

Precise distances, extinctions, and stellar parameters for 150 million Gaia DR2 stars



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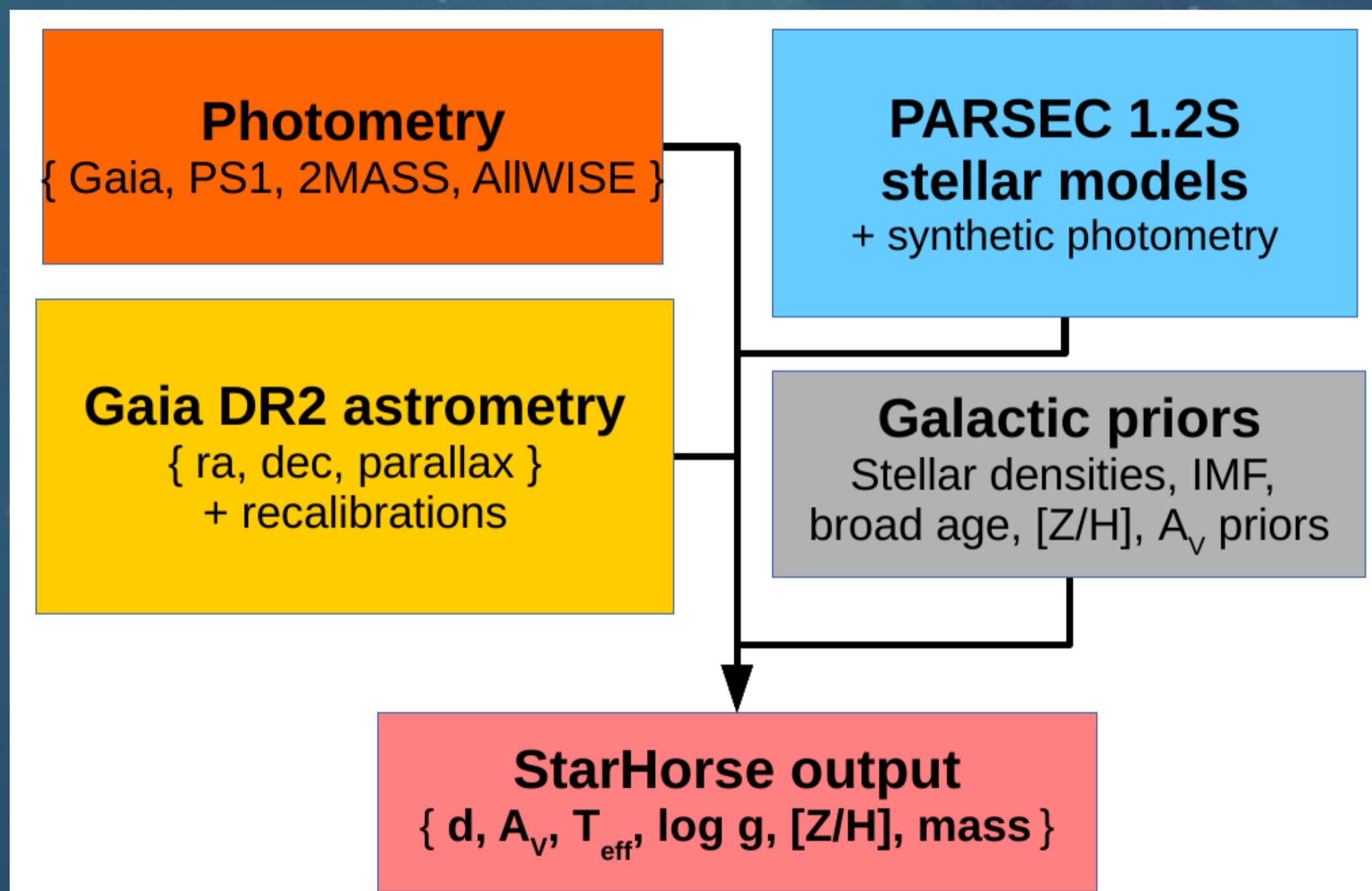
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Summary

