Possibilities for observations of exoplanets in Bulgaria
(… and results up to now)
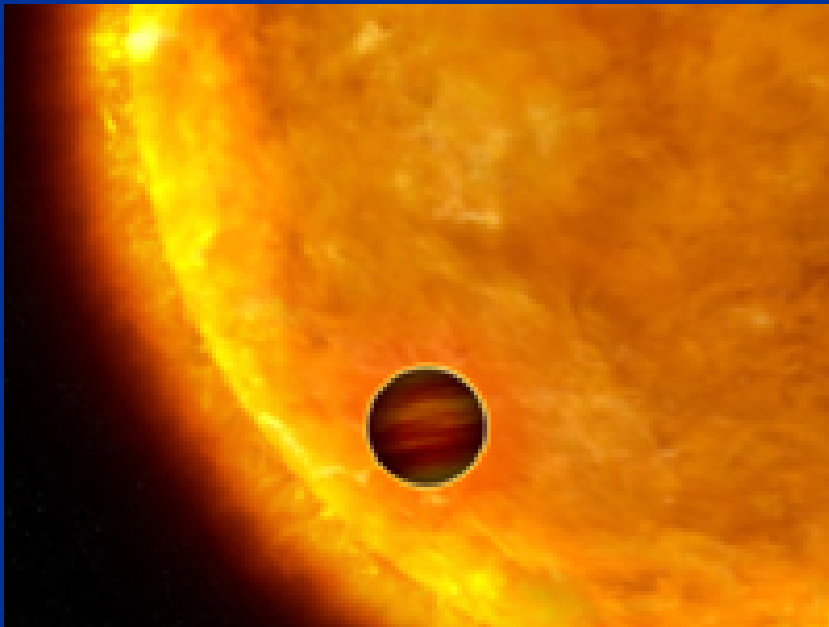
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Jena

Bulgarian National Astronomical Observatory - Rozhen

The Observatory is situated in the Rhodopy Mountains at peak Rozhen.

longitude: 01h 38m 58s
latitude: 41° 41' 48''
Altitude: 1750 m

2m Ritchey Chretien Coude telescope

Optical parameters

- Diameter of the Primary mirror - 2 m
- *System Ritchey-Chretien*:
- Focal lenght - 16 m; Focal ratio - F/8.
- *System Coude*:
- Focal lenght -72 m; Focal ratio - F/36.

CCD cameras

- *CCD-camera VersArray 1300 B*
- 1340 x 1300 pixels, 20 x 20 µm pixel size
- *5.8 x 5.6 arcmin field of view*

- *CCD-camera Photometrics*
  1024 x 1024 pixels, 24 x 24 µm pixel size
- *5.3 x 5.3 arcmin field of view*

Additional equipment

- *Two-channel focal reducer "FoReRo 2"* *Focal ratio - F/5.6*
- *7.6 x 7.6 arcmin field of view*
- *Auto-Guide for the RC-focus of the 2 m RCC-telescope*
- *Coude-spectrograph of the 2-m RCC-telescope*

Filters

- UBVRI, Z, Ha

Appropriate and useful for observations of transits of exoplanets and precise photometry of faint objects

50/70 cm Schmidt telescope

Optical parameters:

- Diameter of the corrector plate: 50 cm;
- Diameter of the spherical mirror: 70 cm;
- Focal length: 1728 mm;
- Focal ratio: F/3.44.

CCD-camera FLI PL 16803

- 4096 x 4096 pixels, 9 x 9 μm pixel size
- *1.2 x 1.2 ° field of view*

Filters

- UBVRI

Appropriate for wide-field observations

Cassegrain telescope "Zeiss-600"

Optical parameters:

- Diameter of the primary mirror 60 cm;
- Focal length: 750 cm;
- Focal ratio: F/10.7.

