

Optical data of ERS made at 60cm ASV and 2m Rozhen telescopes useful for the link of ICRF – future Gaia CRF

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Introduction

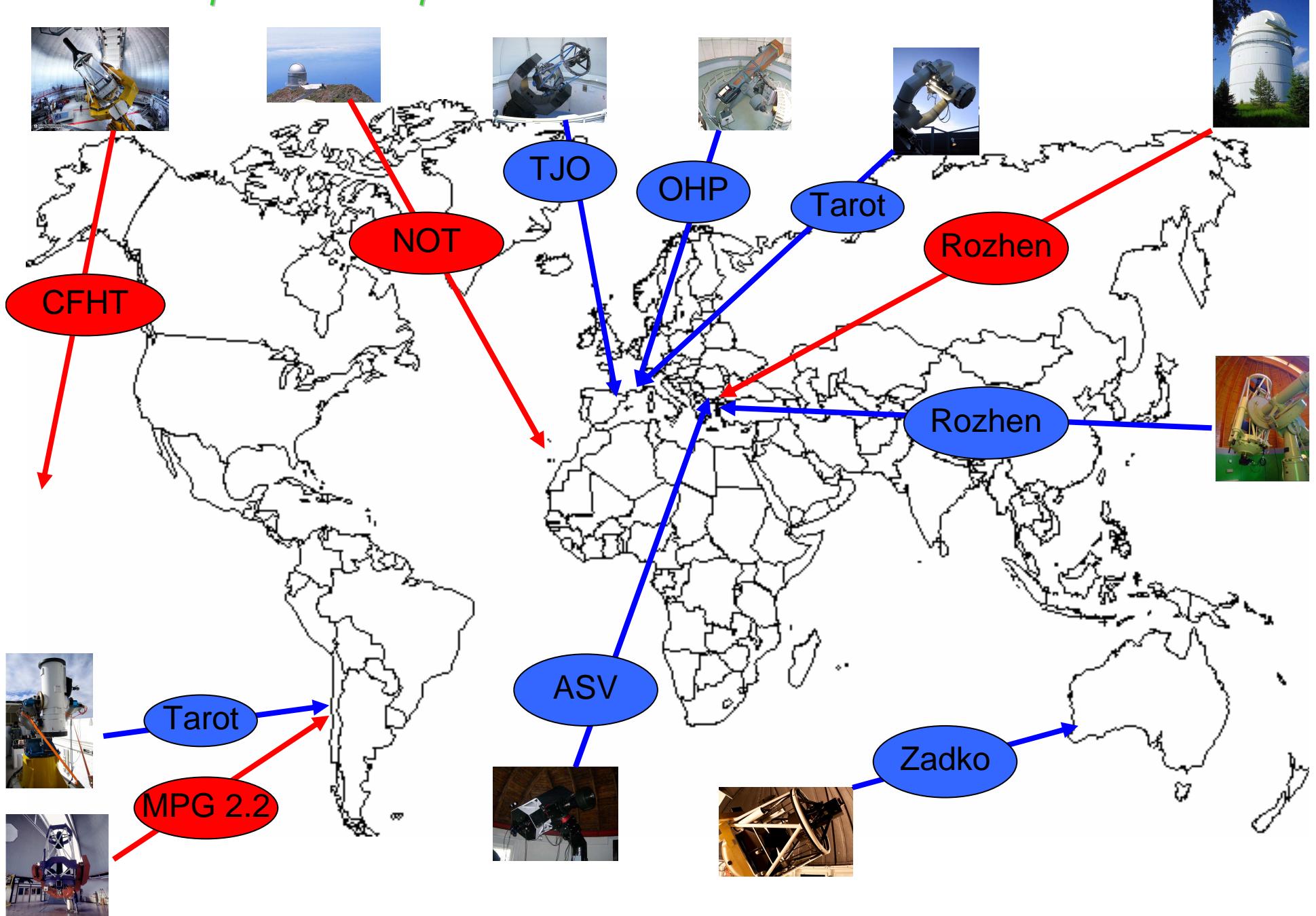
- ❖ The European space astrometry mission Gaia (ESA) in 2013, celestial reference frame (QSOs based one as ICRF 1997, ICRF2 2009, Gaia CRF), extragalactic radio sources (ERS) in optical domain, 500 000 QSOs as the base of a new optical reference frame, a set of common ERS (optical/radio, morphology and photometry of targets).
- ❖ International WEBT (Whole Earth Blazar Telescope, 1997) and India-Bulgarian collaboration.
- ❖ The follow-up network for the Gaia photometric alerts.



Stations

- ❖ Mini-network (5 tel.):
- ❖ 60cm ASV (Astronomical Station Vidojevica, AOB, Serbia),
- ❖ 2m Rozhen (NAO BAS, Bulgaria), 60cm Rozhen, 50/70cm Schmidh (Rozhen),
- ❖ 60cm Belogradchik AO (Bulgaria).
- ❖ Johnson UBV and Cousins RI filters.

