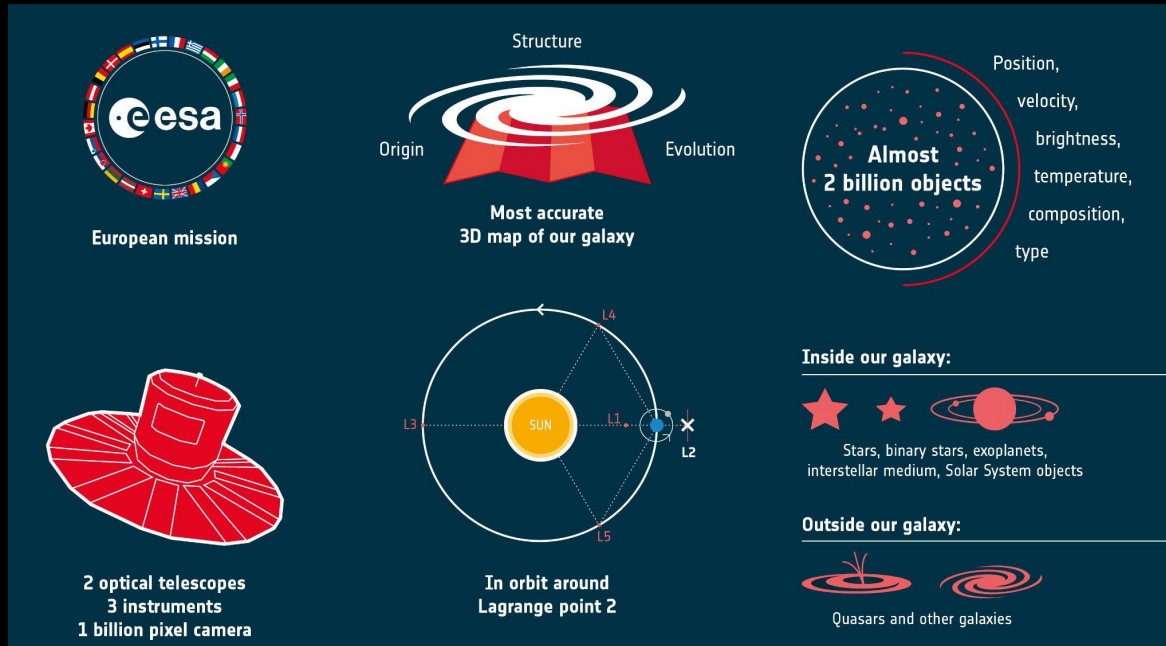


SNO GAIA

Anjana Mohandasan

Jean-Marc Petit

What is Gaia ?



The infographic is set against a dark blue background. It features several key elements: the ESA logo with a circular border of European flags; a red ribbon graphic representing the galaxy's structure and evolution; a circular field of red dots representing the 2 billion objects Gaia will map; a red line-art illustration of the Gaia spacecraft; a diagram of the Sun at the center of the galaxy with Lagrange points L1 through L5 marked; and two sections describing the mission's focus: 'Inside our galaxy' (stars, binary stars, exoplanets, etc.) and 'Outside our galaxy' (quasars and other galaxies).

European mission

Structure
Origin Evolution

Most accurate 3D map of our galaxy

Almost 2 billion objects

Position, velocity, brightness, temperature, composition, type

2 optical telescopes
3 instruments
1 billion pixel camera

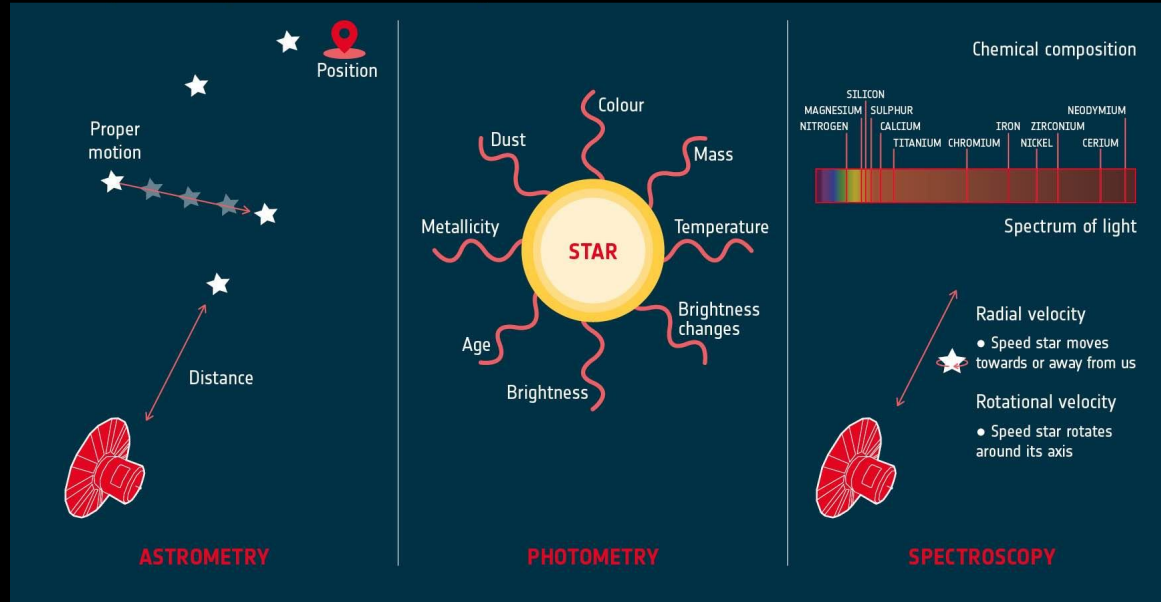
In orbit around Lagrange point 2

Inside our galaxy:
Stars, binary stars, exoplanets, interstellar medium, Solar System objects

Outside our galaxy:
Quasars and other galaxies

- **Goal** - 3D map of the Galaxy
- **Accepted** - 2000 Horizon 2000
- **Launch** - 2013 Kourou, Soyuz ST-B
- **Observation** - Jul 2014 – Jan 2025

How does it work?



