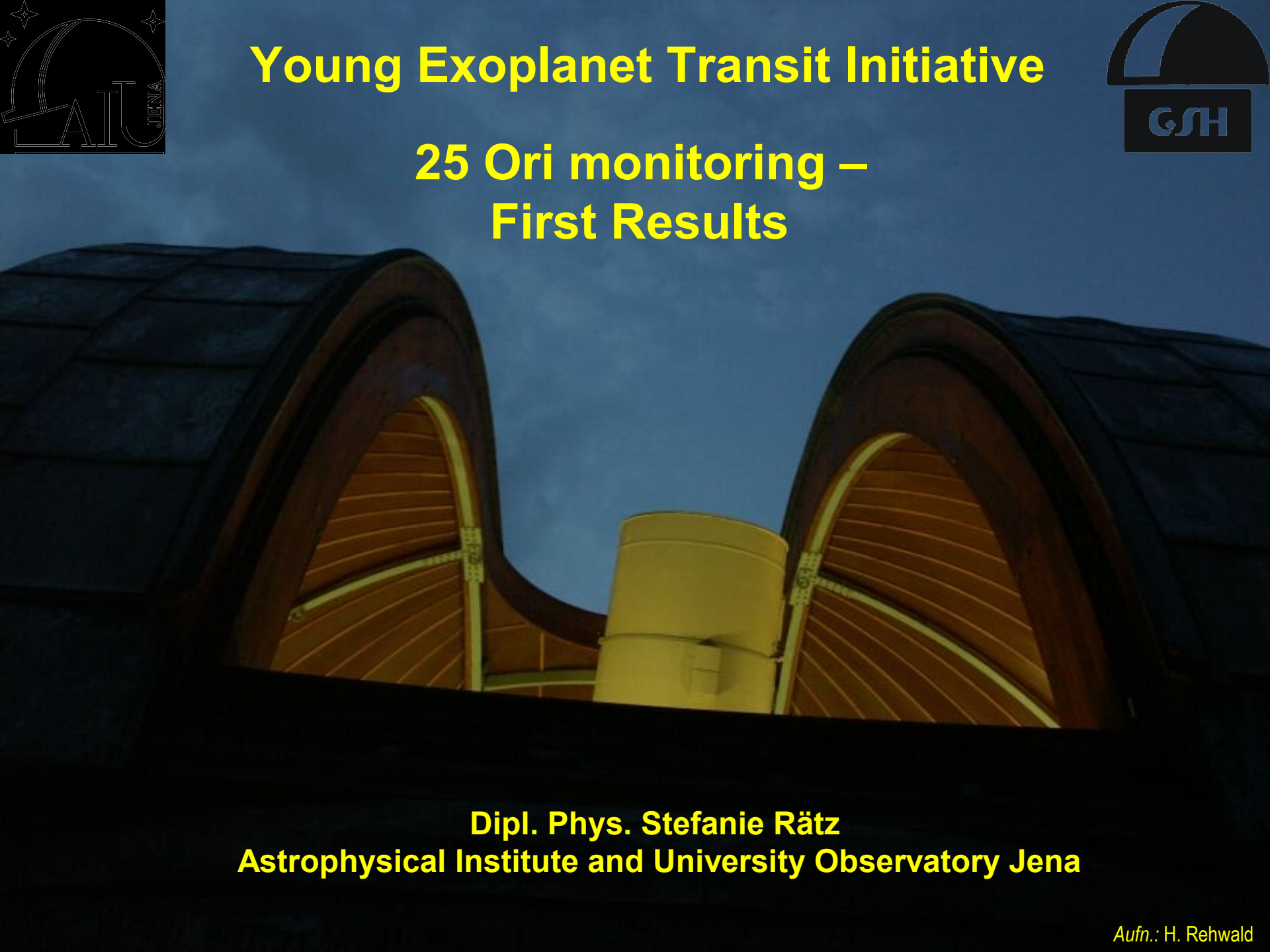
Young Exoplanet Transit Initiative

25 Ori monitoring – First Results



Dipl. Phys. Stefanie Rätz
Astrophysical Institute and University Observatory Jena

