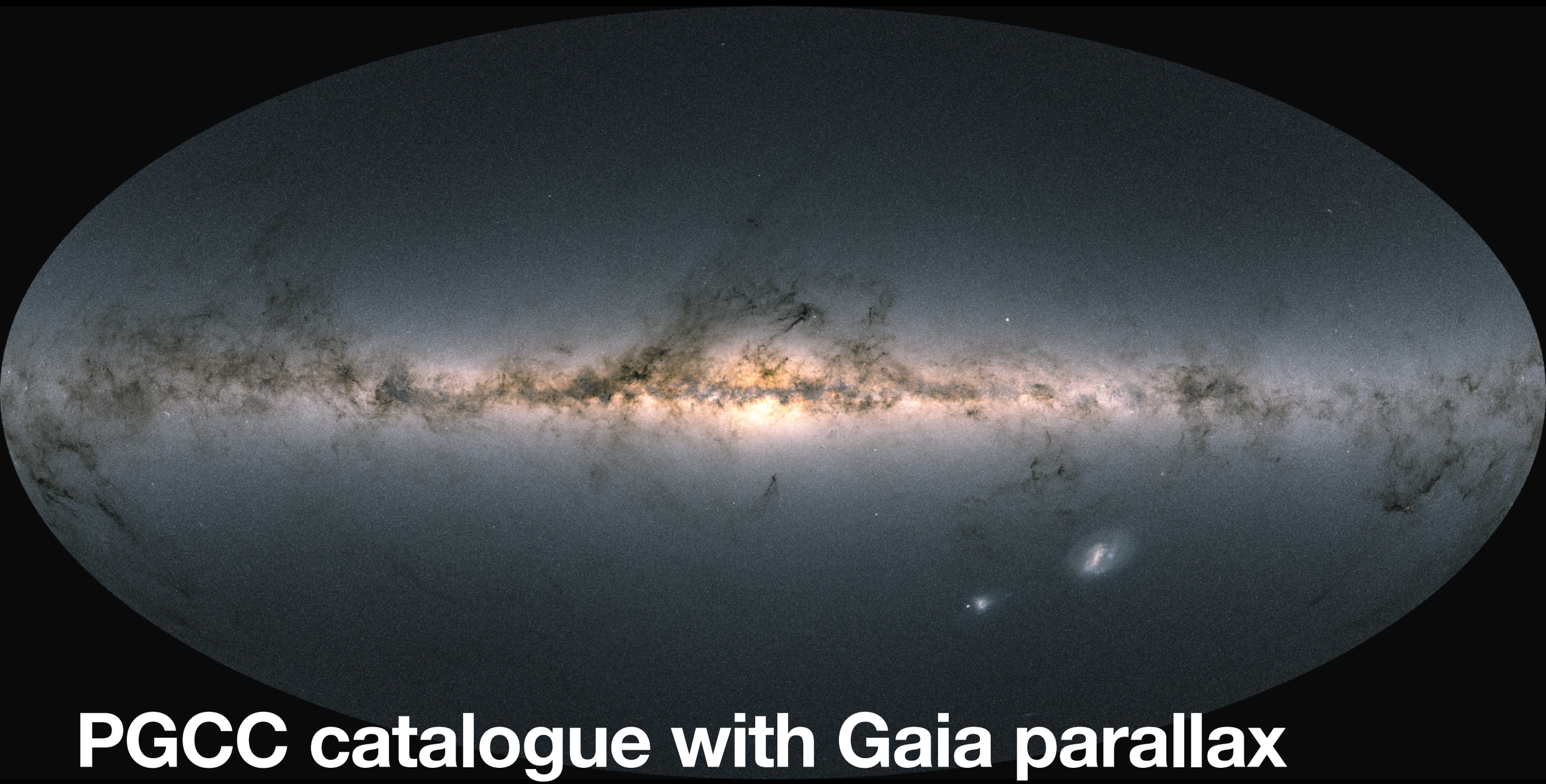
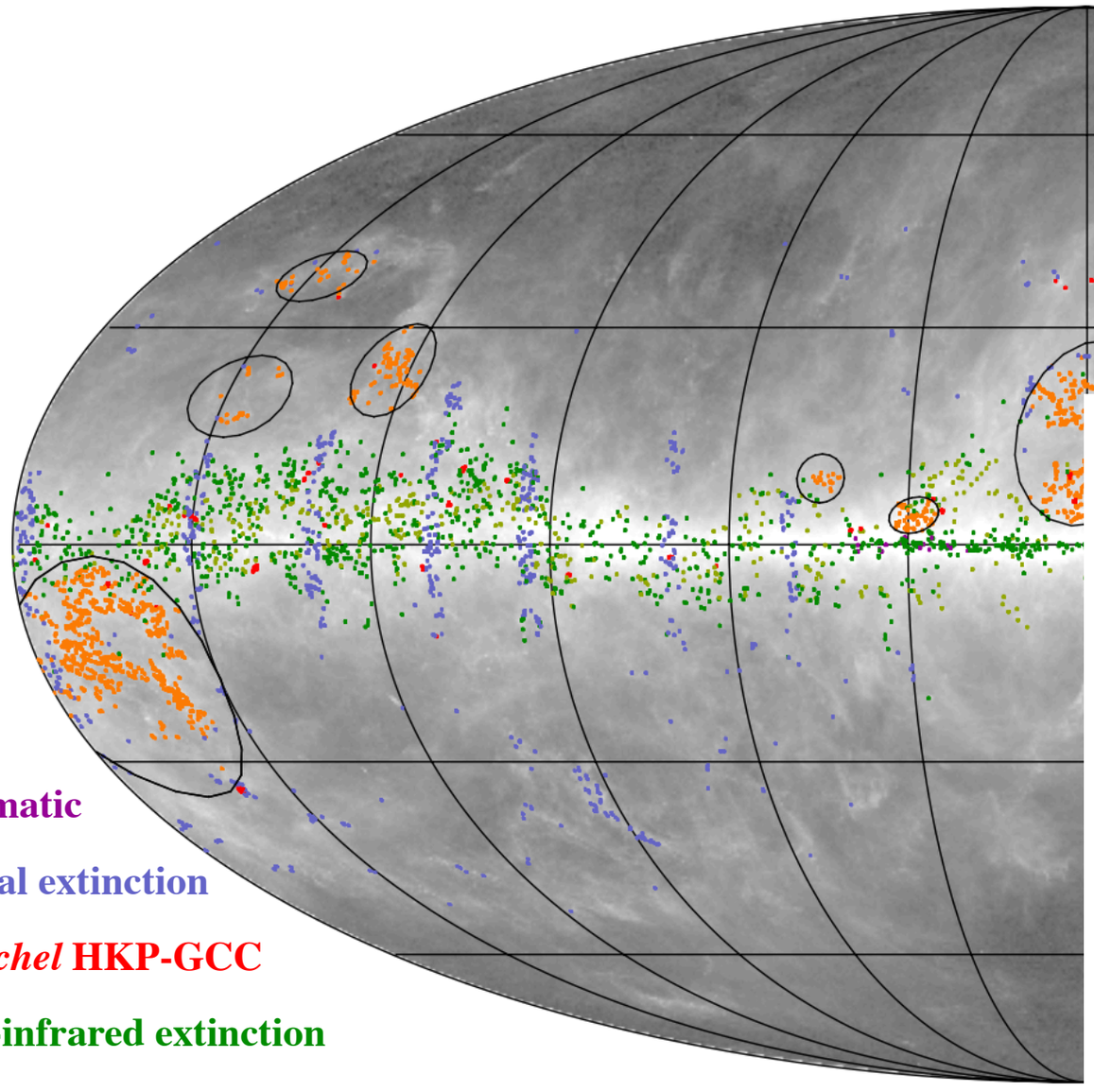


PGCC catalogue with Gaia parallax measurements

Doug Marshall

GCC meeting - Barcelona - May 24 2023

PGCC - distances



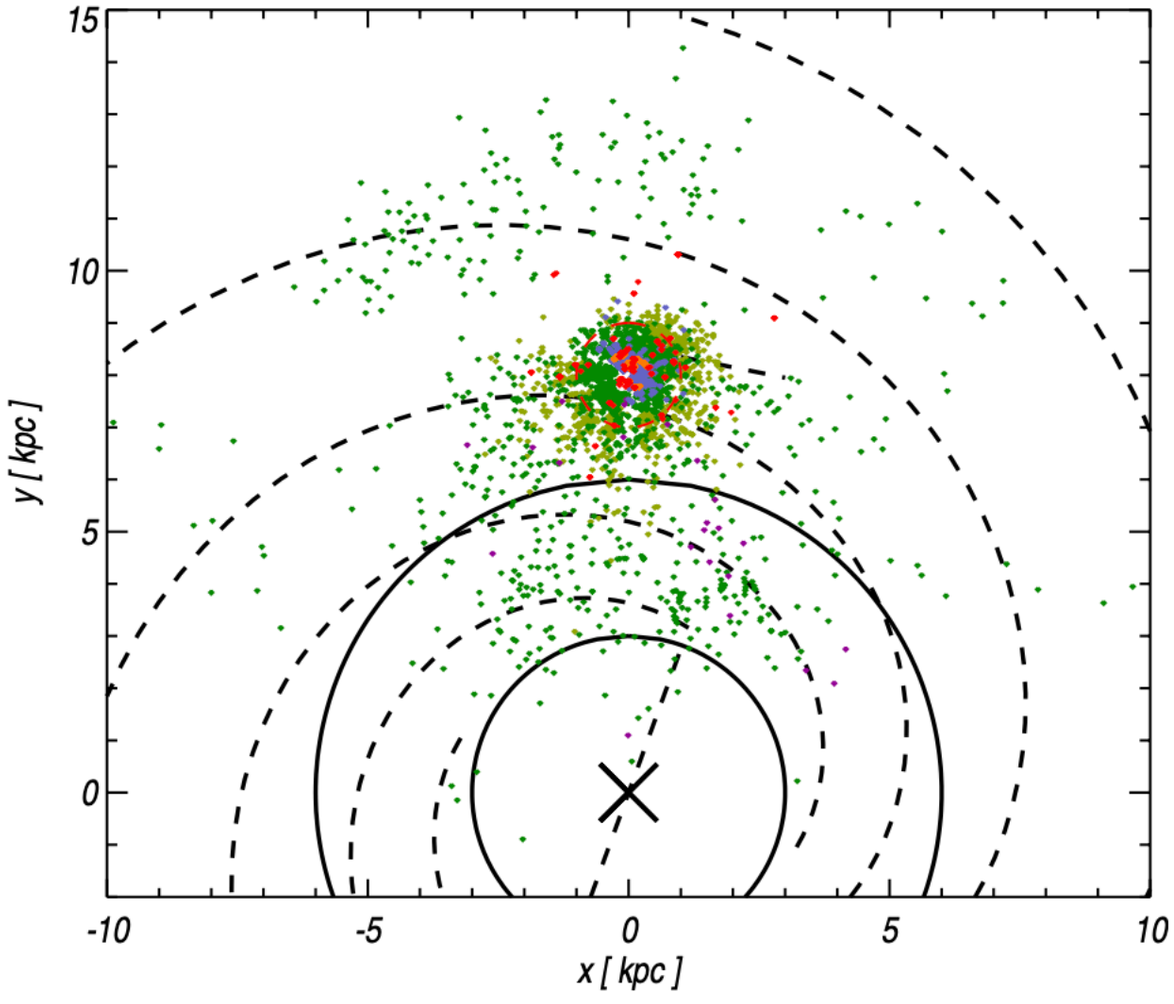
kinematic

optical extinction

***Herschel* HKP-GCC**

near-infrared extinction

molecular complex association



Planck collaboration, Montier et al. (2015)

WHAT IS GAIA?

European mission

Structure

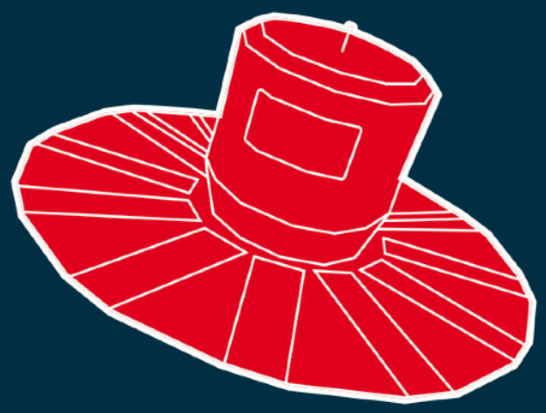
Origin

Evolution

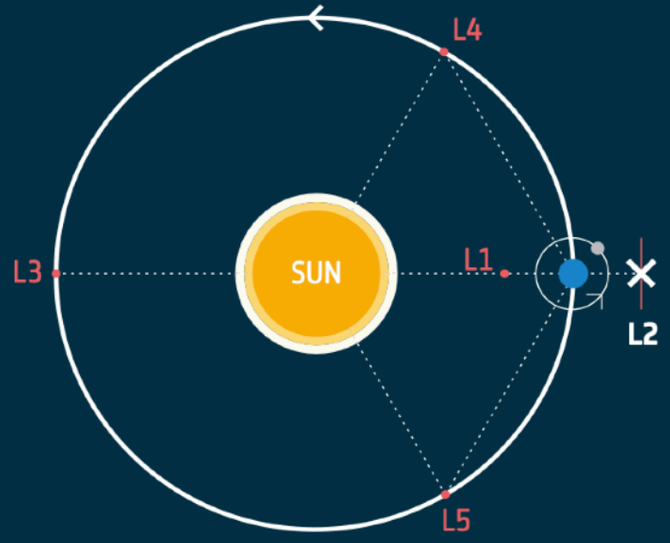
Most accurate
3D map of our galaxy

Position,
velocity,
brightness,
temperature,
composition,
type

Almost
2 billion objects



2 optical telescopes
3 instruments
1 billion pixel camera



In orbit around
Lagrange point 2

Inside our galaxy:

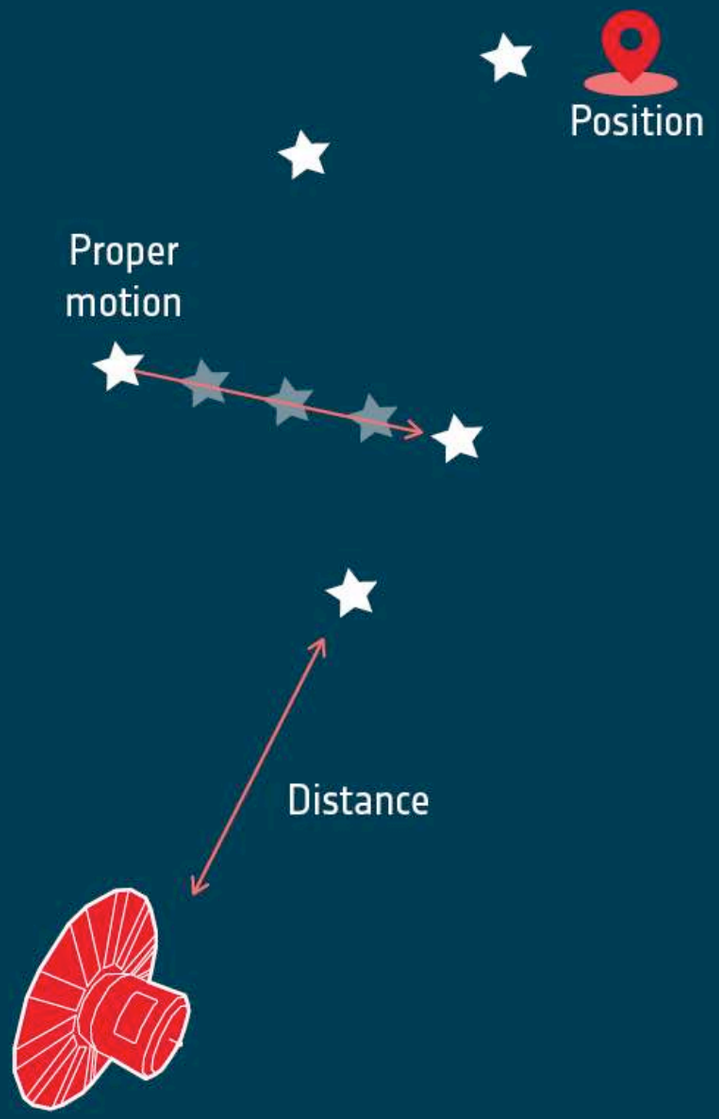
Stars, binary stars, exoplanets,
interstellar medium, Solar System objects