The set of optical telescopes



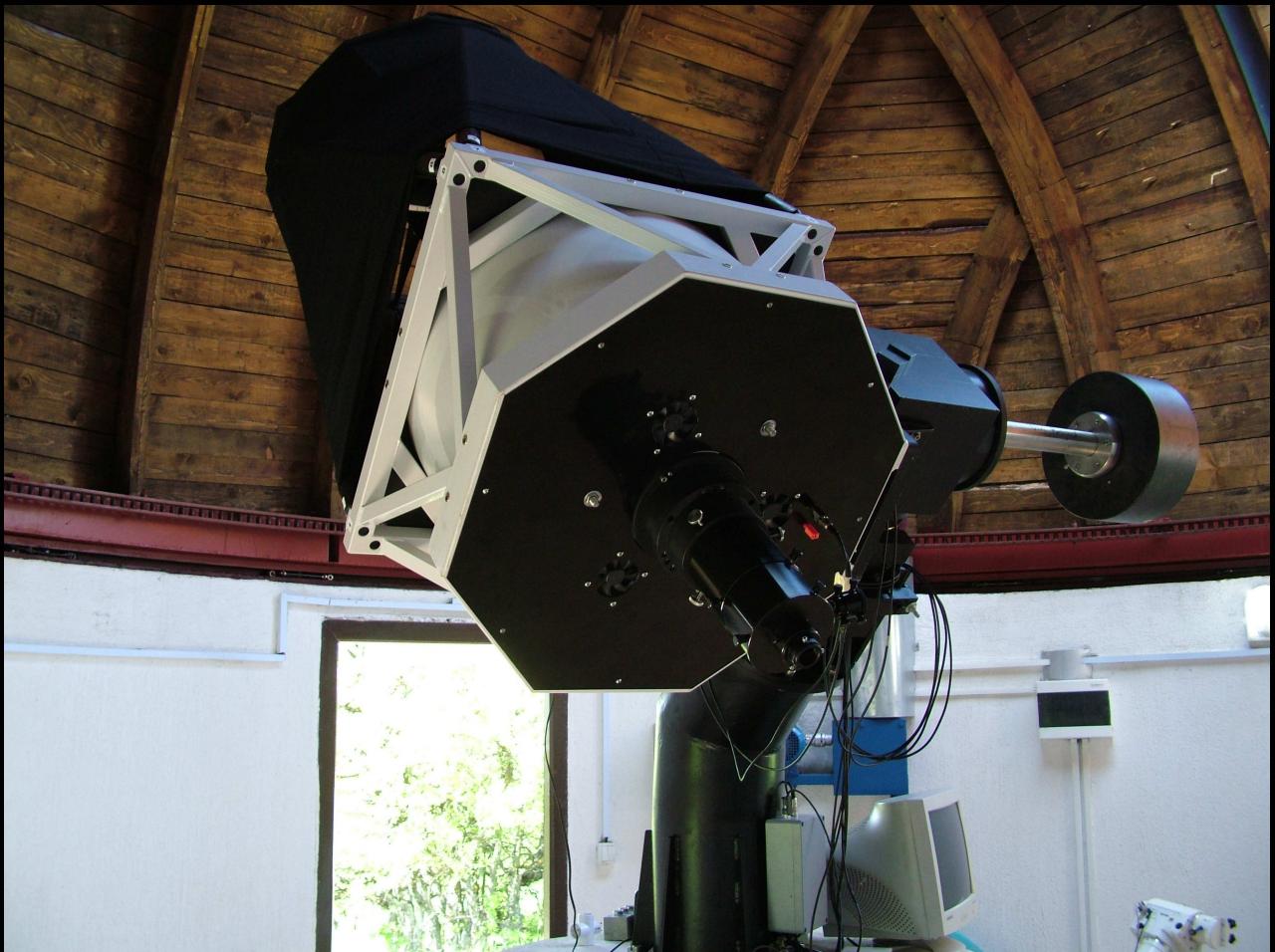


The instruments:

- 1) 60 cm Cassegrain (long.= 21.5° , lat.= 43.1° , h=1150m), CCD Apogee Alta U42,
- 2) 2m Ritchey-Chrétien (24.7° , 41.7° , 1730m), CCD VersArray 1300B,
- 3) 60cm Cassegrain (24.7° , 41.7° , 1759m), CCD FLI PL09000,
- 4) 50/70cm Schmidt-camera (24.7° , 41.7° , 1759m), CCD SBIG STL11000M,
- 5) 60cm Cassegrain (22.7° , 43.6° , 650m), CCD FLI PL09000.



60cm ASV, since mid
2011





Optical observations of targets

- 1) The ASV ($D/F=0.6/6m$) tel.
The CCD Apogee Alta U42:
2048x2048 pixels, pixel size is
 $13.5 \times 13.5 \mu\text{m}$, scale is
 $0.^{\circ}46/\text{pixel}$, $\text{FOV}=15.8 \times 15.8'$.
- 2) The RC ($D/F=2/16m$) tel. of
Rozhen National Astron.
Observatory (NAO) of
Bulgarian Academy of
Sciences (BAS). The CCD
VersArray 1300B: 1340x1300,
 $20 \times 20 \mu\text{m}$, $0.^{\circ}26/\text{px}$, $5.6 \times 5.6'$.



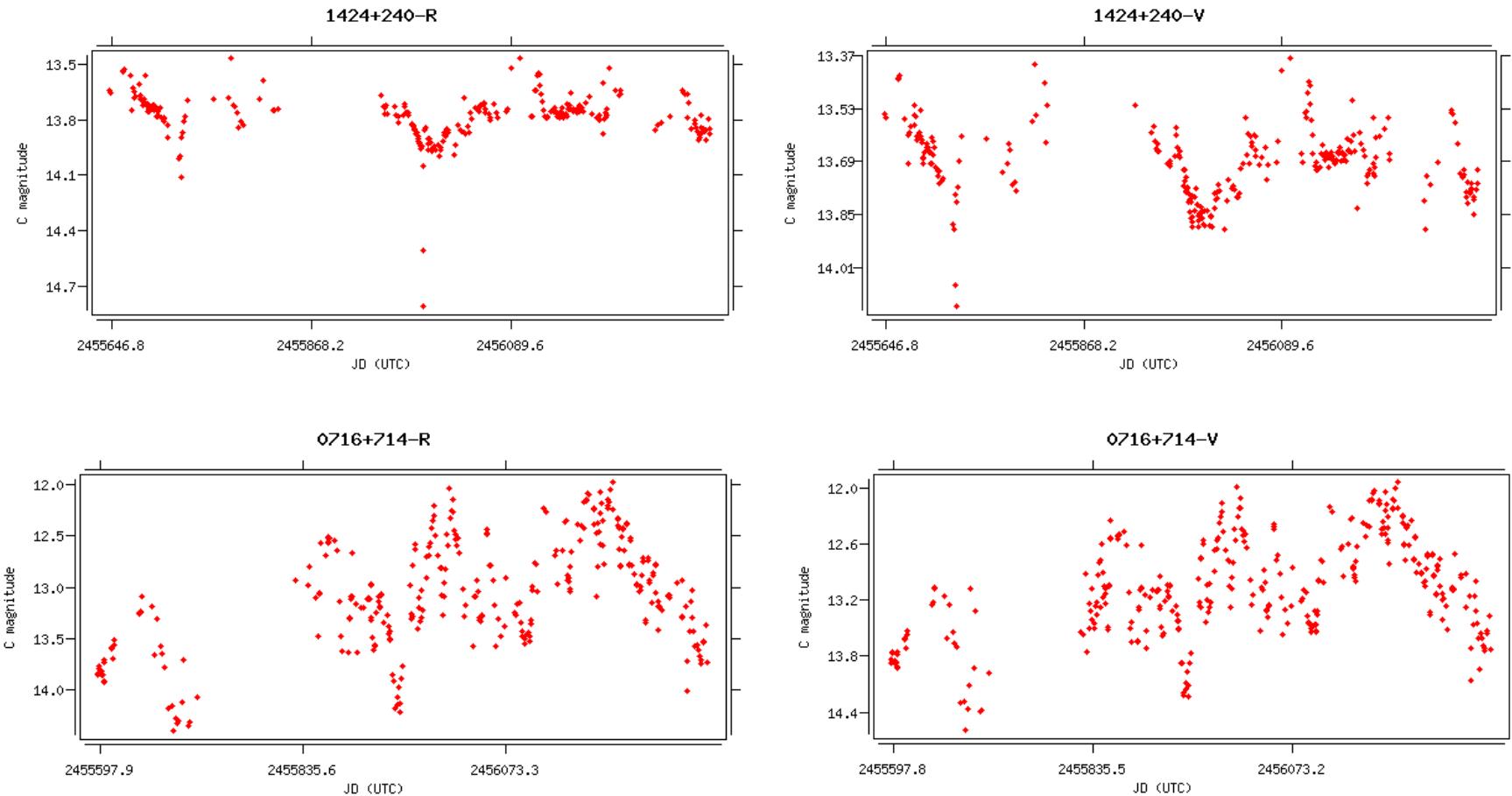
- 3) The 60cm Rozhen ($F=7.5\text{m}$) tel. The CCD FLI PL09000: 3056×3056 , $12\times 12\mu\text{m}$, $0.^{\circ}33/\text{pixel}$, $16.8\times 16.8'$.
- 4) The 50/70cm Schmidt ($F=1.72\text{m}$), Rozhen. The CCD SBIG STL11000M: 4008×2672 , $9\times 9\mu\text{m}$, $1.^{\circ}08/\text{pixel}$, $72.1\times 48.1'$.
- 5) The 60cm Belogradchik ($F=7.5\text{m}$) tel. The CCD FLI PL09000: 3056×3056 , $12\times 12\mu\text{m}$, $0.^{\circ}33/\text{pixel}$, $16.8\times 16.8'$.
- 1') CCD SBIG-ST-10XME: 2184×1472 , $6.8\times 6.8\mu\text{m}$, $0.^{\circ}23/\text{pixel}$, $8.5\times 5.9'$, AO(adaptive optics)



