Active nuclei of distant galaxies:
Variability and physical parameters

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Активни ядра на далечни галактики:
Променливост и физически параметри

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It is well known that the AGN's are variable objects, but there is not enough data for the variability and physical properties of these objects especially of high-redshifted quasars. That was the reason to perform long-term optical monitoring of the high-redshifted radio-quiet quasar Q 2203+292 (z=4.4).

The observations have been obtained during 4 years mainly with the 2m telescope at NAO Rozhen in Cousins R-band. The spatial flux variations (Markov 2005) of the instrumental magnitudes of the objects on the images, taken with the CCD-cameras working on the 2m telescope are studied and taken into consideration. Using VLT - FORS1 image of the quasar, field with standards and the Rozhen images of Q 2203+292 we defined 24 reference stars in the field around the quasar. The magnitude errors of these stars are less than 0.04 mag and they can be used for standards in other studies of objects near the quasar field.

We found only 4 other observational data (McCarthy et al. 1988, Schneider et al. 1989, Crampton et al. 1992, Crampton - private communication 2007) of the quasar. Since some of them were observed in filters other than the R_C filter used by us, we calculated R_C-r for redshift z=4.4 using the Q 2203+292 spectrum from Constantin et al. (2002) convolving it with the transmission curves of the standard R_C filter and the other r-filters used in the literature studies. We have also taken into consideration the different zero-point fluxes for the used photometric systems. After the homogenization of the data we detected a variability of 0.9 mag during the last 20 years, i.e. 3.7 years in the rest-frame of the quasar. The detected variability during our monitoring is 0.3 mag.

The structure function of the quasar Q 2203+292 is estimated for the first time. Using our own quasar spectrum, build from the median spectra of Constantin et al. (2002) and Vanden Berk et al. (2001) we calculated

R_C–r as a function of redshift z ($0 < z < 5$) to have universal comparison between different r-filters and to derive K-corrections for a comparison of the properties of Q 2203+292 and the SDSS QSOs (Schneider et al. 2005). We calculated the absolute luminosity (M_R=–29.39 mag) and the minimum mass of the emitting gas in the quasar broad line region ($M_{BLR} = 0.29 - 0.44 \, M_\odot$), following Baldwin et al. (2003).

We carried out a search for associated with the quasar emission line objects, using narrow band filter, centered at 6572Å, corresponding to Lyα at z=4.4. In field of view 5 arcmin^2 we found no evidence for sources with emission lines falling into the bandpass of our narrow band filter down to a surface brightness level of $\sim$24.5 mag/arcsec^2.

Except the study of Q 2203+292 in the thesis are discussed also the international multi-wavelength campaigns for five blazars, carried out in the last years. The original observations (more than 630 points in the light curves), obtained with the 50/70 cm Schmidt telescope and 2 m telescope at NAO Rozhen are taken into account.

In the last chapter the possibility for estimation of the black hole masses of a sample of SDSS quasars using their broad emission lines and the continuum luminosity is discussed. The procedure is based on the virial theorem. We found that S/N$\geq$20 is needed to obtain well-constrained line decomposition. The intervening absorption is a major problem and it limiting our automatic processing to $\sim$20% of the SDSS QSO sample.

Key words: quasars: variability, energetics; distant quasars: Q 2203+292

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