

A CCD Camera (ST-6) at Rozhen Observatory: the BVRI System

Abstract. The use of the BVRI system with Shott filters at Rozhen (1750 m above sea level) is described. The mean colour equations are given. The instrumental system occurs close to the standard and only the R system is slightly deviated to shorter wavelengths. The mean extinction coefficients in BVRI are 0.38, 0.26, 0.18 and 0.12 respectively (based on data taken in the Summer of 1993).

Beginning in the Summer of 1993, a SBIG Model ST-6 camera became operational at the RC focus of the 2m telescope of the Rozhen Observatory. This camera was kindly made possible by EAS/ESO support of astronomy in the Central/Eastern European countries.

The dimensions of the CCD camera ST-6 array are 242 x 375 pixels, the scale is 0.30 x 0.34 arcseconds per pixel and the image size is about 1.5 x 2.0 arcminutes. The working temperature of the camera is -40 degrees and the typical exposures are 10 - 20 minutes. More detailed information of the camera is given in the paper by Pravec (1993). The camera ST-6 at Rozhen represents a simple and stable astronomical instrument, useful only for large fields.

A BVRI photometric system with ST-6 was made possible with Shott filters, using the recommendations of Bessel (1990), as follows:

B: 1GG13+1BG12+1BG39;
V: 2GG495+1BG39;
R: 2OG570+2KG3;
I: 3RG9.

In the period July - September 1993 we observed standard stars of Landolt (1983) and Christian et al. (1985). The observations of 24 stars from 10 good nights were used to derive the mean colour equations and the atmosphere extinction coefficients for the Rozhen Observatory (1750m above sea level). The connection between the standard BVRI system, the instrumental bvri system and the air mass $X = 1/\cos Z$, where Z is the angular zenith distance, were obtained in the range $B - V = -0.2 - 1.6$ and $X = 1.1 - 1.5$:-

$$\begin{aligned}V - v &= -0.001(b-v) - 0.259X + \text{const} \\V - v &= -0.025(v-r) - 0.259X + \text{const} \\V - v &= -0.007(v-i) - 0.260X + \text{const} \\B - b &= 0.027(b-v) - 0.386X + \text{const} \\R - r &= -0.133(v-r) - 0.173X + \text{const} \\I - i &= -0.060(v-i) - 0.125X + \text{const} \\B - V &= 1.027(b-v) - 0.128X - 0.590 \\V - R &= 1.108(v-r) - 0.086X + 0.289 \\R - I &= 0.951(r-i) - 0.072X + 0.801 \\V - I &= 1.053(v-i) - 0.135X + 1.094\end{aligned}$$

The mean square deviations of these regression coefficients are 0.04 - 0.05 mag, the maximum deviations are 0.1 mag and the estimated errors of the coefficients are about 5%. Our instrumental system occurs close to the standard one. Only the R system is slightly deviated to the short light waves.

The mean extinction coefficients, obtained from the inverse colour equations, are as follows: in B - 0.38, in V - 0.26, in R - 0.18 and in I - 0.12.

Acknowledgements

The authors express their gratitude to the Bulgarian astronomers who added observations for the investigation of the colour system — Drs. G. Petrov, A. Strigachev, N. Spassova, V. Golev, A. Staneva and H. Markov, or helped in the current work — Drs. N. Kaltcheva, L. Georgiev, P. Nedyalkov and V. Ivanov. The authors are especially grateful to Dr. R. West and Dr. M. Tsvetkov for the efforts in providing the ST-6 camera and to Dr. R. West for the stable computer 'Olivetti' for the camera.

This work was supported by the research grant F-342/1993 of the Bulgarian Ministry of Education and Science and the EAS/ESO Research Grant A-04-027/1994.

References

- Bessel, M.S., 1990. *Proc. Astron. Soc. Pacific*, **102**, 1181.
Christian, C.A., Adams, M., Barnes, J.W., Butcher, H., Hayes, D.S., Mould, J.R. and Siegel, M., 1985. *Proc. Astron. Soc. Pacific*, **97**, 363.
Landolt, A.U., 1983. *Astron. J.*, **88**, 439.
Pravec, P., 1983. Research Study Report for ALBEDO GmbH, Neubiberg, Astronomical Institute in Ondrejov, Czech Republic.

Ts. Georgiev, R. Getov, E. Semkov
Rozhen National Observatory
BG-4700 Smolyan
Bulgaria

A. Mutafov, H. Todorova
St. Kliment Okhridski University of Sofia
Bulgaria