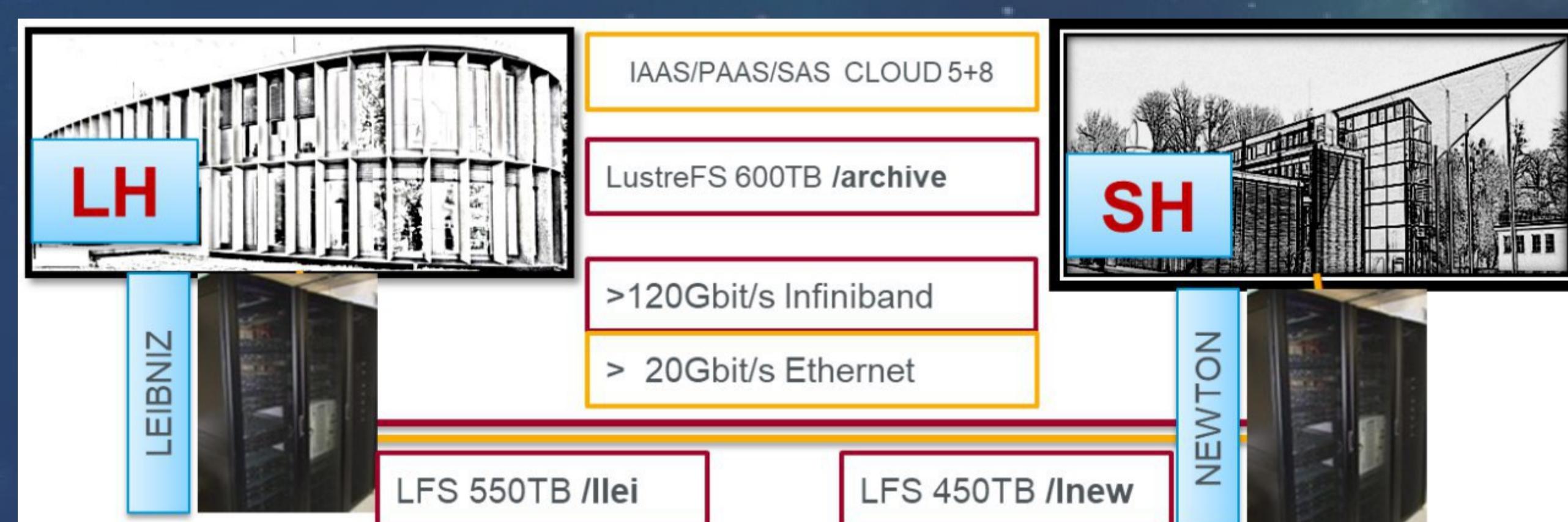
- Yes, the second Gaia data release (DR2) is revolutionising Galactic Astronomy.
- However, Gaia DR2 data products were derived from Gaia data alone. We were wondering if there was room for improvement in terms of stellar distances, extinctions, and astrophysical parameters - when combining Gaia with multi-wavelength photometry.
- We therefore performed a massive isochrone fitting exercise for all 285 million Gaia DR2 objects brighter than G=18. We use StarHorse¹: a flexible Bayesian inference code originally designed for spectroscopic stellar surveys.

