IONSIZED GAS IN THE MAGELLANIC BRIDGE
NEW OBSERVATIONS WITH WHAM
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We recently acquired new spectroscopic Hα observations towards the Magellanic Bridge, using the Wisconsin Hα Mapper observatory, to investigate the warm ionized gas in extensive detail. When completed, these Hα observations will map the extent and large-scale velocity structure of the ionized gas, giving clues on the source(s) of ionization, the ionization fraction, and the mass of the ionized component. Ongoing work will include extensively mapping the Bridge in Hα, [S II], and [N II] as well as deep, targeted pointings in optical lines to gain additional information on the electron temperature, the metallicity, and the sources of the ionization. This study will substantially advance our knowledge of the ionized component of the Bridge and will provide new insights on how this system evolves and interacts with the Magellanic Clouds.

INTRODUCTION:
Halo gas interactions influence galactic evolution in the nearby Magellanic Clouds by affecting their star formation and metallicity. Recent tidal interactions from a near by encounter presumably created this bridge from low metallicity gas that could have originated from the Small Magellanic Cloud halo (e.g., Gardner & Noguchi 1996). These interactions likely induced the observed star formation between these galaxies (e.g., Larson & Tinsley 1978; Barton et al. 2007). The Magellanic System provides an excellent opportunity to examine a richly interacting and rapidly evolving system.

Numerous HI studies provide insight on the neutral component of Bridge but few studies have explored the ionized gas. Lehner et al. 2008 demonstrate the existence of a high ionization fraction in regions within the Magellanic Bridge. Observing the faint emission lines from this ionized gas requires a high-sensitivity instrument. This study uses the Wisconsin Hα Mapper (WHAM), an instrument sensitive to weak optical emissions from diffuse ionized sources, to observe the Bridge.

Many atmospheric lines complicate the identification of the ionized gas within the Bridge. The 12 km s\(^{-1}\) velocity resolution provided by the duel Fabry-Perot design of WHAM enables us to isolate Bridge emission. Without this velocity resolution, subtraction of foreground Galactic emission, atmospheric lines - some which very rapidly in time, and absolute intensity measurements would prove difficult. Though these lines obscure the Bridge emission, the well known geocentric position of the bright lines fosters high precision velocity calibration.

FUTURE WORK:
The Hα map shown in Figure 1 represents only a fraction of our data set, which covers a wider local standard of rest velocity range of +50 to +375 km s\(^{-1}\). We also acquired [S II] and [N II] data at the same beam positions and over the same velocity range. Though we have completed most of the mapped and pointed observations, two newly installed filters allow us to better map the higher velocities gas observations will continue through January to observe the high velocity gas.

REFERENCES:
Barton et al. 2007
Larson & Tinsley 1978

Figure 1: This Hα Magellanic Bridge map features the bright emission over the +110 to +310 km s\(^{-1}\) local standard of rest velocity range. Though this range only covers the intermediate velocities found in the bridge, this map combined with the spectra in Figure 2 illustrate the distribution of Hα throughout the Bridge with faint emission at the center. The removal of the atmospheric lines consisted subtracting 'ons' with an averaged 'off'; further processing of the faint emission will enhance its visibility in the map. The contour lines trace the 10\(^{19}\) cm\(^{-2}\) HI column density at increments of 20, 30, 40, and 50. The brightest Hα emission follows the high density HI gas in the Small Magellanic Cloud Tail (lower left) and the Large Magellanic Cloud (upper right). We fully sampled this region with a half-beam step pattern, as depicted in the upper left, to quickly and completely observe the large scale structure of the ionized gas.

Figure 2: We observed several directions along the length of the Bridge in Hα, [S II], and [N II] for over 8 minutes. Many of these sightlines align with previous studies to compare our sensitivity and to further investigate their physical properties (i.e., Putman et al. 2003). The purple spectra represents the Hα emission and the black spectra depicts the corresponding HI emission. Reduction of the Hα spectra consists of multiple steps: velocity calibration using the geocoronal line and a bright OH line (shown as orange in the bottom right panel) at a geocentric velocity of -272.44 km s\(^{-1}\), the removal of faint atmospheric lines using an atmospheric template (shown in green in the bottom right panel) - a technique employed by the WHAM survey (Haffner et al. 2003), and the subtraction of the geocoronal and bright OH line. Many of these spectra contain Galactic emission below 100 km s\(^{-1}\). The subtraction of the OH line produced an odd bump at 250 km s\(^{-1}\) in each of the displayed spectra. The unfortunate position of the OH line during these observations makes detections of Hα in the lower three panels difficult. Luckily, the offset between the geocentric and local standard of rest frame changes throughout the year allowing the recovery of this data on a future date.