Optical monitoring of QSOs

- Photometry analysis: 60cm ASV tel., 47 objects (~50% with 1 obs., July+Sept.).
- Morphology analysis: 2m Rozhen tel., 54 objects (host galaxy?+QSOs with a known host galaxy, ~40% with 1 or 2 epochs, from 2011).
- (B), V and R filters; Johnson and Cousins

Some photometry results



A&A 526, A25, 2011, Taris, F., et al.

A&A 552, A98, 2013, Taris, F., et al.

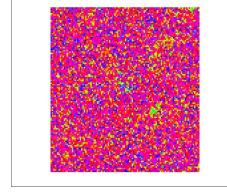
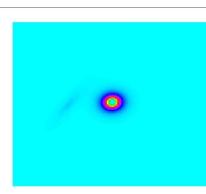
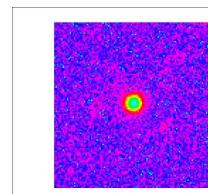
Galfit analysis (Rozhen 2m Telescope)

Sc. Images

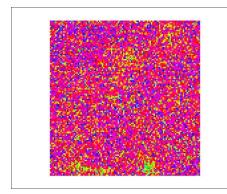
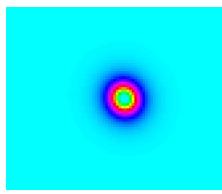
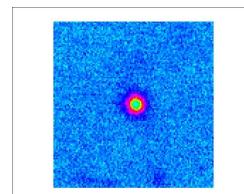
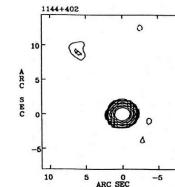
Models

Residuals

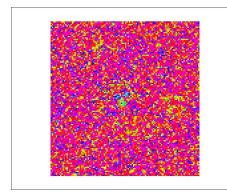
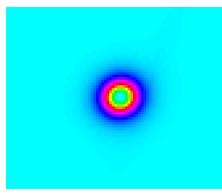
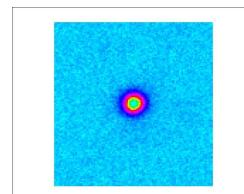
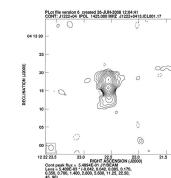
Radio maps



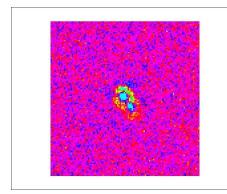
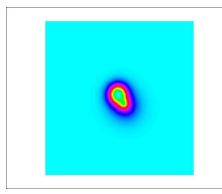
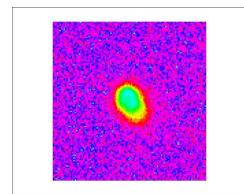
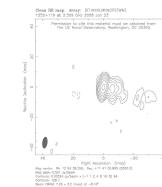
1144+402



