

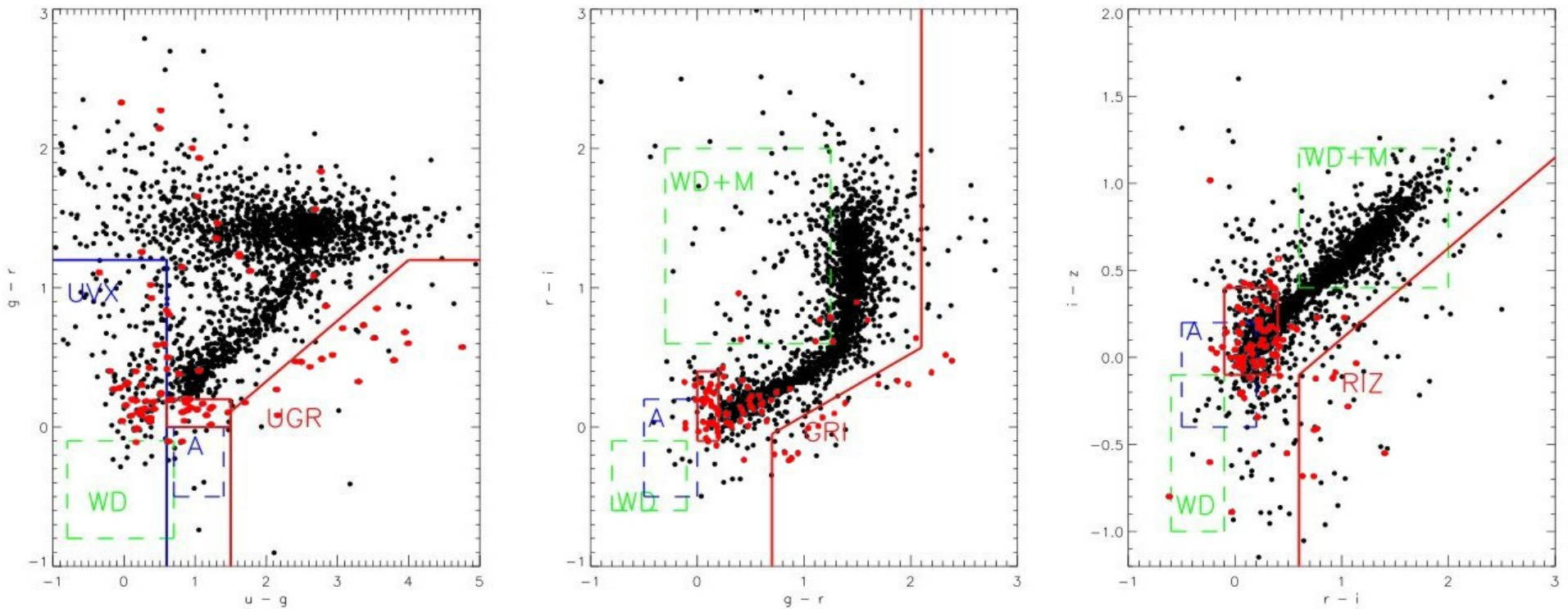
Active Galactic Nuclei Search

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Methods for QSO sample creation

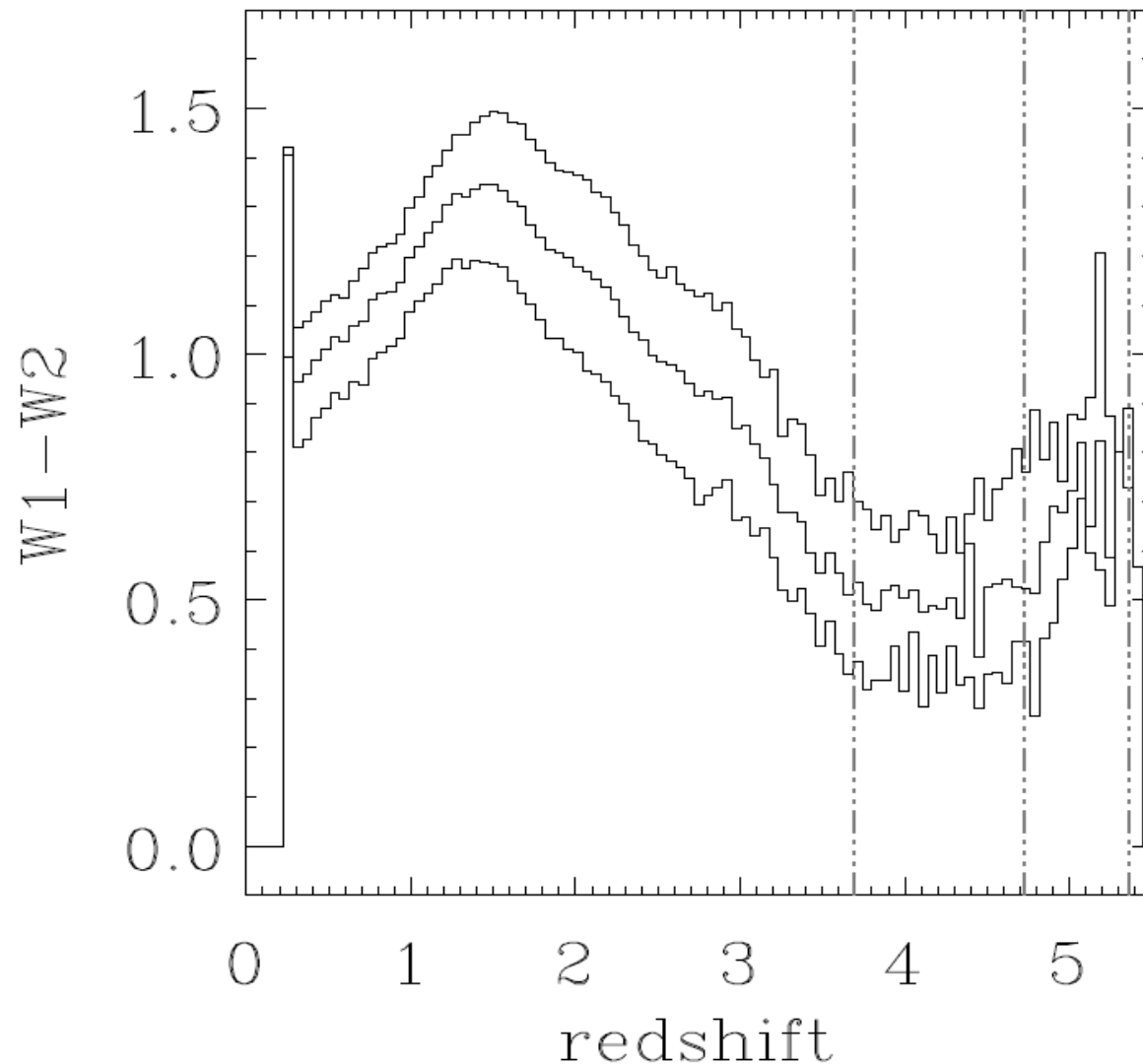
- Broadband photometry in the combination with infrared and ultraviolet surveys
- QSO selection by variability in the optical range
- X-ray surveys
- Medium-band photometry

