Some preliminary photometric results of QSOs useful for the link beween future Gaia CRF and ICRF

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Introduction

- The European space astrometry mission Gaia (ESA), Dec. 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 (~billion stars), a set of common ERS (optical/radio, morphology & photometry of QSOs).
- The follow-up network for the Gaia photometric alerts (Gaia-FUN-TO).

Stations

- Mini-network (5 telescopes):
- 60cm ASV (Astronomical Station Vidojevica of Astron. Obs. in Belgrade-AOB, Serbia),
- 2m Rozhen (National Astron. Obs.-NAO, Bulgarian Academy of Sciences-BAS), 60cm Rozhen, 50/70cm Schmidh (Rozhen),
- 60cm Belogradchik AO (Bulgaria).
- Johnson UBV and Cousins RI filters.

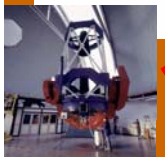
The set of optical telescopes











CFHT

NOT

TJO

OHP

Tarot

Rozhen

Rozhen

Tarot

MPG 2.2

ASV

Zadko

The instruments:

1) 60 cm Cassegrain (long.=21.5º, lat.=43.1º, h=1150m), CCD Apogee Alta U42,

2) 2 m Ritchey-Chrétien (24.7º, 41.7º, 1730m), CCD VersArray 1300B,

3) 60 cm Cassegrain (24.7º, 41.7º, 1759m), CCD FLI PL09000,

4) 50/70 cm Schmidt-camera (24.7º, 41.7º, 1759m), CCD FLI PL16803,

5) 60 cm Cassegrain (22.7º, 43.6º, 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 13.5x13.5 μm, scale is 0.″46/pixel, FoV=15.8x15.8′.
2) The RC (D/F=2/16m) tel., Rozhen NAO, BAS; 33 years, automatization 2010. The CCD VersArray 1300B: 1340x1300, 20x20μm, 0.″26/px, 5.6x5.6′, cooled liquid nitrogen (-110^{o} C).

3) The 60cm Rozhen (F=7.5m) tel. The CCD FLI PL09000: 3056x3056, 12x12μm, 0.″33/pixel, 16.8x16.8'.

4) The 50/70cm Schmidt (F=1.72m), Rozhen. The CCD FLI PL16803: 4096x4096, 9x9μm, 1.″08/pixel, 73.7x73.7′ .

5) The 60cm Belogradchik (F=7.5m) tel. The CCD FLI PL09000: 3056x3056, 12x12μm, 0.″33/pixel, 16.8x16.8'.

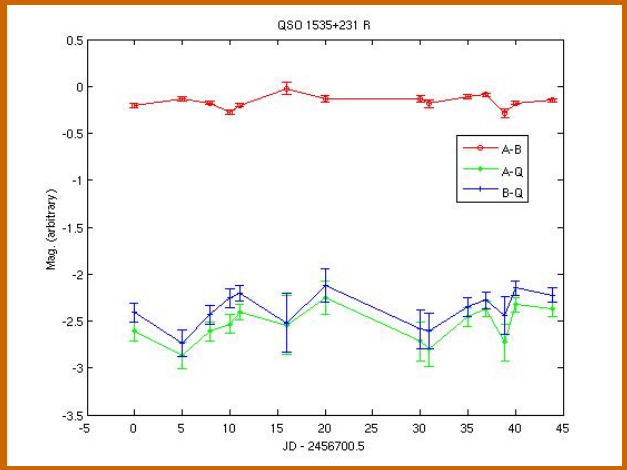
1′) CCD SBIG-ST-10 XME: 2184x1472, 6.8x6.8μm, 0.″23/pixel, 8.4x5.7’, AO(adaptive optics) to improve resolution

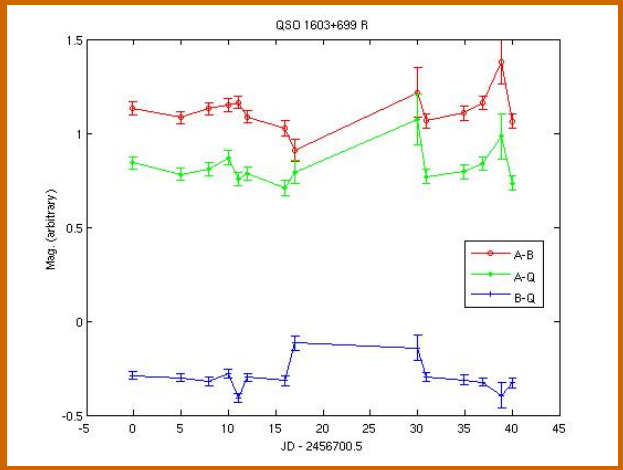
- Telescopi Juan Oró (TJO) 0.8m, Observatori Astronòmic del Montsec (OAdM), Spain

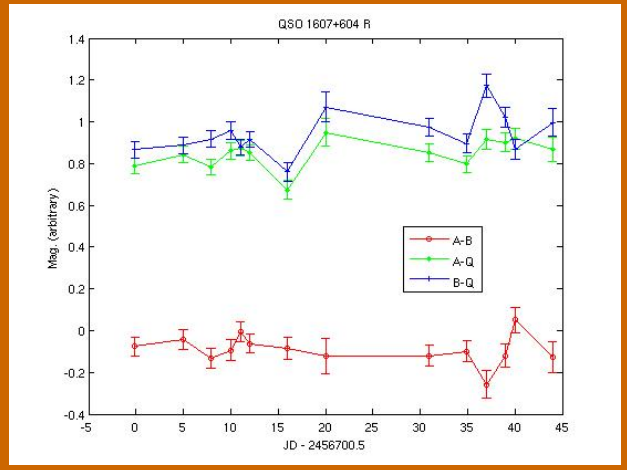
Optical monitoring of QSOs

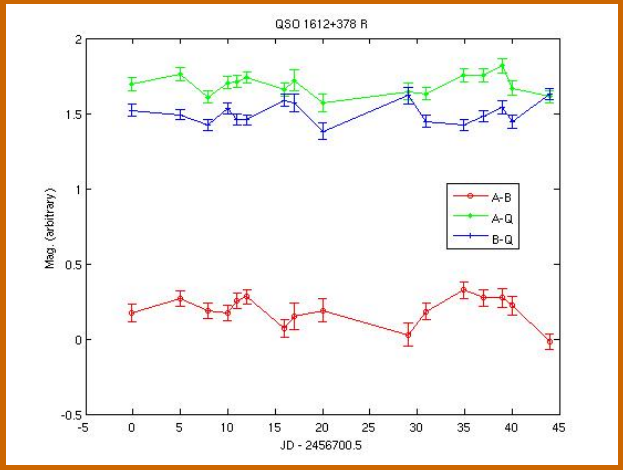
- Photometry analysis: 60cm ASV tel., all 47 objects (~65% >1 obs., from July 2013).
- Morphology analysis (GALFIT): 2m Rozhen & 1.5m tel. (Leopold Figl Obs. for Astrophysics - LFOA of Vienna Univ.), 54 objects (host galaxy?+QSOs, >60% with 1 or 2 epochs, from March 2011).
- (B), V and R filters

1535+231, 1603+699, 1607+604, 1612+378; photometry results in R filter, using 0.8m TJO

