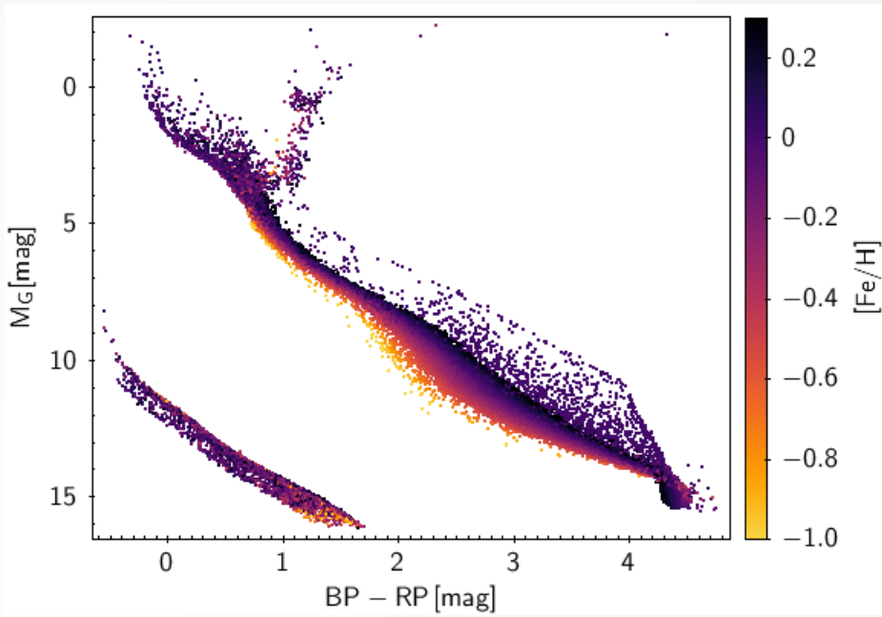
A Gaia early DR3 mock stellar catalog: Galactic prior and selection function

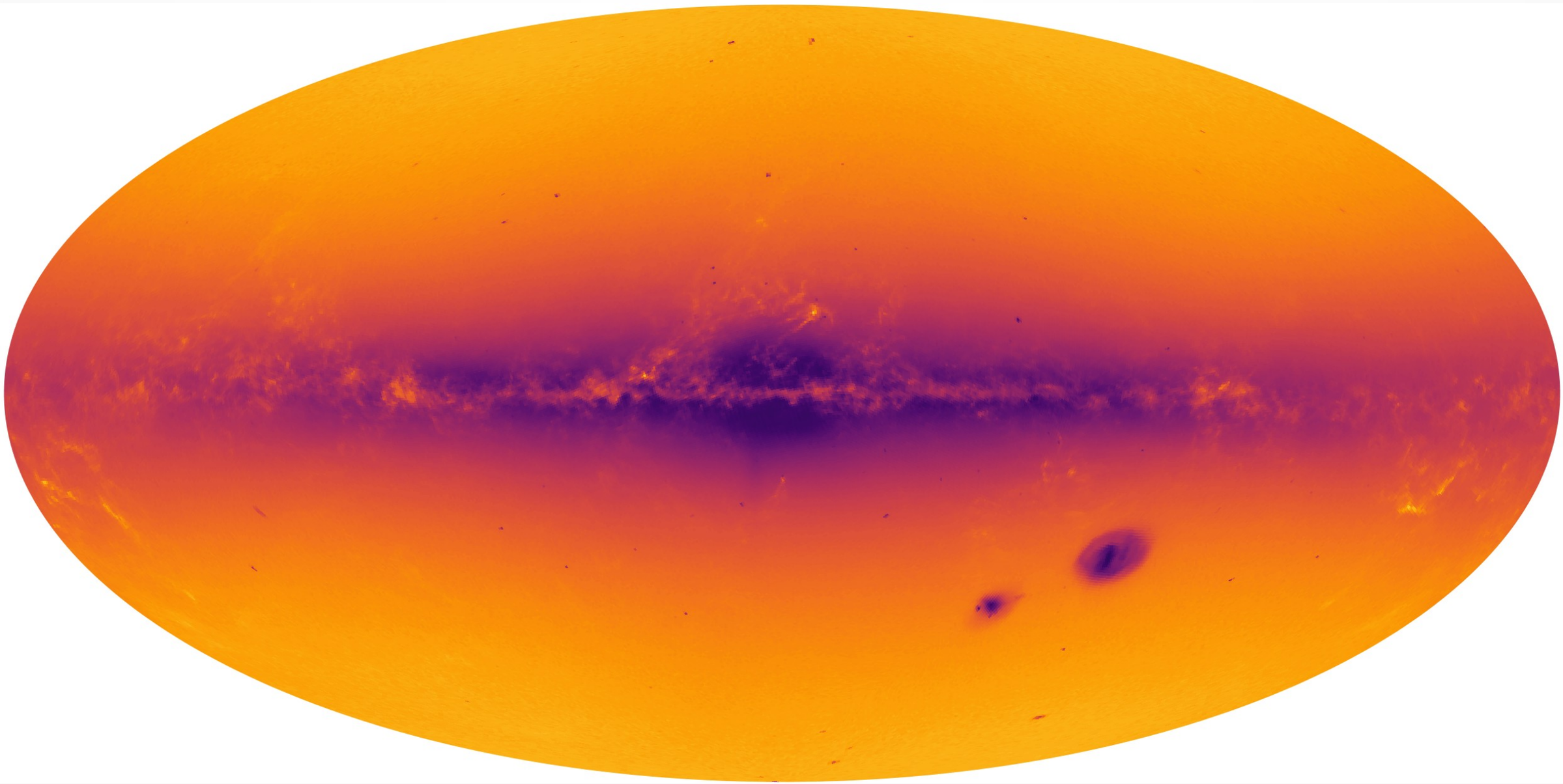


Jan Rybizki (MPIA)

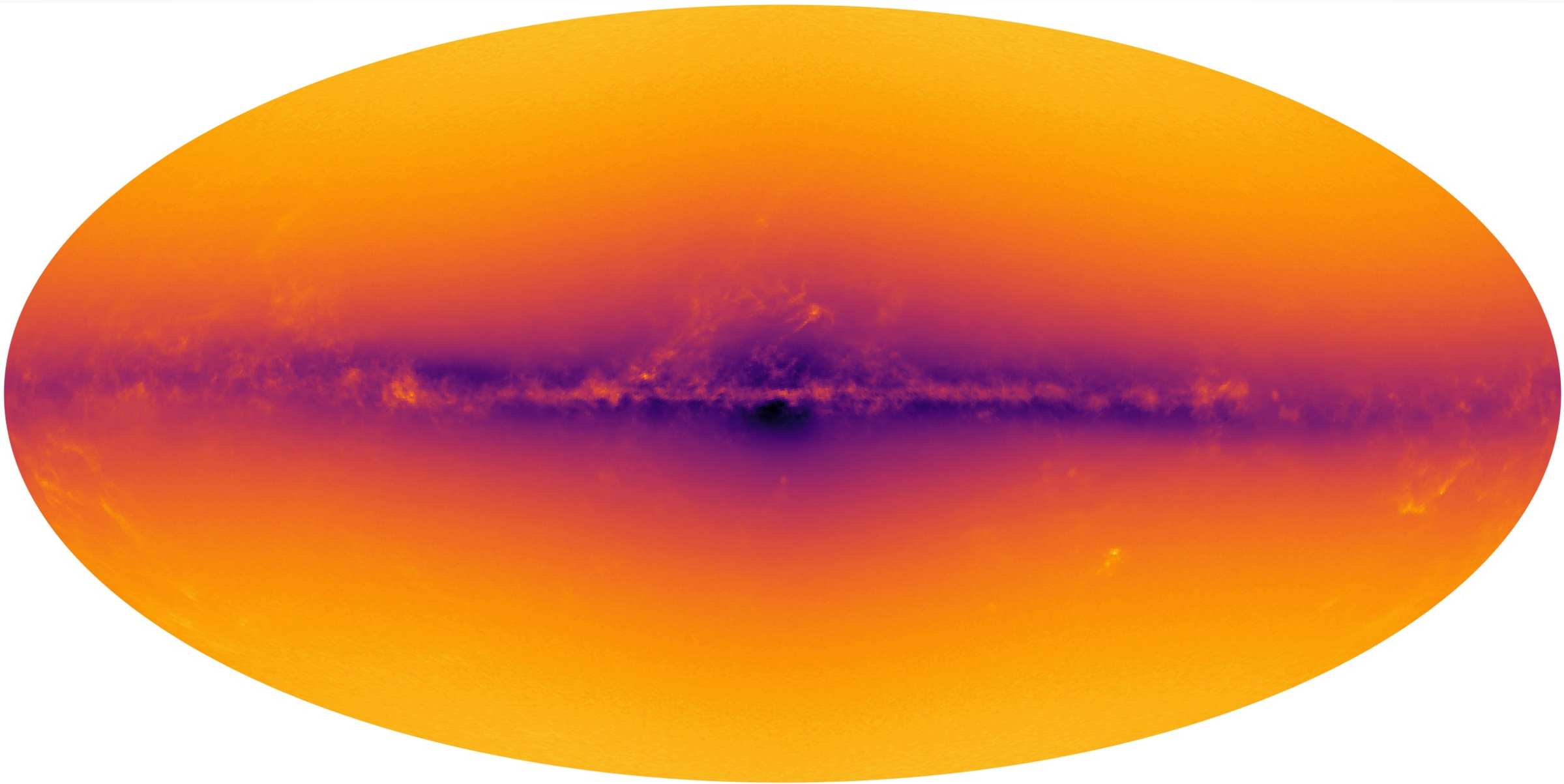
Galaxy Coffee

30th April 2020 (45 days after closure of day-care for children)