Broadband photometry



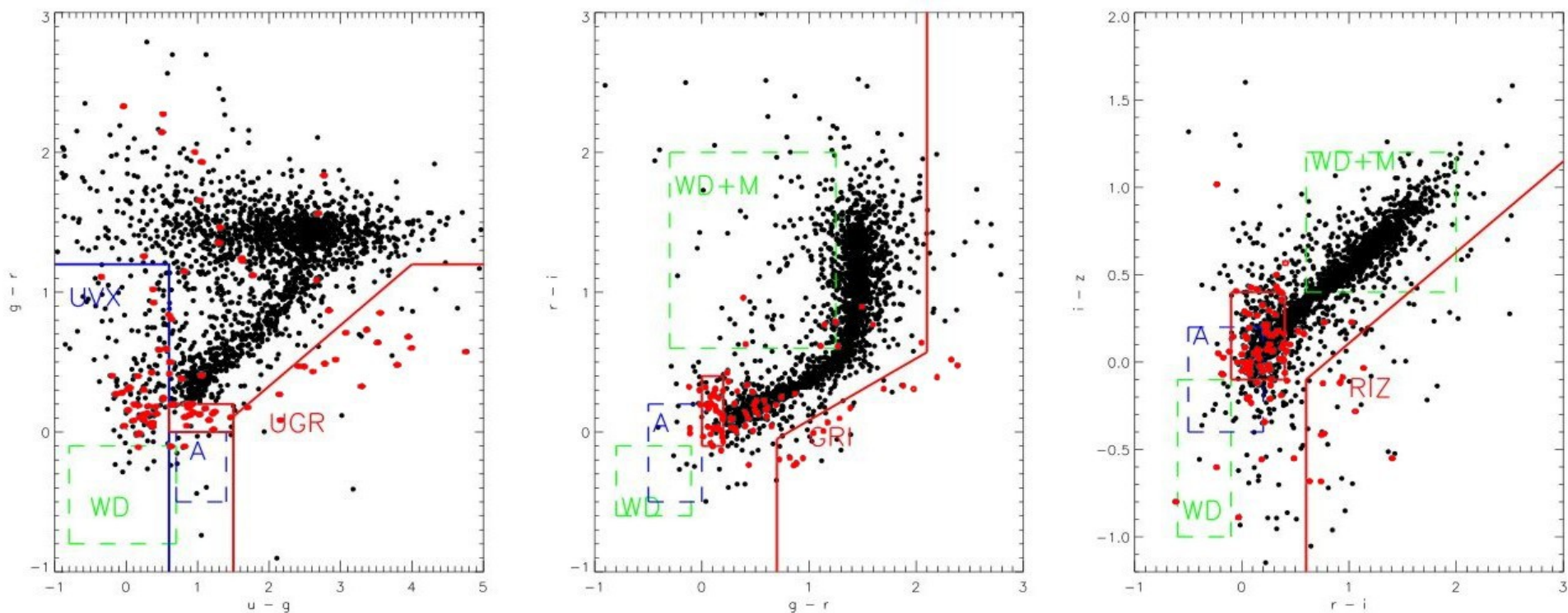
QSO color selection criteria (Richards et al. 2002)

Broadband photometry in the combination with infrared and ultraviolet surveys



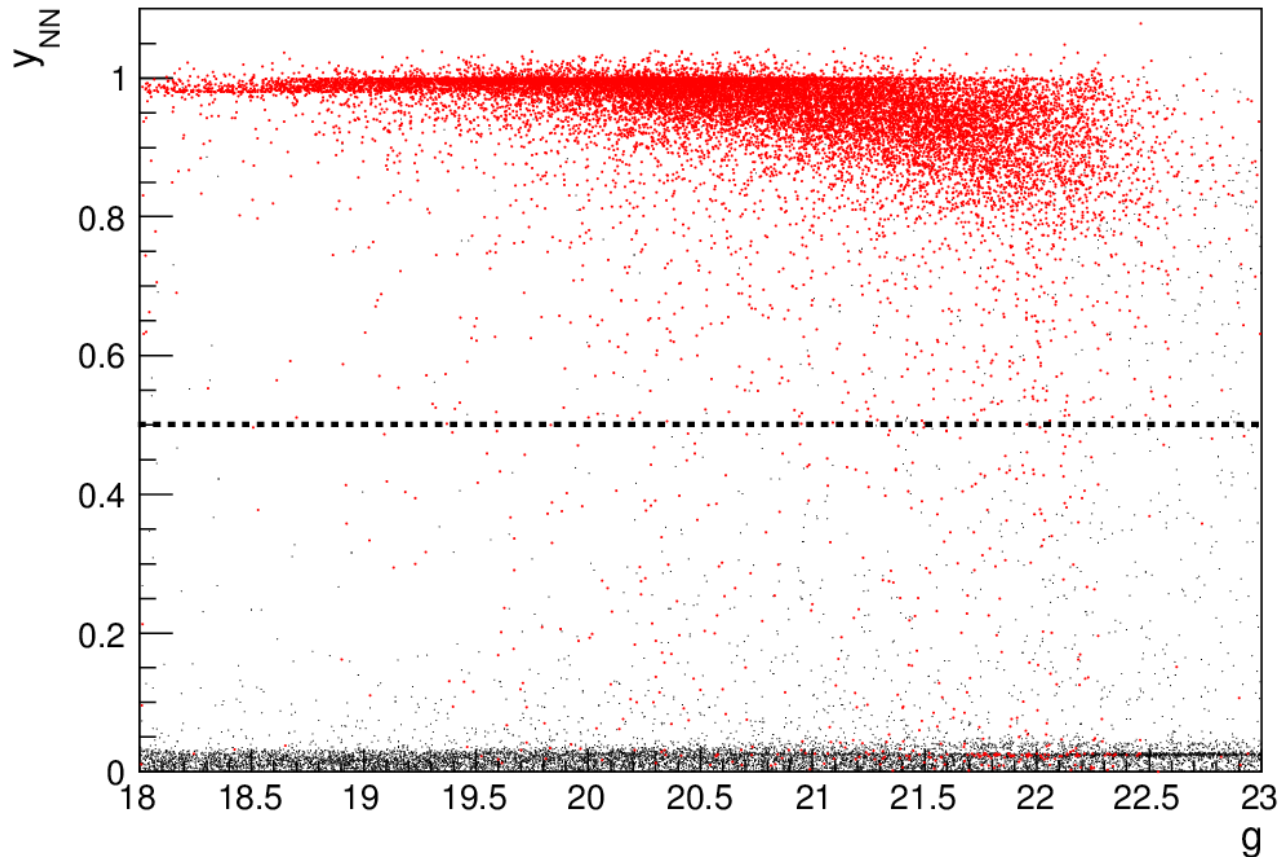
The WISE infrared colors of AGNs.
It is clearly seen that for quasars on $z > 3$ the $W1-W2 > 0.7$ criterion does not work
(Bovy et al. 2015).

