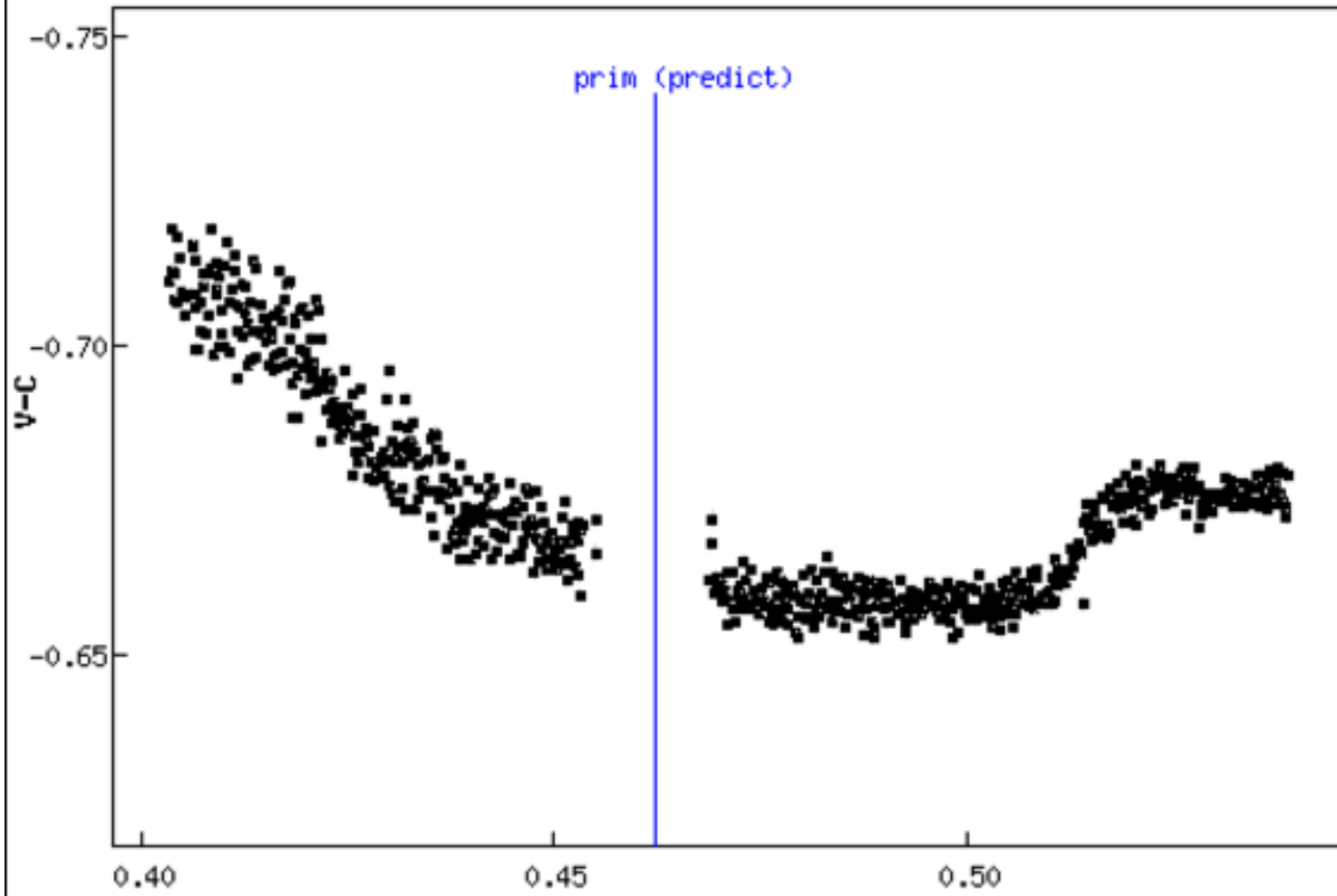
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[Step 1 / 5](#)