Gaia DR2 – a data feast



GDR2mock – help to digest



Philosophy

- Underlying MW model

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- Generate Gaia observables

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- Apply Gaia selection

Philosophy

- Underlying MW model
- Generate Gaia observables
- Apply Gaia selection
- Operate in space of observables using ADQL queries just like real data

Examples - what the mock?

- Selection function
  - Coronado+ 2020

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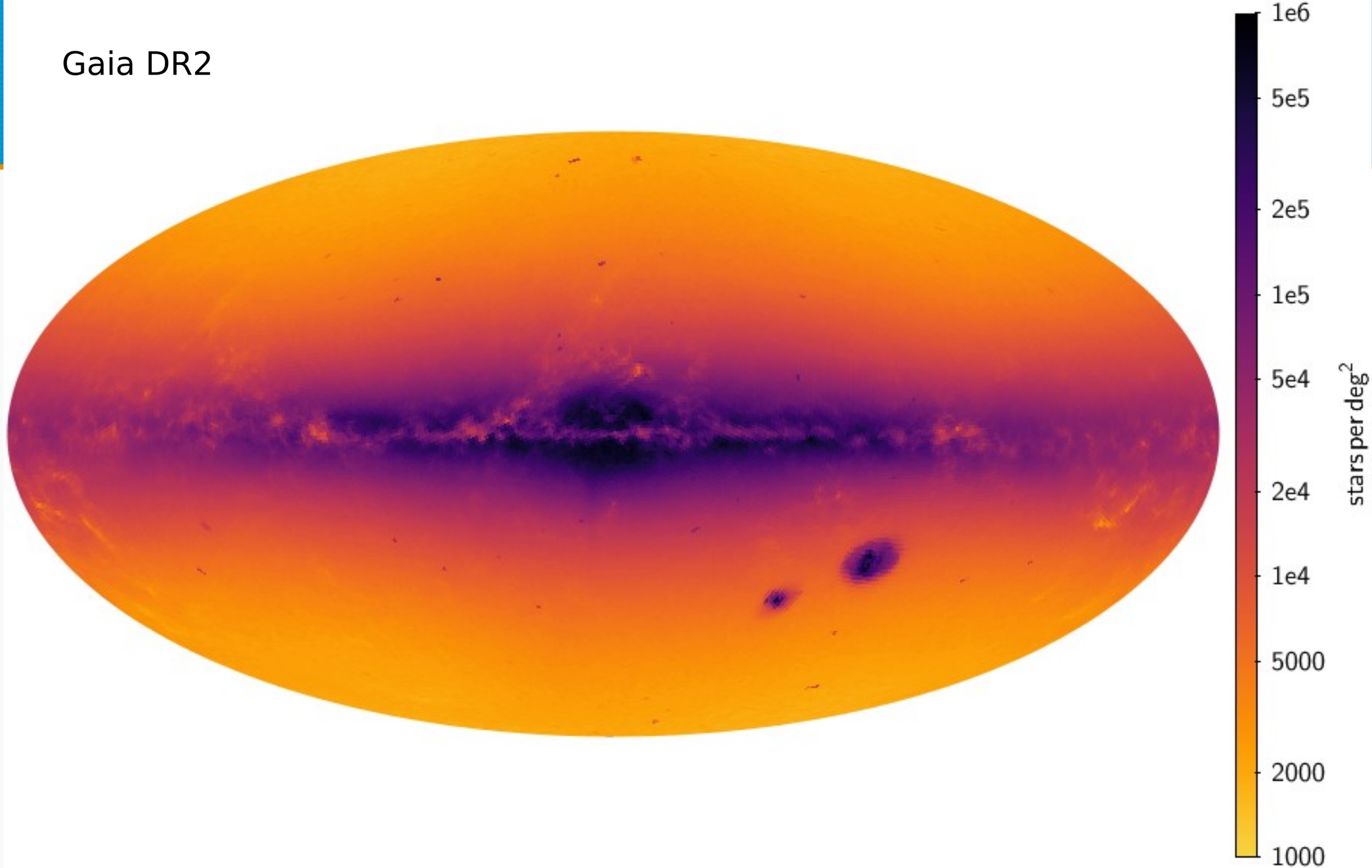
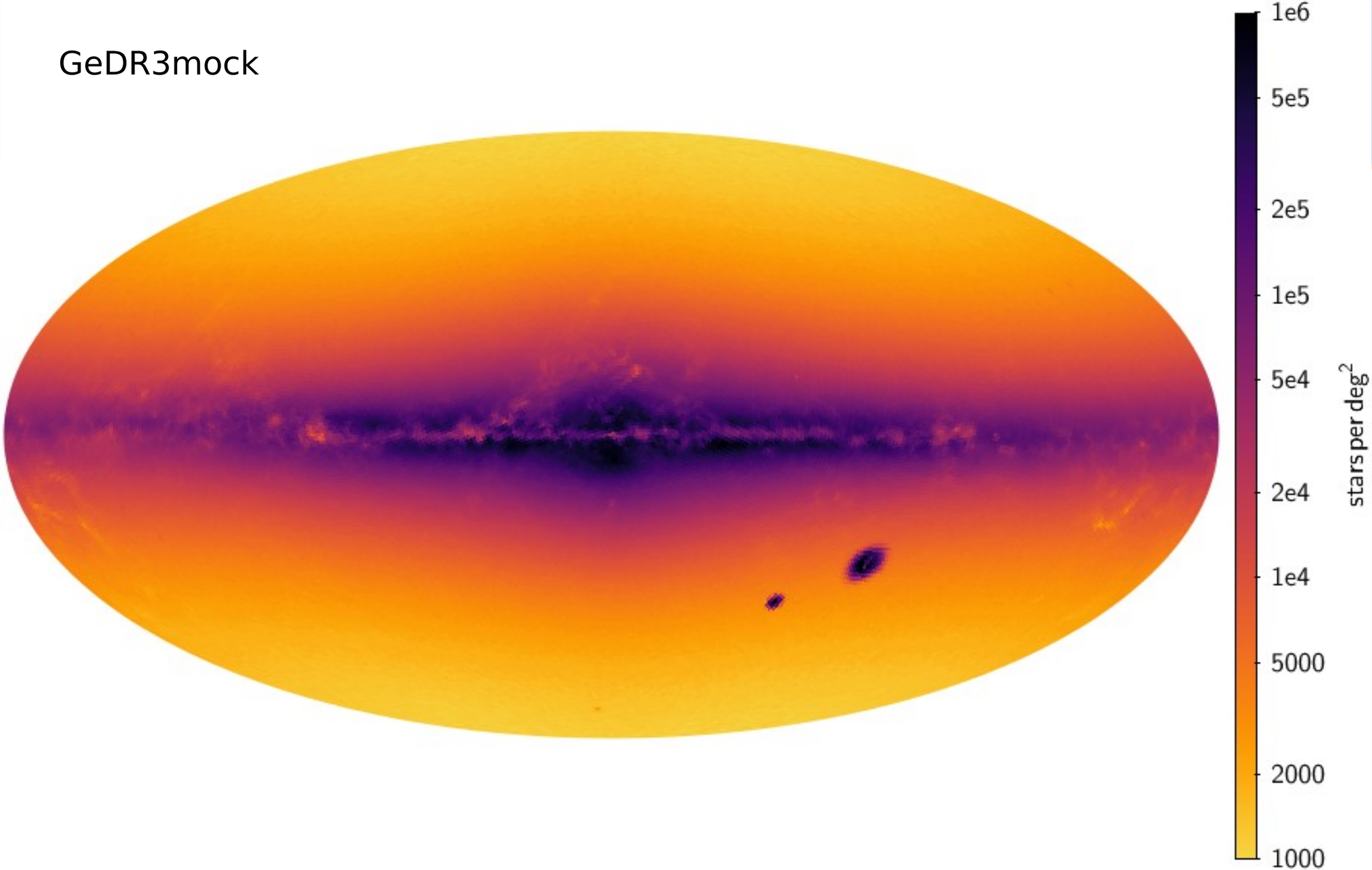
Examples - what the mock?