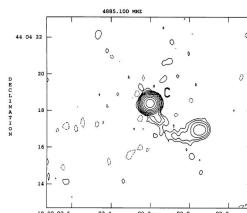
1219+044



1252+119

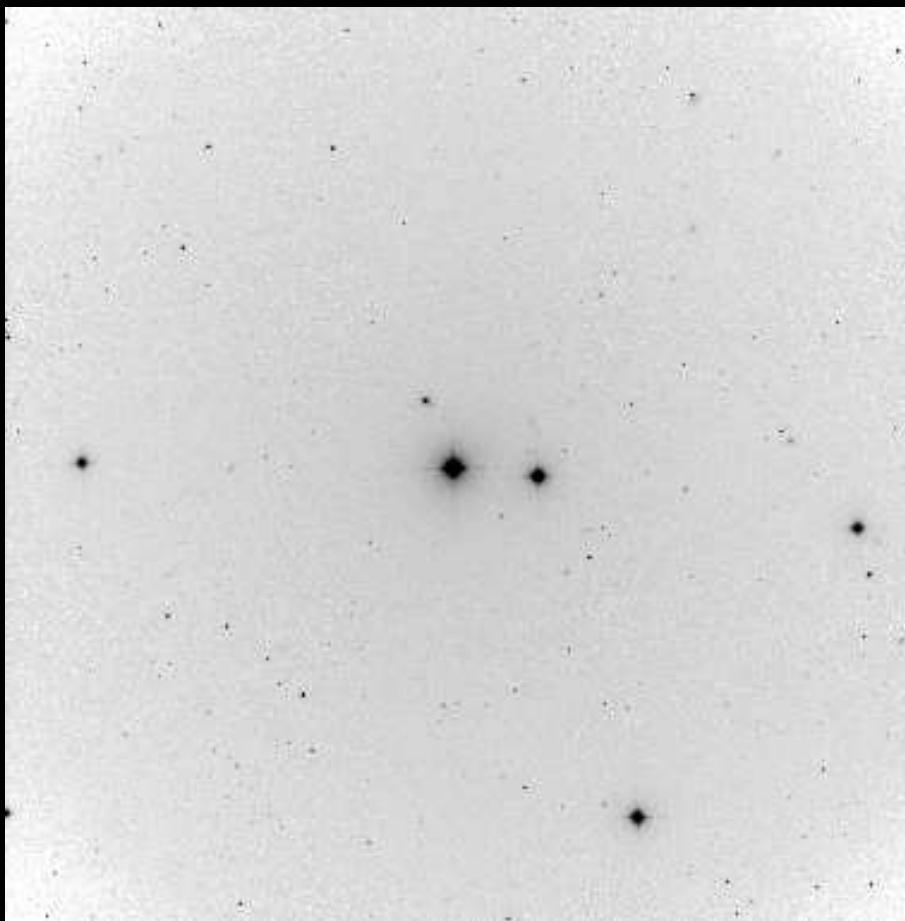


1800+440



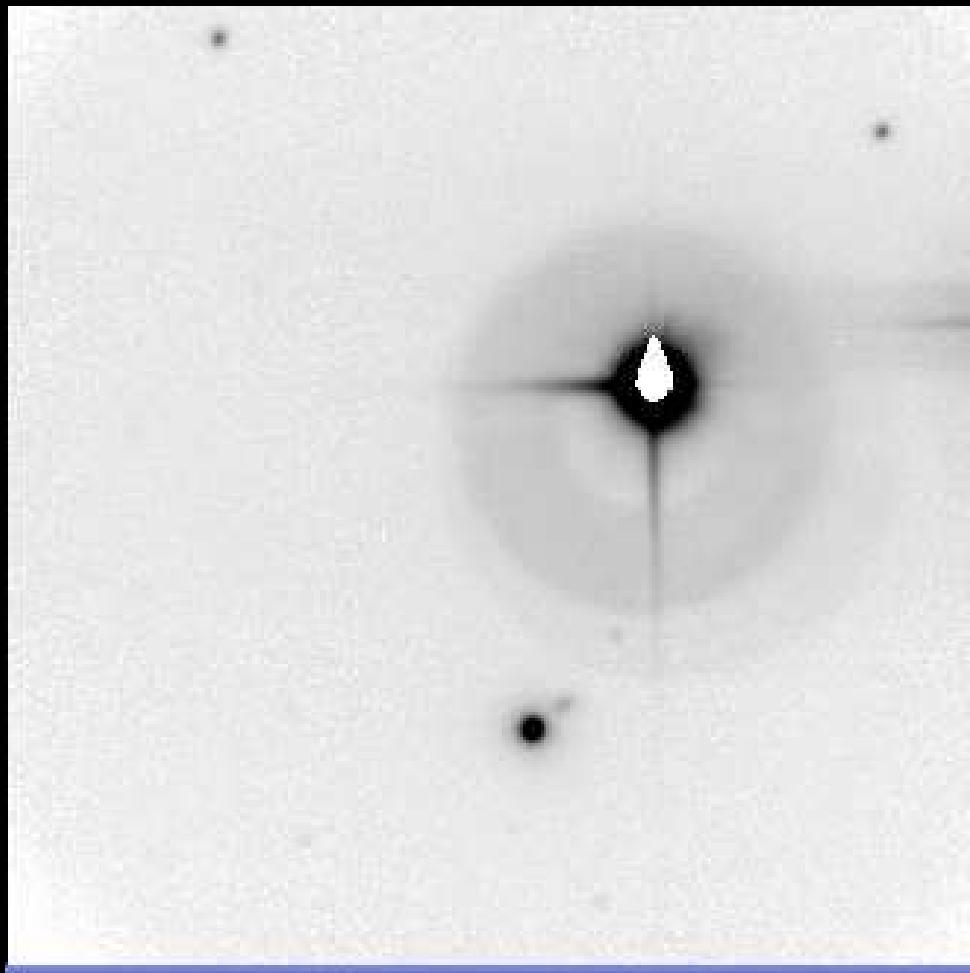


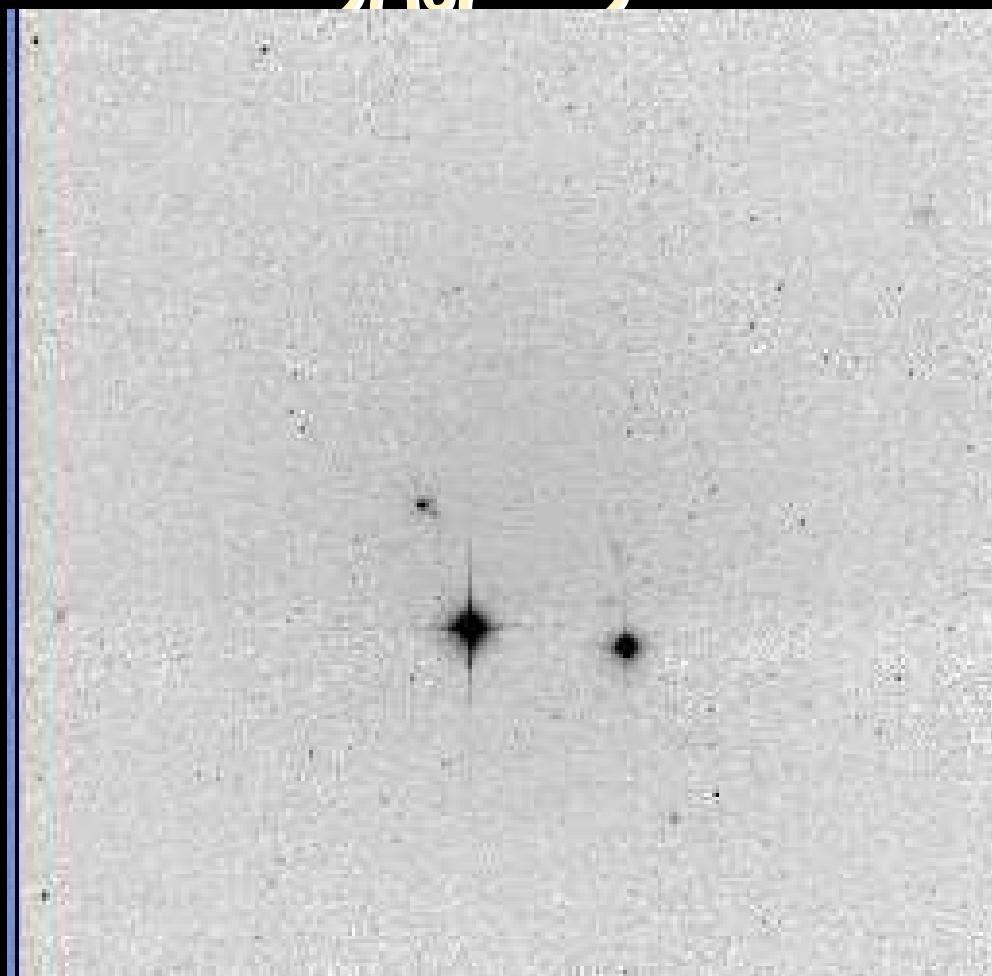
60cm Rozhen, L1101+384, pos., R
filter, exp.=60s, T=-25°C, binning=2