Sky mapper (SM) and
astrometric field (AF)

Blue and Red
Photometers (BP & RP)

Radial Velocity
Spectrometer (RVS)

Gaia SNO: OSUs involved and PIs

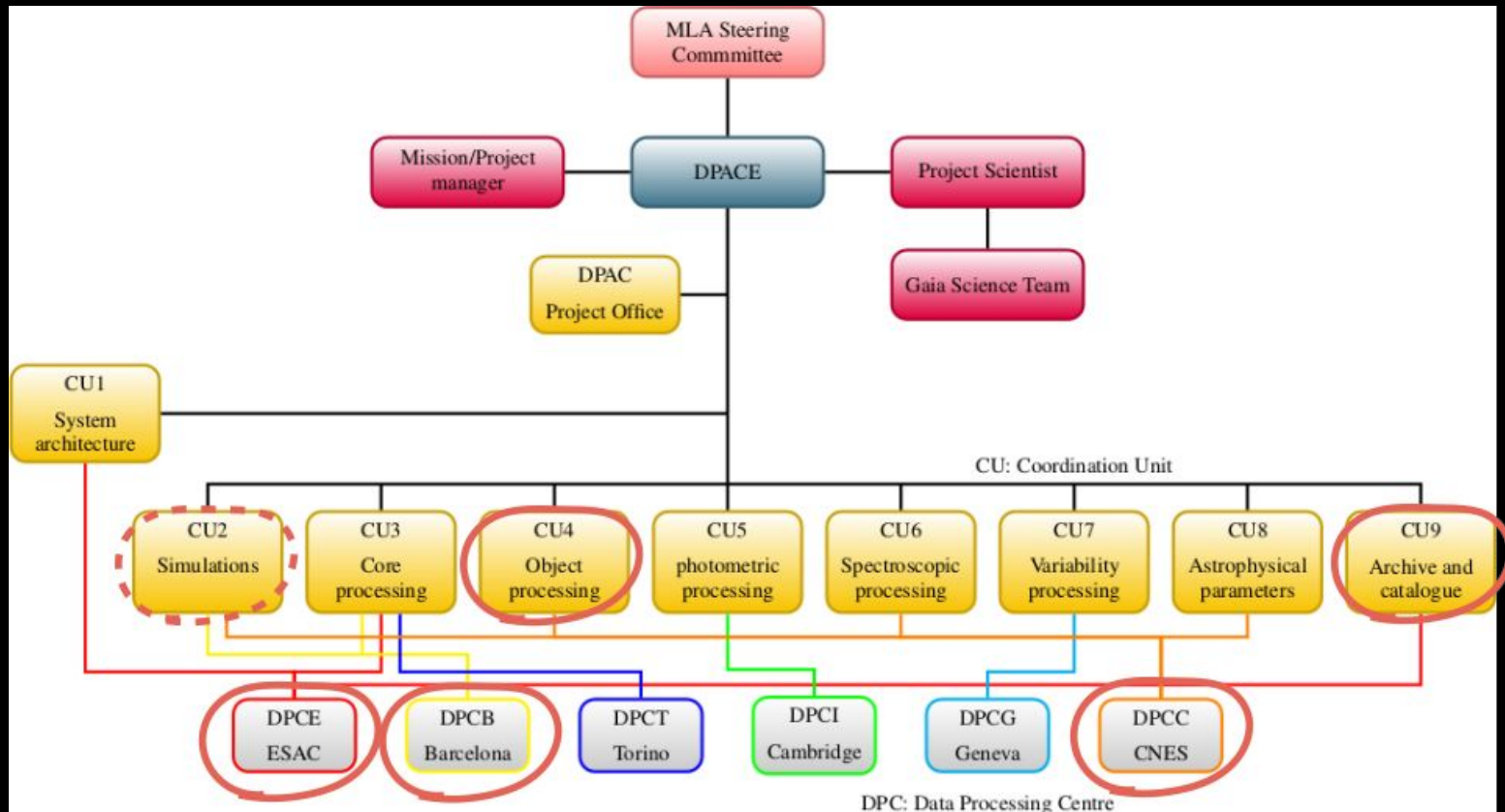
National PI: D. Katz (Obs. PM)

OCA	Paolo TANGA
OASU	Christine DUCOURANT
THETA	Céline REYLÉ
IAP	Brigitte ROCCA-VOLMERANGE
ObAs	Jean-Louis HALBWACHS
OSUG	Carine BABUSIAUX

Structure the French participation in the
“Data Processing and Analysis Consortium” (DPAC)

Gaia organigram

OSU THETA heavily involved
in Gaia DPAC



Gaia data releases

~1 billion stars

~1.6 billion stars

~1.8 billion stars

~1.8 billion stars

~1.8 billion stars

~2 billion stars

~2 billion + stars

DR1

DR2

EDR3

DR3

FPR

DR4

DR5

Sep 2016

Apr 2018

Dec 2020

Jun 2022

Oct 2023

~ 2026

~ 2030

(14 months,
Jul 2014
- Sep 2015)

(22 months,
- May 2016)

(34 months,
- May 2017)

(34 months,
- May 2017)

(up to 66
months,
- Jan 2020)

(66 months,
- Jan 2020)

(126 months
- Jan 2025)

Position and
brightness
Early PLXs
and PMs

Position,
brightness,
PLX, and
PMs
Early RV
and Teff.

Improved
precision over
DR2, in
position,
parallaxes and
PMs

Chemical
abundance,
Binaries,
Variables,
Galaxies,
QSOs, Spectra

Science based
data release,
with DR3
extension.

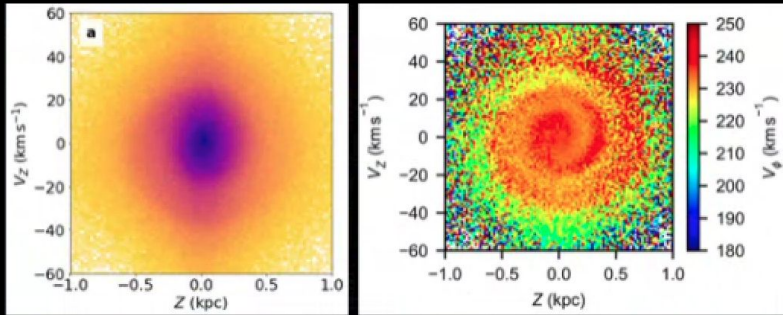
Higher
precision,
better
science...