- Selection function
  - Coronado+ 2020
- False-positive rate in common proper motion pairs
  - El-Badry & Rix 2018
- Distance prior
  - Bailer-Jones+ 2018
- Use-cases I was hoping for:
  - Microlensing, cluster finding, isochrone fitting

Gaia DR2



GeDR3mock



GeDR3mock - updates

- Besancon model updates

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- 3d extinction map

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- A proxy for GDR2 selection function

ADQL example – observed parallax

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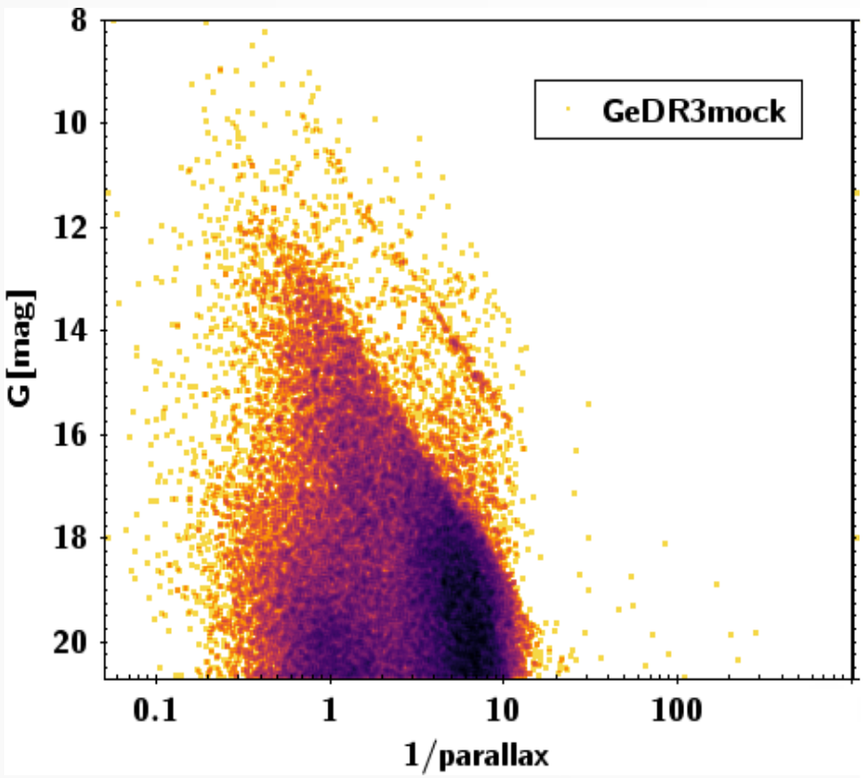
```
SELECT parallax, phot_g_mean_mag,



FROM gedr3mock.main
WHERE source_id BETWEEN 4433793833146253312 AND
     4434356783099674623
-- only a low-density HEALpix of level 5
-- takes few seconds
```

ADQL example – observed parallax



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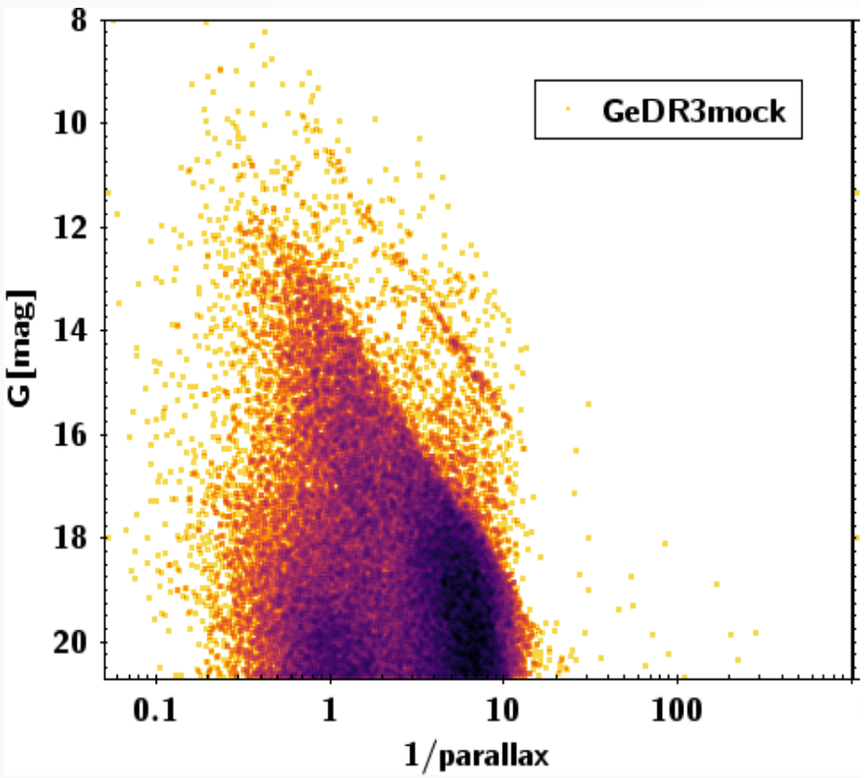
ADQL example – observed parallax

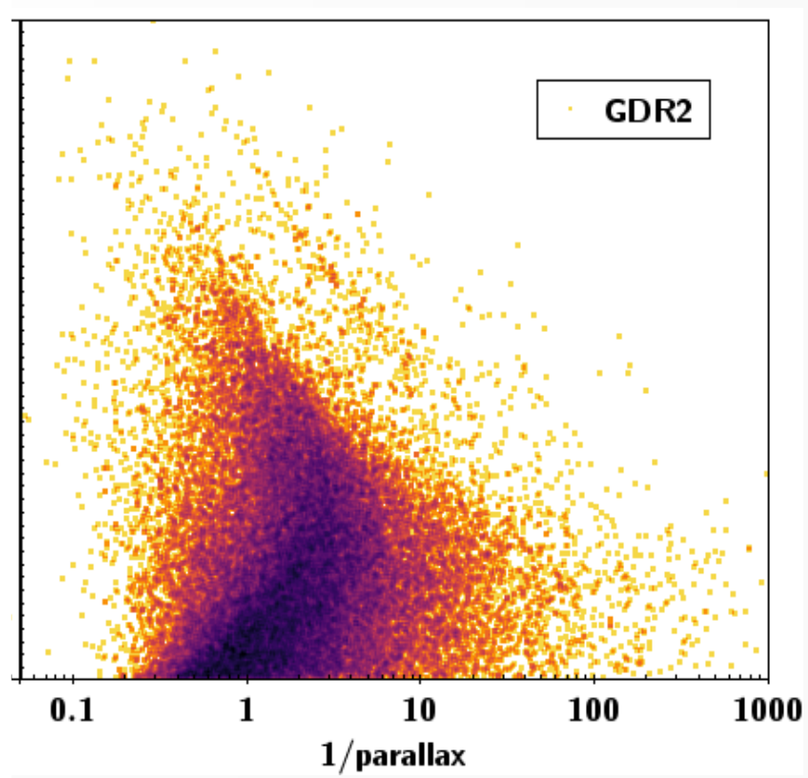
```
SELECT parallax, phot_g_mean_mag,



FROM   gaia.dr2light
WHERE source_id BETWEEN 4433793833146253312 AND
     4434356783099674623
-- only a low-density HEALpix of level 5
-- takes few seconds
```