CCD-camera FLI PL 9000

- 3056 x 3056 pixels, 12 x 12 µm pixel size
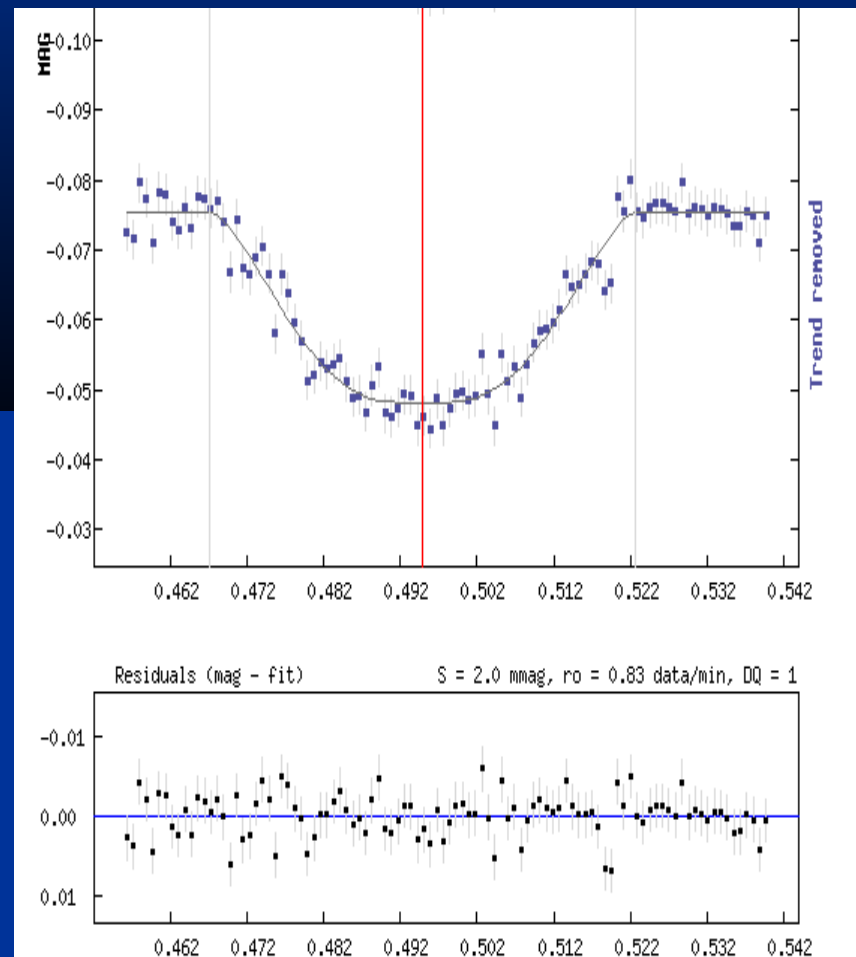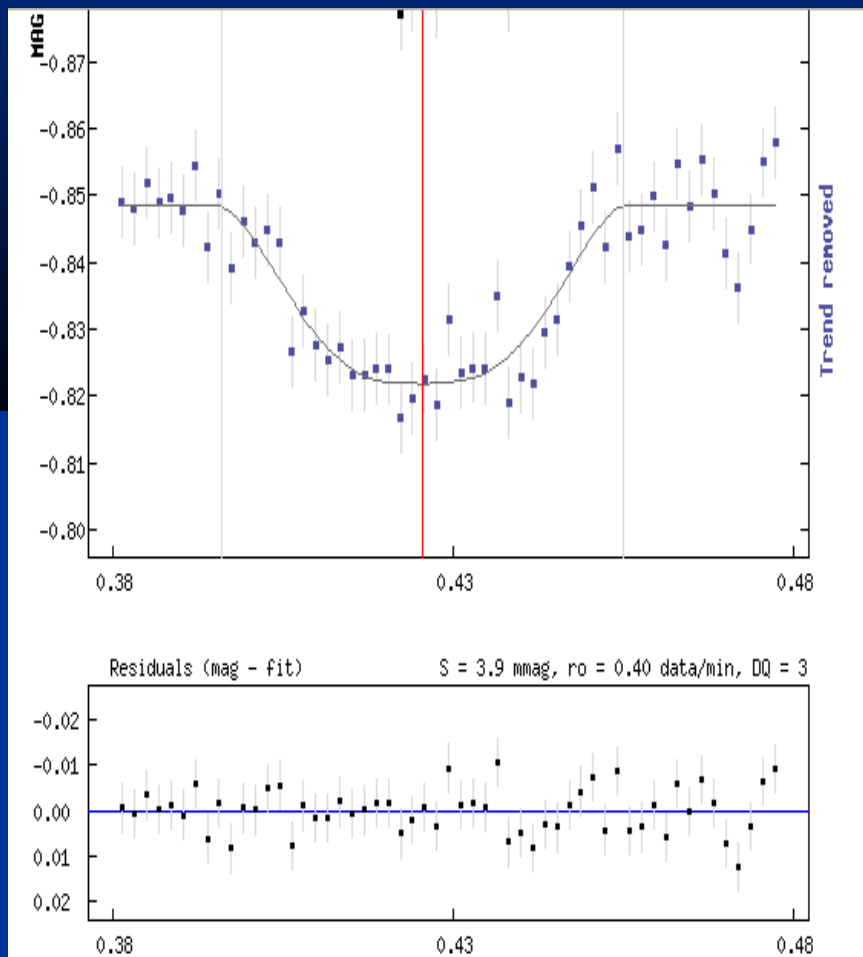- *17.1 x 17.1 arcmin field of view*

