

EXOPLANETARY
RESEARCH DONE BY
MASARYK UNIVERSITY

ROMAN PONČA
ASTROPHYSICS DIVISION
DEPARTMENT OF THEORETICAL PHYSICS AND ASTROPHYSICS
FACULTY OF SCIENCE
MASARYK UNIVERSITY



WHO?



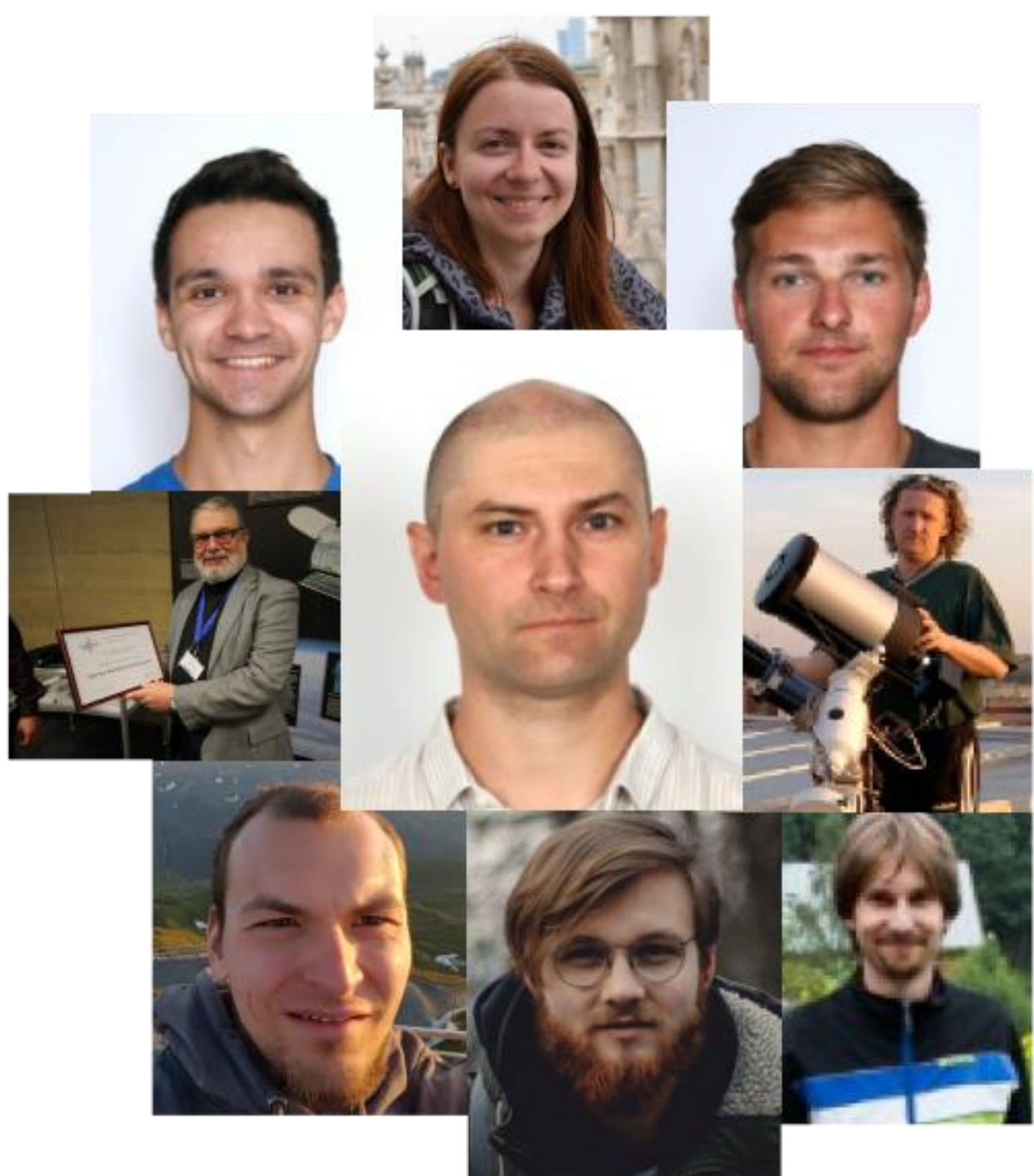
WHERE?



HOW?

PES GROUP

- PULSATING EXOPLANETARY GROUP
- GOALS :
 - RR LYRAE STARS
 - OTHER INTERESTING (MAINLY PULSATING) STARS
 - EXOPLANETS

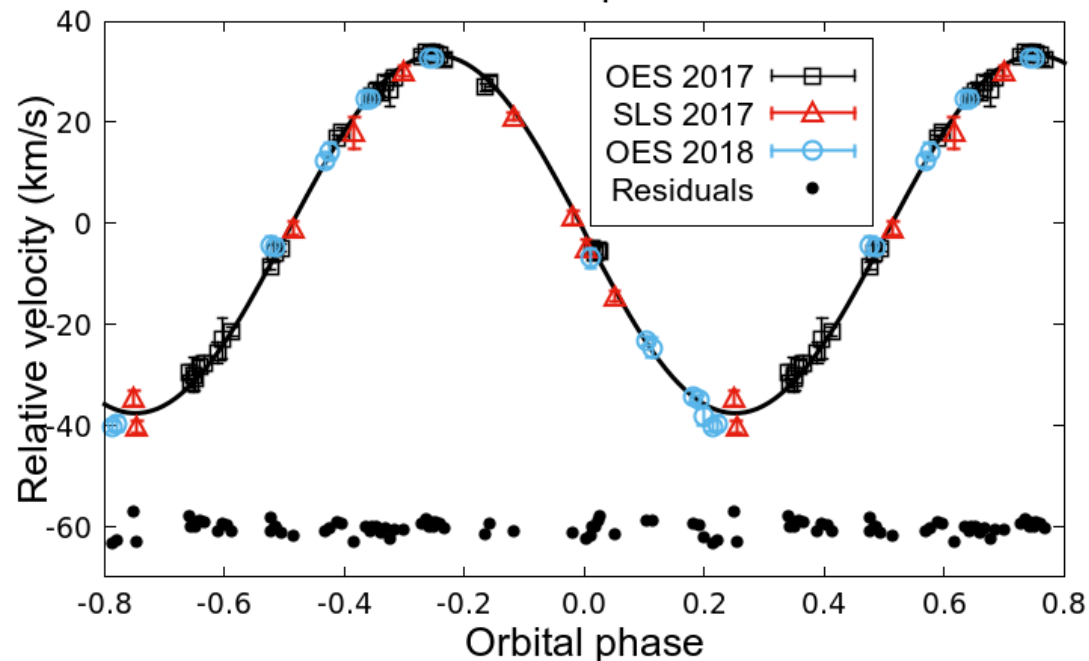
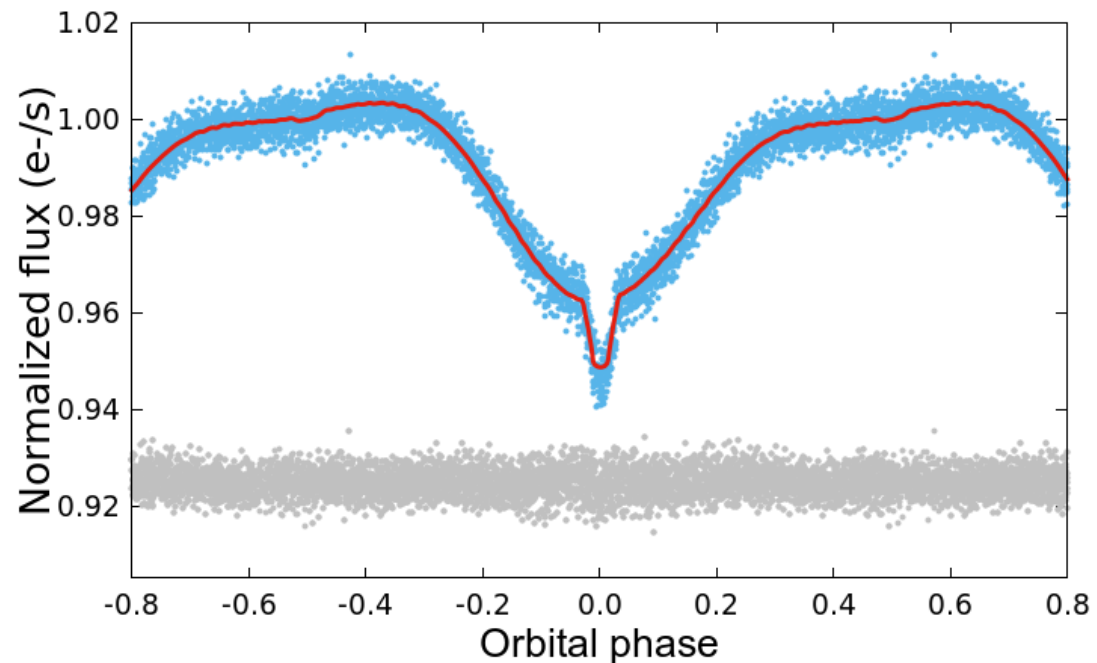