ADQL example – observed parallax





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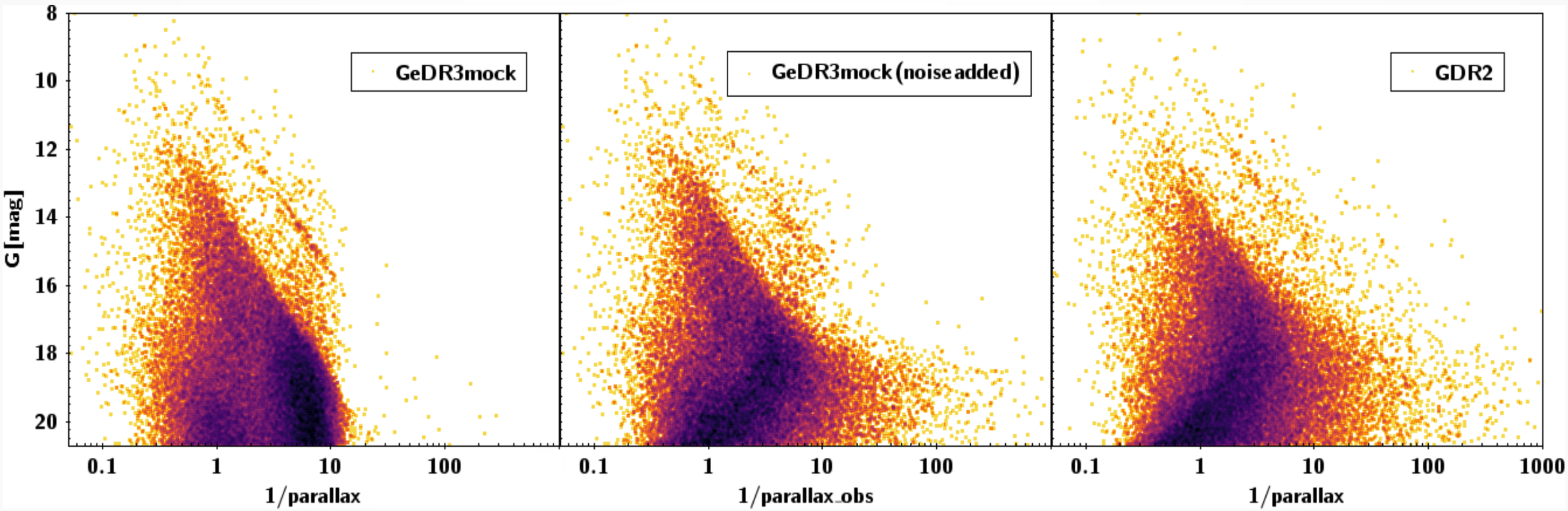
```

ADQL example – observed parallax