Method



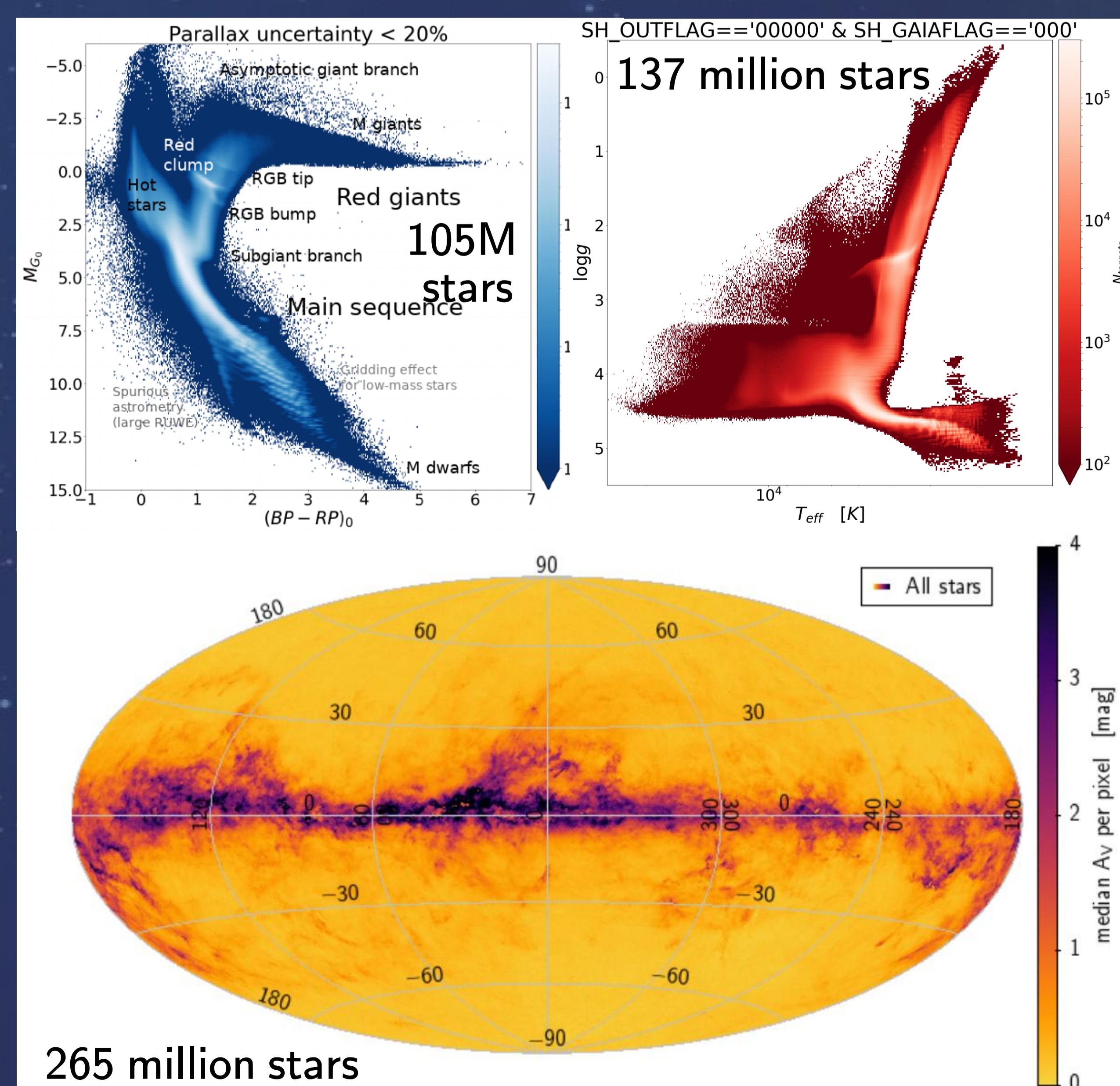
Simplified StarHorse data flow diagram. For each star we compute the posterior probability distribution over a grid of stellar models, distances, and extinctions - given a set of heterogeneous data (astrometry and photometry). We report median statistics in each output parameter.