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	DESIGNATION	RA	DEC	PERIOD	HJDOP	HJDOS	MAX	MIN/AMP	TYPE	OBS	<i>dur. rise</i>	<i>constell.</i>	<i>RA_sort</i>	<i>DE_sort</i>	<i>GEOS checked</i>	<i>obs. priority</i>	<i>filtr</i>	<i>kind of obs</i>	NOTEEK	Type
2	XZ Dra	19:09:42.61	+64:51:32.11	0.476497	2441928.2558	2441928.1605	9.59	10.65	RRAB/BL			0.2	Dra	19	+64	ok	1	BVRI	BVRI, as often as possible	Binary candidate, LITE, RV + Blazhko effect, TESS primary target
3	RV CrB	16:19:25.85	+29:42:47.59	0.33168533	2450210.3851	2450210.2657	11.14	11.7	RRC			0.36	CrB	16	+29	ok	1	BVI	BVI, as often as possible	Binary candidate, LITE; Additional pulsation modes, interesting period variations
4	VW CVn	13:29:42.22	+28:52:49.29	0.42499879	2449466.2073	0.0000	11.96	12.43	RRC				CVn	13	+28	ok	1	BVI	BVI, as often as possible	Additional pulsation modes, interesting period variations
5	DD Dra	18:44:04.61	+60:46:12.79	0.32675	2447304.3148	0.0000	11.2	12	RRC				Dra	18	+60	ok	1	BVI	BVI, as often as possible	Additional pulsation modes, interesting period variations
6	TV Lyn	07:33:31.73	+47:48:09.79	0.24065119	2440950.7073	2440950.6062	11.24	11.66	RRC			0.42	Lyn	07	+47	ok	1	BVI	BVI, as often as possible	Additional pulsation modes
7	RU Psc	01:14:26.04	+24:24:56.41	0.390385	2440143.4027	2440143.2153	9.93	10.4	RRC			0.48	Psc	01	+24	ok	1	BVI	BVI, as often as possible	Additional pulsation modes, interesting period variations
8	SX UMa	13:26:13.46	+56:15:25.09	0.3071178	2445109.3413	2445109.2246	9.15	11.21	RRC			0.38	UMa	13	+56	ok	1	BVI	BVI, as often as possible	Additional pulsation modes, interesting period variations
9	RZ Cep	22:39:13.18	+64:51:30.6	3.087022037	2442632.8741	2442631.8863	9.15	9.72	RRC/BL			0.32	Cep	22	+64	ok	1	BVI	BVI, as often as possible	Additional pulsation modes, interesting period variations
10	XZ Cyg	19:32:29.31	+56:23:17.48	0.46659299	2444124.0597	0.0000	8.9	10.16	RRAB/BL				Cyg	19	+56	ok	1	BVRI	BVRI, as often as possible	Binary candidate, PM, Blazhko effect, TESS primary target
11	HY Com	12:18:16.02	+16:09:15.91	0.4485981	2453826.6810	0.0000	10.25	10.73	RRC				Com	12	+16	ok	1	BVI	BVI, as often as possible	Binary candidate, PM, Additional pulsation modes, interesting period variations
12	DH Peg	22:15:25.64	+06:49:21.39	0.235514	2444463.4340	2444463.3343	9.15	9.8	RRC			0.39	Peg	22	+06	ok	1	BVI	BVI, as often as possible	Additional pulsation modes
13	RW Ari	02:16:03.72	+17:31:58.9	0.35429	2451139.2420				RRC				Ari	02	+17		2	BVI	BVI, as often as possible	Binary candidate, LITE, ED, Additional pulsation modes
14	CQ Boo	14:54:04.85	+15:37:46.81	0.28187436	2450948.3856	2450948.2729	11.65	12.25	RRC			0.4	Boo	14	+15	ok	2	BVI	BVI, as often as possible	Additional pulsation modes
15	UY Cam	07:58:58.88	+72:47:15.39	0.26704234	2435565.1464	2435565.0262	11.33	11.66	RRC			0.45	Cam	07	+72	ok	2	BVI	BVI, as often as possible	Binary candidate, LITE, Additional pulsation modes
16	CI Com	12:14:11.19	+14:01:49.1	0.3600848	2450925.5525		13.6	14	RRC				Com	12	+14		2	VR	VR, full phase + maximum times	Binary candidate, Extreme period variation
17	BH Peg	22:53:01.04	+15:47:16.58	0.640993	2439365.2800	2439365.1518	9.99	10.79	RRAB/BL			0.2	Peg	22	+15	ok	2	BVRI	BVRI, as often as possible	Binary candidate, LITE, Blazhko effect, TESS primary target; BG Peg in the FOV
18	XX And	01:17:27.41	+38:57:02.0	0.722757	2453662.5750	2453662.4232	10.08	11.13	RRAb			0.21	And	01	+38	ok	2	BVRI	BVRI phase and maximum times	Binary candidate, LITE, PM
19	RS Boo	14:33:33.21	+31:45:16.59	0.37733838	2454189.4705	2454189.4064	9.63	10.88	RRAb			0.17	Boo	14	+31	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE, PM
20	TW Boo	14:45:05.94	+41:01:44.11	0.53226755	2456838.4737	2456838.4045	10.63	11.68	RRAb			0.13	Boo	14	+41	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, PM
21	AH Cam	04:06:38.89	+55:29:59.71	0.3687146	2454079.4856	2454079.4082	11.31	12.33	RRAB/BL			0.21	Cam	04	+55	ok	3	BVRI	BVRI, as often as possible	
22	EW Cam	07:27:27.99	+72:42:12.49	0.628408	2448500.5480	0.0000	9.33	9.83	RRAb				Cam	07	+72	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, PM
23	RW Cnc	09:19:06.04	+29:03:55.69	0.547199	2439556.3140	2439556.2429	10.7	12.6	RRAb			0.13	Cnc	09	+29	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE
24	S Com	12:32:45.63	+27:01:45.40	0.586589	2453796.5250	2453796.4429	10.89	12.13	RRAb			0.14	Com	12	+27	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE
25	RU CVn	13:59:33.28	+31:39:04.28	0.57325382	2455343.4970	0.0000	11.36	12.48	RRAb				CVn	13	+31	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE
26	SU Dra	11:37:56.51	+67:19:45.99	0.66042414	2454928.4720	2454928.3729	9.18	10.27	RRAb			0.15	Dra	11	+67	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE
27	BK Dra	19:18:20.67	+66:24:47.98	0.5920792	2455006.4381	2455006.3671	10.59	11.87	RRAb			0.12	Dra	19	+66	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE, RV
28	VX Her	16:30:40.73	+18:22:00.15	0.4553593	2454985.4380	2454985.3742	9.89	11.21	RRAb			0.14	Her	16	+18	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE, ED, PM
29	TW Her	17:54:31.20	+30:24:37.69	0.39959932	2455420.5206	0.0000	10.52	11.83	RRAb				Her	17	+30	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, PM
30	VZ Her	17:13:04.00	+35:58:42.99	0.44032789	2436788.8980	2436788.8408	10.72	12.04	RRAb			0.13	Her	17	+35	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, PM
31	RR Leo	10:07:43.38	+23:59:30.22	0.4523933	2443295.4020	2443295.3432	9.94	11.27	RRAb			0.13	Leo	10	+23	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, LITE, PM
32	TT Lyn	09:03:07.79	+44:35:08.1	0.59743124	2455203.4462	2455203.3446	9.42	10.21	RRAb			0.17	Lyn	09	+44	ok	3	BVRI	BVRI full phase, maximum times	Binary candidate, LITE
33	CN Lyr	18:41:15.95	+28:43:21.10	0.41138314	2454269.4350	2454269.3445	11.07	11.76	RRAb			0.22	Lyr	18	+28	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, RV, PM
34	AV Peg	21:52:02.79	+22:34:29.30	0.3903747	2443790.3160	2443790.2496	9.88	10.92	RRAb			0.17	Peg	21	+22	ok	3	BVRI	BVRI full phase +maximum times	Binary candidate, LITE, PM
35	AR Per	04:17:17.20	+47:24:00.61	0.4255072	2454743.6057	2454743.5376	9.92	10.83	RRAb			0.16	Per	04	+47	ok	3	BVRI	BVRI, as often as possible	
36	TU UMa	11:29:48.49	+30:04:02.38	0.55765759	2438275.9750	2438275.8858	9.26	10.24	RRAb			0.16	UMa	11	+30	ok	3	BVRI	BVRI full phase + maximum times	Binary candidate, LITE, PM, RV

	A	B	C	D	E	F	G	H	I
1	ATT: cell colors: green - good lo yellow - info lo red - bad lo or techn problems use 'note' not 'comments'		MUO NWT 0.62m f/4 G2-16000 UBVRlbyv	HaP NWT 0.62m f/4 MI G2-4000 BVRI-C	VYS NWT 0.5m f/4 MI G2-4000 UBVRI-C, Ha, OIII, SII	SMO NWT 0.2m f/4.0 MI G2-1600 UBVRl-C	TRO NWT 0.3m f/3.85 MI G2-1600 BVRI-C	ZNO NWT 0.2m f/4.0 MI G2-402 BVRI-C	ZHE NWT 0.2m f/5.2 MI G2-402 BVRI-C
126	Tue	03-19-19							
127	Wed	03-20-19				TV Lyn			
128	Thu	03-21-19				TV Lyn TW Boo			
129	Fri	03-22-19				TV Lyn			
130	Sat	03-23-19				TV Lyn TW Boo			
147	Tue	04-09-19				TV Lyn			
148	Wed	04-10-19							
152	Sun	04-14-19							
153	Mon	04-15-19				TV Lyn			
154	Tue	04-16-19			RV CrB	XZ Dra			
155	Wed	04-17-19	TV Lyn + RV CrB			SX UMa			
156	Thu	04-18-19	TV Lyn + RV CrB	DD Dra		SX UMa			XZ Dra
157	Fri	04-19-19				SX UMa			XZ Cyg
158	Sat	04-20-19	TV Lyn+RV CrB			SX UMa			
159	Sun	04-21-19	RV CrB			SX UMa		RZ Cep	XZ Cyg
160	Mon	04-22-19	TV Lyn + SX UMa			SX UMa			HY Com
161	Tue	04-23-19							
162	Wed	04-24-19						HY Com	

