**Star formation in the VMR.** In Giant Molecular Clouds, stars with different masses form following different modalities, with high and intermediate mass star formation occurring mostly in clusters, along with some low mass stars, which also form in isolation.

The Vela Molecular Ridge (VMR) [11], located in the galactic plane (b = ±3°) outside the solar circle (l ~ 260° - 275°) with most of the gas at a distance of ~700 pc, is probably one of the best regions for studying the processes involved in star formation (clustering, isolation, matter flows).

During the last decade we have presented several studies on VMR essentially based on IR imaging and spectroscopy, unveiling a remarkable concentration of young intermediate-mass stars with bolometric luminosities < 10^3 L⊙. Some of them have been identified as the driving sources of well studied mass flows ([2], [3], [4]). We have found ([5], [16]) that far-IR sources with L_bol > 10^3 L⊙ coincide with young embedded clusters (size ~ 0.1 pc, ~ 50 – 100 members). In particular, we found that the region of the VMR named cloud D hosts a large number of these, revealing a high efficiency in this mode of star formation. At the same time, the presence of IRAS sources having bolometric luminosities of only few solar luminosities, shows that the formation of isolated low mass stars is also active in this region. The observations of the VMR offer the unique opportunity to study the modalities of the star formation in the plane of the Galaxy, at variance with traditional regions (e.g. Taurus, Orion) located outside the plane. Therefore, the properties derivable from the VMR are the most suitable for obtaining a direct comparison with those of other galaxies, whose planes represent the main volume we are able to sample.

**Data.** Recently we mapped a ~ 1 deg^2 area of the cloud D in the 12 CO(1-0) without unprecedented resolution (43") and sampling (50", the typical size of hosted clusters and molecular cores) using the 15 m SEST telescope in La Silla. The gas (contour levels in Fig.2-a) shows a filamentary structure connecting regions of enhanced emission.

Complementary data have been also acquired in the (usually) optically thick 12 CO(2-1) line, that can be used, in combination with 12 CO(1-0), to infer reasonable values of the gas temperature along the map (although in the latter transition the data coverage is not complete).

Since its small critical density and high optical depth, 12 CO(1-0) is not a good tracer of the densest condensations of gas. Furthermore, CO tends to freeze out in the dust grains at the largest densities. Hence we mapped the same region in the 1.2 mm continuum using the SIMBA bolometer array on the SEST, with a resolution of 25" (~0.1 pc), to trace the dust thermal emission arising from the dense gas (Fig.2-a; [7], [8]). The dust map (coloured in Fig.2-a), indeed, presents a clumpy structure generally peaked within the intense gas emission regions.

**Dust clumps.** In this presentation we focus on the analysis of the 1.2 mm condensations found in the dust map, especially in relation with the position of the point sources of the IR catalogues.

To identify the dust clumps we have applied the automated procedure CLUMP FIND [9], filtering out the original output catalogue through conservative criteria on both deconvolved clump size and lower intensity contour level. This results in a robust sample of 29 condensations that typically show a non gaussian morphology and a tendency to clusterization (Fig.2-b), both suggesting a scenario of multiple star formation.

The derived masses (evaluated by assuming T = 30 K, \( k = 0.5 \) g cm^{-2}, gas to dust ratio of 100) range from 0.2 to 80 M⊙ and the mass spectrum obtained, N ~ \( M^{-1.5} \) (Fig.1), appears to be flatter than the IMF of field stars [10], but in agreement with the ones reported for other clouds (\( \alpha = 1.5 - 1.7 \)) (e.g. [11]).

![Figure 1: 1.2 mm clump mass spectrum compared with IMF of field stars](106.pdf)

** Associations with FIR sources. ** Aiming to obtain a census of the VMR-D young stellar content and to evaluate the relative fraction of Class 0/I/II objects, we searched for NIR/FIR counterparts (2MASS, IRAS, MSX) of the dust clumps. In particular, we considered a dust clump as associated with an IRAS/MSX point source if the region included in 2 FWHM of the clump overlaps (or is tangent to) the 3σ uncertainty ellipse of the FIR source. So we found that about 50% of the clumps shows an association (Fig.2-c,-e), a percentage in agreement with the results obtained for the GMC associated with RCW 106 by Mookerjea et al. [11].

The other half sample does not have any IRAS or MSX
counterpart and could then represent either cold Class 0 sources or pre-stellar cores where the collapse has not yet taken place (Fig 2-d).

The presence of multiple NIR (2MASS) sources in the neighborhood of the millimeter peaks has been considered as an indication of clustering (Fig 2-c) and we are performing an analysis based on NIR colours and spatial association with IRAS/MSX uncertainty to construct reliable Spectral Energy Distributions on a wide wavelength range (1 μm – 1 mm).

Properties of associated/unassociated clumps. We have planned a set of observations aimed to clarify the physical conditions of the unassociated clumps (candidate targets for ALMA). At the moment some general considerations can be done. Some of these clumps are brighter than the weakest ones which present association: this circumstance allows to exclude a lack of counterpart due to sensitivity effects. Moreover, searching VMR-D for methanol, $OH$, $H_2O$ masers has given negative results (e.g. [12]) while both an UCHII region [13] and the presence of a radio continuum (Parkes-MIT survey) can be associated only to one IRAS source. These facts indicate that VMR-D is characterized by low to intermediate-mass star formation. Finally, the averaged mass of the associated clumps ($< M_{assoc} > = 19 M_\odot$) is larger by a factor of 5 than that of the unassociated ones: however this can be interpreted as due to the assumption of a constant value of the temperature also for the youngest condensations, for which lesser values should be adopted.

As for the dust map, an analogous search for condensations has been performed on the $^{12}CO(1-0)$ data by using the 3D version of CLUMP-FIND [9], which allows to separate different velocity components as well. We have detected 49 individual gas clumps; about 50% of them are coincident with the dust ones and the analysis is currently in progress.