Self-consistent physical parameters for 5 intermediate-age SMC stellar clusters from CMD modelling

Bruno Dias⌘ (bdias@eso.org)
Universidade de São Paulo, Brazil; ESO, Chile
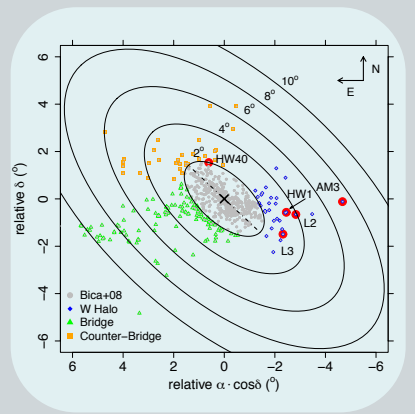Collaborators: L. Kerber, B. Barbuy, B. Santiago, S. Ortolani, E. Balbinot

Motivation

✓ Small Magellanic Cloud (SMC) has a complex star formation history and evolution due to strong tidal interactions with Large Cloud and Milky Way (e.g. Diaz+12);

✓ Field and cluster stars have similar star formation history (Piatti+05,12);

✓ Star clusters in SMC are useful tools to determine ages and metallicities for each SMC region;

✓ There is a spread in metallicities for clusters with ages ~4-10 Gyr, around the Pagel+98 chemical evolution model (Parisi+09, Piatti+11);

✓ Stellar counterparts of the tidal gas structures may be characterized by age/metallicity gradients, however out to a>2°, no gradient was found to date (Piatti12).
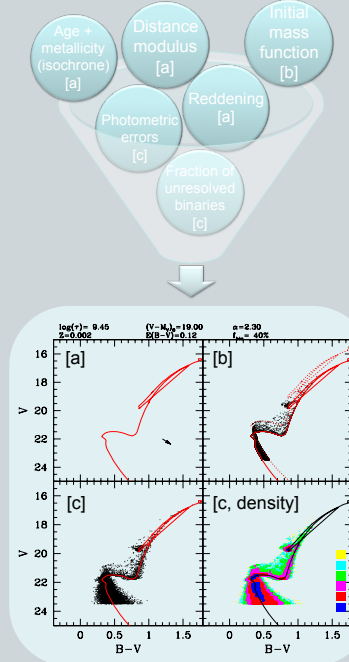
Goals

✓ To determine age, metallicity, and distance in a self-consistent way for the SMC clusters: AM3, Lindsay2, Lindsay 3, HW1, HW40;

✓ To relate the cluster properties and 3D distribution to chemical evolution models and tidal gas structures;

✓ To observe clusters in the outer regions of the Small Cloud;
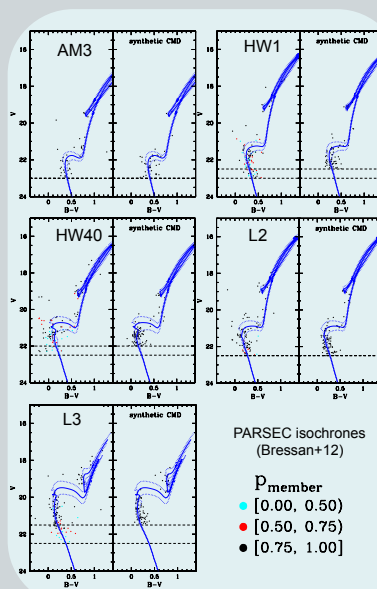
✓ To classify 3 groups of clusters in outer regions.

Synthetic CMD fitting

Age + metallicity (isochrone) [a]
Distance modulus [a]
Initial mass function [b]
Photometric errors [c]
Reddening [a]
Fraction of unresolved binaries [c]

log(τ) = 9.45   (V−M_V) = 19.00   α = 2.30
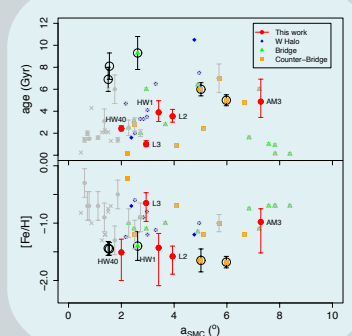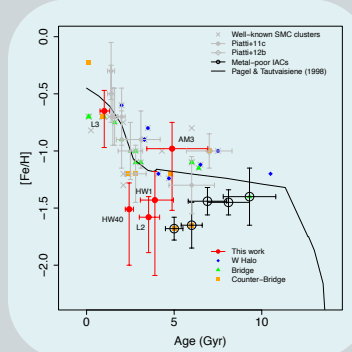Z = 0.002   E(B−V) = 0.12   f_bin = 40%

✓ A grid of ~9000 synthetic CMDs is made for different values of age, metallicity, distance, and reddening;

✓ One observed CMD is compared with the entire grid in order to find the best fit, with the maximum likelihood.

Best fits

AM3   HW1   HW40   L2   L3   synthetic CMD

PARSEC isochrones (Bressan+12)

p_{member}
[0.00, 0.50)
[0.50, 0.75)
[0.75, 1.00]

Discussion & conclusions

✓ L2 and HW1 are studied for the first time in this work: they are physically close and have similar age (~4.0 Gyr) and metallicity ([Fe/H] ~ -1.5 dex);

✓ Results on AM3, L3, HW40 = literature;

✓ Results follow Pagel+98 model, with some dispersion for intermediate-age clusters;

✓ To analyse gradients in the outer regions of SMC, it is useful to separate these clusters in groups, as showed above;

✓ 4 clusters are in the West Halo region, that need more homogeneous studies to check for age and metallicity gradients.

References

❖ Bica et al. 2008, MNRAS, 389, 678
❖ Bressan et al. 2012, MNRAS, 427, 127
❖ Dias et al. 2013 (about to submit to A&A)
❖ Diaz & Bekki 2012, ApJ, 750, 36
❖ Parisi et al. 2009, AJ, 138, 517
❖ Piatti et al. 2005, MNRAS, 358, 1215
❖ Piatti 2011, MNRAS, 418, 69
❖ Piatti 2012, MNRAS, 422, 1109

⌘BD is a PhD student jointly at University of Sao Paulo - Brazil (Prof. Dr. Beatriz Barbuy), and ESO - Chile (Dr. Ivo Saviane).

More info:
bdias@eso.org
www.astro.iag.usp.br/~bdias