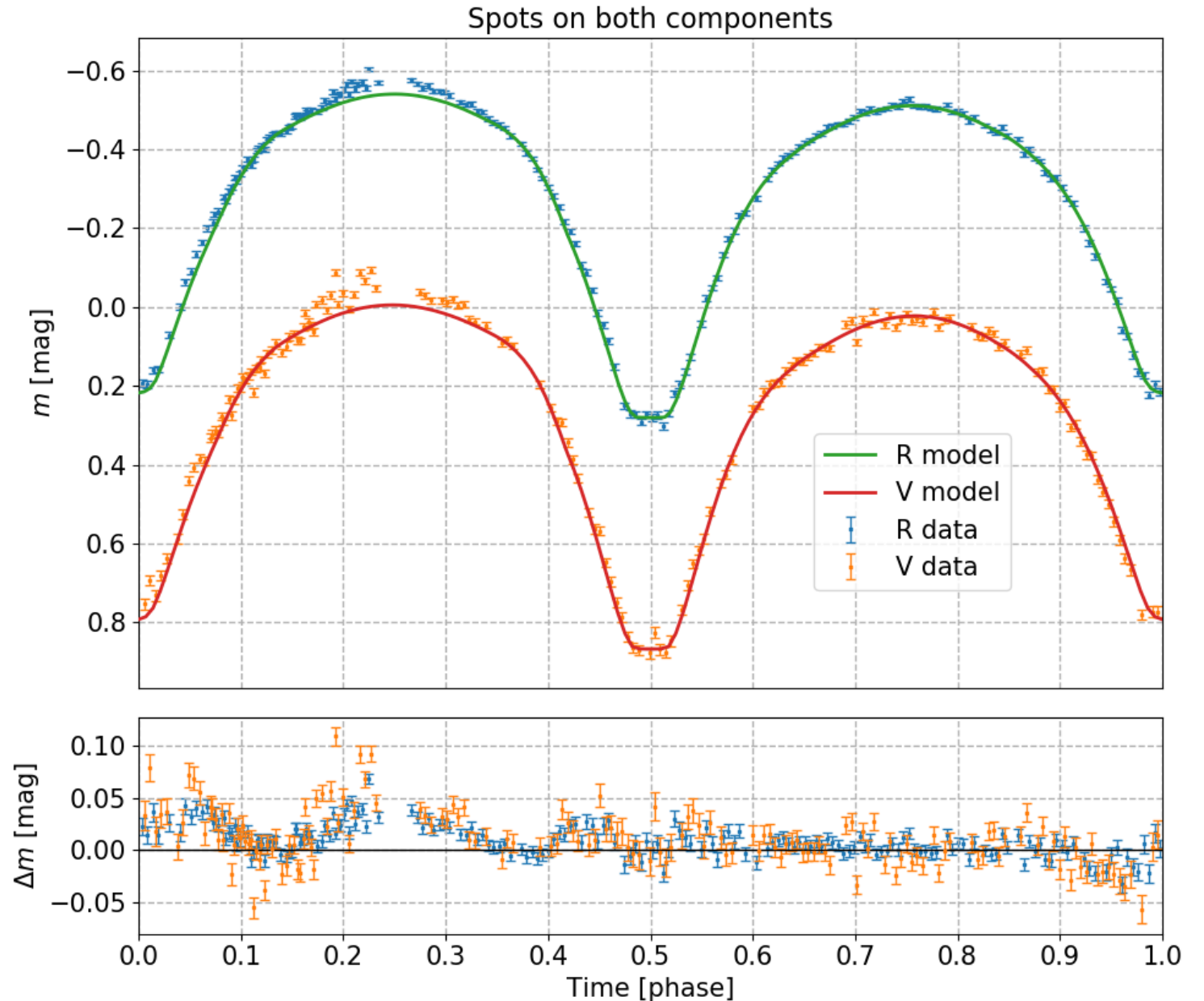
K2 MISSION

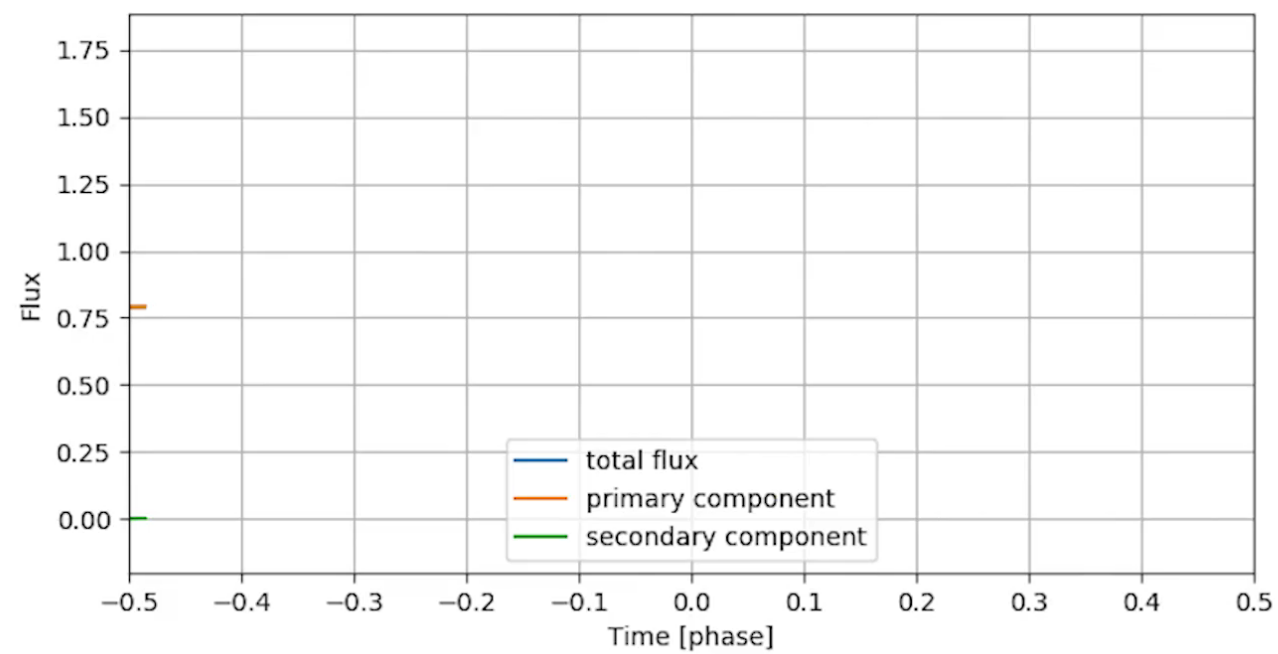
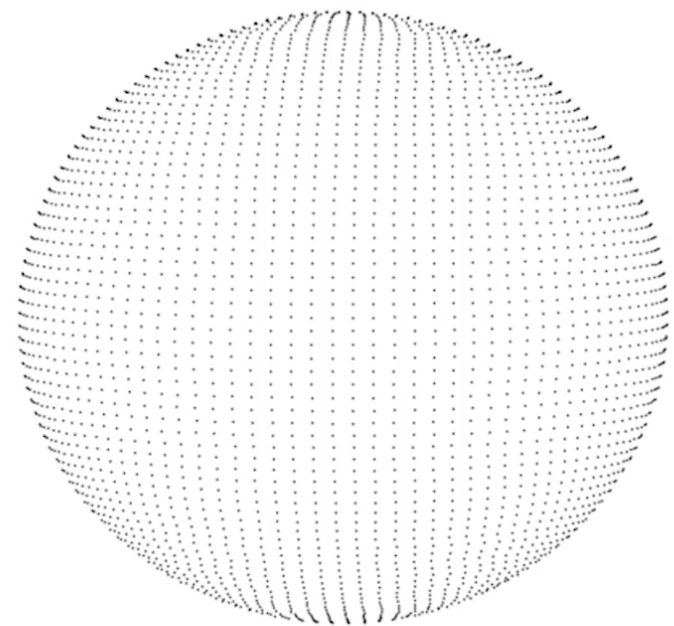
- FIRST THOUGHTS:
EXOPLANET
- SPECTROSCOPY: BINARY
STAR
- CP STAR IN BINARY WITH
PERIOD UNDER 3 DAYS
- DELTA SCT PULSATION



