

3D extinction maps of the Milky Way solar neighborhood with Gaia GSP-Spec

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DUST EXTINCTION

We estimate the extinction $E_{(B_p-R_p)}$ in the Gaia bands by subtracting the observed colour ($B_p - R_p$) to a theoretical one calculated on the stellar **GSP-Spec atmospheric parameters** and a Teff-colour relation (*Casagrande+2021*). Thanks to the **small spectral domain** of the RVS (845-870 nm), the estimated Teff has the **advantage to be unaffected by extinction effect**. Removing stars in the foreground, we can create a **full-sky 2D map** of the extinction distribution in the Milky Way using **only Gaia data**.

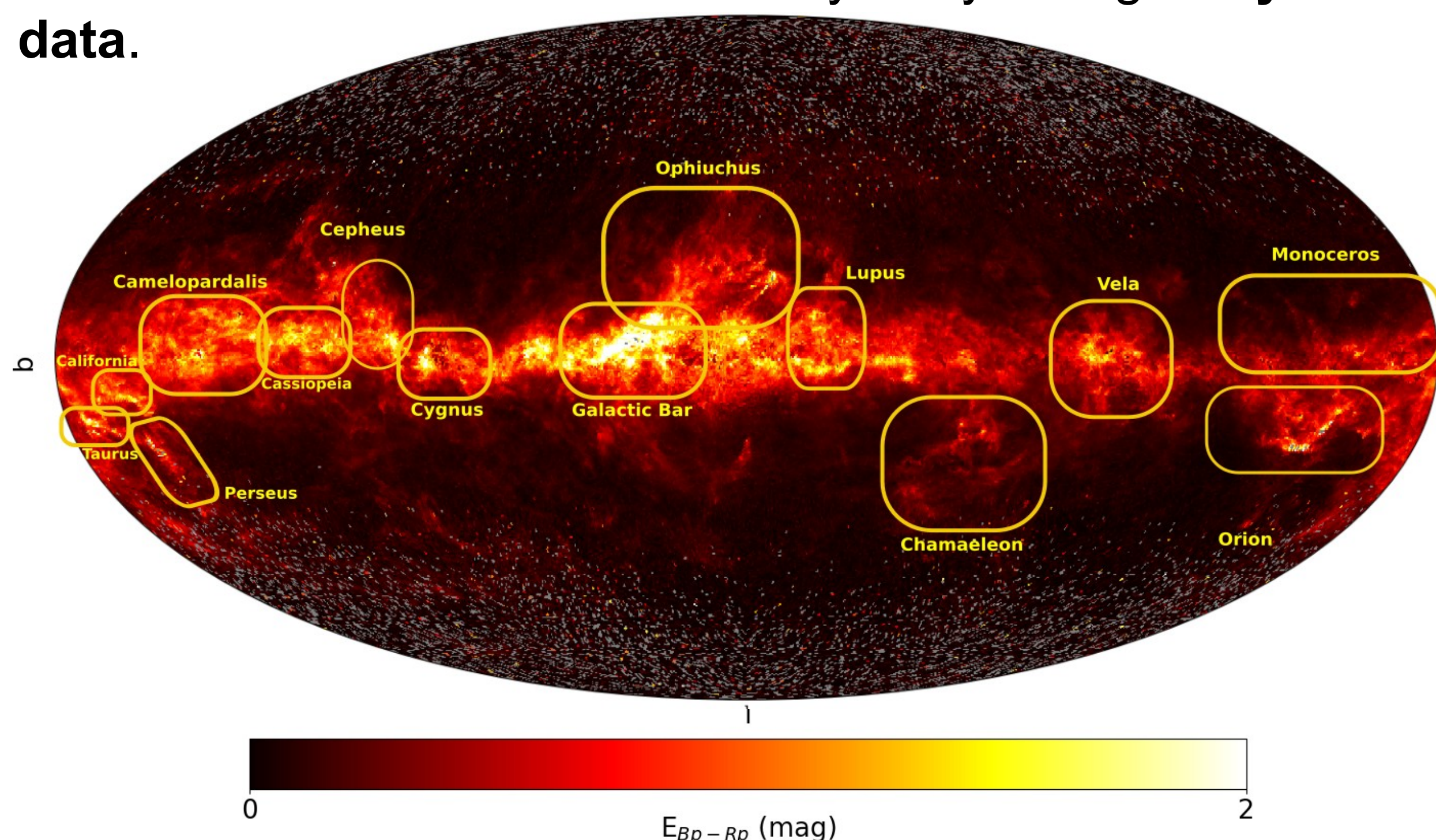


Fig 1 : 2D HEALPix full-sky map of cumulative $E_{(B_p-R_p)}$ for 3498270 stars (distance > 700 pc) with an approximate resolution of 0.46° .

- ➔ **Clear distribution of the dust** and well known **important structures are retrieved**.
- ➔ Estimation of the extinction directly from the observations **without** any priors, likelihoods involve in other methods.

