Stellar Population in the Large Magellanic Cloud Bar

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Instruments:	WFPC2 Proprietary period: 12
Cycle 9 primary orbits:	18
Cycle 9 parallel orbits:	0

Abstract

Large scale processes controlling star formation and nucleosynthesis are fundamental but poorly understood. This is especially true for external galaxies. A detailed study of individual main sequence stars in the LMC bar is proposed. The LMC is close enough to allow this, has considerable spread in stellar ages and a structure permitting identification of stellar populations and their structural features. The bar presumably plays a dominant role in the chemical and dynamical evolution of the galaxy. Our knowledge is, at best, based on educated guesses. Still, the major population of the bar is quite old, and many member stars are relatively evolved. The bar seems to contain stars similar to those of Intermediate to Extreme Pop II in the Galaxy. We want to study the history of star formation, chemical evolution and initial mass function of the population dominating the bar. We will use field stars close to the turn off point in the HR diagram. From earlier studies, we know that 250–500 such stars are available for uvby photometry in the PC field. We aim at an accuracy of 0.1–0.2 dex in Me/H and 25% or better in relative ages. This requires an accuracy of about 0.02 mag in the uvby indices, which can be reached, taking into account errors in calibration, flat fielding, guiding and problems due to crowding. For a study of the luminosity function fainter stars will be included as well.

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Total number of investigators: 3
Number of ESA investigators: 1 (indicated by * after name)

Observing Summary:

Target	RA	DEC	V	Configuration,mode,aperture spectral elements	Total orbits	Flags
LARGE MAGELLANIC CLOUD	05 20 52.2	-69 35 31	1	WFPC2 IMAGE F336W,F410M,F467M,F547M	18	CVZ
				Grand total orbit request	18	

■ Scientific Justification

Processes driving star formation and nucleosynthesis are poorly known, especially for external galaxies. For studies of such processes, the LMC offers unique possibilities. It is close enough to allow study of individual main sequence stars, it has a large spread in stellar ages and a structure permitting safe identification of different stellar populations and their properties. The LMC is thus favourable for studies of large-scale star formation and for tests of current theories on the evolution of galaxies.

Our knowledge of LMC star formation, has, until now, been limited to data from broad-band photometry, mostly of sparsely populated fields. Due to image growding, mainly relatively bright stars have been reached and studied so far. Still, it has been clear, that different parts of the LMC show different population characteristics. Effects of sporadic bursts of star formation and a stellar population a few Gyr old have been observed before.

In the LMC, the bar presumably dominates the chemical and dynamical evolution, in addition to close encounters with the SMC and the Galaxy. Gravitationally dominating, the bar is probably a motor of massive star formation. In such a scenario, clouds of gas and dust in outer parts of the galaxy are captured by the bar and fall in its direction.

Outside the bar, two populations are mixed: one old "halo population" and one younger "disk population". Also, LMC clusters show two populations. Older globular clusters are similar to Galaxy counterparts, while a younger population of clusters has a median age somewhat above 1 Gyr with some clusters up to 4 Gyr old. M giants stars in a field in the Western part of the bar seem to divide into a smaller young and larger old population.

In number and integrated mass, LMC stars of the youngest generations are of smaller importance. Stars defining global galactic properties are much older and may have a chemical composition considerably different from that of the youngest populations. How much older the dominating stars may be, and how different their chemical compositions are, has remained unknown. Of key significance in this respect is the composition of the bar.

To be able to study evolutionary signatures of larger amounts of stars in the LMC bar, we need observing material with excellent image quality. In addition, we need tools for reliable abundance investigations that are able to reach objects of intrinsic luminosity close to that of the Sun.

Hence, we propose to perform Strömgren photometry using the WFPC2 of HST. Resolving the faint members of the LMC bar cannot be done using the present ground based telescopes. The HST is a unique possibility for obtaining images with very high spatial resolution and high accuracy. The necessity of high accuracy photometry originates in the understanding of the turn off point from which we will be able to determine the age or the ages of the bar stellar population.

Description of the Observations

The stellar population of the LMC bar has sub turnoff point magnitudes of 23 mag in visual. In order not to be dominated by observational errors for, especially, the turnoff point, we aim for a S/N of 50 for visual 23 mag. Using the ETC available for the WFPC2, we estimate that we need the following observing time: F336W 27000 sec, F410M 19000 sec, F467M 11000 sec, and F547M 1800 sec. For the case of CVZ, including overheads and SAA, we estimate the number of orbits needed to be 18. Due to the cosmic ray hits and also to be able to perform dithering of the images, the long observing times should be split into shorter exposures, each of approximately ten minutes.

Special Requirements

CVZ: to optimize the observing time!

Supporting/coordinated Observations

Justify Duplications

Related HST Programs