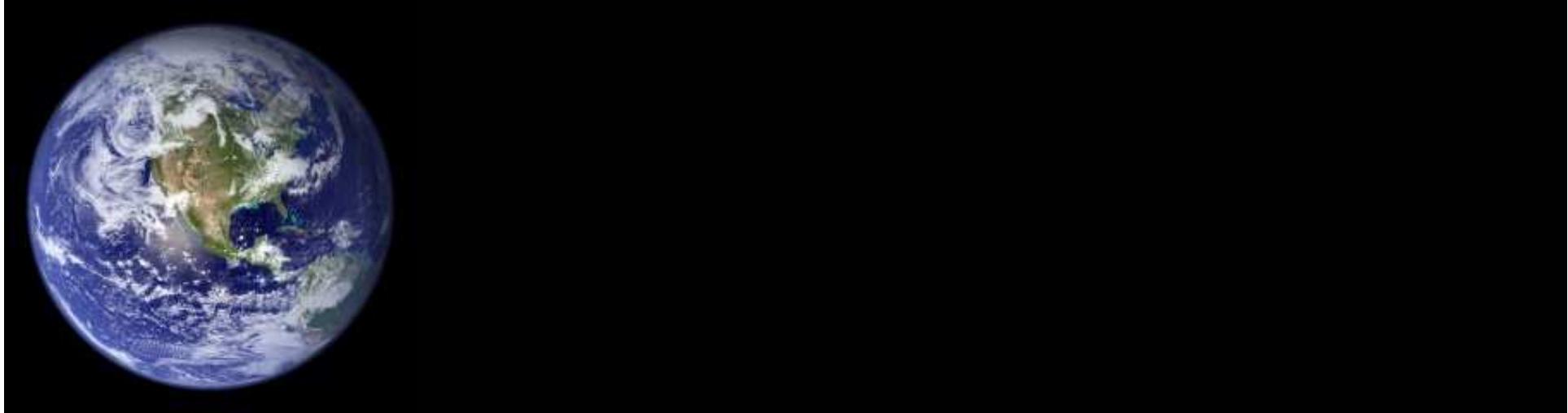


2m Rozhen, L1101+384, pos., R
filter, exp.=20s, T=-110°C, 1

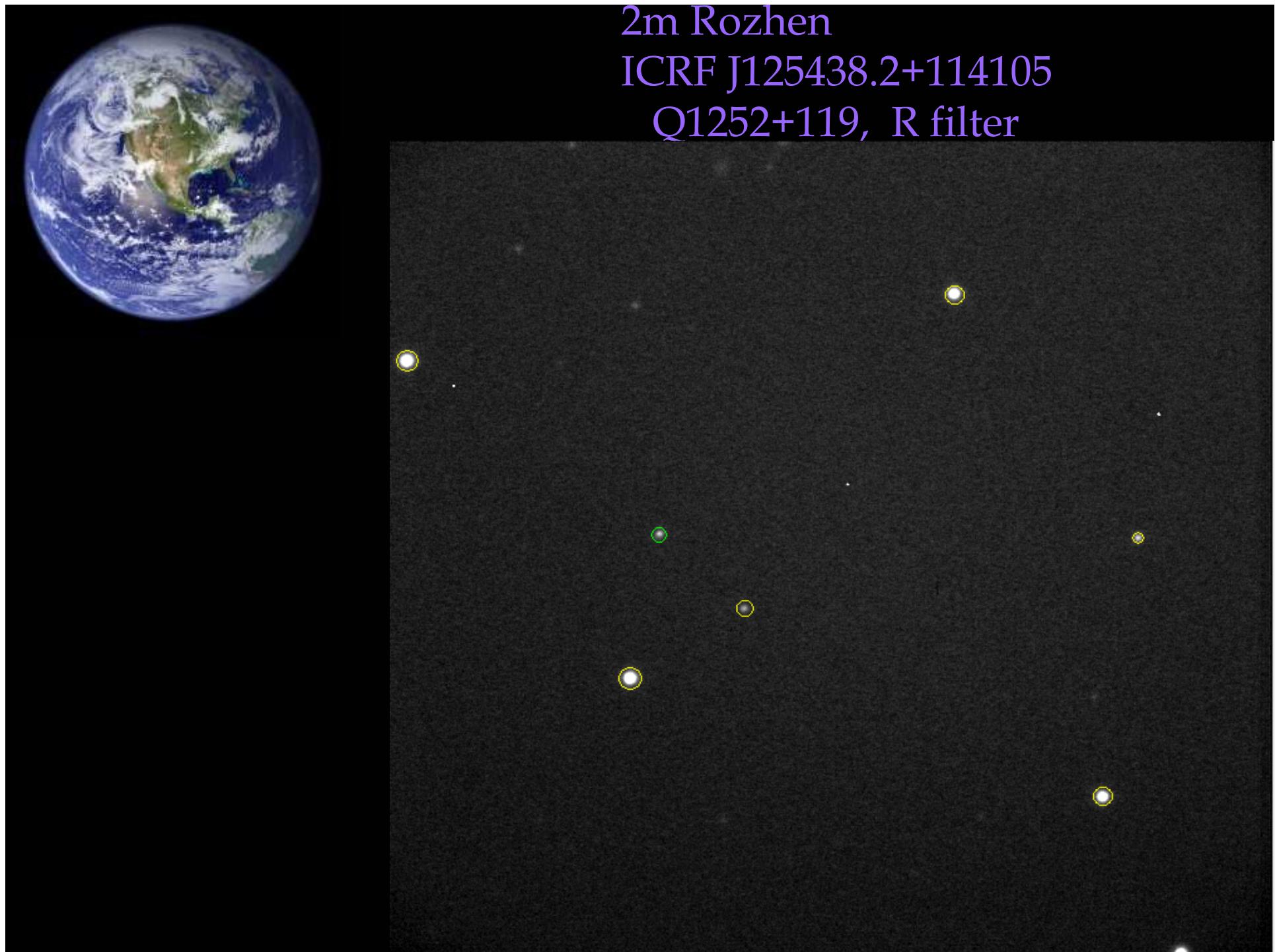




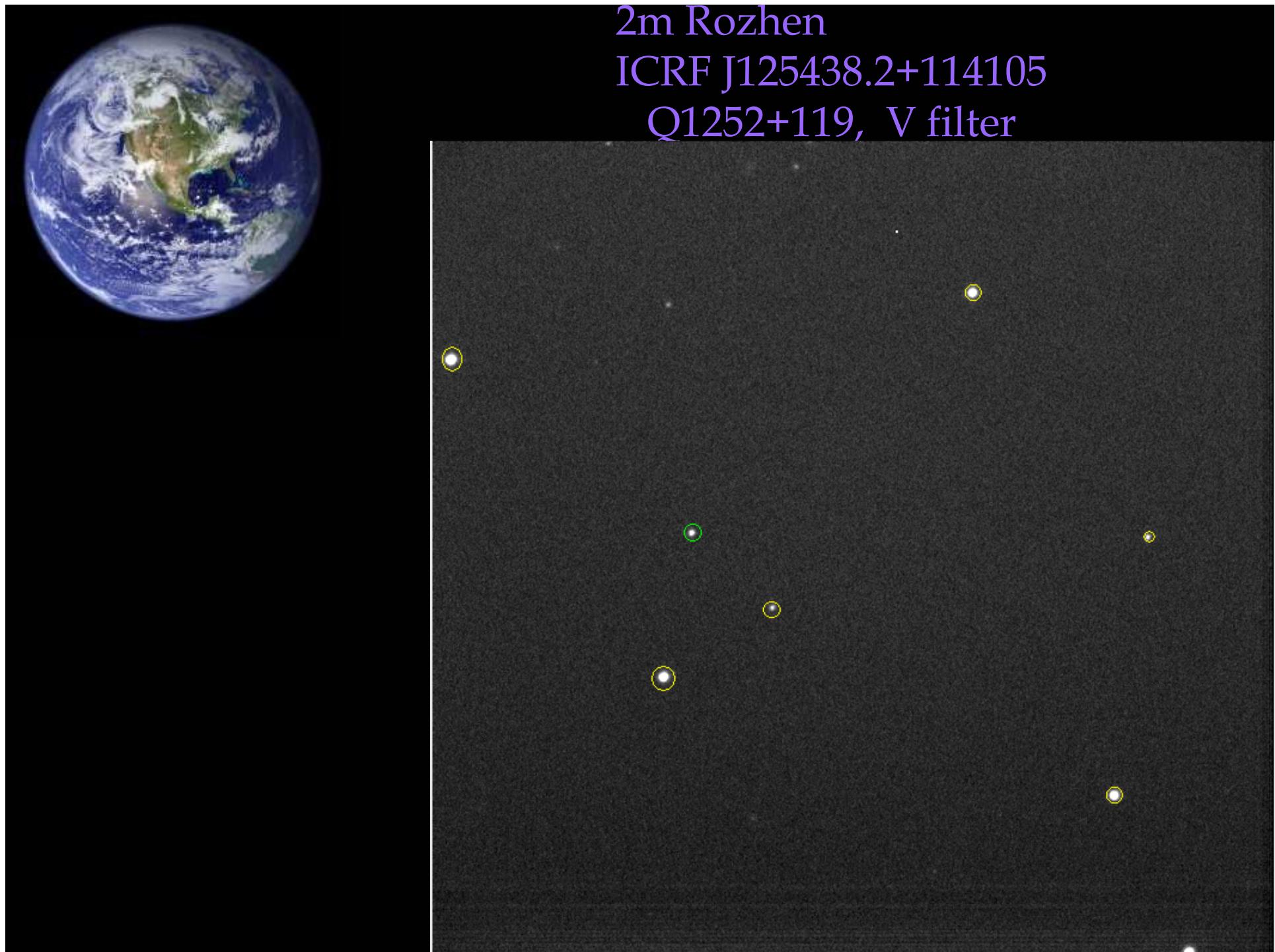
6UCIII ASV,
L1101+384, pos., R
filter, exp.=15s, T=-
20°C 2



ERS	RA	DEC	MAG	EXP.(s)	
				V	R
L1215+303	12 ^h 17 ^m 52 ^s .0819	30 ⁰ 07'00".636	15.7	5	5
Q1219+044	12 ^h 22 ^m 22 ^s .5496	04 ⁰ 13'15".776	18.0	20	20
L1221+809	12 ^h 23 ^m 40 ^s .4937	80 ⁰ 40'04".340	18.0	20	20
Q1240+381	12 ^h 42 ^m 51 ^s .3691	37 ⁰ 51'00".025	19.0	30, 60, 90	10, 15
Q1252+119	12 ^h 54 ^m 38 ^s .2556	11 ⁰ 41'05".895	16.2	5	5