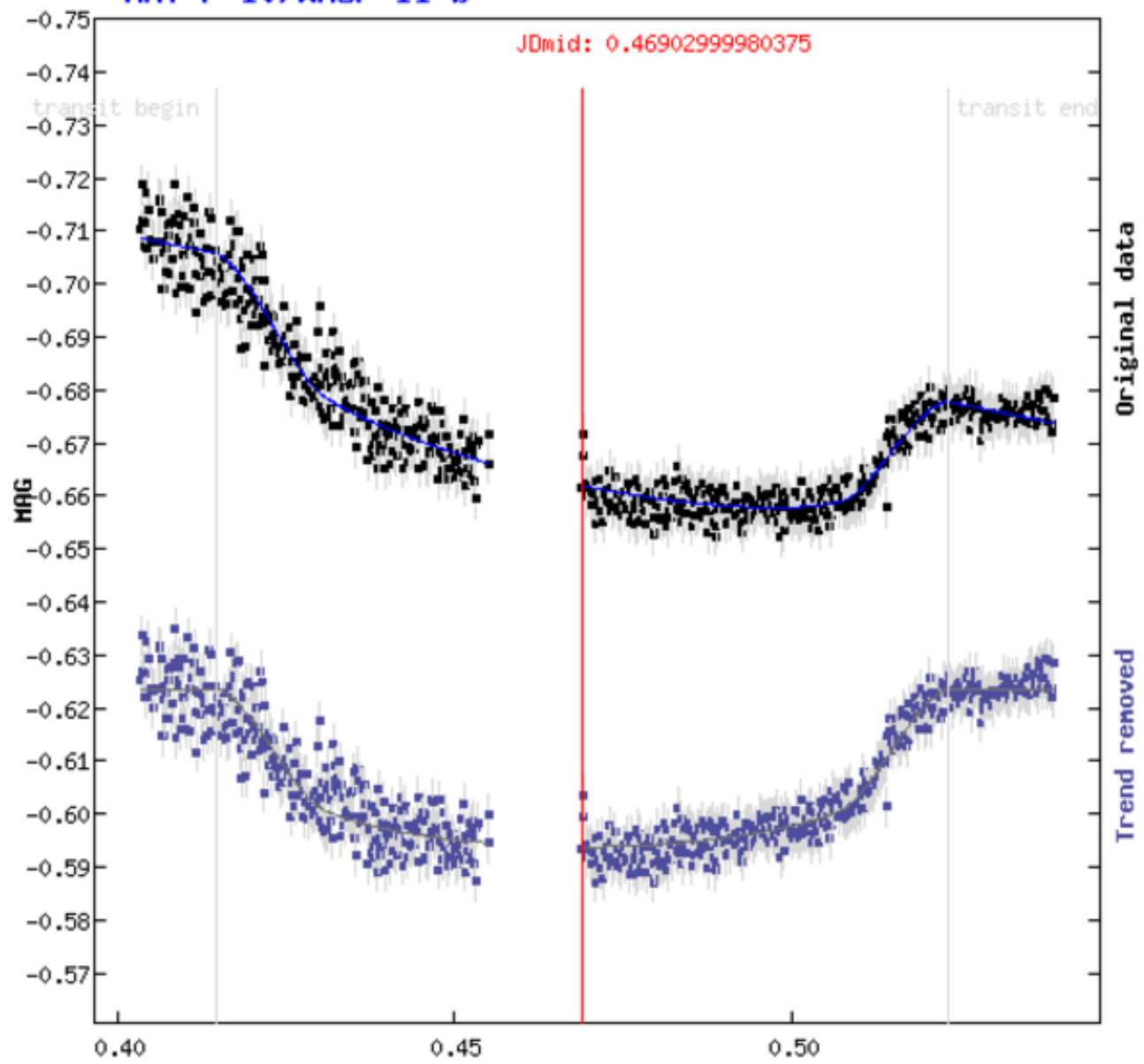
**INSTRUCTION:** In the first step, just select an exoplanet and load data file with observation. Also select if data are in geocentric or heliocentric JD and specify, if brightness is given in MAG or FLUX. Both geocentric and heliocentric JD must be computed from COORDINATED UNIVERSAL TIME (UTC) with leap seconds included (common time in your PC / notebook).

<b>Choose exoplanet</b>	HAT-P-10/WASP-11 b Ari ▼
<b>Data file with observation:</b> <i>Required 3 columns: JD, MAG, ERROR. Other columns are ignored. <u>Columns must be separated by space or TAB.</u></i>	Pasirinkti failą curve.txt
<b>JD format:</b>	<input checked="" type="radio"/> geocentric <input type="radio"/> heliocentric (both based on UTC)
<b>Brightness column:</b>	<input checked="" type="radio"/> in magnitudes <input type="radio"/> in flux
	Continue >

HAT-P-10/WASP-11 b



# HAT-P-10/WASP-11 b



JD mid: 2457257.46903 +/- 0.00022

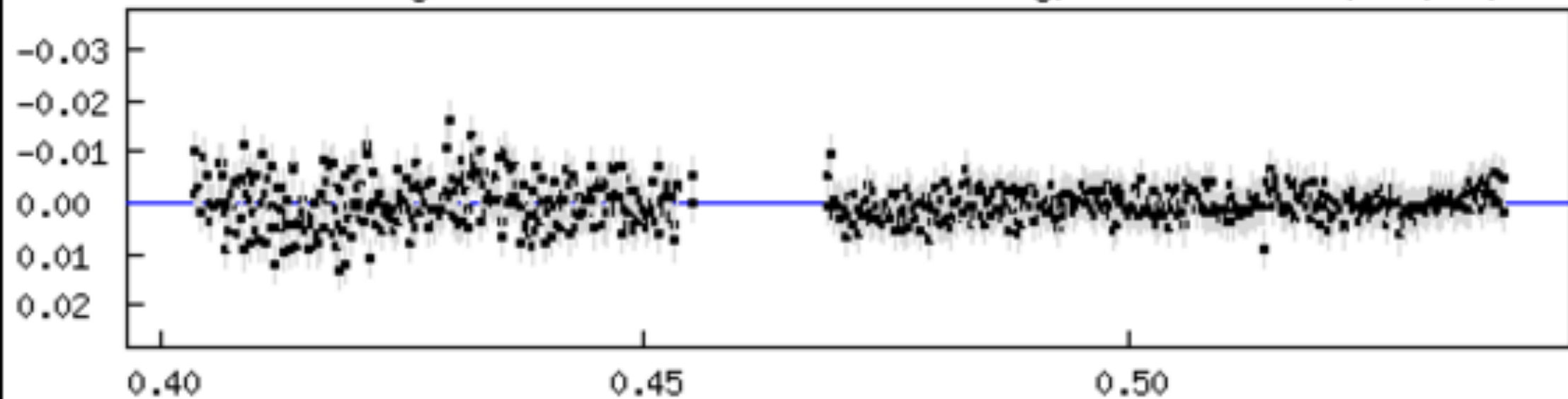
HJD mid: 2457257.46965 +/- 0.00022 (helcor = 0.00062)

