Map production details

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Isosurfaces

Several of these maps are generated from Blender 3.0 renders of density isosurfaces derived from data files provided to me by Ronald Drimmel (OB stars based on Gaia DR3) and Rosine Lallement (dust based on Gaia EDR3).

The star data files were converted to point clouds bounded within a cylinder of radius 6 kpc and height +/- 400 parsecs from the galactic plane.

The longitude values for the star data were randomly "jittered" within a range of 2.5 degrees to reduce spikes / "fingers of god".

The star count values were binned to a 3D grid with elements of size 4x4x4 parsecs for the 5 kpc map and a bin of 1x1x1 parsecs for the 1 kpc and 100 pc maps. The data was then gaussian smoothed using bandwidths that varied depending on the density values.

The marching cubes algorithm as implemented by the vtkSliceCubes function in the Python VTK binding is used to generate the density isosurfaces.

The images use a traditional terrestrial cartography colour palette as it is a well proven and familiar colour scheme for maps.

For simplicity in presentation, the isosurfaces are rendered using a top down orthographic projection above the galactic plane and layered with the higher density isosurfaces on top of the lower density isosurfaces.

The result resembles a terrestrial elevation map.

In reality the denser isosurfaces are located inside the less dense isosurfaces.

Sources

Isosurface algorithm inspired by "Cosmography of OB stars in the solar neighbourhood." Astronomy & Astrophysics 584 (2015): A26 by H. Bouy and J. Alves.

Hot star density and bar orientation from "Gaia Data Release 3: Mapping the asymmetric disc of the Milky Way" by the Gaia Collaboration, R. Drimmel, et al. 2022. Data provided to me by Ronald Drimmel in two files: OBstars_v1_good.fits and missing_bright_OBs.csv.

Dust from "Three-dimensional extinction maps: Inverting inter-calibrated

extinction catalogues" by J.R. Vergely, R. Lallement and N.L.J. Cox, 2022.
Rosine Lallement very kindly sent me three dust extinction cubes.

Star clusters updated from data originally described in "Painting a portrait of the Galactic disc with its stellar clusters" by T. Cantat-Gaudin, et. al. 2020. Data provided to me by Ronald Drimmel in the file OCs.csv.

Masers from "Trigonometric parallaxes of high-mass star-forming regions: our view of the Milky Way." The Astrophysical Journal 885.2 (2019): 131 by M. J. Reid et al.

HII region positions determined by known ionizing stars and clusters with sizes estimated using Douglas Finkbeiner's H-alpha Full Sky Map and distances taken from "Estimating Distances from Parallaxes. V. Geometric and Photogeometric Distances to 1.47 Billion Stars in Gaia Early Data Release 3" by C.A.L. Bailer-Jones et.al. 2021. Thank you to several astronomers who helped add to the list of ionizing stars including Alec Thomson, Alex Hill, Eric Mamajek and Robert Benjamin.

Stars within 100 parsecs from "Gaia Early Data Release 3: The Gaia Catalogue of Nearby Stars" by the Gaia Collaboration, R.L. Smart, et. al. 2020.

Stars within 10 parsecs from "The 10 parsec sample in the Gaia era" by C. Reylé et.al. 2021.

Hydrogen clouds within 10 parsecs illustrated by NASA based on research by J. Linsky and S. Redfield.

Image of the Sgr A* black hole from the Event Horizon Telescope (EHT) Collaboration.

Data from galaxies in the Milky Way neighbourhood from "The velocity anisotropy of the Milky Way satellite system." Monthly Notices of the Royal Astronomical Society 486.2 (2019): 2679-2694 by Alexander H. Riley, et al.

The 3D model of the Milky Way was constructed in Blender by Stefan Payne-Wardenaar (Twitter: @StefanPWinc).

Galactic cartography by Kevin Jardine (Twitter: @galaxy_map).