BM UMA

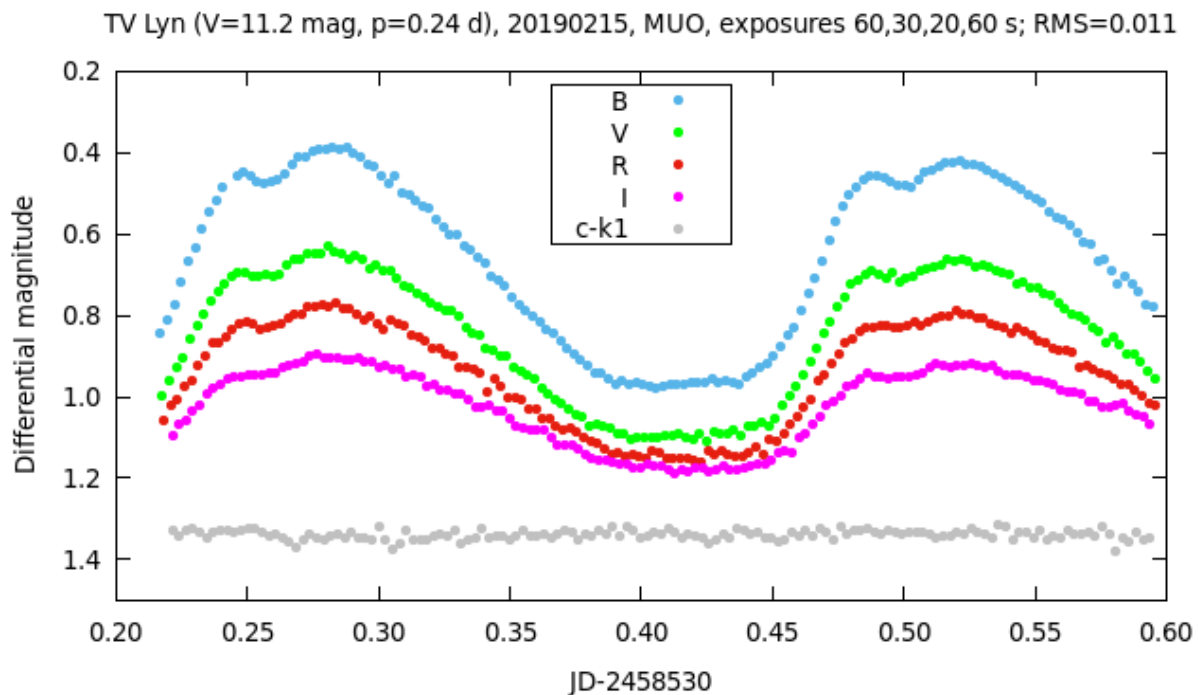
- CONTACT BINARY STAR
- MASS RATIO: 0.53
- TEMP DIFFERENCE: 220K
- SPECTRAL CLASS: K
- NEGATIVE O'CONNELL EFFECT





TV LYN

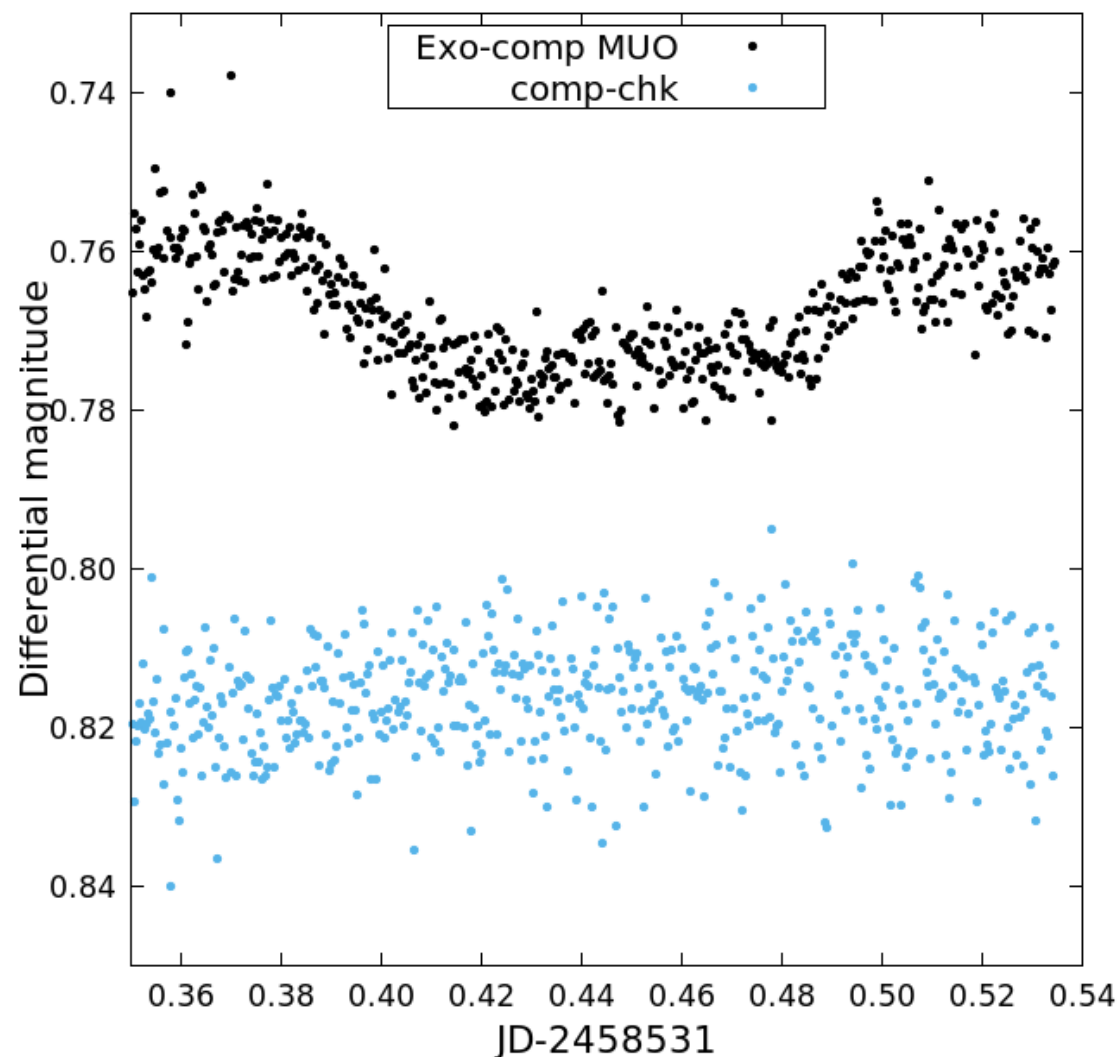
- MULTICOLOR PHOTOMETRY OF RR LYRAE STARS
- CHECKING LIGHT CURVE STABILITY
- TRYING TO FIND RR LYRAE BINARY



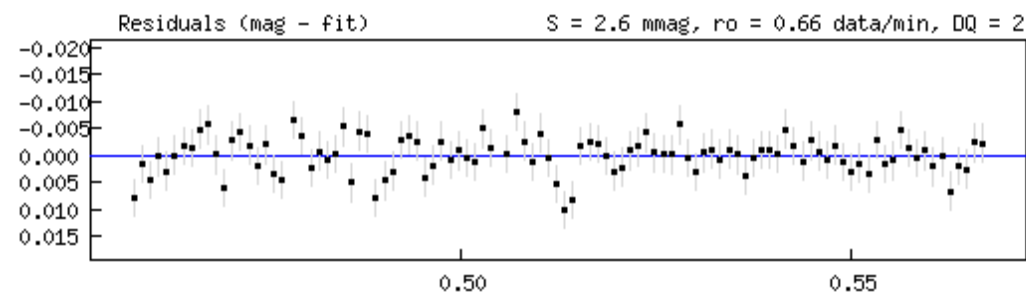
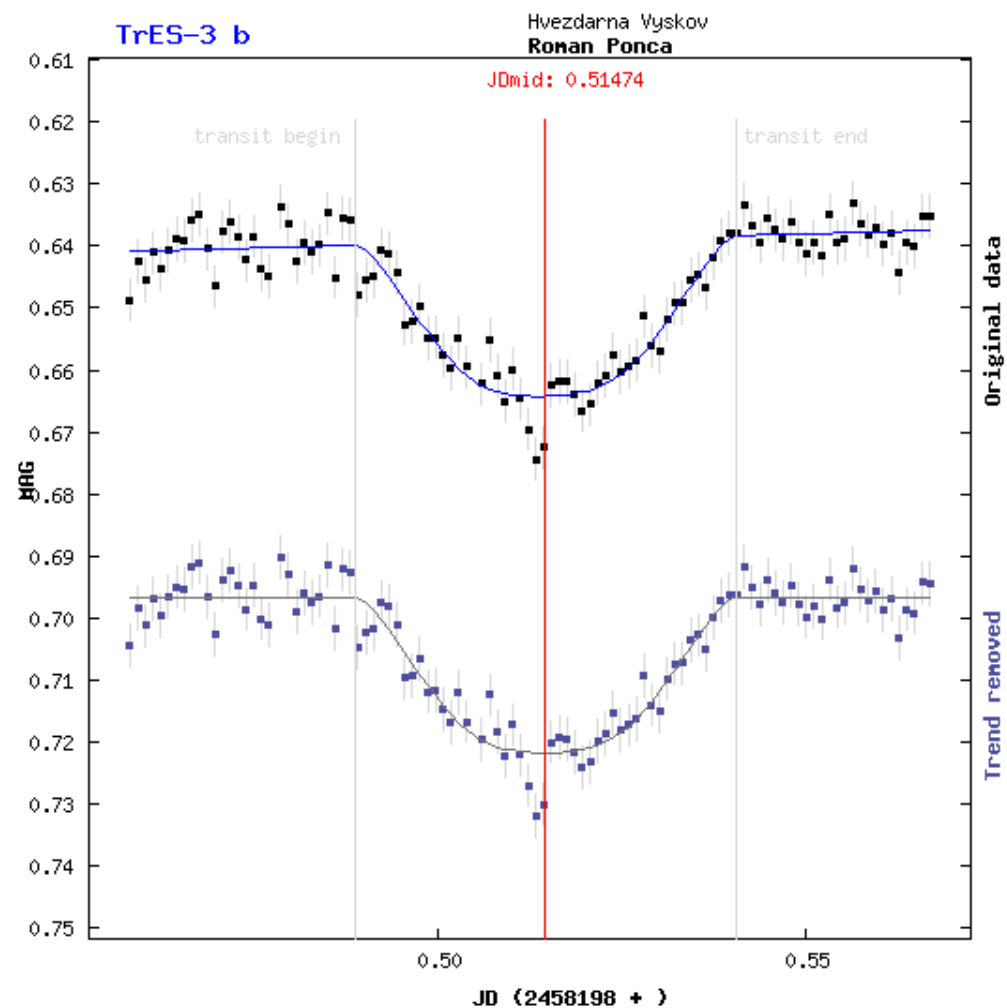
XO-6B

