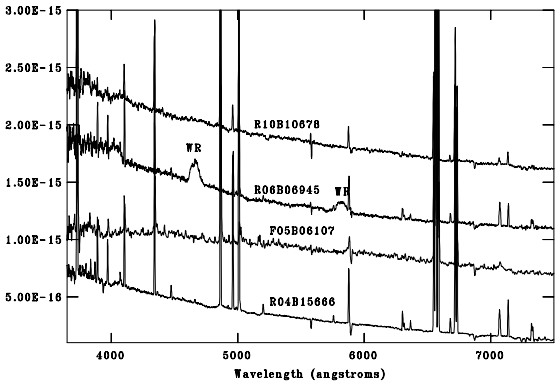

Fig. 1. Extracted spectra of 4 compact stellar clusters. The fluxes are in units of erg cm^{-2} s^{-1} Å^{-1}. The fluxes of the top 3 spectra are displaced upwards for the sake of clarity.

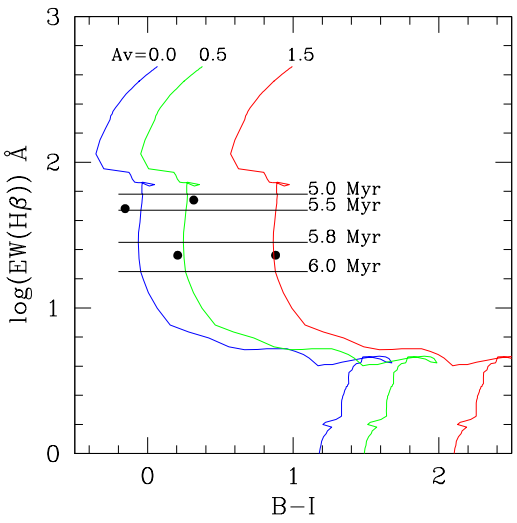

Fig. 2. Age and reddening of M81 clusters. Evolutionary track for an instantaneous burst model using STARBURST99 (Leitherer et al. 1999) is shown, rededdened by $Av = 0, 0.5$ and 1.5 magnitudes. The horizontal lines denote the EW at 4 epochs between 5 and 6 Myr.

software package. The spectra were extracted so as to include all the observed Hα emission associated to the cluster in the spatial direction. Extracted spectra of four of the clusters are shown in Figure 1.

3. RESULTS

All the targeted CSCs are found to be associated with nebular emission. In this work, we show the results for the brightest CSC, R04B15666, and three other CSCs, all brighter than $B = 20$ mag. The Hβ emission equivalent widths (EW) measured on the extracted spectra are plotted against their $F435W - F814W$ ($B - I$ for short) color in Figure 2. It can be seen that all the clusters are consistent with ages between 5 and 6 Myr, with extinction $Av < 1.5$ mag.

Considering that the 1 arcsec slit-width (18 pc) encloses a region larger than the cluster size < 8 pc (see the contribution of Santiago-Cortés et al. 2011), the presence of emission lines at the position of the cluster does not necessarily imply that the cluster stars are responsible for the ionization. Massive stars in the field and associations around the cluster could as well be responsible for the ionization. The foolproof way of establishing that the clusters are young objects is by identifying age-sensitive spectral features originating in the atmospheres of cluster stars. All the four spectra show rising continuum in the blue, without any signs of absorption features typical of intermediate-age or old stellar populations, as can be seen in Figure 1. One of the studied clusters, R06B06945, clearly shows broad emission lines, which are denoted by the letters WR in the figure. We identify these as CIII λ4650 and CIV λ5806 features, characteristic of Wolf-Rayet stars of type WC. The age of this cluster as inferred from EW is consistent with the presence of WR features. Thus, our spectra confirm the young age of the brightest CSCs. We obtain masses between 3000–18000 $M_\odot$ for the 4 CSCs, all below the upper mass limit of 2×10^4 $M_\odot$ derived by Santiago-Cortés et al. (2010).

4. CONCLUSIONS

We have carried out spectroscopic observations of 11 CSCs and 2 GCs using the 10.4 m GTC, and present here the results for 4 CSCs, including that for the brightest CSC. The Hβ emission equivalent width, optical colors from HST, and the absence of stellar absorption lines in the blue, together suggest ages less than 6 Myr for the clusters. In one of these CSCs, we detected WR features characteristic of WC stars. The determined young age of these bright objects, which lie in the upper part of the cluster color-magnitude diagram, ensures that there are no CSCs in M81 with masses exceeding 2×10^4 $M_\odot$. Thus, its seems that though compact clusters are formed in large numbers in star-forming galaxies such as M81, conditions in these giant galaxies don't favor the formation of massive clusters.

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