Broadband photometry on $z > 3$



QSO color selection criteria (Richards et al. 2002)

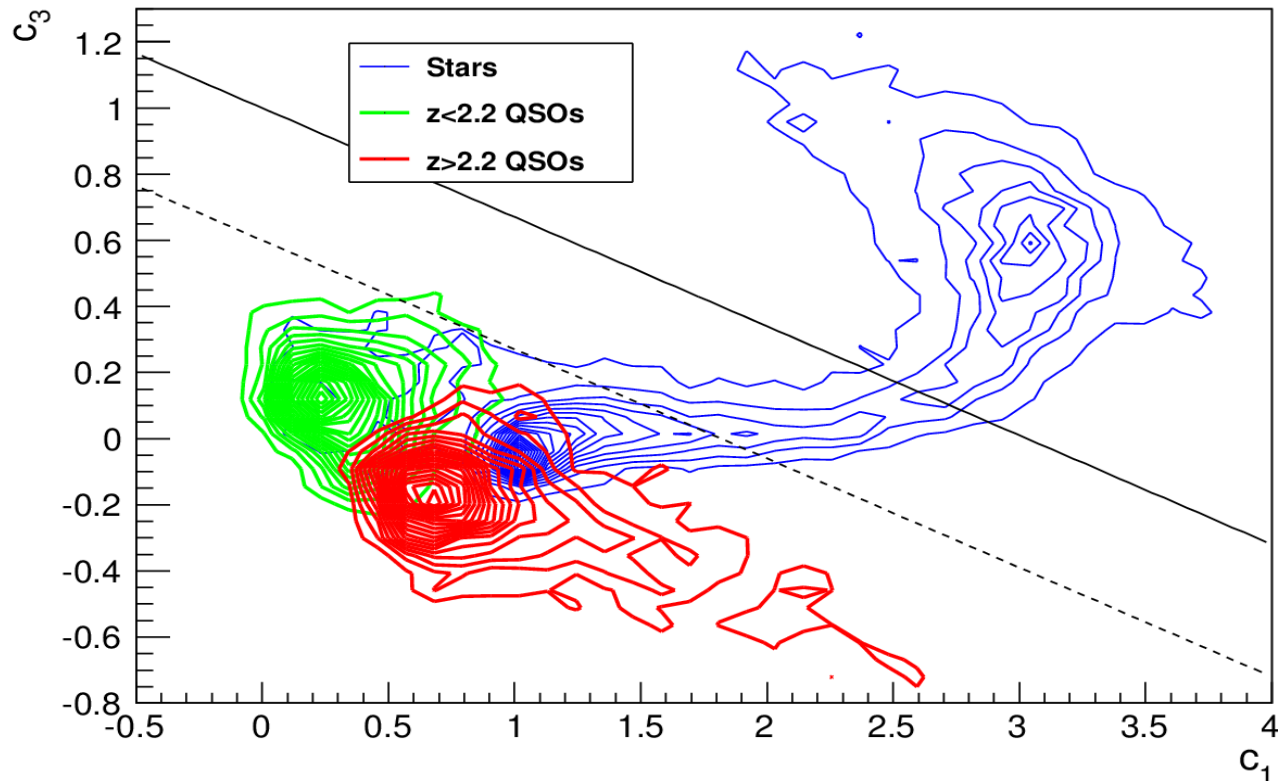
QSO selection by variability in the optical range



Output of the variability Neural Network as a function of g magnitude for a sample of known stars (small black dots near $y_{NN} = 0$) and for known quasars (larger red dots at $y_{NN} \sim 1$). BOSS targets and the MMT point-source targets are required to pass the criterion $y_{NN} > 0.5$.

(Palanque-Delabrouille et al. 2013)

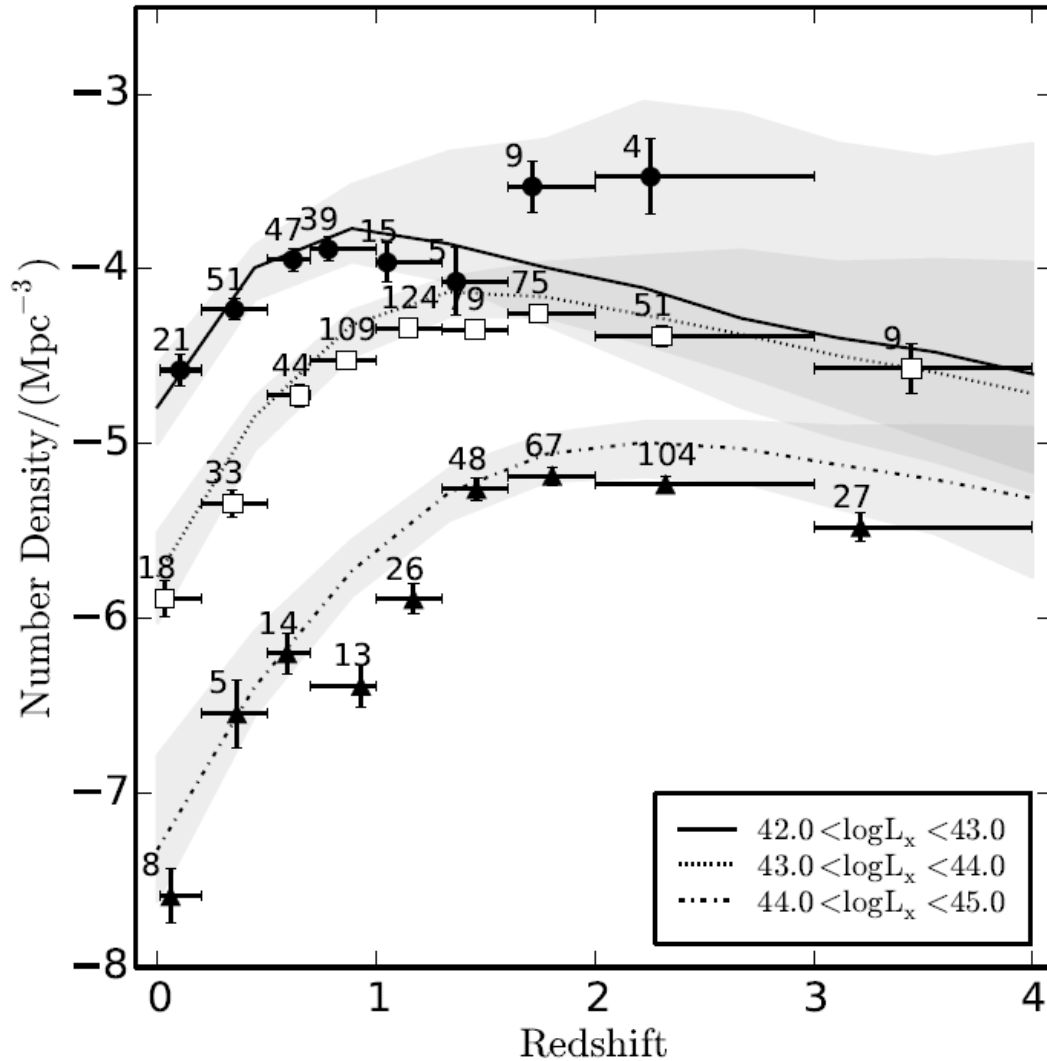
QSO selection by variability in the optical range



The BOSS+MMT color selection criteria (Palanque-Delabrouille et al. 2013). Locus of stars (upper blue contours), $z < 2.2$ quasars (lower left green contours) and $z > 2.2$ quasars (lower right red contours) in the c_3 vs. c_1 color-color plane. The upper solid line corresponds to the color cut $c_3 < 1.0 - c_1/3$ (loose, for point sources) and the lower dashed line to $c_3 < 0.6 - c_1/3$ (strict, for extended sources).

