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Exploring Extinction and Structure in the Milky Way Disk With 2MASS and *Spitzer*

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Abstract. We present new maps of the distribution of both dust and stars across the Galactic disk, based largely on an improved analysis of 2MASS and Spitzer-IRAC data. The infrared extinction law is rederived throughout the disk and we found strong longitudinal variations in both diffuse and dense environments that we incorporate in our analysis.

Keywords. dust, extinction — Galaxy: disk — Galaxy: structure — infrared: ISM

Many Galactic dust studies to date have found an IR extinction law that is nearly constant and universal in the diffuse interstellar medium (ISM; e.g., Indebetouw *et al.* 2005), but more recent work has demonstrated that in regions of dense ISM, such as dark cores, the MIR A_λ curve becomes shallower, likely due to dust grain growth (e.g., Weingartner & Draine 2001). Thus, we questioned whether the Galactic extinction law would change substantially through the various ISM environments in the disk, beyond the simple, frequently-used "dense"/"diffuse" paradigm.

For this study, we combined photometry from the MIR *Spitzer*/IRAC surveys (Benjamin *et al.* 2003), spanning ∼150° of nearly contiguous disk longitude, with the NIR 2MASS Catalogue (Skrutskie *et al.* 2006), to obtain a consistent set of photometric data in 7 bands (1.2–8 μm). Using red clump stars, we have measured the relative extinction law along many lines of sight in the Galactic disk. We find strong, monotonic variations in A_λ/A_{Ks} as a function of galacto-centric angle, symmetric about the centre. This behaviour (a steepening extinction law at larger angles) persists even after the removal of known dense ISM, traced by ^{13}CO emission (GRS; Jackson *et al.* 2006), which suggests a secondary Galactic-scale dust property gradient (Zasowski *et al.* 2009).

We include these extinction law variations in a new technique for stellar reddening estimation, which uses long-baseline N/MIR colours to derive star-by-star extinction values more robustly than NIR-only techniques; in addition, this RJCE method (Rayleigh Jeans Color Excess method; Majewski, Nidever, & Zasowski, *in prep.*) preserves stellar type information to create reliably-cleaned mid-plane colour-magnitude diagrams. The preservation of stellar type and luminosity class information permits 3-D mapping of the stars and the intervening dust without reliance on a static Galactic model.

References

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