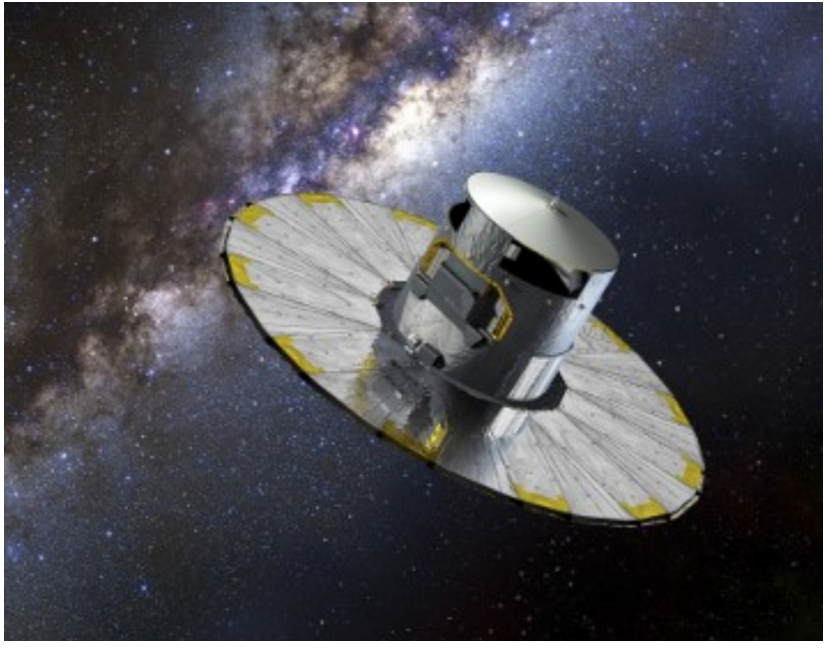
Empirical selection function of the Gaia radial velocity sample

Jan Rybizki,[1]★ Hans-Walter Rix,[1] Markus Demleitner,[2] Coryn A.L. Bailer-Jones[1]
and William J. Cooper[3,4]

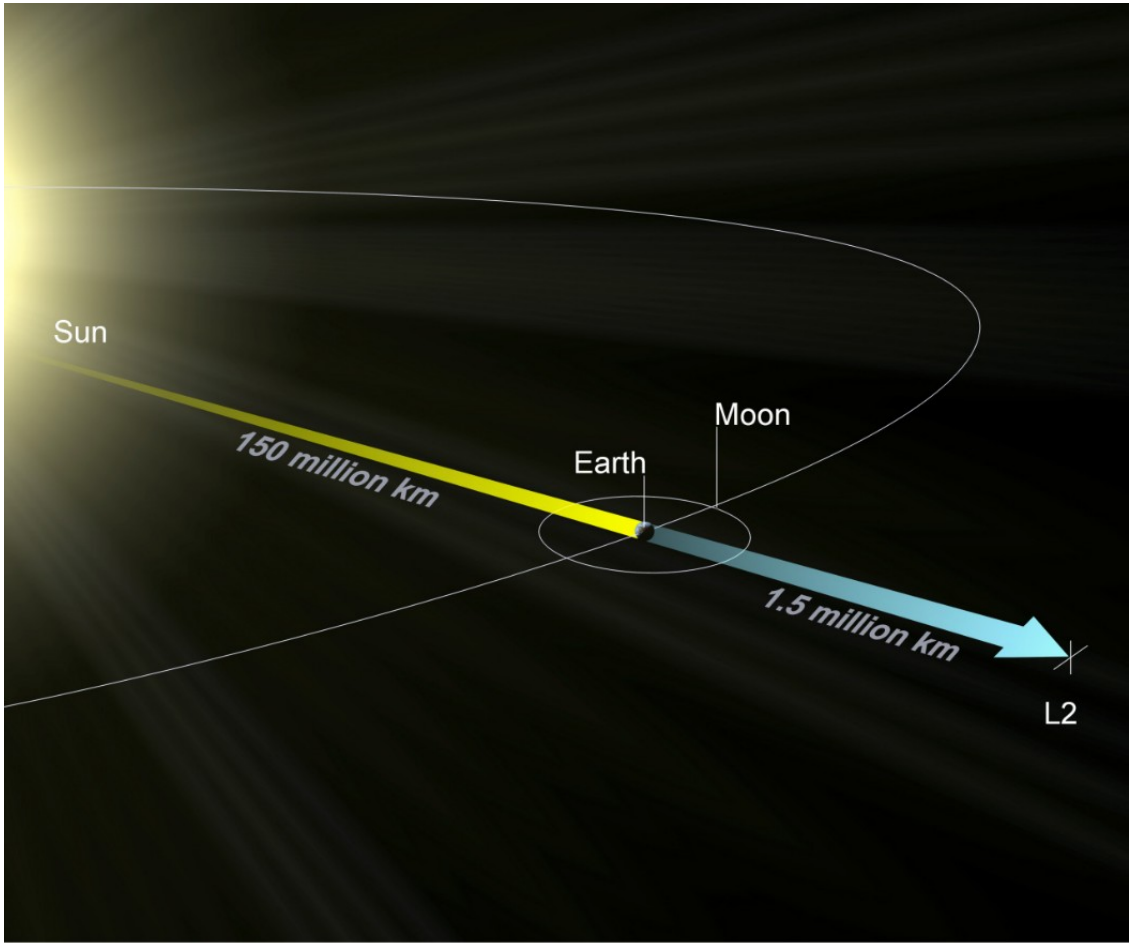


Credit: ESA

Jan Rybizki (MPIA)
Galaxy Coffee 22nd April 2021 (Earth day)

Gaia satellite

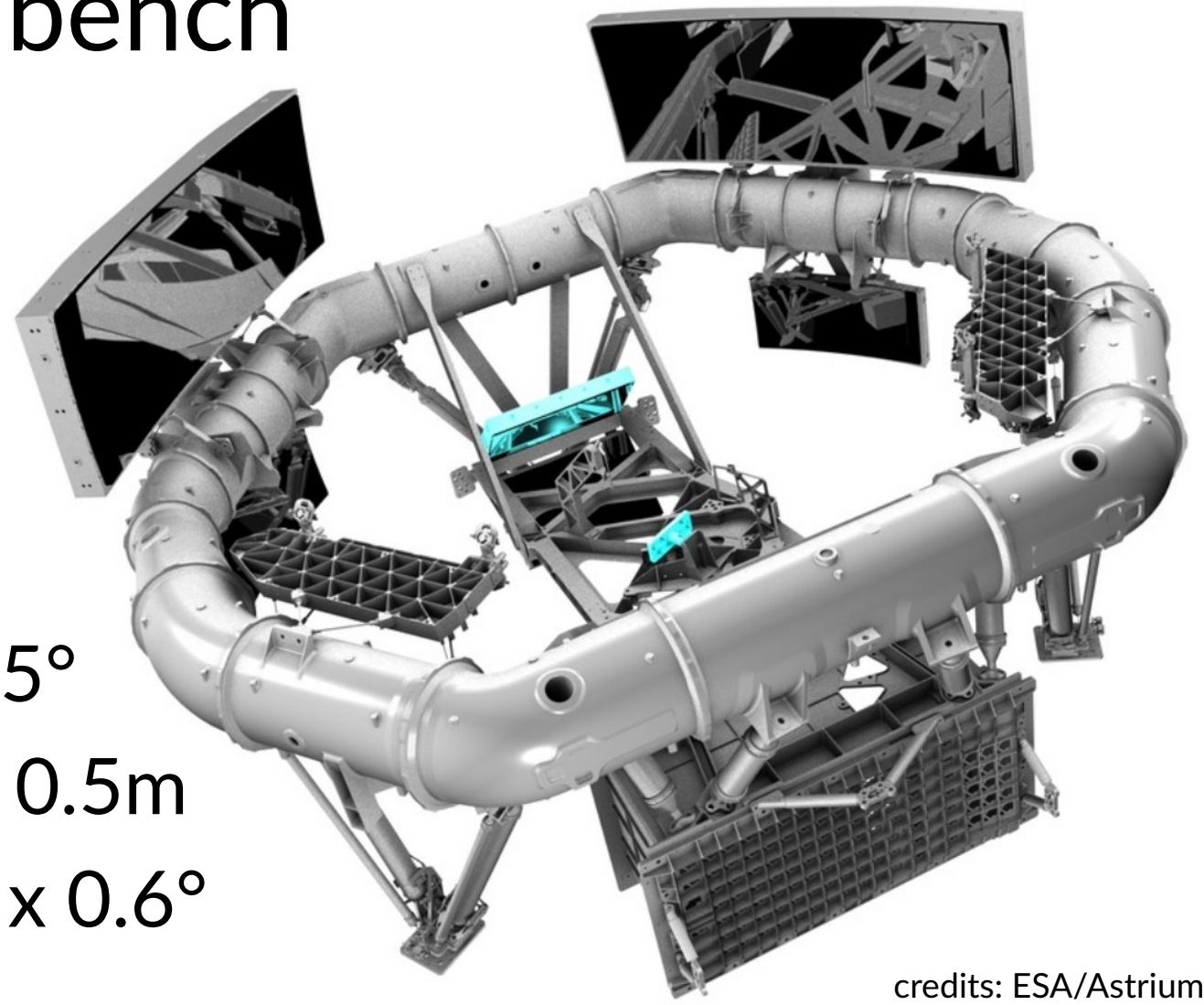
- Launched 12/2013
- Orbits around L2
- 6h rotation period
- 2M sources per hour
- Downlink ~1MB/s



