

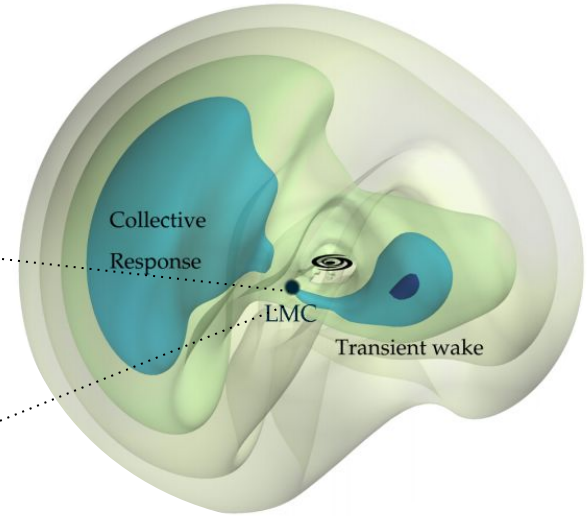
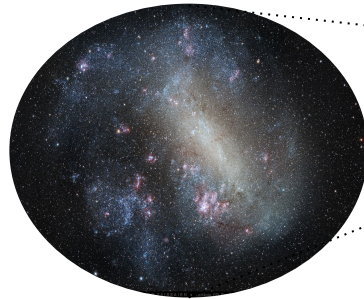
La Vía Láctea y la Gran Nube de Magallanes: Oportunidades y retos para la Cosmología de Campo Cercano

Nicolas Garavito-Camargo

Uniandes

Seminario de Astronomia

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<https://recastronomia.github.io>



¿Quiénes somos?

RECA es una asociación que busca crear y mantener vínculos fuertes entre los estudiantes de astronomía de Colombia.

Más >



¿Quién eres tú?

Ayudanos a conocer, re-conocer y ubicar a los estudiantes de RECA. Si eres colombiano y estas proyectandote profesionalmente en astronomía por favor llena nuestro censo electronico.

Más >

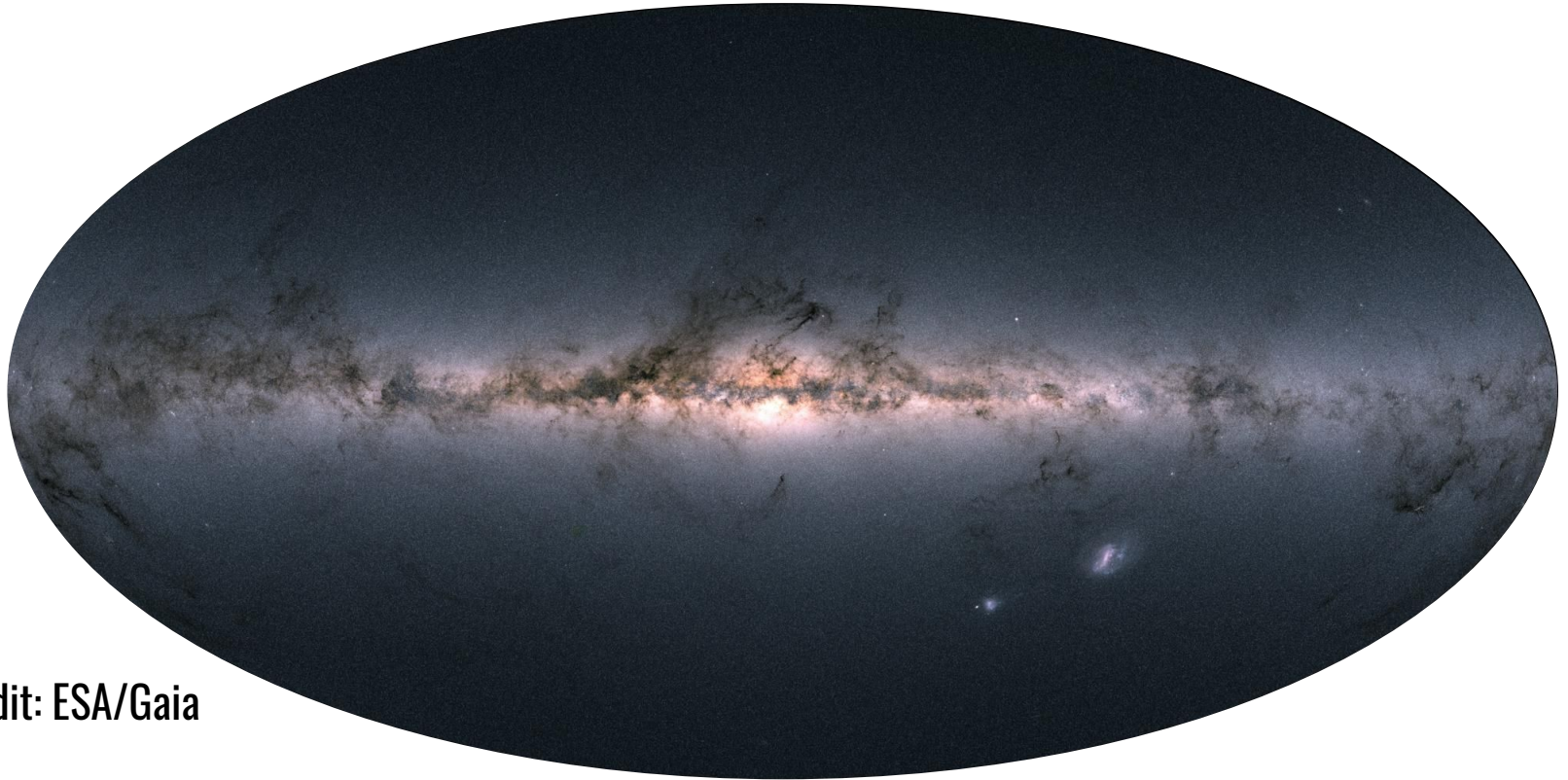


¡Únete a nuestra comunidad en Slack!