- DATA FROM OUR MAIN OBSERVATORY
- 60CM TELESCOPE
- DISPERSION 0.007 MAG

XO-6b (V=10.25 mag), 60cm Newtonian, R, exp 20 s, RMS=0.007 mag



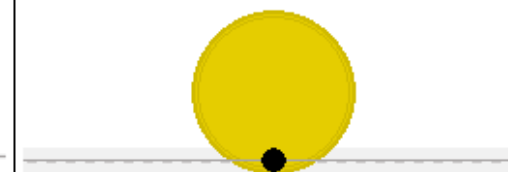
TRES 3B

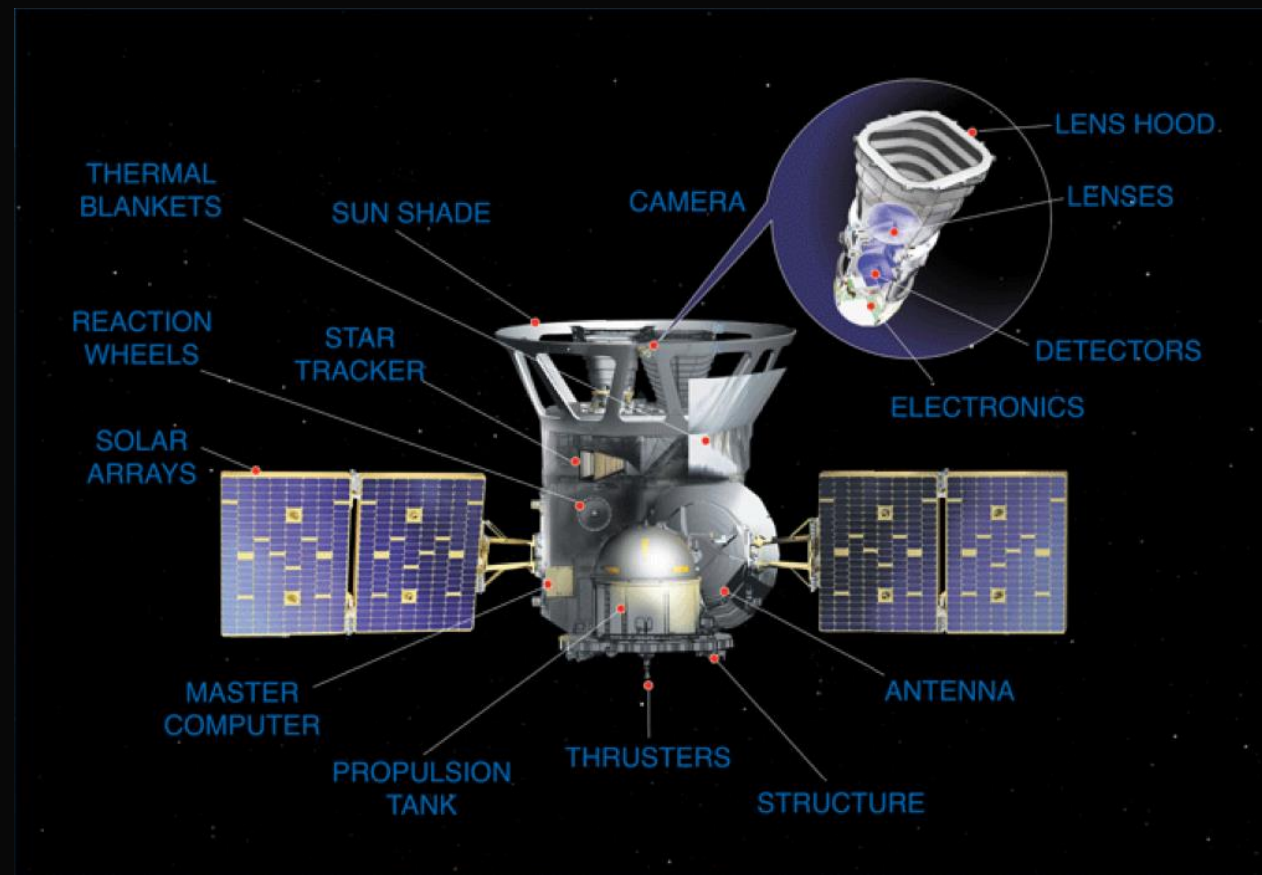


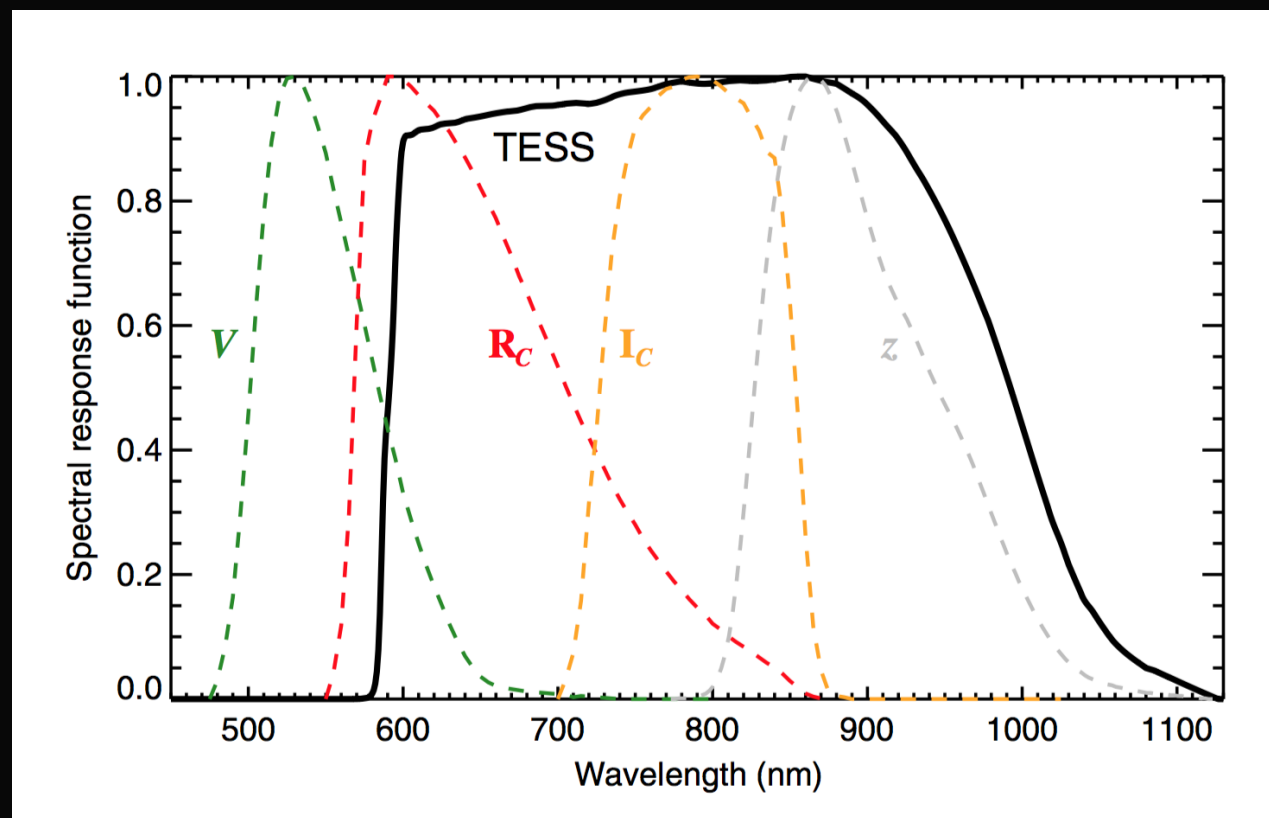
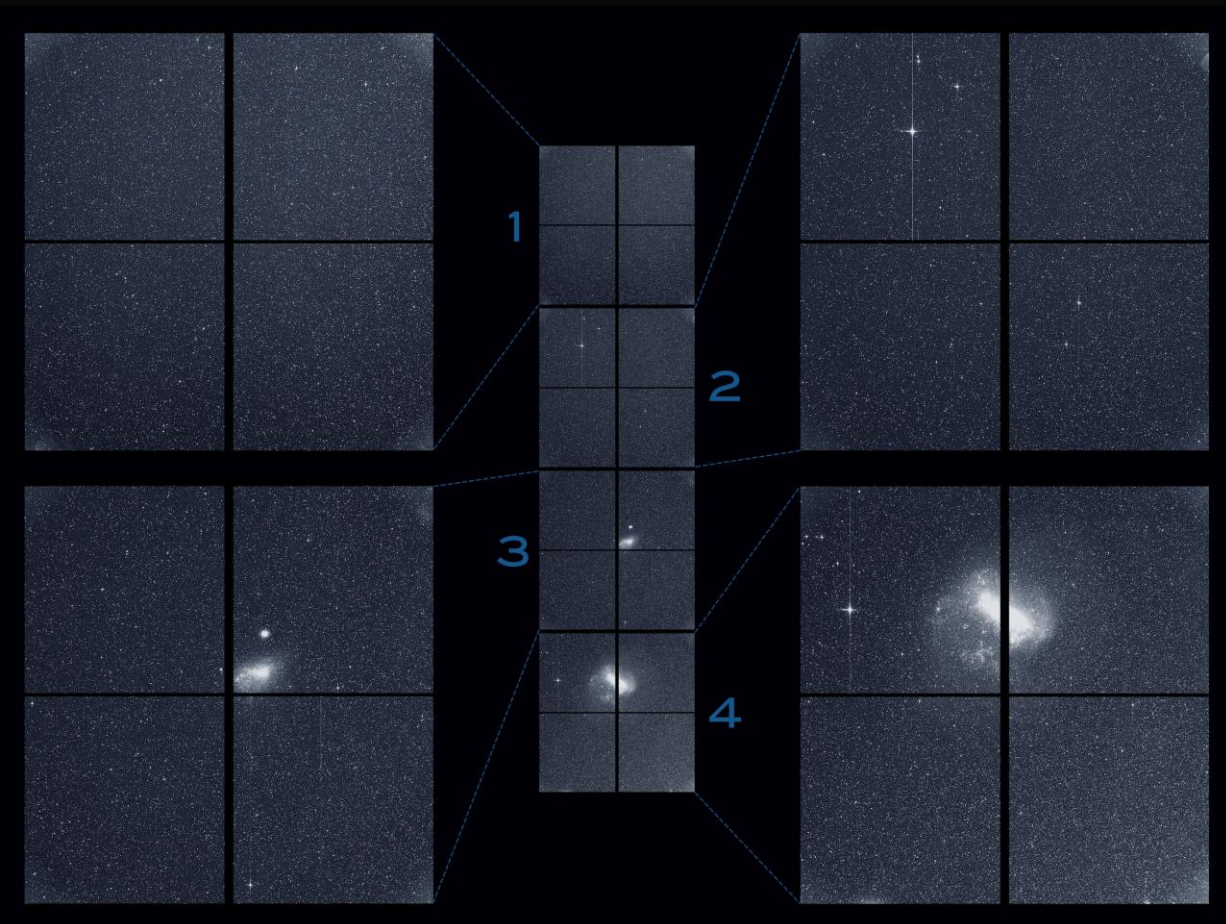
Catalogue geometry



