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MAPPING THE INTERSTELLAR GALACTIC EXTINCTION: A MODEL-INDEPENDENT WAY.

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Abstract. All last attempts to establish a 3D map of the Galactic extinction like Marshall et al. (2006) were based on models/data comparisons. In my poster, I presented a new model-independent method to map the Galactic interstellar extinction. We developed an algorithm which detect the Red Clump stars tail on CMDs and convert its position into a distance-extinction sample. We used 2MASS and UKIDSS data which give us a detailed 3D-map in the galactic plane.

Keywords: Techniques: photmetric, surveys, (Stars:) Hertzsprung-Russell and C-M diagrams, Stars: horizontal-branch, (ISM:) dust, extinction, Galaxy: structure

1 Introduction

To perform detailed studies on the Milky Way and its components, we must accurately measure the distance to big structures shaping the Galaxy. Unfortunately, this measurement is difficult because of the pilling up of features in a same line of sight and the high extinction in the disc. Without astrometry, photometric distances needs an accurate extinction value. Establishing a correct extinction map is therefore a crucial step in a stars density mapping process.

All past attempts to establish a 3D map of the Galactic extinction, e.g. Marshall et al. (2006), were based on model/data comparison. In this work, we present a new model-independent method to map the Galactic interstellar extinction. We use the 2MASS and UKIDSS near-infrared (NIR) photometry surveys in the Galactic planez and the Red Clump (RC) stars as a distance indicators.

2 From the detection of the Red Clump tail ...

As one can see in Fig. 1, RC stars extend in a tail due to extinction. We detect the location of this RC tail on our CMDs. Our detection stops at the completeness limit of the studied field. Using the solar neighbourhood properties of the RC, we convert color-magnitude coordinates into a distance-extinction (D, Av) sample. An example of the detection is presented in Fig. 1.

In order to establish a non-cumulative continuous map we need to smooth our detection sample. We take into account the studied field with a 1.0 weight and the two contiguous fields with a 0.05 weight. We force the spline to monotonically increase and use it to construct our 3D-interstellar extinction map.

3 ... To a 3D-interstellar extinction map

One can see on Fig. 2 a clear hole at l $\in$ [4,10]°and D $\in$ [0,3.5] kpc from the Galactic Center (GC) which is inside of the bar radius. At 4 kpc from the GC, we see the molecular ring. On this map, three high extinction areas can be seen at l $\simeq$ 18-19°, l $\simeq$ 23-24°and l $\simeq$ 27-28°. Those features can be associated to the end of the near side of the Galactic bar and the region where is the origin of the Crux-Scutum arm (Hammersley et al. 2000; Green et al. 2011). This map come along with Vallée (2008) spiral arms.

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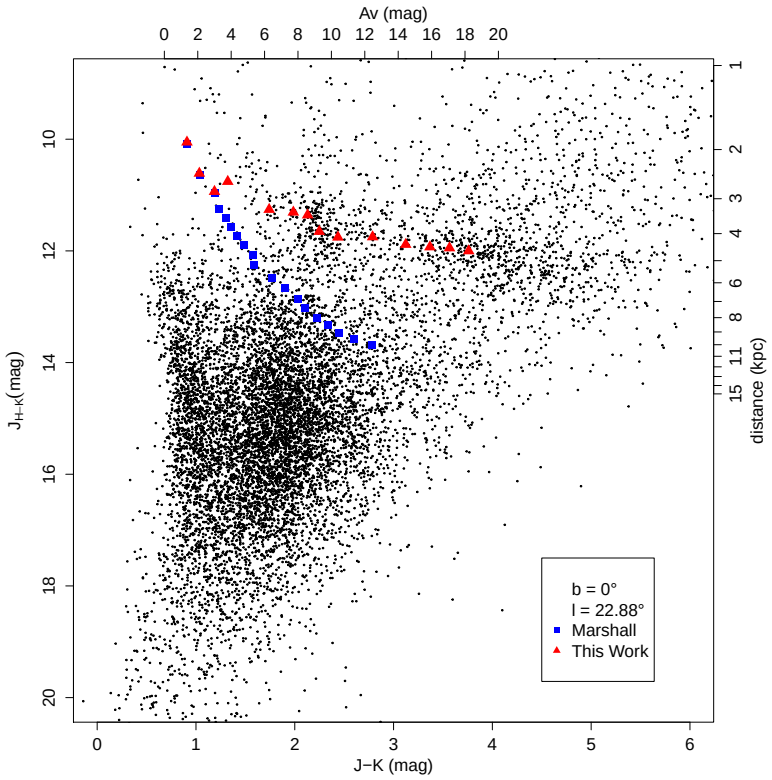

Fig. 1. UKIDSS CMD of the l=22.88°, b=0°field. Distance (D) and cumulative extinction (Av) axis are added to the CMD and calculated for a medium RC star (from solar neighbourhood properties). Following Babusiaux & Gilmore (2005), we used the reddening-independent magnitude as Y-axis. Black dots represent the observed data. Blue squares represent Marshall et al. (2006) model. Red triangles represent the result of the detection algorithm for this field.

