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AN ALL-SKY SURVEY OF FAR-INFRARED LOOPS

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We report on the first results of an all-sky survey program to investigate the large-scale structure of the interstellar medium in the Galactic neighbourhood of our Solar System, using far-infrared *IRAS* data. Our work focuses mainly on the indicators of past high pressure events (supernova explosions and stellar winds). We have identified several of these objects as loop- or arc-like intensity enhancements in the far infrared, and have analyzed their individual FIR properties and their distribution on the sky.

Shell- or arc-like local intensity enhancements are detected in many tracers of the interstellar medium (ISM) and are usually explained as expanding shells from supernova (SN) explosions and stellar winds of massive stars, or products of interstellar supersonic turbulence. Loop-like structures can be detected in the far-infrared wavelength range due to the features of the dust emission and the characteristics of the distribution of young embedded objects.

In our work, a visual search was carried out on the *IRAS* ISSA plates (Wheelock et al. 1994) at 100 and 60 μm. This work is an extension of the survey performed in the 2nd Galactic Quadrant (Tóth, Kiss, & Moór 1996; Moór, Kiss, & Tóth 2001).

We approximated the shape of the loops identified by eye with an ellipse, and a 2-D least square fit method was used to determine the parameters (central coordinates, minor and major axes, and position angle).

We extracted a radially averaged surface intensity profile at 60 and 100 μm for the suspected loops, extending to a distance of twice the axes of the fitted ellipse, using 40 concentric ellipsoidal rings. In order to filter out many subjective effects due to the by-eye investigation, and to check if our loops really show the expected FIR intensity excess over the local background, we derived a parameter that describes the significance of the intensity excess of the loops: $\Psi = I_{\rm ex}/\sigma_{\rm ex}$. Here $I_{\rm ex}$ is the maximum intensity excess and $\sigma_{\rm ex}$ is the standard deviation of the background-removed intensity in the "non-loop" position of the 100 μm intensity profile. We also characterize our loops by the "color index" (I_{60}/I_{100}) calculated from the 60 and 100 μm ISSA intensities, which may account for differences in FIR emission properties in the loop walls.

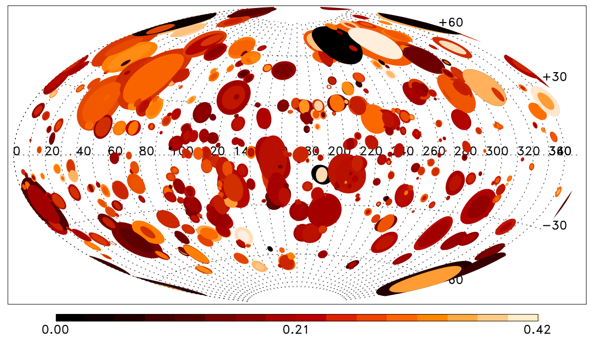

Fig. 1. Distribution of GIRLs on the sky (Galactic coords.). The color of the ellipses represent the color indices (I_{60}/I_{100}) of the loop walls and the loop interiors.

We identified altogether 472 FIR loops (112, 141, 142, 83 in the 1st, 2nd, 3rd, and 4th Galactic Quadrants, respectively). We call these objects "GIRLs", abbreviating "Galactic InfraRed Loops".

The Galactic longitude distribution of the GIRLs reflects the spiral structure of the Galaxy. The distribution in Galactic latitude (b) of the loop centers shows a surprisingly large number of GIRLs at high b, which cannot be explained by projection and distance effects only.

A number of loops are parts of structures appearing on scales larger than the individual loop diameters. The most prominent example is a huge chain of loops in Figure 1 seen around the position ($l = 110°, b = -20°$).

Most of the loops show the color of the extended Galactic emission, or "cirrus" ($I_{60}/I_{100} = 0.21$), as presented in Figure 1.

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