Filters

- UBVRI
- additional filter-wheel for Ha, narrow-band filters, etc.

**Appropriate for observations of transits of exoplanets and variable stars**

The first exoplanet TrES-3b observed at NAO-Rozhen

The TrES-3b transit detected in 2007 with 60-cm telescope equipped by CCD camera SBIG STL 11000M …
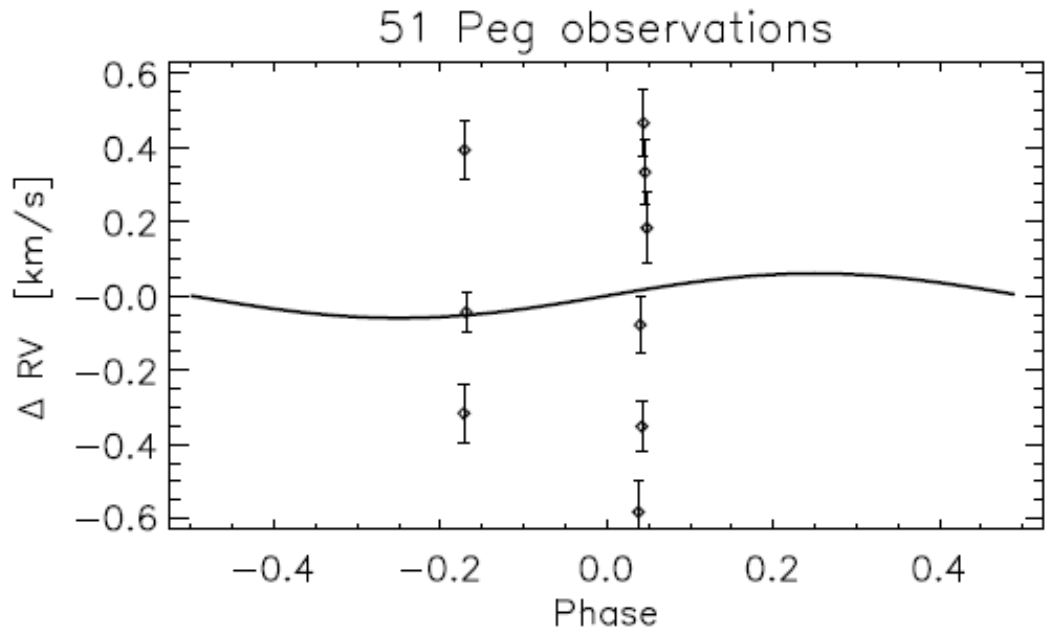
… and the same object 3 year later with the new CCD camera FLI ProLline PL09000.