Measured geometry









WHO?



WHERE?



HOW?

INSTRUMENTS

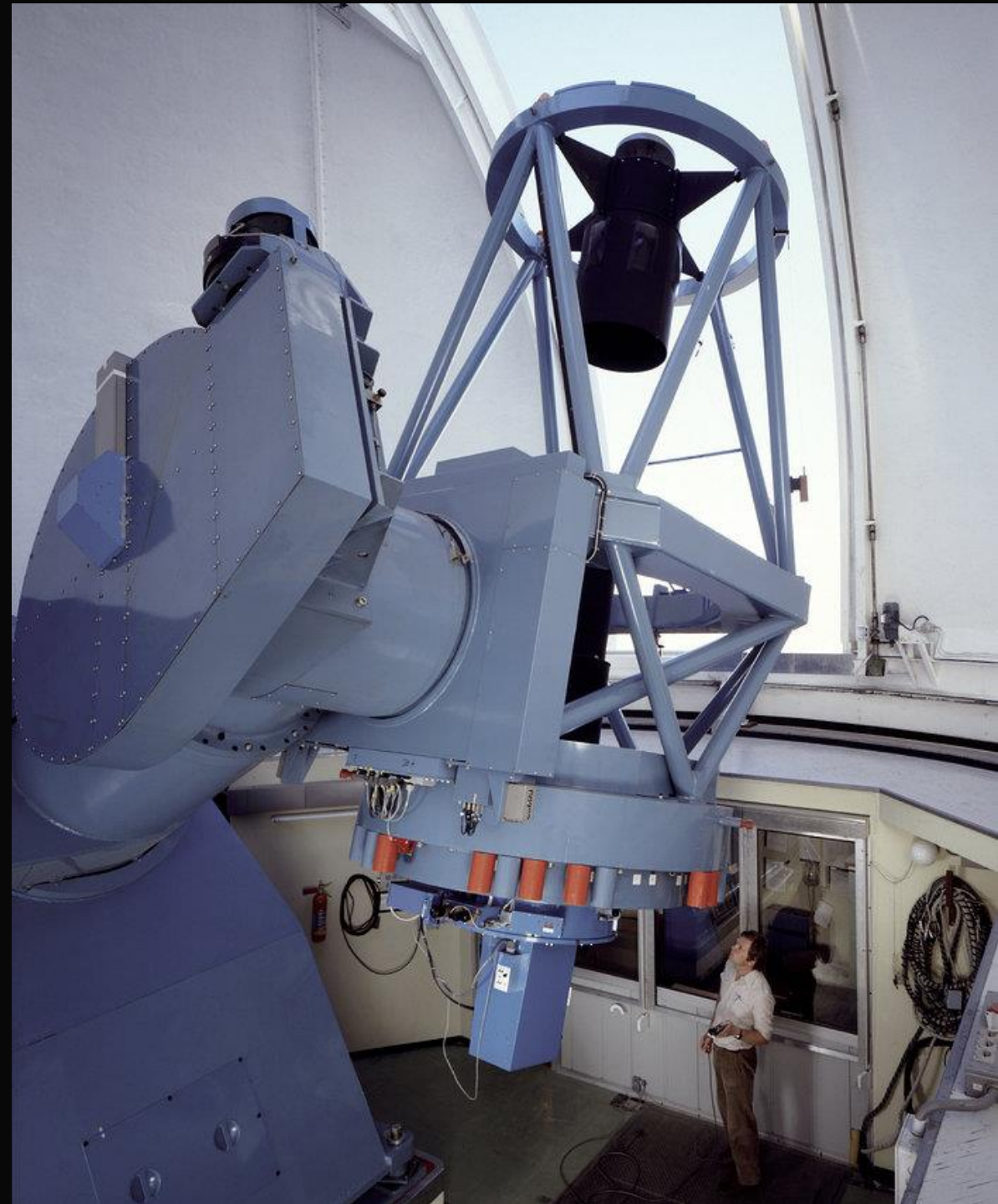
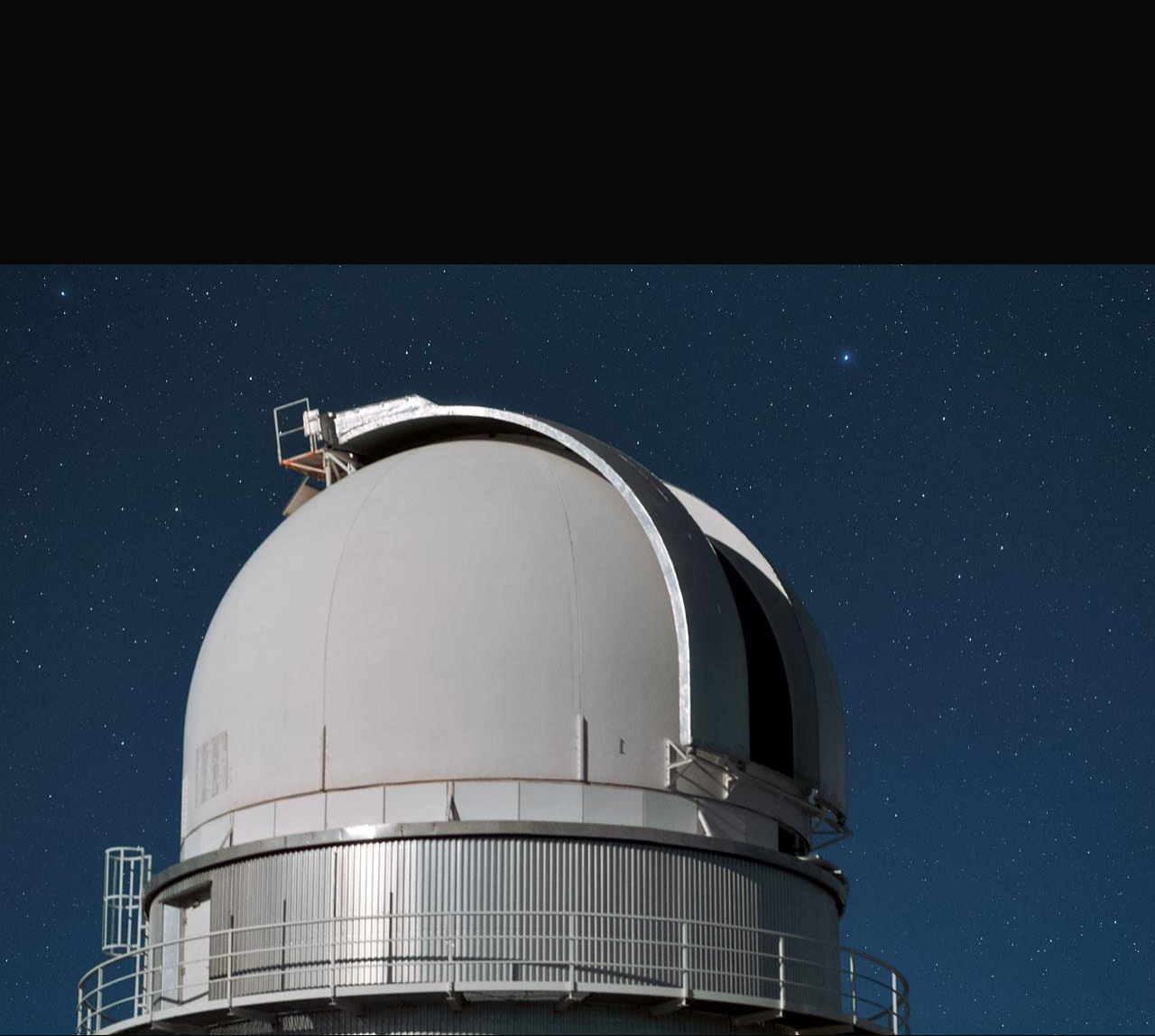
- MASARYK UNIVERSITY OBSERVATORY
 - NWT 0.6M F/4 - MI G4-16000
 - SC 0.35M F/10 - MI G2-4000
- VYŠKOV OBSERVATORY
 - NWT 0.5M F/4 - MI G2-4000
 - NWT 0.25M F/4 - MI G2-0402
- TOSCANA REMOTE OBSERVATORY
 - NWT 0.3M F/3.85 - MI G2-1600
- SOUTH MORAVIAN OBSERVATORY
 - NWT 0.2M F/4 - MI G2-1600
- ZNOJMO OBSERVATORY
 - NWT 0.2M F/4 - MI G2-0402
- LOUNY OBSERVATORY
 - NWT 0.5M F/5.2 - MI G2-0402

