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PRESENTACIóN MURAL

Astrophysical properties of star fields in the Large Magellanic Cloud

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Abstract. We present CCD Washington CT_1 photometry for the unprecedented database of some 5.5 million of stars distributed throughout the entire Large Magellanic Cloud (LMC) main body. The quality and performance of the data were rigurously examined from extensive completeness artificial star tests over the whole mosaic image data set, so that field **colour-magnitude** diagrams (CMDs) were **accurately** produced. From the star field **CMD** Hess diagrams, we identified the peaks at the **main-sequence turnoff** and **red clump** locations to date the most dominant sub-population (or "representative" population) in the stellar population mix, while their metallicities were estimated from the CMD location of the most populous **red giant branch** track. The dispersion associated with the mean ages and metallicities result in general a satisfactory estimate of the age/metallicity spread, although some few individual representative subfields have slightly larger age/metallicity spread. As far as we are aware, these larger age spread do not affect the subsequent analysis. **A detailed version of this work can be seen in Piatti et al. (2012, AJ, 144, 100).**

Resumen. Presentamos resultados obtenidos a partir de datos CCD en el sistema fotométrico de Washington de $\sim$ 5.5 millones de estrellas distribuidas en toda la Nube Mayor de Magallanes (NMM). La calidad y *performance* de los datos fueron rigurosamente examinados a partir de **numerosas pruebas** de completitud con estrellas artificiales **en todo el conjunto de imágenes mosaico,** de modo que diagramas **color-magnitud (DCM)** fueron precisamente **confeccionados**. **A partir de los DCM de Hess de las estrellas del campo,** identificamos **los picos del** *turnoff* **de la secuencia principal y** del *clump* de las gigantes rojas **para datar** la **sub-población más** dominante **(o población representativa) en la composición de poblaciones estelares, mientras que sus metalicidades fueron estimadas a partir de la ubicación de la rama de las gigantes rojas más poblada. La dispersión asociada con las edades y metalicidades medias resulta en general una estimación satisfactoria de la dispersión edad/metalicidad, aunque algunos pocos subcampos representativos individuales tienen una ligeramenta mayor dispersión edad/metalicidad. Hasta donde estamos seguros, esta mayor dispersión en edad no**

afecta posteriores análisis. Una versión detallada de este trabajo puede verse en Piatti et al. (2012, AJ, 144, 100).

1. Analysis

In this study we present, for the first time, CCD Washington CT_1T_2 photometry **-obtained with the CTIO 4m Blanco telescope and the MOSAIC II camera attached-** of some 5.5 million stars in twenty-one 36'×36' fields distributed throughout the entire LMC main body. Fig. 1 depicts a schematic finding chart of the LMC. It includes the positions of the cataloged star clusters as compiled by Bica et al. (2008) represented by dots; the loci of fields at the northern end of the LMC main body previously studied by Piatti et al. (1999); and the present 21 fields (labelled big boxes).

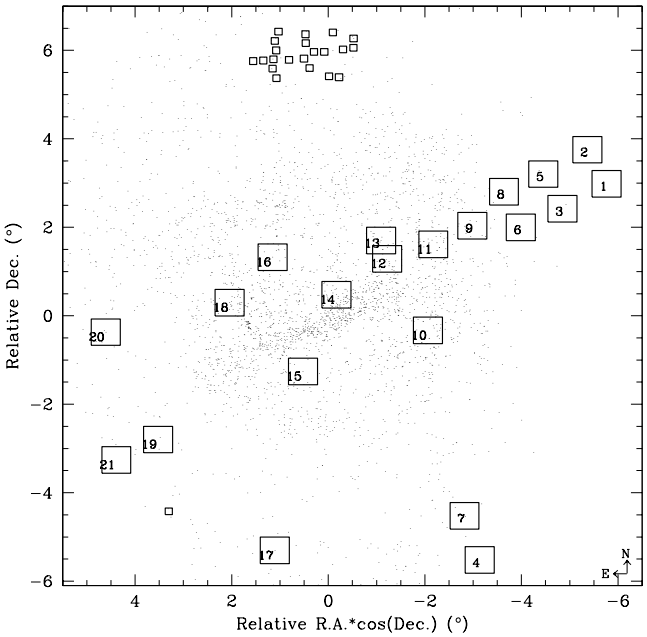

Figure 1. **Schematic** finding chart of the LMC with the relative position of the selected fields.

We performed extensive artificial star tests over the whole mosaic image data set in order to quantify the photometry quality as a function of the star brightness and crowding. After 5 different random artificial star distribution experiments per image, we built mean completeness functions as a function of the magnitude involved and found that the 50% completeness level is reached at $C \sim$ 23.5-25.0 and $T_1 \sim$ 23.0-24.5, depending on the crowding and exposure time, and that the behaviour of the photometric errors with magnitude for the observed stars guarantees the accuracy of the morphology and position of the main features in the **colour-magnitude** diagrams (CMDs) that we investigate.