*"A legacy data
for astronomy,
a GPS for the
entire galaxy"*

upcoming

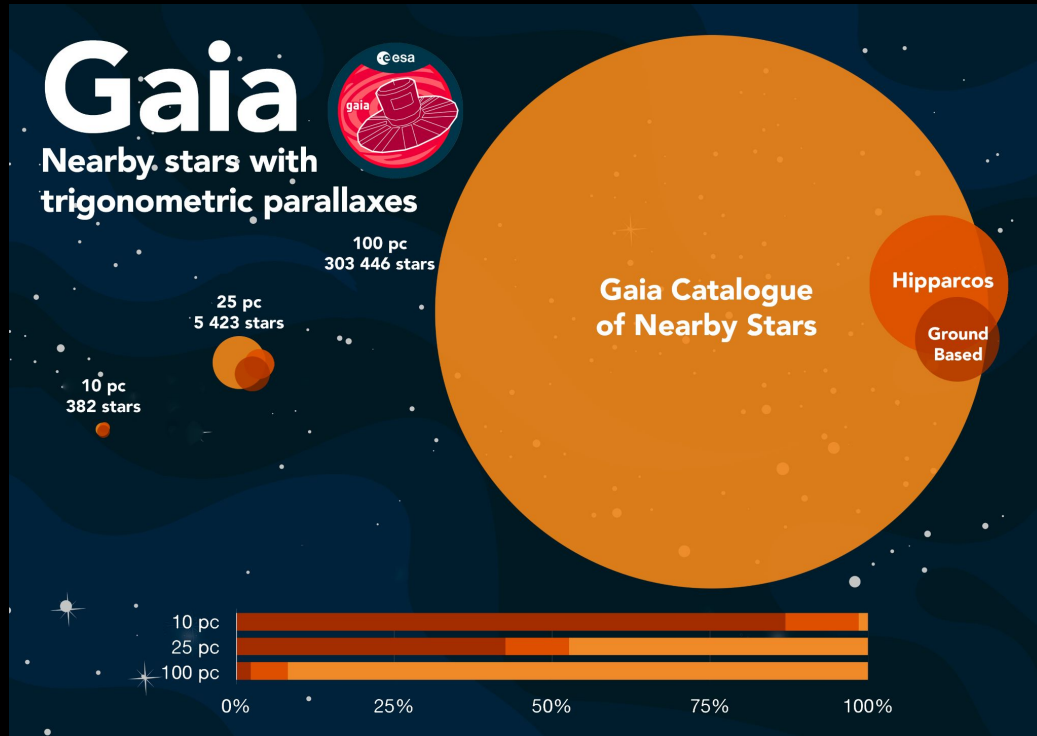
DR3 Results: Passage of Sagittarius dwarf galaxy

- Distribution of 6 million stars in solar neighbourhood
- Evidence of gravitational disturbance suffered by MW 900 million years ago