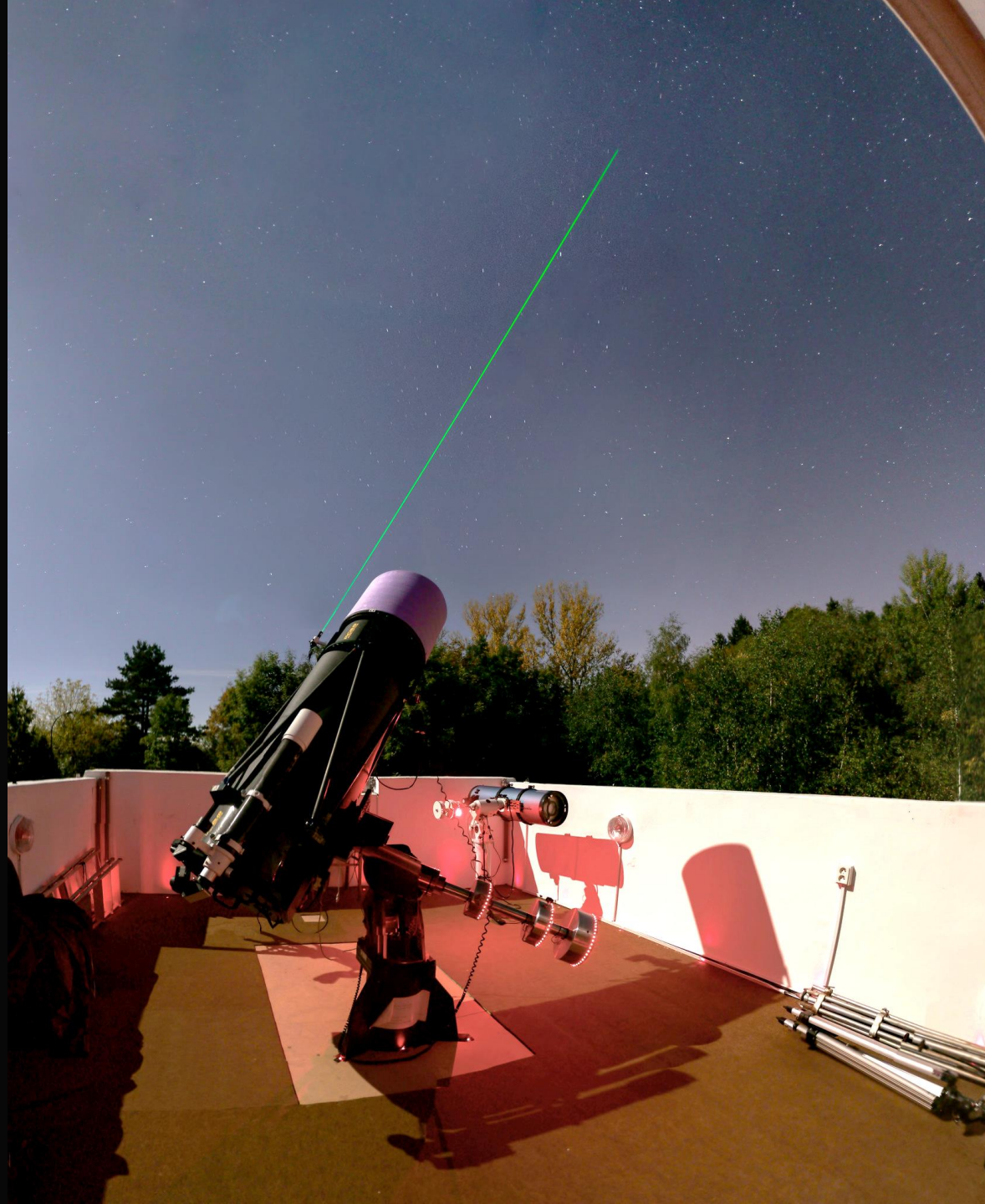


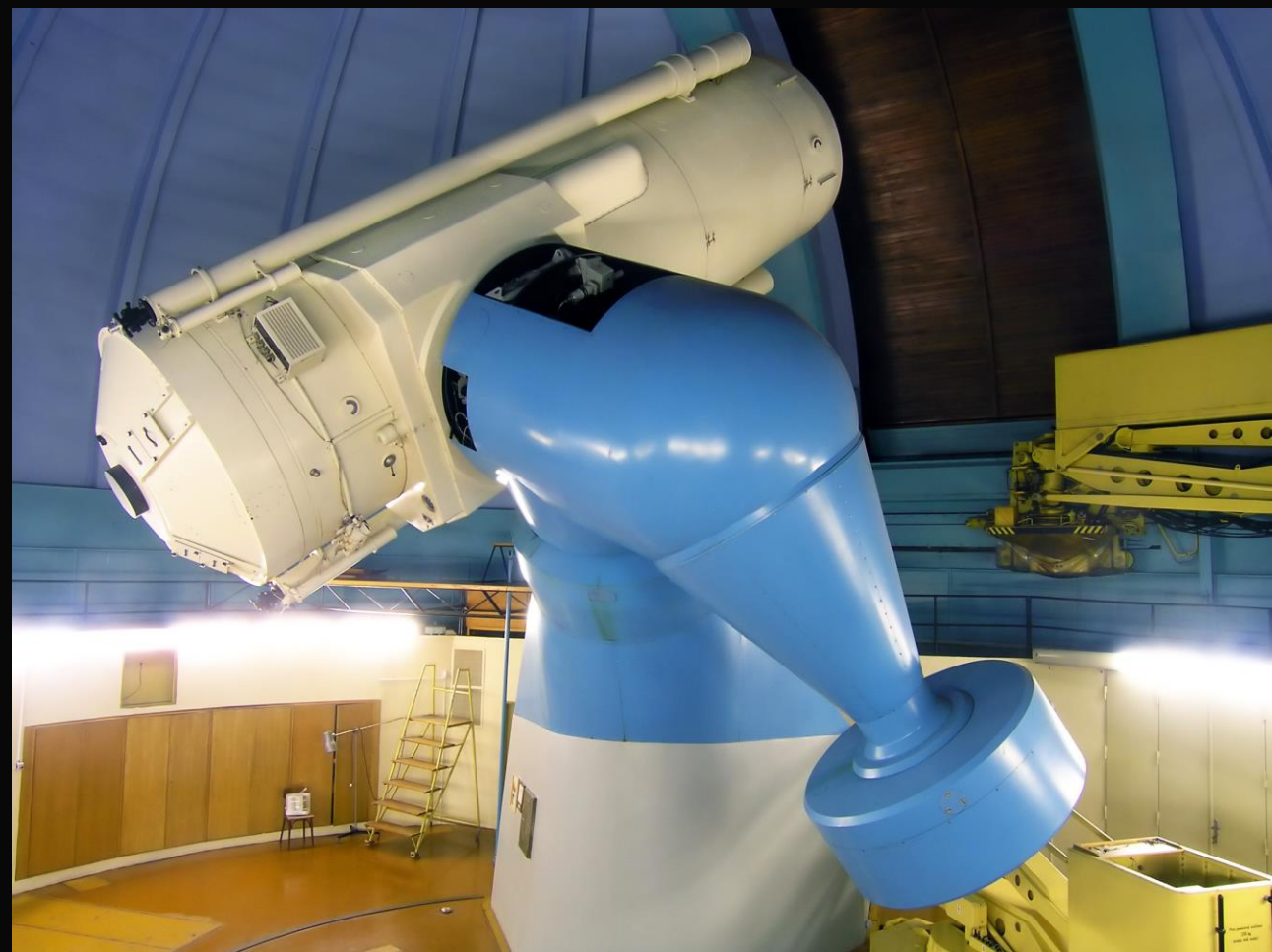
















WHO?

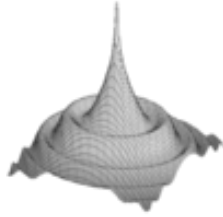


WHERE?