Outside our galaxy:

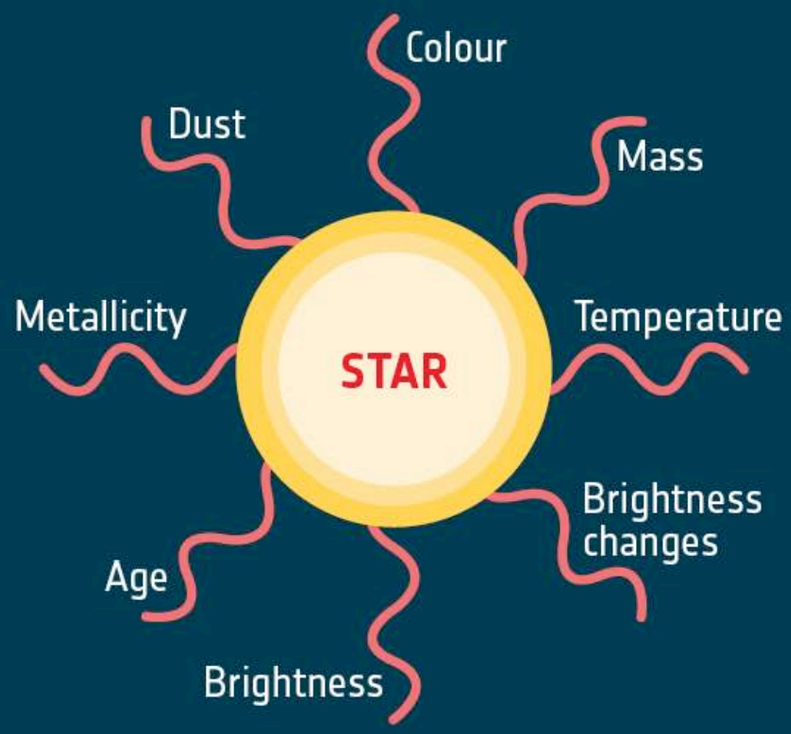
Quasars and other galaxies

GAIA'S OBSERVING TECHNIQUES

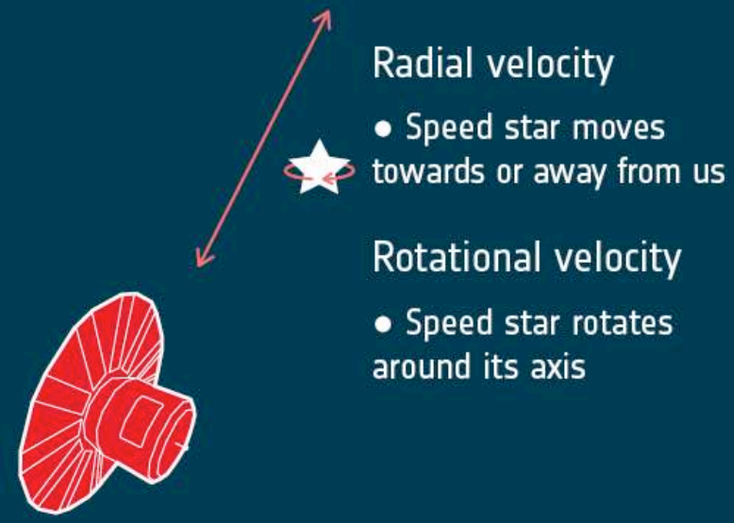
Techniques to study the stars in our cosmic neighbourhood.