Computational challenge



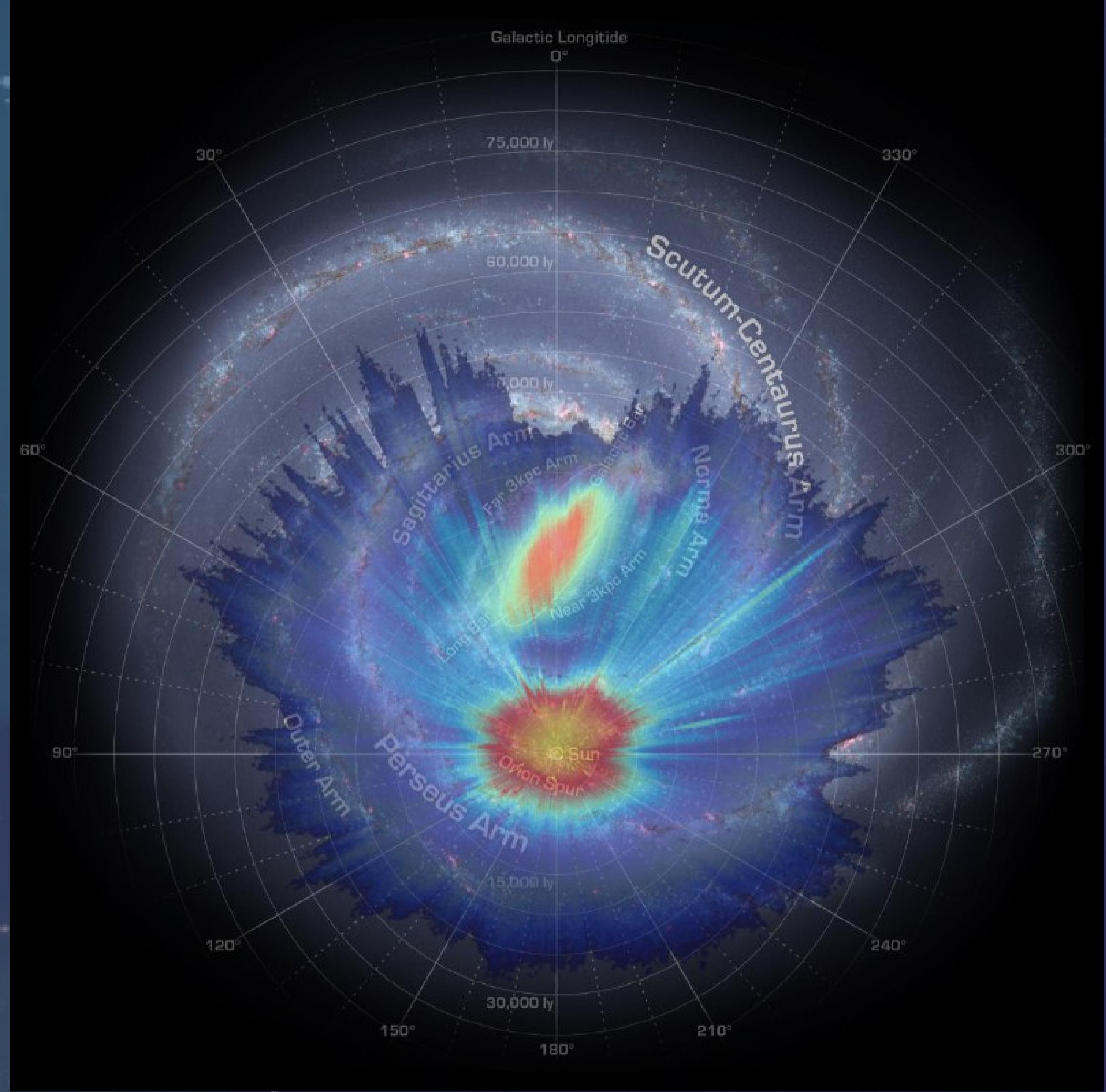
AIP Infrastructure used for this project. In total, 19 years of CPU time was needed...

Some results



Some immediate results from our catalogue: extinction-corrected colour-magnitude diagrams, Kiel diagrams, extinction maps.... Use flagged results carefully! See our paper for extensive validation.

The emergence of the Galactic bar in stellar density



Face-on map of the Galaxy derived from Gaia DR2 coupled with Pan-STARRS1, 2MASS, and AllWISE. The data reveal the first "direct image" of the Galactic bar in the stellar density distribution. Watch out for an ESA press release soon!