Aufn.: H. Rehwald

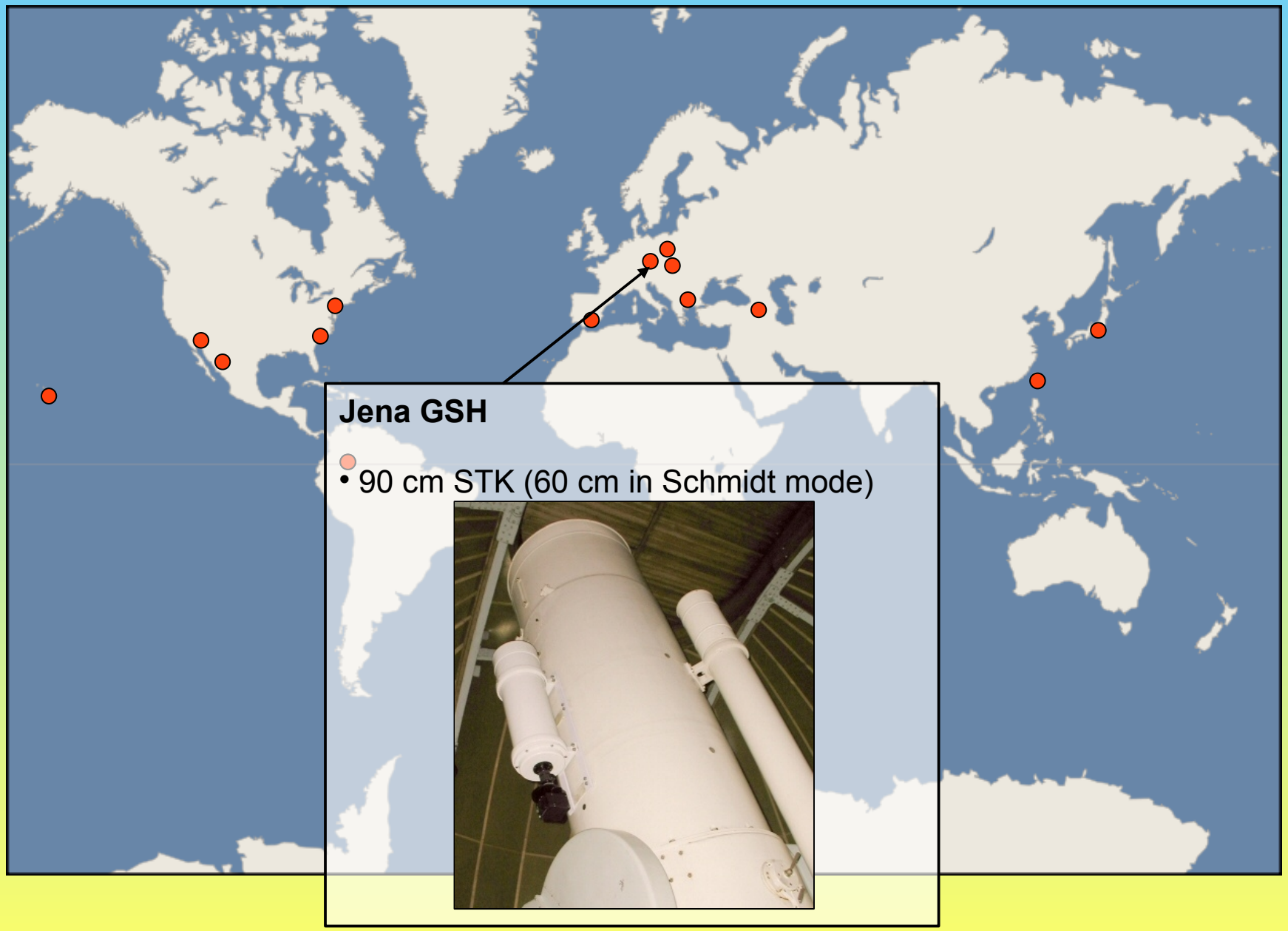
The 25 Ori Project

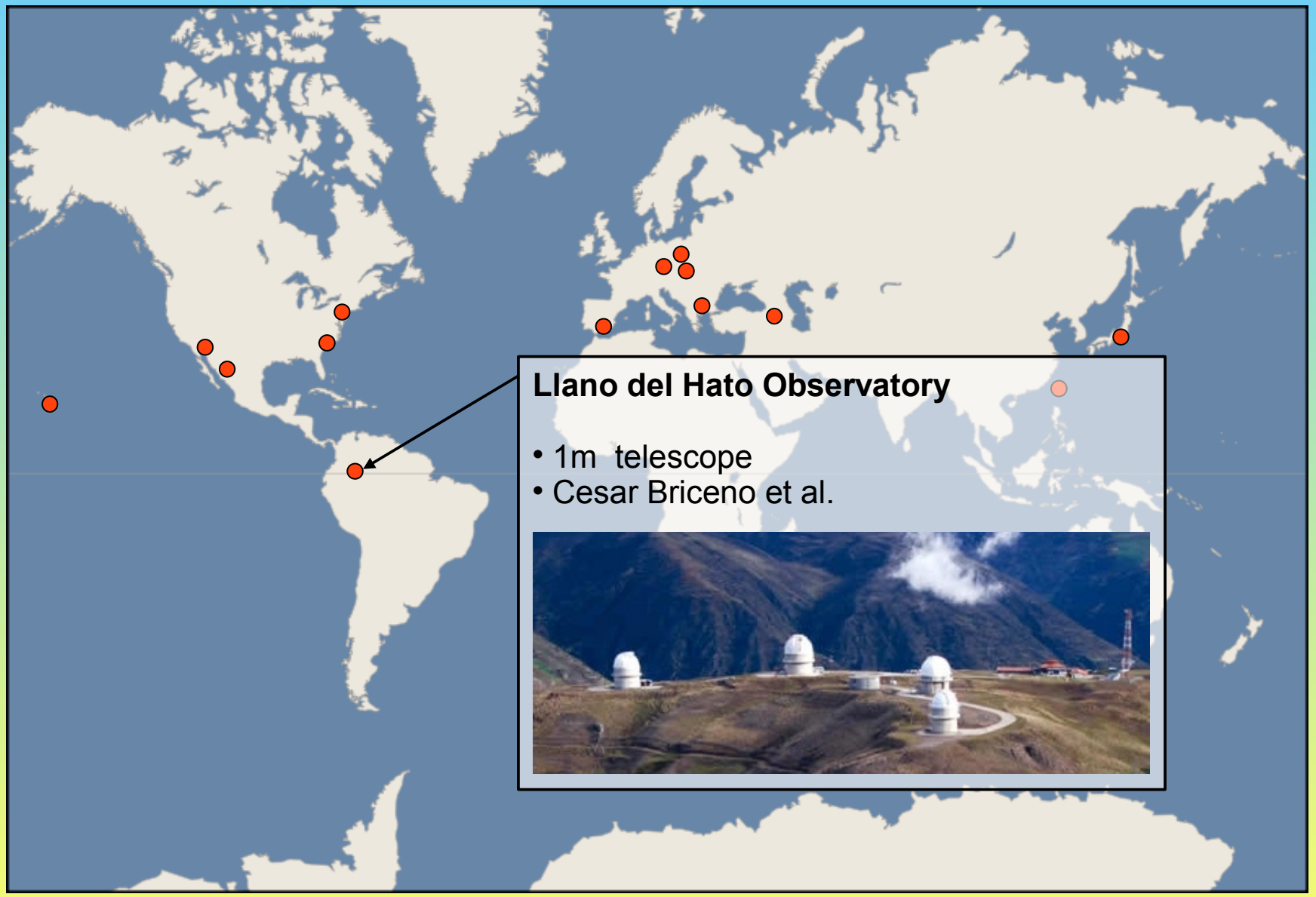
- Detection and study of complete planetary systems at young ages below 10 Myrs

  → complete:
  - inner planets (< 1 AU) with the transit method
  - intermediate separation planets (1-80 AU) with astrometry
  - wide planets (> 80 AU) with adaptive optics (AO) imaging

- Target selection: why 25 Ori?
  - Young (below 10 Myrs)
  - Near-by
  - Many cluster members with intermediate magnitudes
  - Location near the celestial equator

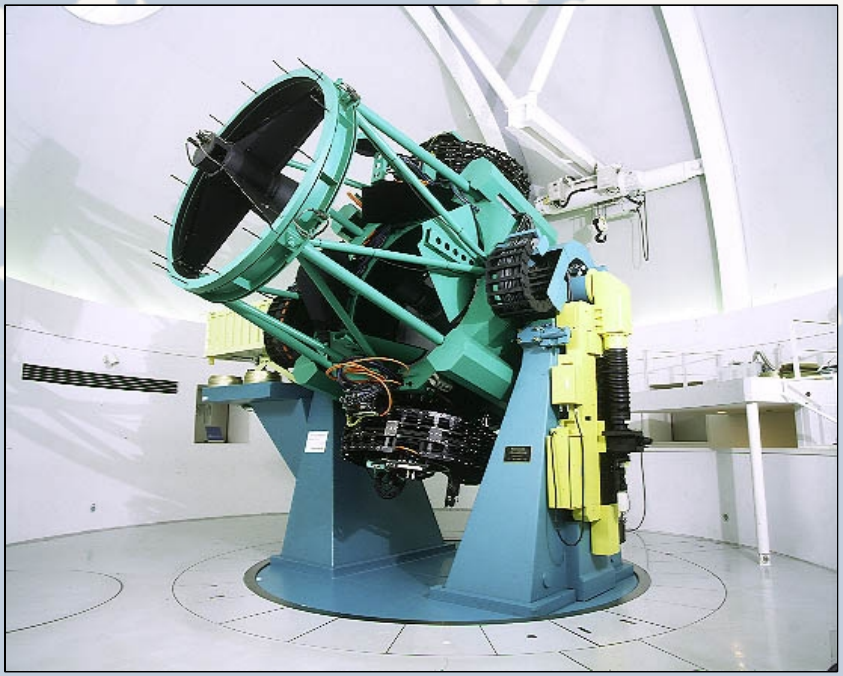
- Status:
  - Start of the monitoring of 25 Ori: January 2010
  - Observations were carried out with at three different Observatories

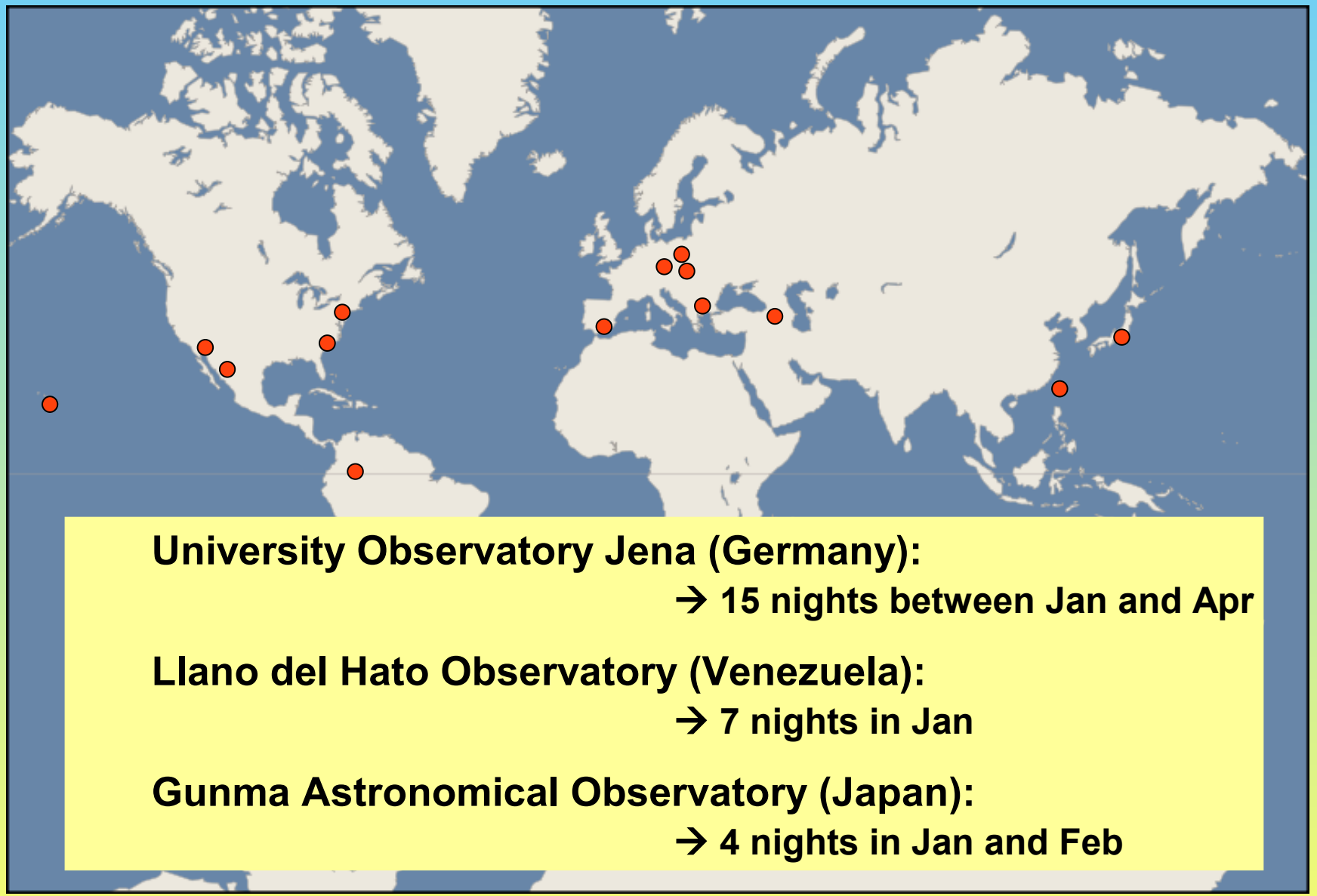

Jena GSH
• 90 cm STK (60 cm in Schmidt mode)


Llano del Hato Observatory
• 1m telescope
• Cesar Briceno et al.