ASTROMETRY



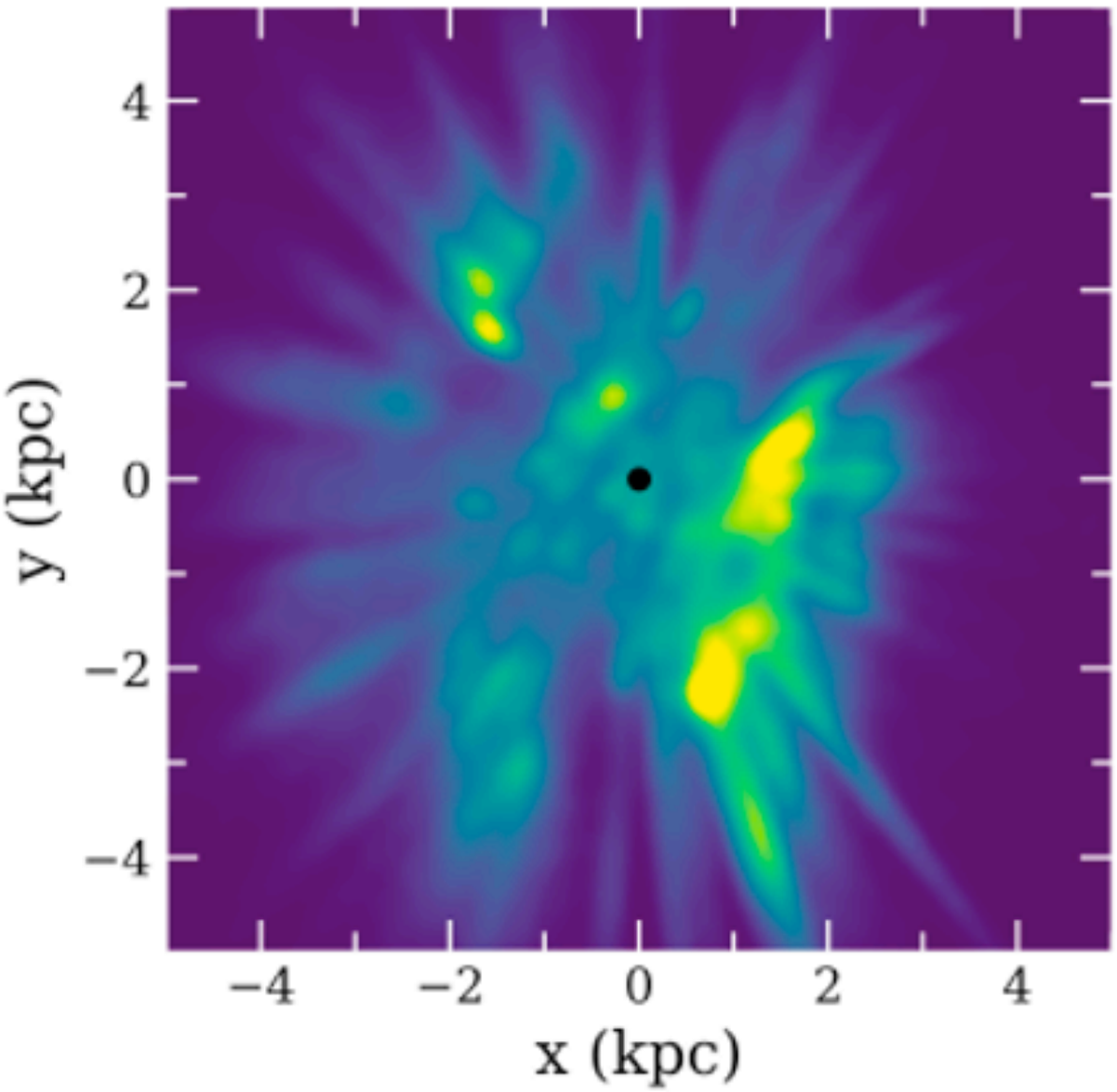
PHOTOMETRY



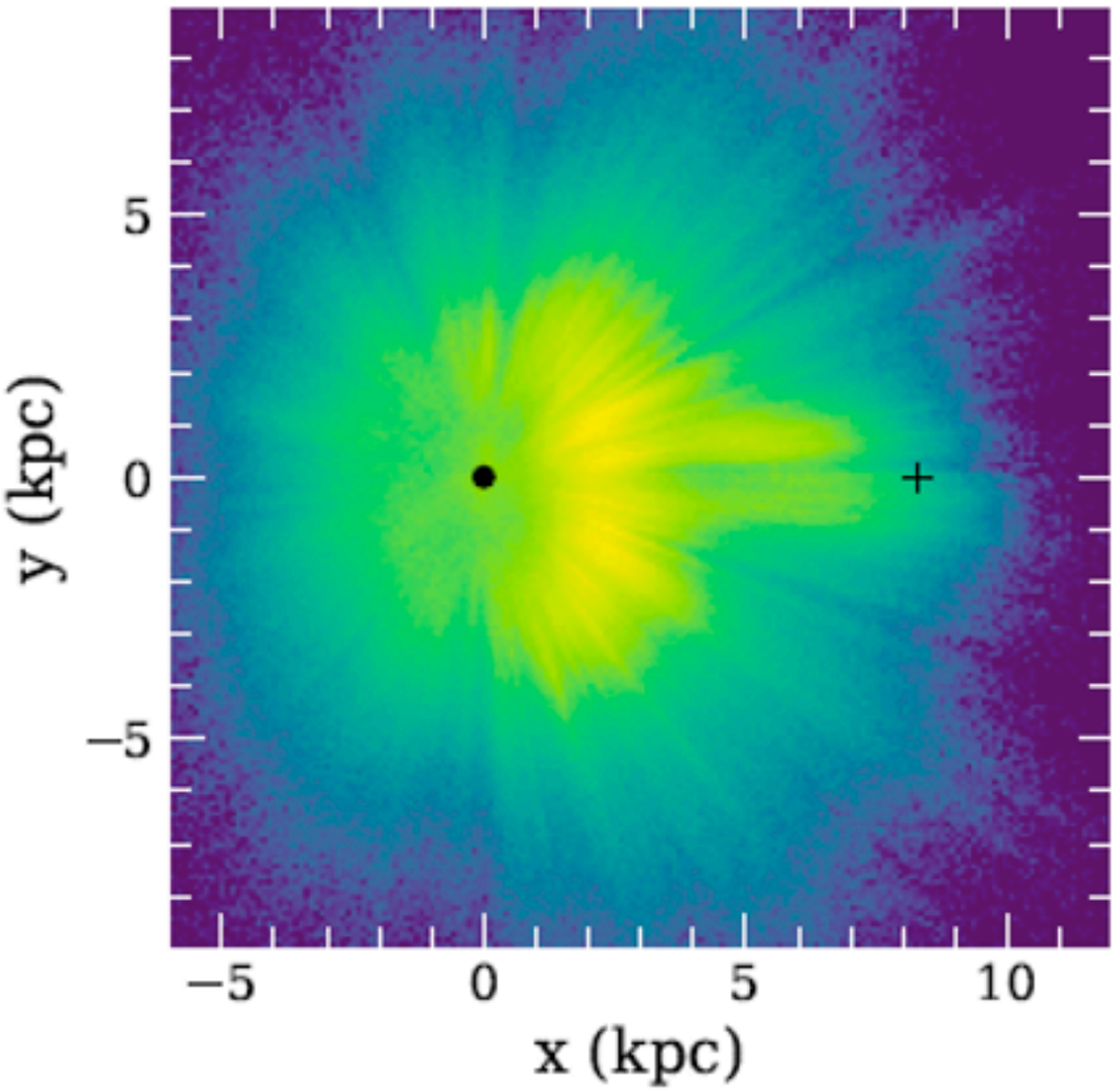
SPECTROSCOPY

Galactic structure

OB stars

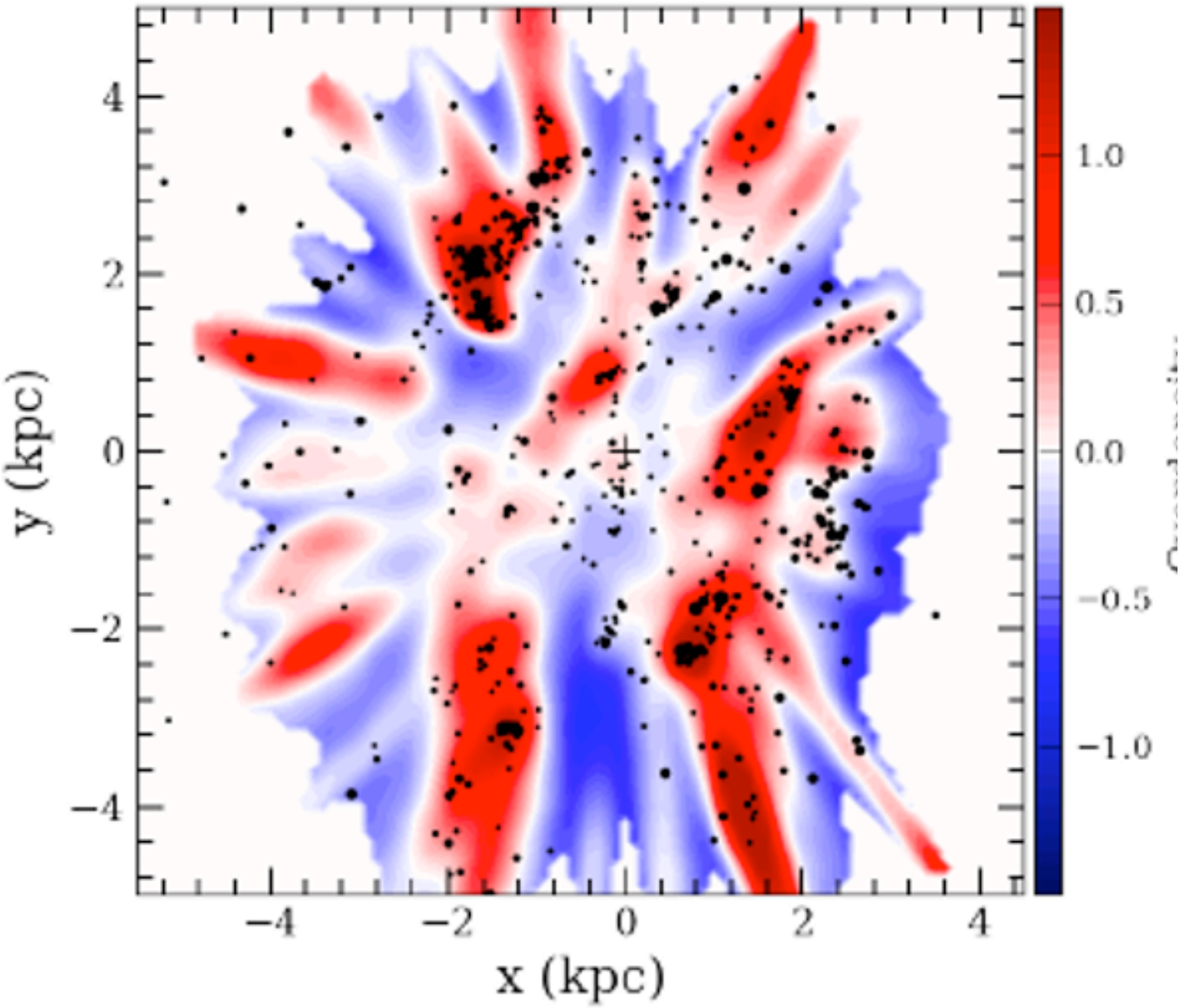


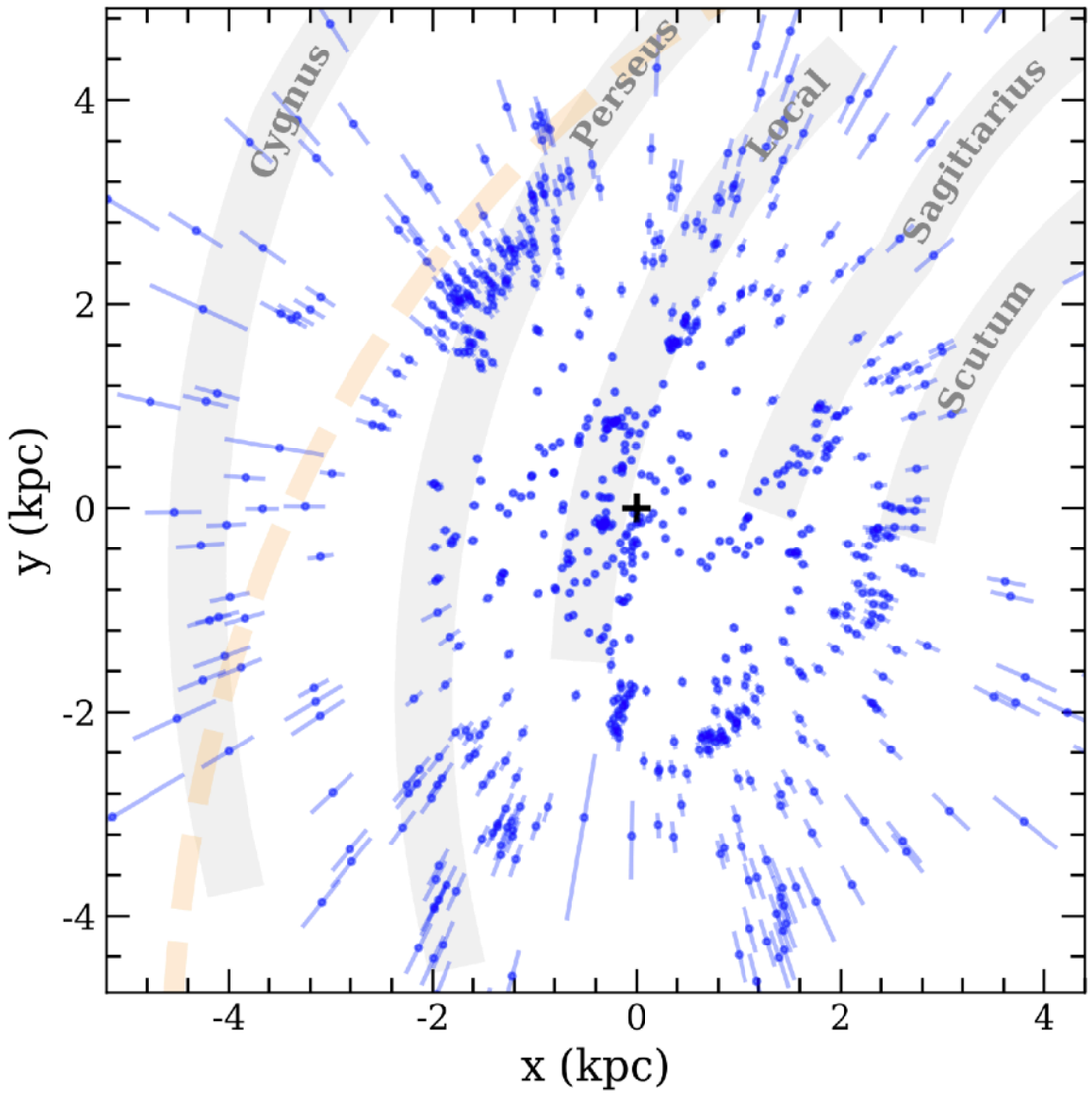
RGB stars



Gaia collaboration, Drimmel et al. (2022)

Galactic structure

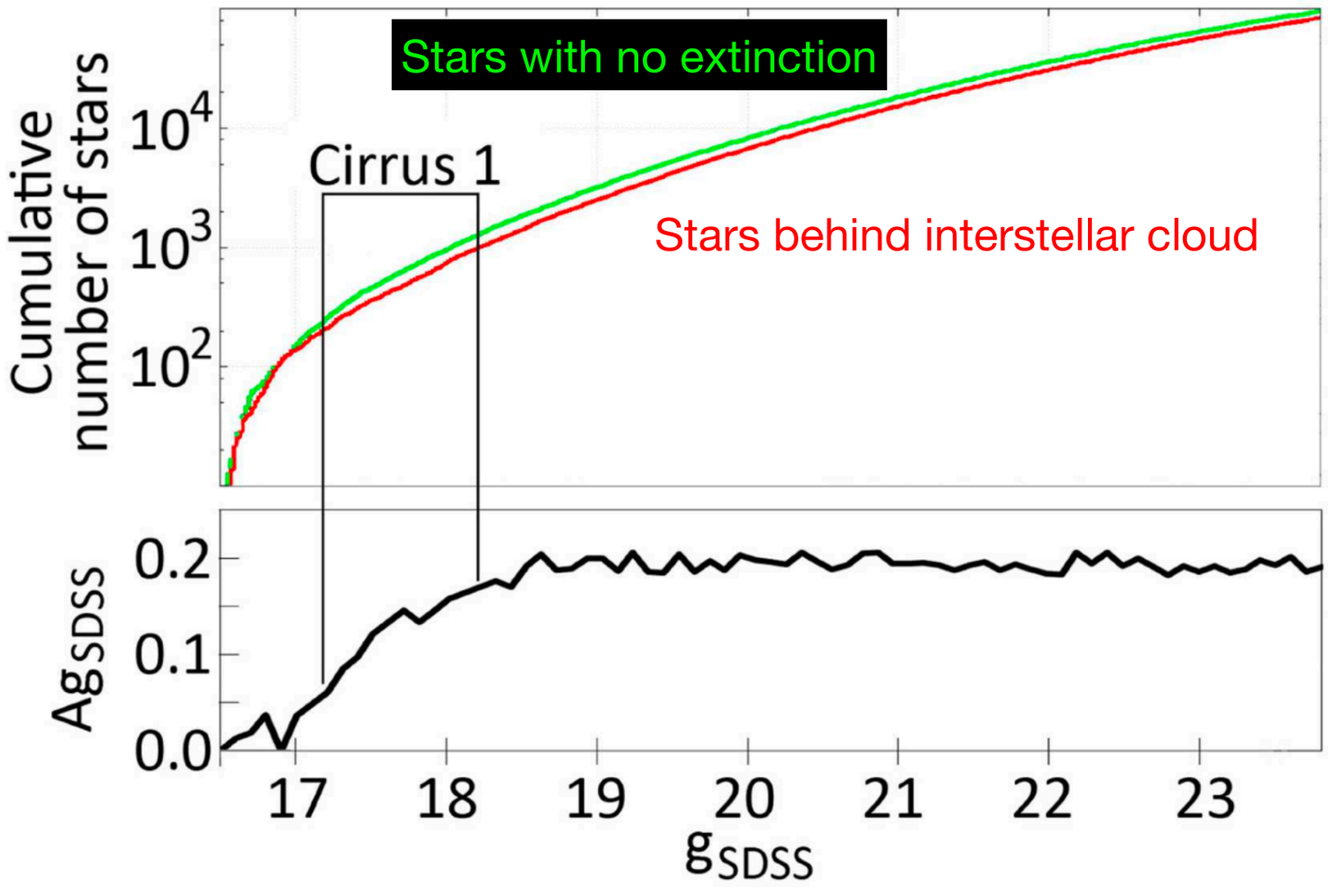




Gaia collaboration, Drimmel et al. (2022)

Wolf diagrams

Introduced by Wolf (1930)

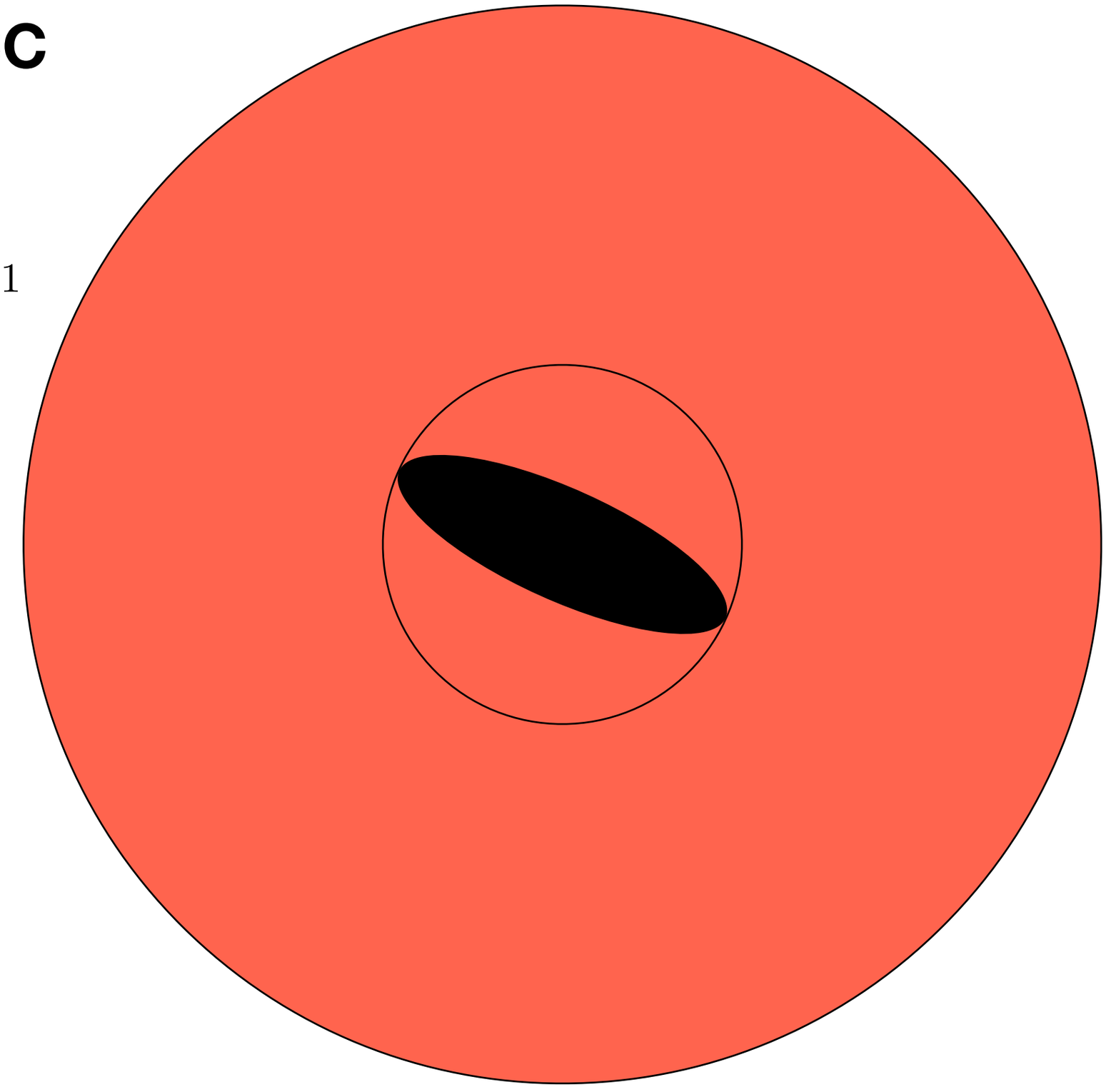


Example by Gontcharov et al. (2023)