Conéctate con todos los estudiantes colombianos de astronomía del país y del exterior. Encontrarás diferentes canales para consejos, noticias, eventos y más.

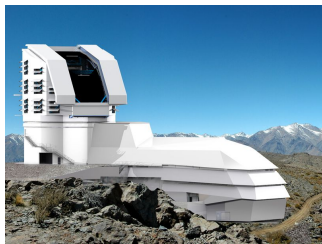
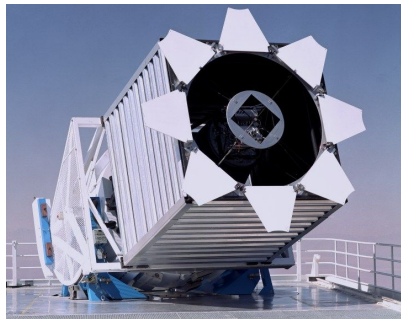
Más >

The Milky Way is the frontier to study the details of galaxy assembly and test Dark Matter models

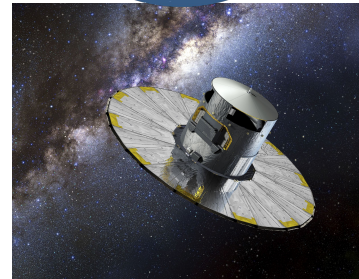
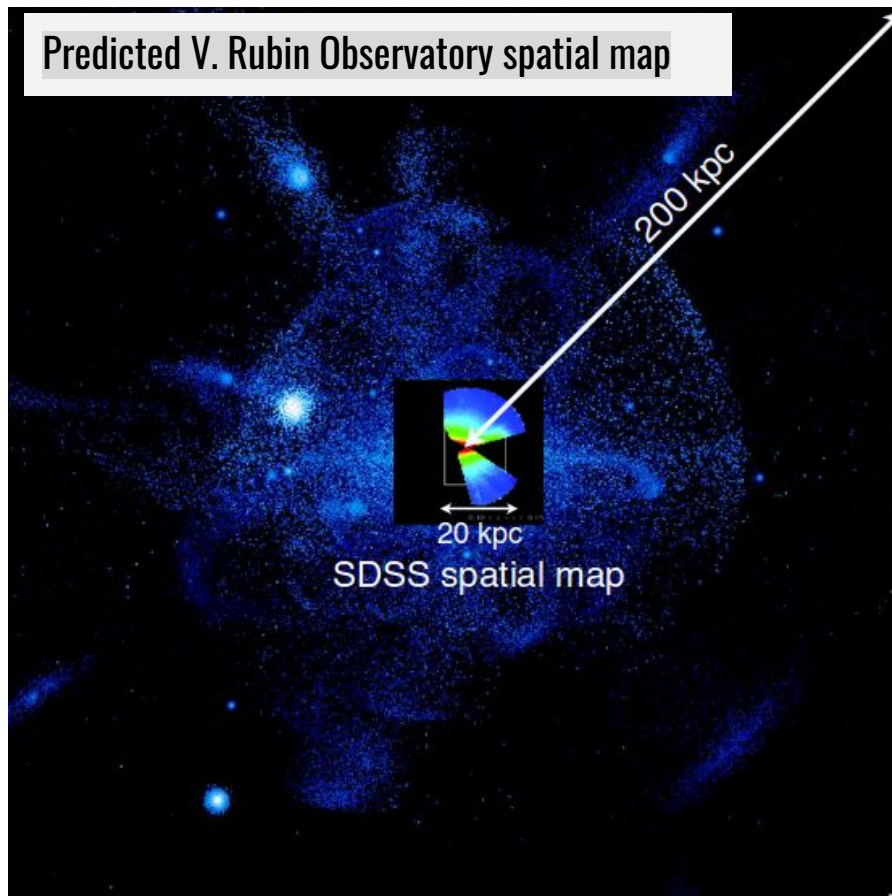


Credit: ESA/Gaia

Current and future observational programs are revealing the multidimensional Milky Way (photometry, spectroscopy, proper motions)



Predicted V. Rubin Observatory spatial map



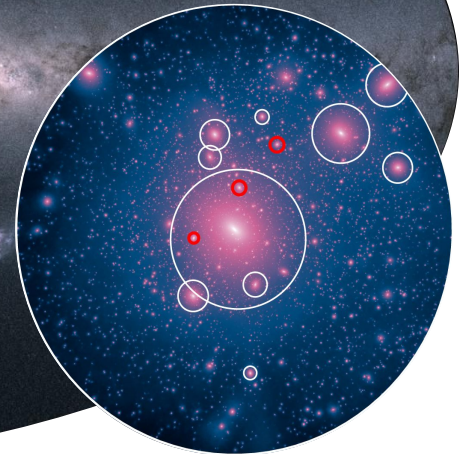
The Milky Way is the frontier to study the details of galaxy assembly and test Dark Matter models

How has the Milky Way assembled over time ?