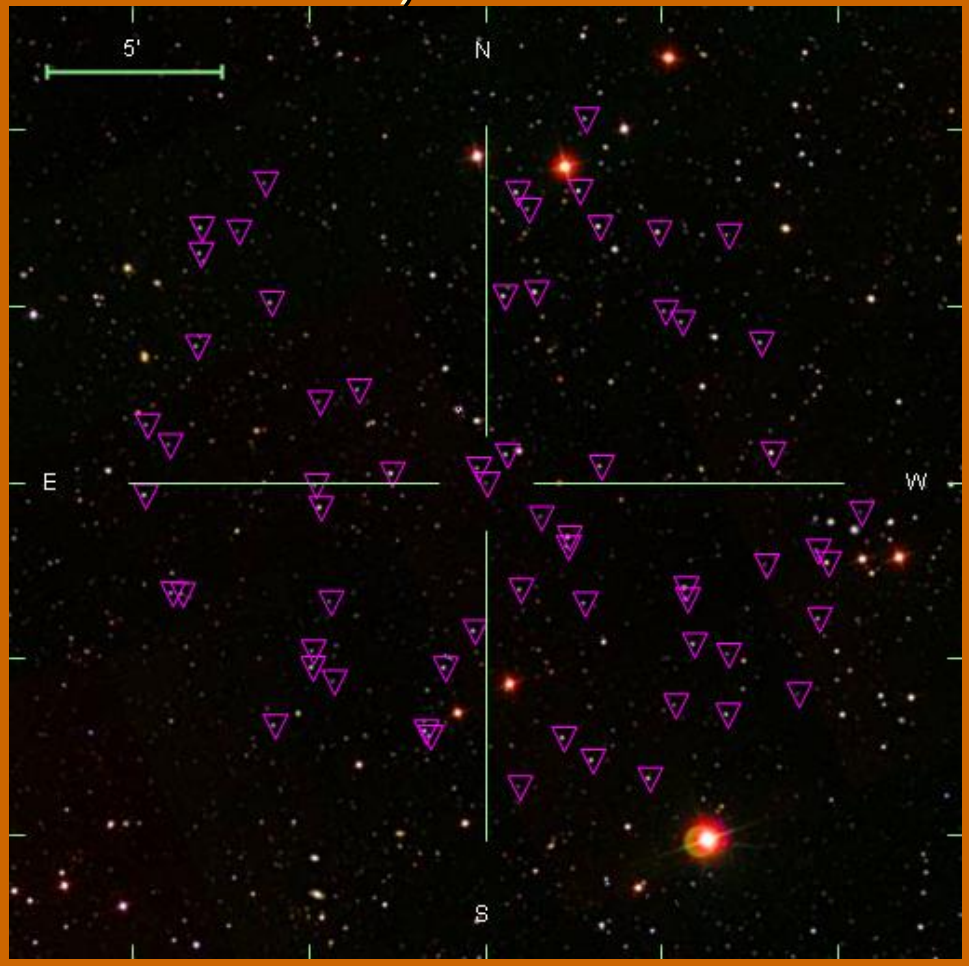




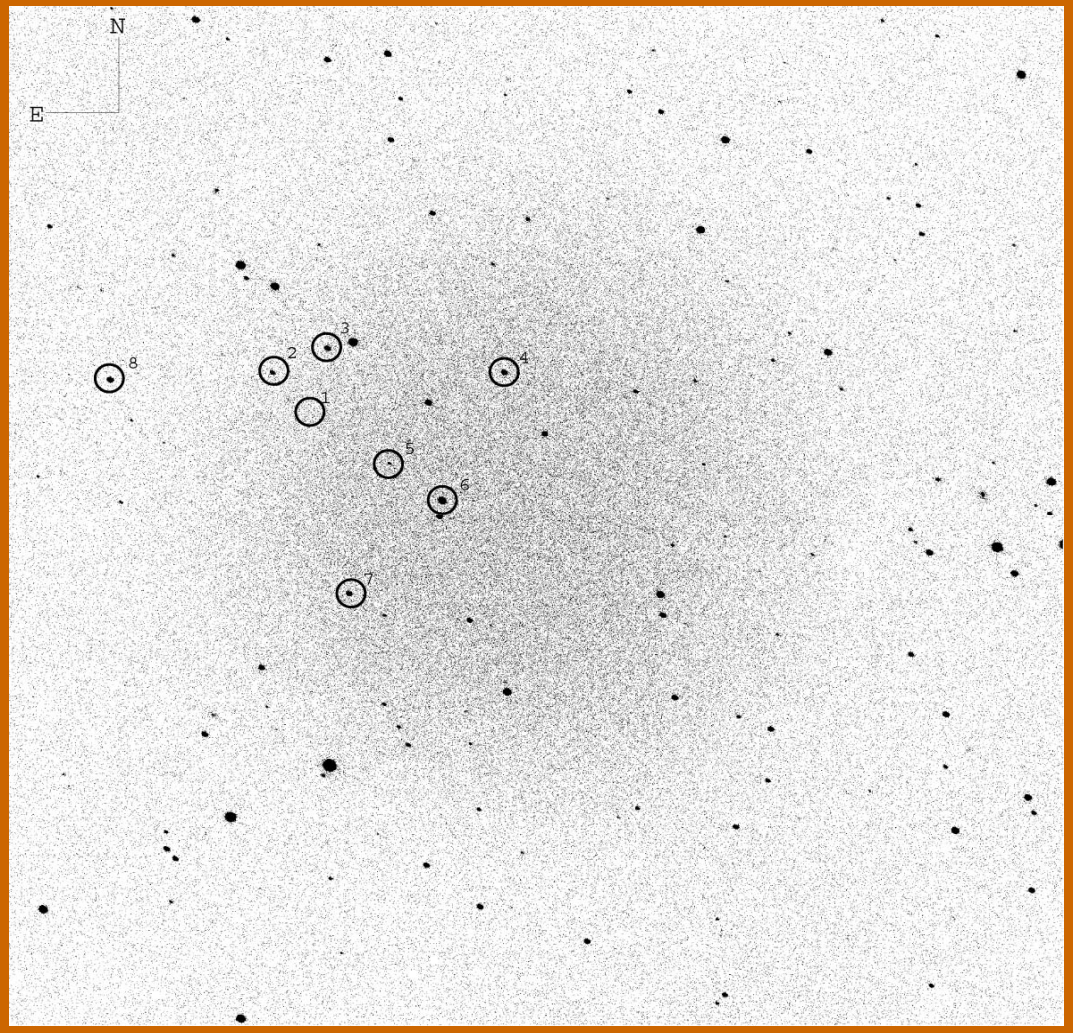




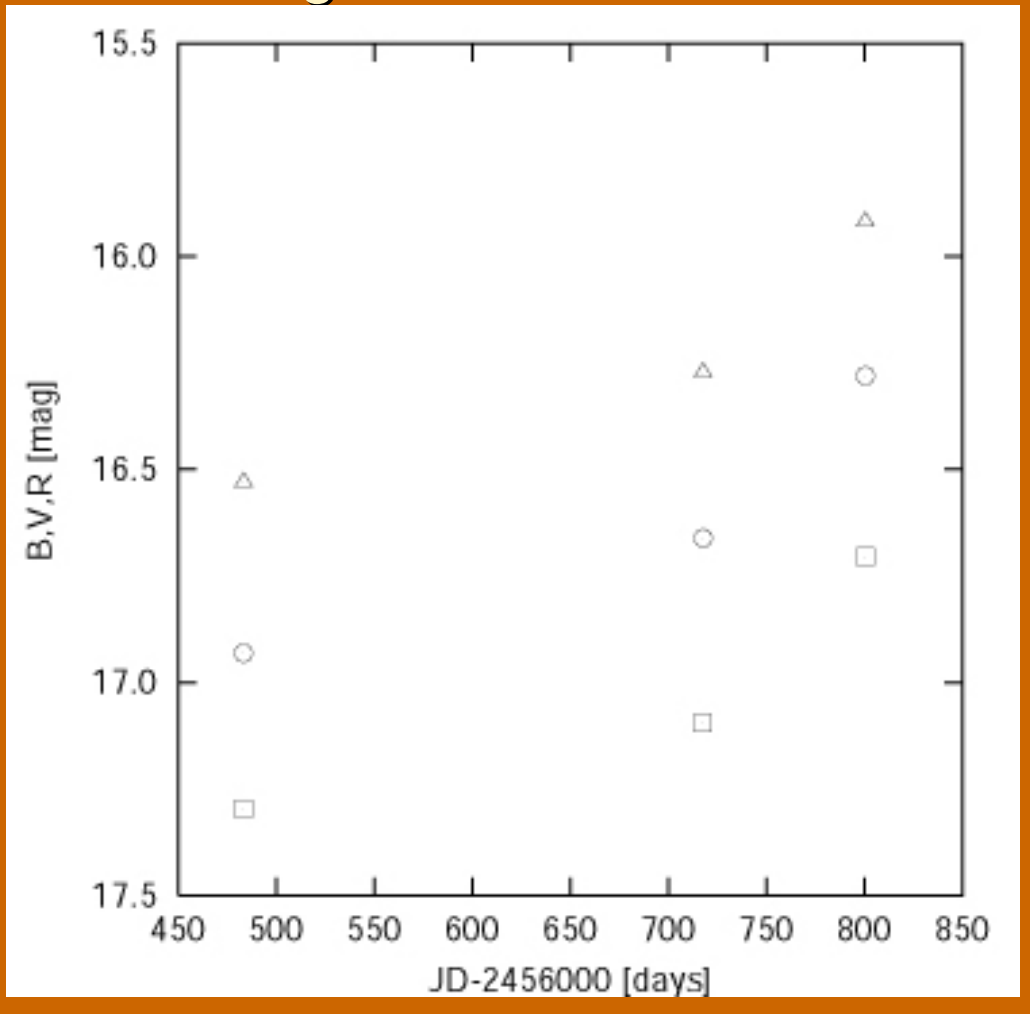
1535+231, SDSS ugriz>BVRI via transformations (Chonis and Gaskell, 2008, Astron.J. 135)