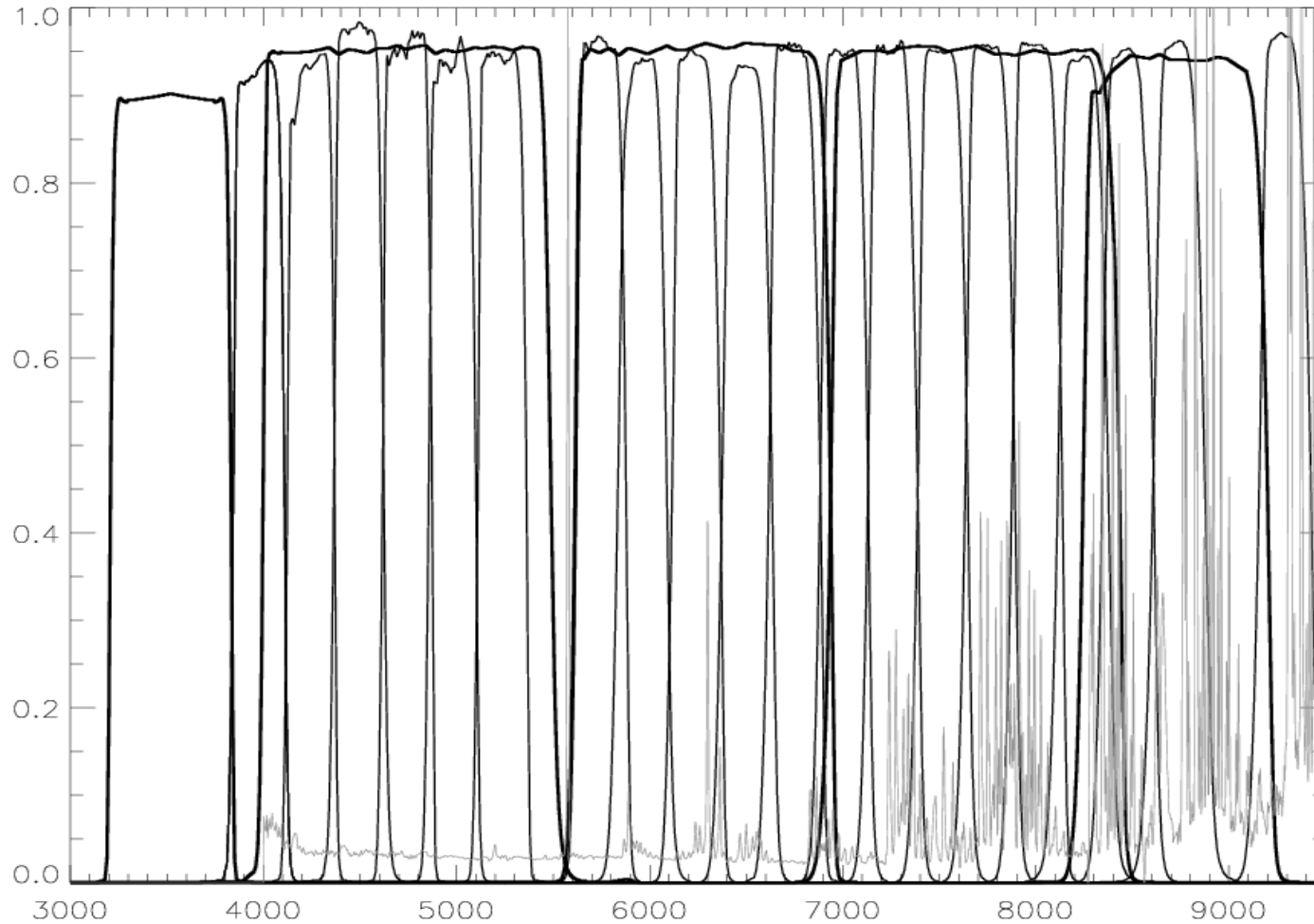
$$c_1 = 0.95(u - g) + 0.31(g - r) + 0.11(r - i) ,$$
$$c_3 = -0.39(u - g) + 0.79(g - r) + 0.47(r - i) .$$

X-ray surveys



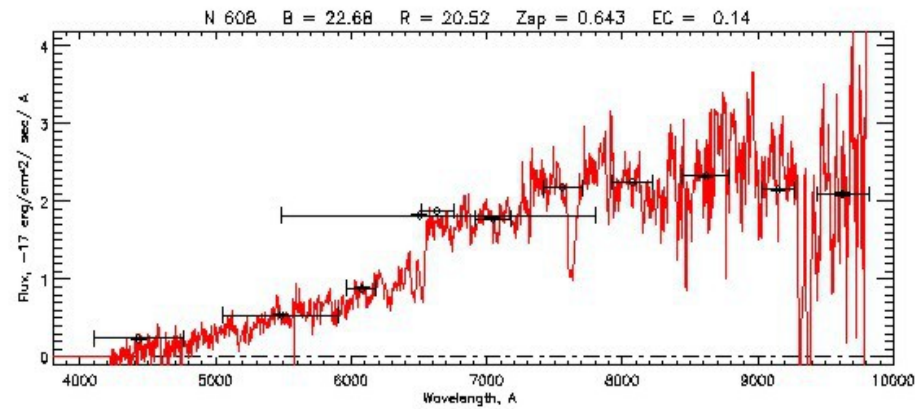
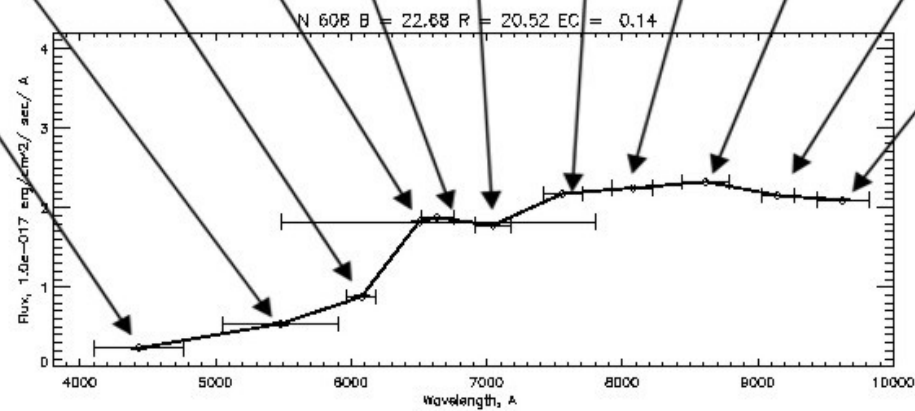
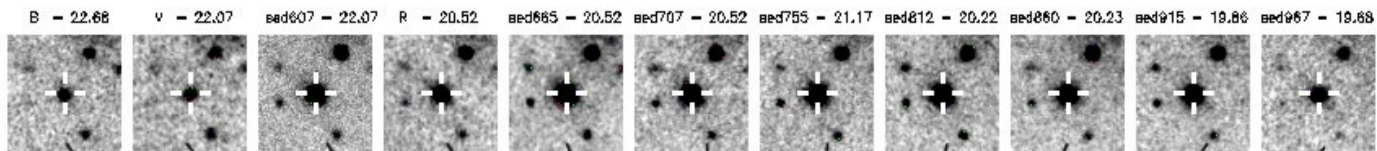
The number density of quasars from x-ray data (Hasinger et al. 2016)

