ATLASGAL

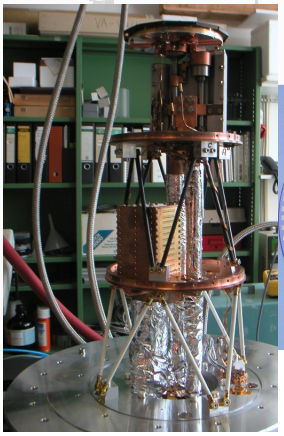
APEX Telescope Large Area Survey: the Galaxy

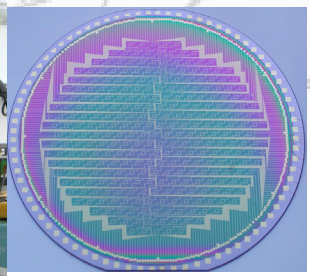
In 2006, we will start a large area (several hundred square degrees) survey of the Galactic Plane with bolometer arrays. It will provide a global view of star formation at submillimeter wavelengths at an unprecedented level of detail. First priority is given to an unbiased survey at 870 μm with a sensitivity high enough to detect solar mass gas condensations at distances of thousands of light years. With complementary observations at 350 μm, 1.4 and 2 mm, the physical properties, such as masses and temperatures for all regions of massive star formation up to the Galactic center's distance (ca. 30000 light years) will be revealed. Limited targeted observations will also be conducted with spectral-line receivers, mostly in CO lines, giving new clues to galactic structure and dynamics. In combination with other Galactic surveys at similar resolution (e.g. MSX, Herschel), these new surveys will yield a global understanding of star formation at the Galactic scale.

Why submillimeter?

From the ground, the atmosphere is completely opaque to infrared radiation, between 20 and 150 μm. Observing this range requires spatial facilities, limited in size and very expensive. With a surface 12 times larger than Herschel, the APEX antenna provides a fantastic sensitivity at wavelengths longer than 200 μm, where cold dusty objects emit most of their energy.

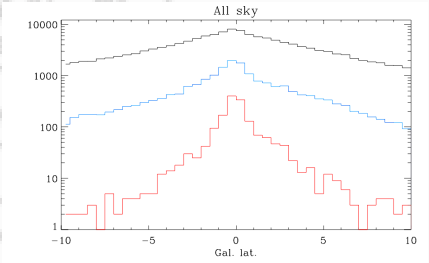
LABOCA





Survey strategy

As shown by infrared surveys, the star formation activity is tightly concentrated in a thin layer along the Galactic disk. One half of all massive young stars in the Galaxy are located in the ±1° range of latitude. They are also mostly found between –80° and +80° in longitude.



Young massive stars detected by IRAS (red line) show a strong peak at small Galactic latitudes compared to the distribution of all IRAS sources (black), or those detected at 25 and 60 μm (blue). While 12% of IRAS sources are in the ±1° range, 55% of these young stars are there.

The area ±1° in latitude, –80° to +20° in longitude will first be part of a **shallow survey**, which will take about one month. Dusty molecular cores down to **one solar mass** will already be detected at distances of 3000 light years.

On a few years timescale, a **deep survey** of the same area will be performed. It will reveal all cores of more massive than some 10 solar masses at the distance of the Galactic Center. A few nearby star-forming regions will be more deeply observed to look for individual protostars well below one solar mass. Limited areas will also be mapped at 350 μm.

The northern part of the plane, at longitudes above +20°, will be covered by a similar survey with the James Clerk Maxwell Telescope

LABOCA is a new 295-element bolometer array that will observe at 870 μm. With a field of view of 11' and a sensitivity close to 100 mJy in one second, this is the perfect tool to conduct large area surveys. It will be installed at the APEX telescope in December 2005.

Max-Planck-Institut
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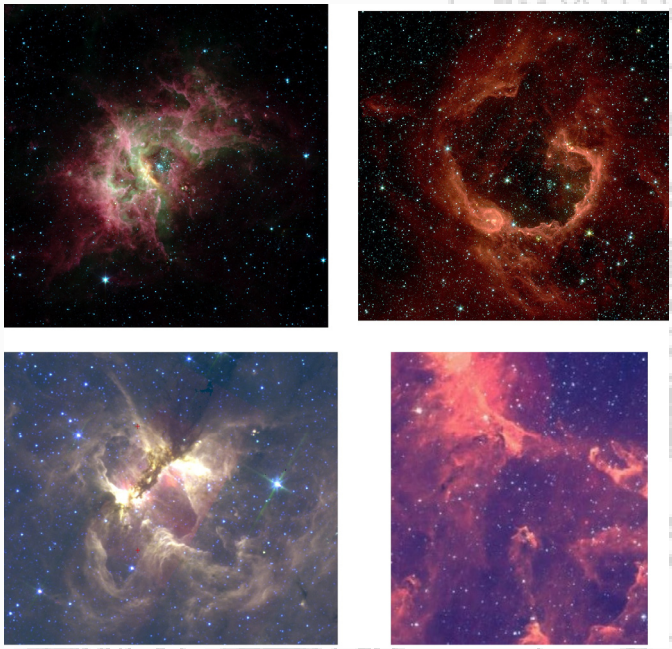
Infrared survey: GLIMPSE

The GLIMPSE survey, observed at 3.6, 4.5, 5.8 and 8.0 μm with the Spitzer Space Telescope, covers 240 deg^2 of the inner Galactic Plane, from 10° to 70° in longitude on either side of the Galactic Centre, and from –1° to +1° in latitude. The primary science goals include studying the structure of the inner Galaxy and investigating the statistics and physics of star formation. The GLIMPSE II survey, which will cover the central 20°, has recently been approved.



Four regions of star formation, as observed by GLIMPSE

An infrared view of the Galactic plane (at wavelengths of 60, 100 and 240 μm) as seen by COBE/DIRBE

Infrared survey: MSX

The MSX survey covers the Galactic Plane, in the ±5° range of latitude (3600 deg^2), in four infrared bands centered at 8, 12, 15 and 21 μm. Observations were performed with a 30 cm diameter space telescope, with an 18" spatial resolution. This survey resulted in a 400 000 point source catalogue.

MSX 4.5x1 deg^2 map covering the Galactic Center

Future infrared survey: Hi-Gal

The Herschel satellite will be launched in 2007. This 3.5 m diameter telescope will cover the infrared range, between 60 and 600 μm.

The **Hi-Gal open-time key project** proposes to map the Galactic Plane in the 60 – 600 μm range. The area to be surveyed is a 5° wide strip over all the Galactic Plane (total: 1800 deg^2). Three main topics drive the science case for this survey: star formation, post-main sequence stars and the interstellar medium.

The APEX survey of the Galaxy will result in a complete atlas of cold dusty objects throughout the southern Milky Way and reveal their physical properties. In combination with other Galactic surveys, these data will yield a global understanding of the star formation at the scale of the whole Milky Way. It will make APEX a true pathfinder for future projects with the Herschel satellite and the ALMA interferometer.

Credit for Figures: GLIMPSE: NASA / JPL-Caltech / E. Churchwell
COBE/DIRBE: Michael Hauser (STScI) / NASA
Herschel: ESA (Artist view)