Main Sequence Fitting Ages for a Large Sample of LMC Clusters

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Abstract
Detailed age-abundance relations are necessary to fully explore the star formation history and chemical enrichment history of a galaxy. Star clusters are ideal targets for constraining a galaxy’s age-abundance relation since they preserve a record of their host galaxy’s chemical abundances at the time of their formation. While the LMC has an extensive, well studied cluster system, no large database of cluster ages determined via main sequence fitting currently exists. To address this shortcoming, we have compiled deep optical photometry from a variety of sources that reaches down below the main sequence turn off in a large sample of LMC clusters. These data are combined with our Ca II triplet based cluster abundances, thereby allowing us to lift the age-metallicity degeneracy and determine accurate cluster ages via main sequence fitting with theoretical isochrones. Herein we present our cluster ages, an updated age-metallicity relation for the LMC, and a brief discussion of work that uses these results.

Optical Color-Magnitude Diagrams
Shown are CMDs for a sample of LMC clusters in our data set. Using theoretical isochrones from Girardi et al. (2002), we determine cluster ages by matching the brightness of the red clump stars and color of the unevolved main sequence. Isochrone abundances are chosen based on the metallicities we calculated from our Ca II triplet spectra (Grocholski et al. 2006). For clusters with no [Fe/H] from the Ca II triplet (e.g. Hodge 14), we adopt isochrones with [Fe/H] = -0.5.

Metallicity Distribution
We compare our Ca II triplet based metallicity distribution function (bottom panel) to that of Olszewski et al. (1991; top and middle). The light grey histogram shows all clusters in each study, while the dark grey represents only clusters in common between the two. Our results show that the intermediate-age clusters have a very tight distribution (mean [Fe/H] = -0.48; σ = 0.09) with no tail toward solar metallicities.

Cluster Information
In the table we list information for the 42 LMC clusters for which we have optical photometry. Note that, for the purposes of this poster, we assume that all four globular clusters in our sample are 13 Gyr old. Errors in our cluster ages are taken to be σ(log(age)) = 0.05.

Age-Metallicity Relation
The age-metallicity relation for the LMC cluster system, based on our main sequence fitting ages and Ca II triplet metallicities. For clarity, a close up of the intermediate-age clusters is shown in the inset. Over plotted are the smooth (dashed line) and bursting (solid line) chemical evolution models from Pagel & Tautvaišienė (1998).

Intermediate-Age Cluster Distribution
By combining our ages and abundances with near-infrared photometry of the red clump, we determined absolute distances to a sample of intermediate-age LMC clusters (filled symbols; Grocholski et al. 2007). This plot illustrates that both the old globulars (open symbols; taken from the literature) and intermediate-age clusters are distributed along the disk of the LMC, as defined by the field stars.