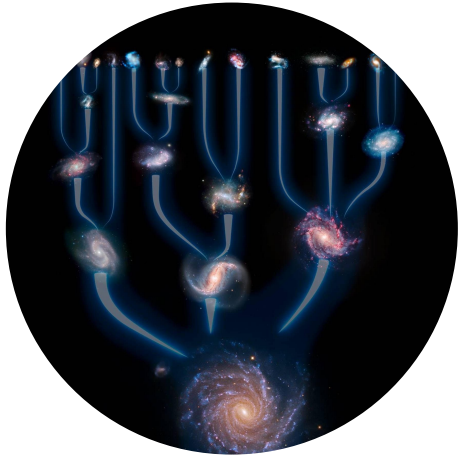
Credit: ESA/Gaia

What is the Nature of Dark Matter?



The Milky Way is the frontier to study the details of galaxy assembly and test Dark Matter models

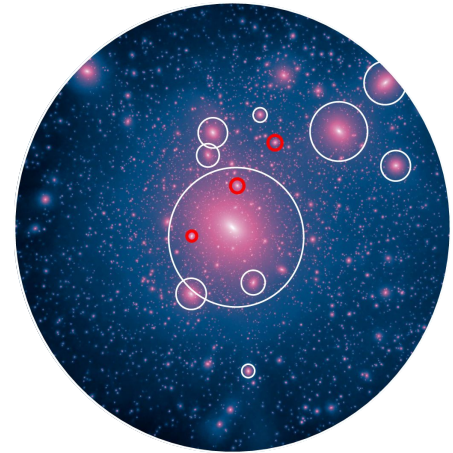
How has the Milky Way assemble over time ?



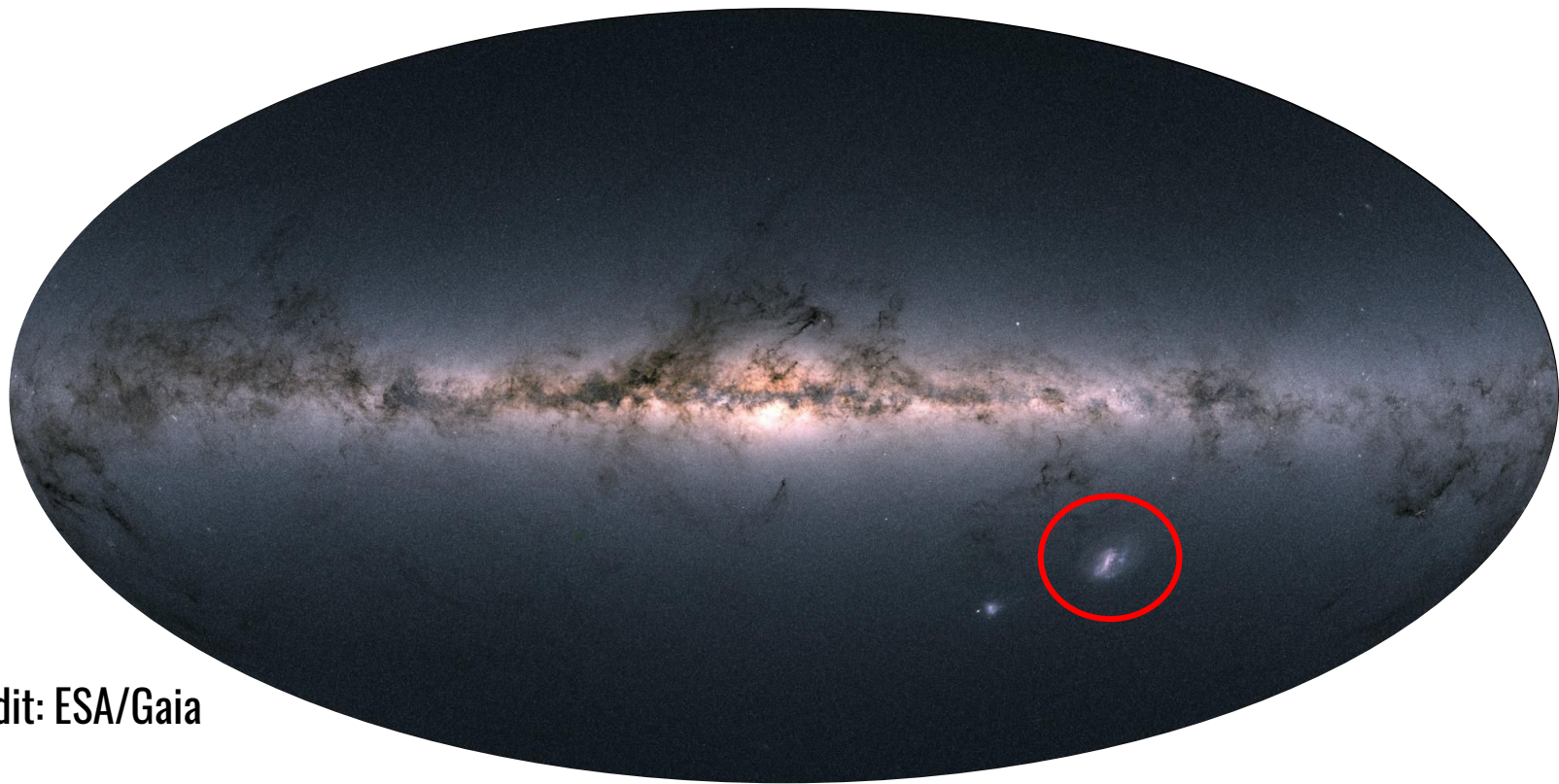
Key ingredients:

- Understand the kinematics of the stellar halo.
- Some knowledge of the gravitational potential of the MW.

What is the Nature of Dark Matter?

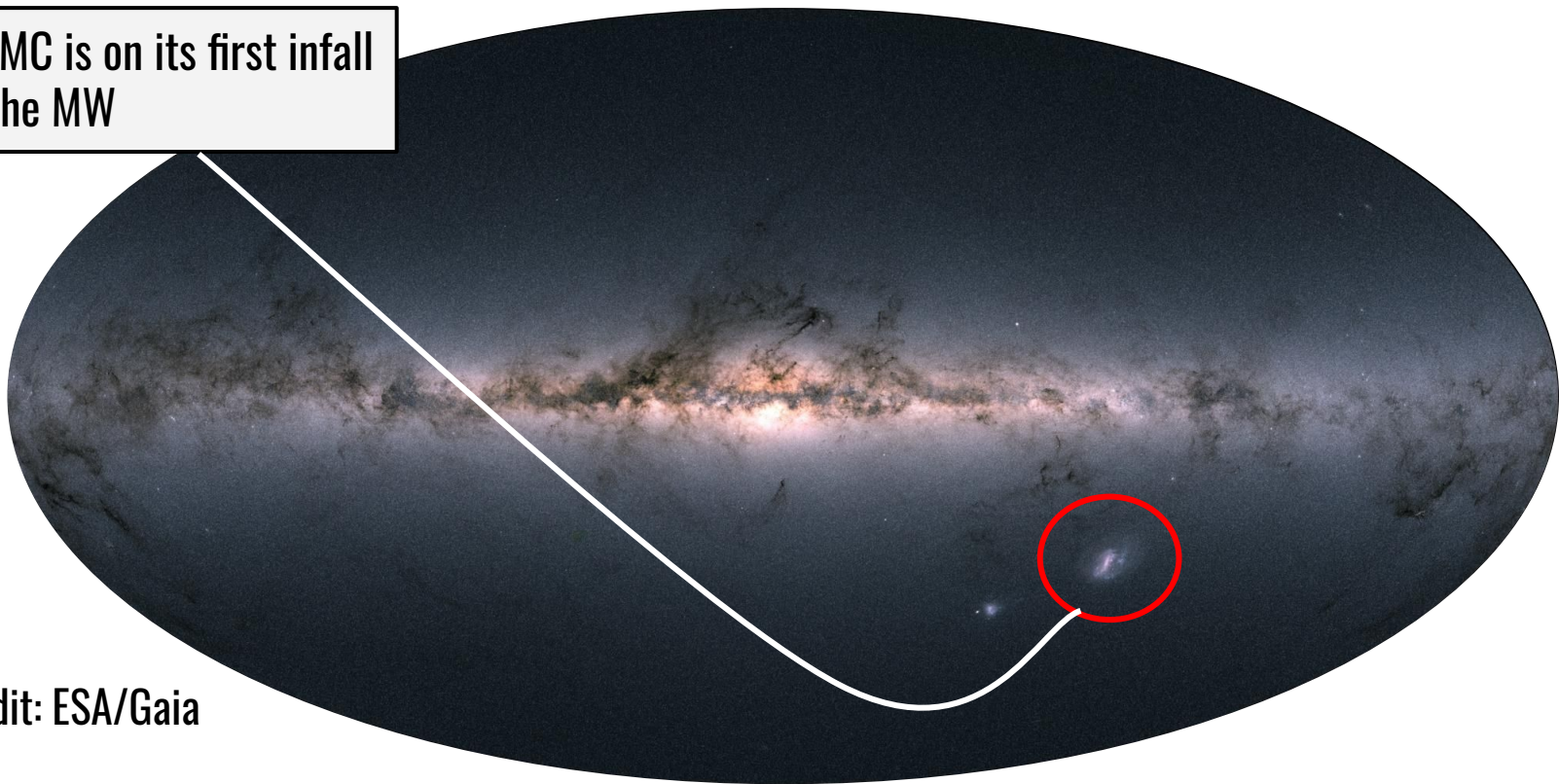






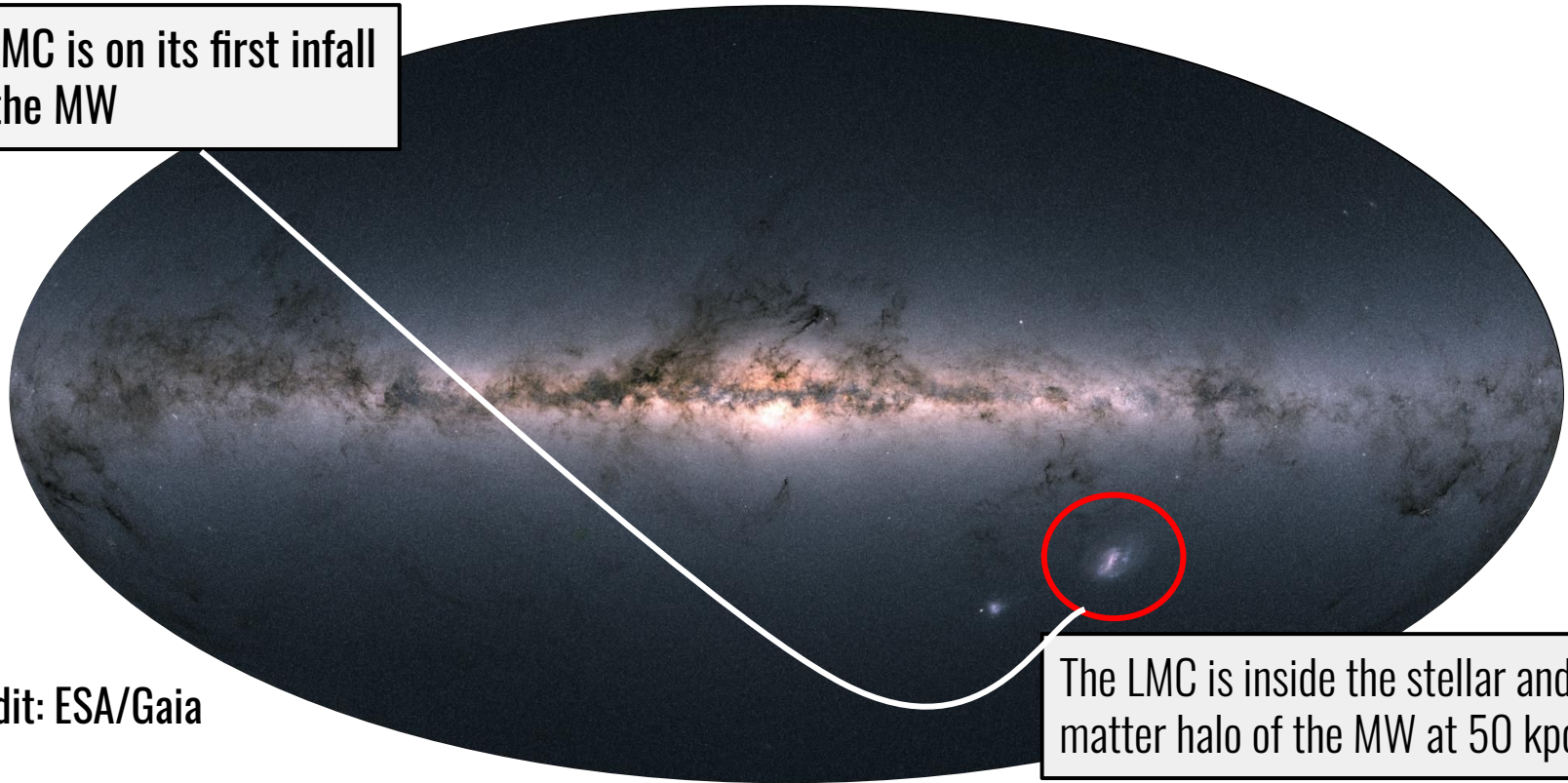
Credit: ESA/Gaia

The LMC is on its first infall into the MW



Credit: ESA/Gaia

The LMC is on its first infall into the MW

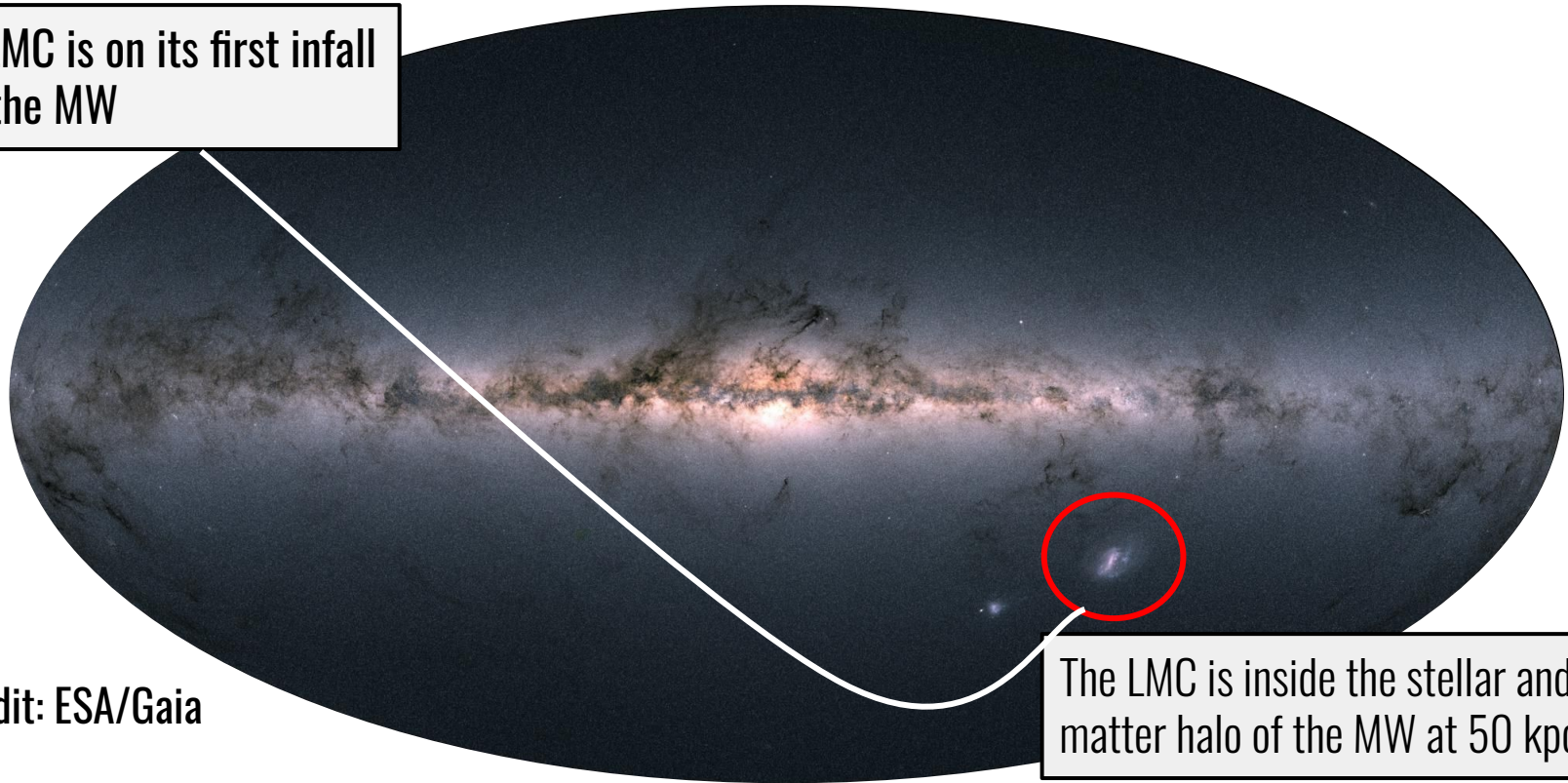