VALIDATION

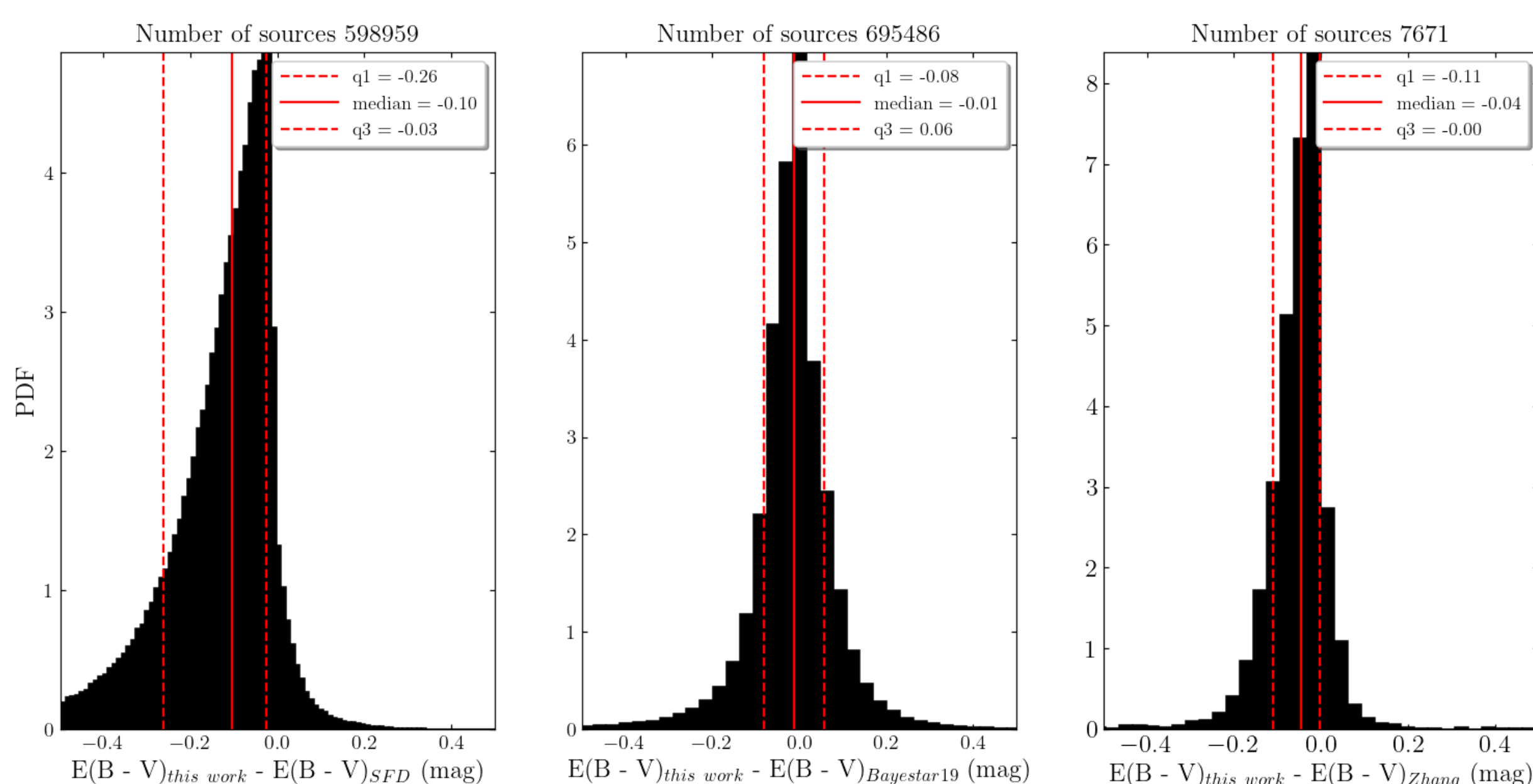


Fig 2 : Comparative histograms between converted $E_{(B_p-R_p)}$ with $E_{(B-V)}$ from Schlegel+1998 (first panel), Green+2019 (second panel) and Zhang+2023 (third panel)

- ➔ Our results show **strong consistency** with previous extinction maps based on different methods and surveys.

RESULTS

Selecting stars from **the disc** and imposing **strict quality flags**, we discretised the data in spherical coordinates (r, ϕ, θ), and projected the results onto the XY plane to create **3D map** of the $E_{(B_p-R_p)}$ distribution.

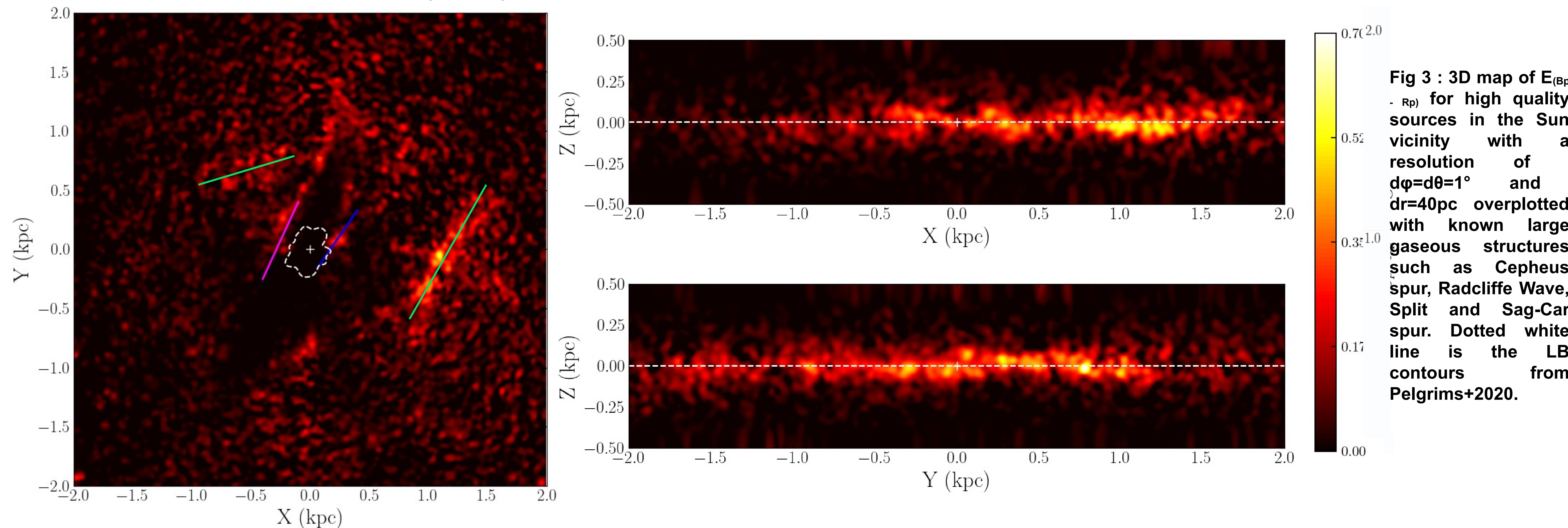


Fig 3 : 3D map of $E_{(B_p-R_p)}$ for high quality sources in the Sun vicinity with a resolution of $d\phi=d\theta=1^\circ$ and $dr=40\text{pc}$ overplotted with known large gaseous structures such as Cepheus spur, Radcliffe Wave, Split and Sag-Car spur. Dotted white line is the LB contours from Pelgrims+2020.