Gunma Astronomical Observatory

- 1.5-m telescope
- Kengo Tachihara et al.





University Observatory Jena (Germany):

→ 15 nights between Jan and Apr

Llano del Hato Observatory (Venezuela):

→ 7 nights in Jan

Gunma Astronomical Observatory (Japan):

→ 4 nights in Jan and Feb

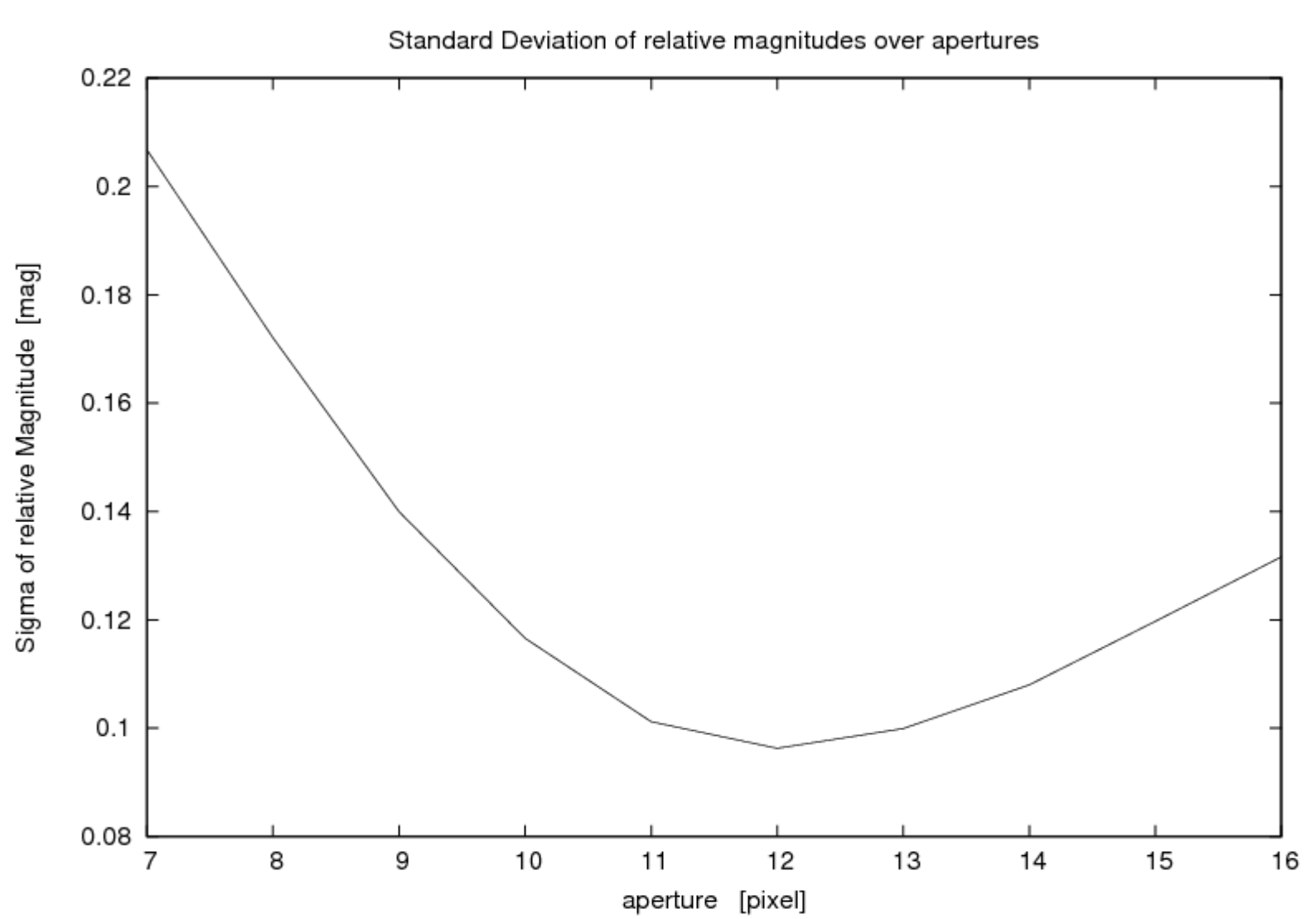
The Algorithm for analysing Data

We developed an algorithm, which is based on the application of several programs

Photometry

- First we perform aperture photometry
- Therefore we use the IRAF task *chphot* which is based on the standard IRAF routine *phot*
- With *chphot* it‘s possible to do the photometry on every field star at the same time
- *chphot* requires a list of the pixel coordinates of every star in the FoV (every star gets an internal number)
- Measurements are done with 10 different apertures

The Algorithm for analysing Data



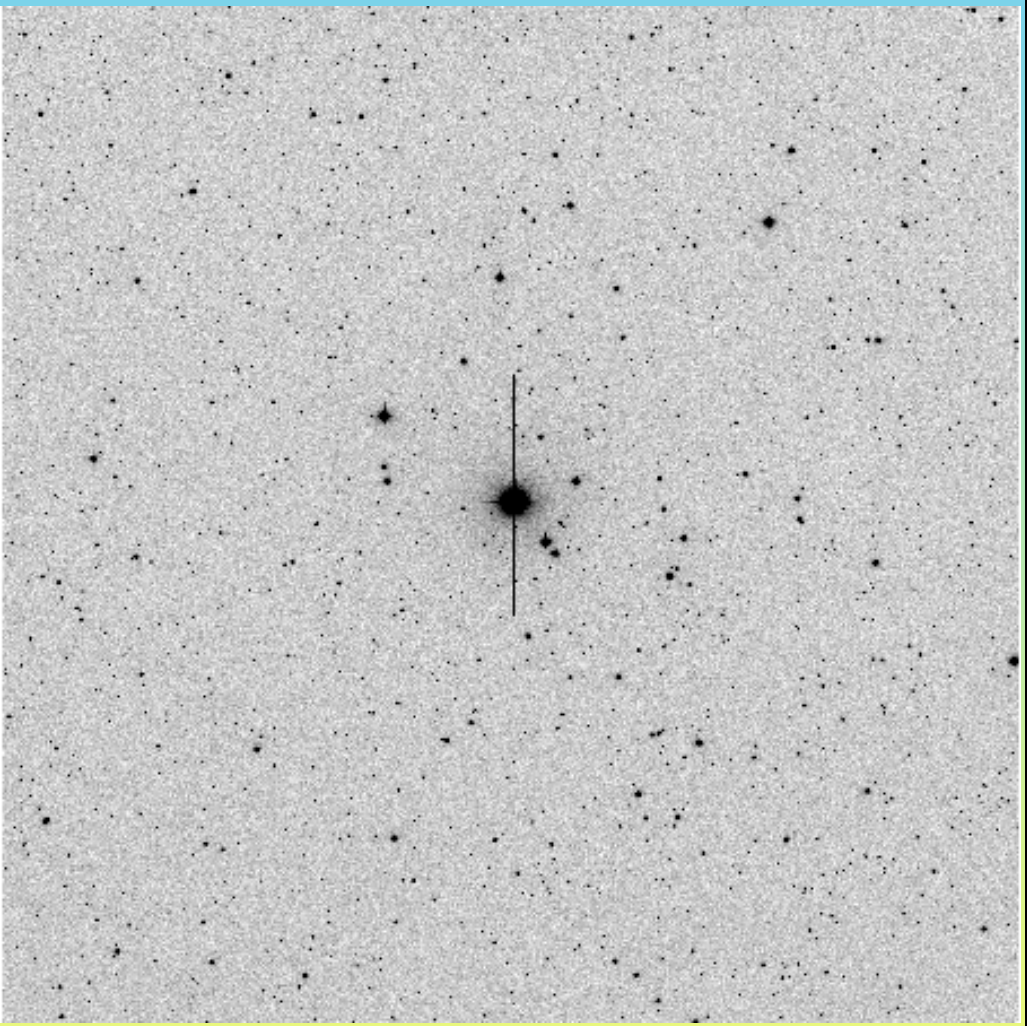
- Measurements are done with 10 different apertures

A algorithm for differential photometry: an optimum artificial comparison star

Broeg et al. Feb. 2005

- a big problem of the differential photometry is the search for a good comparison star (cs)
- one should use as many cs as possible to reduce noise, but there is the risk that one (or more) stars are variable
- one should use all available field stars
- the algorithm decides which cs are the best, by taking the weighted average of them
- it computes the artificial cs by automatically weighting down the cs according to their variability