The LMC is inside the stellar and dark matter halo of the MW at 50 kpc

Credit: ESA/Gaia

LMC is 10%-20% the mass of the MW at infall

The LMC is on its first infall into the MW



The LMC is inside the stellar and dark matter halo of the MW at 50 kpc

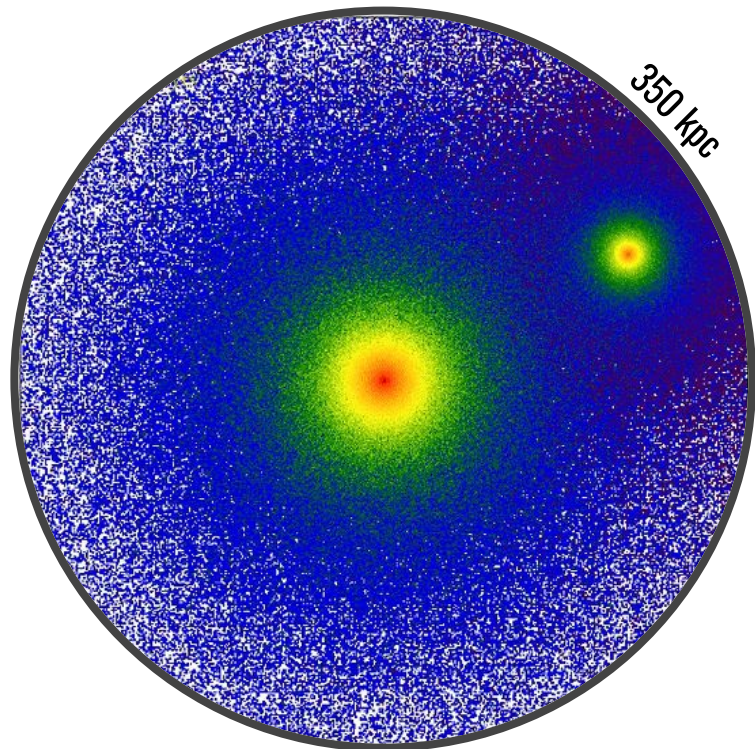
Credit: ESA/Gaia

Modelling the MW-LMC interaction using N-body simulations

Suite of 8 high resolution N-body simulations:

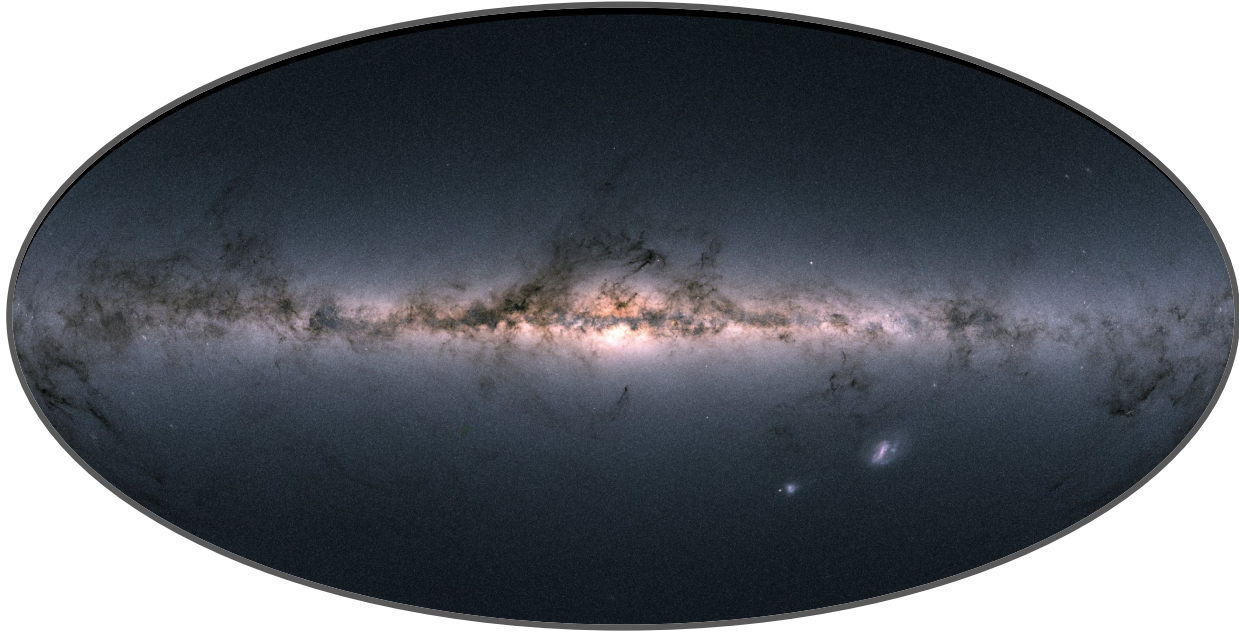
- 4 LMC mass models
- 2 MW models

Reproduce the LMC present day position and velocity within 2σ of HST observations (Kallivayalil+13)