Credit: ESA

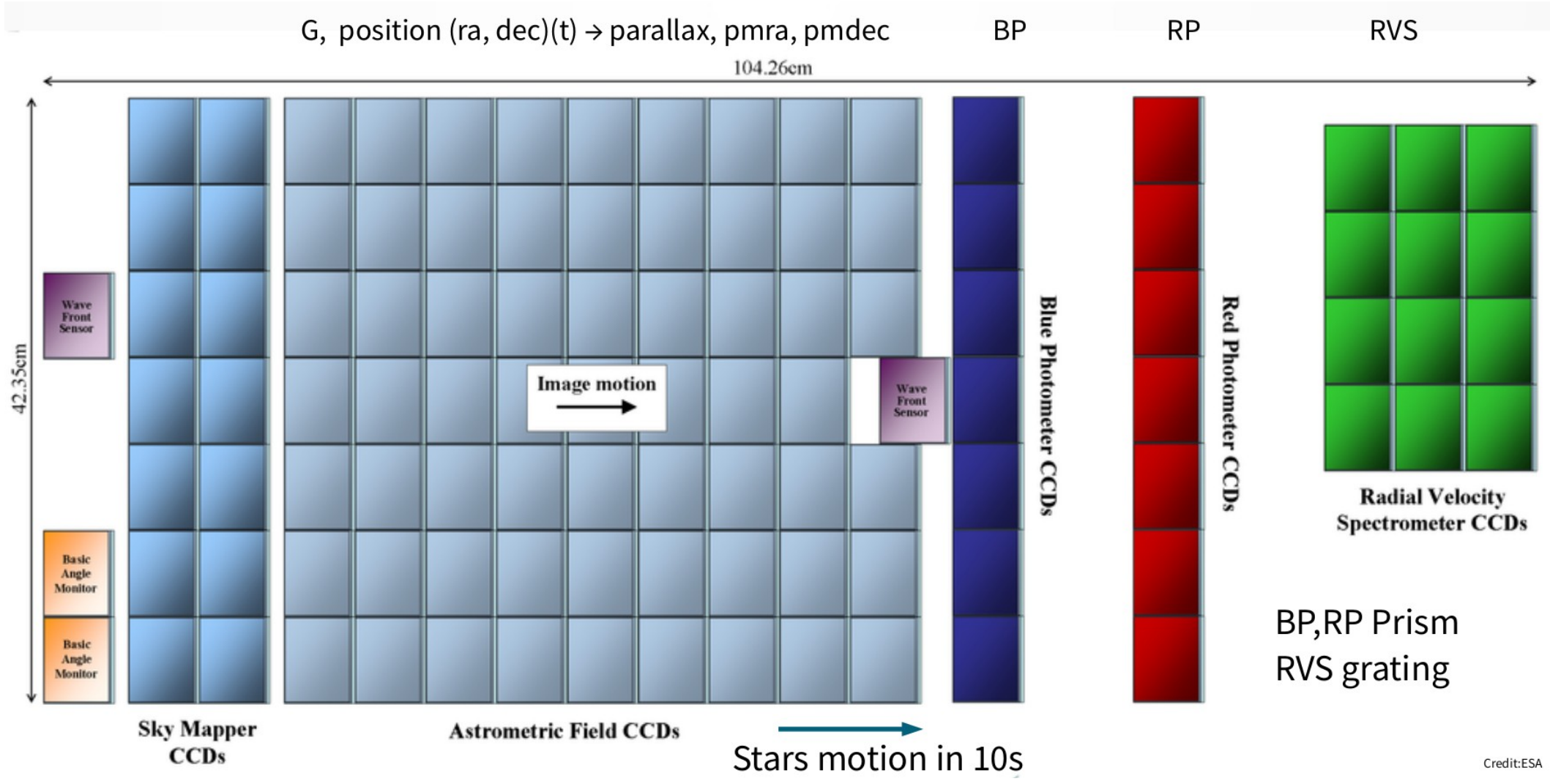
Optical bench

- 2 main mirrors
- Basic angle is 106.5°
- Aperture: 1.45m x 0.5m
- Field of view: 1.7° x 0.6°

