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The UV spectrum of the Galactic Bulge

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Abstract. The aim of this work is to investigate the possible existence of the UV-excess in the Milky Way bulge and its correlation with the presence of sdB stars in the bulge. The integrated spectrum of a bulge region from the UV to the optical was constructed. Results show that this bulge region has only a very weak UV excess

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The UV excess is a feature that elliptical galaxies and bulges of spiral galaxies show in their spectra at wavelengths below 2300 Å. It is now widely accepted that this UV emission is caused by evolved low mass stars, in particular Extreme Horizontal Branch (EHB) stars, mostly observed as sdB stars (spectral classification). The bulge of our Galaxy is the closest stellar system similar to the ellipticals, in age and metallicity, where it is possible to resolve these stars. A sample of sdBs star candidates was observed in the Galactic bulge by Zoccali *et al.* (2003), by means of V and I photometry of the region MW05 from the ESO Imaging Survey (EIS1). The follow-up spectroscopic analysis of these stars confirmed indeed that most of them are bulge sdBs, while some candidates turned out to be disk sdBs or cool stars (for more details, see Busso *et al.* 2005). Using both photometric and spectroscopic data and also spectral libraries, the integrated spectrum of the observed region was constructed following the recipe by Santos *et al.* (1995). The photometric data were corrected for reddening. The color magnitude diagram (CMD) was also decontaminated from globular cluster NGC 6558 stars and from the foreground disk population. The final CMD for the bulge field is shown in the left panel of Fig. 1. For the construction of the integrated spectrum only the Main Sequence (MS), Red Giant Branch, Red, Blue and Extended Horizontal Branch (HB) stars (in black) were considered, because it was not possible to verify the bulge membership of other types of stars (in grey) such as post HB (filled triangles) stars, Blue Straggler candidates (filled circles) and part of the low MS stars. In any case post-HB stars should play only a marginal role in the UV excess (Brown *et al.* 1997). We used two spectral libraries (Pickles 1998 and BaSel, Lejeune *et al.* 1997) and the Bamberg archive of optical and UV-spectra of hot subdwarfs (Heber, priv.comm.). In the CMD, we defined small boxes and for each of them the appropriate library spectrum was chosen. The total integrated spectrum of the bulge region was calculated as sum of all spectra (f_j) associated to the CMD boxes, taking in account their weights C_J : $F_{TOT} = \Sigma C_j f_j$. The weights are correlated to the magnitudes of the stars in the boxes. The result is shown in the right panel of Fig. 1, where also the comparison with the integrated spectra (from Bruzual & Charlot 2003) of two simple stellar populations (SSPs) with an age of 11 Gyr and metallicity Z = 0.008 and Z = 0.02 is shown. While the two integrated spectra obtained

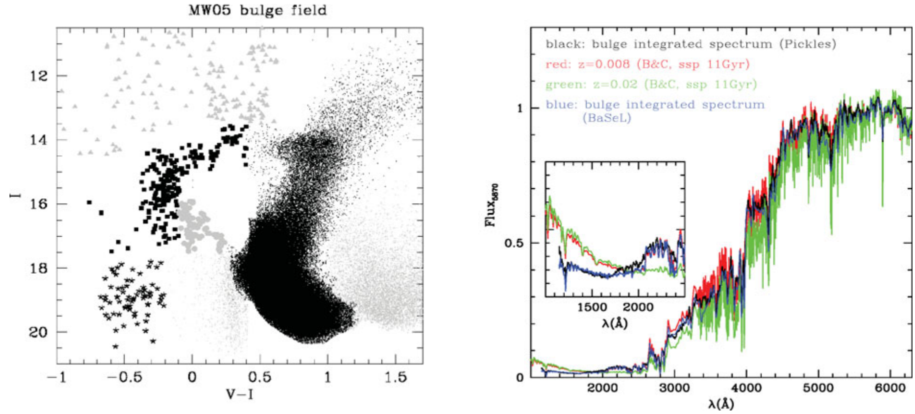

Figure 1. Left panel: final color magnitude diagram for the bulge field MW05 (see text for the stars shown with different symbols). Right panel: comparison between integrated spectra and single stellar population SED in the whole wavelength range from UV to optical in the big panel and only in the UV range in the small panel.

using the Pickles and BaSeL library are very similar, both in the optical and UV range, neither of the SSPs agrees perfectly with the integrated spectra. Probably a population with an intermediate metallicity would fit better in the optical range. It is necessary to keep in mind though that the bulge is not a SSP but it has a metallicity distribution with a peak intermediate between the metallicity of the two SSPs adopted. Integrated and SSP spectra do not match in the UV instead, with the SSP spectra showing a larger UV flux. There could be two reasons for this: firstly, the exclusion in the bulge integrated spectrum of post-HB and post-AGB stars, which are instead taken into account in the SSP spectra; secondly, probably the selection of sdBs stars was too strict. On the base of the spectroscopic analysis we selected only 55% of the candidates in the color magnitude diagram as bulge sdBs to construct the integrated spectrum. Taking into account also the stars with unknown membership the percentage would raise to 65%, increasing the UV flux by about 20%, which is still insufficient to achieve agreement with the SSP predictions. Thus this region of the Galactic bulge probably shows only a very weak UV excess, in contrast to what is observed in the bulge of M31. This is consistent with UV observations of the closest extragalactic systems, which show that this UV excess can vary strongly from object to object (Rich *et al.* 2005). For more details about this work, see Busso & Moehler (2008).

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