Garavito-Camargo, Besla+19

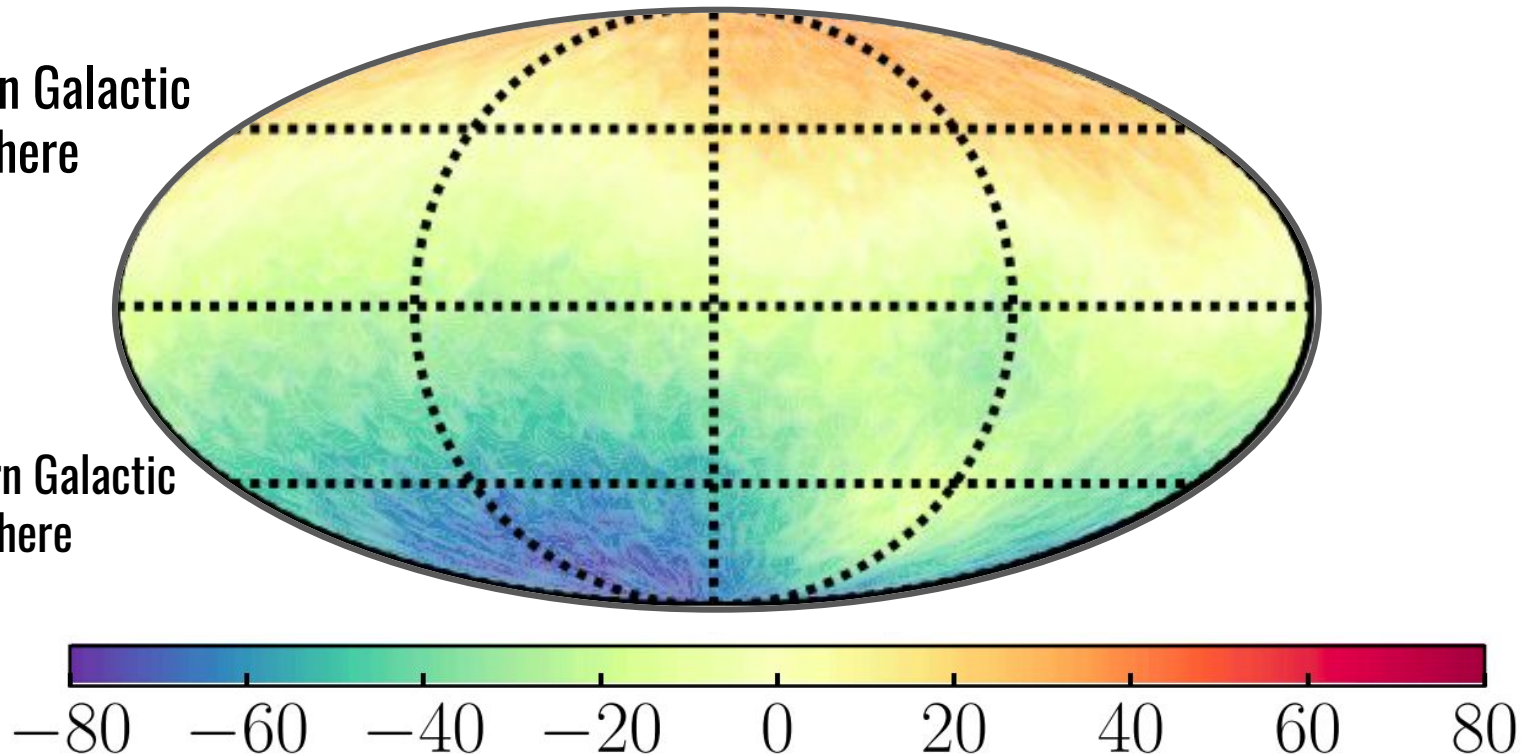
Effect in the velocities of the MW's outer stellar halo: Reflex motion