Duration: 156.8 +/- 0.7 minutes

Depth: 0.0298 +/- 0.0004 mag

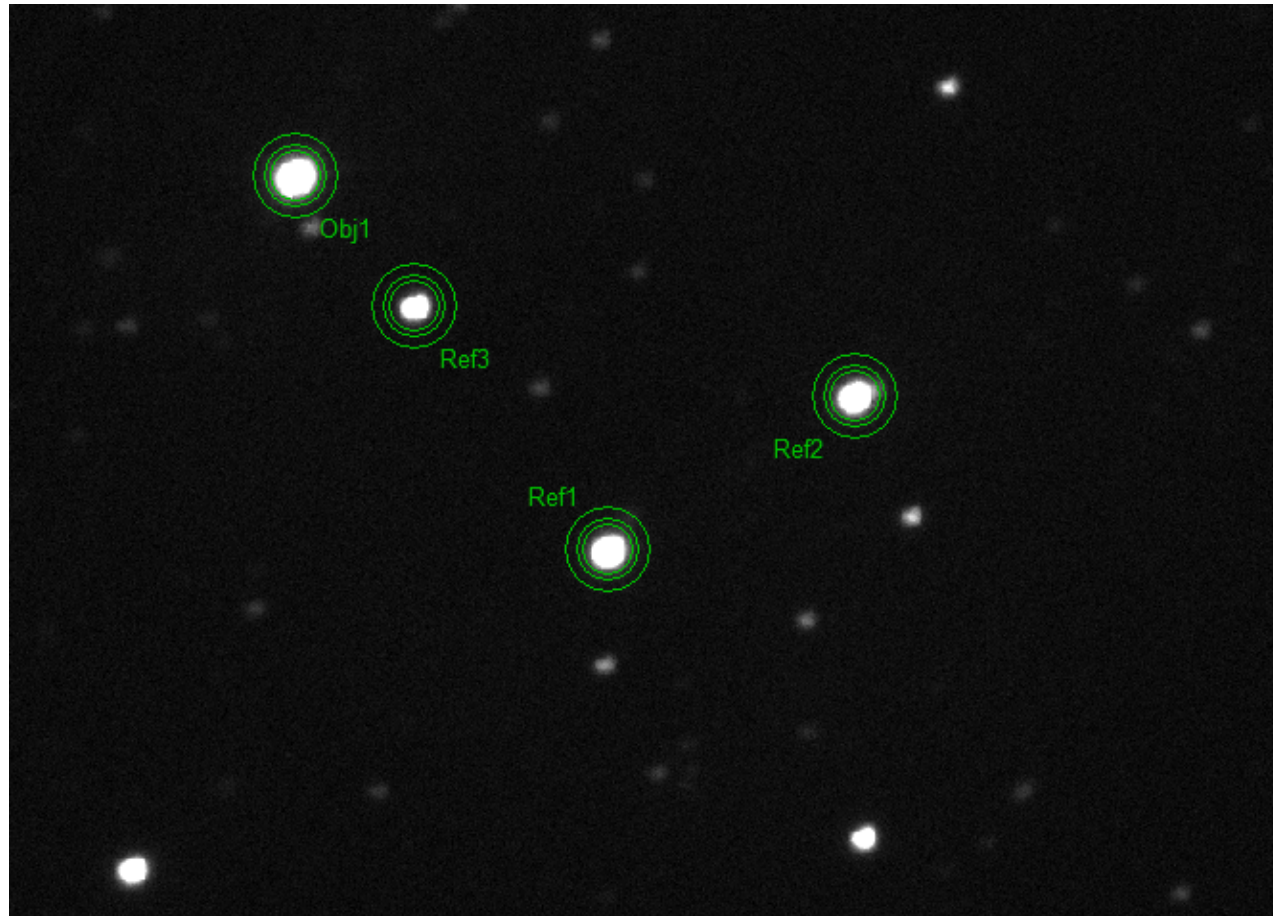
Residuals (mag - fit)