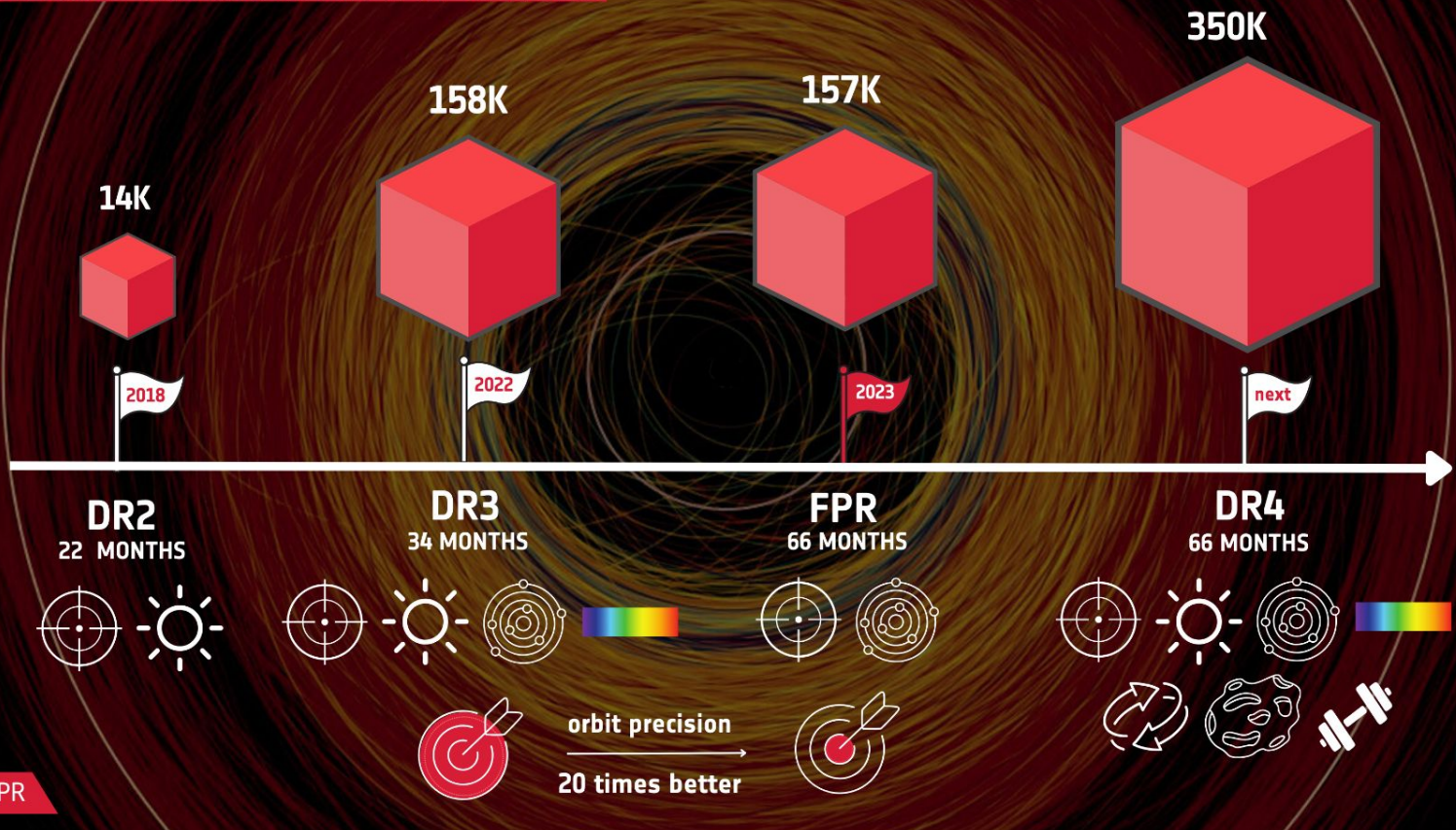
Crédit: T. Antoja

DR3 Results: Gaia catalogue of nearby stars



GAIA FOCUSED PRODUCT RELEASE

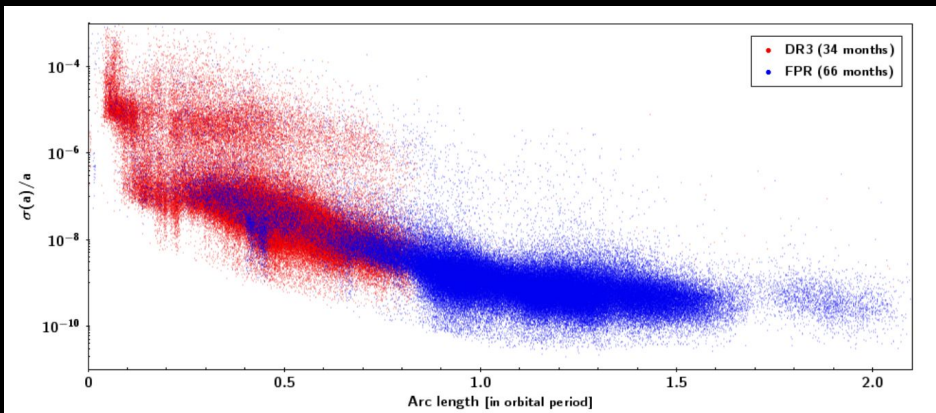
GAIA'S FOCUS ON SOLAR SYSTEM OBJECTS



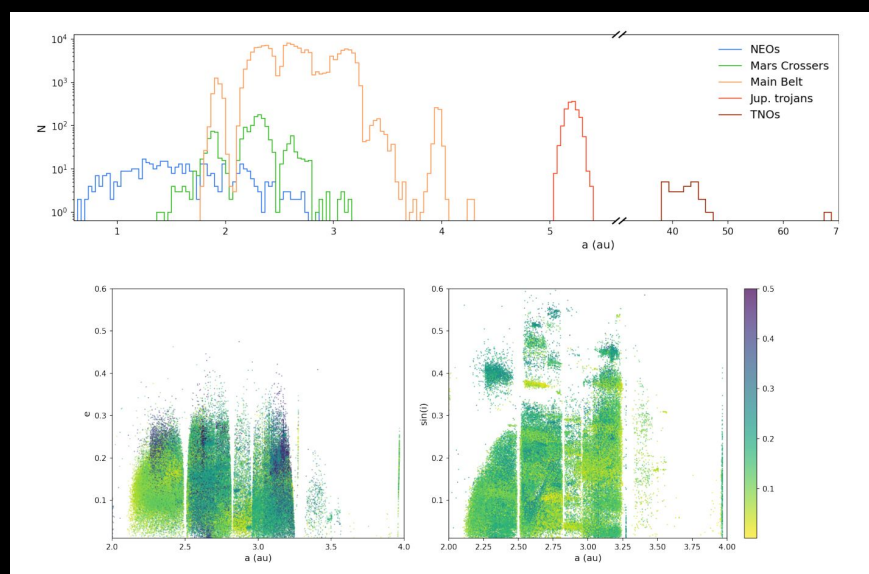
#GaiaFPR



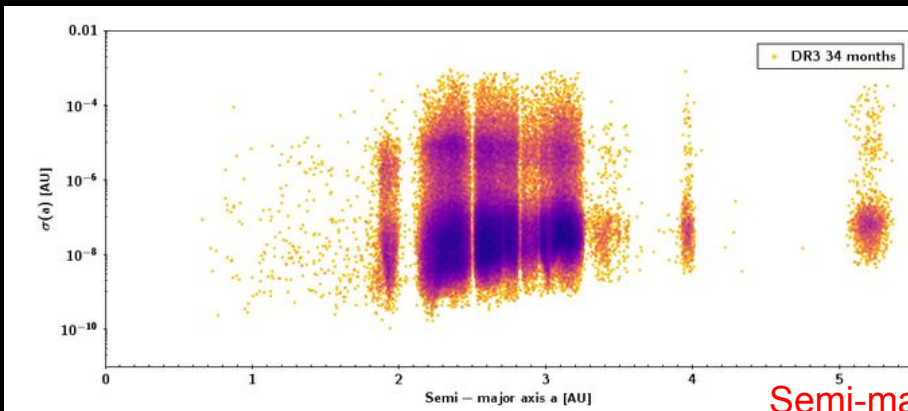
FPR Results: SSOs



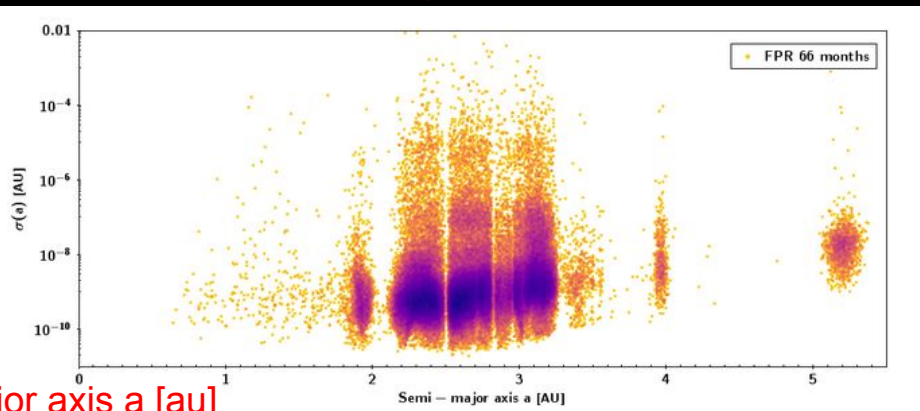
Arc length [in orbital period]



Semi-major axis a [au]



Semi-major axis a [au]



Gaia folks @Obs :)





Service Activities

Prior to launch

Gaia simulations: GUM, GOG, used to prepare the mission, to check the algorithms of different CUs.