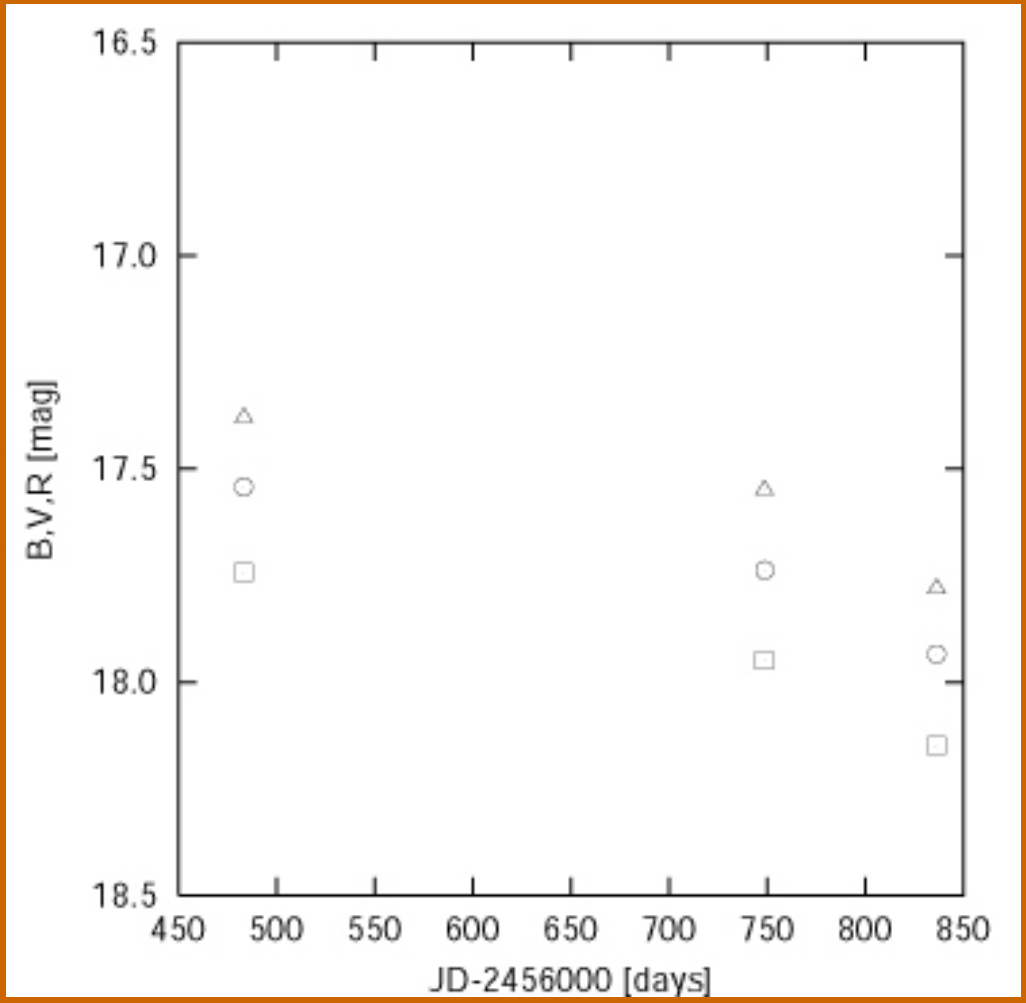
1535+231 (1) and comparison stars (2-8)