```
SELECT parallax, phot_g_mean_mag,
GAVO_NORMAL_RANDOM(parallax,parallax_error) AS
    parallax_obs
FROM gedr3mock.main
WHERE source_id BETWEEN 4433793833146253312 AND
    4434356783099674623
-- only a low-density HEALpix of level 5
-- takes few seconds
```

ADQL example – observed parallax



Forward model

github.com/jan-rybizki/Galaxia_wrap

MW model

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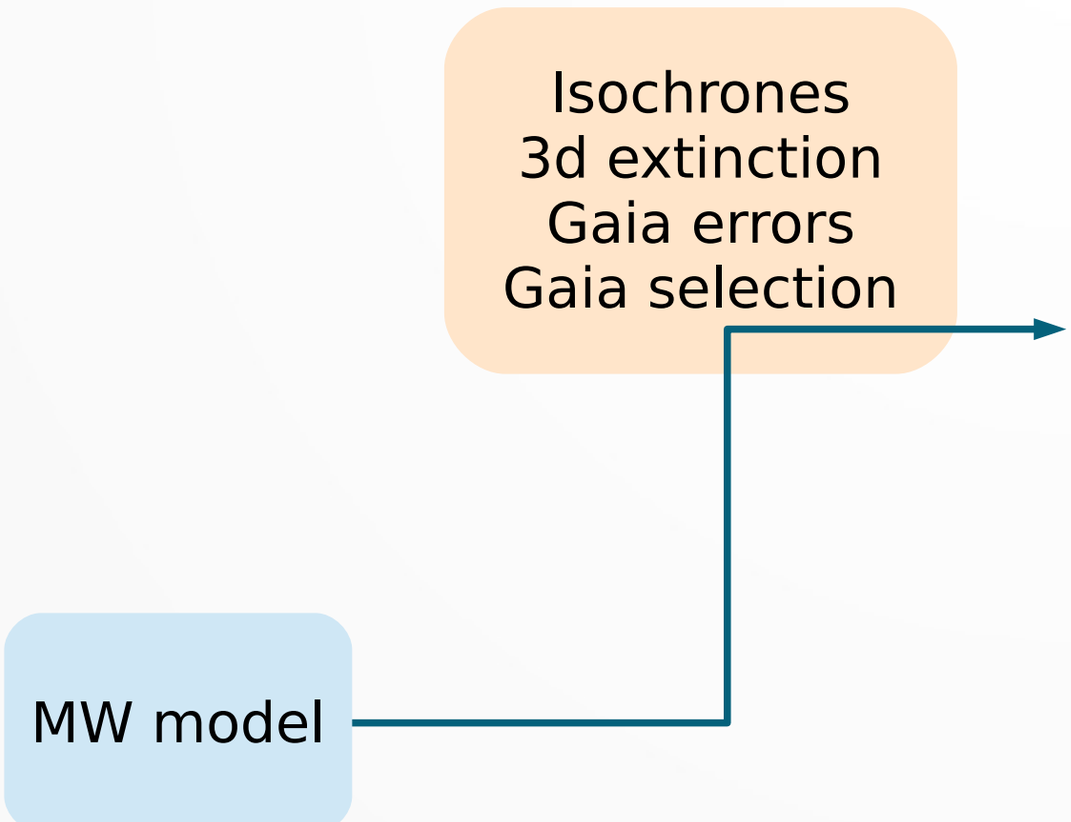

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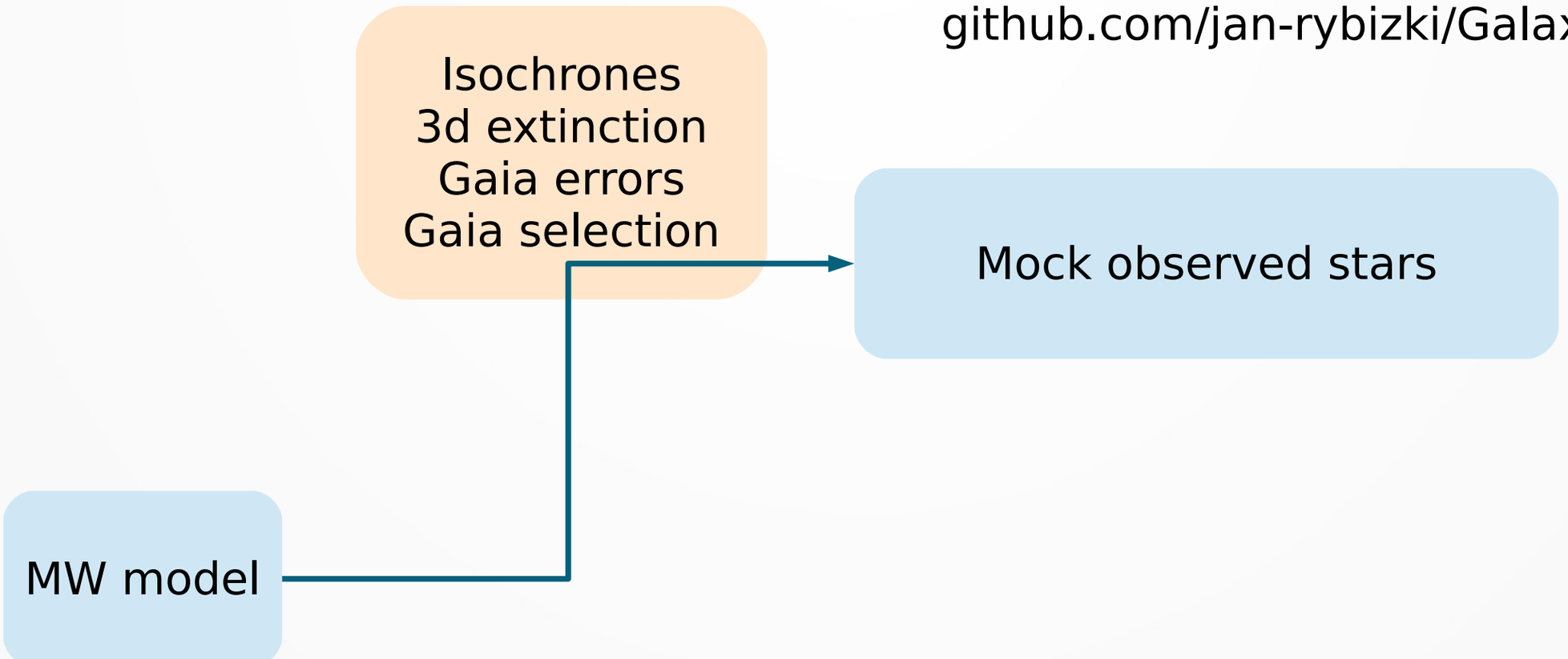

