Characterizing the Low-Mass Molecular Component in the Northern Small Magellanic Cloud

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ABSTRACT: As part of the SMC component of the MAGMA project (see also posters by Hughes and Wong), three molecular complexes in the north SMC are mapped with the Mopra telescope. We have resolved large, contiguous regions into cloud complexes of up to 6 cores. These observations show that the weaker molecular clouds in the north of the SMC conform to existing empirically-related properties of their counterparts in the south-west of the SMC, while at the same time showing significantly narrower line-widths for their estimated radii. Importantly, we find that the observed molecular emission does not always correlate well with dust emission, as observed at 70 and 160 microns. We also identify two examples where molecular material is distributed over two distinct and widely separate velocity ranges within closely spaced lines of sight, suggesting the action of an energetic process sometime in the history of the SMC which has caused the two components to accelerate apart.

OBSERVATIONS: We focused on selected regions in the north of the SMC, shown as boxed regions towards the top of Figure 1, labelled NE-1, NE-3 and a newly-named region: NE-4 (following Rubio et al, 1986). The observations were made with the Mopra Telescope, in Narrabri, Australia. The UNSW-MOPS broadband backend system was used in the high-resolution mode, configured to the 12CO(J=1-0) transition at 115.27 GHz. The data were processed using the LIVEXDA and GridZILLA processing software. Smoothing the data slightly resulted in an RMS noise of 0.57 mJy, a beamsize of 0.55 arcsec.

RESULTS: We estimate the virial mass with $M = \frac{K}{\Delta V^2}$, and find that the populations overlap in virial mass and line-width, but that the SMC CO cloud population have smaller median masses and smaller line-widths, consistent for a less driven population. We find that the populations overlap in virial mass and line-width, but that the SMC CO cloud population have smaller median masses and smaller line-widths, consistent for a less driven population.

CONCLUSIONS: We find that the CO cloud population in the north SMC is significantly different to that of the south-west, in terms of its velocity/radius properties. They imply that the properties of the ISM between the two regions are also different, in some as-yet-unquantified way. We notice that a difference is reflected also in the general properties of the HI regions (from data collated by Bica et al, 2007), where the northern SMC shows a relatively narrower velocity dispersion for their radii. We also compare the SMC CO cloud population to the LMC CO cloud population, and find that the populations overlap in virial mass and line-width, but that the SMC CO cloud population have smaller median masses and smaller line-widths, consistent for a less enriched ISM which is forming stars less actively.

ACKNOWLEDGMENTS: This work was supported by the Japan Society for the Promotion of Science (JSPS) Fellows (E. Muller and T. Onishi). NE-3c and a newly-named region: NE-4 (following Rubio et al, 1986). The observations were made with the Mopra Telescope, in Narrabri, Australia. The UNSW-MOPS broadband backend system was used in the high-resolution mode, configured to the 12CO(J=1-0) transition at 115.27 GHz. The data were processed using the LIVEXDA and GridZILLA processing software.