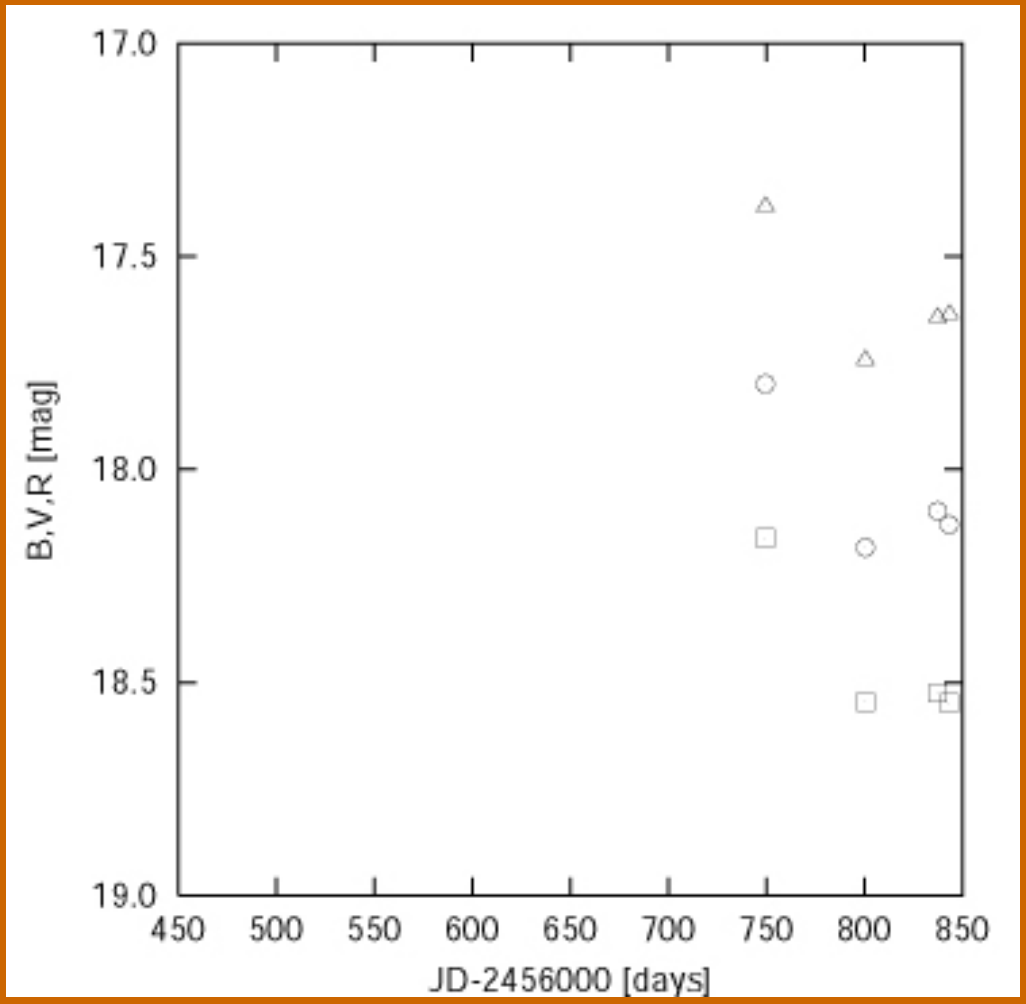
1034+574, July 9th 2013 – May 22nd 2014; B(.059, .019, .031)-square, V(.026, .006, .009)-circle, R(.024, .006, .005)-triangle



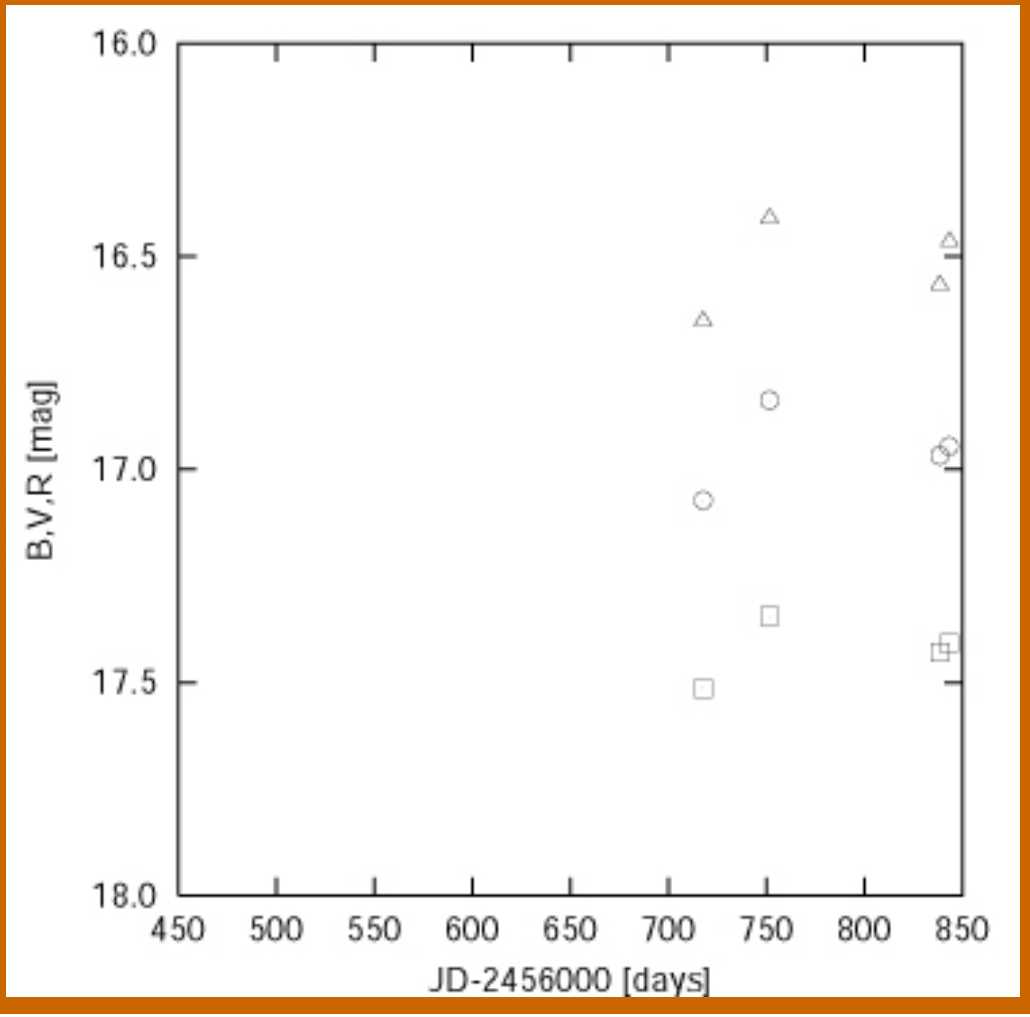
1212+467, July 9th 2013 – 27th June 2014; B(/, .082, .028), V(.034, .057, .027) and R(.039, .020, .012)



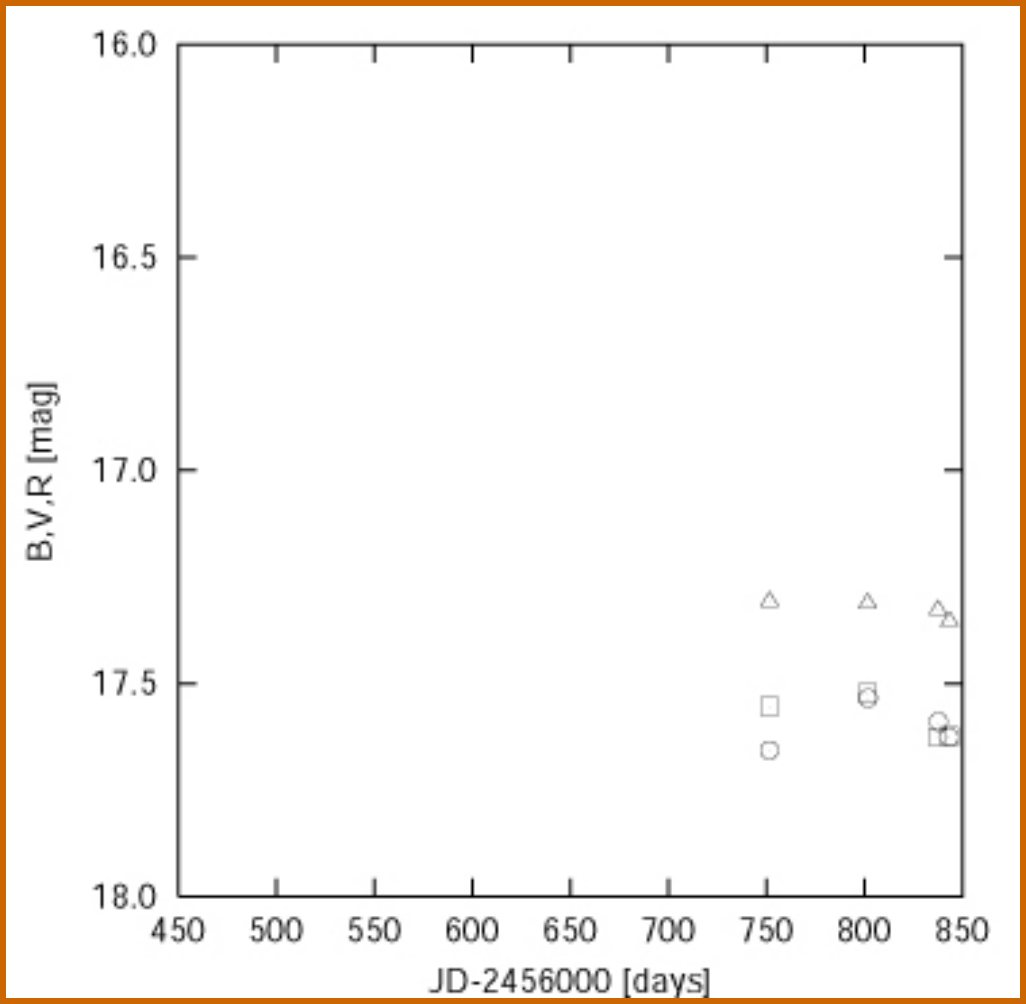
1242+574, April 1st 2014 – July 4th 2014; B(.087, .151, .079, .068), V(.042, .054, .031, .034) and R(.020, .026, .020, .064)