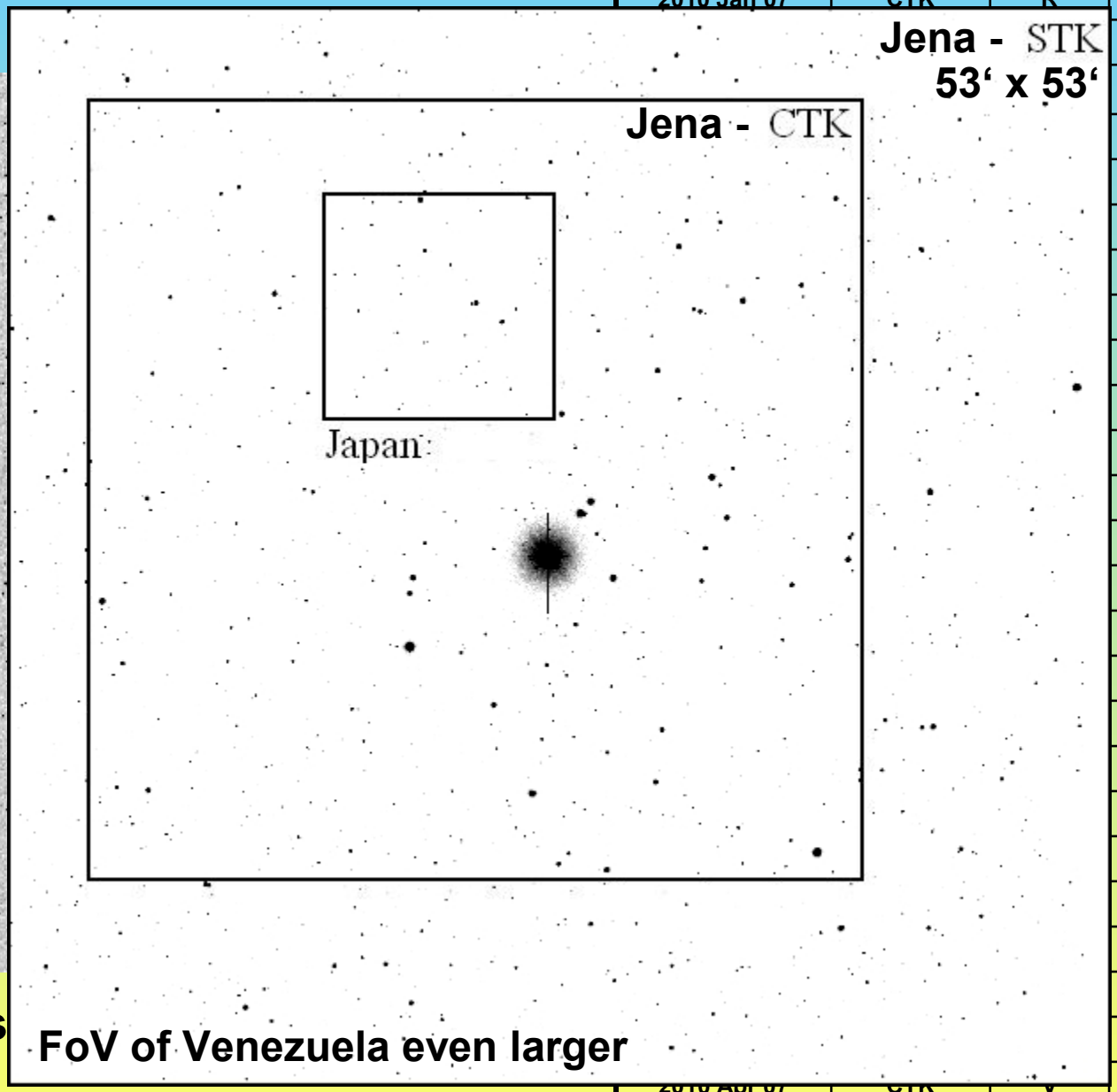
First Results



Stars in the FoV: 2497

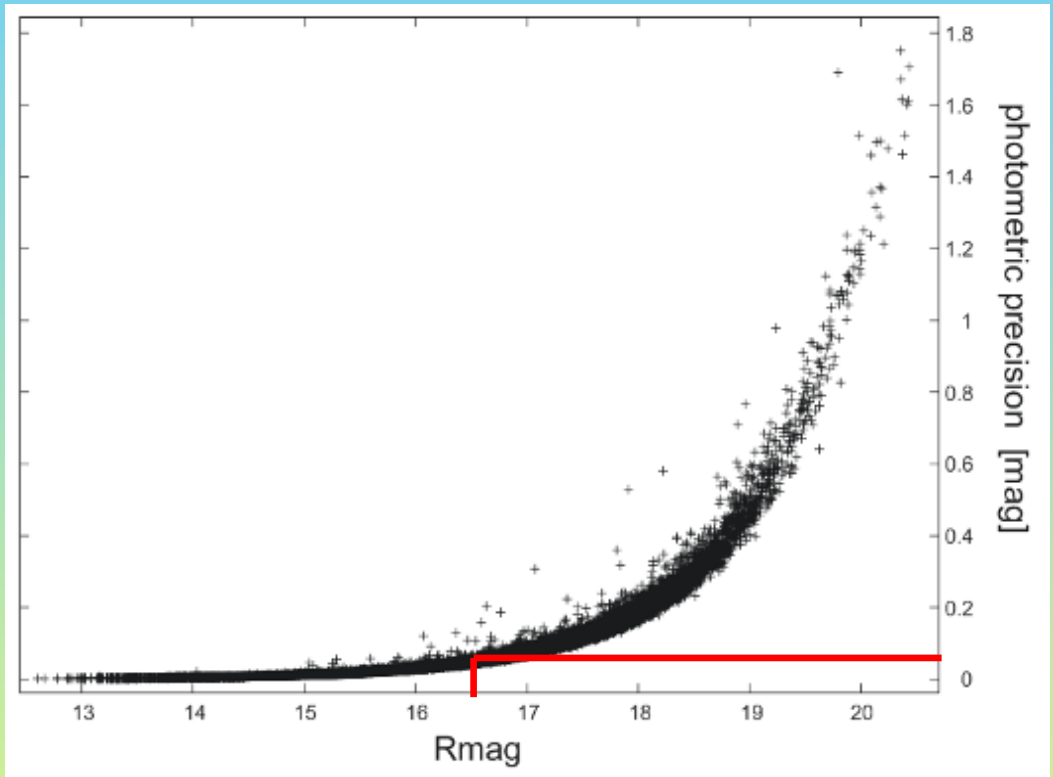
Date	Camera	Filter	Exptime	Number
2010 Jan 07	CTK	R	10s,60s	43,42
2010 Jan 12	CTK	R	10s,60s	119,118
2010 Jan 26	CTK	R	10s,60s	152,151
2010 Feb 03	CTK	R	10s,60s	15,14
2010 Feb 08	CTK	V	10s,60s	35,34
	STK	R	5s,30s	58,58
2010 Feb 18	CTK	V	60s	122
	STK	R	5s,50s	132,131
2010 Feb 20	CTK	V	60s	64
	STK	R	5s,50s	76,76
2010 Feb 22	CTK	V	60s	48
	STK	R	5s,50s	40,40
2010 Mar 04	CTK	V	60s	73
	STK	R	5s,50s	83,82
2010 Mar 24	CTK	V	60s	3
	STK	R	5s,50s	18,18
2010 Mar 25	CTK	V	60s	19
	STK	R	5s,50s	22,21
2010 Mar 28	CTK	V,R	60s	27,2
	STK	R	5s,50s	29,30
2010 Apr 02	CTK	V	60s	24
	STK	R	5s,50s	27,27
2010 Apr 06	CTK	V	60s	33
	STK	R	5s,50s	38,37
2010 Apr 07	CTK	V	60s	22
	STK	R	5s,50s	26,25

First Results



Date	Camera	Filter	Exptime	Number
2010 Jan 07	CTK	R	10s,60s	43,42
			10s,60s	119,118
			10s,60s	152,151
			10s,60s	15,14
			10s,60s	35,34
			5s,30s	58,58
			60s	122
			5s,50s	132,131
			60s	64
			5s,50s	76,76
			60s	48
			5s,50s	40,40
			60s	73
			5s,50s	83,82
			60s	3
			5s,50s	18,18
			60s	19
			5s,50s	22,21
			60s	27,2
			5s,50s	29,30
			60s	24
			5s,50s	27,27
			60s	33
			5s,50s	38,37
2010 Apr 07	CTK	V	60s	22
	STK	R	5s,50s	26,25

Mean photometric precision vs. R magnitude at 60s exposure time for STK



Detection limit for transiting planets:

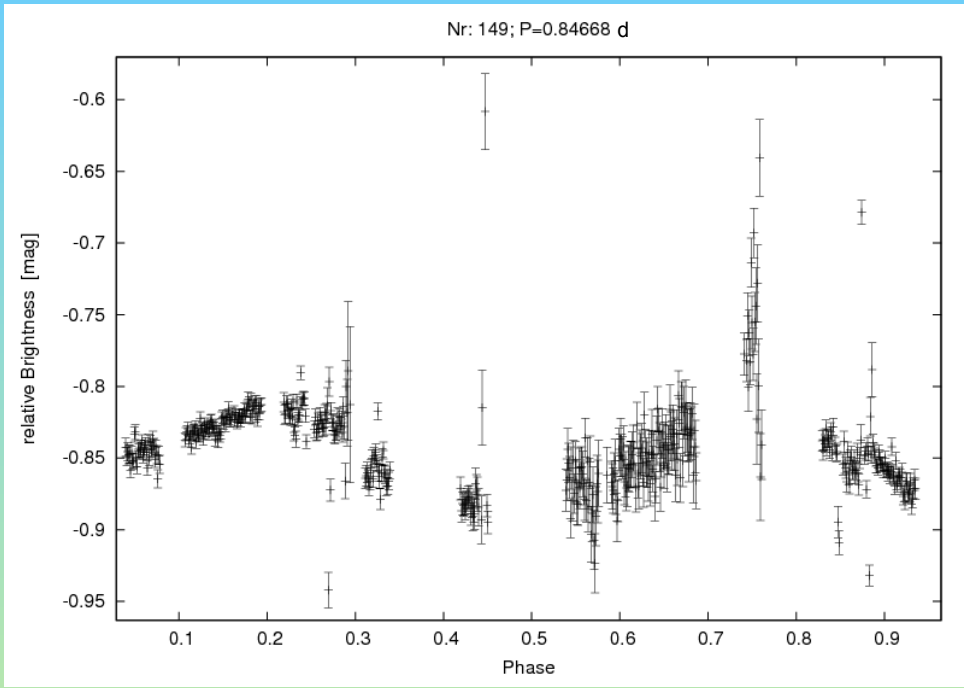
A transit with a depth of 5% can be detected at stars up to