After launch

Vetting of catalogues before public releases.

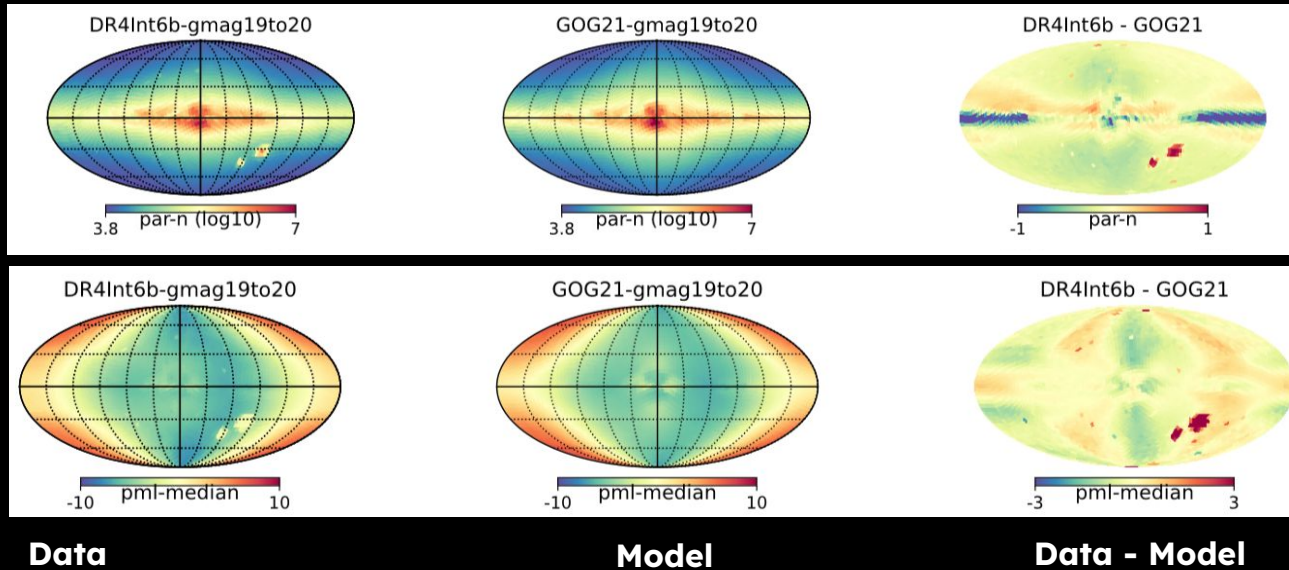
DR4 activities

- Validation and Technical Report (VTR) of different iterations of the catalogue.
- Performance validation for different science cases (e.g., PVP on the bottom of the main sequence).

DR4 VTR

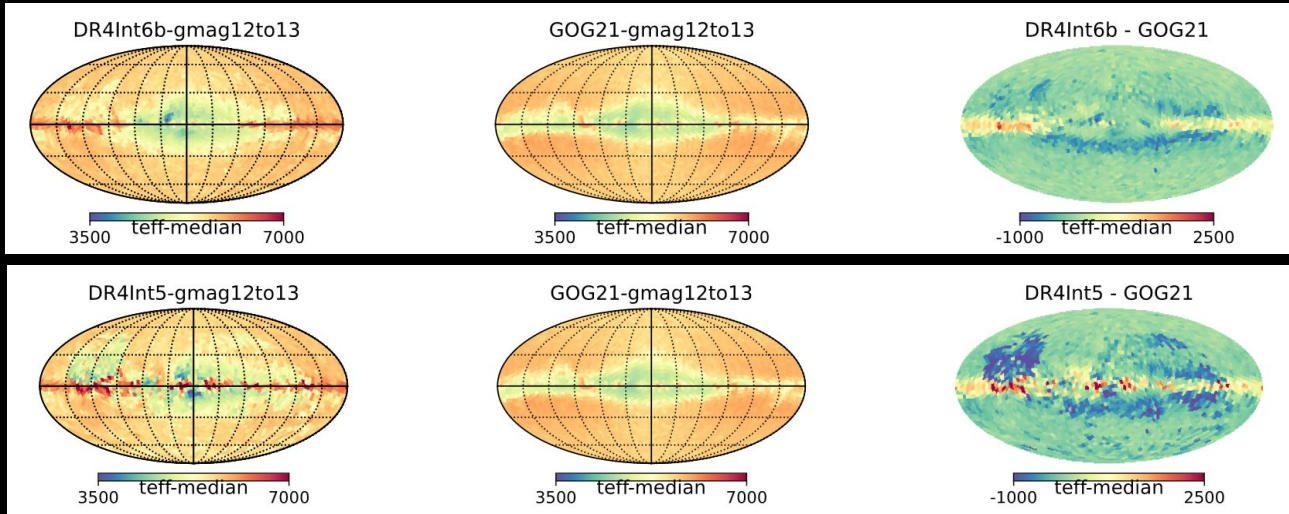
Stats

Integration 6



DR4 VTR

Effective temperature



Data

Model

Data - Model

Integration 6
Integration 5

DR5

SKY-SCANNING COMPLETE FOR ESA'S MILKY WAY MAPPER GAIA

From 24 July 2014 to 15 January 2025, Gaia made more than three trillion observations of two billion stars and other objects, which revolutionised the view of our home galaxy and cosmic neighbourhood.