- ➔ **Clear extinction patterns in 3D** with observable wavy pattern of the extinction distribution along the Z-axis.
- ➔ Clear structure such as the **Local Bubble (LB)**, the **Radcliffe Wave** (pink), the **Split** (blue), **Cepheus Spur** or **Sag-Car** one (green) are retrieved.

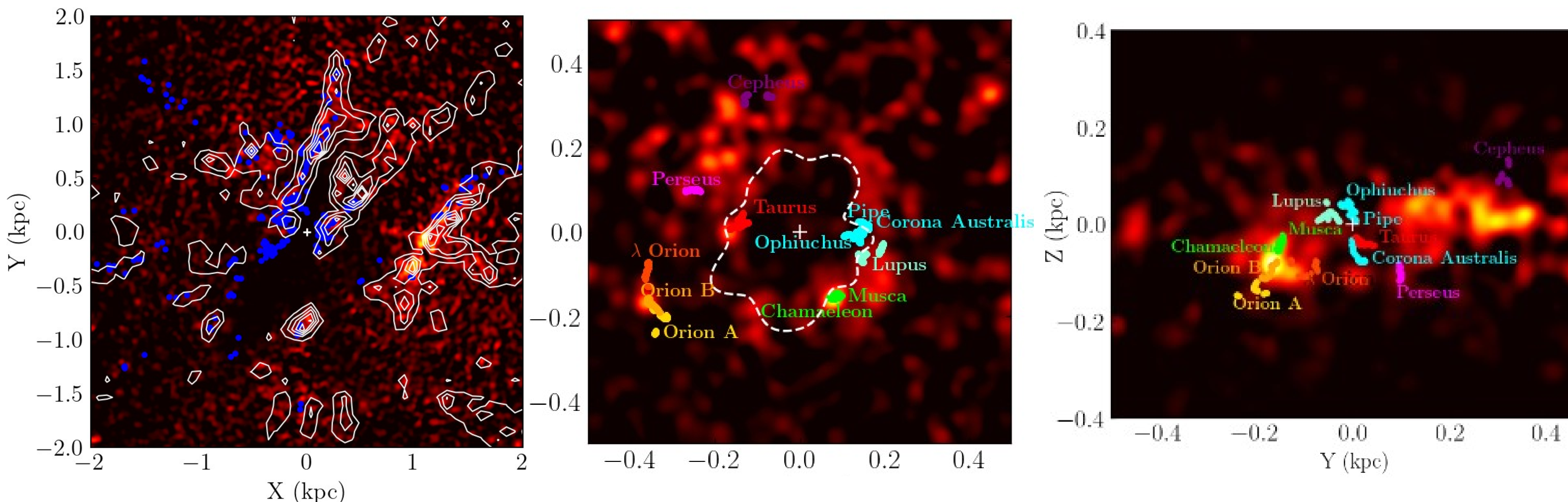


Fig 4 : Same than Fig.3, overplotted with young stellar objects from Star Formation Handbook catalogue in blue (*Zucker+2021*) and extinction contours in white (*Vergely+2022*).

Fig 5 : 3D map of $E_{(B_p-R_p)}$ for high quality sources around the LB with a resolution of $d\phi=d\theta=1^\circ$ and $dr=30\text{pc}$ overplotted with molecular clusters (*Zucker+2021;2022*).

- ➔ The positions of the young stellar objects are **visually aligned** with our dust cloud distribution, also **consistent** with current literature of extinction distribution in the Solar vicinity.
- ➔ **High resolution view of the LB**, with a clear **wavy pattern of the extinction distribution along the YZ plane** coherent with the Radcliffe Wave structure (*Alves+2020*).