Mem. S.A.It. Vol. 87, 676

Memorie della

Analyzing the age determination of 12 SMC star clusters

Randa Asa'd and Adnan Shahpurwala

American University of Sharjah, Physics Department, P.O.Box 26666, Sharjah, UAE
e-mail: raasad@aus.edu

Abstract. We compare the ages of 12 SMC clusters obtained using different stellar population model libraries with the CMD ages and show that we get good age predictions for all models except few outliers.

Key words. Magellanic Clouds – star clusters: general

1. Introduction

We use the updated version of Analyzer of Spectra for Age Determination ($ASAD_2$) package[1] to obtain the ages of a sample of 12 SMC stellar clusters[2] from their integrated spectra. Our goal is to investigate the accuracy of the age determination using different stellar populations model libraries and different statistical methods. The sample is shown in Table 1. In this work we use both the χ^2 minimization method and Kolmogorov−Smirnov (K-S) test to comparing the observed integrated spectra to the spectral models for a wavelength range of 3626 − 6230 Å, and a step size of 3Å normalized at 5870Å. The Cardelli et al. (1989) extinction law was used with reddening values between 0.00 and 0.50 in steps of 0.01. We use the stellar populations model libraries of Gonzalez Delgado et al. (2005), GALAXEV (Bruzual & Charlot 2003) and MILES (Vazdekis et al. 2015).

[1] https://randaasad.wordpress.com/reseach-interests/asad-package/

[2] from Andrea Ahumada through private communication. The data obtained was in FITS format.

2. Results and discussion

The results are shown in Table 2. Column 2 lists the age obtained with Gonzalez Delgado et al. (2005) using the χ^2 minimization method, Column 3 lists the age obtained with GALAXEV using the χ^2 minimization method, Column 4 lists the age obtained with MILES using the χ^2 minimization method, Column 5 lists the age obtained with Gonzalez Delgado et al. (2005) using the K-S method, Column 6 lists the age obtained with GALAXEV using the K-S method and finally Column 7 lists the age obtained with MILES using the K-S method. Note that the ages provided by MILES start at log (age/year) 7.78, NGC299 is younger than the age range predicted by MILES.

The upper panel of Figure 1 show the results of the three models using the χ^2 minimization compared to CMD ages. The lower panel show the results using the three models using the K-S test compared to CMD ages. 75% of the results are within the range of +/- log (Age/year) 0.5. The outliers are around

Table 1. The SMC clusters sample

Name	CMD log (Age/year)	Age Reference
HW73	8.15	Glatt et al. (2010)
IC1624	8.35	Glatt et al. (2010)
Lindsay48	7.80	Glatt et al. (2010)
Lindsay56	7.80	Glatt et al. (2010)
NGC121	10.0	Baume et al. (2008)
NGC256	7.80	Glatt et al. (2010)
NGC265	8.50	Chiosi & Vallenari (2007)
NGC290	7.80	Chiosi & Vallenari (2007)
NGC299	7.40	Piatti et al. (2008) [3]
NGC306	7.90	Piatti et al. (2008) [4]
NGC643	9.00	Piatti et al. (2007)
NGC796	8.04	Piatti et al. (2007)

Table 2. Results

Name	Age[1]	Age[2]	Age[3]	Age[4]	Age[5]	Age[6]
HW73	8.25	8.26	8.04	8.25	7.96	8.04
IC1624	8.10	7.81	8.04	7.95	7.81	8.04
Lindsay48	6.80	6.68	7.78	6.80	6.66	7.78
Lindsay56	7.30	6.86	7.78	6.90	6.60	7.78
NGC121	9.40	9.36	9.50	9.30	9.21	9.30
NGC256	8.10	7.86	8.11	7.95	7.86	8.15
NGC265	8.40	8.31	8.40	8.50	8.21	8.54
NGC290	7.50	7.68	7.78	7.45	7.68	7.84
NGC299	7.00	7.02	-	7.20	7.18	-
NGC306	7.55	7.68	8.11	7.55	7.68	7.78
NGC643	9.10	9.06	9.10	9.05	8.96	8.90
NGC796	6.80	6.66	7.78	6.80	6.60	7.78

log (Age/year) 8 and 10. For log (Age/year) 10 metallicity affects the age determination (Asa'd et al. 2016).