3 TRILLION

Observations

2 BILLION

Stars & other objects observed

938 MILLION

Camera pixels on board

15 300

Spacecraft 'pirouettes'

55 KG

Cold nitrogen gas consumed

3827

Days in science operations

50 000 HOURS

Ground station time used

580 MILLION

Accesses of Gaia catalogue so far

13 000

Refereed scientific publications so far

2.8 MILLION

Commands sent to spacecraft

142 TB

Downlinked data (compressed)

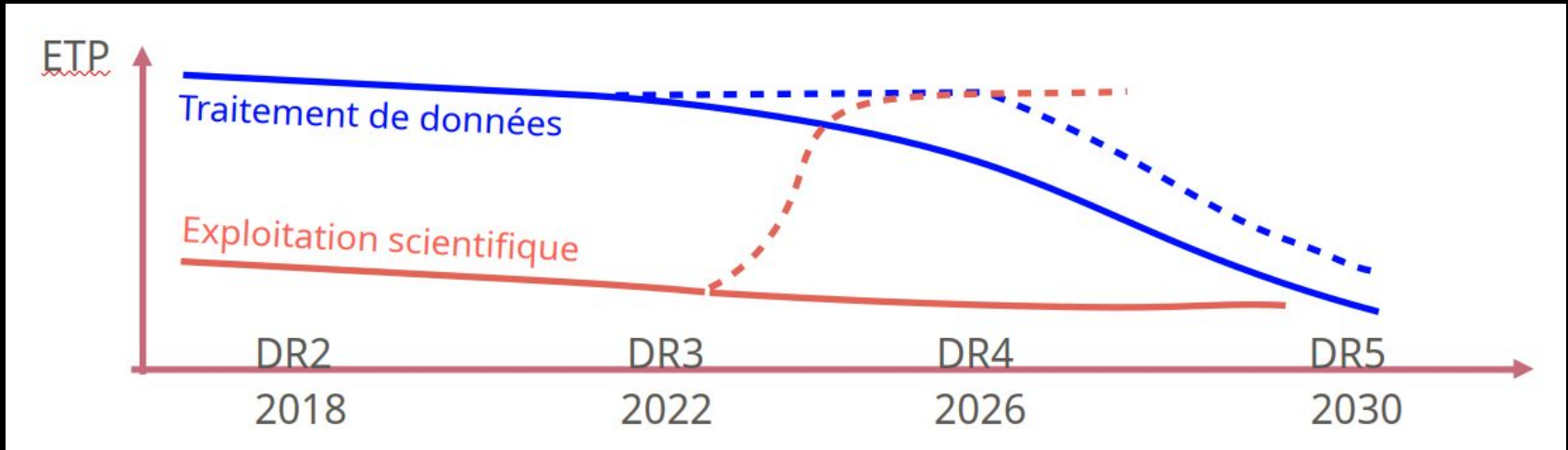
500 TB

Volume of data release 4
(5.5 years of observations)



Gaia SNO: Ends in 2030

Resources



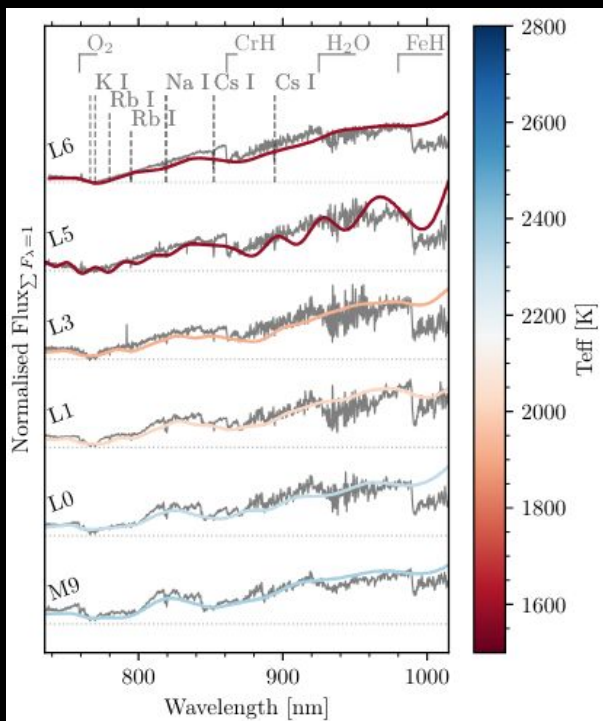


Thank you

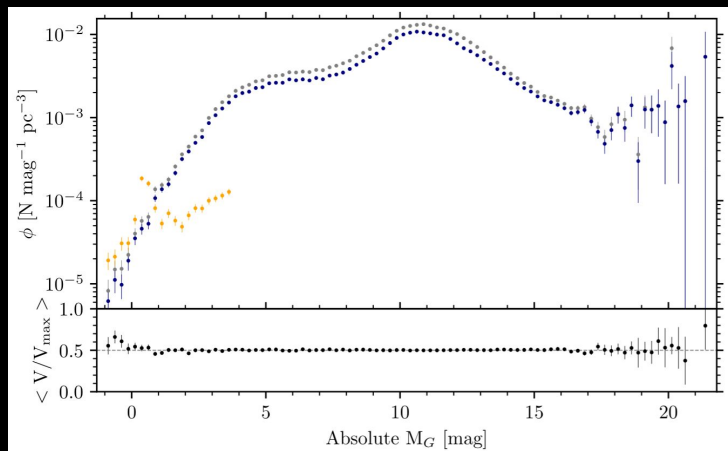
DR4 & **DR5**
2026 2030

Stay tuned!