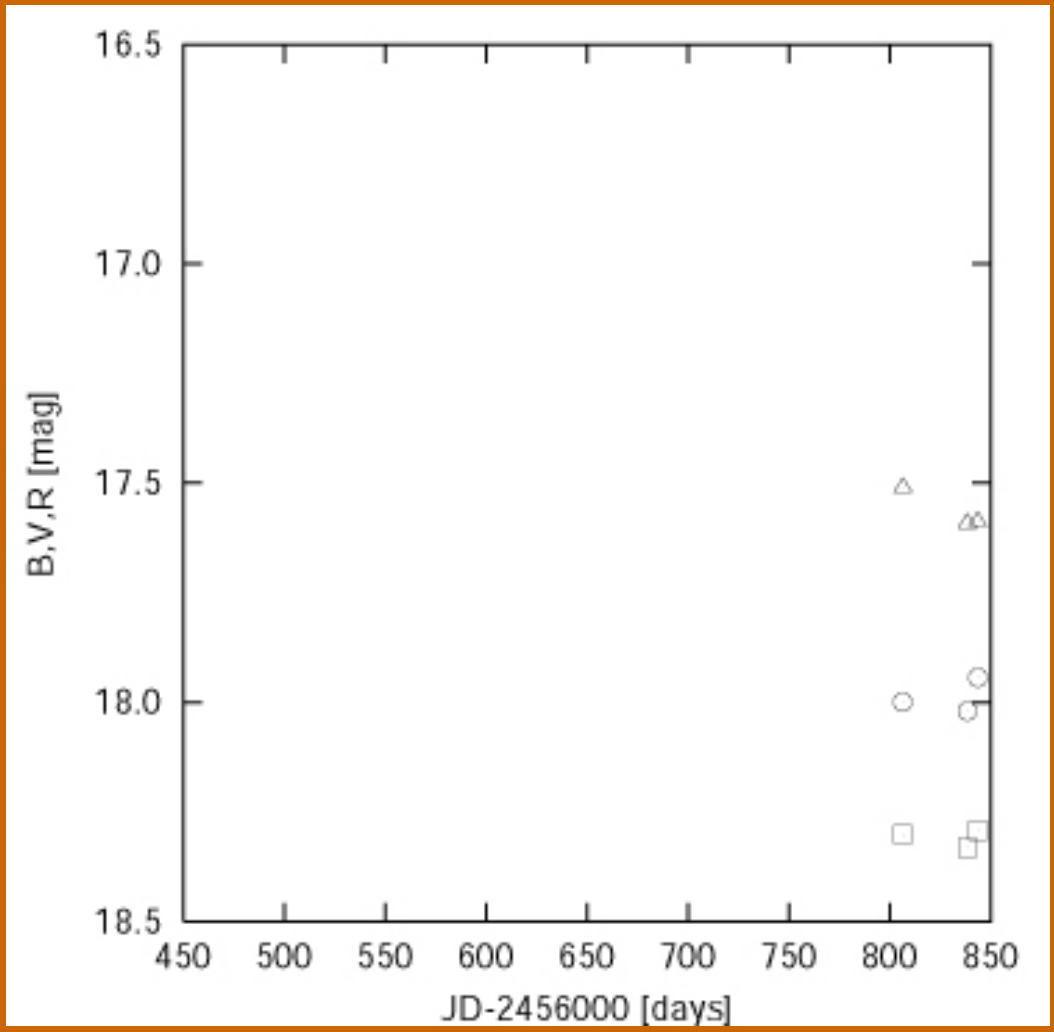
1312+240, Feb. 28th 2014 – July 4th 2014; B(.039, .046, .031, .026), V(.022, .016, .019, .012) and R(.016, .007, .015, 149)



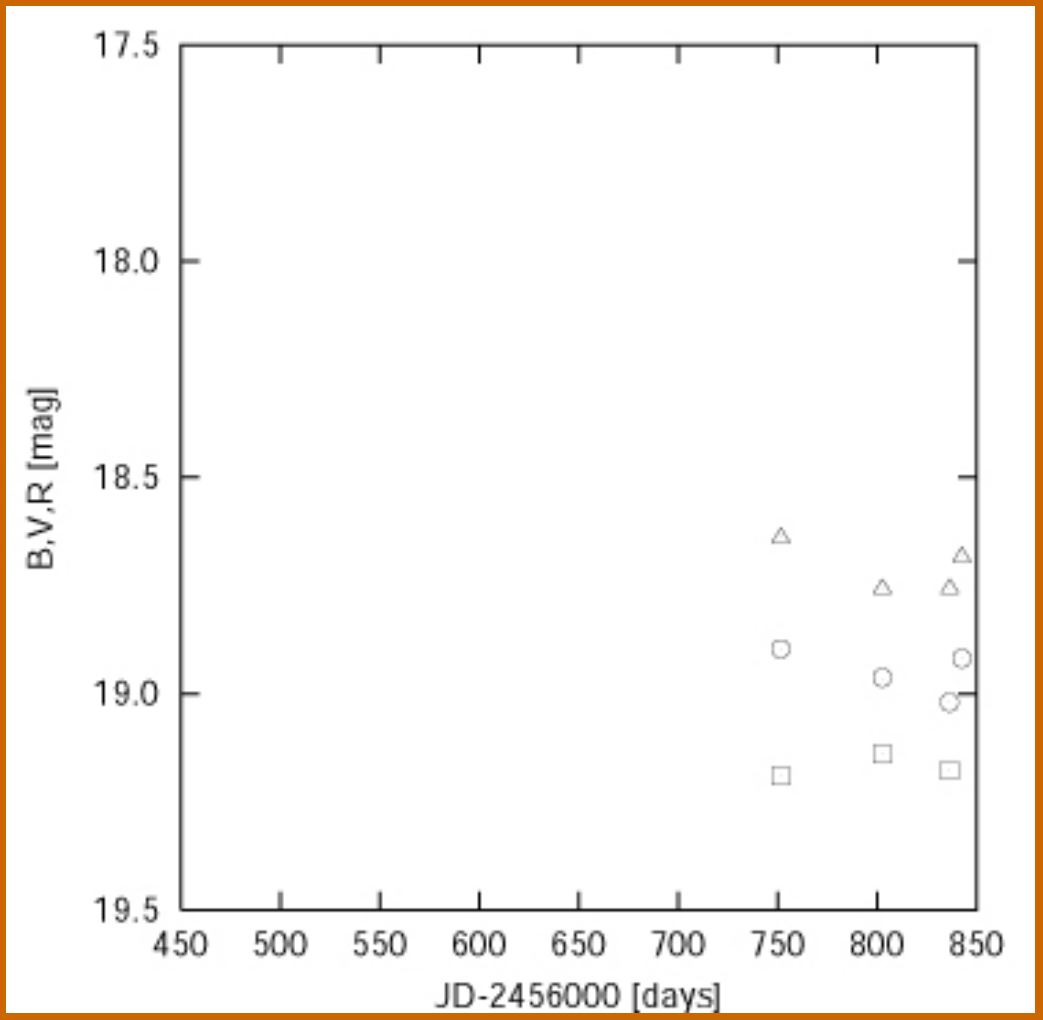
1429+249, April 3rd 2014 – July 4th 2014; B(.063, /, .055, .054), V(.022, /, .025, .024) and R(.009, /, .022, .010)