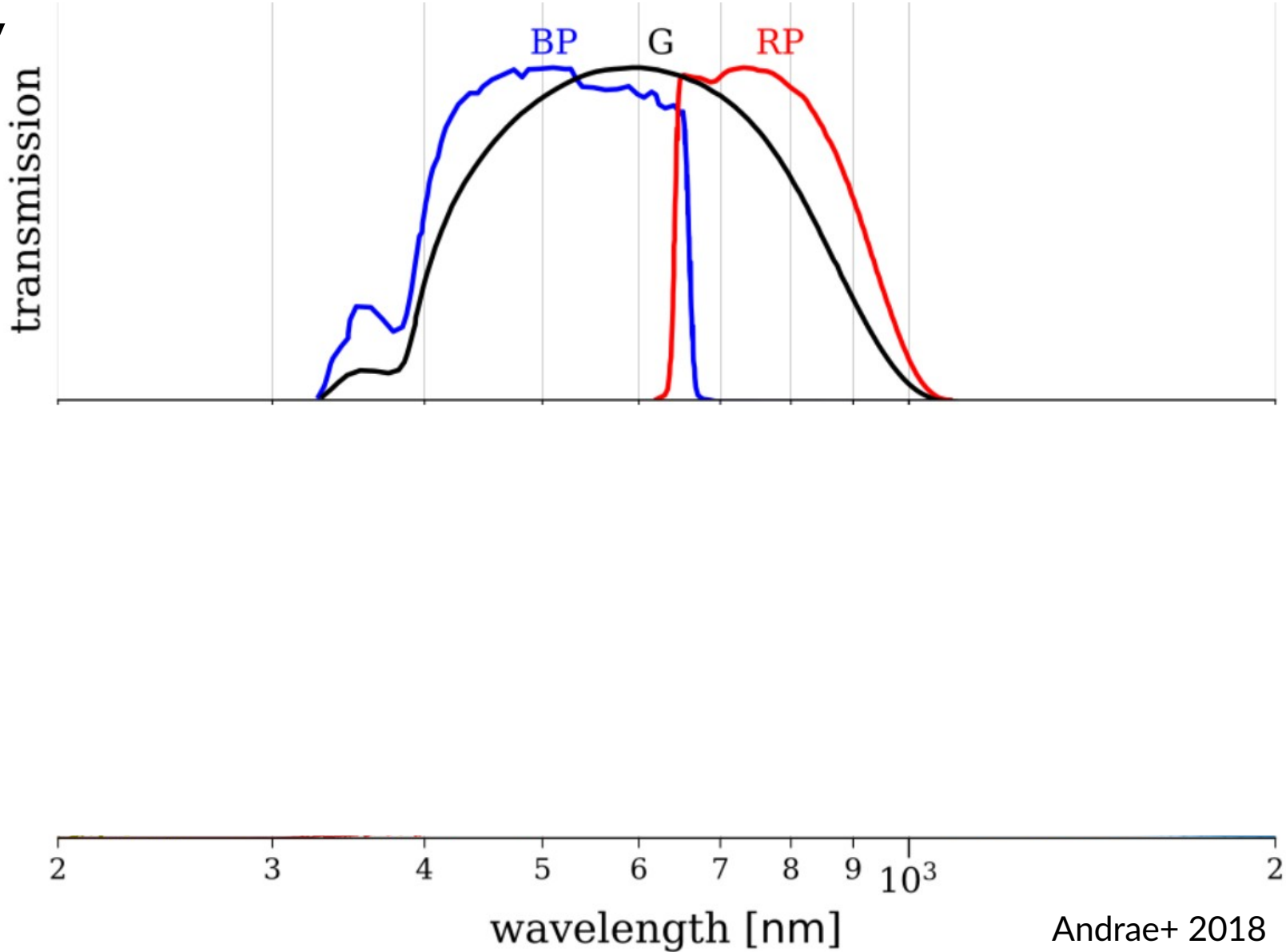


credits: ESA/Astrium

Focal plane

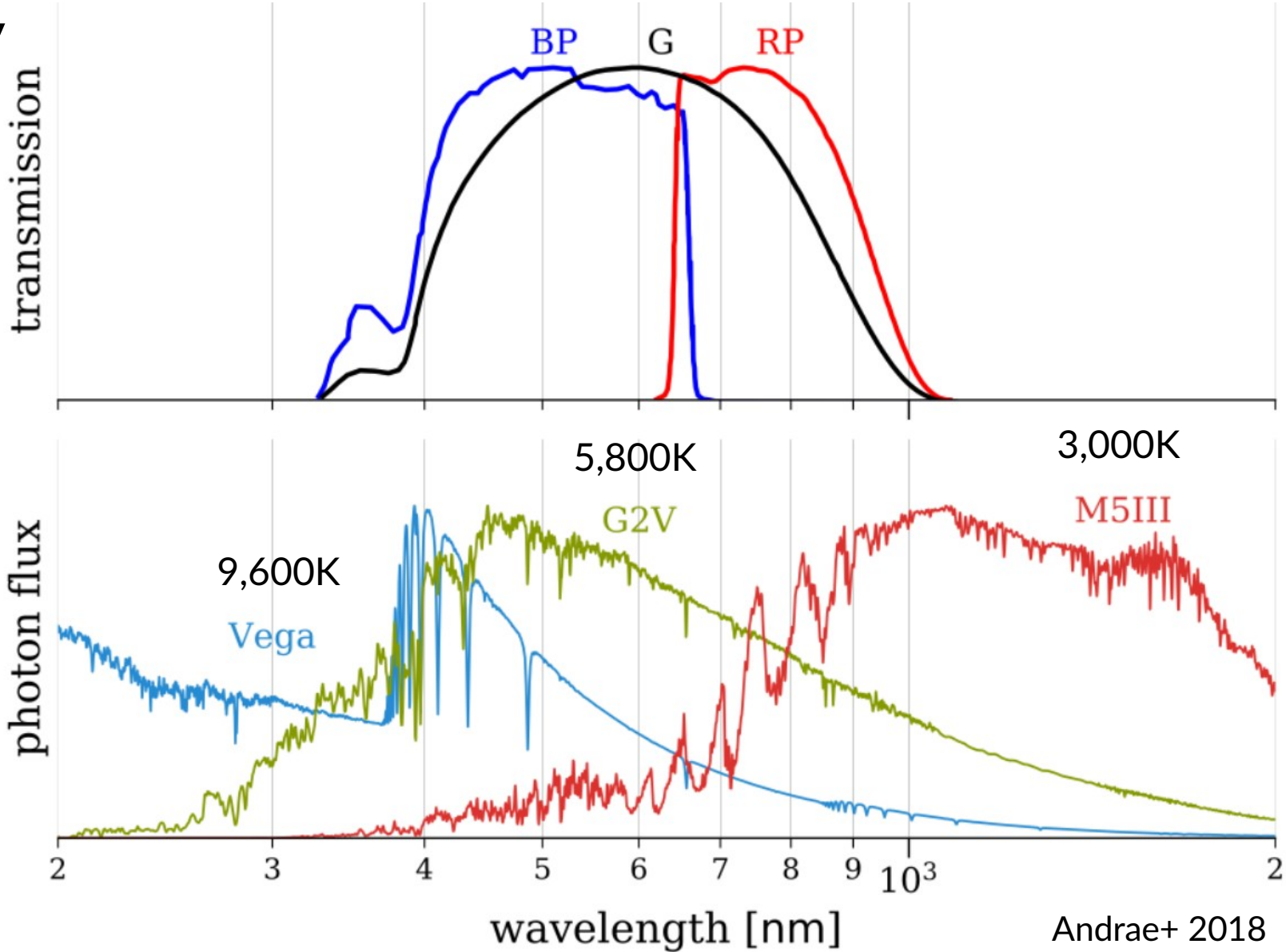

G, position (ra, dec)(t) → parallax, pmra, pmdec
BP
RP
RVS
104.26cm
42.35cm
Wave Front Sensor
Basic Angle Monitor
Basic Angle Monitor
Image motion
Wave Front Sensor
Blue Photometer CCDs
Red Photometer CCDs
Radial Velocity Spectrometer CCDs
BP,RP Prism
RVS grating
Sky Mapper CCDs
Astrometric Field CCDs
Stars motion in 10s
Credit:ESA