Gaia parallax

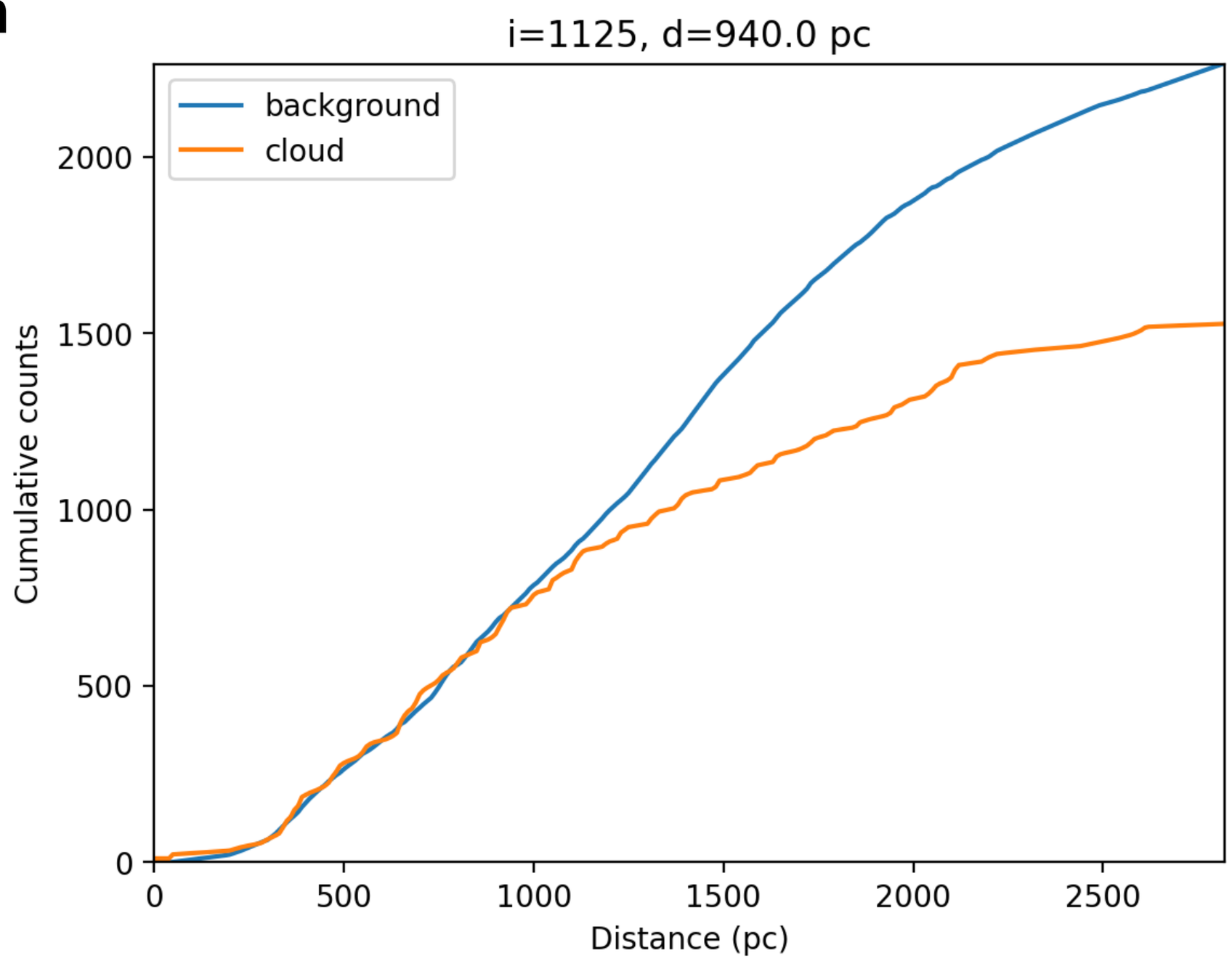
Distance to PGCC clumps

$$x = \frac{\left[\pi(3r)^2 - \pi ab\right]}{\pi ab} = \frac{9r^2}{ab} - 1$$



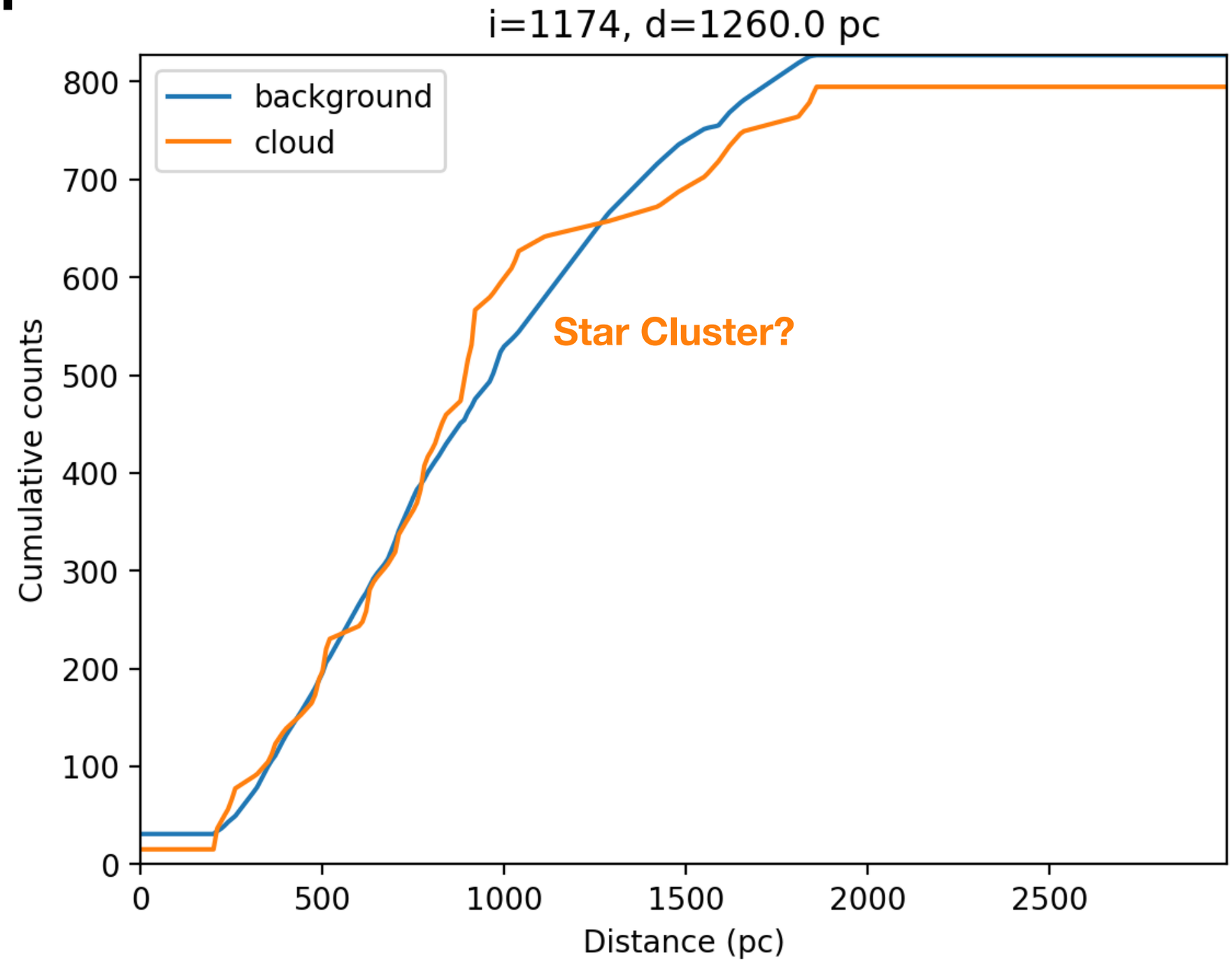
Gaia parallax

Cumulative count distribution



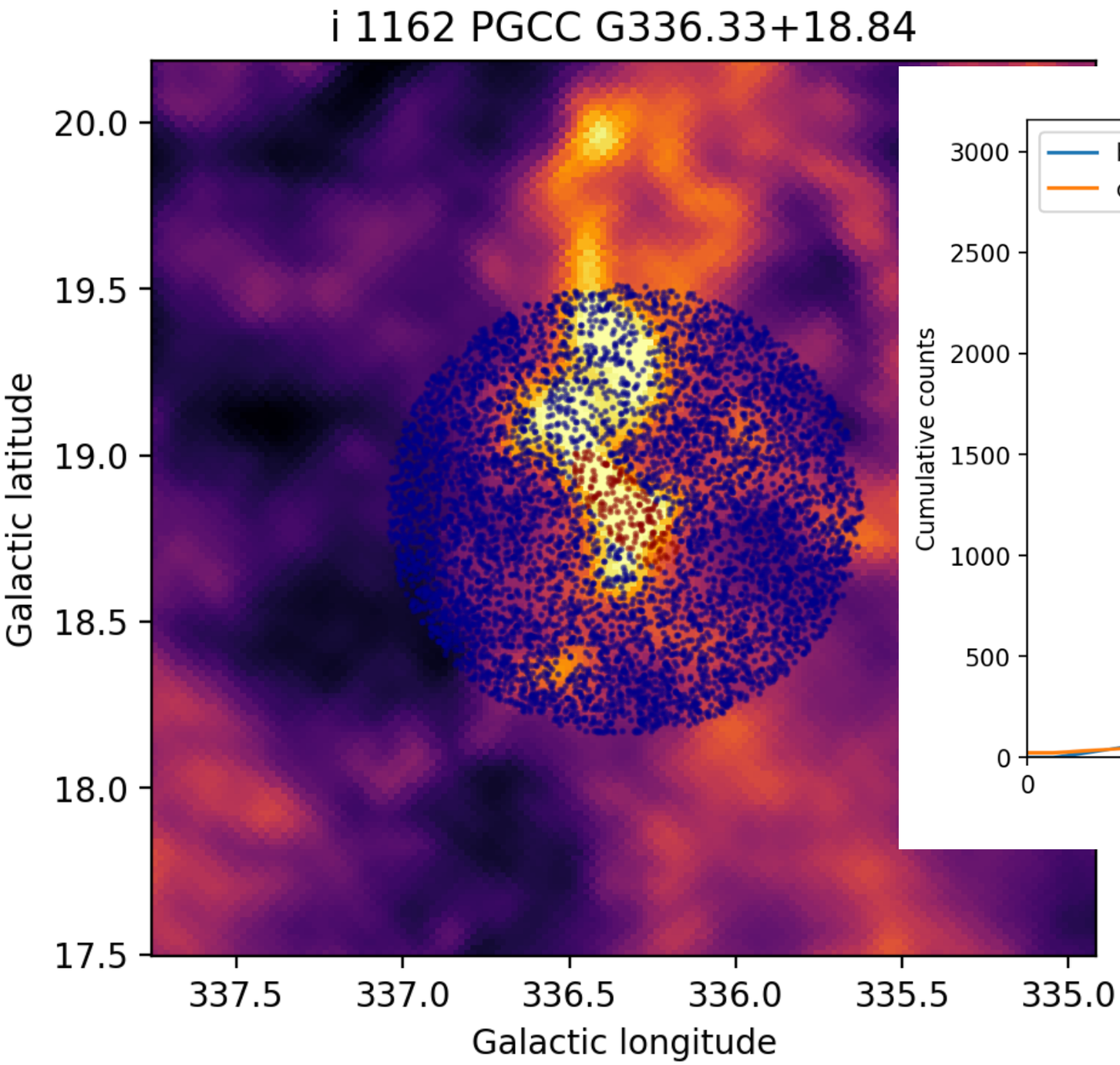
Gaia parallax

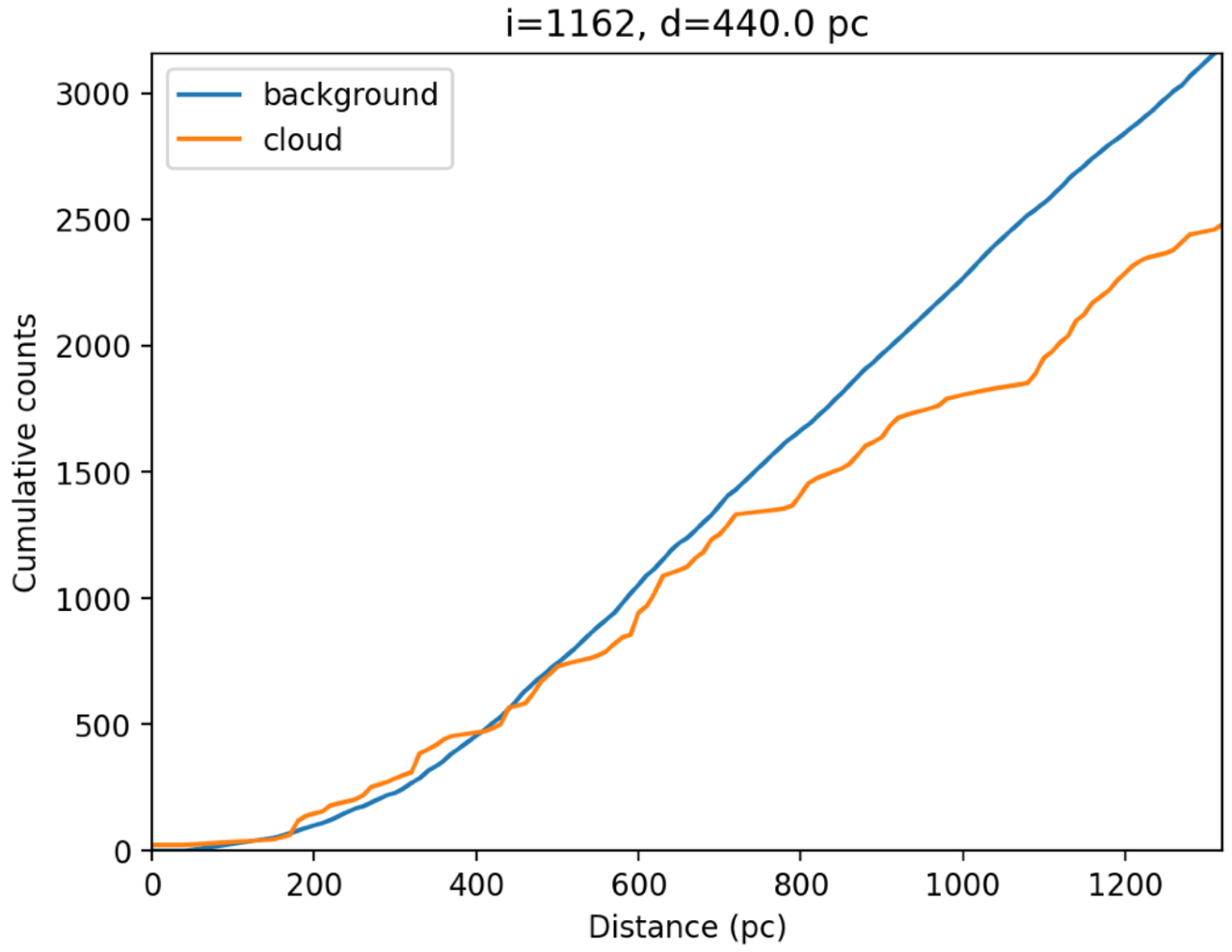
Cumulative count distribution



Gaia parallax

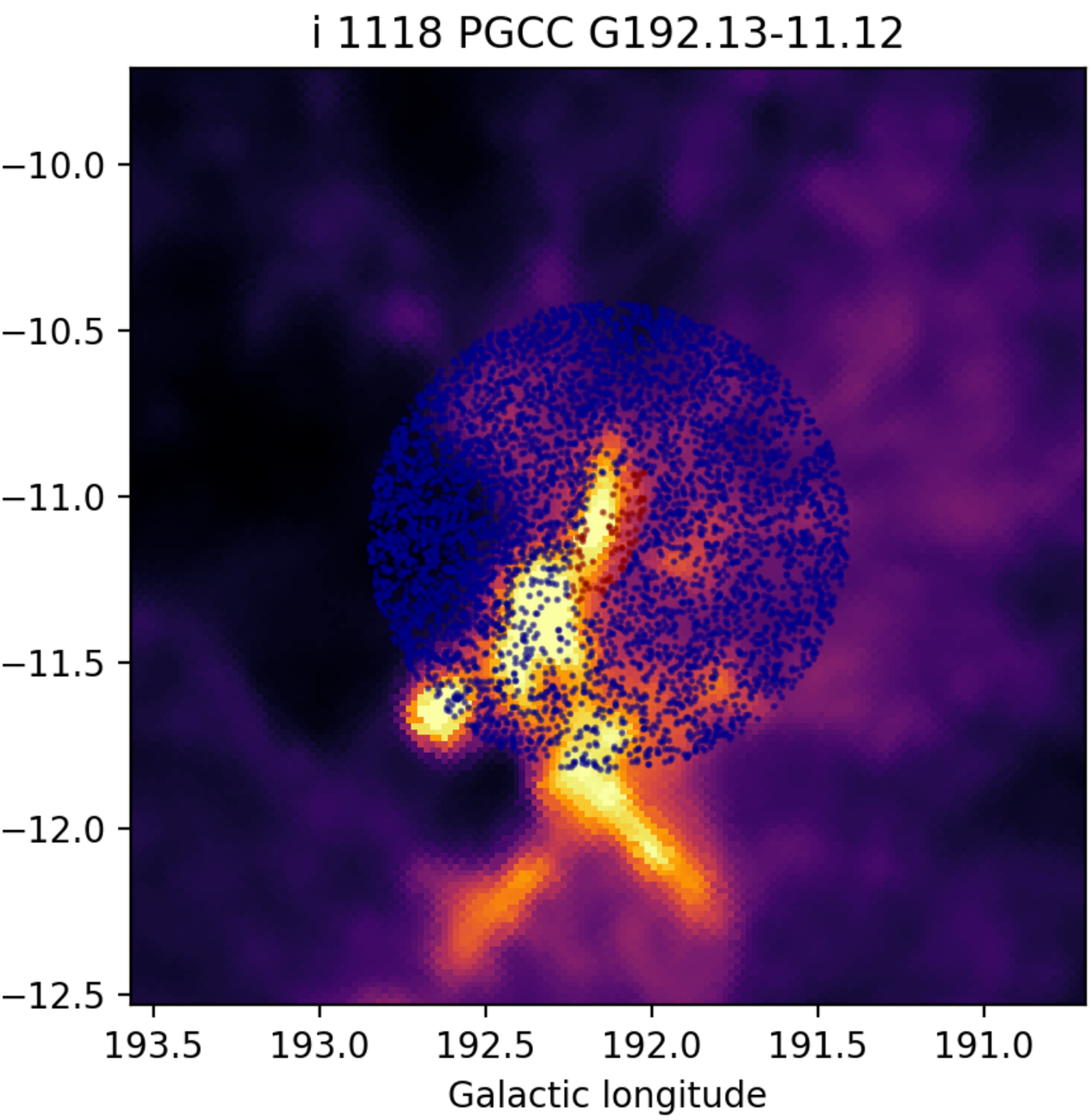
Distance to PGCC clumps

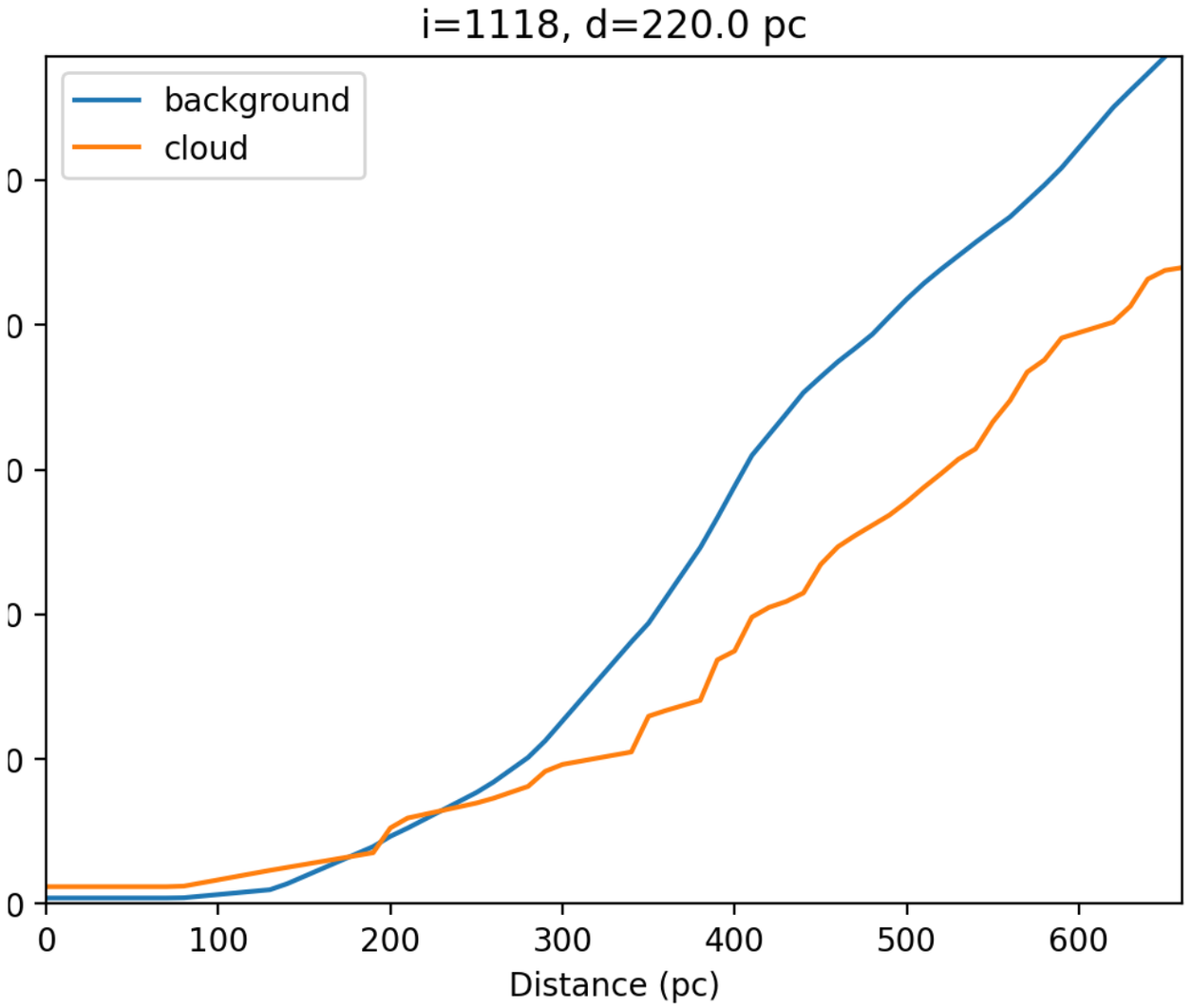




Gaia parallax

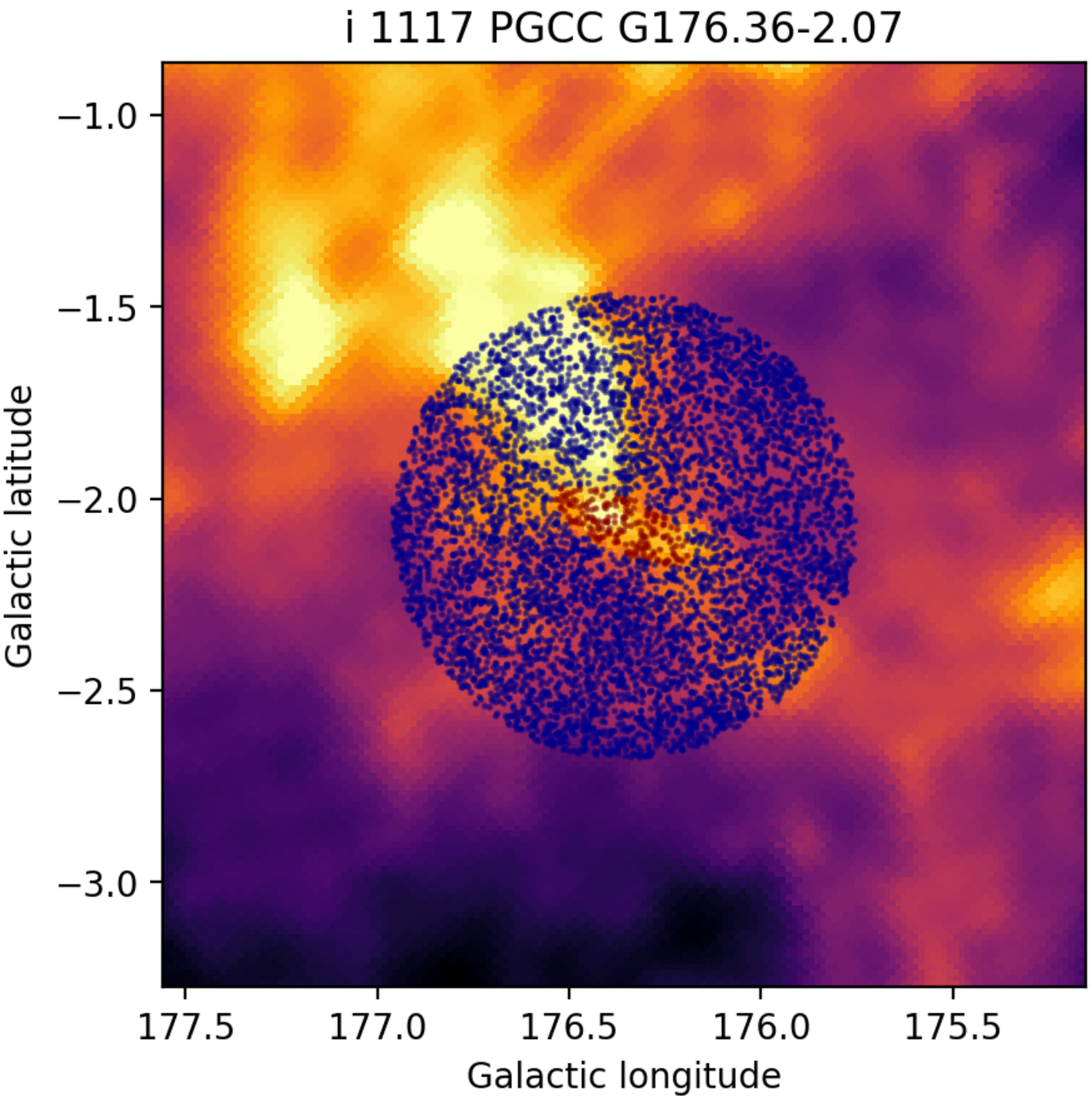
Distance to PGCC clumps

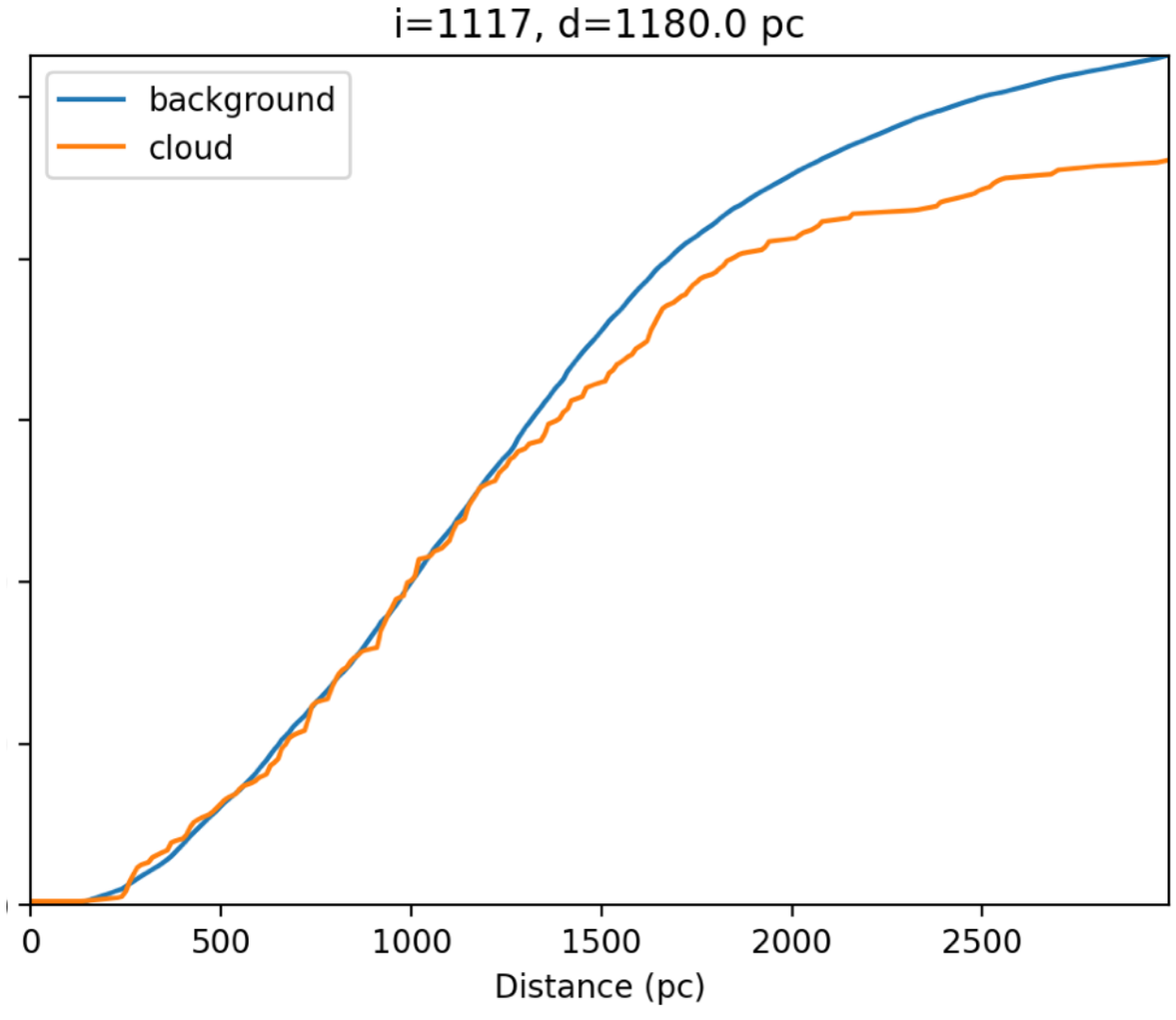


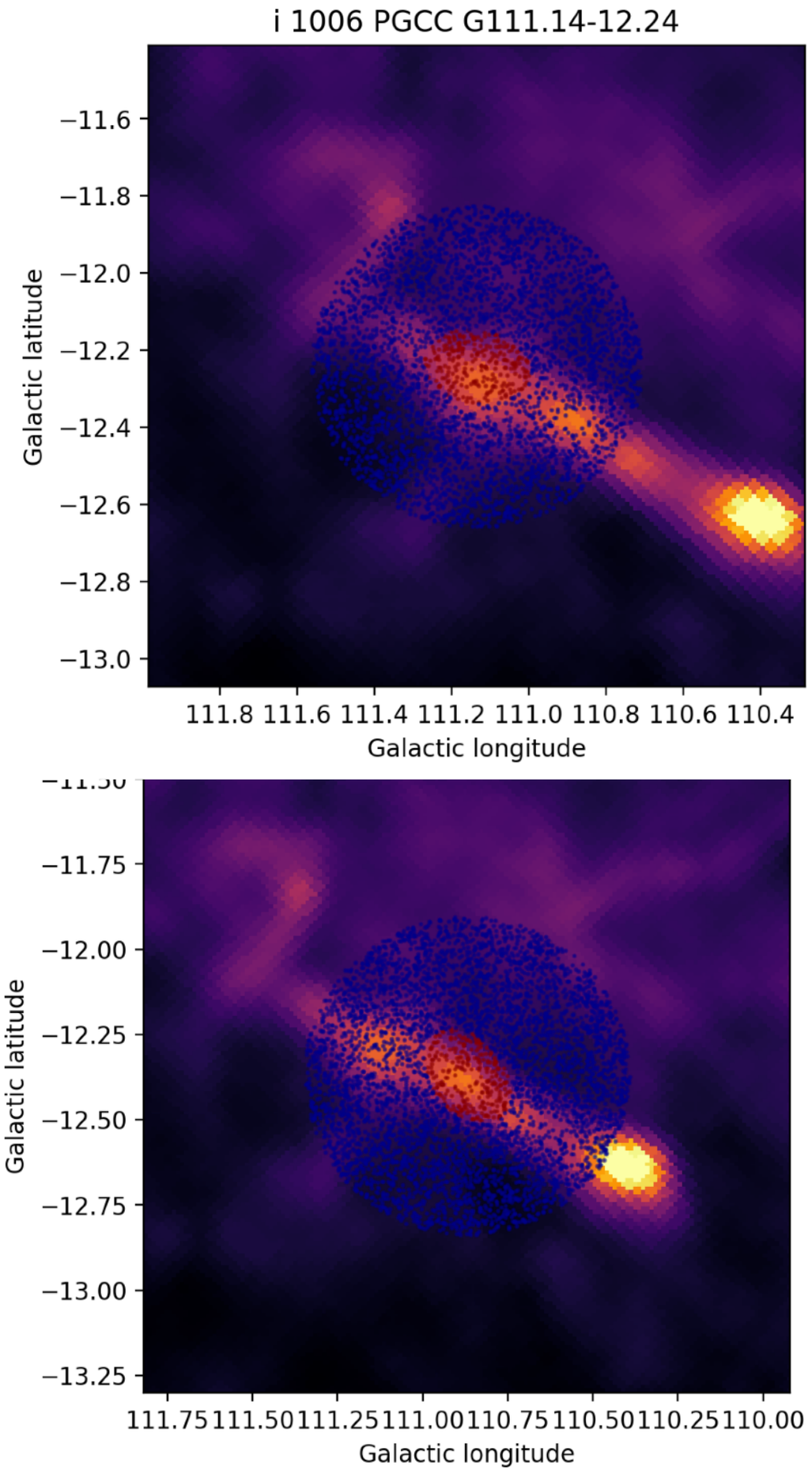


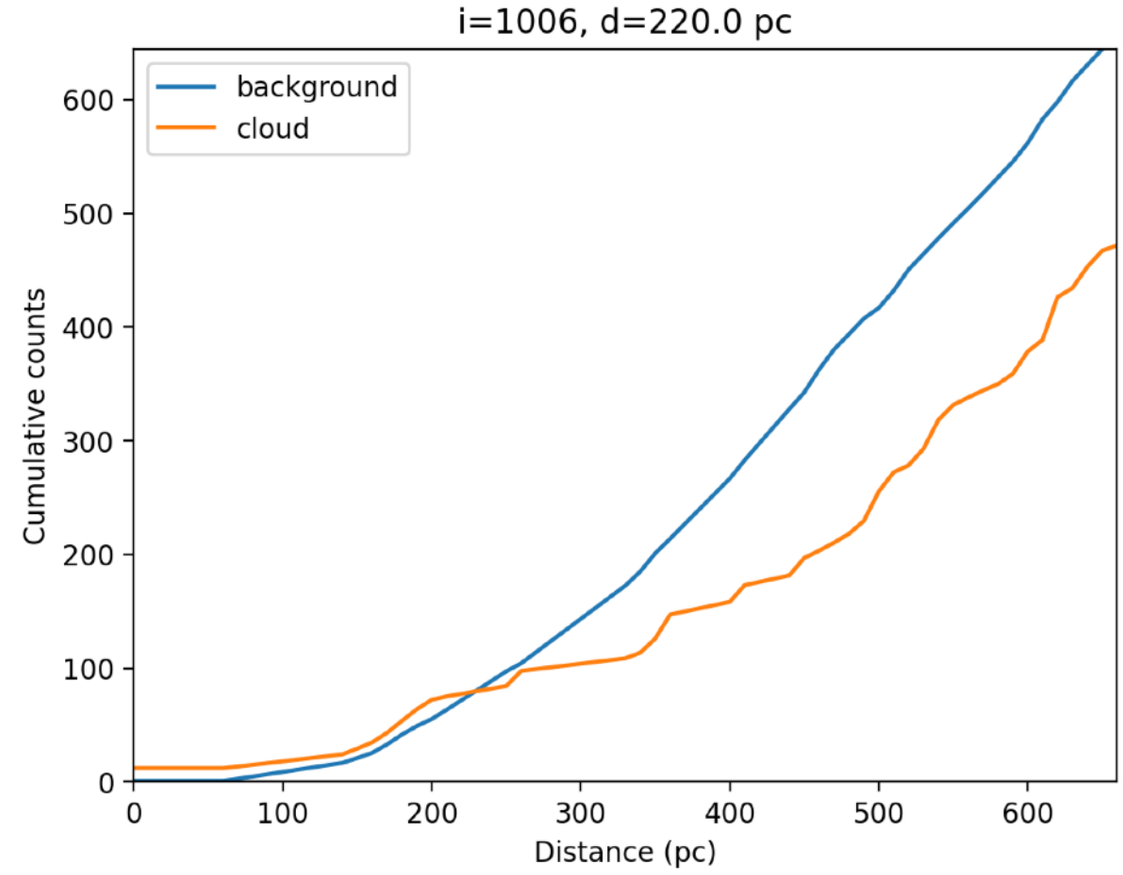
Gaia parallax

Distance to PGCC clumps

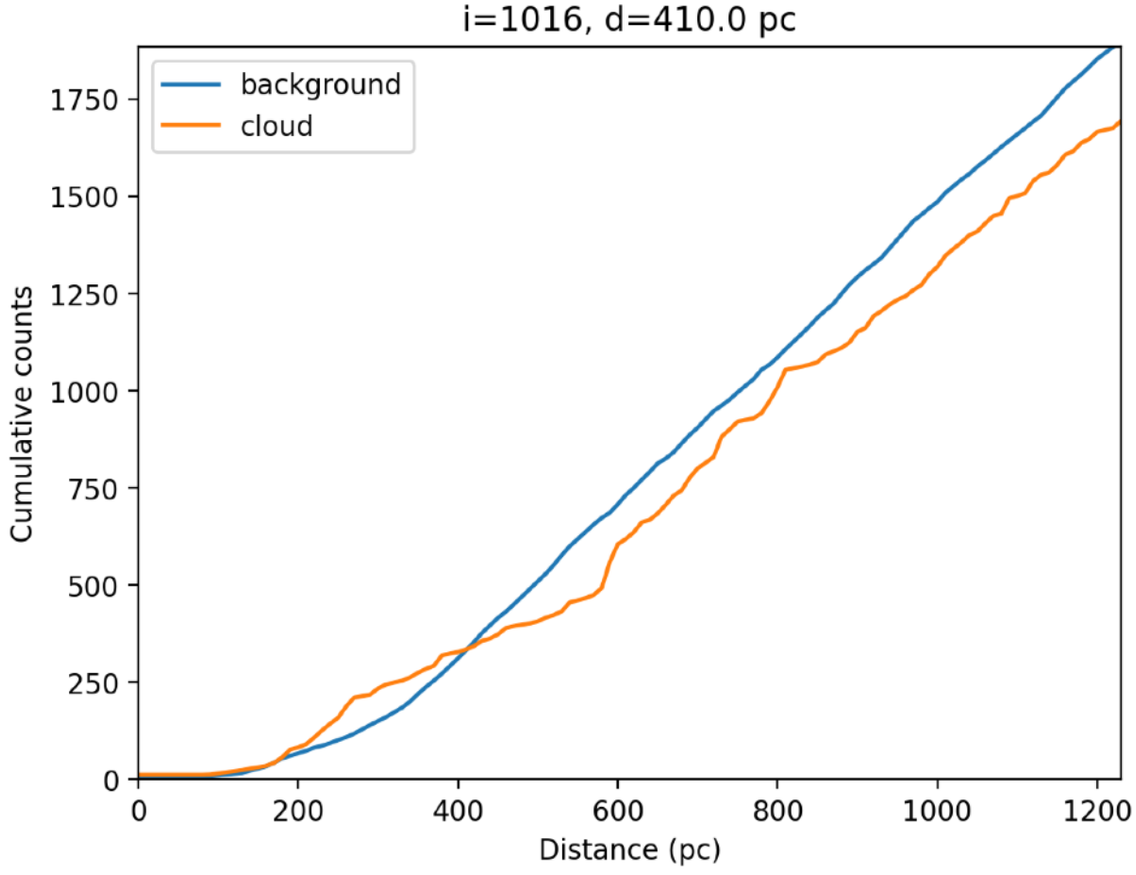





i 1006 PGCC G111.14-12.24
Galactic latitude
−11.6
−11.8
−12.0
−12.2
−12.4
−12.6
−12.8
−13.0
111.8 111.6 111.4 111.2 111.0 110.8 110.6 110.4