3. Conclusion and work in progress

Integrated spectra of star clusters can predict the ages of SMC star clusters. $ASAD_2$ package was used to obtain the ages of 12 SMC clusters covering a wide age range. Three stellar populations model libraries and two statistical methods were tested showing good results within the range of +/- log (Age/year) 0.5. We notice outliers around log (Age/year) 8 as well as log (Age/year) 10. For the older age the effect of metallicity is significant causing this underestimation of age (Asa'd et al. 2016). Figure 2 shows the spectral match and the age-reddening surface plot for the result obtained by Gonzalez Delgado et al. (2005) using the χ^2 minimization method for Lindsay56. This needs more investigation which is our work in progress.

Acknowledgements. I am grateful to Andrea Ahumada for sharing the integrated spectra of the sample used in this study

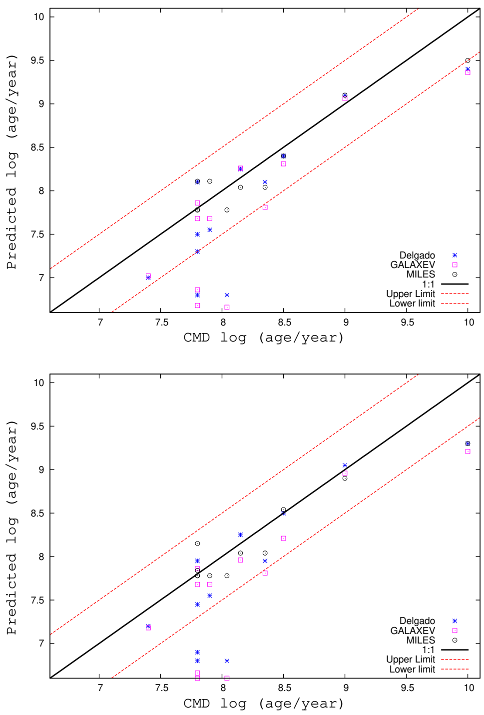

Fig. 1. The results obtained for the SMC clusters using Gonzalez Delgado et al. (2005), GALAXEV and MILES by applying the χ^2 minimization method (upper panel) and the K-S test (lower panel) compared to CMD ages. The red lines are to show the region of +/- log (Age/year) 0.5

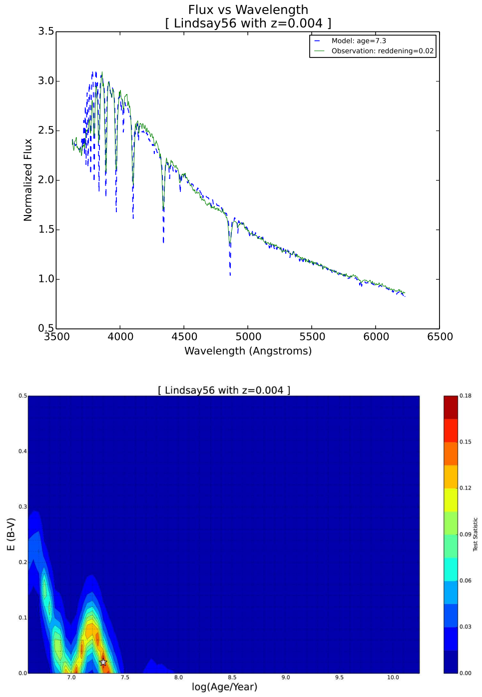

Fig. 2. The spectral match and the age-reddening surface plot for the outlier result obtained by Gonzalez Delgado et al. (2005) using the χ^2 minimization method for Lindsay56.

References

Asa'd, R. S., Vazdekis, A., & Zeinelabdin, S. 2016, MNRAS, 457, 2151

Baume, G., Noël, N. E. D., Costa, E., et al. 2008, MNRAS, 390, 1683

Bruzual, G., & Charlot, S. 2003, MNRAS, 344, 1000

Cardelli, J. A., Clayton, G. C., & Mathis, J. S. 1989, ApJ, 345, 245

Chiosi, E., & Vallenari, A. 2007, A&A, 466, 165

Glatt, K., Grebel, E. K., & Koch, A. 2010, A&A, 517, A50

Gonzalez Delgado, R. M., et al. 2005, MNRAS, 357, 945

Piatti, A. E., et al. 2007, MNRAS, 382, 1203

Piatti, A. E., et al. 2008, MNRAS, 389, 429

Vazdekis, A., Coelho, P., Cassisi, S., et al. 2015, MNRAS, 449, 1177