4 Perspectives

The method presented here allows us to map the Galactic interstellar extinction but does not give any clue on stellar density. We have begun to work on a new method to deduce both 3D-extinction and stars density map from NIR photometry, including VVV survey to obtain detailed data in both 1st and 4th quarters. To achieve this, we are using a Bayesian method with only isochrones, an initial mass function and a star formation rate as priors.

5 Conclusion

In conclusion, using the Red Clump stars as distance indicators, we have produced a 3D extinction map in the Galactic plane. The 2MASS data gives us an all-sky overview while the UKIDSS data provides a detailed map in the 1st quarter, which will be completed with VVV data in the 4th.

References

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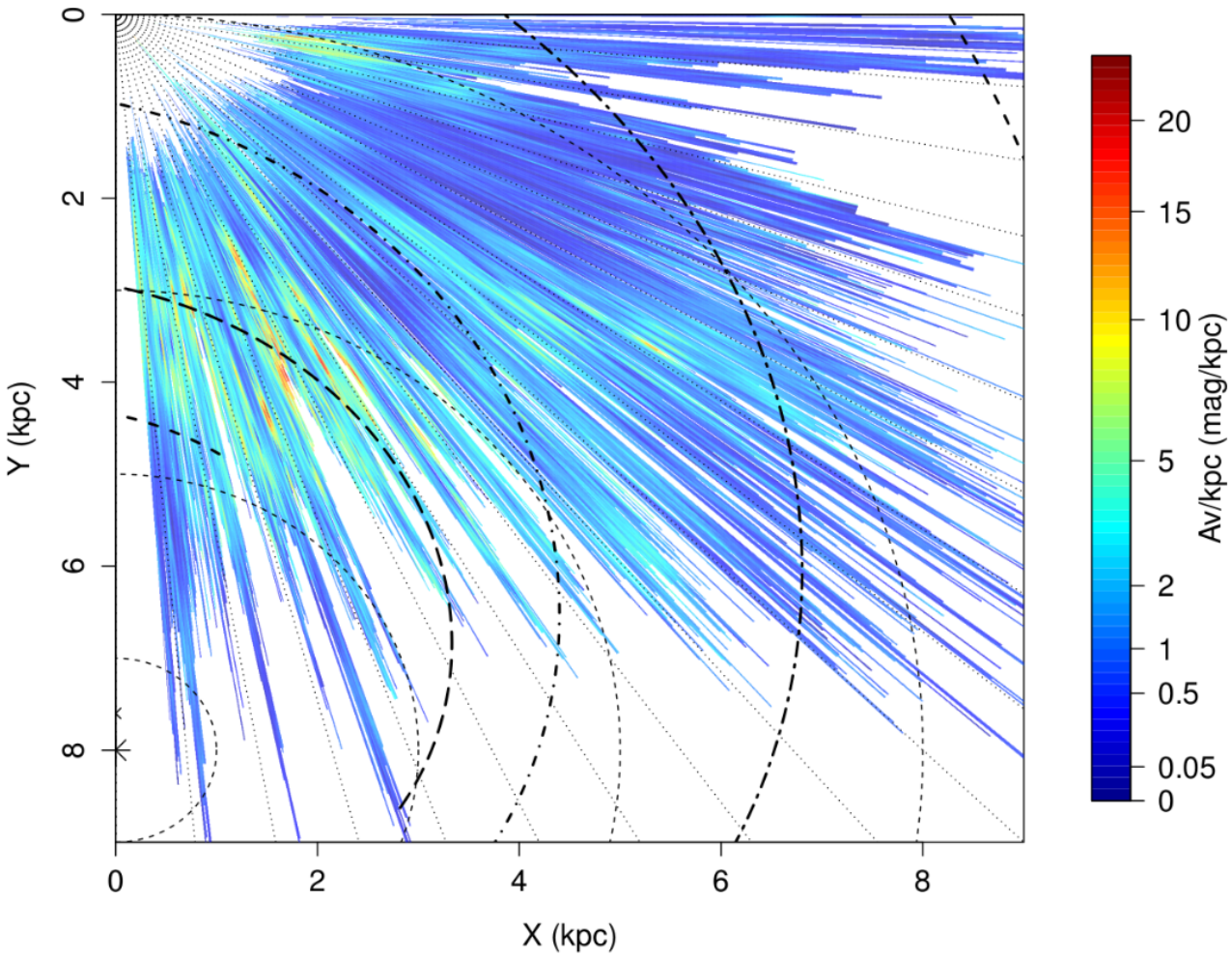

Fig. 2. Map produced using UKIDSS data through the detection-regression process described hereabove. Vallée (2008) arms (bold dashed lines) and circles with R=1,3,5,8 kpc radii (thin dashed lines) are over-plotted.