Galactic longitude

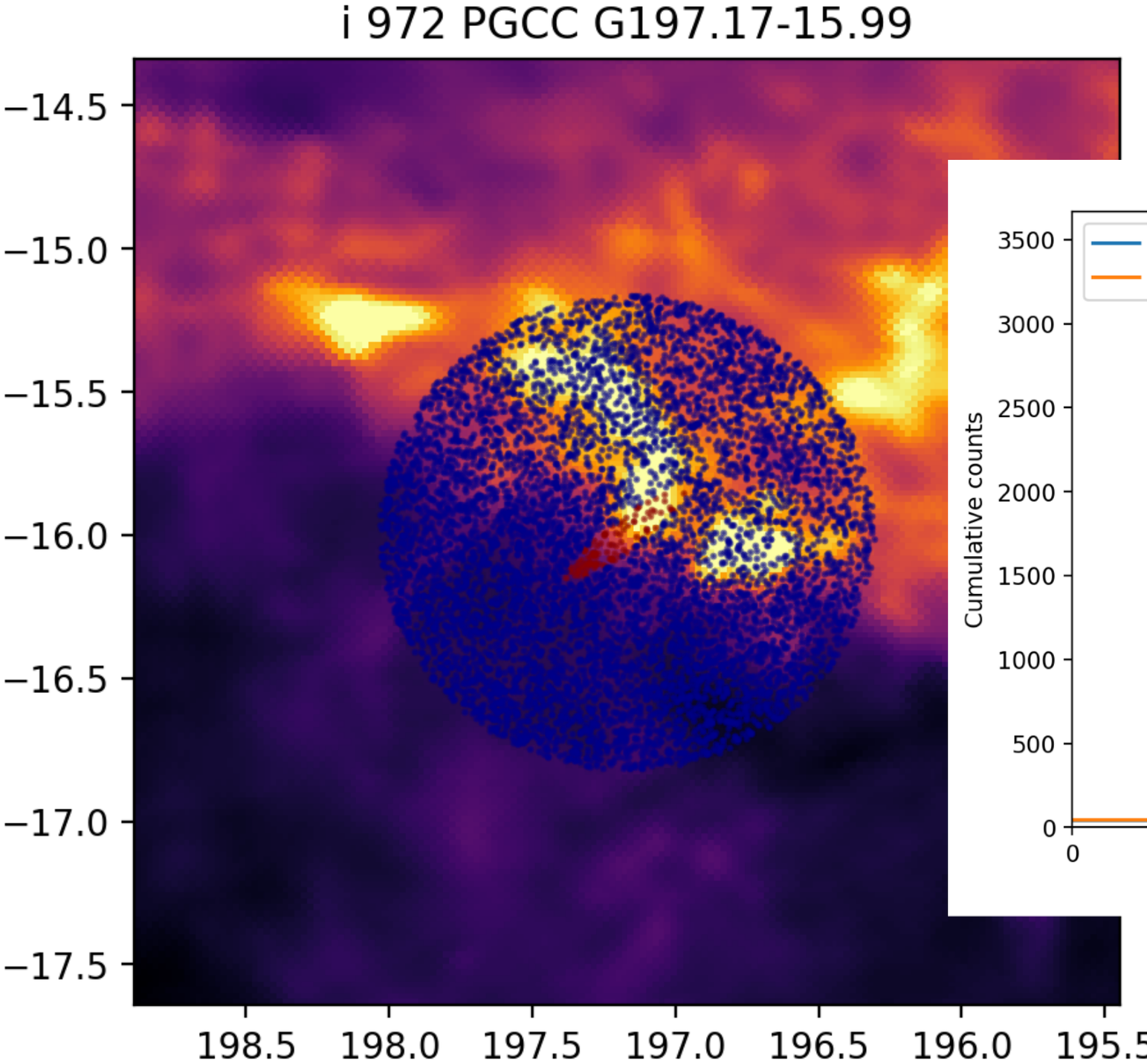

i=1006, d=220.0 pc
background
cloud
Cumulative counts
0
100
200
300
400
500
600
Distance (pc)

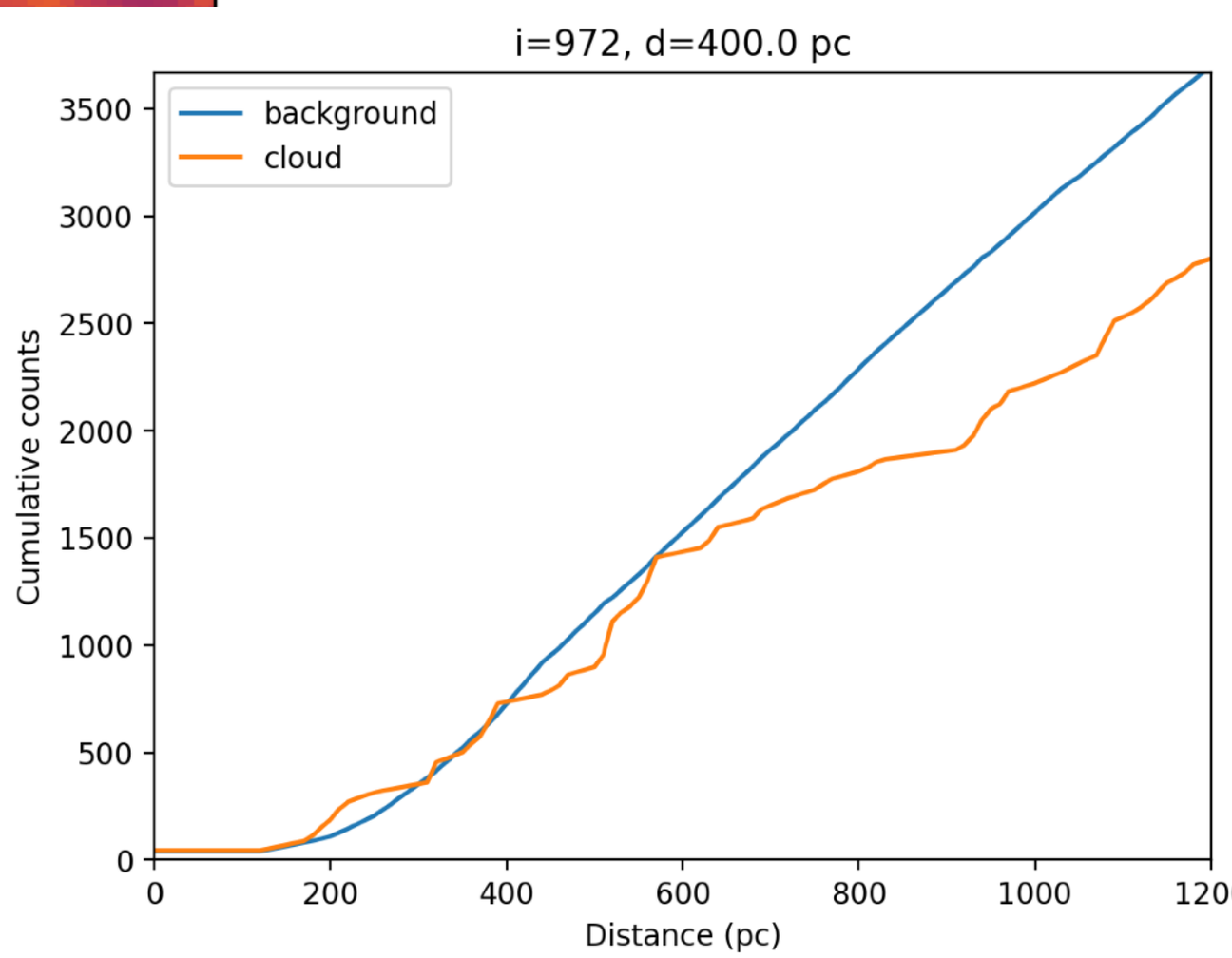
Galactic latitude
−11.75
−12.00
−12.25
−12.50
−12.75
−13.00
−13.25
111.75 111.50 111.25 111.00 110.75 110.50 110.25 110.00
Galactic longitude


i=1016, d=410.0 pc
background
cloud
Cumulative counts
0
250
500
750
1000
1250
1500
1750
0
200
400
600
800
1000
1200
Distance (pc)