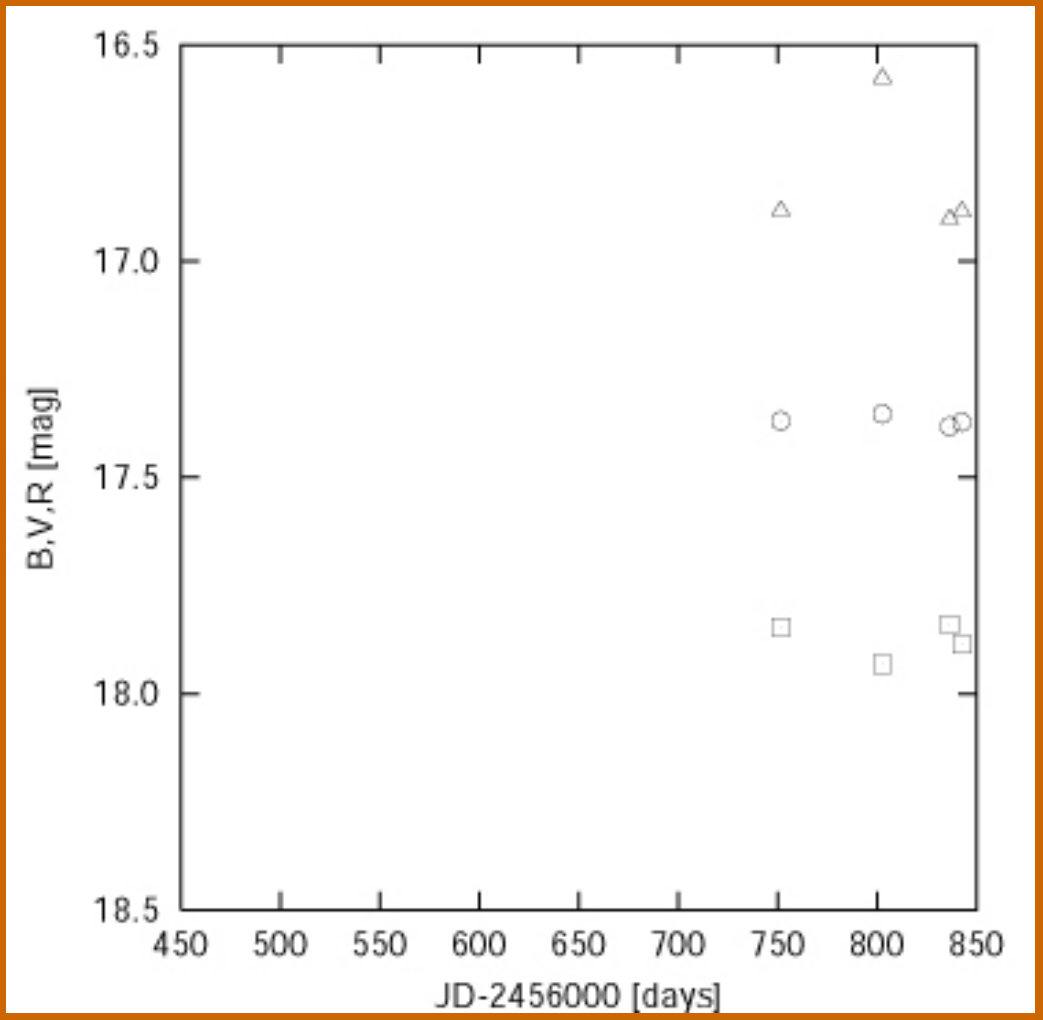
1518+162, May 28th 2014 – July 4th 2014; B(.049, .104, .086), V(.027, .019, .030) and R(.084, .013, .023)



1535+231, April 3rd 2014 – July 3rd 2014; B(.151, .110, .054, /), V(.041, .041, .046, /) and R(.057, .108, .057, .115)



1556+335, April 3rd 2014 – July 3rd 2014; B(.020, .077, .064, .096), V(.013, .025, .010, .017) and R(.015, /, .010, .009)



Conclusions

- The optical observations of QSOs are useful for photometry (SDSS, ugriz>BVR) and morphology tasks by using mentioned telescopes (and good CCD detectors); seeing=1.″5 to 3.″5, and 1.″2 for 60cm ASV.
- Correct calibration (dark, bias, flat, +dead/hot pixels) and stacking. It is possible to catch ~20mag target by using 2m Rozhen tel. and until 19.0mag (exp.<5^m) with other mentioned instruments. St.error of photometry ~order 0.01mag
- Problems: optical faintness of QSOs, atmospheric influences, technical problems, etc. Star guider for >5^m exp.

Thank you!