The UM/CTIO Magellanic Cloud Emission-line Survey

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Abstract: The Magellanic Clouds are unique in providing us with sites to study the interstellar medium (ISM) and its components at all scales. To promote the pursuit of such studies, we have begun the Magellanic Cloud Emission-line Survey (MCELS), a deep imaging survey of both of these nearby galaxies in the emission of Hα, [S II], and [O III]. The emission-line images will be used in detailed optical and multiwavelength studies of H II regions, supernova remnants, planetary nebulae, superbubbles, and supergiant shells. Together with parallel surveys at other wavelengths, this survey will provide the foundation upon which to build a deeper understanding of the ISM in the Clouds and other galaxies, from small scales ($\sim$1 pc) all the way up to global scales.

Keywords: Magellanic Clouds — surveys — ISM: general

1 Introduction

While we can study some H II regions, supernova remnants (SNRs), planetary nebulae (PNe), and other nebular structures in detail in our own Galaxy, we lack the global perspective to study their general properties, especially in the optical where interstellar absorption prevents observations of all but the relatively local environment. Studies of distant galaxies provide the global view, but are limited in their ability to examine the detailed interactions on the scales of filaments or stars. The Large and Small Magellanic Clouds are unique in providing us with sites to study the interstellar medium (ISM) and its components at all scales. Their proximity and low foreground absorption make them the ideal laboratories for both studies of individual H II regions, SNRs, and superbubbles, and investigations of the global properties using samples of these objects.

To undertake such research, uniform datasets are needed to provide the basis for the identification, classification, and detailed study of the many components of the ISM. Until recently, optical surveys of the ISM in the Magellanic Clouds were limited to photographic studies performed in individual emission lines (e.g. Hα in Davies, Elliot & Meaburn 1976 and [O III] in Morgan et al. 1995). More recent surveys with modern CCD detectors have generally been limited either in area or in resolution. With the relatively recent combination of a large format CCD detector with the Schmidt telescope at CTIO, we have undertaken a deep multiple emission-line CCD survey of both the LMC and SMC, known as the UM/CTIO Magellanic Cloud Emission-line Survey (MCELS).

2 MCELS Details

Taking advantage of the wide field of view available on the UM/CTIO Curtis Schmidt telescope coupled to the sensitivity and large area of the newly available STIS 2k CCD, we are imaging the the central $8° \times 8°$ of the LMC and of the central $3 \cdot 5° \times 4 \cdot 5°$ of the SMC, covering most of the gaseous extent of both galaxies. This instrument provides $2 \cdot 035'$ pixel^{-1}, giving $\sim 3''$ resolution with a field of view of $1 \cdot 1° \times 1 \cdot 1°$. A grid of multiple, overlapping fields is being used to provide uniform coverage of the Clouds with minimal CCD artifacts.

In order to isolate the emission lines, we are using custom-made 4-inch narrow-band interference filters (corrected for the fast beam of the Curtis Schmidt) of Hα ($\lambda_c = 6563$, $\Delta\lambda = 30$ Å), [S II] ($\lambda_c = 6724$, $\Delta\lambda = 50$ Å), and [O III] ($\lambda_c = 5007$, $\Delta\lambda = 40$ Å). Images in two 'continuum-band' filters (at $\lambda_c = 6850$, $\Delta\lambda = 95$ Å and $\lambda_c = 5130$, $\Delta\lambda = 155$ Å) are also obtained to allow subtraction of the stellar background, leaving only emission-line objects. We plan to reach a limiting surface brightness in all three emission lines of approximately 3×10^{-17} erg cm^{-2} s^{-1} arcsec^{-2}, a surface brightness roughly equivalent to the diffuse Hα background measured in the LMC.

3 Preliminary Survey Results

MCELS observations began in November 1995, and as of February 1997 we had completed almost half of the survey of both Clouds. Preliminary analysis

of both survey and pre-survey emission-line data has already yielded significant results, providing identification or supporting optical imagery of four newly discovered supernova remnants (Smith et al. 1994; Chu et al. 1994, 1997) and optical data for the multiwavelength analyses of SNRs (Williams et al. 1997), superbubbles (Mac Low et al. 1997), and supergiant shells (Points et al. 1997). When complete, the survey will provide definitive samples of wind-blown bubbles, PNe, and SNRs, as well as calibrated multiple emission-line images of HII regions, superbubbles, and supergiant shells. Further information about the MCELS, including details about the datasets and their eventual public release, can be found at

http://www.astro.lsa.umich.edu/mcels.

Acknowledgments

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