Gaia parallax

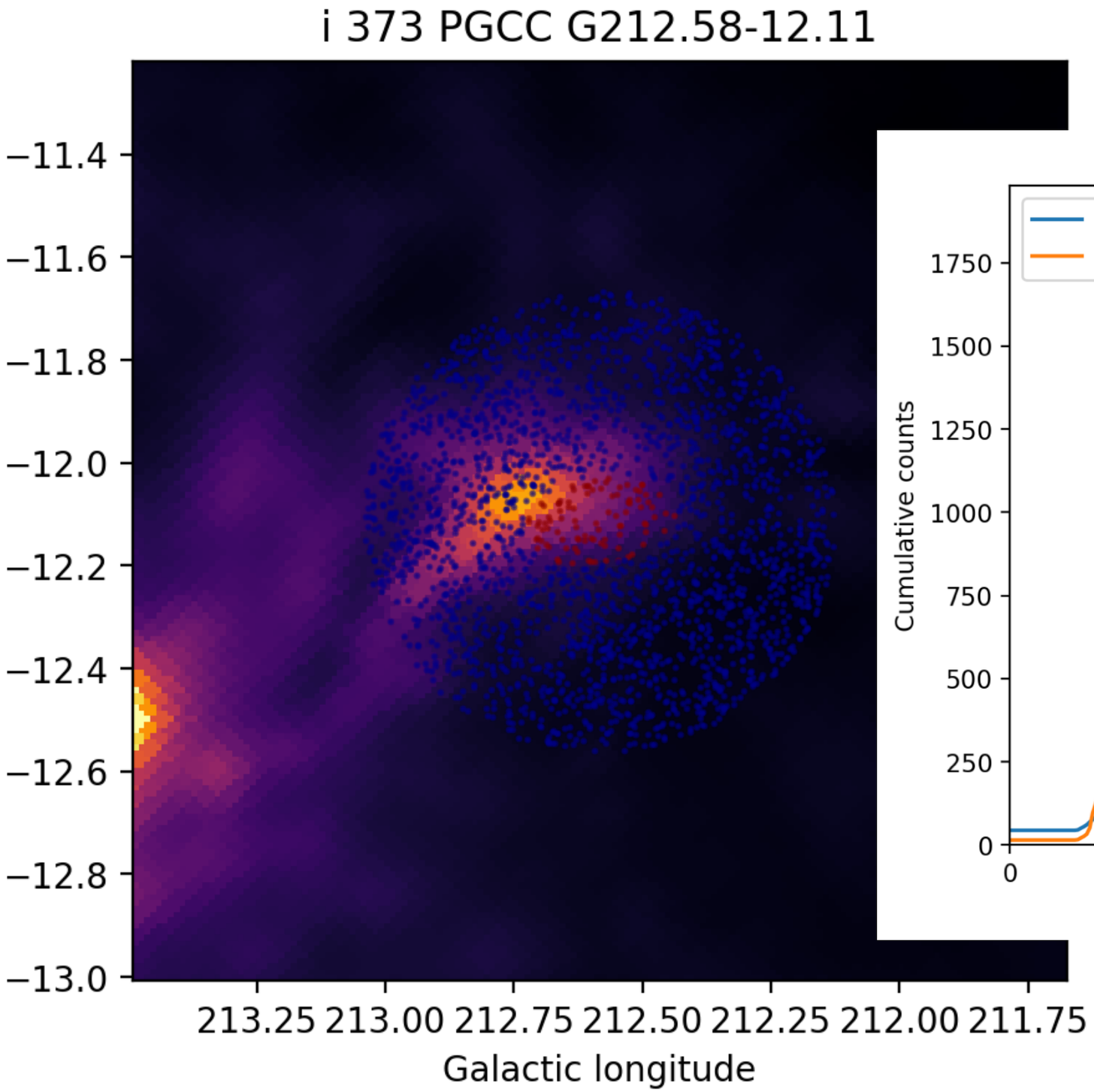
Distance to PGCC clumps

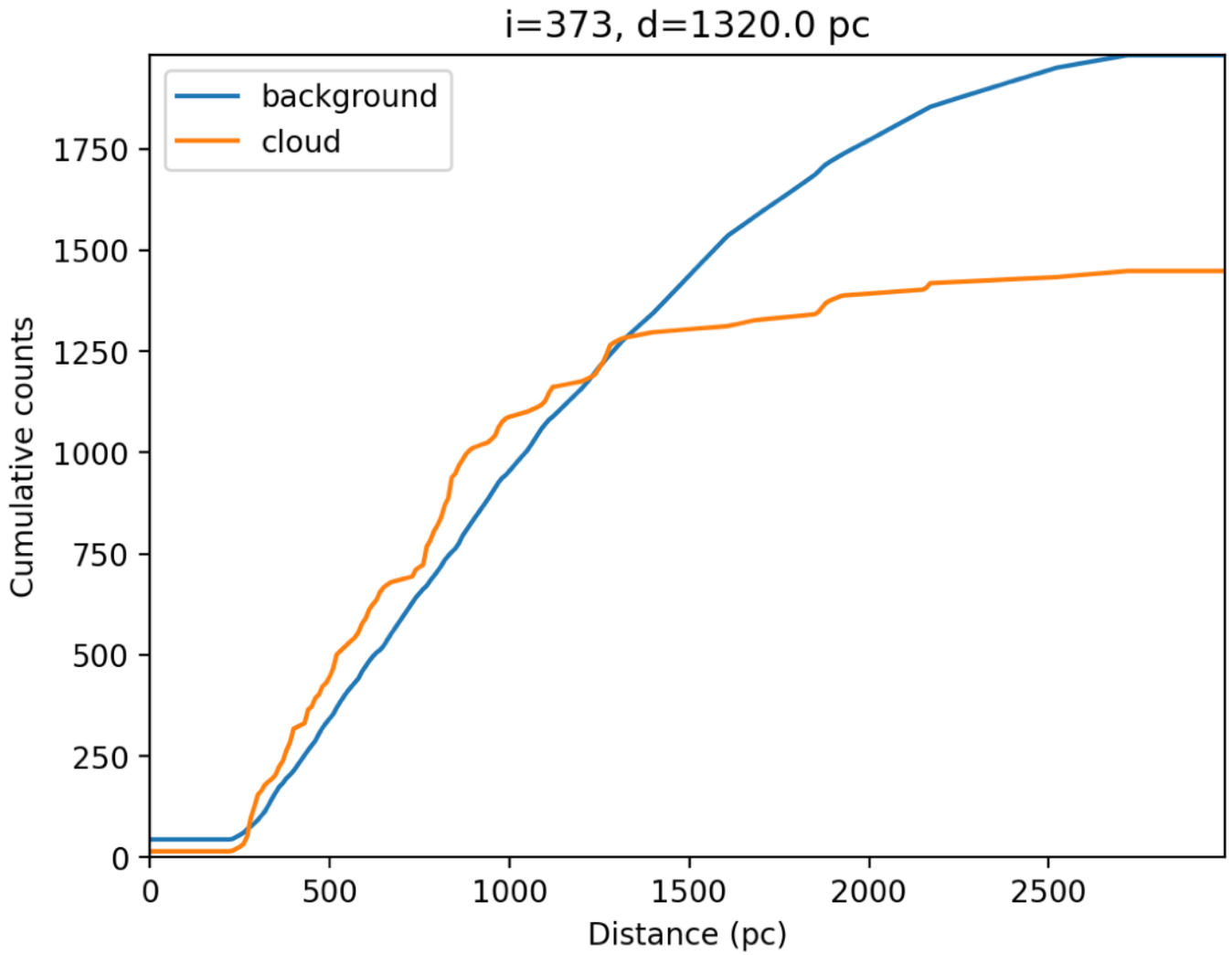




Gaia parallax

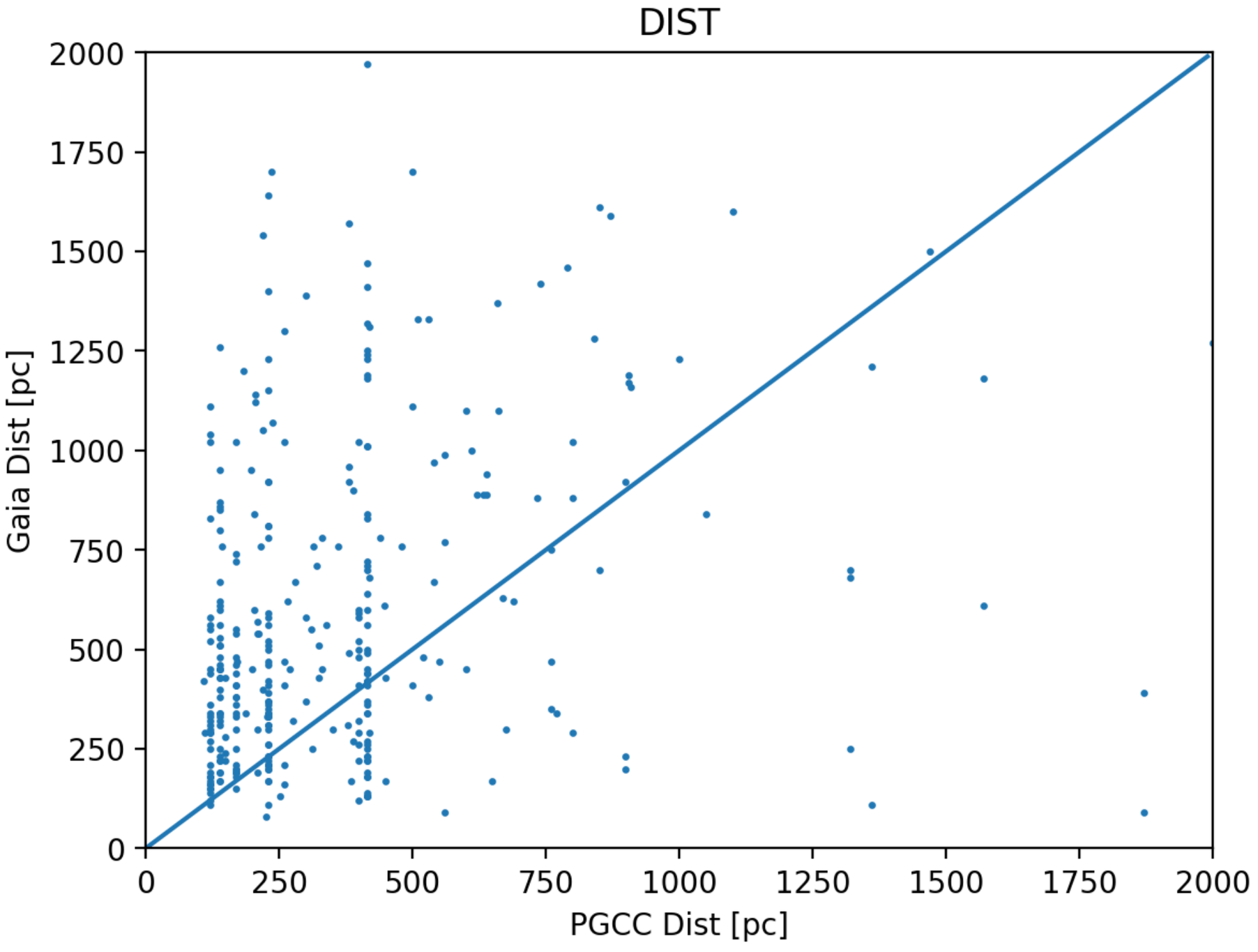
Distance to PGCC

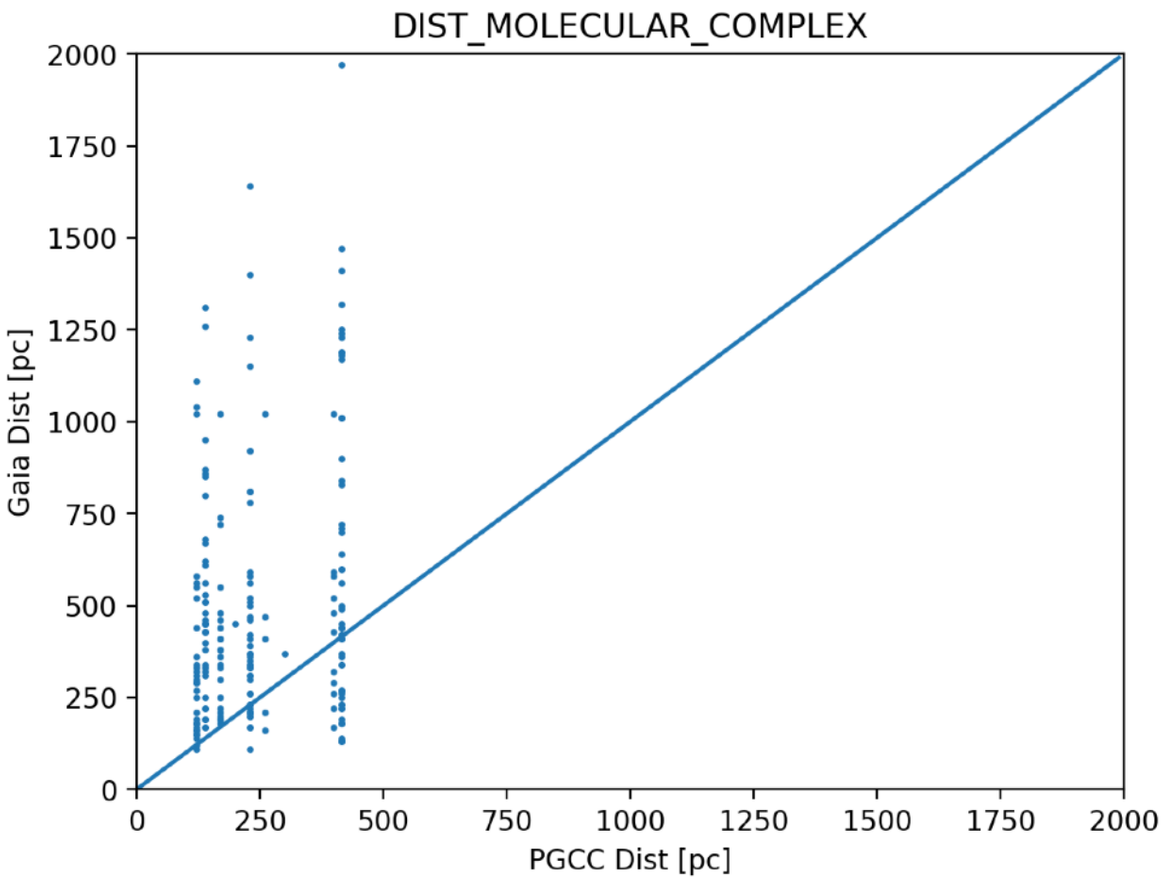


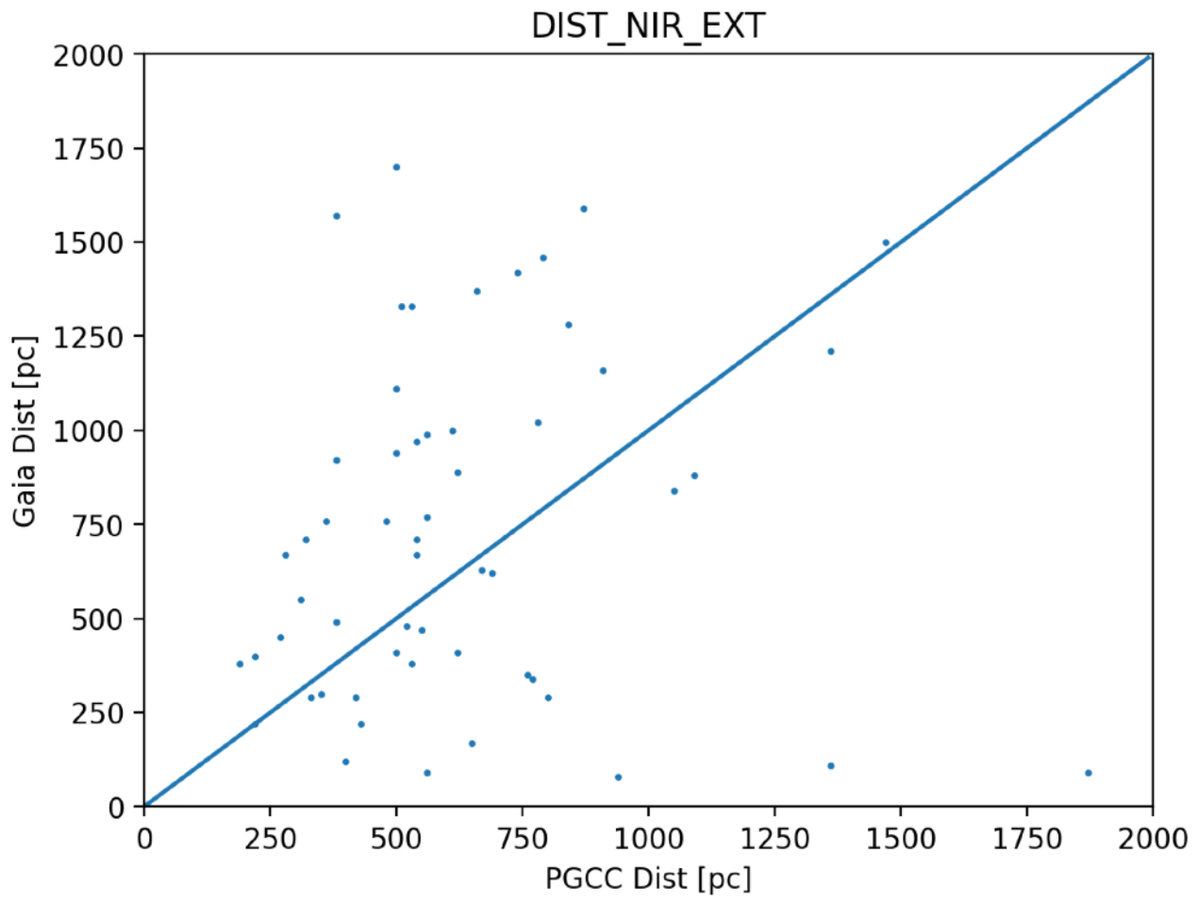


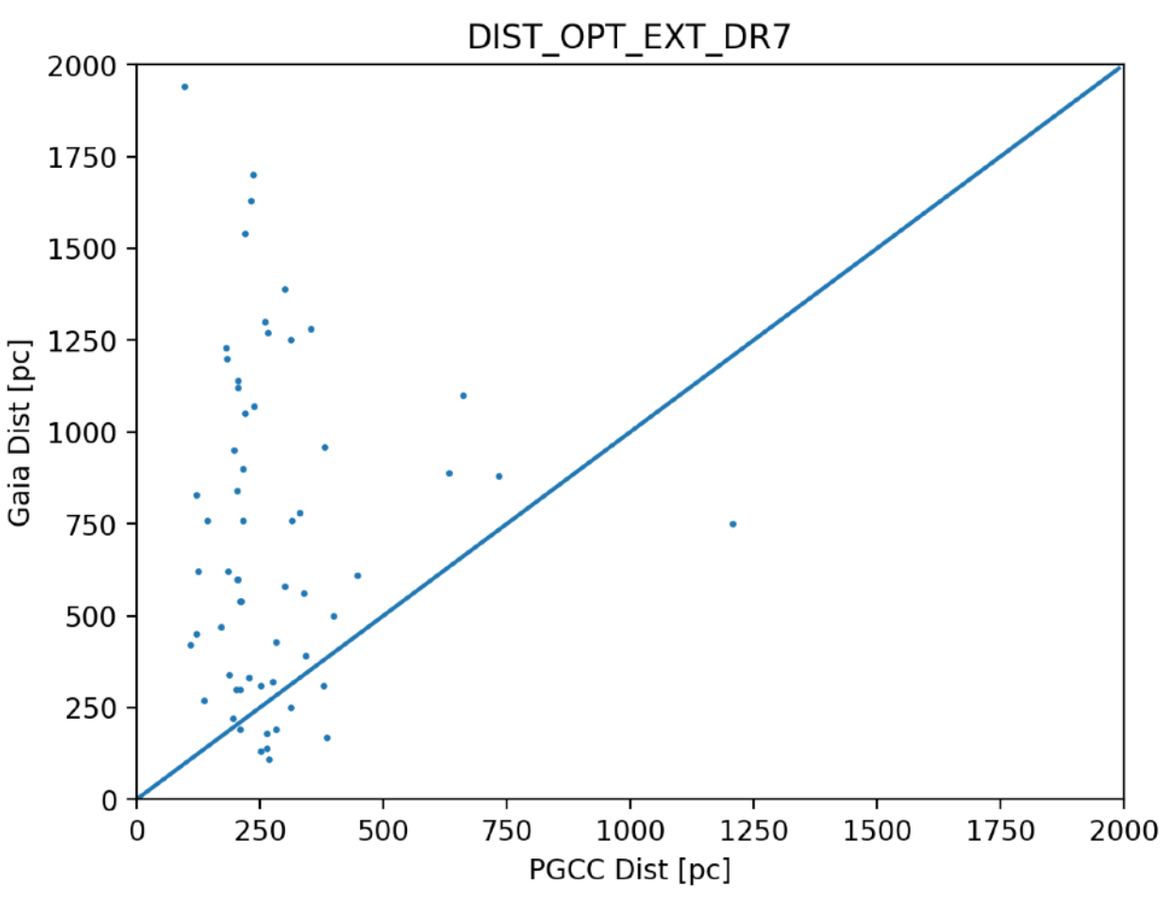
Gaia parallax

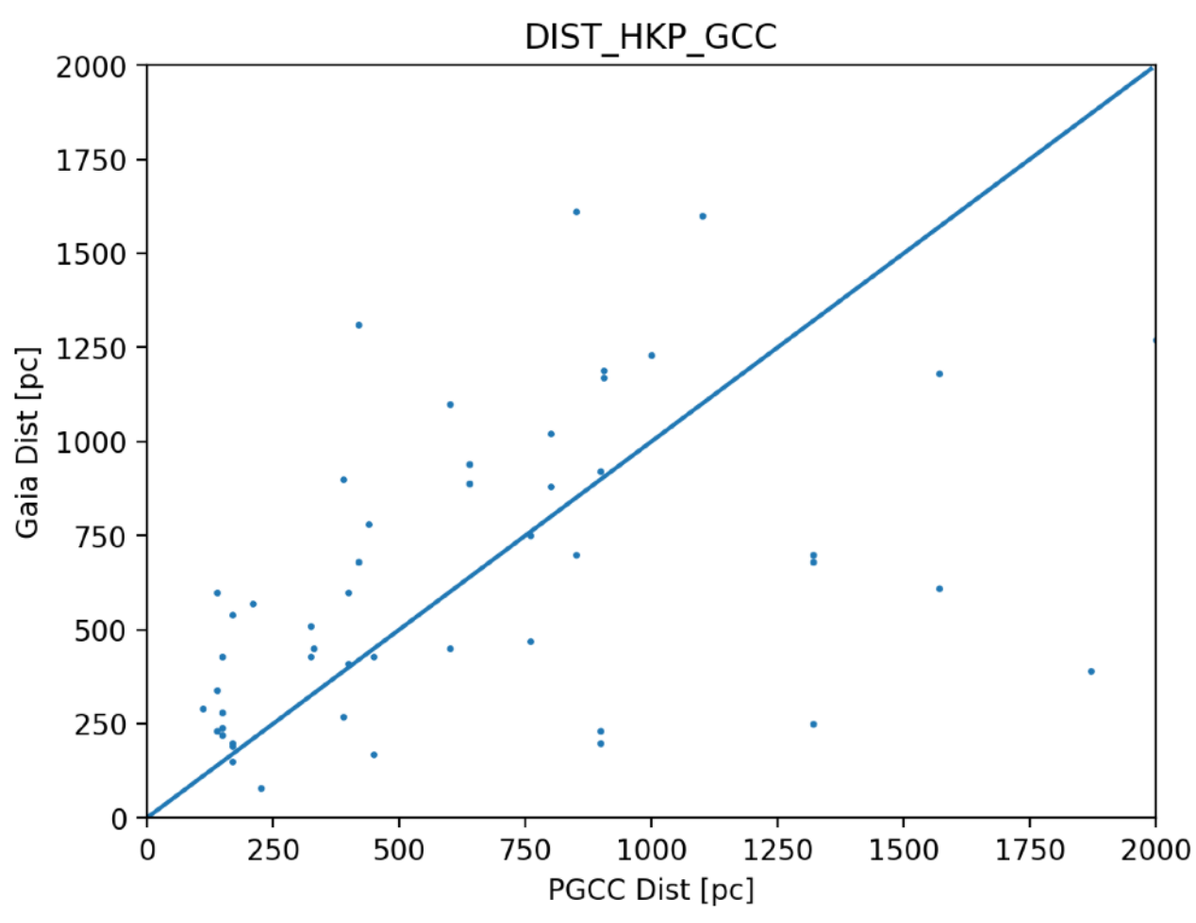
Comparison with PGCC




DIST_MOLECULAR_COMPLEX
Gaia Dist [pc]
PGCC Dist [pc]
0
250
500
750
1000
1250
1500
1750
2000


DIST_NIR_EXT
Gaia Dist [pc]
PGCC Dist [pc]
0
250
500
750
1000
1250
1500
1750
2000


DIST_OPT_EXT_DR7
Gaia Dist [pc]
PGCC Dist [pc]
0
250
500
750
1000
1250
1500
1750
2000


DIST_HKP_GCC
Gaia Dist [pc]
PGCC Dist [pc]
0
250
500
750
1000
1250
1500
1750
2000

What is A_0 ?

Observed flux in the presence of extinction

$$f(\lambda) = F(\lambda) \times 10^{-0.4A(\lambda)}$$

Fitzpatrick (1999)

E(B-V) = 0.5 & Teff = $3x10^4$

$$A'(\lambda) = \frac{A(\lambda)}{E(B-V)}$$