The first exoplanet XO-2b observed with 2 m telescope at NAO-Rozhen
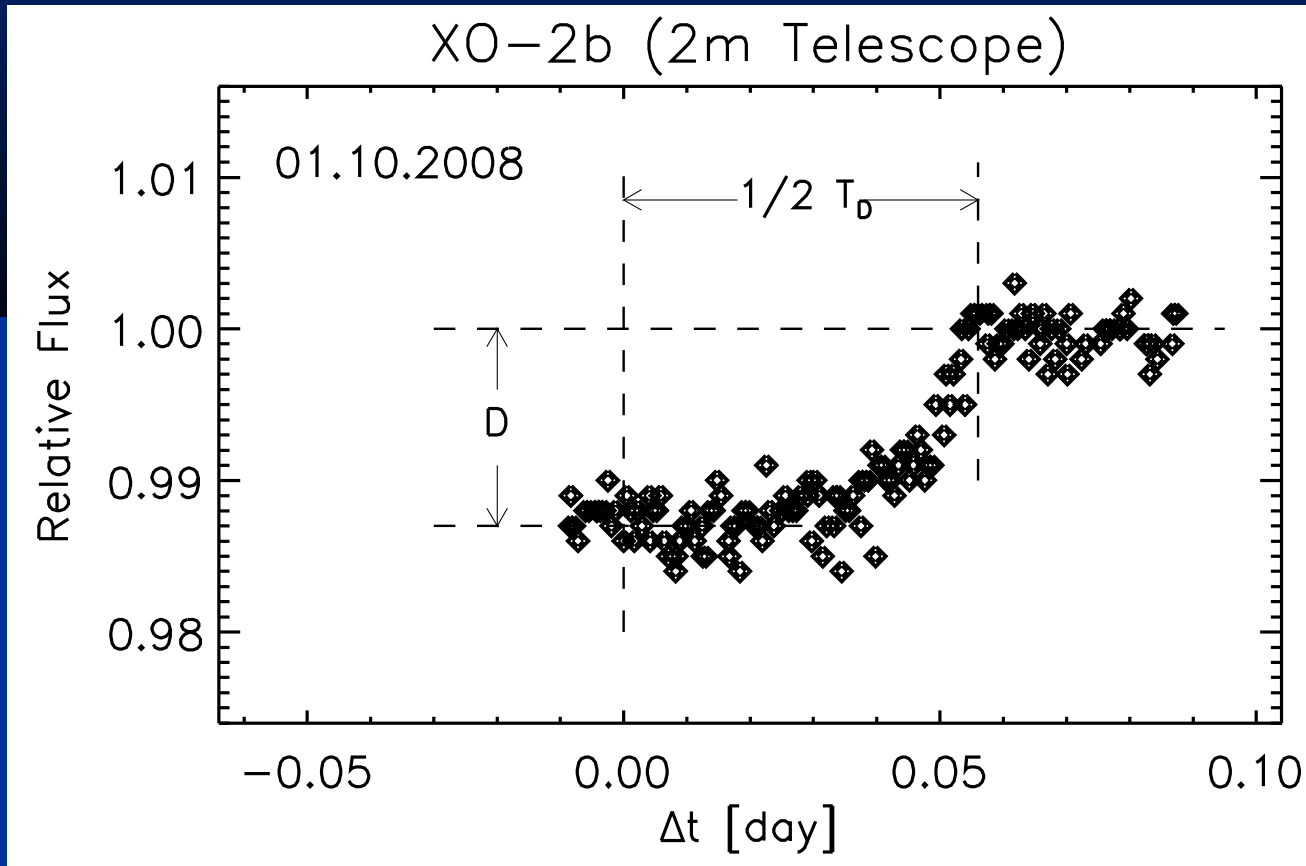
Observations made with CCD camera *VersArray* at the Ritchey-Chretien focus in 2008.

Possibilities for spectral observations of exoplanets by our 2-m telescope

51 Peg observations

The tests for spectral observations of the exoplanet 51 Peg b revealed considerable difference between the expected radial velocities (the sinusoidal line) and those detected by us (the points with error bars).