Medium-band photometry

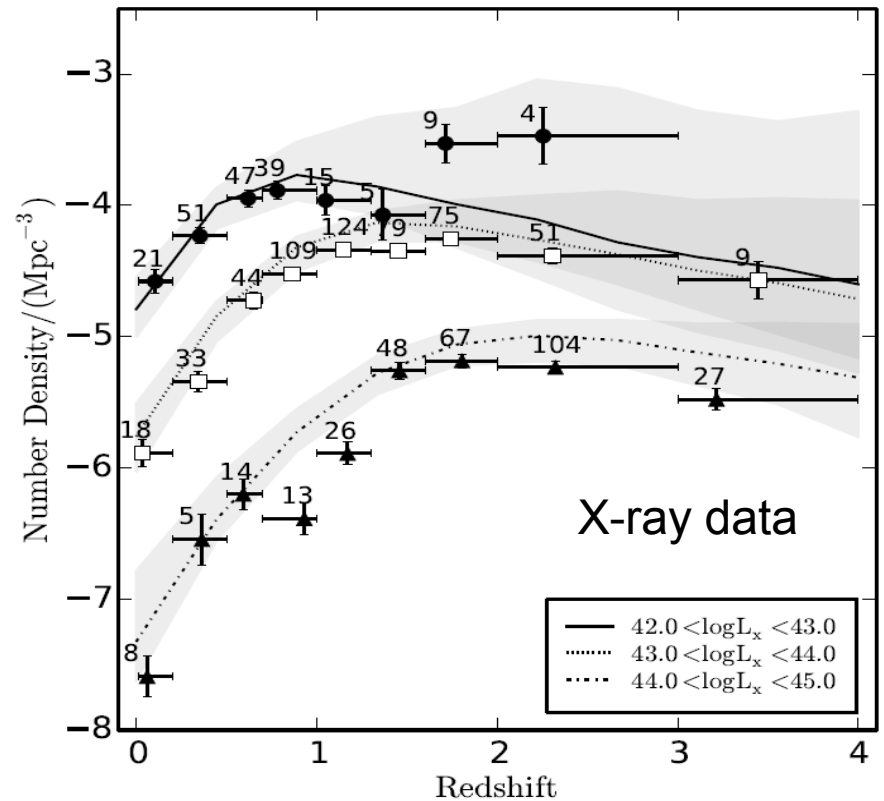
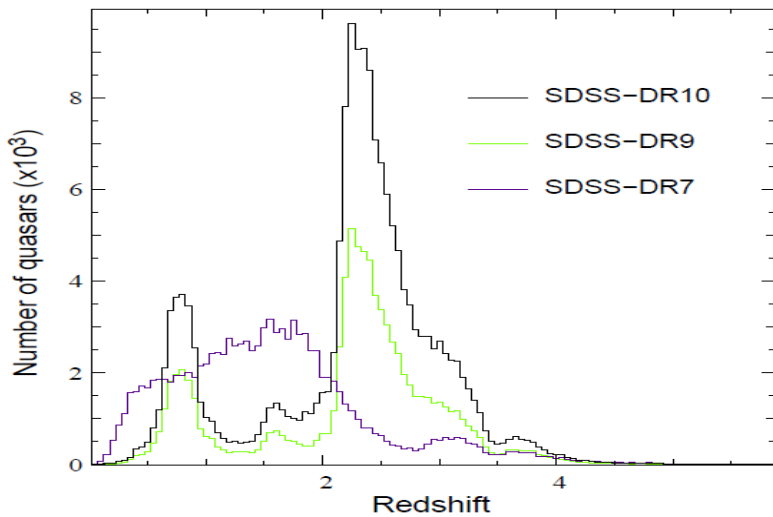
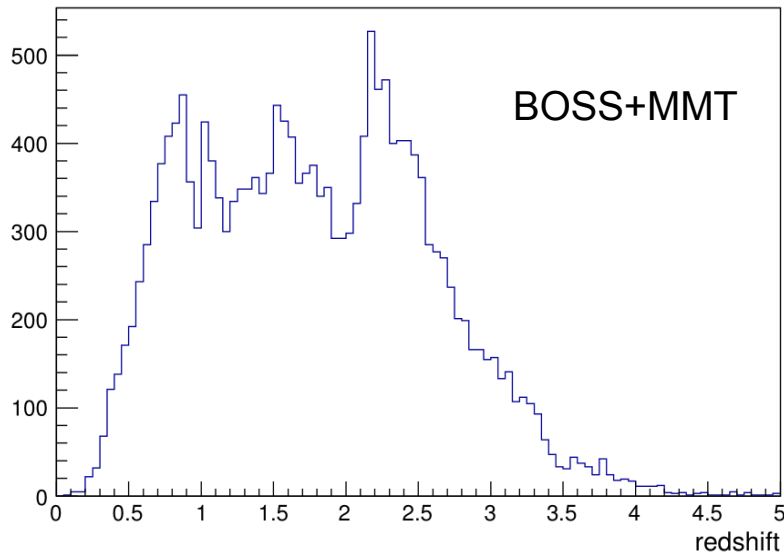


Transmission of broadband and medium-band MBBS filters.

