

STRUCTURE OF THE OUTER GALACTIC DISK WITH GAIA DR2



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In this work, we study the structure of the outer Galactic disk up to Galactocentric distance R=20 kpc. We use the Gaia DR2 data on which we apply a deconvolution technique in the parallax errors. We recover for each line of sight the distribution of stars as a function of distance, which we use to construct density maps, that we analyze. We study structural features of the outer Galactic disk, mainly the warp.



CONTEXT

The structure of outer disc of our Galaxy is still not well described and there are many features that need to be better understood. Second Gaia data release (DR2) provides data in unprecedented quality that can be analyzed to shed some light on the outermost parts of the Milky Way.



METHODOLOGY

- ▶ To calculate the stellar density, we need to measure star counts as a function of the distance. However, the error of parallax increases with distance from us, so our analysis would be correct only within roughly 5 kpc from the Sun. To be able to reach higher distances, we correct this effect using Lucy's deconvolution method to obtain accurate distance measurement up to R=20 kpc.
- From the corrected star counts we can calculate density as

$$p(1/\pi) = \frac{N(\pi)\pi^4}{\Delta \pi \omega \int_{M_{G,low\ lim}}^{M_{G,low\ lim}+1} \mathrm{d}M_G \Phi(M_G)} , \ M_{G,low\ lim} = m_{G,low\ lim} - 5log_{10}(1/\pi) - 10 - A_G(1/\pi) .$$

We fit the resulting density with known models of warp, such as

$$z_w = z_0 + z_1 \cdot \sin(\phi - \phi_1) + z_2 \cdot \sin(2\phi - \phi_2)$$



RESULTS

We construct density maps, that we can analyze to study the structural features of the outer Galactic disk





RESULTS

- One of the most interesting features is the warp
- We compare amplitude of the warp found from our data with results of other authors - it is evident that there is strong dependence of the warp amplitude on the age of the population



Cepheids, which are very young stars have much higher warp amplitude, than the whole population

our work - whole population
our work - young population
López-Corredoira et al. (2002b)
Yusifov (2004), Pulsars

- Reylé et al. (2009)
- Chen et al. (2019), Cepheids
- Skowron et al. (2019a), Cepheids
- Li et al. (2019), OB stars

XIV.0 Reunión Científica 13-15 julio 2020

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PROSPECTS FOR THE FUTURE

Applying our method, we have already reached distances previously unexplored. A future analysis of next Gaia data release combined with the deconvolution method based on Lucy's method of inversion, will allow us to explore even higher distances. The future data release will provide a much deeper magnitude limit and much lower parallax errors, which will allow us to extend the range of Galactocentric distances and study the morphology of the disk and of the stellar halo at very large distances.