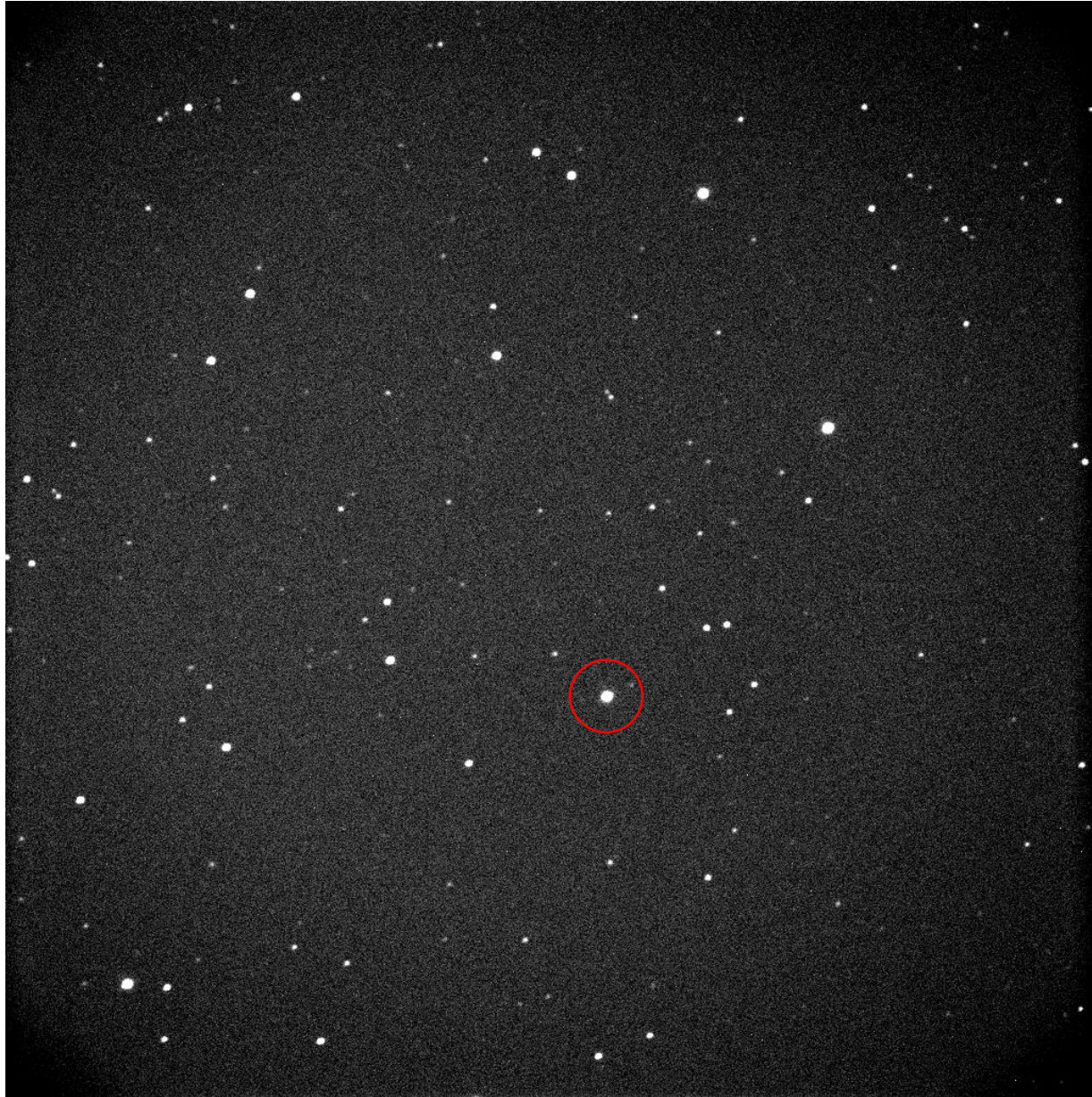
HOW?

MUNIPACK



- EASY-TO-USE TOOL FOR ASTROMETRY AND PHOTOMETRY
- EASY ACCESS TO VIRTUAL OBSERVATORY
- ROBUST STATISTICAL METHODS
- DATA PRODUCTION
- COLOR IMAGING

TOI 00503.01 B



```
export FITS_KEY_TEMPERATURE='CCD-TEMP'  
export FITS_KEY_LONGITUDE='LONG-OBS'  
export FITS_KEY_LATITUDE='LAT--OBS'
```

```
# correction images
```

```
munipack bias -o masterbias bias_*.fits
```

```
munipack dark -bias masterbias.fits -o masterdark dark_*.fits
```

```
munipack flat -bias masterbias.fits -dark masterdark.fits -o masterflat flat_V_*.fits
```

```
# photometry correction
RA=124.3204155    # 8 17 16.90
DEC=12.6013638    # 12 36 04.91
munipack phcorr -bias masterbias.fits -dark masterdark.fits -flat masterflat_V.fits
                toi_V_*.fits

# astrometry
munipack find -f 5 toi_V_*.fits
munipack aphot toi_V_*.fits
munipack cone -r 0.2 -o cone_toi.fits $RA $DEC
munipack astrometry -c cone_toi.fits toi_V_*.fits

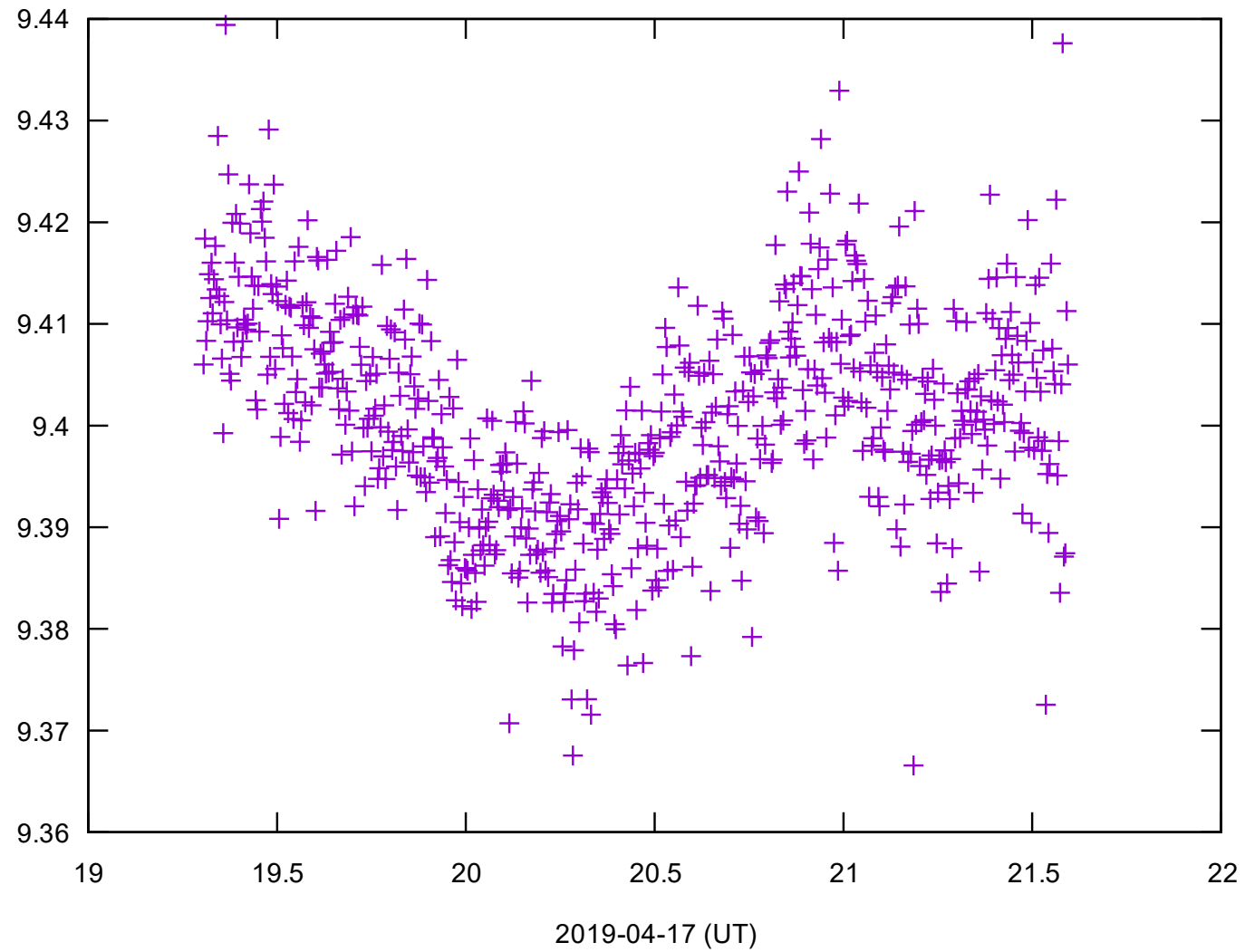
# combining reference image
munipack kombine -o ref_V.fits toi_V_*.fits
munipack find -f 5 ref_V.fits
munipack aphot ref_V.fits
munipack astrometry -c cone_toi.fits ref_V.fits
```

```
# reference image calibration
munipack phcal --photosys-ref Johnson -f V -c cone_toi.fits --saper 4 ref_V.fits

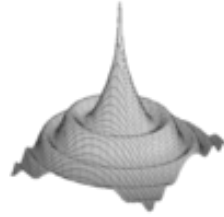
# calibration
for A in toi_V_?????.fits; do
    munipack phcal --photosys-ref Johnson -f V --saper 4 -r ref_V_cal.fits $A
done

# light curve
munipack timeseries -l MAG --stdout -c "$RA,$DEC"
    toi_V_????_cal.fits > toi_V.lc
```

TOI 00503.01 B



MUNIPACK



- MULTIPLATFORM SOFTWARE MAINTAINED ONLY UNDER LINUX
- GRAPHICAL AND COMMAND-LINE INTERFACE
- MORE INFO: MUNIPACK.PHYSICS.MUNI.CZ

THANKS FOR YOUR
ATTENTION