SED construction



Number density function by SDSS DR10, BOSS+MMT and X-ray data

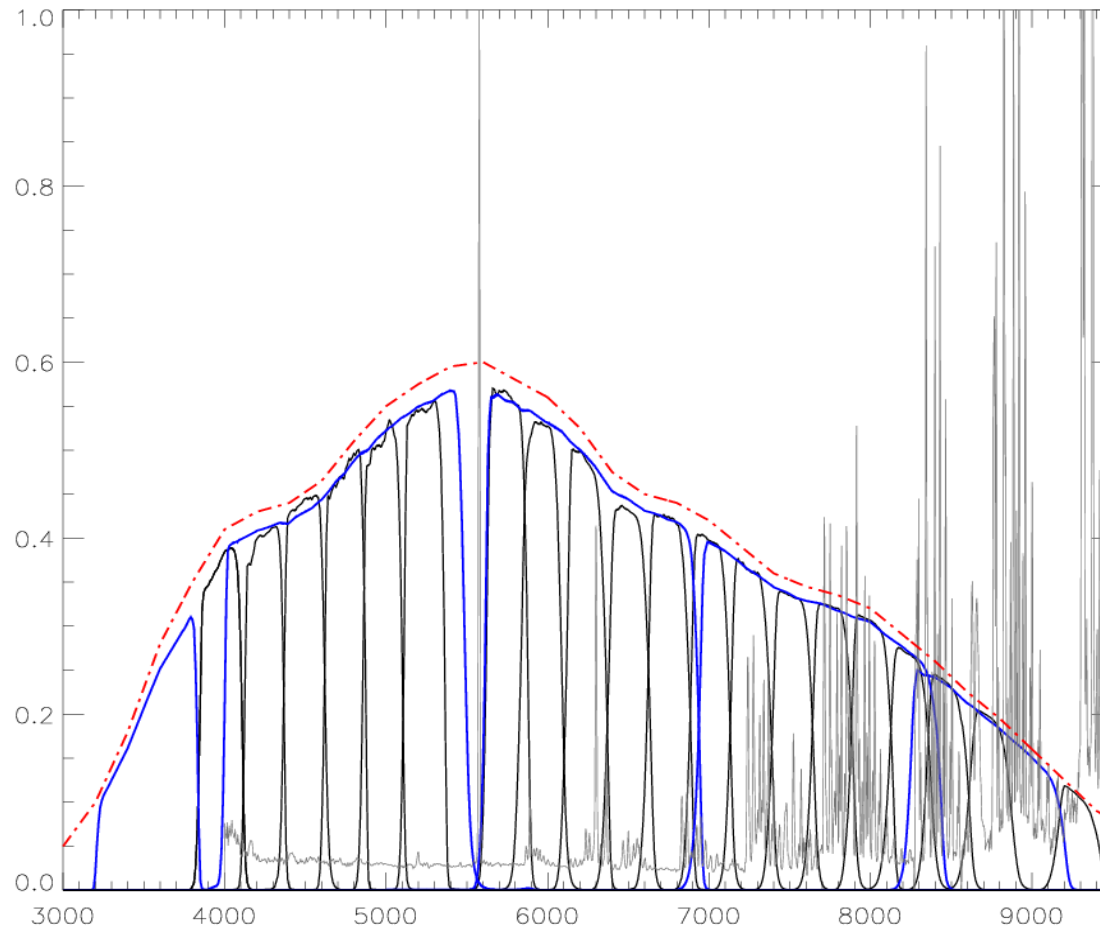


*Palanque-Delabrouille et al. 2013,
Pâris et al. 2014,
Hasinger et al. 2016.*

1-m Schmidt Telescope BAO Observations

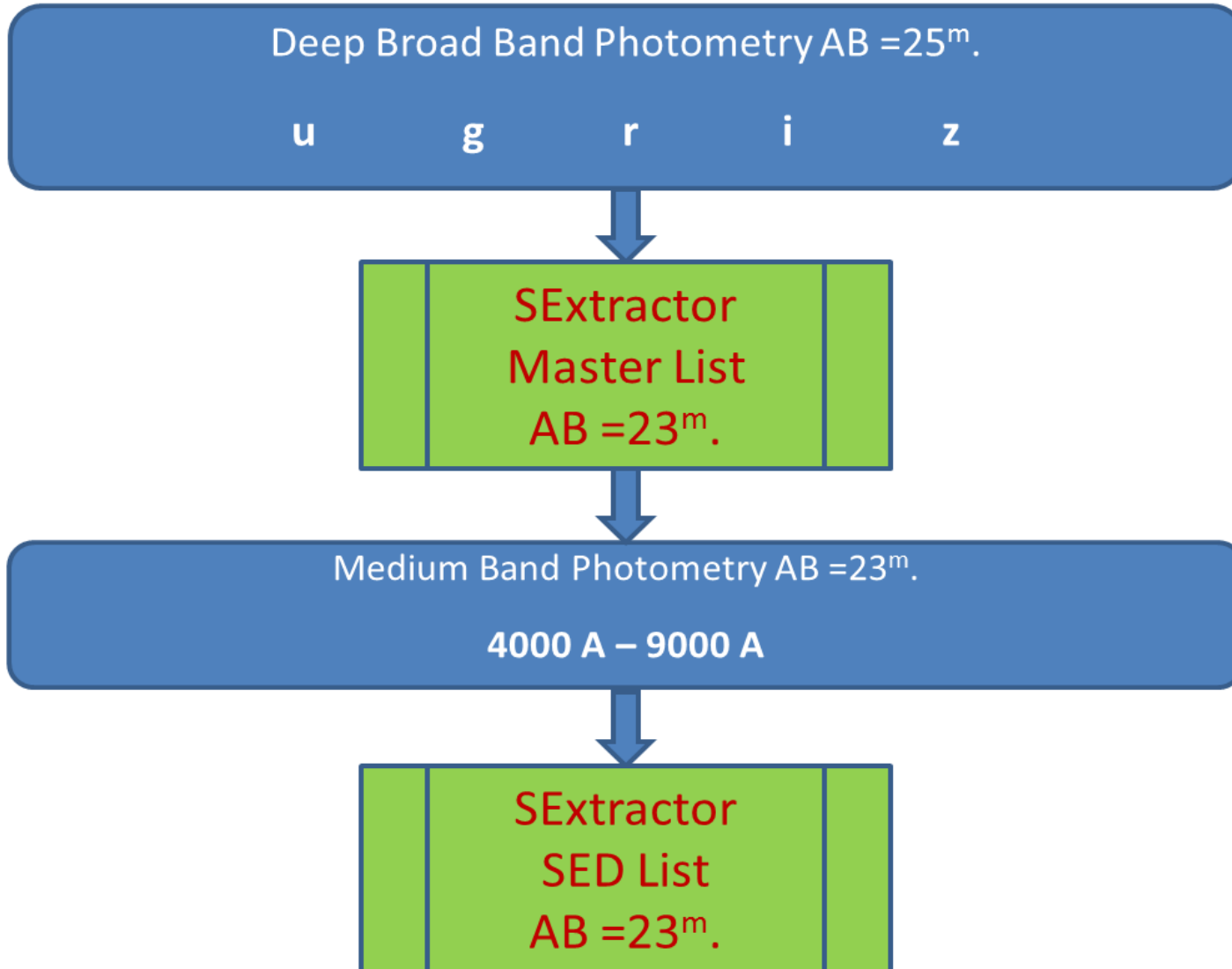
- **Apogee Alta U16M**
- Kodak KAF-16803 4k x 4k
- Pixel Size 9 μk x 9 μk
- Readout Noise <11 e
- Dark Current < 0.01 e/sec
- Q.E. (5500 A) 60 %
- Q.E. (3500 A) 35 %
- Q.E. (9000 A) 18 %

MBBS filter set



Transmission of broadband and medium-band MBBS filters, taking into account the quantum efficiency of the detector.

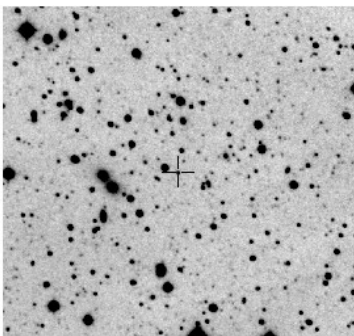
Photometry



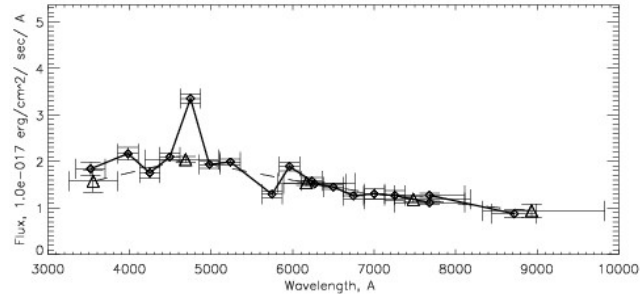
Selected quasars

Object N : 16433

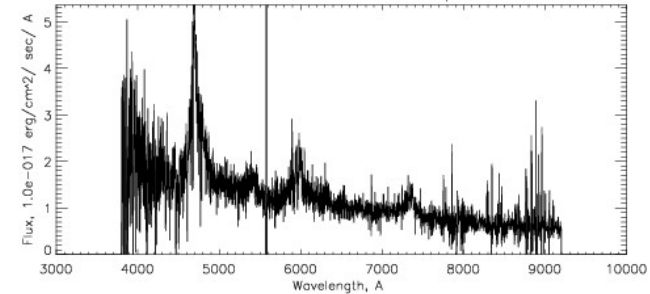
00:16:26.75
16:04:29.86



N 16433 SDSS N 5365 R = 20.65 Rsdss = 20.66 FL = 0 EC = 6 W1 = 18.41 W1-W2 = 2.42