16.5 mag
(M0)

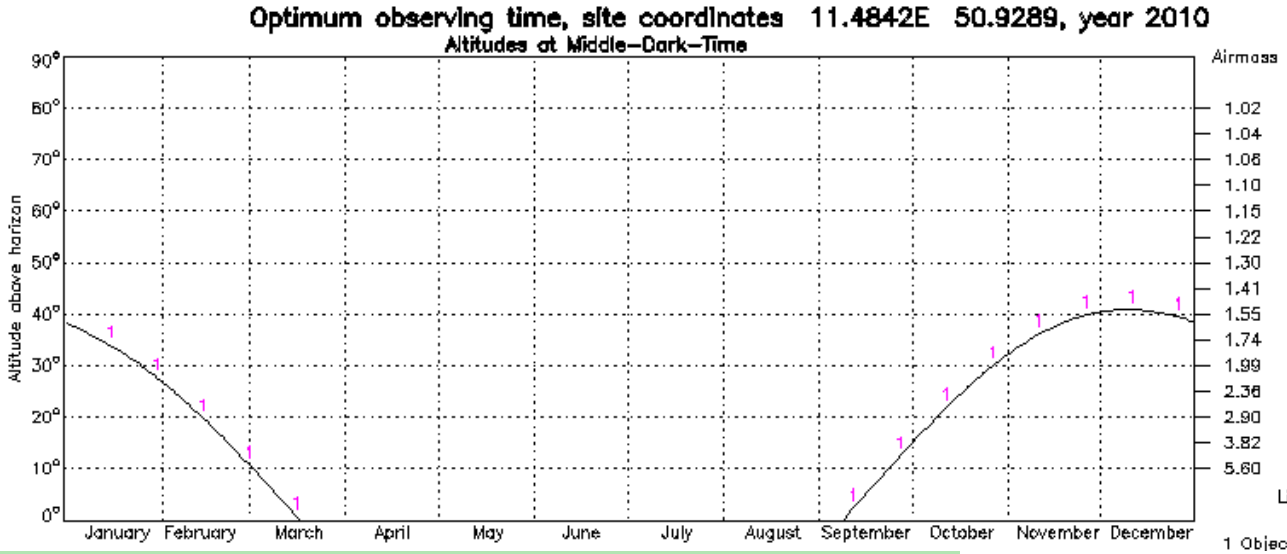
In our FoV:

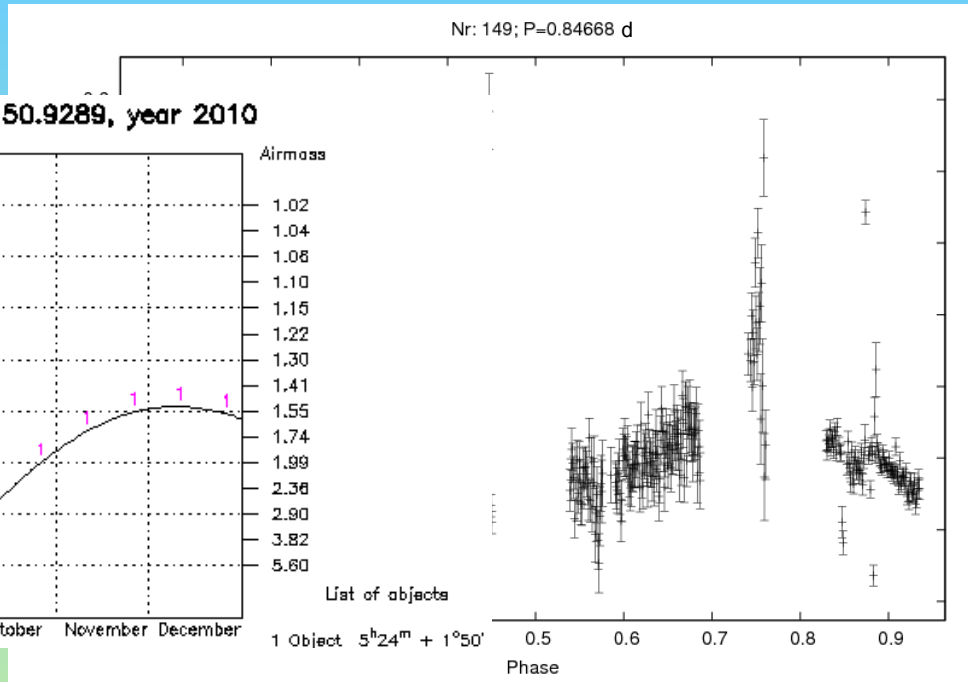
- **~ 2500 stars**
- **830 stars brighter 16.5 mag**