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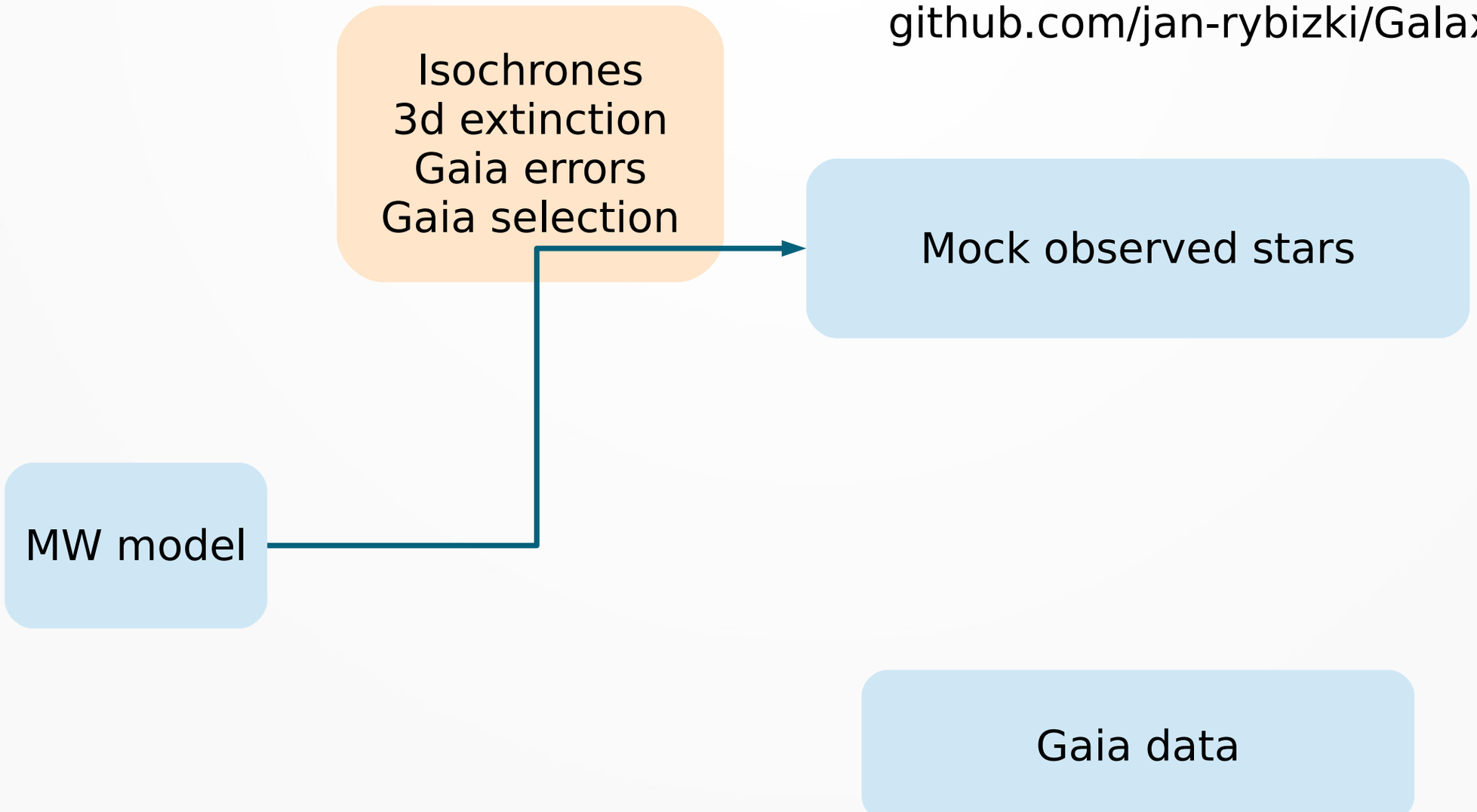

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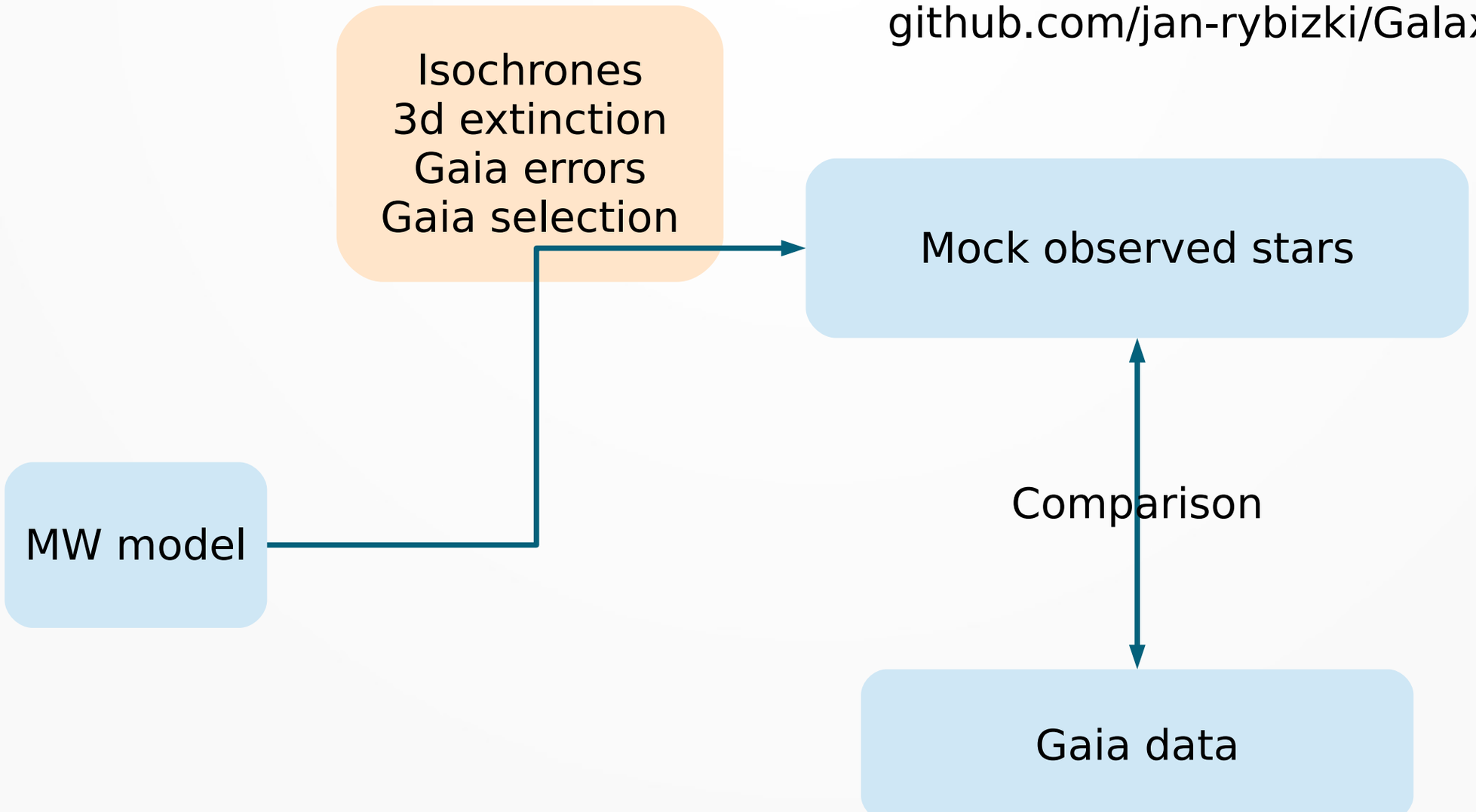

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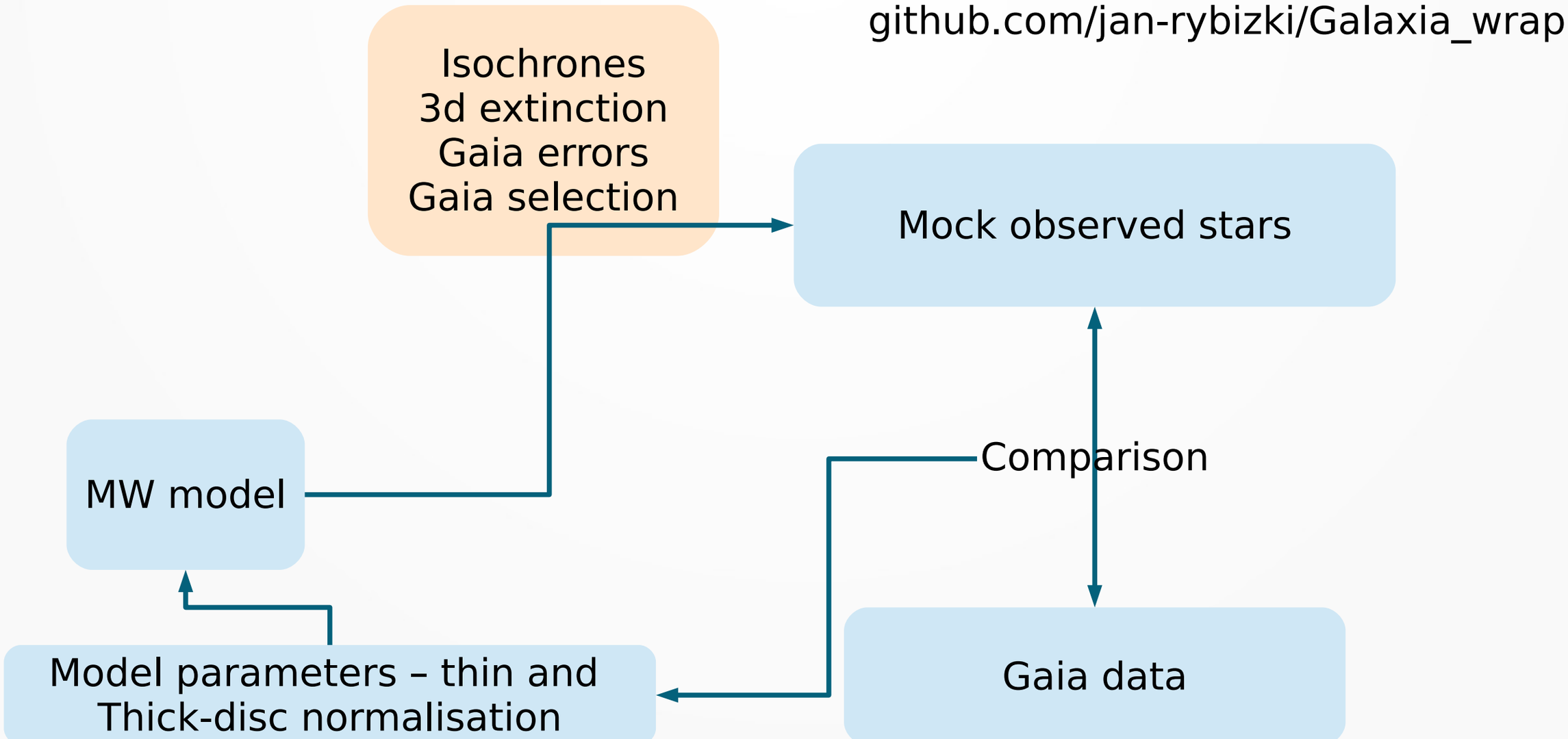
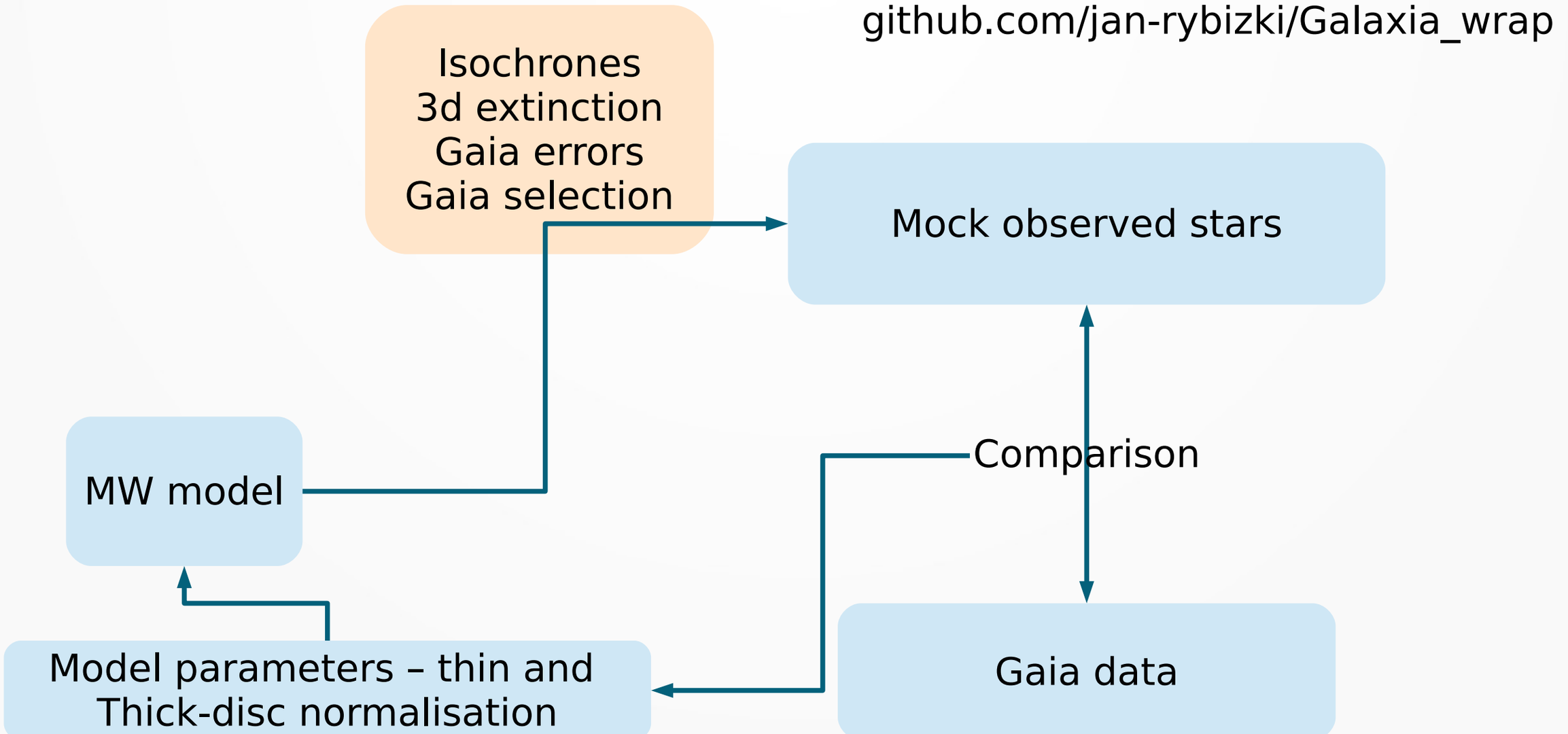


Forward model

Notebook 5(a)

github.com/jan-rybizki/Galaxia_wrap



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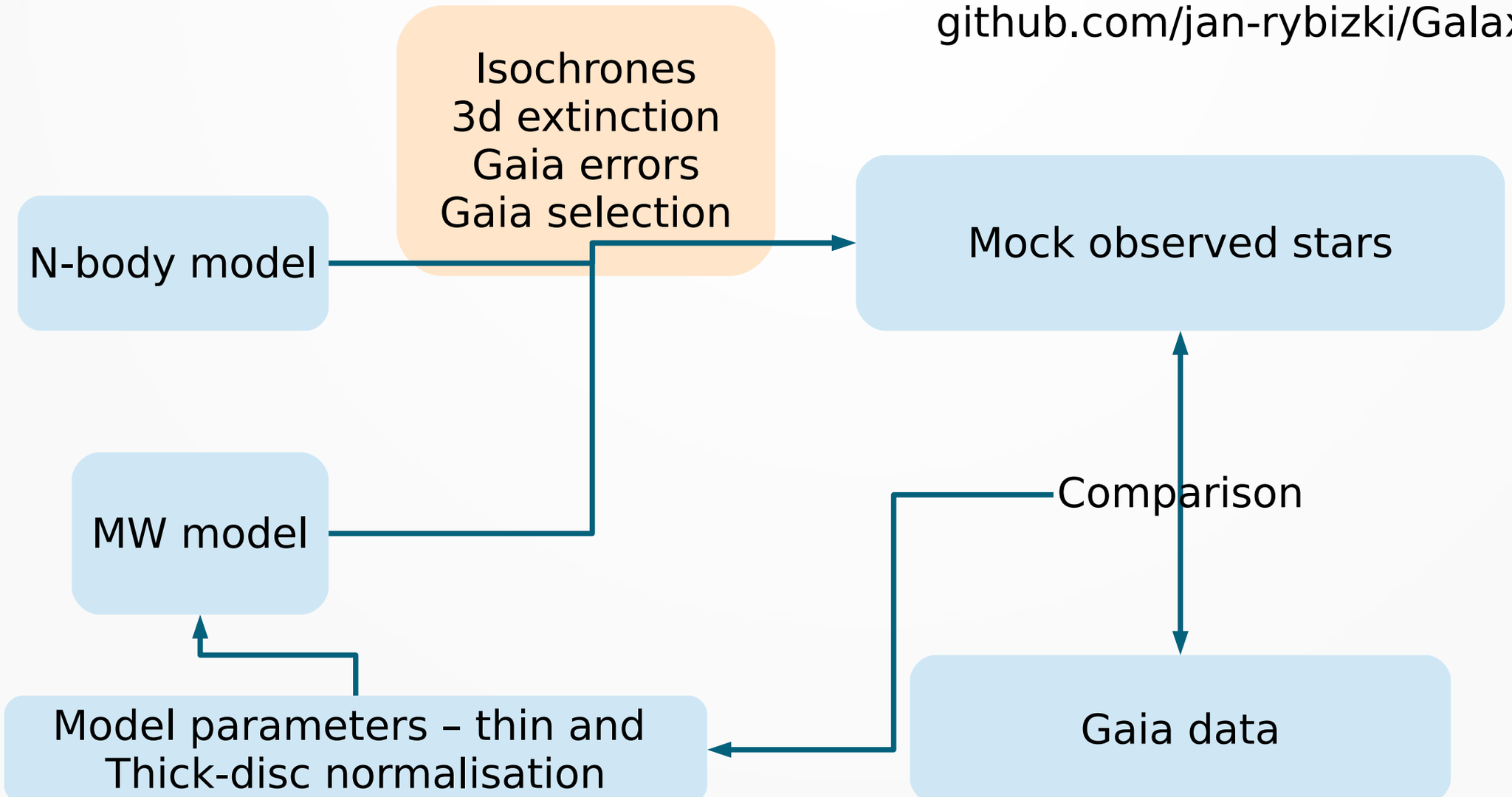