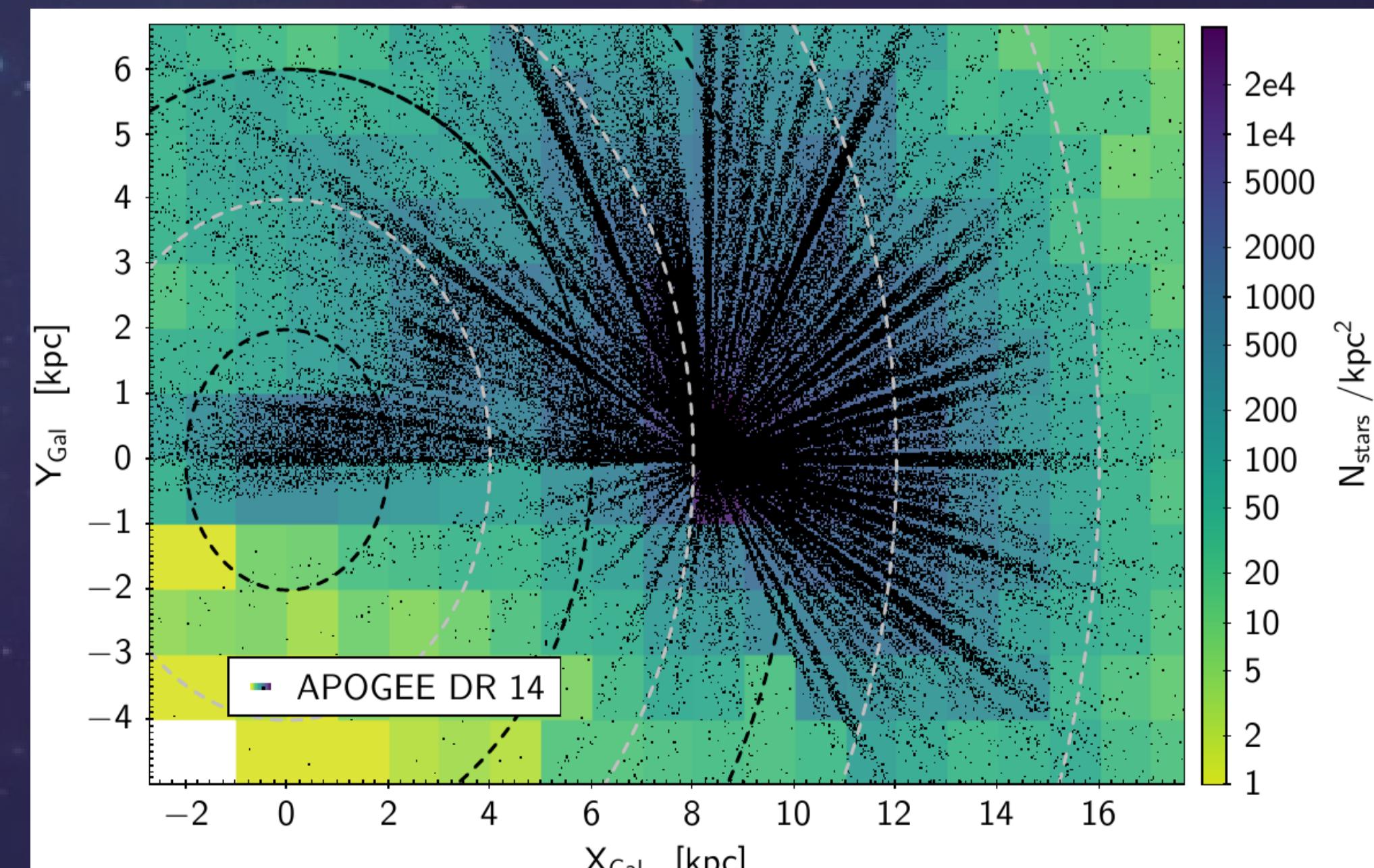
Data access

<https://gaia.aip.de/query/>

The screenshot shows the Gaia@AIP query interface with the following sections:

- Query interface**: Database status, New query job, SQL query, Cone search, Job list, and a SQL query editor.
- SQL query**: A text area containing a complex SQL query related to stellar populations.

Follow-up studies



For 300,000 of the Gaia DR2 stars (among them 8000 in the bulge/bar area), APOGEE spectroscopy is available. The Galactic bar also leaves a characteristic imprint this high-quality subset (Bovy et al. 2019, Queiroz et al., in prep.). Other follow-up projects include improved 3D dust maps and open-cluster parameters/memberships...

Previous StarHorse papers:
Santiago et al. (2016), A&A, 585, A42
Queiroz et al. (2018), MNRAS, 476, 2556-2583

Anders et al. (2019), A&A, accepted (arXiv:1904.11302)