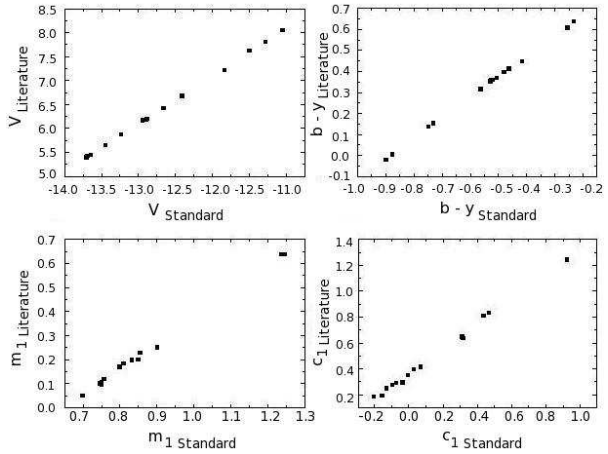

Fig. 1. Sample of the transformation correlations between instrumental and standard values for a group of standard stars for the October, 2007 season.

2.1. *Data acquisition*

Each measurement consisted of five ten-second integrations for each star. The obtained values of the standard stars and for all the observed bright stars are the average of these measurements. A ten-second integration of the sky was subtracted from the *uvby* filters and from the N and W filters that define Hβ. Individual uncertainties were determined by calculating the standard deviations of the fluxes in each filter for each star. The precision of each measurement is a function of both the brightness and the spectral type of each star, but we tried to observe them long enough to obtain a sufficient number of source counts to ensure a signal/noise ratio $N/\sqrt{(N)}$ close to a 0.01 mag accuracy.

Seasonal errors were evaluated through the diferences (calculated minus reported) of the magnitude and colors for the standard stars. Ten to fifteen standard stars were observed each night. Emphasis is made on the large range in the magnitude and color values of the standard stars (see Figure 1).

2.2. *Data reduction*

Standard data reduction procedures have been done with the numerical package NABAPHOT (Arellano Ferro & Parrao 1988). The chosen system was that defined by the standard values of Olsen (1983), and we also took some bright standard stars from the Astronomical Almanac (2006). The transformation equations (1–5) are those given by Crawford & Barnes (1970) and by Crawford & Mander (1966); in these equations D, F, H and L are the slope coefficients for $(b-y)$, m_1, c_1 and β, respectively. B, J and I are the color term coefficients of V, m_1 and c_1. The errors are calculated through the standard stars observed, evaluating the differences in magnitude and colors between the derived values and those of the literature. These differences for V, $(b-y)$, m_1, c_1 and β are ±0.010, ±0.006, ±0.007, ±0.021 and ±0.004 respectively, providing a numerical estimation of our uncertainties when transforming into the standard system.

$$V = 19.096 + 1.000(b-y) + y_{\rm obs}, \quad (1)$$

$$(b-y) = -0.002 + 0.867(b-y)_{\rm obs}, \quad (2)$$

$$m_1 = 0.981 + 0.001(m_1)_{\rm obs} + 0.375(b-y), \quad (3)$$

$$c_1 = -0.648 + 1.044(c_1)_{\rm obs} + 0.042(b-y), \quad (4)$$

$$\mathrm{H}\beta = 2.978 + 1.237(\mathrm{H}\beta)_{\rm obs}. \quad (5)$$

Table 3 lists the photometric values of the observed stars of NGC 1647 and Table 4 the values of the NGC 1778 stars, ordered by decreasing β values. Column 1 reports the WEBDA ID of the stars as listed by Paunzen & Mermilliod (2007), Columns 2 to 5 the Strömgren values V, $(b-y)$, m_1, and c_1 respectively; Column 6, the β value, Columns 7 and 8, the reddening-free indexes $[m_1]$ and $[c_1]$ (independent of interstellar extinction) derived from the observations. Column 9 lists the spectral types reported by Paunzen & Mermilliod (2007), and Column 10 the photometric spectral type obtained from the diagram $[c_1]-[m_1]$.

3. METHODOLOGY

When studying a cluster it is important to establish membership of its star on a star-by-star basis, taking advantage of the Strömgren photometry, with the calibrations made by Nissen (1988) based on the calibrations by Crawford (1975, 1979) for the A and F stars and by Shobbrook (1984) for early type stars. In the present study the determination of physical parameters, such as the effective temperature and surface gravity, has been done through the measured Strömgren photometric data in the standard system, once corrected for interstellar extinction. Theoretical $uvby-\beta$ indexes, such as those of Lester, Gray, & Kurucz (1986, hereinafter LGK86), allowed us to directly compare our photometry with that obtained theoretically. LGK86 calculated grids for stellar atmospheres for G, F, A, B and O stars in a temperature range from 5500 K up to 50000 K; they also calculated $\log g$ and $T_{\rm eff}$ as a function of the Strömgren indexes. The determination was done in the $(b-y)$ versus β diagram and in the $[c_1]$ versus β diagram (Figure 2).

The evaluation of reddening was done by establishing to which spectral class each star belongs: