GALEP, un cartograado espectral de la Galaxia interna con EMIR

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Abstract We propose to use EMIR to obtain near IR spectroscopy of many thousands Galaxy sources, mainly located in the inner regions. These will be selected from their position on IR colour-magnitude diagrams and will include disc, bar bulge and ring sources. The principal aim is to accurately classify the sources to provide a better understanding of, particularly, the redder parts of a infrared CM diagram. Without this information there will remain ambiguities in the interpretation of structures in the inner Galaxy.

1 The project

Over the last six years we have been undertaking a multi-wavelength survey of the Galactic plane combining data from various sources, Two Micron Galactic Survey ([3]), DENIS (I,J,K survey of declination $\delta < +2^\circ$, [2]), JHK images from the 1.5m TCS (TCS-CAIN [1]), *gri* images from the INT WFC (these data sets are now complete). This wavelength range covers a factor of over 10 in penetration of interstellar extinction. The multiple wavelengths will allow, at least statistically, a determination of source type, distance and extinction along the line-of-sight.

In addition, in the last decade there has been an intense effort in mapping the stellar content of the Galaxy, in particular from NIR star counts ground based sur-

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veys (c.f. DENIS and 2MASS) and from NIR & MIR star counts and integrated flux space surveys (c.f. DIRBE, MSX, GLIMPSE). All together, they have contributed to enlarge our knowledge of the galactic stellar distribution and there is now an ever increasing consensus on the main morphological components of the Milky Way. ESO is now undertaking two major photometric surveys, from both hemispheres, in the NIR domain, VISTA and UKIRT (cf. UKIDSS), which will be a prime input source for selecting targets in this proposal.

These huge databases, now photometrically and astrometrically crosscorrelated, permit for the first time to launch projects like the one we are proposing in this document, which will elucidate the true nature of the stellar content of the different structural components of the Galaxy, by adequately selecting the targets for the spectroscopic followup studies from a well populated photometric parameter space.

The above work is beginning to show the structures in the inner Galaxy. The aim of this proposal is to examine spectroscopically a representative selection sources being discovered deep in the Galaxy along a number of different lines of sight using EMIR at the GTC. The majority of the objects lie very close to the Galactic Plane and high extinction means that these objects are impossible to observe at visible wavelengths and so the near IR has to be used. In order to sample the various galactic components, disc, bar, ring, bulge and arms, with unprecedented sensitivity and statistical coverage, we propose to obtain spectra in many regions along the plane throughout the Galactic plane within the reach of the GTC ($0^\circ < \ell < 200^\circ$). In order to obtain a representative sample of the various Galactic components at each location several hundreds of spectra are required. These sources will be chosen from different regions of the C-M diagram and so have a high probability of belonging to a specific component. In this way we will be able to trace how the components change with position in the Galaxy.

The near infrared spectra will allow accurate determination of the spectral type of the sources. In the H and K bands there are a series of molecular lines, OH, H_2O and CO (or carbon molecules for the carbon star) as well as a number metal lines, Na Ca, Fe etc. The features, however, are relatively spread out between 1.5 and 2.4 microns and hence high resolution is not required. The relative strength of these lines coupled with the over all form of the spectra will allow the spectra type to be accurately determined. For example the CO is a good indicator of spectral type for K and early M giants and the H_2O becomes very strong for the very late giants. An on–going preparatory observational work can be found in [4].

The sources will be chosen from their locations in the CM diagrams, built from the TCSCAIN, 2MASS and GLIMPSE databases so that we will know what Galactic component the source belongs to. However, in many respects these diagrams are only partly calibrated because the infrared H–R diagram is still not well determined. Currently we can only be certain of the position of a few spectral types (e.g. the K2III) and even then there are problems. However for the more extreme IR sources (Late M giants and carbon stars) their luminosity function is not well known, yet it is these sources dominate the brighter IR magnitudes. By obtaining spectra of a selection the redder sources it should be possible to determine what they are, and

hence if their position on the CM diagram is due to extinction or that their being intrinsically red.

It has to be emphasised that this proposal aims at acquiring and classifying a significant fraction of the stellar content of the Galactic plane and neighbouring areas, so as to avoid many of the standard a priori assumptions in the form of the stellar luminosity function along the Galaxy. Hence the spatial coverage has to be both large in area and intense in the selection of objects on every field. The fields will be highly concentrated in the Galactic plane since it is not worth having many fields far from the plane as these would be better done in the visible. However some of the fields should be centred on interesting objects, e.g. clusters of massive stars, rather than just on position. These will be taken from GLIMPSE, 2MASS etc. The spectroscopy will be concentrated in the H&K bands, since J spectroscopy would be difficult for many of the objects as they would be invisible.

And additional goal, but not a requirement, of this project is the measurement of radial velocities for using kinematics as a tool for classifying the different populations. EMIR will deliver resolving power of 4250 and 4000 at H&K respectively. That translates into velocity resolutions of 70 and 75 Kms^{-1}. Even if a low resolution grism, of about R= 1500, is finally mounted in the instrument and used for this project, that would imply resolution in velocity of about 200 Kms^{-1}.Once the instrument would be successfully commissioned and if everything is sufficiently stable we can hope to measure velocities to 10% of the resolution (i.e velocities of 7 to 20 Kms^{-1}) as there should be a number of strong lines we can use, and the atmospheric absorption features should give us a good wavelength reference.

Finally, it is worth to mention that the a significant proportion of the sources in this programme will be at the reach of GAIA, so as both databases could be cross correlated increasing the amount of useful information.

References

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