Photometry



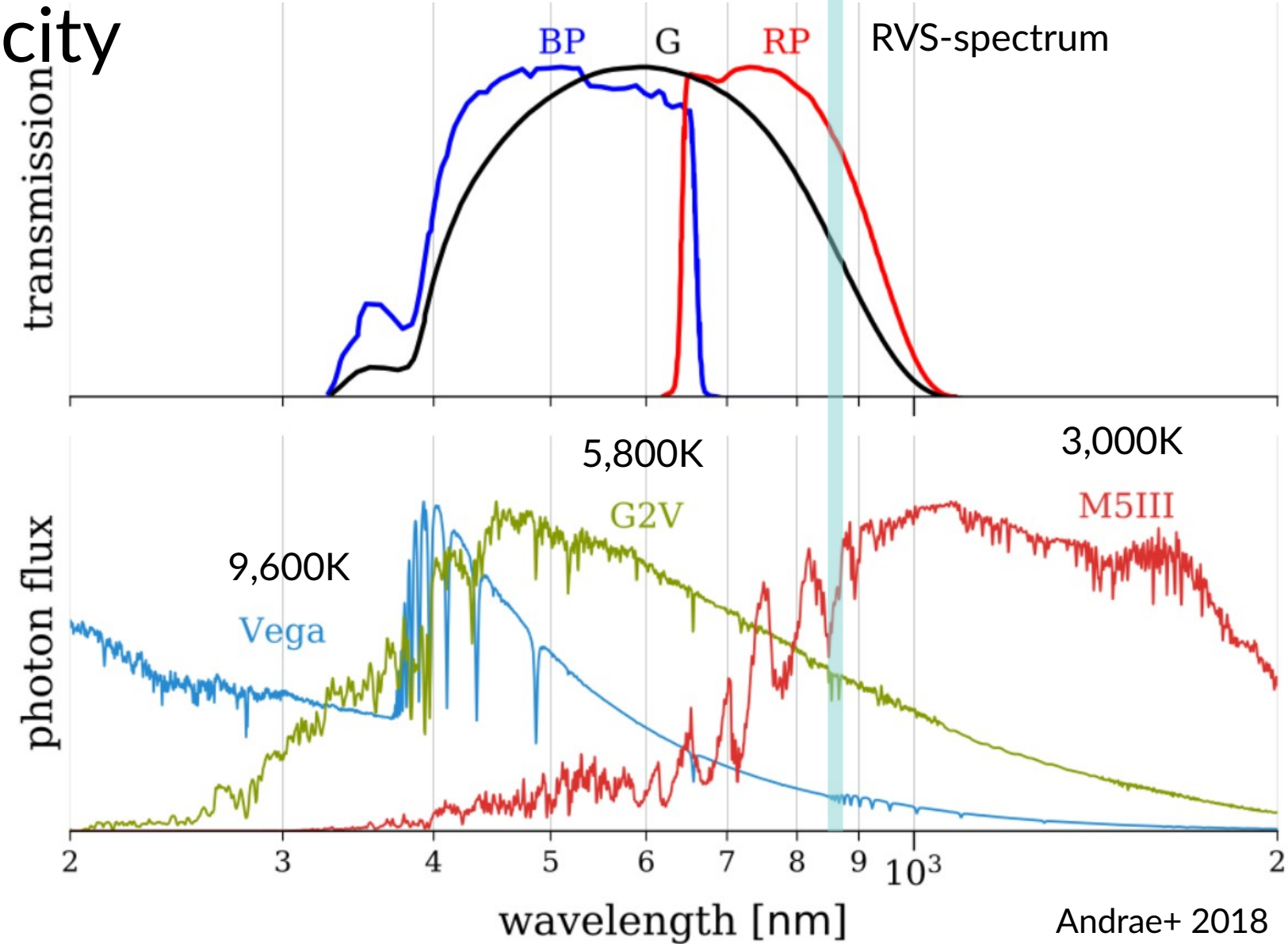
Andrae+ 2018

Photometry



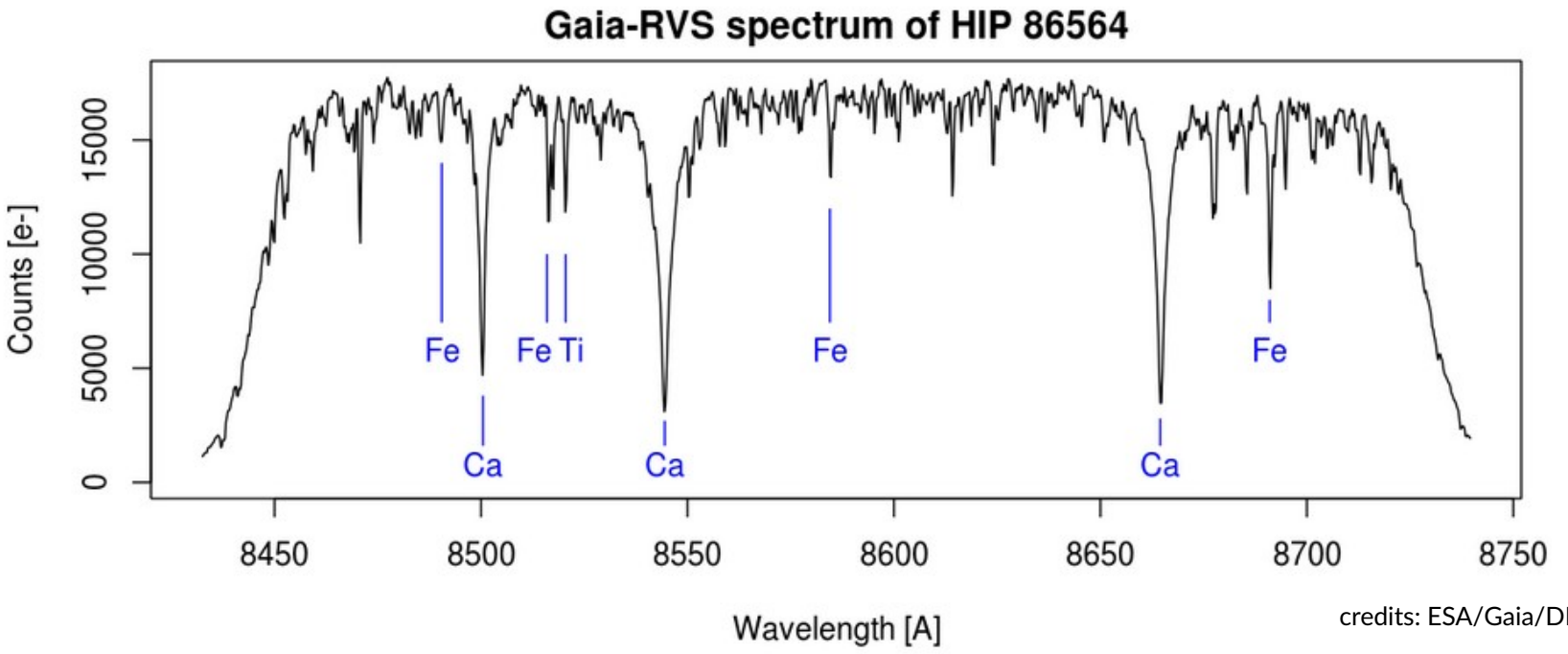
Andrae+ 2018

Radial-Velocity



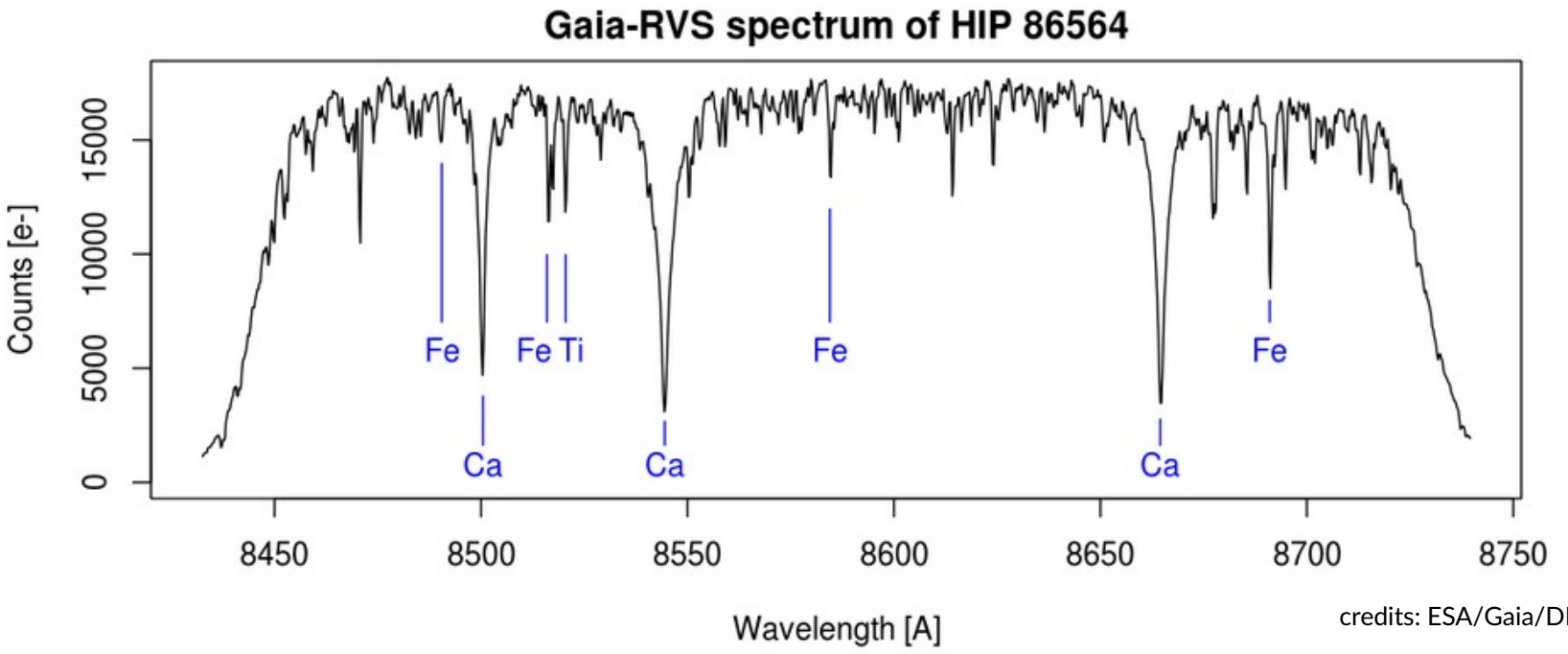
Andrae+ 2018

Radial-Velocity



credits: ESA/Gaia/DPAC/Airbus DS

Radial-Velocity



