The MCELS Data Reduction Pipeline and Its Application to PNe Searches in the LMC
L. Paredes¹, S. Points¹, R. C. Smith¹, A. Rest², G. Damke³, A. Zenteno⁴, and the MCELS Team
¹NOAO/CTIO, ²STScI, ³U. Virginia, ⁴Ludwig-Maximilians-Universität

The Magellanic Clouds Emission-Line Survey (MCELS) obtained observations toward the Large and Small Magellanic Clouds (LMC and SMC, respectively) over six years using the UM/CITRIO Curtis Schmidt telescope to produce deep images in [O III], H-alpha, and [S II] emission lines, in addition to adjacent green and red continuum filters. This survey covered the central 8°x8° of the LMC and the central 3.5°x4.5° of the SMC and encompasses most of the gaseous extent of each galaxy with an angular resolution of ~5 arcsec or better, allowing us to identify and study interstellar structures on ~1-1000 pc physical scales.

We have modified the SuperMACHO/Essence pipeline, developed for Blanco 4m Mosaic II data, to reduce MCELS data in a uniform manner. In addition to basic reductions (e.g., bias-subtraction, flat-fielding, etc.), this pipeline uses spatially-varying convolution kernels to match the PSFs of the narrow-band and broad-band images and produce continuum-subtracted images for the narrow-band filters. We use flux measurements of previously identified planetary nebulae (PNe) in the LMC, e.g., Reid & Parker (2010), and photometry obtained by our pipeline to create color-magnitude and color-color diagrams in the MCELS filters to search for new PNe candidates in the LMC.

Introduction:
The MCELS project was designed to obtain a deep and uniform dataset to measure the physical properties of ionized interstellar structures in the Large and Small Magellanic Clouds (MCs). This survey can be used to investigate the ionized gas structures of wind-blown bubbles, HII regions, planetary nebulae (PNe), supernova remnants (SNRs), superbubbles, and supergiant shells. The MCs are the ideal laboratories in which to study the morphology and physical characteristics of the ISM due to their known distances and low foreground extinction.

Data Acquisition and Coverage:
• UM/CITRIO Curtis Schmidt Telescope
• 54TE 2048x2048 CCD Detector
• 2.3” pixel (~5” resolution)
• Field-of-View: 1.3° x 1.3° (2.3”/pixel)

Planetary Nebulae Detection:
• Planetary Nebulae (PNe) are a common end-point of stellar evolution, becoming observable towards the end of lifetimes of a large fraction of stars between 1-8 solar masses and lasting 30 000-70 000 years.
• In optical bands PNe show numerous emission lines, being [OIII] 5007 the strongest one followed by [OIII] 4959 and Hα, but they essentially do not exhibit a large fraction of continuum flux.
• The detection is made using difference imaging between [OIII] and Green-continuum and Hα and Red-continuum, where we identify point and extended sources using DoPhot.
• Conditions for PNe candidates:
  • Detected point sources in the narrow-band images that have no resolved counterpart in the continuum band.
  • Sources with flux ratio Hα/[OIII] < 1 allowing us to differentiate from a HII compact region.

Conclusions and future work:
• In this ongoing project, we are probing the power of difference imaging algorithms through the pipeline by detecting PNe and other emission line objects.
• We have used photometry on continuum-subtracted fields to detect objects which lack of continuum flux, allowing us to find new candidates and re-classify previous ones.
• In the future, we will expand the search to all fields covered in LMC and SMC, refining our methods in order to define our candidates for spectroscopic follow-up.

References:

The MCELS project has been supported in part by NSF grants AST0507477 and AST0707613 and through the generous support of the Diane B. McLaughlin Fund at the University of Michigan, a bequest from the family of Diane B. McLaughlin in memory of her lasting impact on Astronomy. The National Optical Astronomy Observatory is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), under a cooperative agreement with the National Science Foundation.