Some variable stars

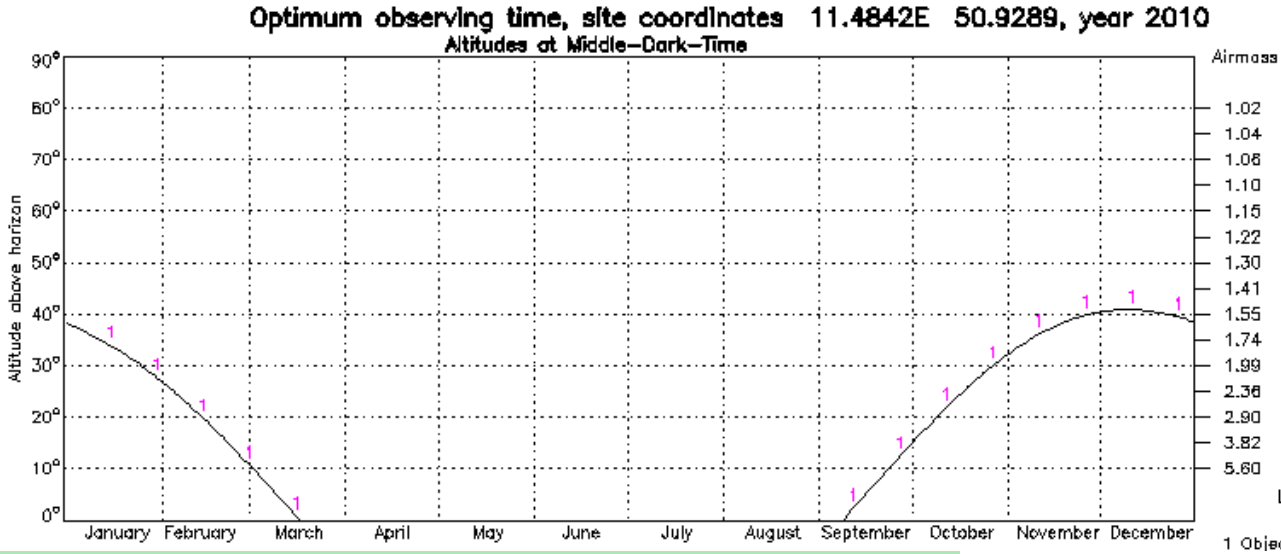


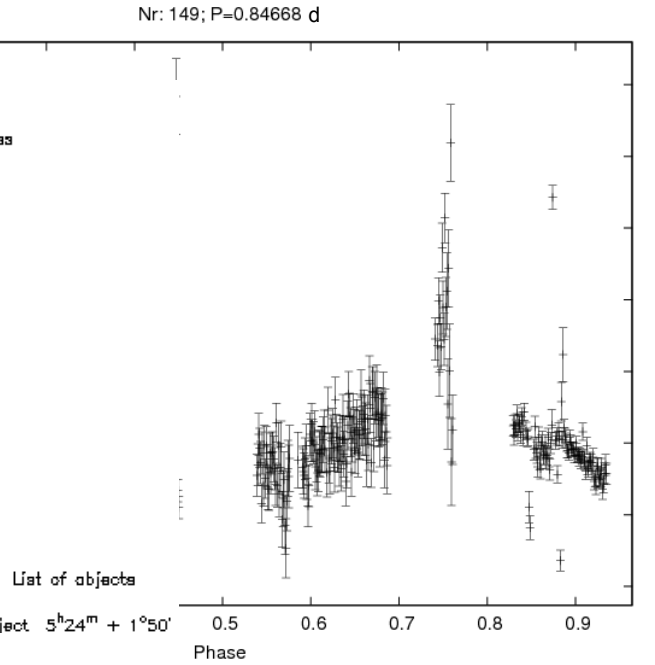
Some variable stars

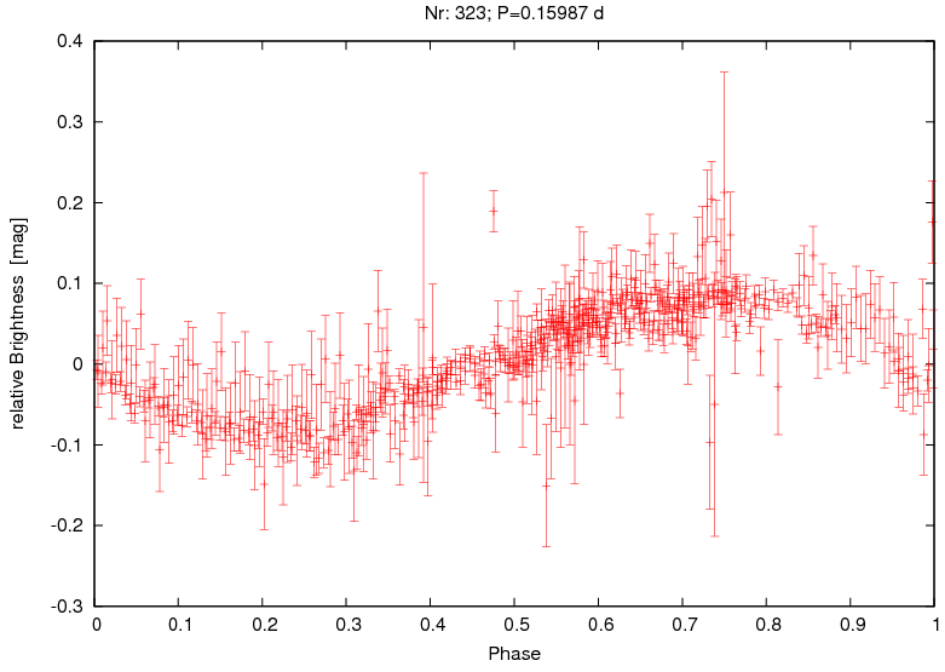


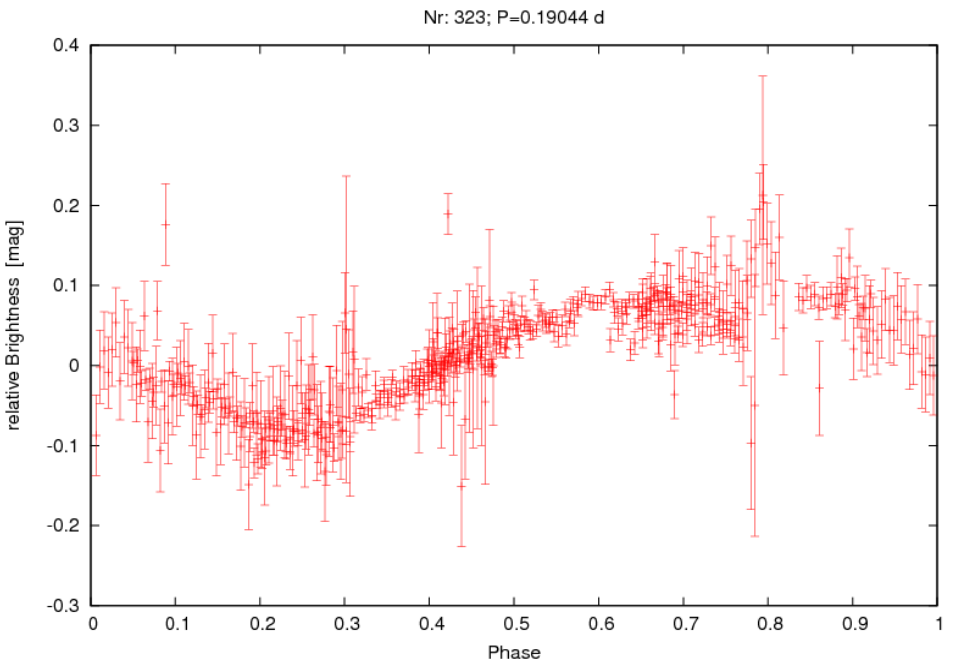


Some variable stars

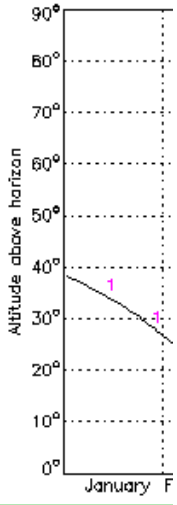


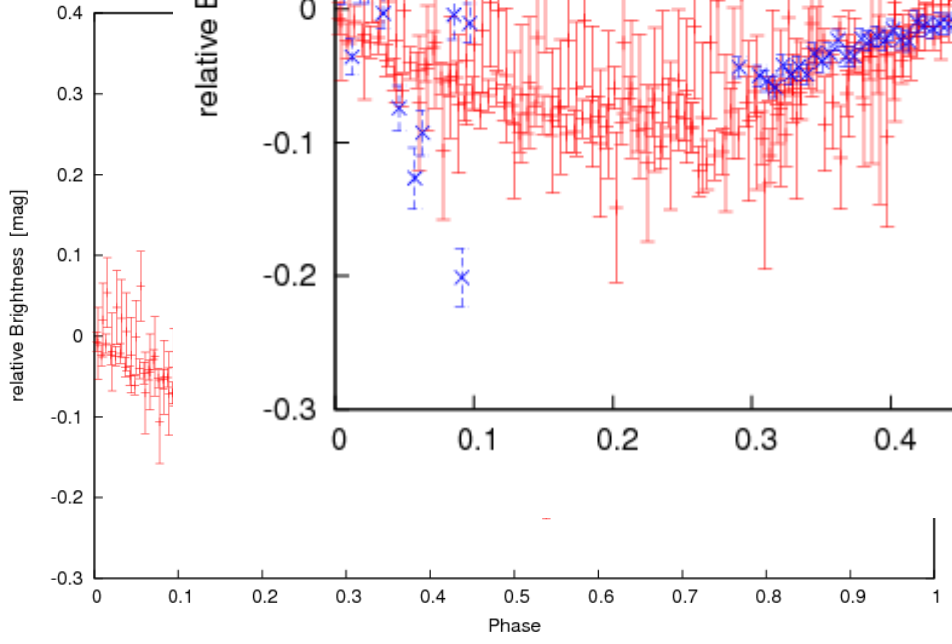




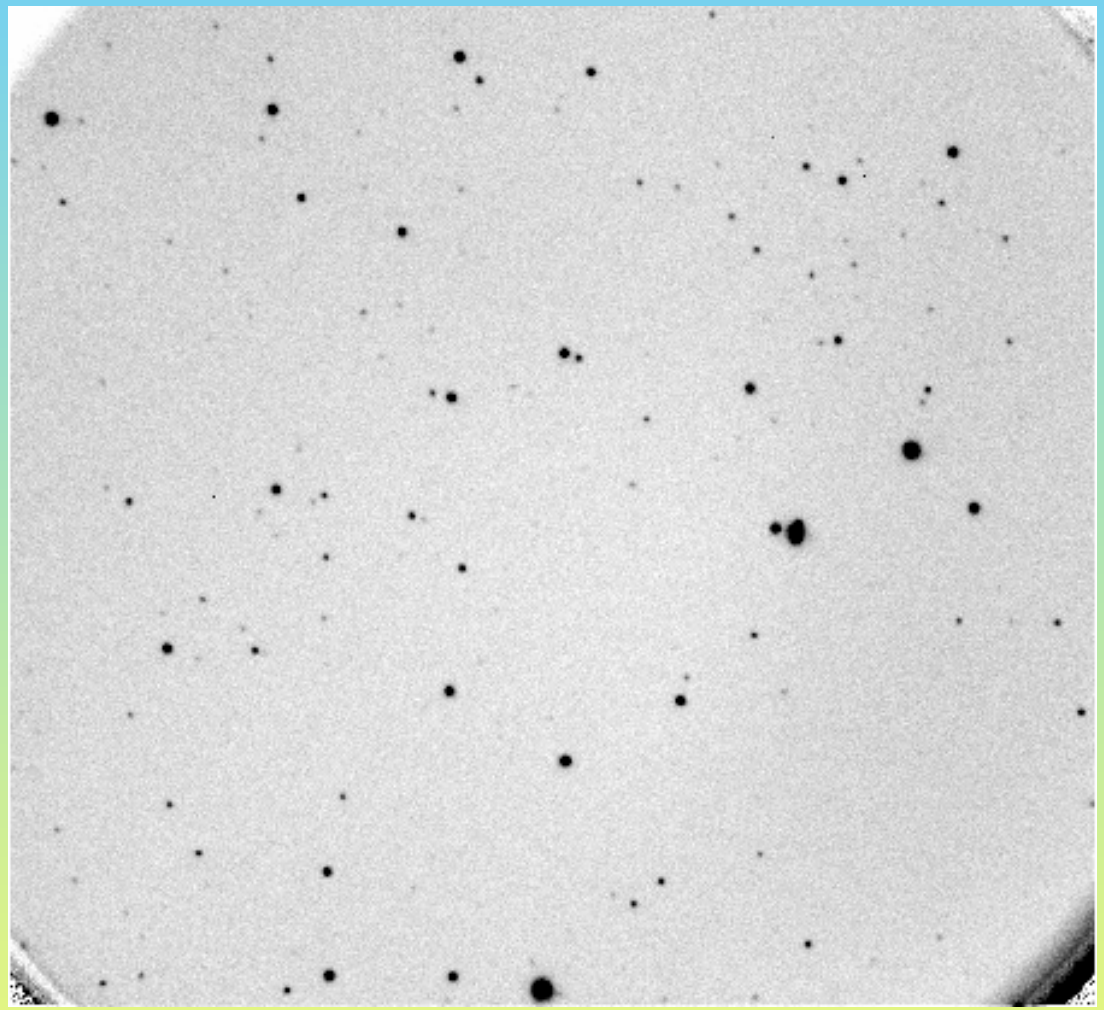


Some variable stars



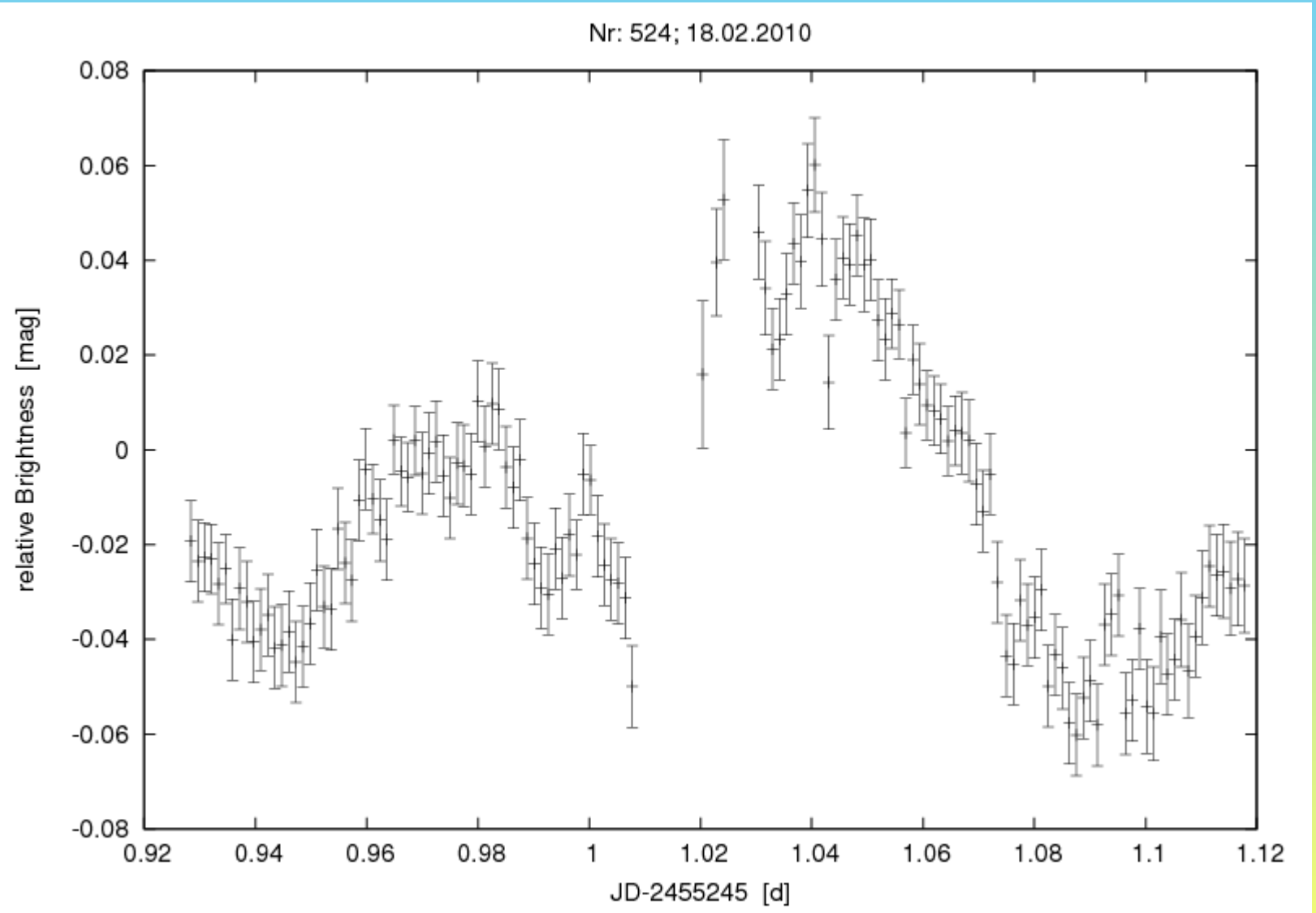