2m Rozhen
ICRF J125438.2+114105
Q1252+119, R filter



2m Rozhen
ICRF J125438.2+114105
Q1252+119, V filter



2m Rozhen
ICRF J121752.0+300700
L1215+303, R filter





2m Rozhen, ICRF J121752.0+300700
L1215+303, V filter

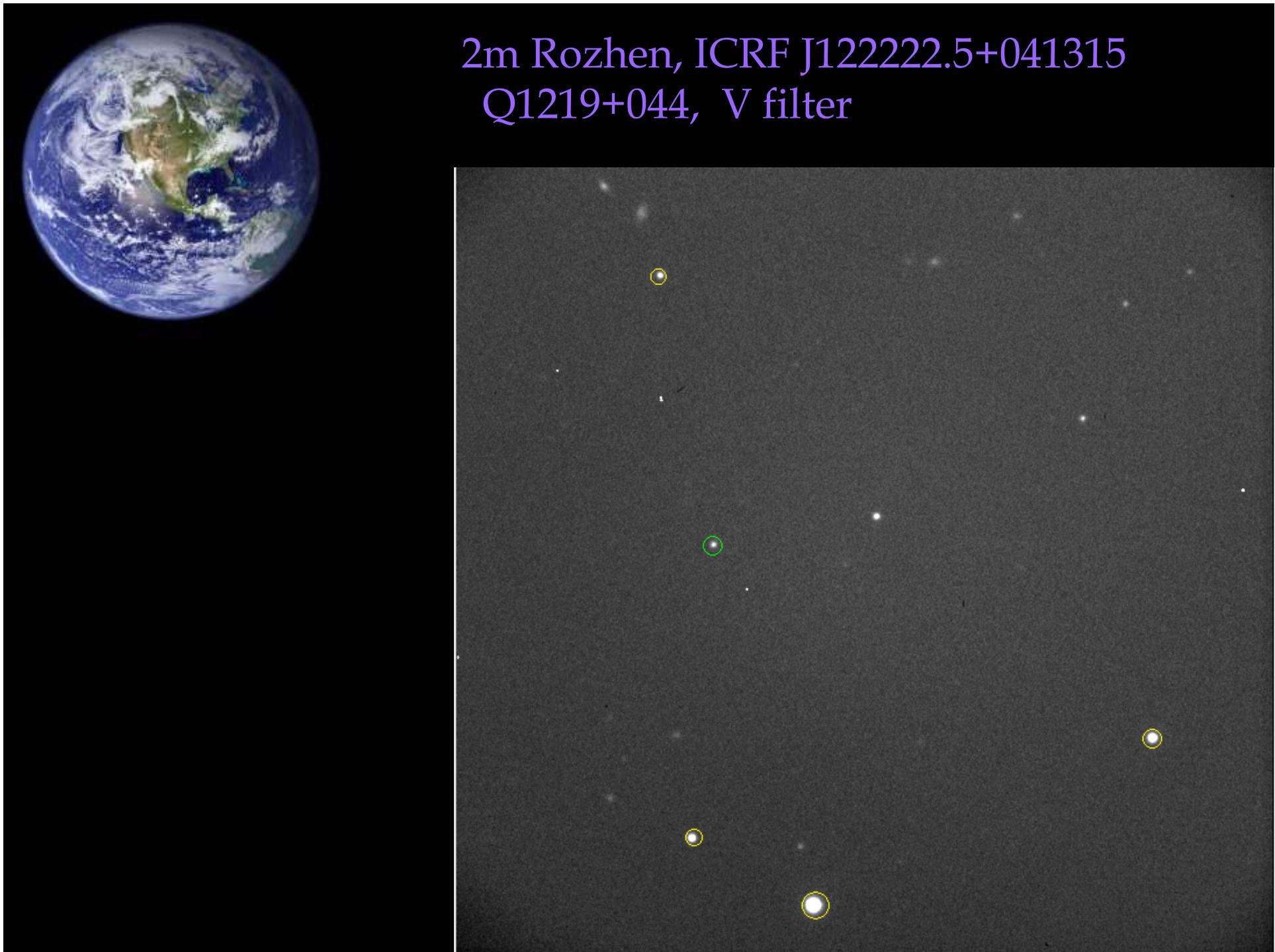




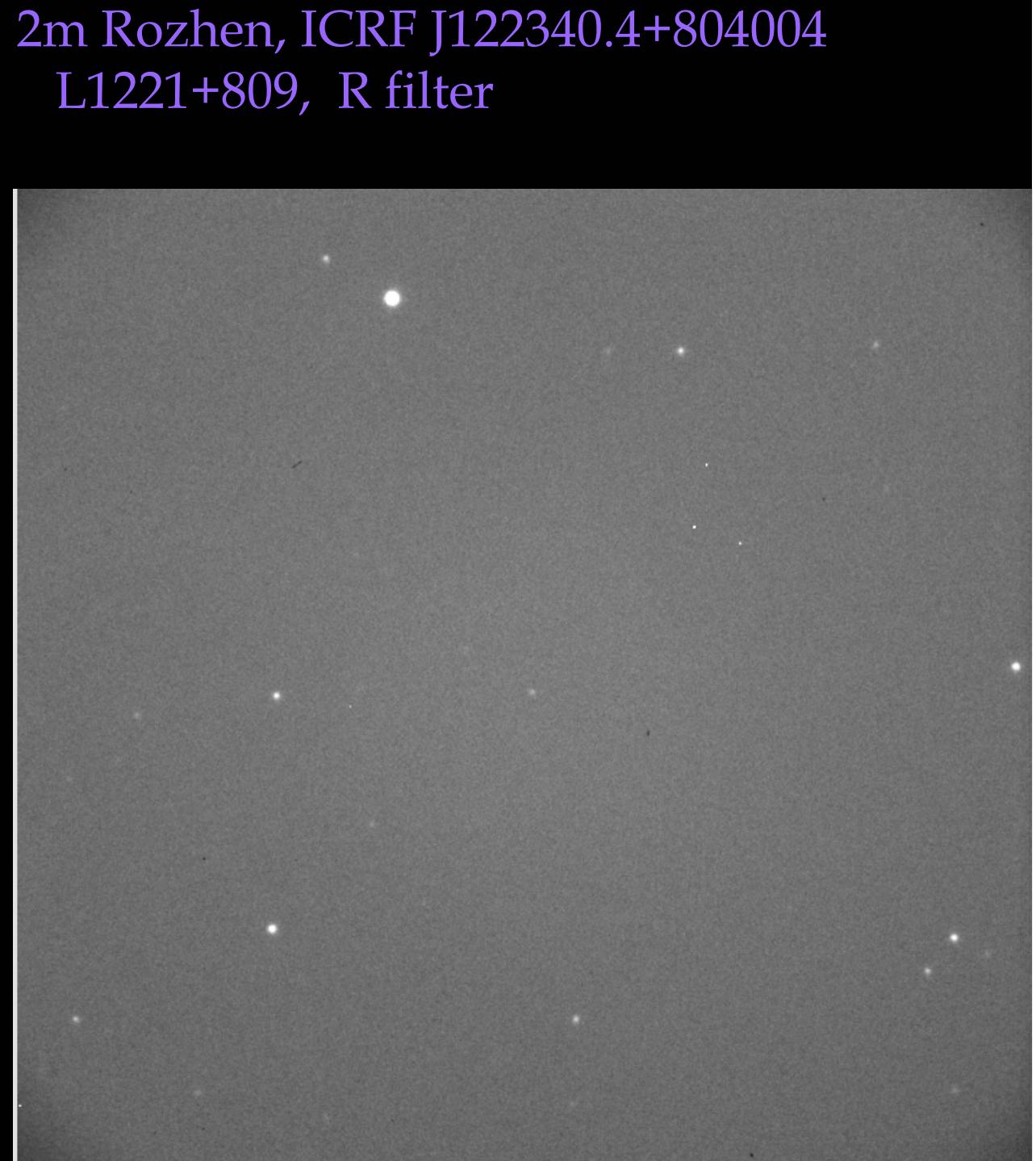
2m Rozhen, ICRF J124251.3+375100
Q1240+381, V filter