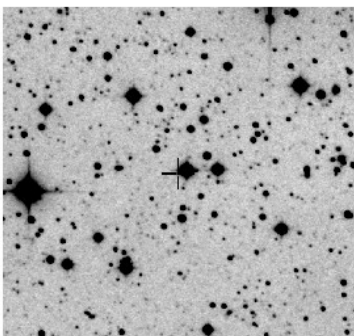


N 16433 SDSS N 5365 Zsp = 2.865

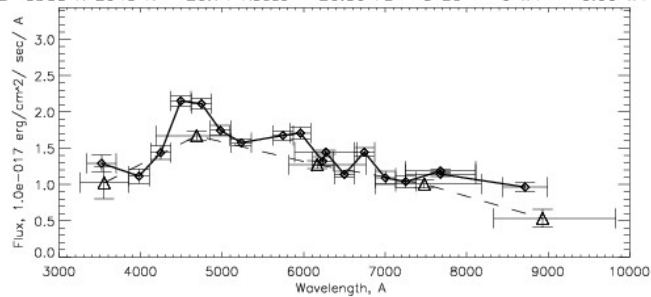


Object N : 17142

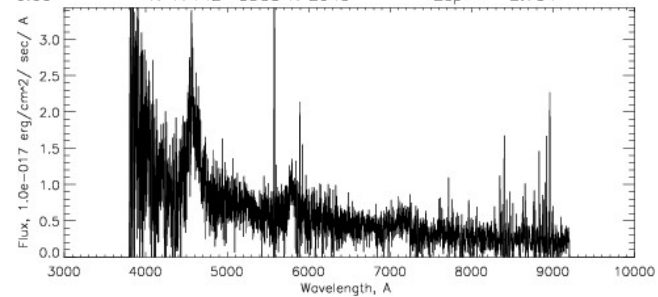
00:16:59.35
16:05:51.74



N 17142 SDSS N 2945 R = 20.71 Rsdss = 20.86 FL = 3 EC = 6 W1 = 0.00 W1-W2 = 0.00

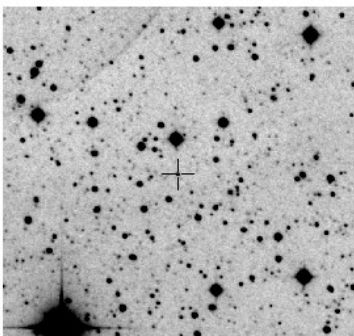


N 17142 SDSS N 2945 Zsp = 2.754

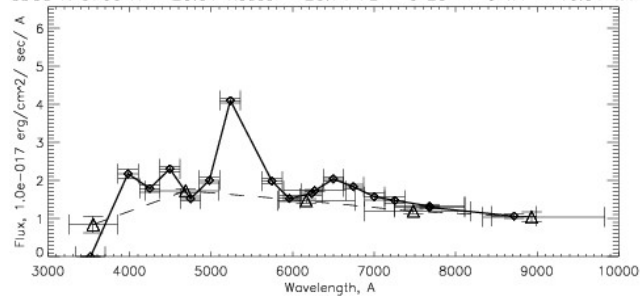


Object N : 19671

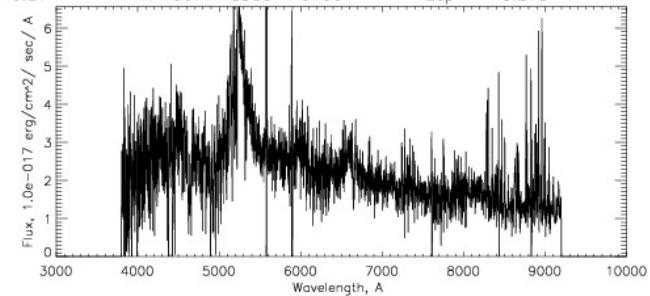
00:17:20.41
16:11:06.94



N 19671 SDSS N 5760 R = 20.51 Rsdss = 20.71 FL = 0 EC = 6 W1 = 16.91 W1-W2 = -0.21