⇒ **The present Coude spectrograph cannot be used for this aim.**

We need high resolution echelle spectrograph for successful spectral observations of exoplanets.

Summary of observed transits of exoplanets at NAO-Roznen

Exoplanet	Number of transits	Telescope	Projects
TrES-3b	2	60-cm	
XO-2b	1	2-m RCC	
WASP-1b	3	60-cm	TTV
WASP-3b	5	60-cm + 2-m	TTV
WASP-10b	5	60-cm + 2-m	TTV
WASP-12b	7	60-cm + 2-m	TTV
WASP-24b	1	60-cm	

# *Summary of the YETI observations at NAO-Roznen*

	60-cm telescope			Schmidt telescope		
	Number of nights	Number of frames	filters	Number of nights	Number of frames	filters
Pre-Run 1	6	984	I	6	1388	R, I
Run 1	8	2368	R	1	380	R
Pre-Run 2				2	1054	I
Run 2	5	1938	R, I	4	2080	R
Run 3	3	951	I	3	1068	R
After Run 3	1	260	R			
2m telescope	1	235	B			
total	17 + 1	6501+ 235		16	5970	

→ **27 different dates, 11 of them out of the three runs; 12 nights in I filter, above 12000 frames**
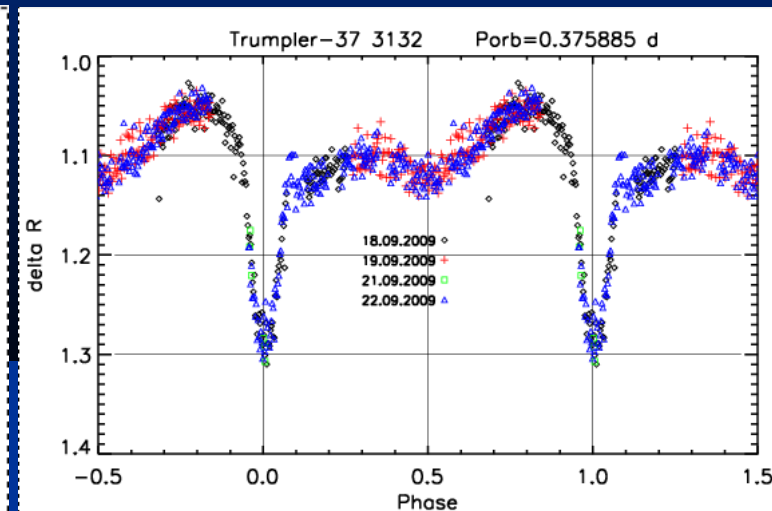
Our favorite Tr-37 3132
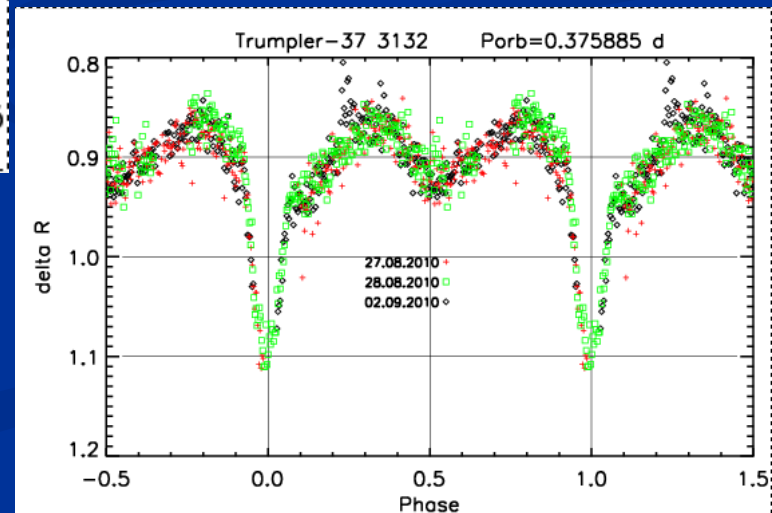
2-m Rozhen, 2010
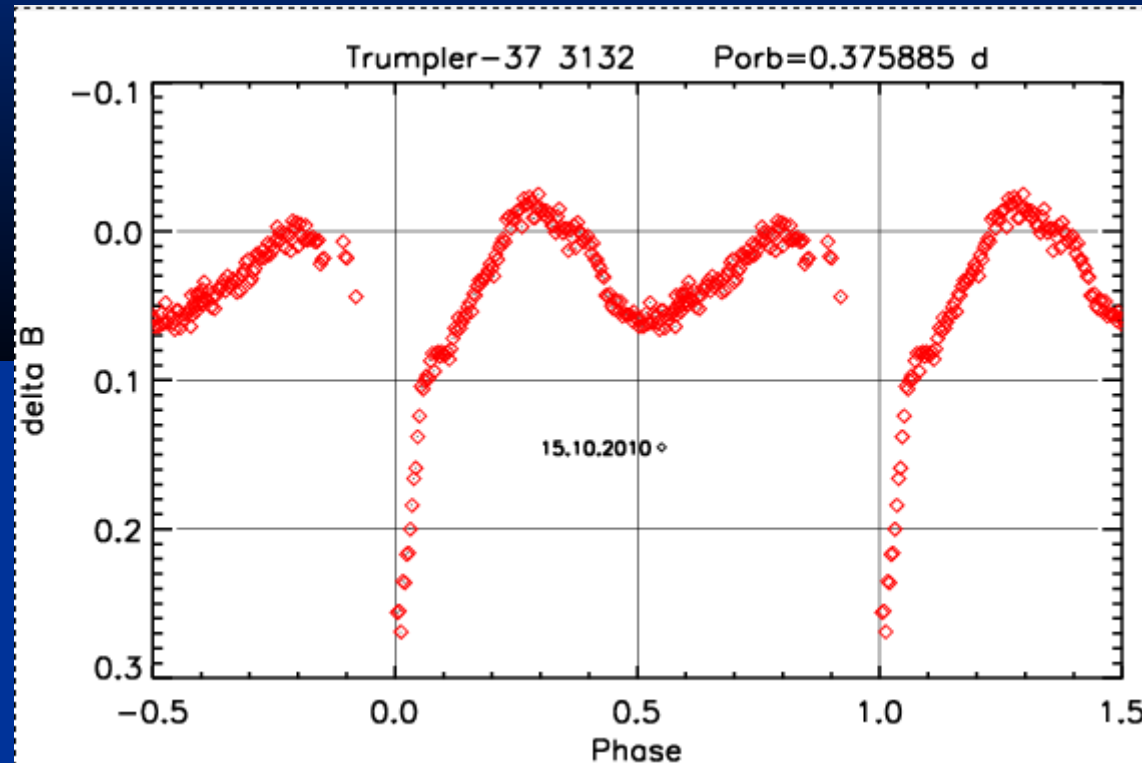
Jena, 2009

60-cm Rozhen, 2010

Peculiarities

• *Variable levels and phases of the light maxima*
• *Broad shallow MinII*
• *Asymmetric MinI*
• *Standstill after MinI*
• *Variable shape of the bottom of MinI*

Our present and future activities

Observations of objects in the framework of the joined projects:

- TTV exoplanets
- some interesting objects from the open cluster Trumpler 37
- Next open clusters in the framework of the YETI project (25 Ori, etc.)
- particular faint YETI objects that are interesting for some partners with our 2-m telescope

  - Inclusion of the 40cm Meade telescope of the Shumen University in the observations of exoplanets.

Our scientific areas out of the exoplanet investigations

- Eclipsing binaries of different types (W UMa, oscillating Algols, RS CVn; M-type binaries)
- Very short period binaries consisting of MS stars
- Brown dwarfs candidates
- Searching for variable stars in certain sky fields observed by us
- Searching for and investigation of newly discovered variable stars from the astronomical data bases (NSVS, etc.)
- Theoretical investigations (modeling of the planet transits)

Acknowledgements

We would like to thank to Dr. Gracian Maciejewski and Prof. Ralph Neuhaeuser for the invitation to work in the framework of joined projects.

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Thank you for your attention!