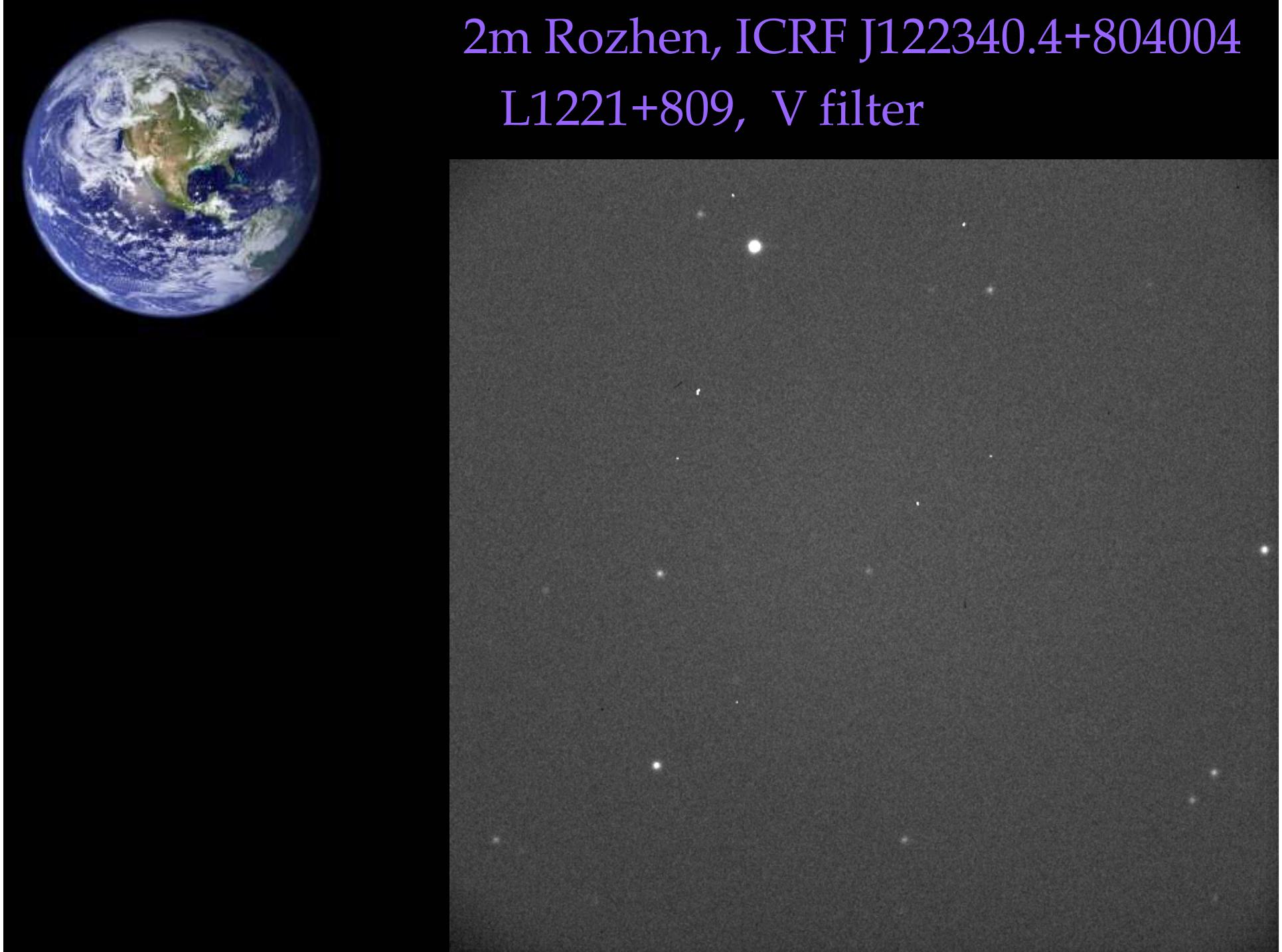


2m Rozhen, ICRF J122222.5+041315
Q1219+044, R filter

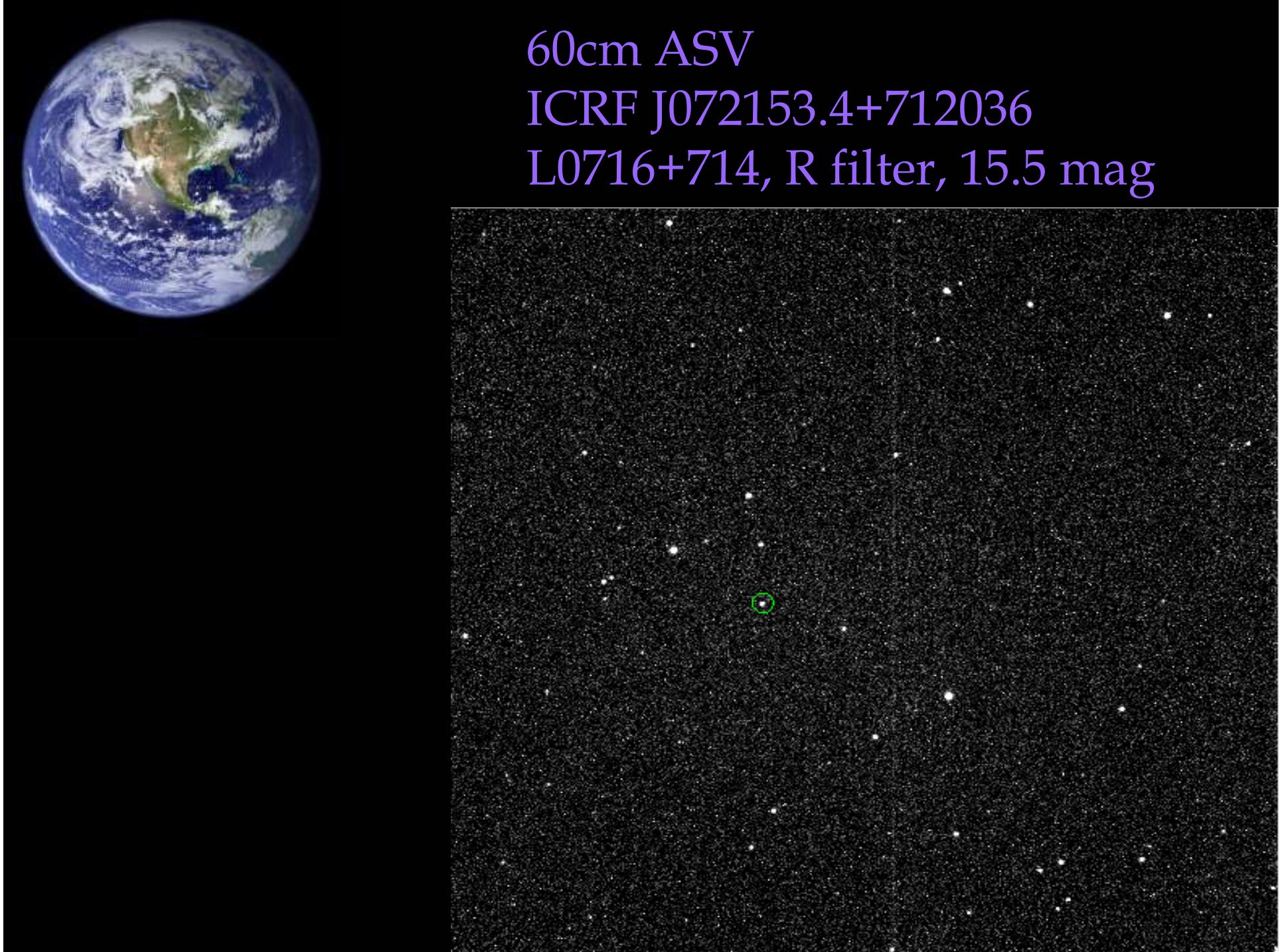


2m Rozhen, ICRF J122222.5+041315
Q1219+044, V filter





2m Rozhen, ICRF J122340.4+804004
L1221+809, V filter



60cm ASV
ICRF J072153.4+712036
L0716+714, R filter, 15.5 mag



Conclusions

- ❖ The observations of ERS (in optical domain) are useful for photometry and morphology tasks by using mentioned telescopes (and good CCD detectors); seeing=1.^{''}5 to 3.^{''}5, 1.^{''}5 for 60cmASV.
- ❖ With calibration (dark, bias, flat, +dead/hot pixels) and stacking of data, it is possible to catch 20mag target by using 2m Rozhen tel. and until 18mag with other mentioned instruments.



Thank you!