VILNIUS CCD PHOTOMETRY OF NGC 4755 AND 47 TUC

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Abstract. CCD observations of the southern clusters NGC 4755 and 47 Tucanae were obtained in the Vilnius photometric system. A brief outline of the data pathway from observations to final analysis via IRAF and ASCAR software is given.

Key words: methods: observational – techniques: image processing, photometric: – globular clusters: individual: 47 Tuc – open clusters: individual: NGC 4755

1. INTRODUCTION

In light of the capabilities of the Vilnius photometric system (Straižys 1992a,b), the idea of extending the system to the southern hemisphere was first considered in 1985, given that none of the already established standard regions (e.g. Zdanavičius et al. 1969, Černis et al. 1989, Černis & Jasevičius 1992) extended south of the celestial equator. This program commenced in 1988 using the 61 cm telescopes at Mount John University Observatory (MJUO) is well advanced; see Forbes, Dodd & Sullivan (1993, 1994), Dodd, Forbes & Sullivan (1993) and Zdanavičius et al. (1995) for further details. Here we describe an attempt to set up the Vilnius system with the

CCD camera of the MJUO. Test frames were acquired for the open cluster NGC 4755 and the globular cluster 47 Tuc.

2. OBSERVATIONS

The observations were made using the 1 m telescope at MJUO (operated by the University of Canterbury) located near Lake Tekapo in the South Island of New Zealand. A cryogenically-cooled CCD camera consisting of a Thomson TH7882 CDA chip with 384×576 pixels, each 23 μm square, operated at $-110°$ C was used. The pixel size corresponds to 0.6 arcsec at the f/7.9 Cassegrain focus of the telescope. Images were collected using the Photometrics PM-3000 computer running FORTH software with extensive local modifications and written to half-inch 9-track magnetic tape for transportation back to Victoria University for reduction. Images from these tapes were then converted into FITS format (Wells, Griesen & Harten 1981) from the native Photometrics one, and read into the Image Reduction and Analysis Facility (IRAF) where subsequent reduction took place. A description of the data pathway and image processing facility can be found in Banks (1992), and of the MJUO data acquisition system and its characteristics in Tobin (1992).

Table 1. Integration times (seconds) of CCD observations.

Cluster	U	P	X	Y	Z	V	S
NGC 4755	70	120	220	10	5.5	7	8
47 Tuc	1200	1000	600	200	150	210	300

Integration times for the observations obtained on December 4, 1994 are given in Table 1. The CCD frames were reduced using the crowded field photometry package DAOPHOT (Stetson 1987), as implemented in IRAF. Seeing was poor during the observations, with a mean of 3.1 arcsec. The cluster NGC 4755 was observed through some clouds.

Instrumental magnitudes and colors were converted to the standard Vilnius system using nine stars within the cluster whose magnitudes had been previously determined photoelectrically. For 47 Tuc only two photoelectric standards were available.

The standardization equations were of the form:

$$m_C = m_{IC} + a_0 + a_1(Y - V)$$

where m_C is the standardized magnitude through the filter C, m_{IC} is the instrumental magnitude through the filter C, a_0 is the zero point shift, and a_1 is the color-term coefficient. The mean rms difference between the transformed CCD and photoelectric magnitude determinations was 0.02 mag.

3. CLASSIFICATION OF STARS

The classification of stars in NGC 4755 and 47 Tucanae was performed using an Automated Stellar Classification and Reporting (ASCAR) software package, which was developed at the Astronomical Institute of the University of Rome "La Sapienza". This package contains two classification techniques:

(a) a comparison method (Sigma-Q) which utilises the main Vilnius Reference Catalogue to select the best match between a program star and a star in the reference catalogue (Smriglio et al. 1986), and

(b) the Graphic Interactive Classification (GIC) method, which uses calibrated Q-Q, Q-color and color-color diagrams as described by Straižys (1992a).

The accuracy in the classification depends primarily on the accuracy of the photometry and secondarily on the quality of the reference catalogue stars. Smriglio et al. (1989) have shown that the Sigma-Q classifications are in good agreement with the published MK classifications. The GIC classifications are achieved interactively with an estimate of the photometric errors on the classification in each Q-Q diagram.

The results of classification of stars and investigation of the parameters of the clusters will be published later, after obtaining more CCD frames and increasing the accuracy of photometric data.

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