The Art of Modelling Stars in the 21st Century
Proceedings IAU Symposium No. 252, 2008
L. Deng & K.L. Chan, eds.

doi:10.1017/S1743921308022618

Observations of clusters with ages from 0.01 to 1.0 Gyr in the Large Magellanic Cloud

Q. Liu[1,2]†, R. de Grijs[3,1], L. C. Deng[1], Y. Hu[1,2] and I. Baraffe[4]

[1]National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012, P. R. China
email:liuq@bao.ac.cn
[2]Graduate University of Chinese Academy of Sciences, Beijing, 100049, P. R. China
[3]Department of Physics & Astronomy,The University of Sheffield, Sheffield S3 7RH,UK
[4]CRAL, École Normale Supérieure, 46 allée d'Italie, 69007 Lyon, France

Abstract. The stellar initial mass function (IMF) is a very important question in modern astrophysics. Globular clusters (GCs) are good samples for studying the IMF, but the Galactic GCs can provide only one time-scale evolutionary stage. The Large Magellanic Cloud (LMC) is an ideal environment for studying the IMF because it contains compact clusters at different evolutionary stages. By studying the IMF at different evolutionary stages, we can see how the mass function evolves with time.

Keywords. Stars: mass function, Large Magellanic Cloud, galaxy: star clusters

1. Introduction

The stellar IMF plays an important role in many astronomical questions. GCs are perfect targets for the study of the IMF, because all stars in a GC have the same age, metallicity and distance from us. Unfortunately, Galactic GCs can only provide evolutionary information on one time scale due to their old ages. LMC is an ideal environment for studying the IMF of star clusters, because the LMC contains a large population of rich compact star clusters covering ages from 0.001 to 10 Gyr, which makes it possible to study star clusters at various evolutionary stages.

2. Observations and data reduction

The supreme spatial resolution of the Hubble Space Telescope (HST) makes it possible to observe stellar systems in extragalactic environments. HST GO program 7307 obtained WFPC2 and STIS imaging observations of 3 pairs of compact star clusters in the LMC. Two clusters in each pair have similar ages, metallicities and distances from the center of the LMC. We used the IRAF/APPHOT package to do aperture photometry and adopted 2-pixel aperture radii on both the WFPC2 and STIS images, then we adopted the method of Holtzman *et al.* (1995) to convert the aperture-corrected WFPC2 photometry to the standard Johnson-Cousins V, I photometry. We take the cluster NGC1818 in the youngest pair as an example in this paper.

3. Model and Results

Many faint stars are pre-main sequence (PMS) stars, and their ages are obtained by fitting the lower part of the clusters MS with Padova isochrones (Girardi *et al.* 2000)

† Present address: No. 20A Datun Road, Chaoyang District Beijing 100012, China

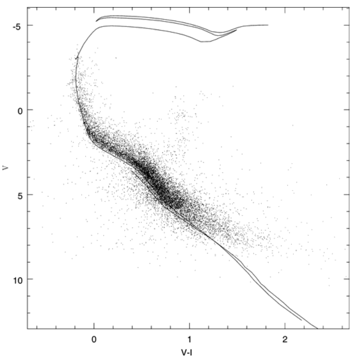

Figure 1. Age and metallicity of NGC1818.

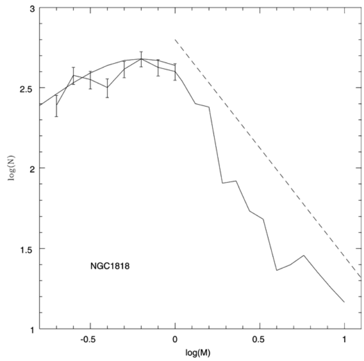

Figure 2. The complete MF of NGC1818.

and the evolutionary models of Baraffe *et al.* (1998). The best fit is shown in Fig1. The red line is the Padova isochrone of log(age/yr) = 7.65 and Z = 0.008. There is no corresponding model of the same metallicity in Baraffe *et al.* (1998), so we did some tests to prove that the differences are negligible. Hence, we adopt the model of Z = 0.006 to calculate the masses of stars. The green line in Fig1 is the improved Baraffe isochrone of log(age/yr) = 7.65 and Z = 0.006. Fig. 2 shows the mass function of NGC1818 above 0.2 $M_\odot$.

4. Conclusions

The IMF is usually assumed to be universal. For NGC 1818, the MF above 1.0 $M_\odot$ follows the power-law distribution with slope −1.35 (de Grijs *et al.* 2002, black line in Fig. 2), and the green dashed line shows the Salpeter IMF (1955) within this mass range. We tried to use a log-normal distribution function (green solid curve in Fig. 2) to fit the MF between 0.2–1.0 $M_\odot$ (red line in Fig2). The result is identical to the IMF of Galactic GCs (Figure 3 in Paresce *et al.* 2000), so we think that the IMF below 1.0 $M_\odot$ in NGC 1818 may follow a log-normal distribution.

Acknowledgements

We would like to acknowledge the useful comments of a referee concerning the solution procedure used in §4. A.N.O. is supported by SERC under grant number GR/F/12345.

References

Baraffe, I., Chabrier, G., Allard, F., & Hauschildt, P. H. 1998, *A&A* 337, 403
de Grijs, R., Gilmore, G. F., Johnson, R. A., & Mackey, A. D 2002, *MNRAS* 331, 245
Girardi, L., Bressan, A., Bertelli, G., & Chiosi, C. 2000, *A&As* 141, 371
Holtzman, J. A., Burrows, C. J., Casertano, S., Hester, J. J., Trauger, J. T., Watson, A. M., & Worthey, G. 1995, *PASP* 107, 1065
Paresce, F. & De Marchi, G. 2000, *ApJ* 534, 870
Salpeter, E. E. 1955, *AJ* 101, 1865

https://doi.org/10.1017/S1743921308022618 Published online by Cambridge University Press