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→ Radial velocity + metallicity + [X/Fe]

Gaia radial velocity sample

- 7.2M sources in GaiaDR2

Gaia radial velocity sample

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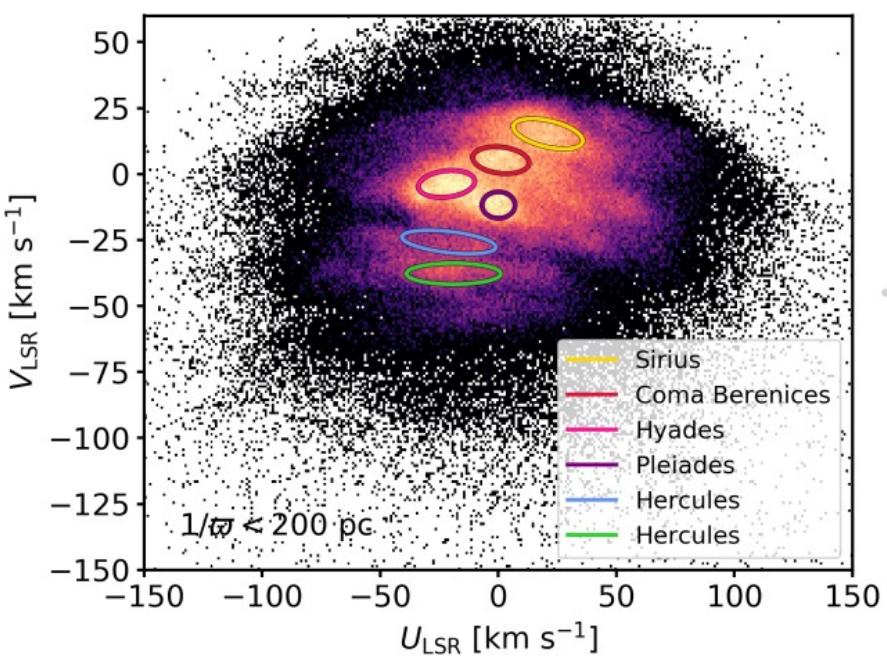