DR3 Results: Ultracool dwarfs

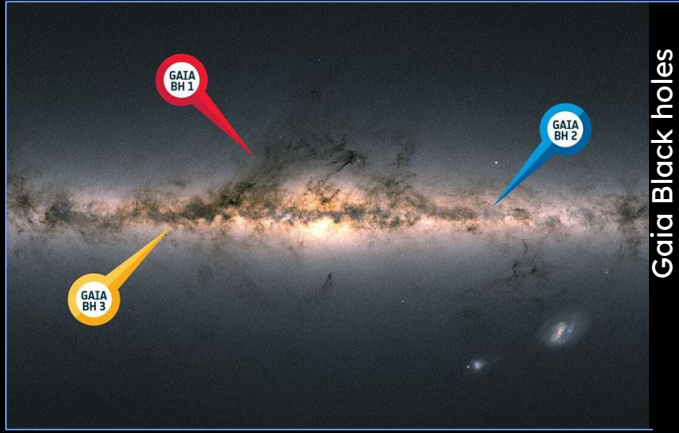


L. M. Sarro. (2023)

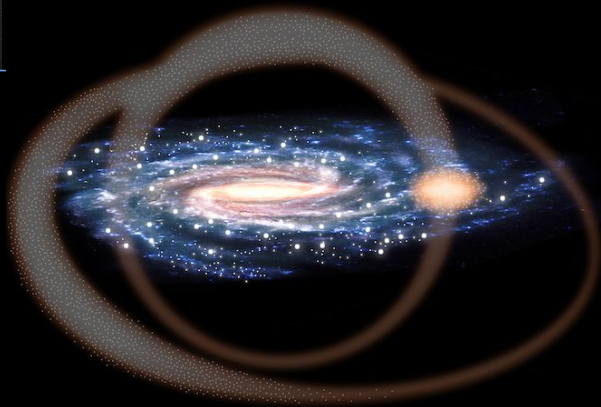
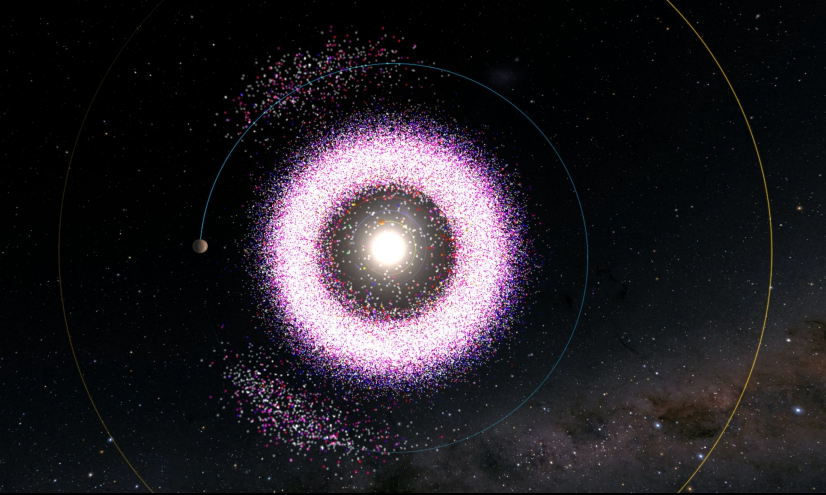


Gaia col. (2021)

