Properties of the ISM in dwarf galaxies

Project C1

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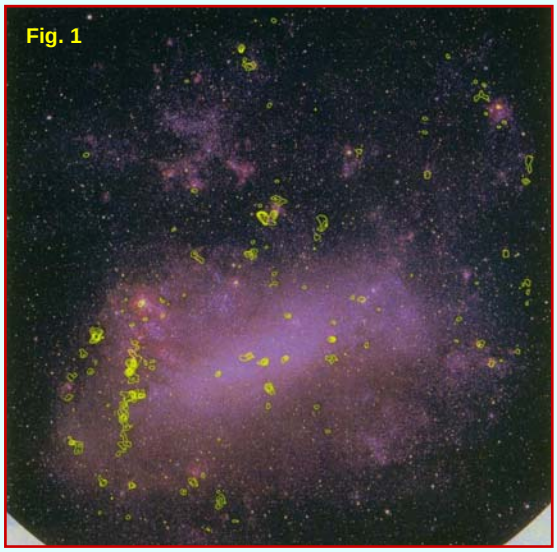
CO in the LMC

The Large Magellanic Cloud (LMC) is the most nearby extragalactic laboratory, with its nearly face-on view. With its low metallicity ($Z \approx 1/10\ Z_\odot$) and strongly varying UV radiation field, it takes on a key role in our investigations of such environments.

A number of previous observations of the LMC in the CO line with SEST (key project by Israel et al. 1993, and subsequent series of papers) and in [CI] and higher rotational transitions of the CO line with AST/RO (Bolatto et al. 2000a, 2000b) have been carried out previously. With a beam size of 3.8' at 490 GHz, those measurements provided a spatial resolution of 55 pc.

The new submm telescope NANTEN2 at Pampa La Bola (Chile), equipped with the 8-channel SMART receiver will for the first time facilitate a systematic mapping programme of the LMC (and SMC) in the submm regime. With a beam size of 40″ in the $^3P_1 \rightarrow {}^3P_0$ transition of the atomic carbon, this investigation will probe the ISM in the LMC on a scale of 10 pc and below. Measurements of [CI] and high-J CO lines will allow permit to investigate the cooling and heating balance in the ISM of the LMC with unprecedented detail.

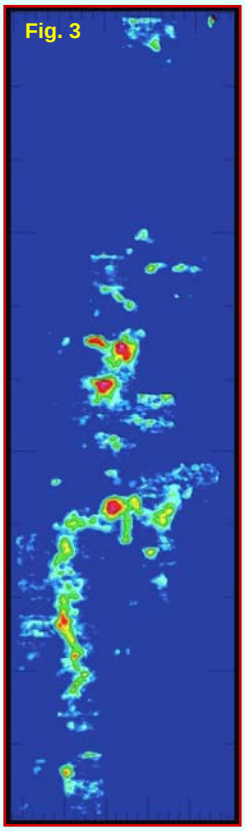
The previous full CO(1→0) map of the LMC obtained with NANTEN by Fukui et al. (1999) is shown in **Fig. 1** and exhibits a wealth of structures. The most salient ones are the chains of molecular clouds south and south-east of 30 Dor. They are likely to be the result of ram pressure, caused by the motion of the LMC through the gas of the Milky-Way halo. This may be the triggering mechanism for enhanced star formation on the eastern edge of the LMC, permitting us to study the relation between the distribution and state of the molecular ISM, and star formation.



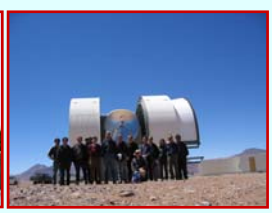
Using the MOPRA telescope, we have started to carry out a survey of the LMC in the CO(1→0) with a spatial resolution of 8 pc (33″ beam). This resolution – the highest in the CO line for the LMC so far – ideally matches the observations planned with NANTEN2. The observations are performed on-the-fly, producing fields of size 5' × 5' with full Nyquist beam sampling, within an hour of observing time, including overheads. The spectral resolution is 0.5 km s^{-1} and the sensitivity ~ 0.3 K (T_A^*).

The observations so far cover the prominent structure commencing in the 30 Dor region and stretching southward, the corresponding portion of the NANTEN map displayed in **Fig. 2**. An enormous wealth of detail is visible in the (identically scaled) MOPRA map (**Fig. 3**), with numerous cloud complexes, but also enigmatic linear features revealed. The latter are reminiscent of the finite sheets discussed by Burkert and Hartmann (2004). The probably trace the immediate location of aligned and condensed clouds resulting from ram pressure.

Since the data have been collected only this June, the full analysis is yet to come. We have started to identify individual clumps using the GAUSSCLUMPS software package. Our measurements are currently being extended into the SMC, while in the LMC we are observing selected regions in the ^{13}CO(1→0) line. With more observing time to come, we shall map the easternmost chain of clouds, mimicking a bow-shock structure (which it probably is!).



MOPRA NANTEN NANTEN2



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