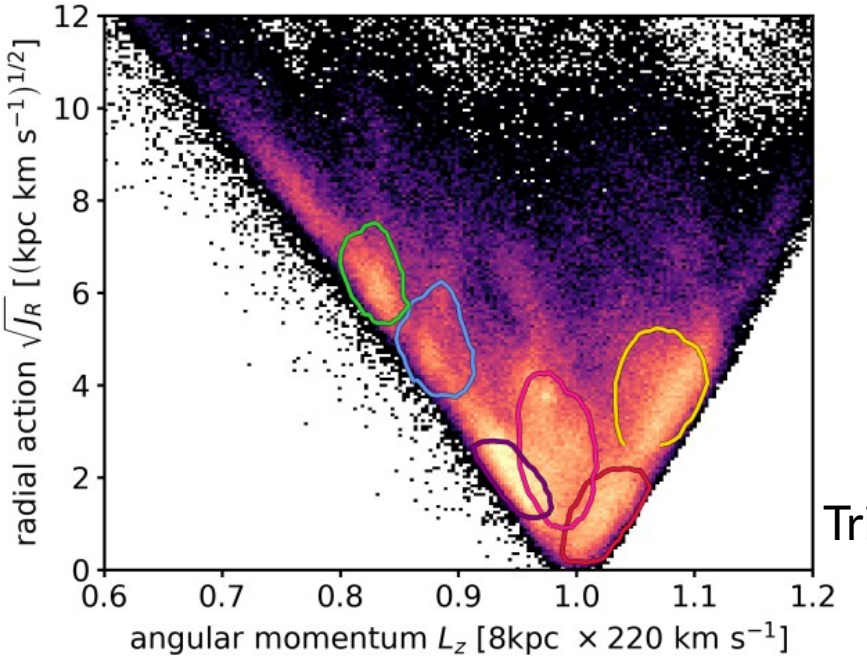

Trick+ 2019

RVS sample selection

- $G_{RVS} < 12$ mag

RVS sample selection

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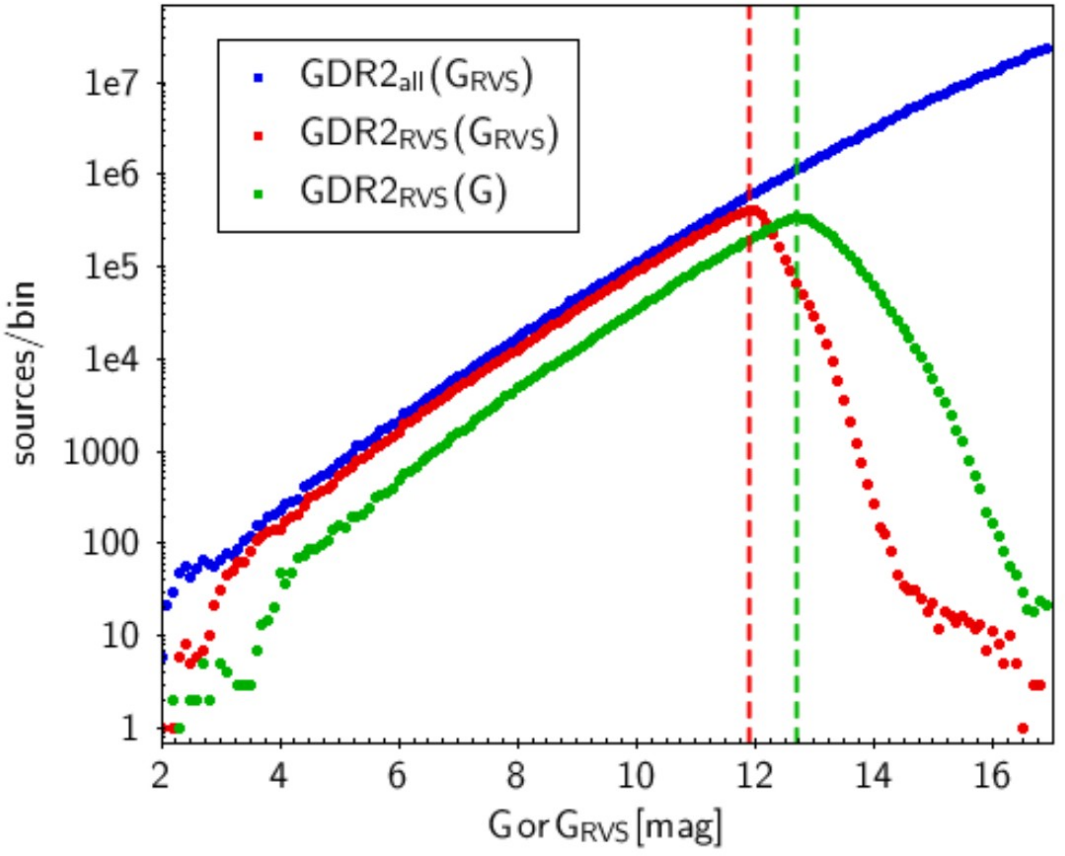
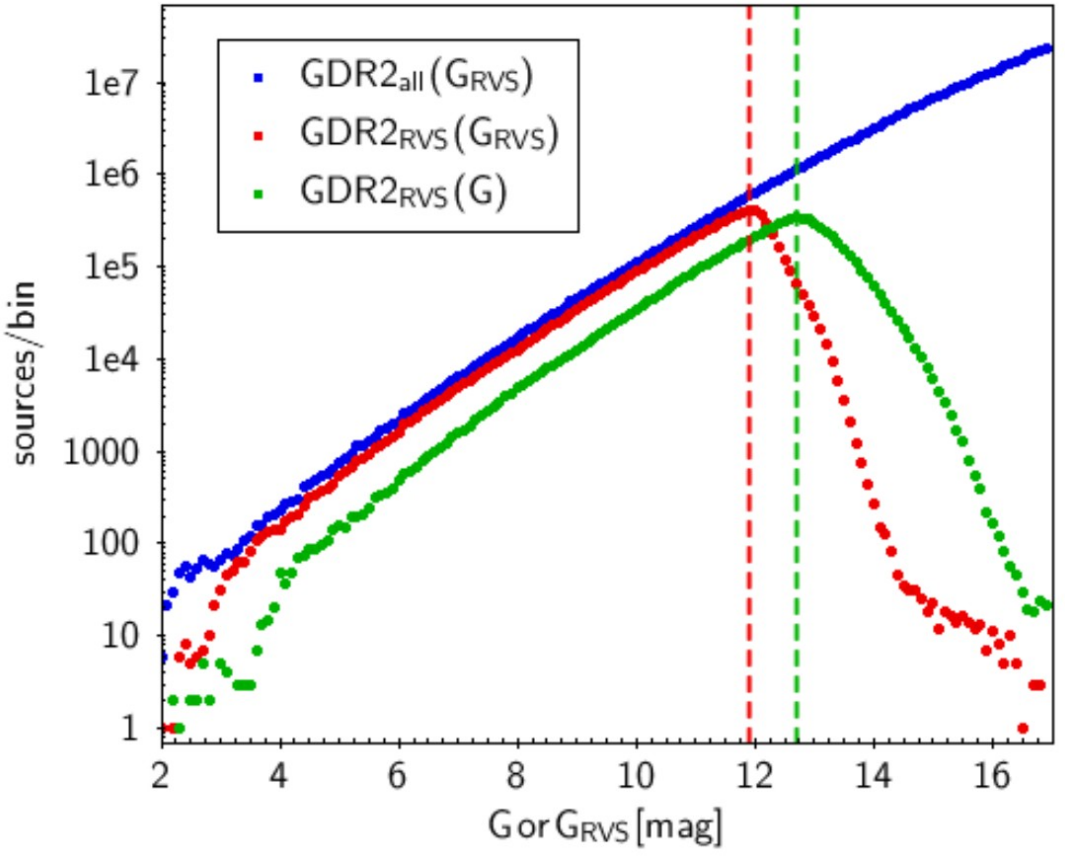


