

Strömgren Photometry of Field Red Giants in the LMC

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Abstract. We present here preliminary results of our program to obtain rough abundance estimates for $> 10^4$ red giant branch and red clump stars in four fields of the LMC. The derived abundance distributions will be a strong constraint on models of the LMC's star-formation history based on field star color-magnitude diagrams.

1. Introduction

An essential ingredient to color-magnitude diagram (CMD) studies of field star populations is the availability of independent metallicity information, owing to the degeneracy of CMD morphology in the age-metallicity plane (e.g., Holtzman et al. 1999). Intermediate-band photometry is a practical way to obtain approximate abundances for the tens of thousands of stars which are contained in a single CCD image of the LMC field. With abundance information for the red giant and red clump stars in our broad-band CMDs (see Smecker-Hane et al. 1999), it will be possible to derive in a self-consistent way the star-formation history and age-metallicity relation for the field star populations of the Large Magellanic Cloud.

2. Data: Observations, Reductions, and Photometry

Our exposure catalog for this program is shown in Table 1. We observed four fields centered at the locations of fields studied with WFPC2 by Smecker-Hane et al. (1999) and Holtzman et al. (1997). Photometric standards from the list of Richtler (1990) were observed extensively each night. All images were reduced within IRAF and photometry obtained using the IRAF/DAOPHOT routines. We corrected our photometry for an extinction $E_{B-V} = 0.09$ mag (Burstein & Heiles 1982) using the extinction curve of Cardelli et al. (1989).

Table 1. Summary of CTIO 1.5-m Observations, $14'8 \times 14'8$ FOV.

Field	R.A. (B1950.0)	Dec.	Date	Exposure time (sec)		
				v	b	y
Disk 1	05:11:22	-71:17:27	28 Nov 97	4 × 1300	2 × 1300	2 × 1200
Disk 2	05:14:33	-65:21:00	29 Nov 97	3 × 1300	2 × 1300	2 × 1200
Disk 3	05:58:36	-68:21:26	29 Nov 97	3 × 1300	2 × 1300	2 × 1200
Bar	05:24:47	-69:49:01	1 Dec 97	2 × 1300	1300 + 1000	1200 + 900

3. Color-Metallicity Plots

According to the calibration of Grebel & Richtler (1992), isoabundance contours for luminosity class I-III stars in the range $0.4 \leq (b - y) \leq 1.1$ are linear in the Strömgren ($m_1, b - y$) plane. Using this calibration, we have determined a mean metallicity $[\text{Fe}/\text{H}] = -0.8 \pm 0.3$ for a subsample of 1,007 RGB stars in our Disk-1 field. 90% of the red giants in this field lie within the range $-1.6 \leq [\text{Fe}/\text{H}] \leq -0.2$.

4. Discussion

Although the RGB stars behave as expected, the red clump apparently obeys a different color-metallicity relation than that of Grebel & Richtler (1992). The reasons for this are still being explored. These stars are important to our analysis because 80% of the stars available to us lie in the region of the clump.

Our preliminary results for the RGB agree well with the prediction of Pagel & Tautvaišienė (1998). However the significance of this is difficult to assess because we are forced to exclude the red clump from our analysis at the present time and our sample is thus incomplete for low metallicities.

Analysis of three further fields is in progress, and we are attempting to model the behavior of the red clump in the ($m_1, b - y$) plane using stellar evolutionary tracks and model atmospheres. Refinement of the color-metallicity calibration is also underway.

References

- Burstein, D., & Heiles, C. 1982, AJ, 87, 1165
 Cardelli, J.A., Clayton, G.C., & Mathis, J.S. 1989, ApJ, 345, 245
 Grebel, E.K., & Richtler, T. 1992, A&A, 253, 359
 Holtzman, J.A., et al. 1997, AJ, 113, 656
 Holtzman, J.A., Mould, J.R., Gallagher, J.S., & WFPC2 IDT 1999, this volume
 Pagel, B.E.J., & Tautvaišienė, G. 1998, MNRAS, 299, 535
 Richtler, T. 1990, A&AS, 86, 103
 Smecker-Hane, T.A., Gallagher, J.S., Cole, A.A., Tolstoy, E., & Stetson, P.B. 1999, this volume