

THE STABILITY AND ACCURACY OF THE uvby SYSTEM

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ABSTRACT. The recent analysis by Olsen (1983) of uvby data demonstrates the difficulty of comparing observations obtained with different equipment. He detected systematic errors in the standard stars of Crawford and Barnes (1970), who merged several sources. The introduction of new photometers with quasi-rectangular passbands (Nielsen 1983), which give theoretically nontransformable output, (Young 1974), could make the problem more acute.

In order to evaluate the transformation errors for stars of various types and luminosities, we have simulated observations made with standard and non-standard equipment. Large uncorrectable deviations are observed mainly for objects outside the range $0.0 < b-y < 0.4$ and in the u filter. The rectangular passbands have many advantages, however. They can be very stable and accurately reproducible. Hence the problem of transformability may not exist between such systems. Since many uvby observations are to be collected with such equipment, it could be advantageous to define a new standard "rectangular" uvby system along with the conventional one.

REFERENCES

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Nielsen, R. F. 1983, Inst. Theo. Astrophys., Oslo, Report No. 59, 141.
Olsen, E. H. 1983, Astron. Astrophys. Suppl., **54**, 55.
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DISCUSSION

LYNGÅ: The effects of interstellar extinction are different in the two systems (interference and rectangular) but this can be handled as long as the amount of extinction is known.

ADELMAN: It would be easier to synthesize uvby or other photometric colors from spectrophotometry if rectangular rather than conventional filters were used. One must be very careful in placing the bandpasses so that either errors in wavelength centering or large radial velocities will not bring strong lines into or out of the bandpass.

PHILIP: When Relyea and I did our work on matching the four-color indices to the predictions of atmospheric models, we had to take the shape of the passband into account when we calculated the relationship between the theoretical and observed colors. At this point in the work it would have been easier to have used a slot.

JASCHEK: How precisely can you define the windows of the rectangular filter? Can you repeat the positioning of the filter, say within 10 Å?

ARDEBERG: Square filters are, of course, in themselves very appropriate - at least in principle. However, for spectra that are line rich, the definition of square filters are normally quite critical. therefore, grating plus pre-selecting slot plus filter is often the best solution.

PHILIP: Erik Olsen has done four-color photometry with a grating and a slot for thousands of early-type stars and his rms errors are very small.

CAYREL: How can the Strömgren temperature index (b-y) still be a good index at spectral classes as late as M?

PHILIP: The idea of extending the four-color system to later type stars is not a new one. Bell has used the predictions of atmospheric models to construct synthetic spectra that indicate that the m_1 index should be a good indicator of metal abundance for late type stars. I used the 16 inch telescope at Kitt Peak National Observatory and observed some red giants in some of the brighter globular clusters. I calculated the delta m_1 index and found a good relation between it and [Fe/H].

ARDEBERG: For main sequence, as well as for giant stars, our comparisons between (b-y) and MK spectral type give very tight relations. This is true down to stars of middle M type.

PHILIP: When one works with Population II early-type stars it is obvious that there are great differences in the c_1 and m_1 indices for these stars and Population I stars of the same (b-y) index. If I observed one night with Crawford's filters and the next night with rectangular slots

and I was observing some peculiar stars I would not know how much of the effect was due to the star and how much was instrumental. The danger, when you go to a new system, is that you may misinterpret results for peculiar stars. A new system must be calibrated very carefully and the differences from the standard four-color system must be well determined.

PARTHASARATHY: $(b-y)$ may not be a good T_{eff} indicator for stars with anomalous CN and CH strength.

ARDEBERG: Our tight relations in the $(b-y)$, $c-(1)$ diagram is valid only for "normal" stars. Stars with CNO anomalies are not included. They certainly should be treated separately.

TOBIN: The question of bandpass shape is also important for single-channel photometers because manufacturers may now deliver interference filters with rectangular and not bell-shaped transmissions.