Investigations on the Galactic Star Formation Activity

Y.Maruccia, B.Maiolo, F.Strafella [1]

[1]Dipartimento di Fisica, Università del Salento, Italy

In the last three decades the capabilities to observe the infrared (IR) sky experienced an enormous increase due to both the development of sensitive detectors and space-borne telescopes. In this context the IR astronomy has been the main tool for studying the star-formation (SF) activity in our Galaxy, as well as in extragalactic objects. In particular we are engaged in exploiting the IR observation capabilities of the Herschel/ESA IR Observatory to characterize the star formation taking place in the more dense region of the Milky Way (the disk), where large parts of the molecular clouds are "seen" to form stars. Given the difficulties to see through the Galactic disk, due to the confusion and contamination from background sources, this is a challenging task so that we are involved in a large collaboration (HiGAL consortium, [1]) among international institutions aiming to obtain an IR survey of the Galactic plane with unprecedented sensitivity and covering the whole range of the galactic longitudes ($0° < \mathrm{Glon} < 360°$) and two degrees in galactic latitude ($+1° < \mathrm{Glat} < -1°$). A first part of this survey has been already carried out with angular extension shown in Figure 1. An example of the fantastic images emerging from these observations is shown in Figure 2.

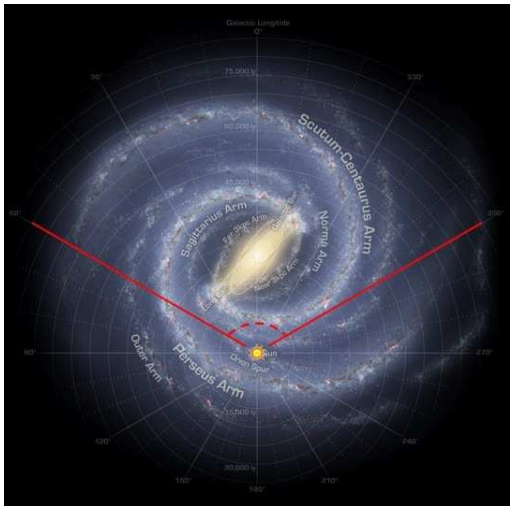

Figure 1. Top view of the Milky Way. The red lines show the angular extension of the completed survey (120 degrees around the Galactic center). An extension to the full range of longitudes has been approved and the observational activity is ongoing at the Herschel/ESA observatory.

At the end of the Science Demonstration Phase of the Herschel Observatory we obtained the first images that have been used to verify the capabilities of the survey and to produce first results (see e.g. [2], [3], [4]). On this basis we are now investigating the protostellar content of different molecular clouds with the aim to correlate the characters of the protostellar population (as the SF rate, efficiency, and the mass function) with the physical, chemical and morphological parameters of the parent molecular clouds. To this aim we are presently engaged in the detection and photometry of the point-like sources in approximately 30 square degrees of the survey, an essential activity for producing a sensitive, complete and unbiased catalog of the IR sources in the Galactic disk.

Our attention has been also focused on the Vela Molecular Cloud, a star forming region for which we already obtained, by means of Spitzer/NASA observations, the catalog of the IR sources ([5]). We exploited this information along with the observations of this region by the BLAST experiment [6], that observed the Vela region at the wavelengths 250,350,500 μm, to select candidate young objects to be used for further targeted observations. These have been carried out in many molecular lines by using the radio telescopes at Mopra and Parkes (Australia) and the preliminary results can be found in [7].

REFERENCES

1. S. Molinari *et al.*, Hi-GAL: The Herschel Infrared Galactic Plane Survey, PASP **122**, 314 (2010)
2. S. Molinari *et al.*, Clouds, ???laments, and protostars: The Herschel Hi-GAL Milky Way, A&A **518**, L100
3. D. Elia *et al.*, A Herschel study of YSO evolutionary stages and formation timelines in two fields of the Hi-GAL survey, A&A **518**, L97 (2010)
4. P.G. Martin *et al.*, Direct estimate of cirrus noise in Herschel Hi-GAL images, A&A **518**, L105, 2010

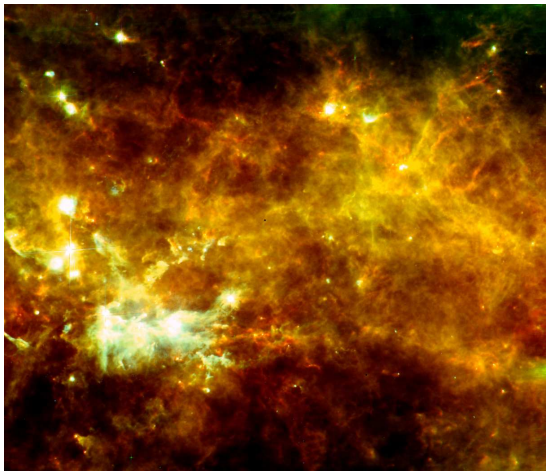

Figure 2. Composite image of the Galactic Plane in the Vulpecula region (taken at longitude l=59 deg), obtained by combining images from the Herschel/ESA Galactic Plane Survey taken at 70, 160, 350 micron. Shock fronts, ionized regions and bubbles are seen along with a rich texture due to the interstellar medium.

5. F. Strafella *et al.*, The Spitzer-IRAC Point-Source Catalog of the Vela-D Cloud, ApJ **719**, 9 (2010)
6. L. Olmi *et al.*, The BLAST Survey of the Vela Molecular Cloud: Physical Properties of the Dense Cores, ApJ **707**, 1836 (2009)
7. L. Olmi *et al.*, A Spectral Line Survey of Starless and Proto-Stellar Cores toward the Vela-D Molecular Clou, arXiv-1201.4798v1 (2012)