RVS sample selection

- G_{RVS} < 12 mag
- 3550K < Teff < 6900K



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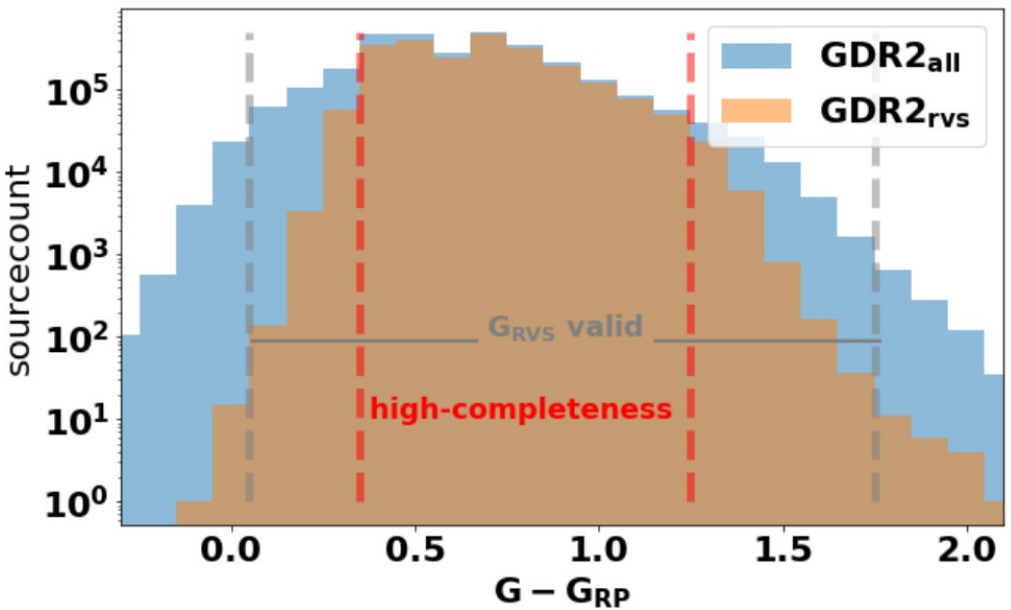
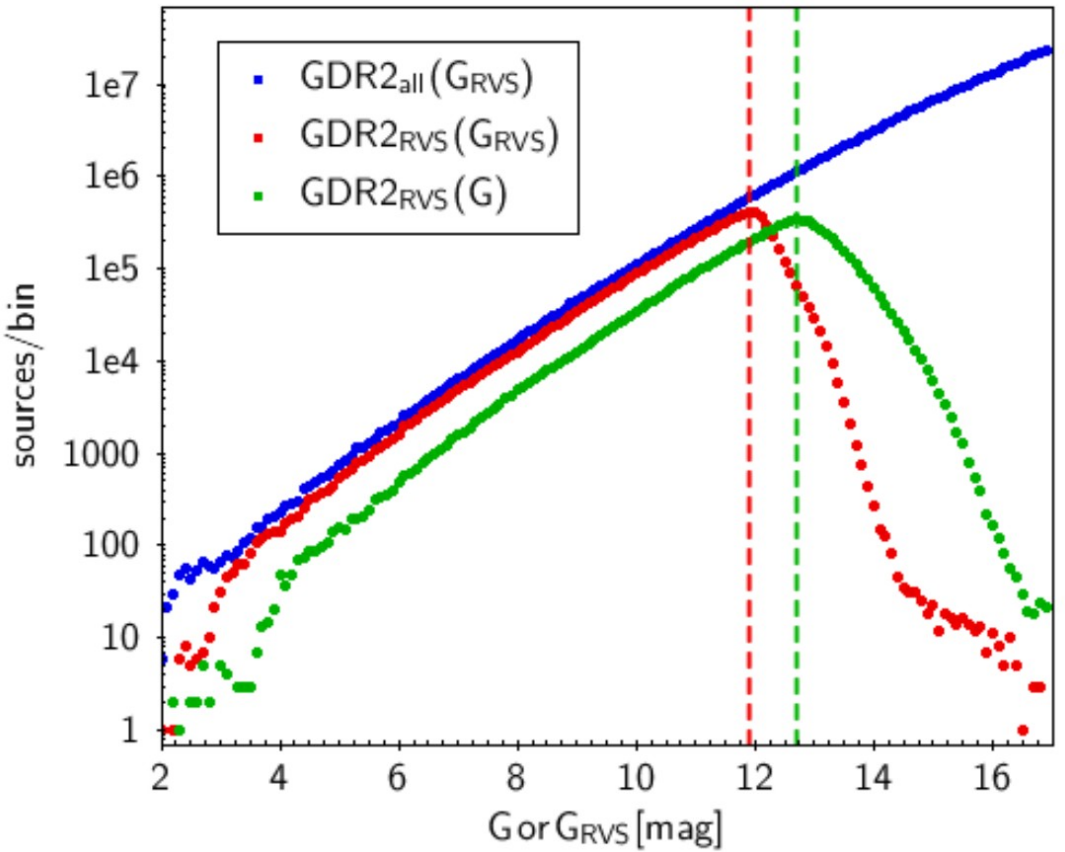
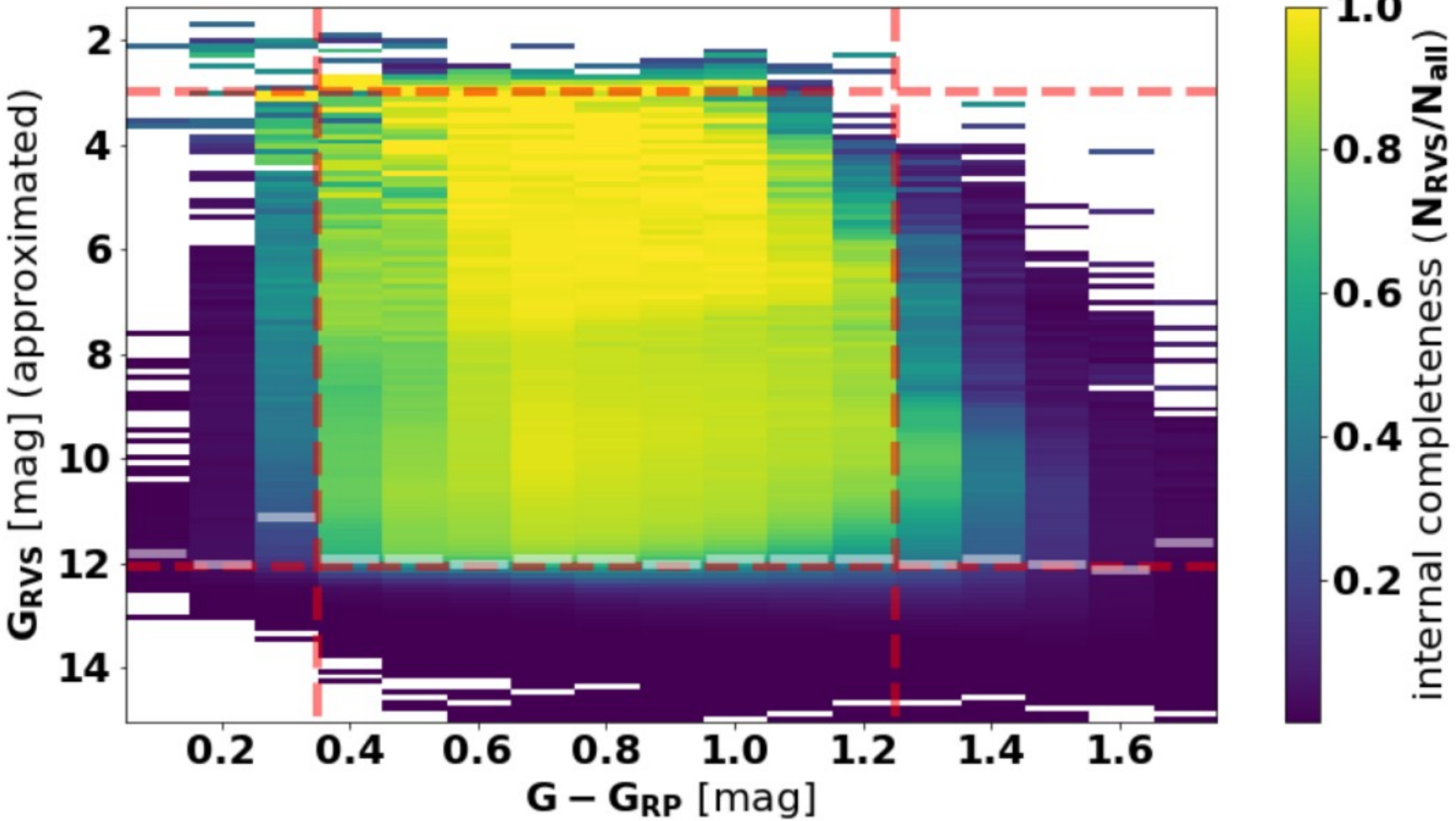


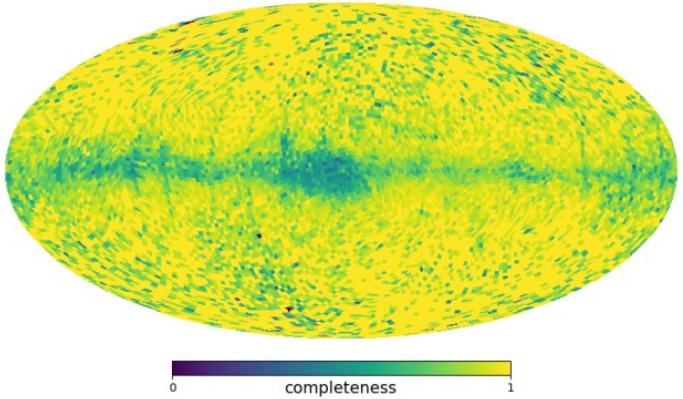


Completeness as a function of CMD



Completeness as a function of sky

G_{RVS} = 11.0 mag



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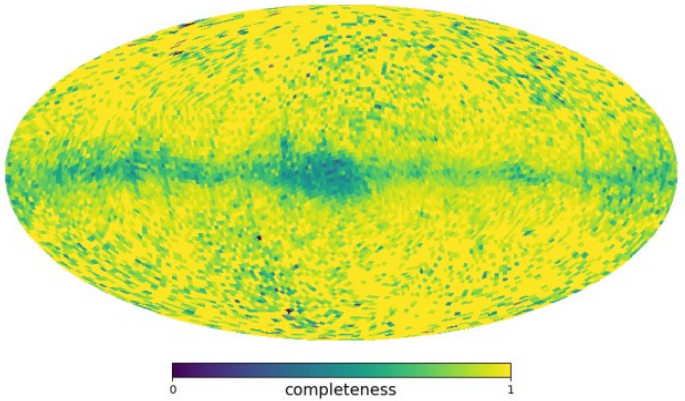
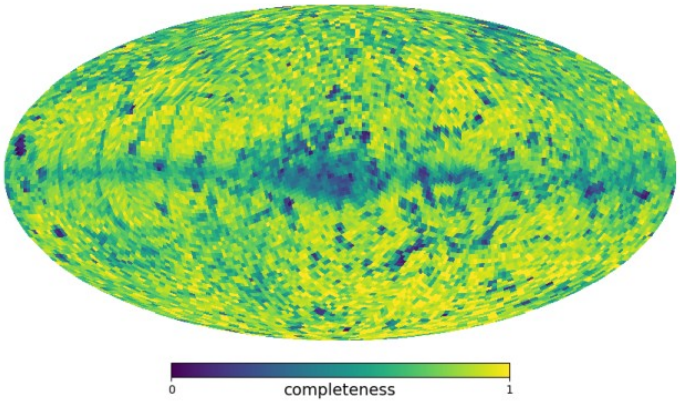