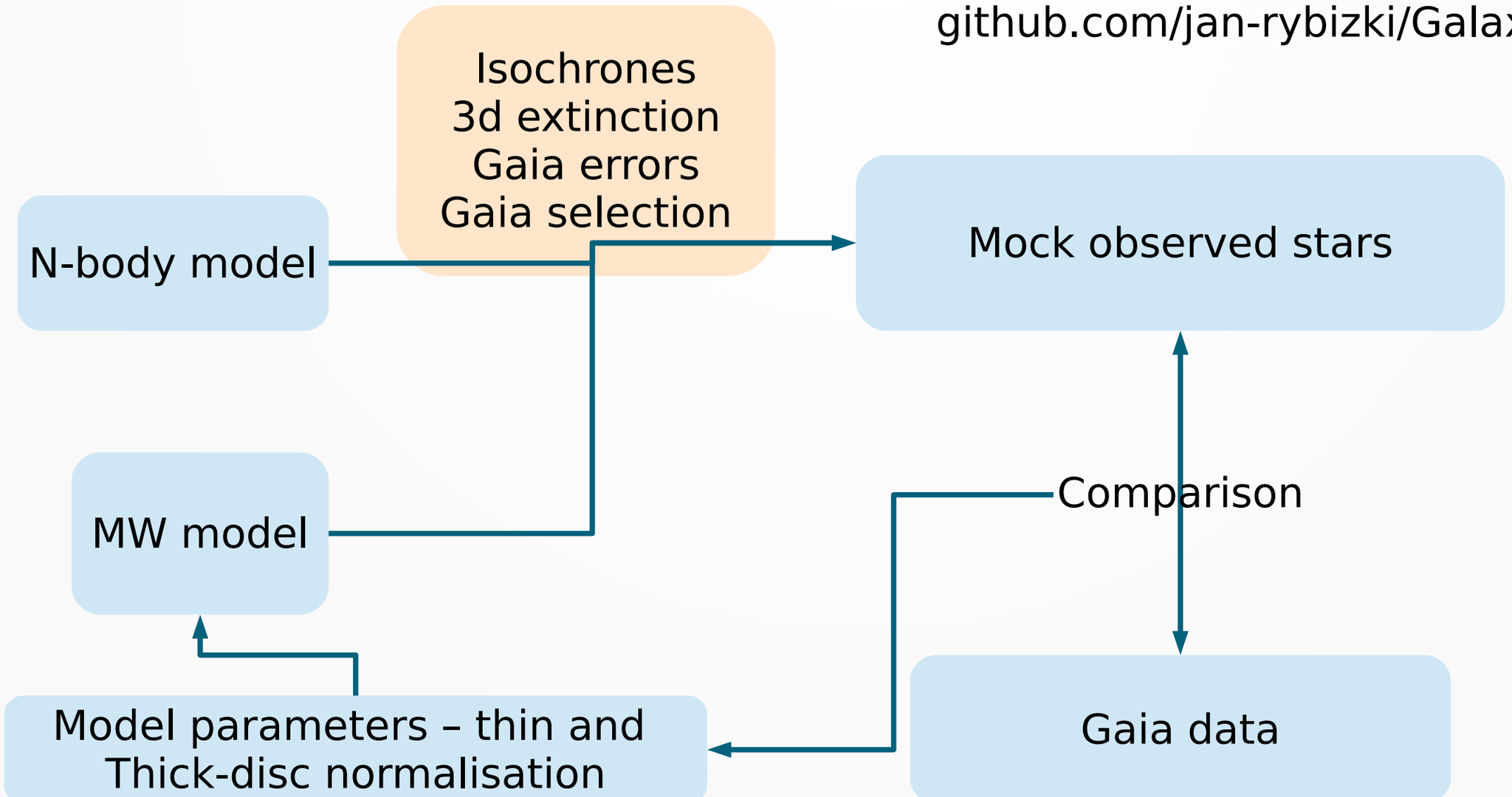


Forward model

Notebook 6 & 7

github.com/jan-rybizki/Galaxia_wrap



Magnitude limit approximated by the mode of the magnitude distribution

color
&
parallax

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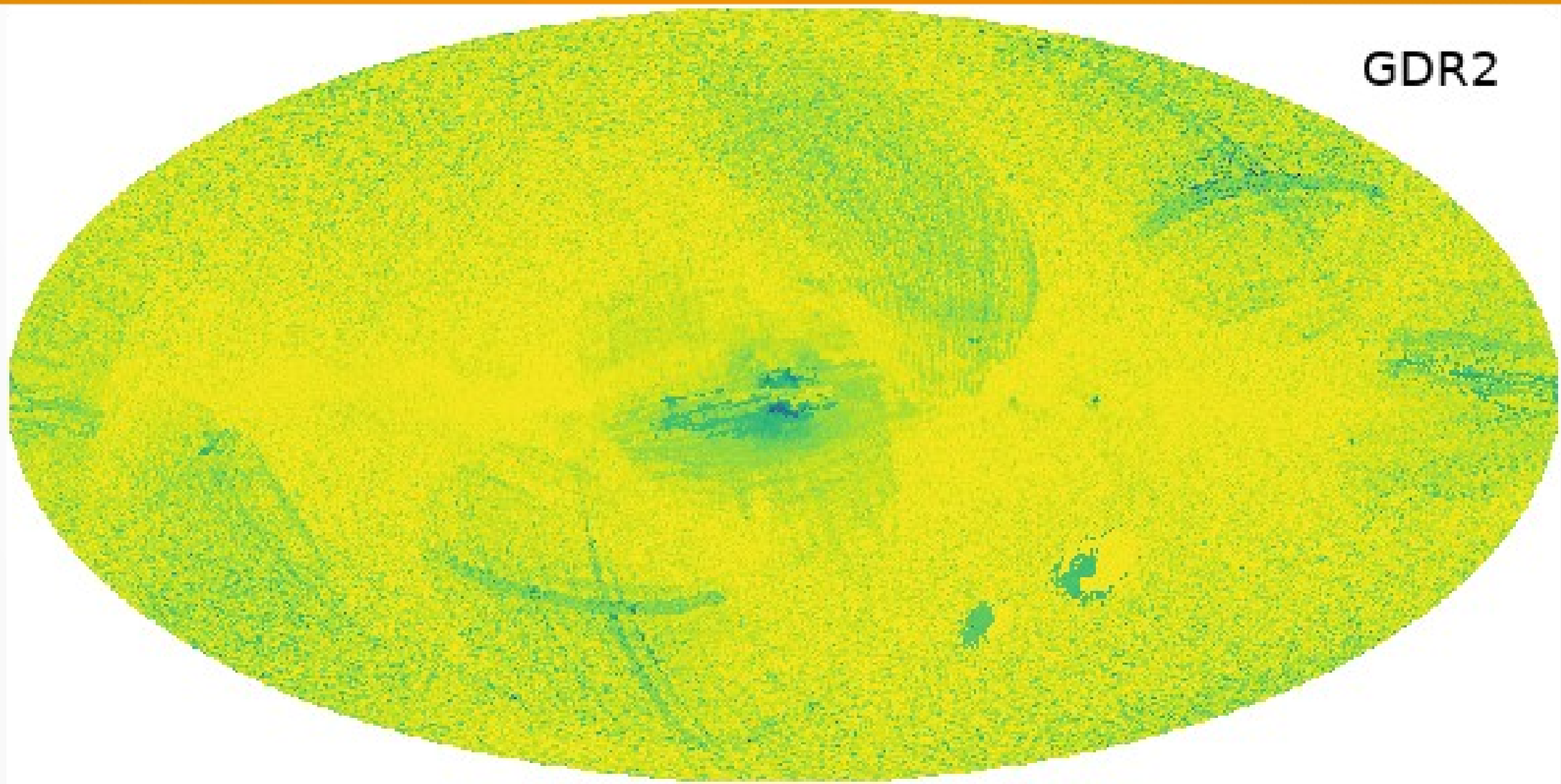
parallax



Could do with GeDR3mock

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- Assess selection function of your sample

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- Optimize your favorite Galaxy model

Could do with GeDR3mock