S = 2.7 mmag, ro = 3.99 data/min, DQ = 1

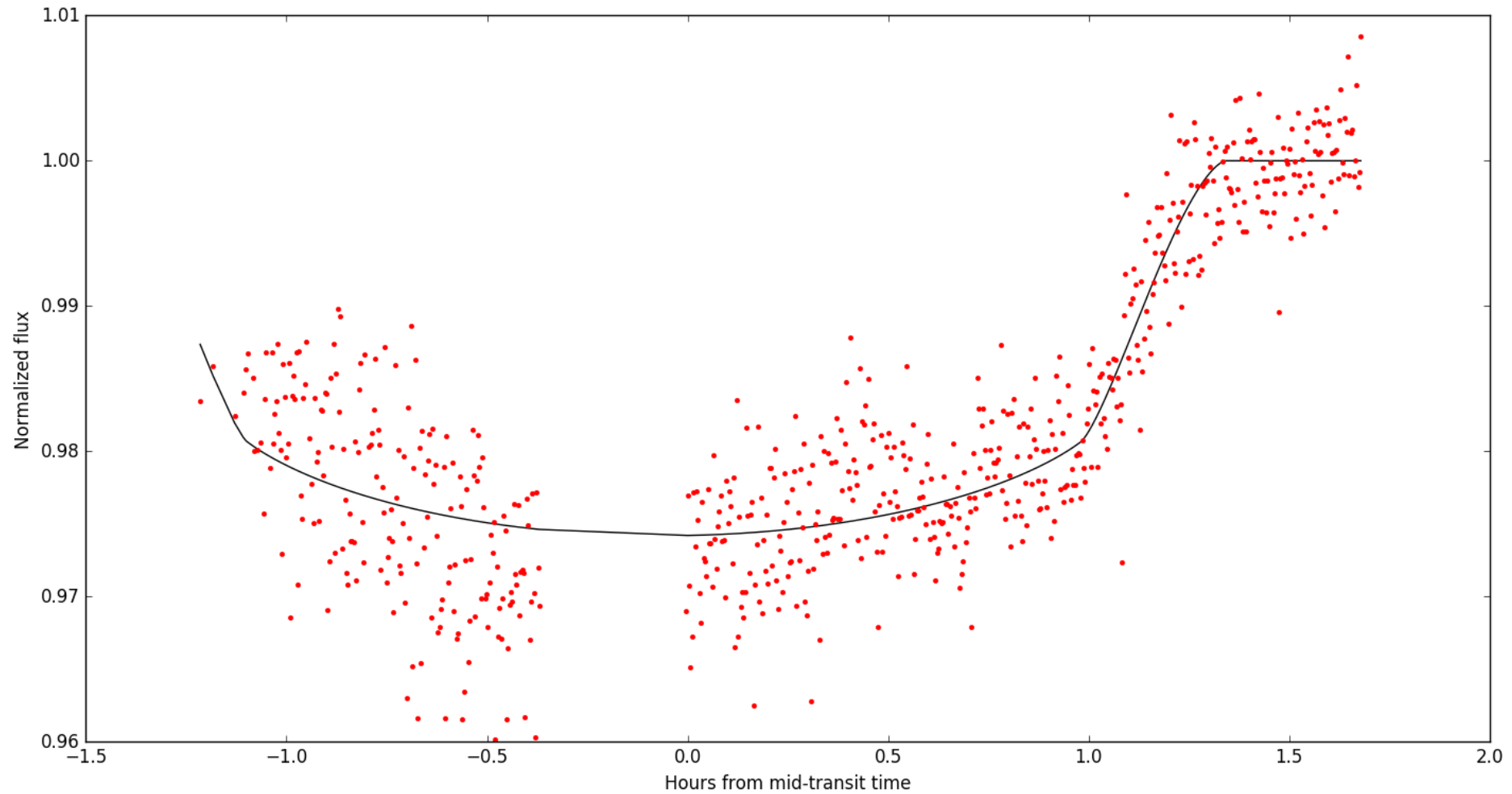




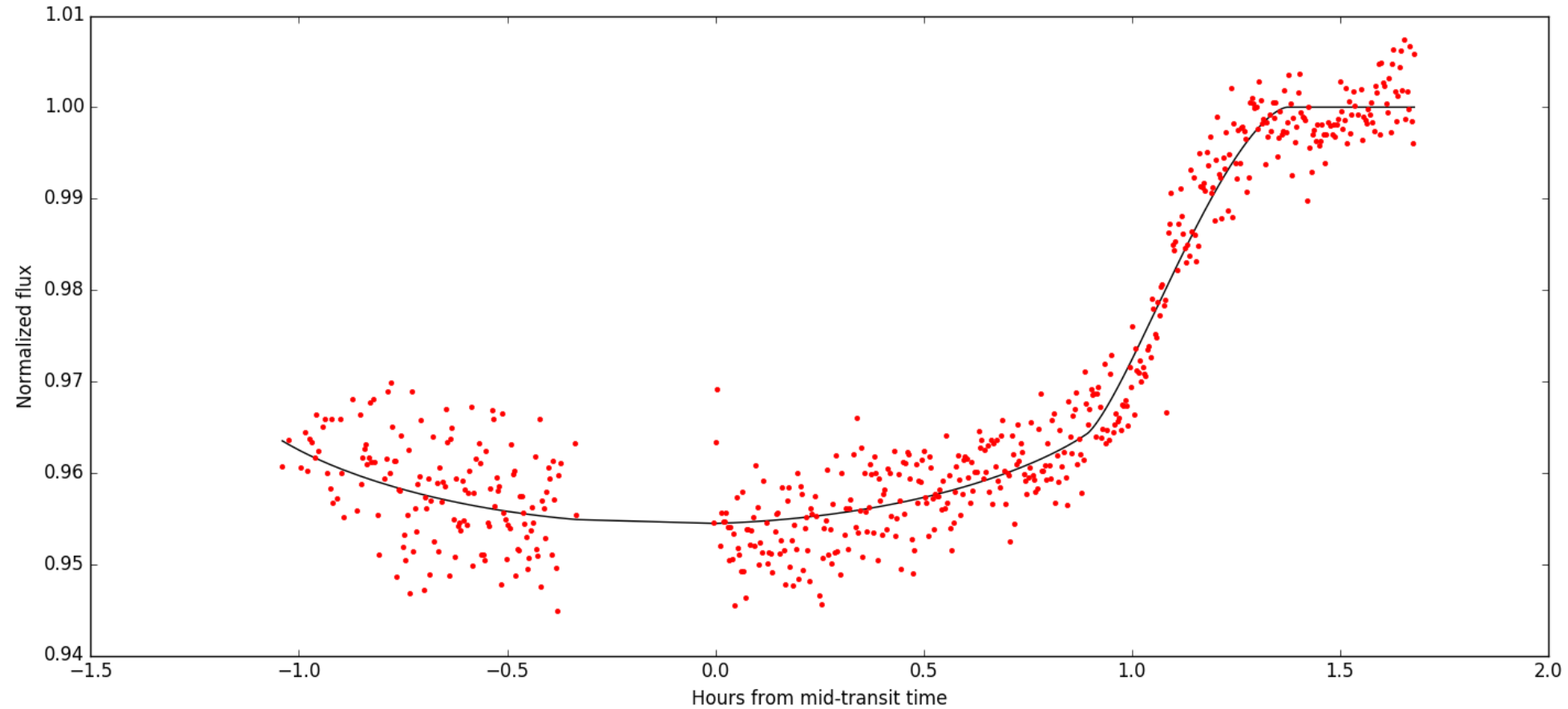
# Maxim data

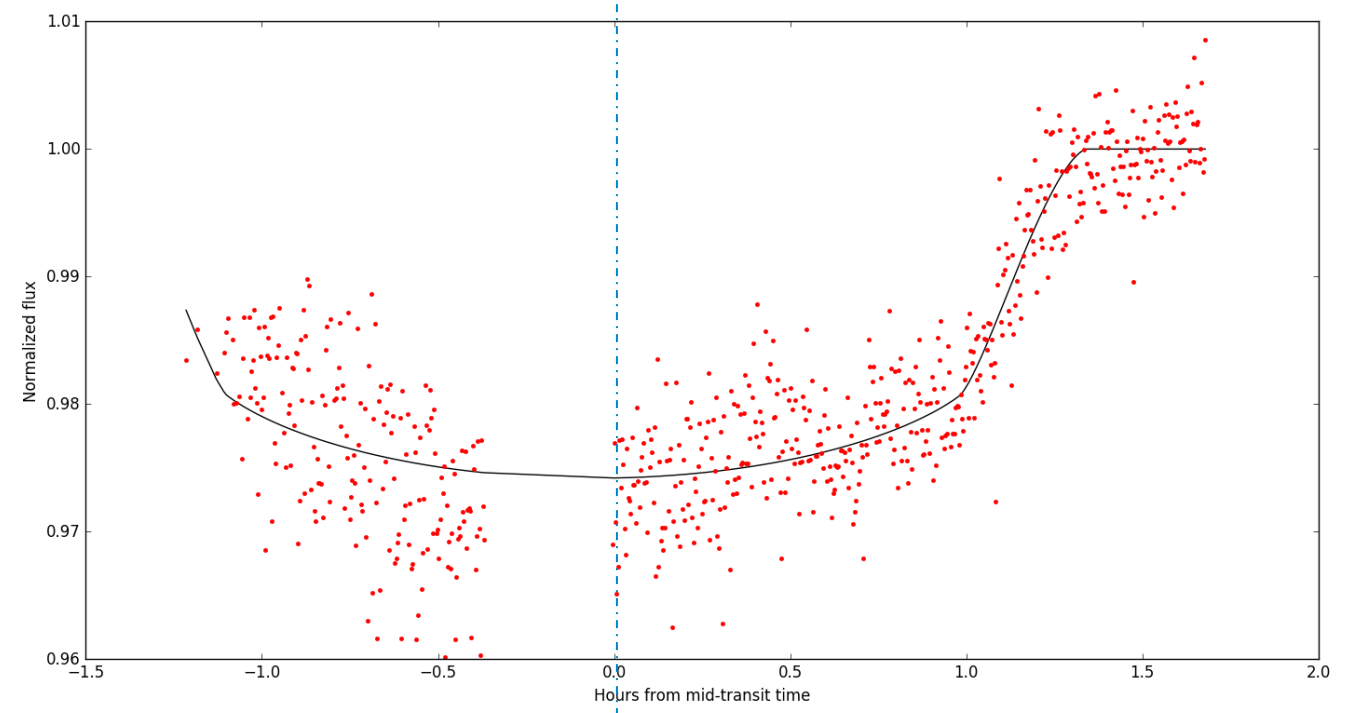
