

THE CENTRE OF THE LMC BAR

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1. Programme and observations

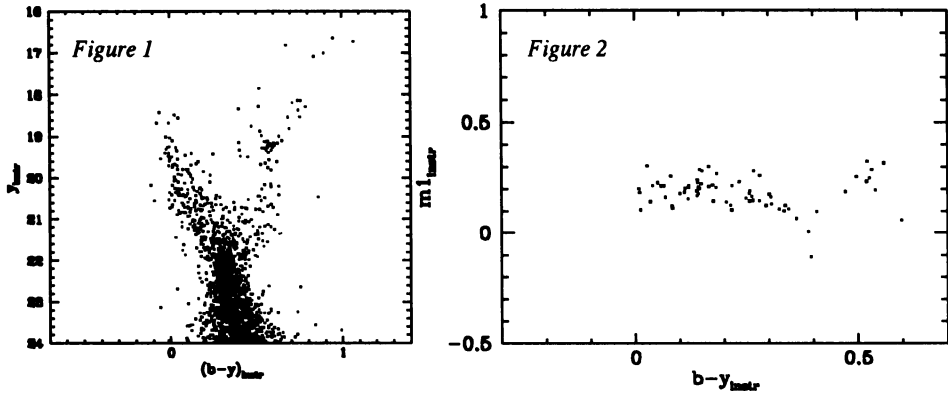
We study star formation and chemical evolution in the LMC Bar centre with the HST PC and uvby photometry. For all bands, mean turn off star data have σ around 0.015 mag. Present data have zero points from stars in M67. b-y of these stars coincides with target turn off. All measurement bands have zero point accuracy better than 0.010 mag.

2. Colour Magnitude Diagram, metallicity and the uvby system

The uvby system (Strömgren, 1963), designed for T_e 9000-5500 K, is equally useful to $T_e=4000$ K (Ardeberg and Lindgren 1981; Olsen, 1984; Ardeberg et al., 1997). With $\sigma < 0.04$ mag, we get a CMD to $y=24.0$, Fig. 1, close to complete to $y\cong 22.7$. Analysis for possible field effects on the PSF is still pending. Less important for the CMD, the impact on abundance may be significant. Now, we limit abundance discussion to a central 25% field and turn off stars, $y=20.5-21.5$. Images significantly superpositioned are excluded. Interstellar extinction is modest at the LMC centre (Ardeberg et al., 1985; Schwering and Israel, 1991, Oestreicher et al., 1995) and neglected here.

3. Some results and discussion

We evaluated the young population with a luminosity function (LF) of the galactic zero age main sequence (ZAMS). For open cluster data (Taff,



1974), we made smooth interpolation. Fitting the LF to the bright CM data, using our number statistics to $y=22.7$, we find 30% young stars in the LMC Bar centre. As an alternative, we derived the young population from the LF and the older populations from the giant branch and isochrones (Bergbusch and Vandenberg, 1992). The ratio of young and old populations is similar to that from the LF and number statistics. From our data and isochrones (Van den Berg, 1985), a large portion of the young component seems less than 500 million years old. The width of the low giant branch indicates a mixture of stellar ages. From isochrones (Bergbusch and Van den Berg, 1992), we find star formation activity between 2 and 9 Gyears. Stars older than 10 Gyears seem rare. Absence of CMD data with $0.3 < b-y < 0.5$ and $19.5 < y < 20.5$ indicates low star formation for ages 0.5-2 Gyears. We propose repeated bursts of or more continuous star formation from 9 to 2 Gyears ago followed by low or no formation activity until new strong star formation less than 500 million years ago.

Also with due caution, as our data are zero point corrected only, Fig. 2, m_1 versus $b-y$, is interesting. The $[Me/H]$ dispersion is limited. Disregarding three stars, $\sigma < 0.4$ dex. Omitting the same stars, average $[Me/H] = -0.7 \pm 0.2$. There may be a small evolutionary effect, with the older population more metal poor than the younger. The three stars with low m_1 indicate a minority of stars with $[Me/H]$ significantly below -0.7 . The average $[Me/H]$ may also be estimated from the CMD. Morphology of the horizontal branch and colour of the horizontal and giant branches give $[Me/H] = -0.5$. The metallicity of the bulk of stars in the LMC Bar centre seems to be $1/3 - 1/5$ of the solar value, while some stars may have significantly lower $[Me/H]$ values.

We used a new method to derive the faint LF. It includes stars individually unidentifiable but statistically measurable (Snel, 1997). We compare the LMC Bar centre LF with that of the solar neighbourhood (Wielen et al., 1983). The two LFs are similar, the LMC LF being somewhat steeper.