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- Please provide me with a good n-body simulation of the Magellanic clouds

Updates for Gaia DR3 full

- Binaries

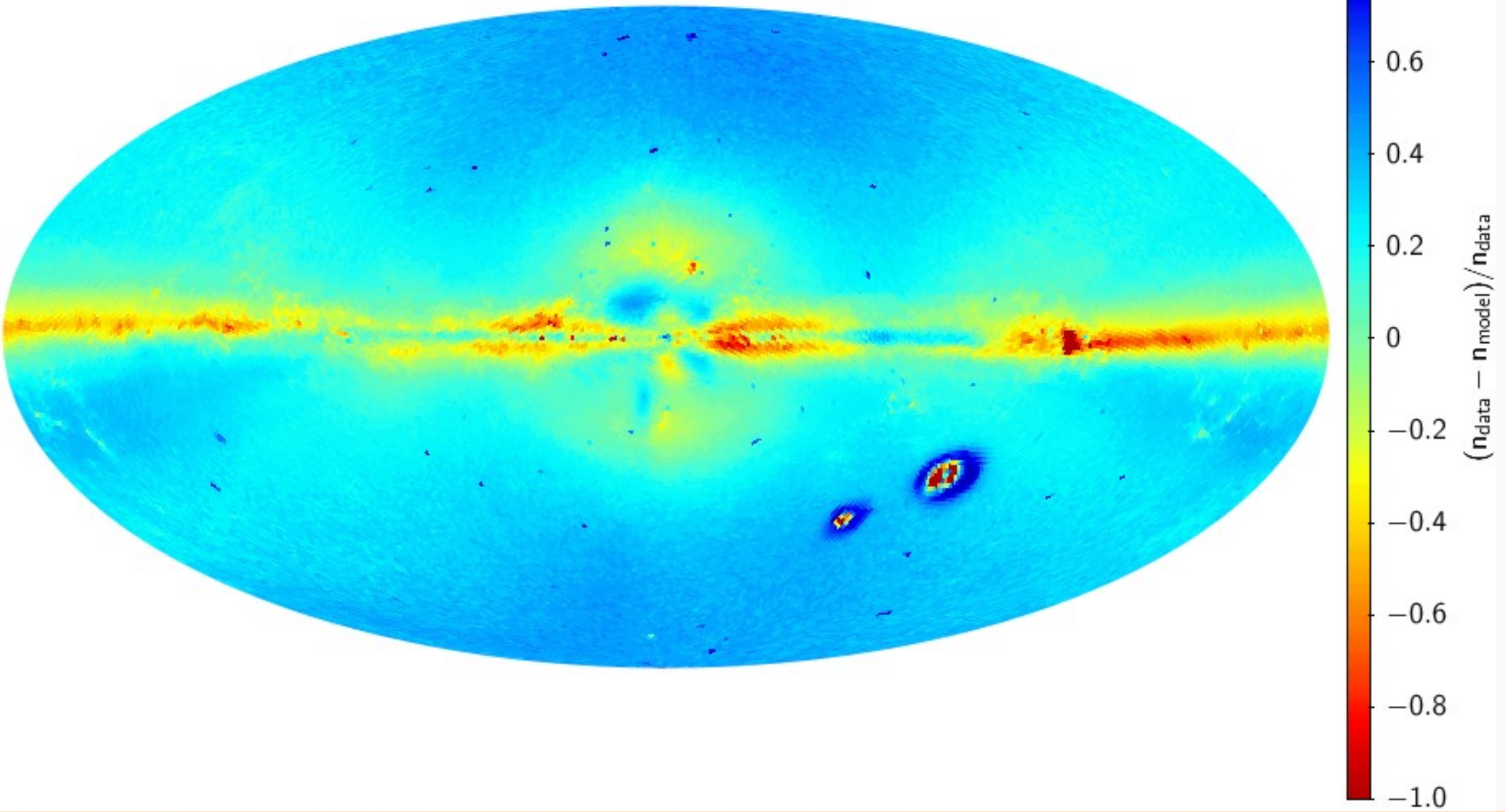
Updates for Gaia DR3 full

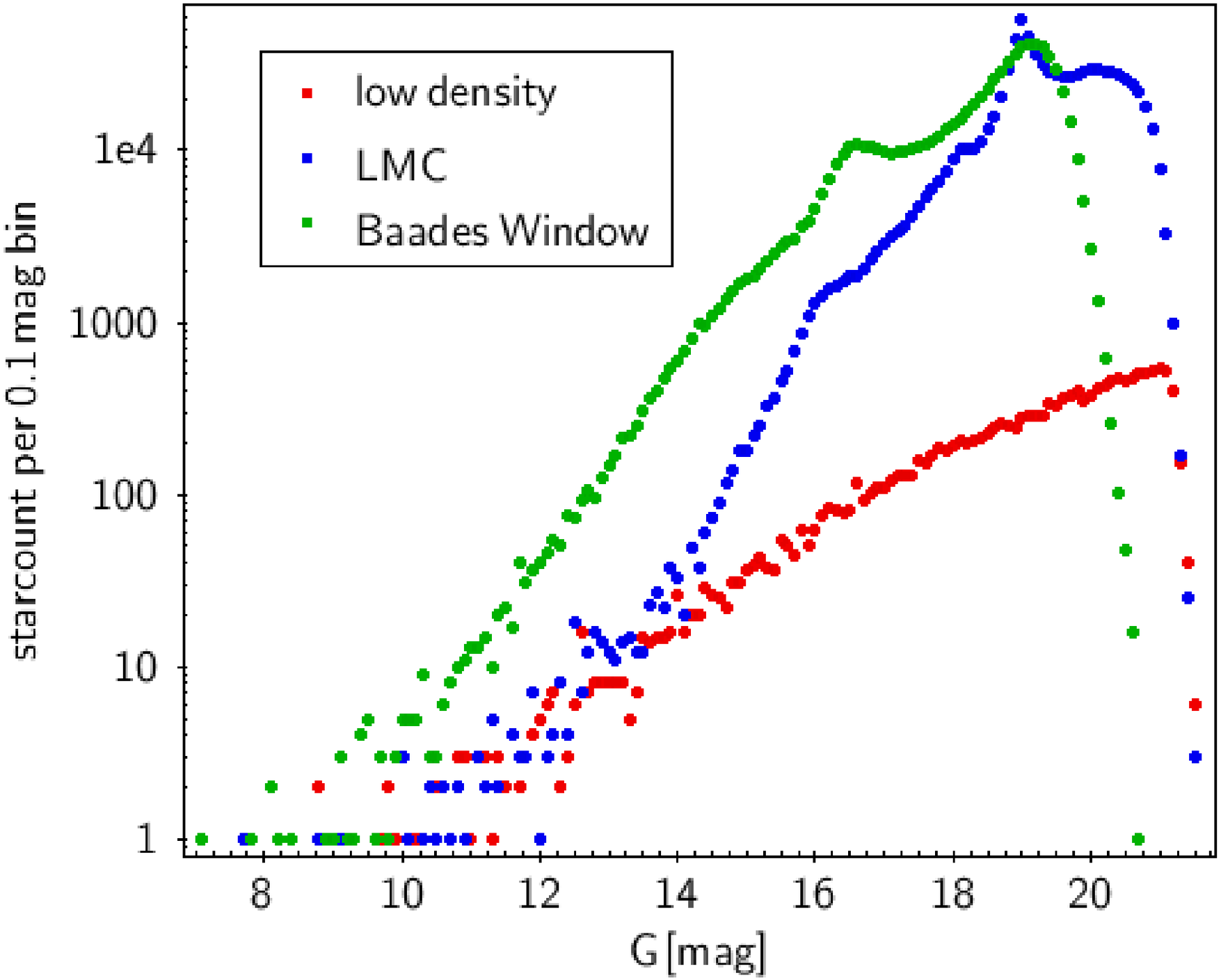
- Binaries
- Galaxies and quasars

Updates for Gaia DR3 full

- Binaries
- Galaxies and quasars
- Chemical abundances

Thank you for your attention




low density
LMC
Baades Window
1e4
1000
100
10
1
starcount per 0.1 mag bin
8
10
12
14
16
18
20
G [mag]