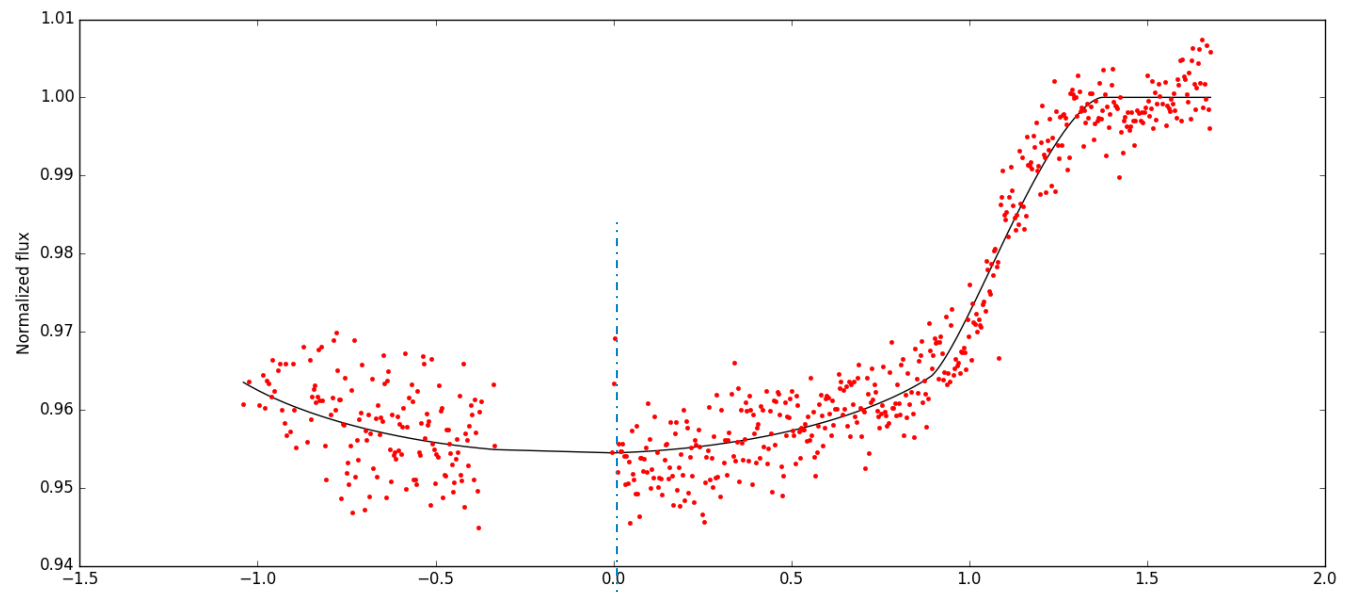


# Light curve (maxim)



# Light curve (Muniwin)





# Conclusions

- There is a variety of software allowing amateurs to perform photometric analysis on observational data in order to detect exoplanetary transits.
- A careful account for flat fields must take place, because even though reducing data scatter, it may bias the real depth of the transit