$$R = \frac{A_V}{E(B-V)}$$

User can choose R and Av to produce specific extinction curve :

$$A(\lambda) = A_V \frac{A'(\lambda)}{R}$$

R and Av can be seen as extinction parameters

What is A_0 ?

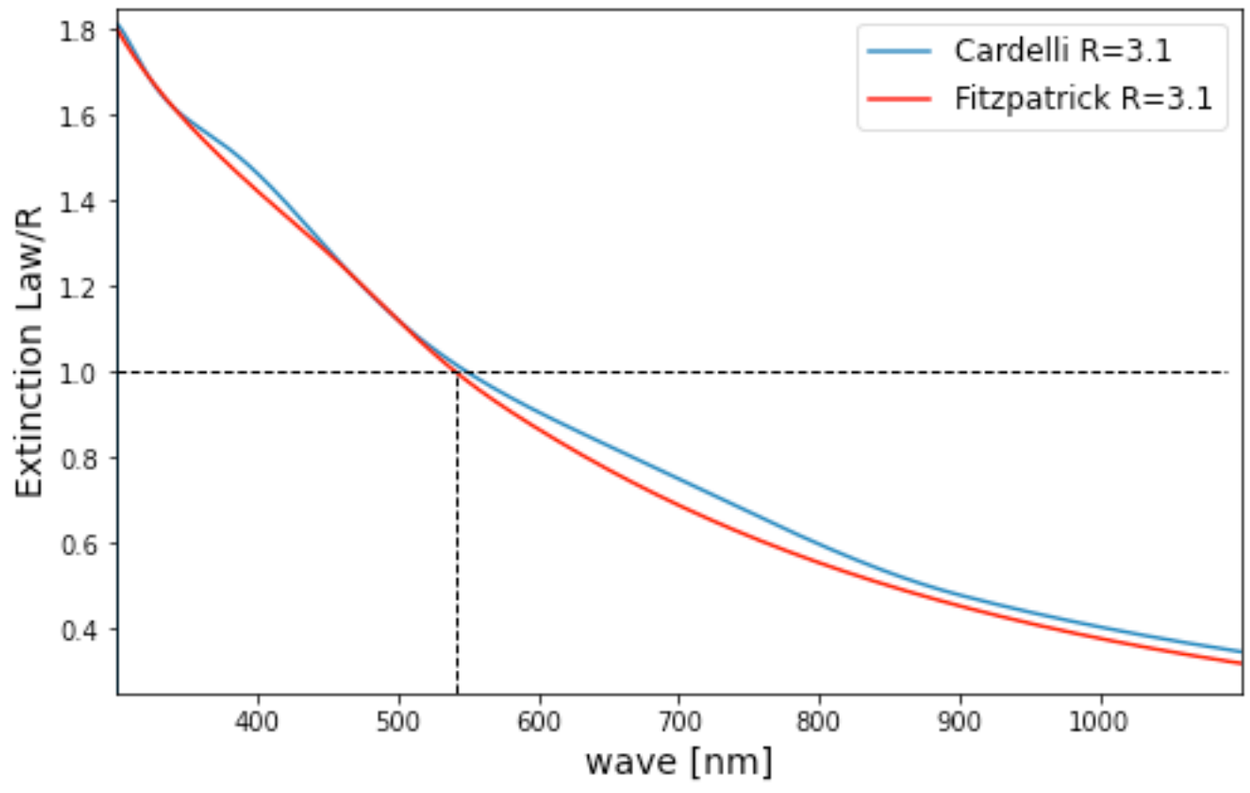
User can choose R and Av to produce specific extinction curve :

$$A(\lambda) = A_V \frac{A'(\lambda)}{R}$$

We choose R = 3.1 and observe that

$$\frac{A'(\lambda)}{3.1} = 1$$

at the specific wavelength 541.4 nm



Gaia collaboration, online documentation for DR3

$$f(\lambda) = F(\lambda) \times 10^{-0.4 A_0 [A'(\lambda)/3.1]}$$

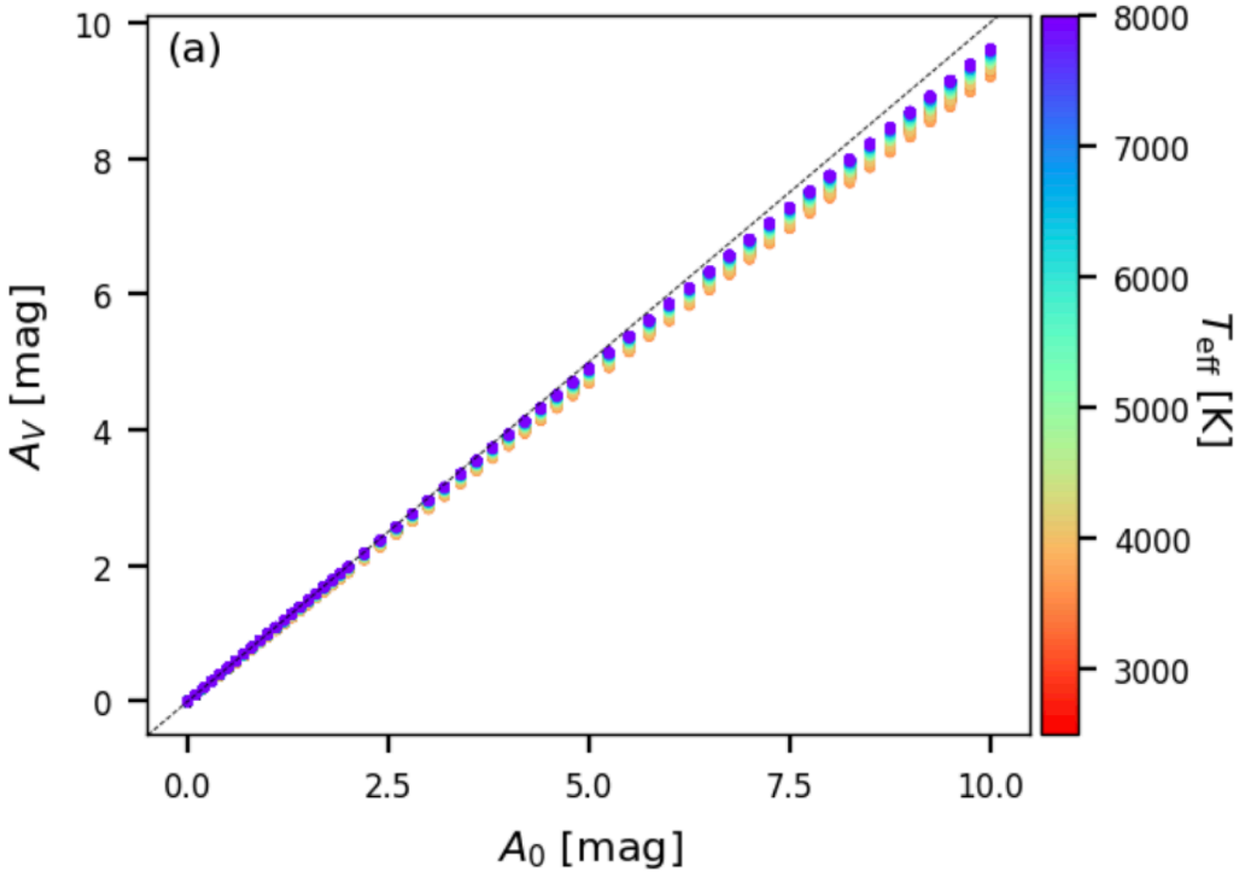
What is the link between A_0 and A_λ?

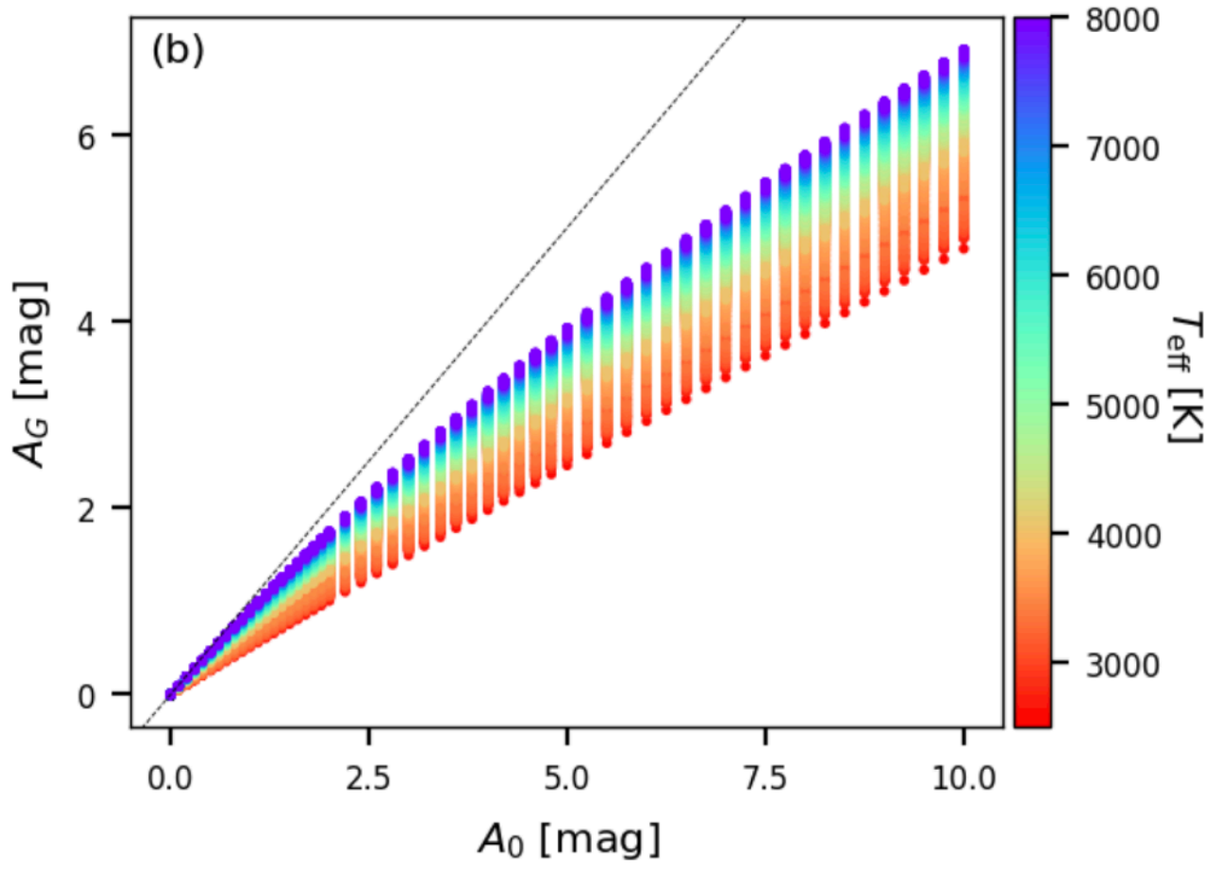
Extinction in specific passband (for ex. G)

$$F_G = \int T_G(\lambda) F(\lambda) d\lambda$$

$$f_G = \int T_G(\lambda) f(\lambda) d\lambda$$

$$A_G = 2.5 \log \left(\frac{F_G}{f_G} \right)$$





Gaia collaboration, online documentation for DR3