Results from Gunma Observatory

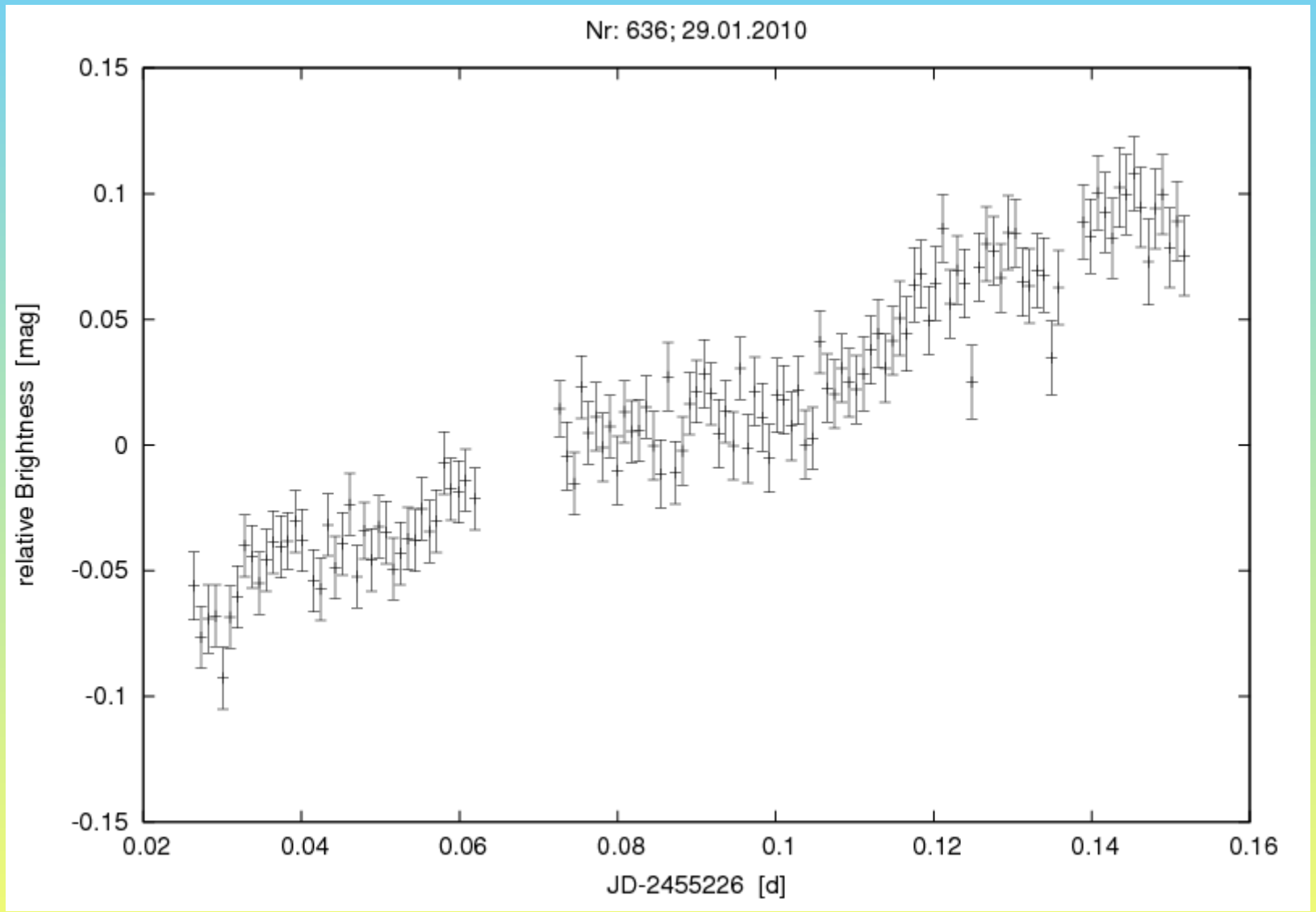


Stars in the FoV: ~ 150

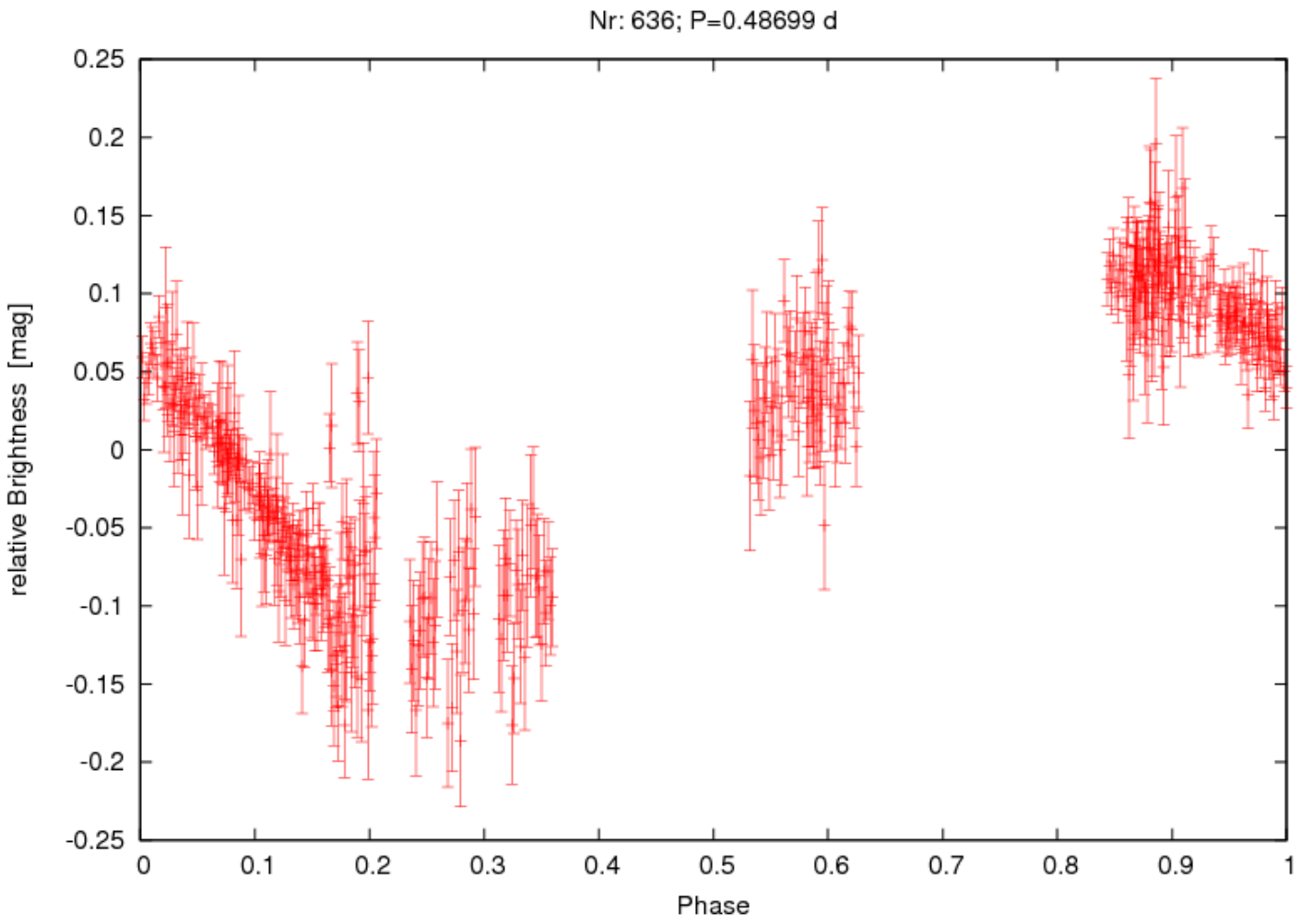
Results from Gunma Observatory



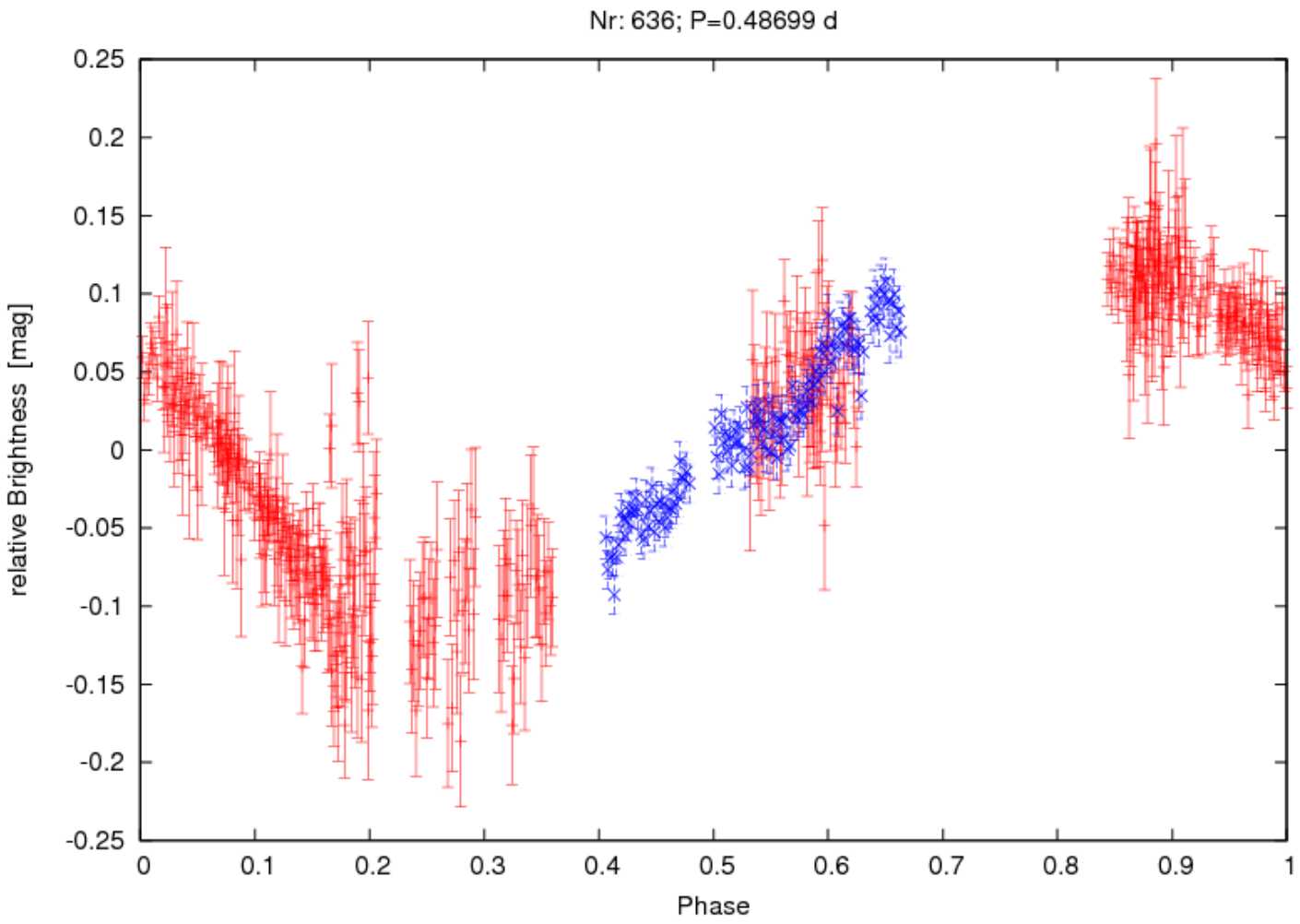
Results from Gunma Observatory



Combined results from the University Observatory Jena and Gunma Observatory



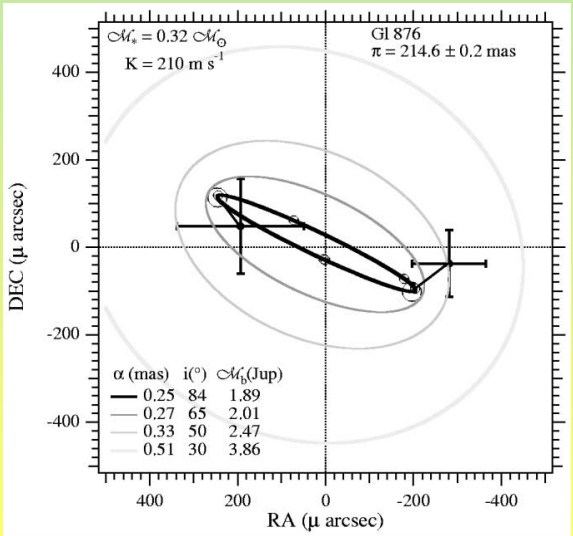
Combined results from the University Observatory Jena and Gunma Observatory



Outlook

- Upcoming worldwide 25 Ori photometry campaigns:
  - 2010 December 10 - 17
  - 2011 January 14 - 24
  - 2011 February 16 – 28

- Astrometry (multi-epoch AO imaging) for intermediate planets and adaptive optics direct imaging (2 epochs) for wide planets:
  - 1st epoch observation: 3 nights with NaCo VLT 2010 December 22-24
  - 2nd epoch observation: one year later




Thank you for your attention !!!