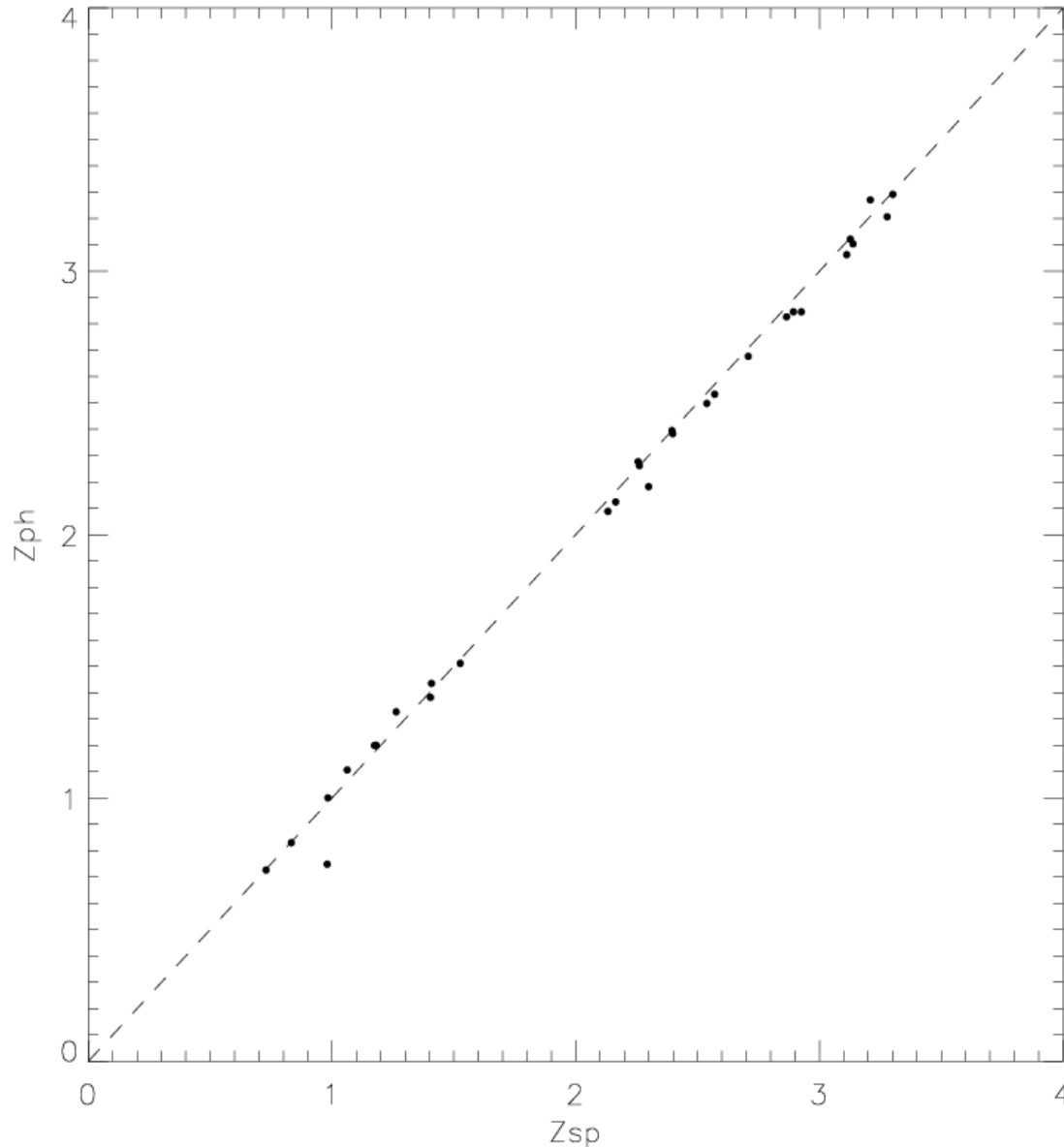


N 19671 SDSS N 5760 Zsp = 3.278



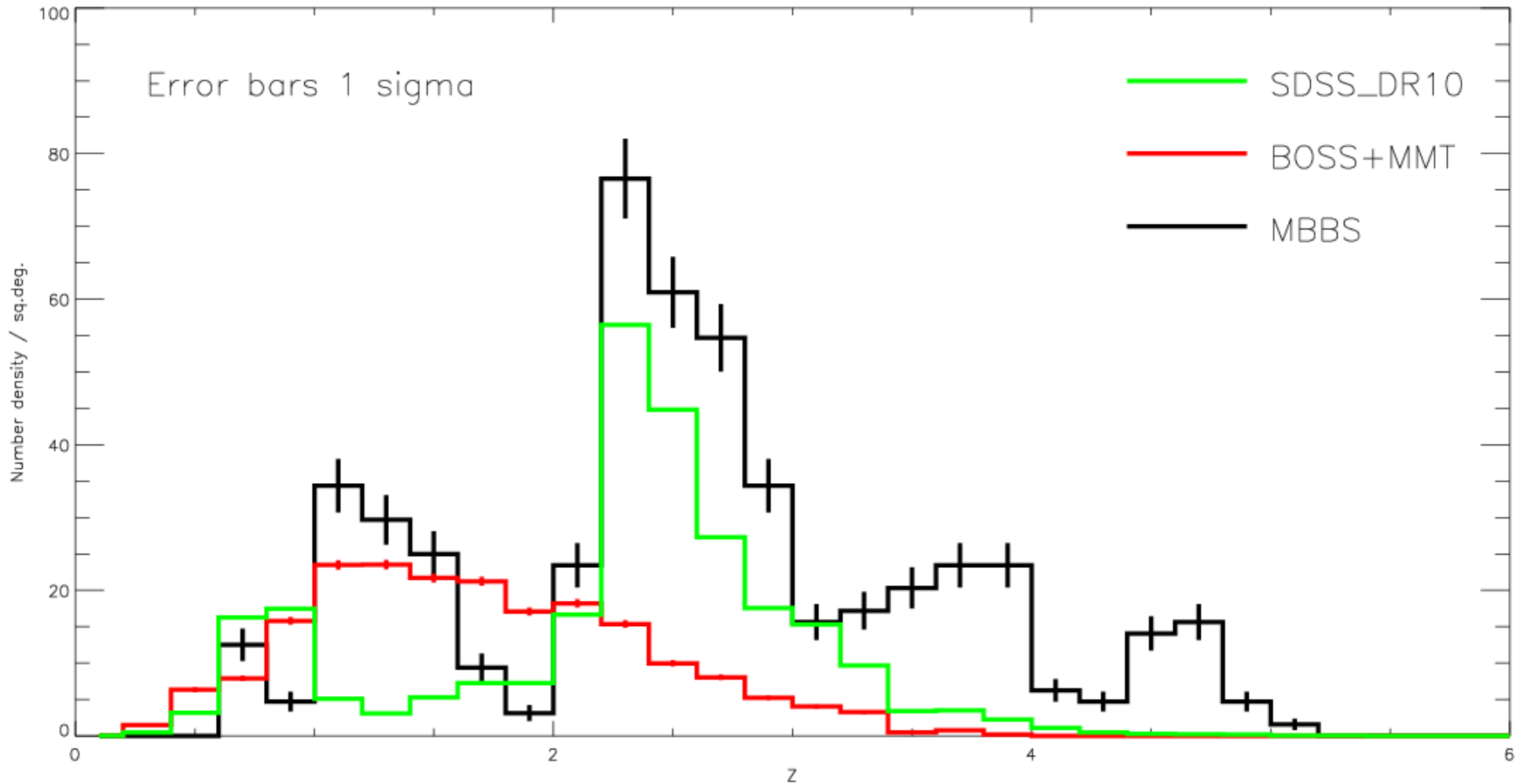
The medium-band QSO SEDs and their spectra

Redshift determination



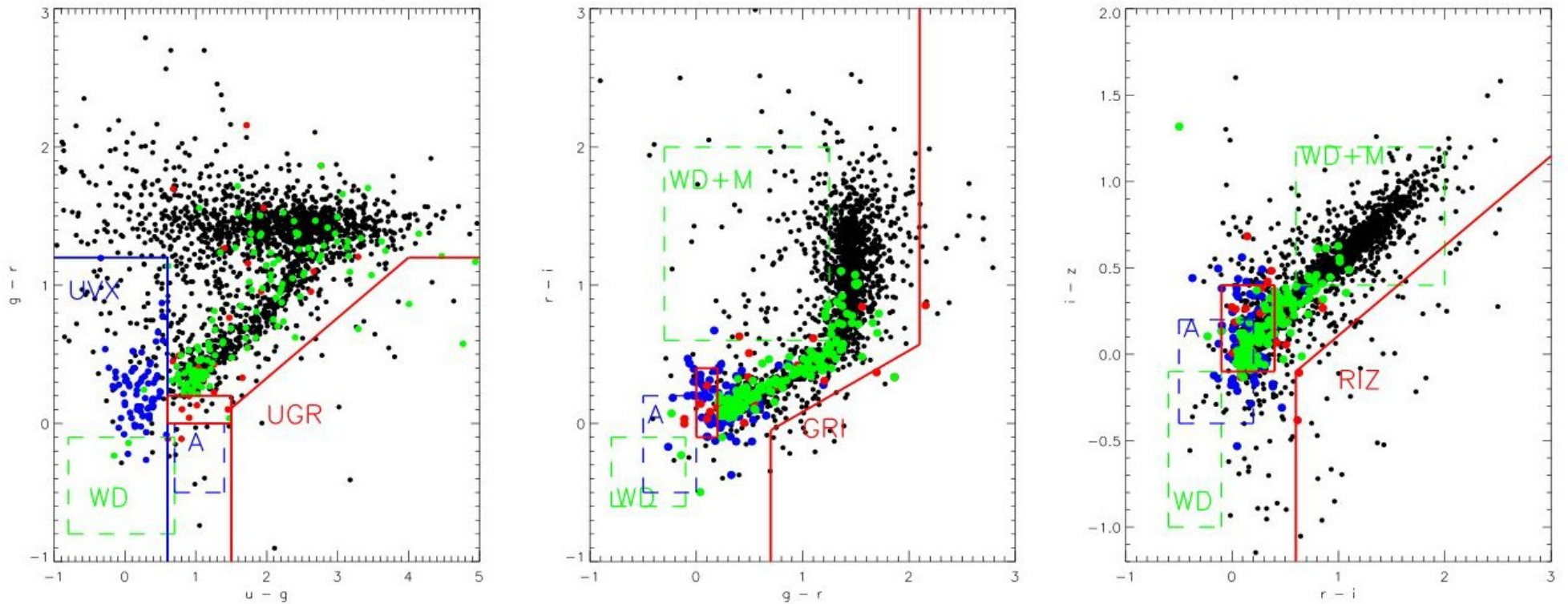
The accuracy of the photometric redshift determination from the medium-band photometry data. Along the vertical axis - the photometric redshift of quasars, along the horizontal - their spectroscopic redshift. $\sigma = 0.02$ (Dodonov 2016).

Results



*Comparison of the number density of quasars
from three different samples.
 $\Delta z = 0.2$.*

Results



*Comparison of the number density of quasars
from three different samples.
 $\Delta z = 0.2$.*