G_{RVS} = 12.0 mag



Completeness as a function of sky

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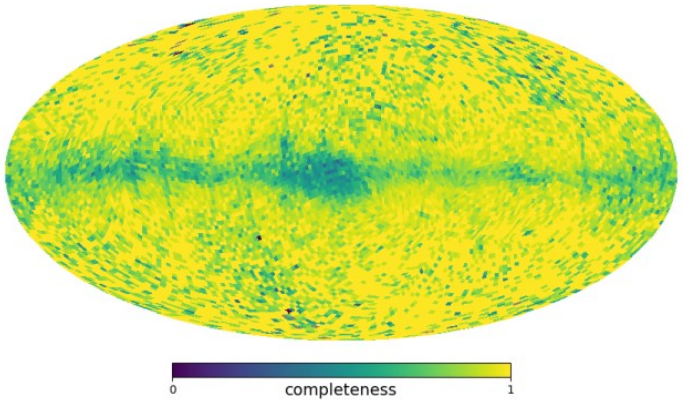

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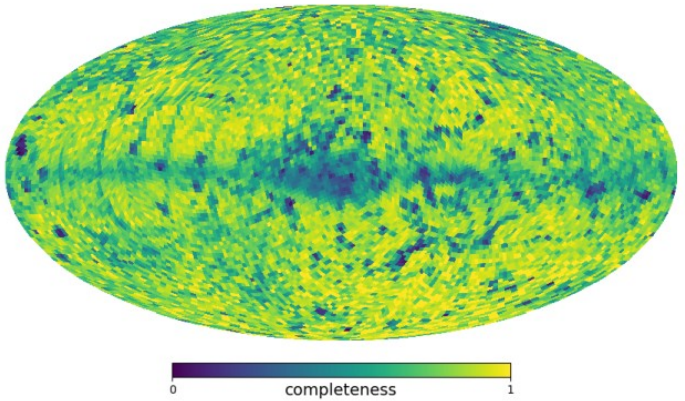
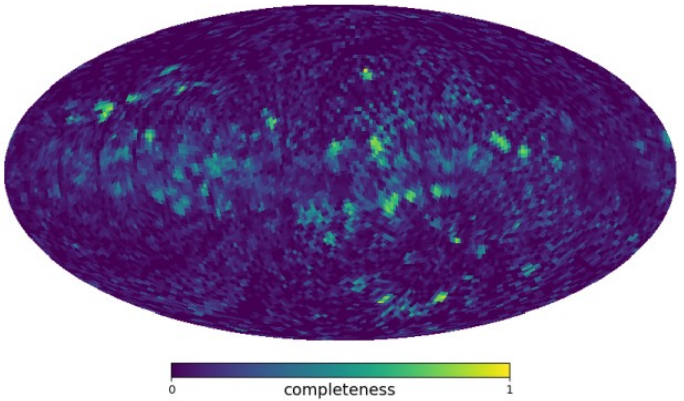


G_{RVS} = 12.5 mag



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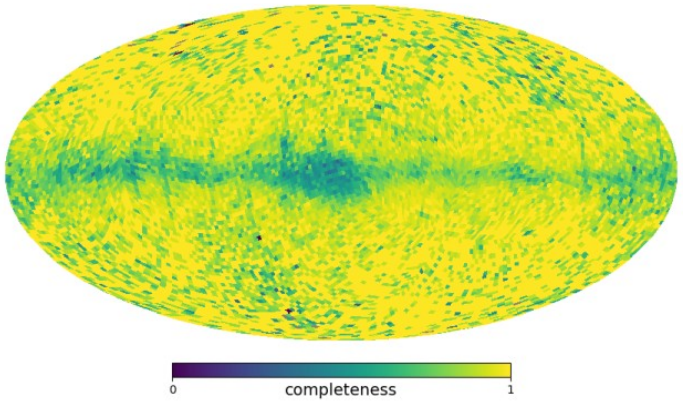

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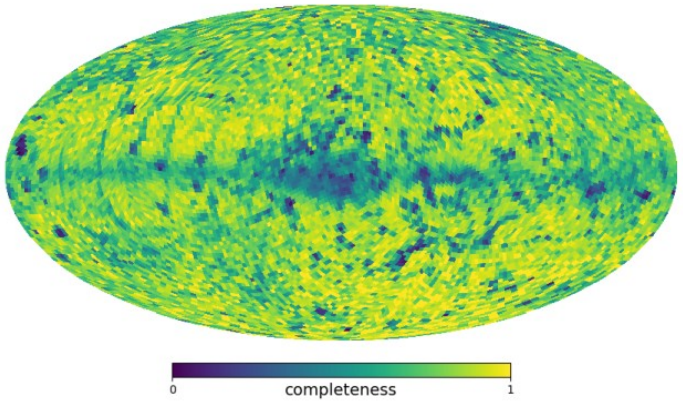

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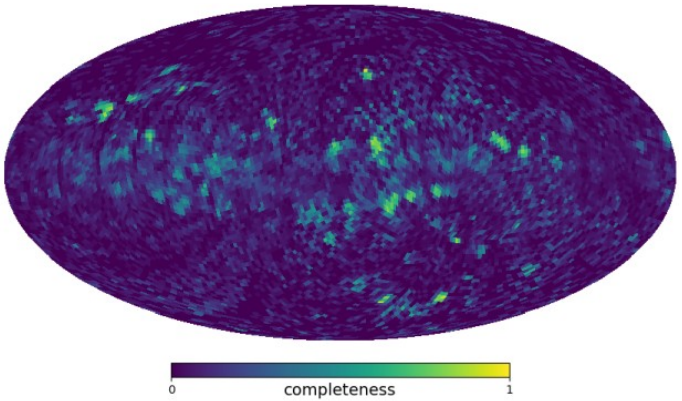
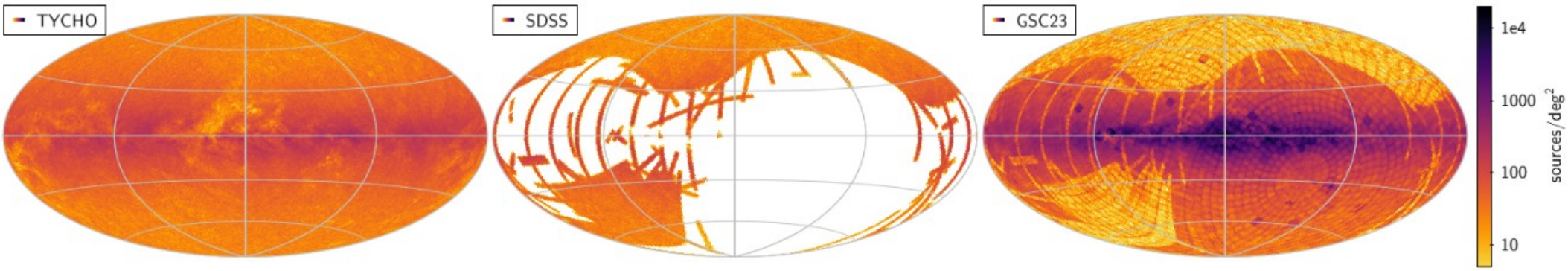


Iinitial Gaia Source List (IGSL) main input catalogues:



E.g. compare Nbody- to Gaia-data

- https://github.com/jan-rybizki/Galaxia_wrap
  - nbody particles → Gaia observables (like GeDR3mock)
- https://github.com/jan-rybizki/gdr2_completeness
  - Apply selection function cuts on mock data
  - Apply same selection function cuts on real data
- Compare apples with apples

Summary

- The RVS sample is a unique data set
- It incorporates known selection effects
- We provide a function describing these in
  - Ra, dec, G_{RVS} and G-G_{RP}
  - And a converter from G, $G_{RP} \rightarrow G_{RVS}$
- RVS sample representative only for high completeness
- If you want to explore the selection function in your browser:
  - mpia.de/homes/rybizki under ‘Visualisations’

Thank you for your attention

Completeness as a function of sky