Then, we built CMDs and Hess diagrams for each one of the 336 9'x 9' subfields, and measured T_1 **magnitudes** for the so-called representative stellar

population of each field, namely, the **main-sequence turnoff (MSTO)** with the largest number of stars. The resultant representative T_1(MSTO) mags are on average ~ 0.5 mag brighter than the T_1 mags for the faintest 100% completeness level of the respective field, so that we reach the TO of the representative population of each field with negligible loss of stars. Fig. 2 shows the relationship between the T_1 magnitude corresponding to the 100% completeness level and that for the representative stellar population of each field. Since the 100% completeness photometry is achieved at a fainter T_1 mag than that for the representative MSTO, we actually observed the oldest populations in each field. The prevailing TOs are typically $\sim$ 25%-50% more frequent than the following less dominant population.

We also investigated the **red clumps** (RCs) of the studied LMC fields, assuming that the peak of T_1(RC) mag distribution corresponds to the most populous T_1(MSTO) in the respective field. We built T_1 histograms for these RC stars and performed Gaussian fits to derive the mean RC mag values and the FWHMs of the T_1(RC) distributions. Fig. 3 shows the results for **3** of the selected fields in order to illustrate the applied procedure. Although we are interested in the central (mean) T_1 mag, the difference between the RC distributions and the resulting Gaussian fits in some few cases also tells us about the existence of certain amount of differential reddening along the line-of-sight towards those fields.

Finally, δT_1 indices -the difference in magnitude between the RC and the MSTO- were computed using the representative T_1(MSTO) and T_1(RC) mags. From these values we estimated the ages of the prevailing population in the studied LMC field using the calibration obtained by Geisler et al. (1997). We also estimated representative metallicities following the **standard giant branch** (SGB) procedure of entering absolute M_{T_1} magnitudes and intrinsic $(C-T_1)_o$ colours for each subfield into Fig. 4 of Geisler & Sarajedini (1999). The measured metallicity values were corrected by applying a robust procedure which takes into account the age-metallicity degeneracy effect.

The age dispersion has been calculated bearing in mind the broadness of the distributions of the representative MS TOs and RCs, as well as that of the red giant branch, instead of the photometric errors at T_1(MSTO), T_1(RC) mags, respectively. The former are clearly larger, and represent in general a satisfactory estimate of the spread around the prevailing population, although some individual subfields have slightly larger spreads. These larger age spreads should not affect the subsequent results. In order to take into account the metallicity spread, we assume a dispersion of 0.2 dex for the measured metallicities, although the SGB procedure allows to estimate [Fe/H] values with an uncertainty of 0.1 dex, to which we added the uncertainties coming from the age corrections in order to assign formal dispersions to the final metallicity values.

2. References

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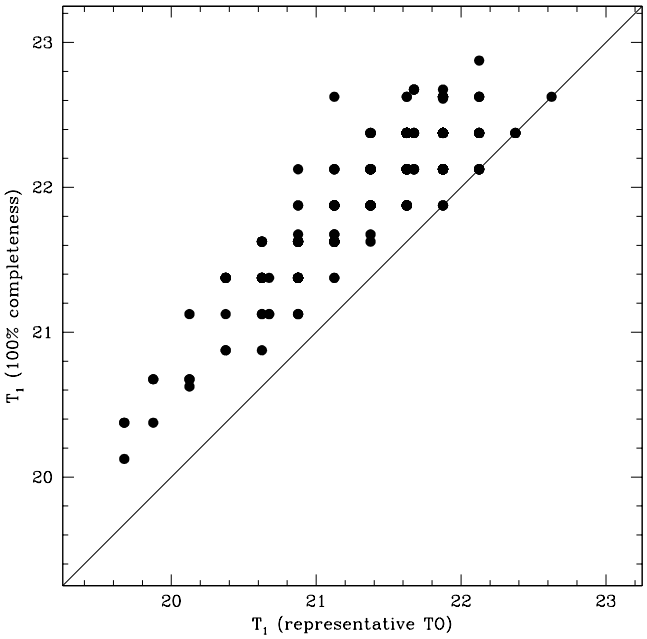

Figure 2. Comparison between the T_1 mag for the 100% completeness level and that for the respective MSTO for the 336 LMC subfields.

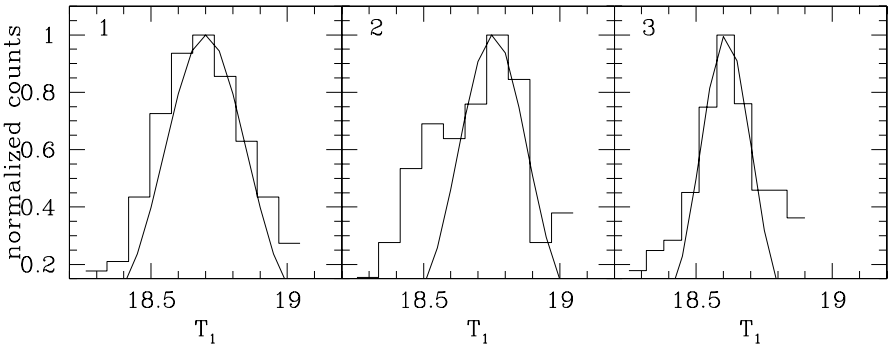

Figure 3. The **red clump** star distribution for **3** of the 21 selected LMC fields. The resulting Gaussian fits are also superimposed.