DR3: results



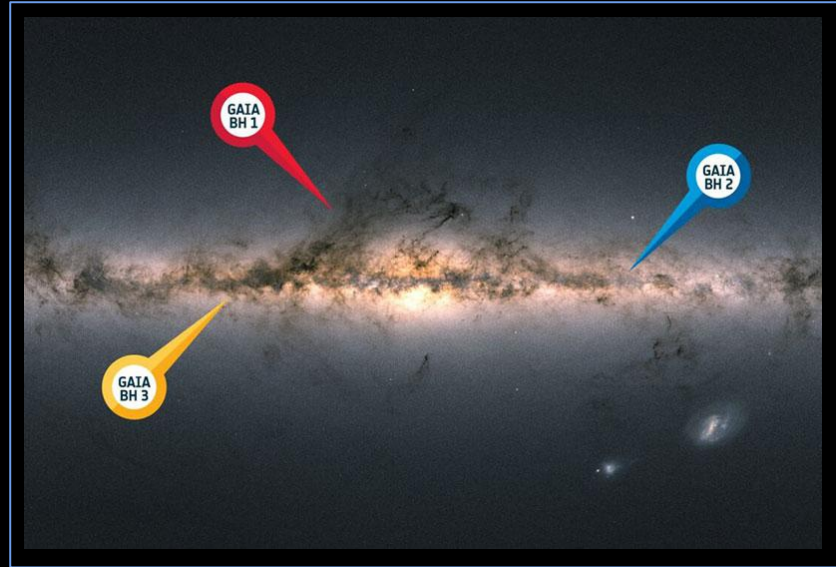
Overview of asteroid orbits in Gaia



Milky Way satellites

UCD? GCNS

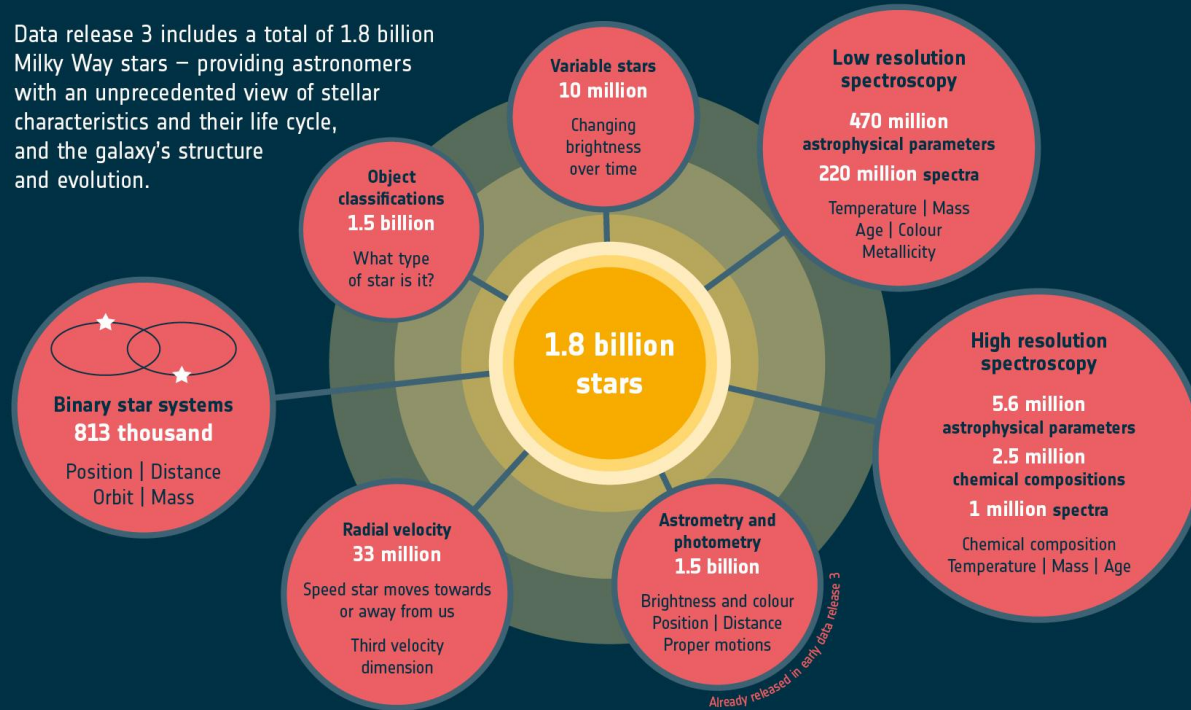
DR3: results



Quiescent stellar mass Gaia
Black holes

DR3

Data release 3 includes a total of 1.8 billion Milky Way stars – providing astronomers with an unprecedented view of stellar characteristics and their life cycle, and the galaxy's structure and evolution.



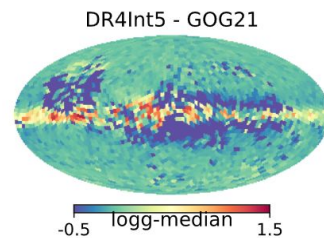
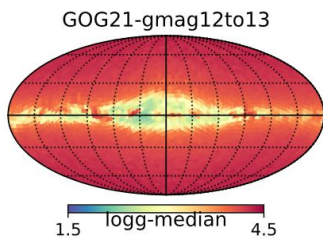
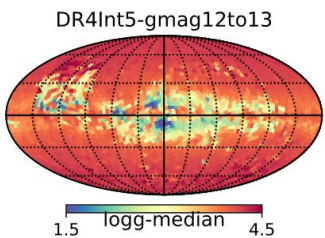
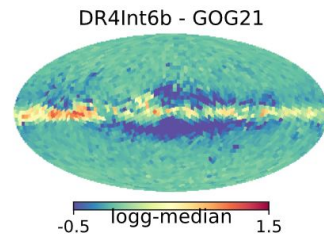
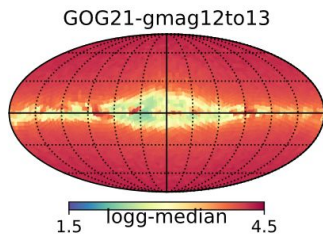
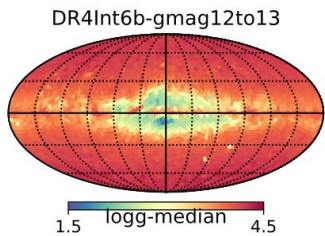
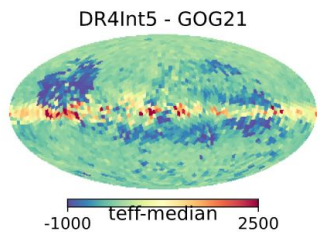
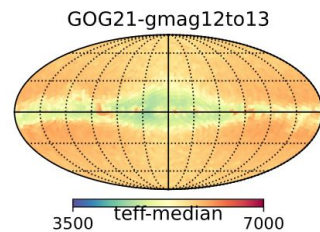
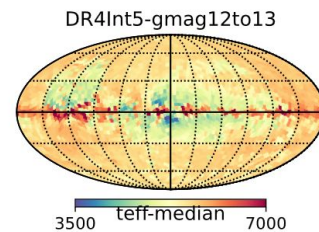
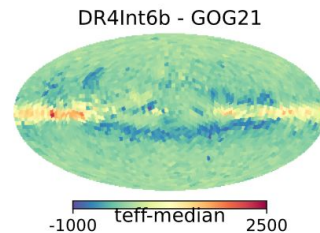
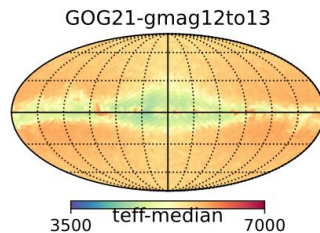
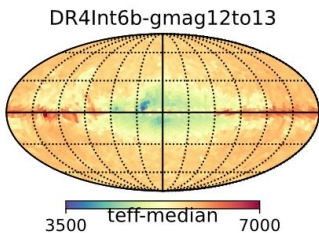
OSUs involved and PIs National PI: D. Katz (ObsPM)

OCA	Stéphane MAZEVET
OASU	Nadia SENECHAL
THETA	Philippe ROUSSELOT
IAP	Kumiko KOTERA
ObAs	Pierre-Alain DUC
OSUG	Nathalie COTTE

Structure the French participation in the
“Data Processing and Analysis Consortium” (DPAC)

Effective temperature

DR4
VTR



Surface gravity

Integration 6
Integration 5

Integration 6
Integration 5

DR4: Activities

- Gaia Data Processing and Analysis Consortium (DPAC)
- Validation of different iterations of the catalogue
- Performance validation for different science cases
 - PVP - orbits of small bodies (???)
 - PVP - bottom of the main sequence
- ???



???

Gaia impact

GAIA CELEBRATES 10 YEARS IN SPACE

14 814
sky scans



813 687
binary stars

4.8 MILLION
galaxy candidates



~450
people in Gaia collaboration



126 TB
of data gathered

observes
~3400
stars per second

1.8 BILLION
stars



25
countries

128
PhD theses



20
orbits around L2



214
exoplanet candidates

158 152
Solar System objects



10 000+
papers

#GAIAMISSION

