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Photometric Monitoring of Selected Quasars: The Highly Luminous Quasar HS 1946+7658

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Abstract. We present and discuss Johnson – Cousins V and R photometry of the highly luminous quasar HS 1946+7658 ($z = 3.051$). We found no evidence for strong variability during one year of monitoring.

1. Introduction

The quasar HS 1946+7658 is the most luminous quasar discovered up to now – it has an absolute magnitude of -31.1 ($H_0 = 50\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$, $q_0 = 0$, Galactic reddening taken into account) at a rest wavelength of 1450 Å (Hagen et al. 1992). Hagen et al. (1992) found that the quasar had in 1986 approximately the same brightness as in 1991. Kuhn et al. (1995) obtained V magnitude of the quasar to be 16.17 ± 0.02 that is close to the approximate V magnitude derived by Hagen et al. (1992). These data points are too sparse but it seems that the quasar is not strongly variable. We need a lot of data points in order to say more about the variability of HS 1946+7658. To solve this problem, we carried out an HS 1946+7658 monitoring program since July 1997.

2. Observations and Data Reduction

Observations were performed using a 1024×1024 Photometrics CCD camera attached at the RC focus of the 2-m telescope at the NAO – Rozhen. Standard broad-band Johnson – Cousins V and R filters were used. Several frames per night in each filter were usually taken; the seeing was better than 2.″5 during all nights. The frames were bias subtracted, flat-fielded and cosmic rays cleaned using procedures under MIDAS.

We made relative photometry – the quasar flux was measured relative to six field stars, in order to be independent of the photometrical conditions. No absolute calibration of the magnitudes of the comparision stars was made. The instrumental magnitudes of the quasar and comparision stars were obtained through aperture photometry with an aperture radius equal to the estimated FWHM of the frame. The magnitude differences $\delta_{klmn} = mag_{kmn}^{(\mathrm{quasar})} - mag_{klmn}^{(\mathrm{star})}$ (here k counts the frames obtained during a given night, l counts the comparison stars, m is V or R filter and n means epoch of the observation) obtained for a given set of values for l, m and n were weighted averaged over k. The variations of these averaged diferences relative to its mean value (over n), namely the quantities $\Delta\delta_{lmn} = \delta_{lmn} - \delta_{lm}$, were plotted together for all l. We found that

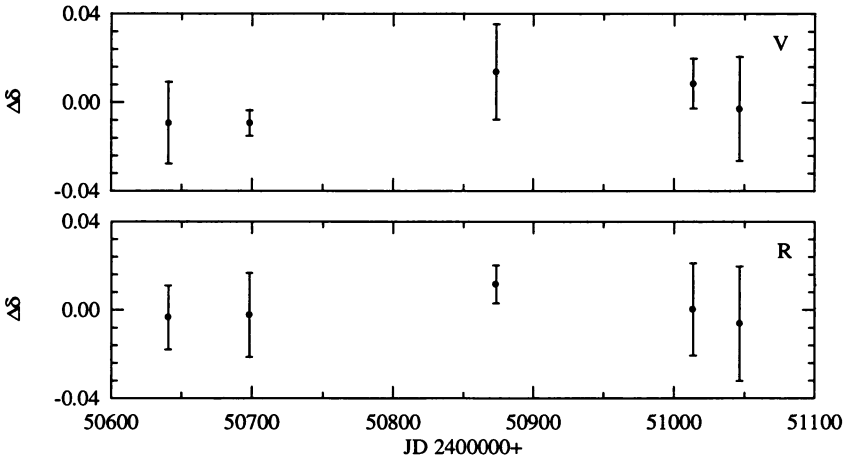

Figure 1. The quantity $\Delta\delta_{mn}$ for V and R bands.

$\Delta\delta_{lmn}$ for two of the comparison stars showed large deviations and we discarded these stars. Finally, for each epoch n, $\Delta\delta_{lmn}$ were weighted averaged over l to produce the final result $\Delta\delta_{mn}$ that is plotted on Fig. 1 for V and R bands. The error bars plotted are calculated from $\sigma^2 = \sigma^2_{\rm phot} + \sigma^2_{\rm star}$ where $\sigma^2_{\rm phot}$ is the error obtained from aperture photometry, and $\sigma^2_{\rm star}$ is max $|(\Delta\delta_{lmn} - \Delta\delta_{mn})|$.

3. Discussion

Our photometric measurements in both bands are consistent with an almost constant flux: there is slight evidence for a weak brightening at the beginning of 1998 followed by fading (Fig. 1). Both light curves are well fitted by a third order polynomial. Due to the lack of absolute calibration we cannot compare our data with the above cited photometry of HS 1946+7658 in order to follow the long-term photometrical behaviour of the quasar. In the future we plan to make an absolute calibration of the magnitudes of the comparision stars and to include data points from the 0.6-m telescope at the AO – Belogradchik, as well as to obtain deep images of the field around HS 1946+7658 (see Tripp et al. 1996).

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