Reflex motion observed at $R_{\text{gal}}=100$ kpc

Northern Galactic Hemisphere

Southern Galactic Hemisphere



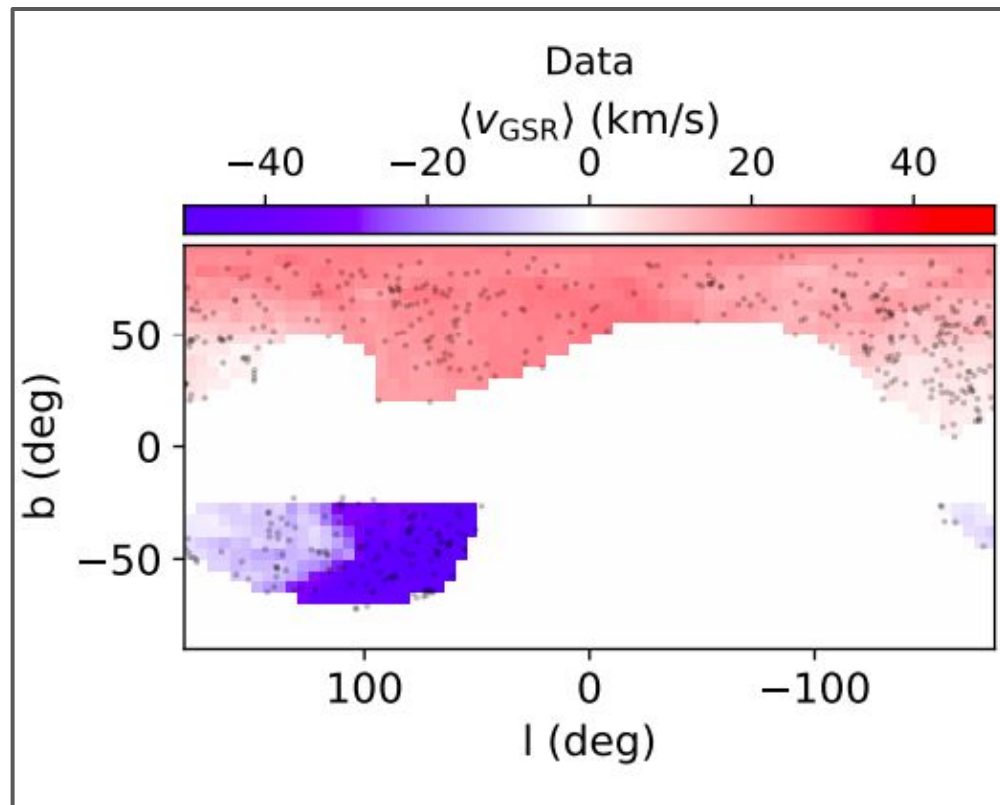
V_r [km/s]

Garavito-Camargo, Besla+19

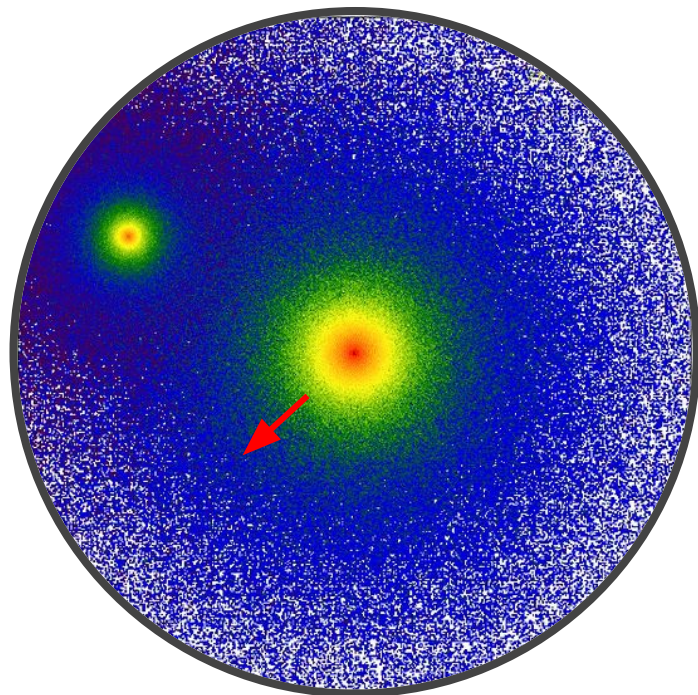
Gaia's detection of the reflex motion direction

K-giants
K-giants
BHB/BS
RR Lyrae
BHB/BS
BHB

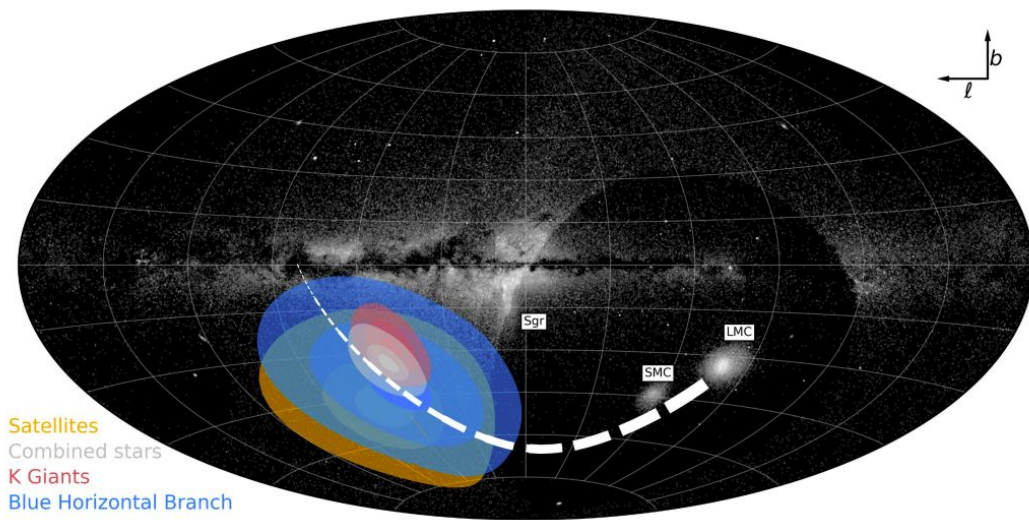
846 stars between
50 -105 kpc



Gaia's detection of the reflex motion direction

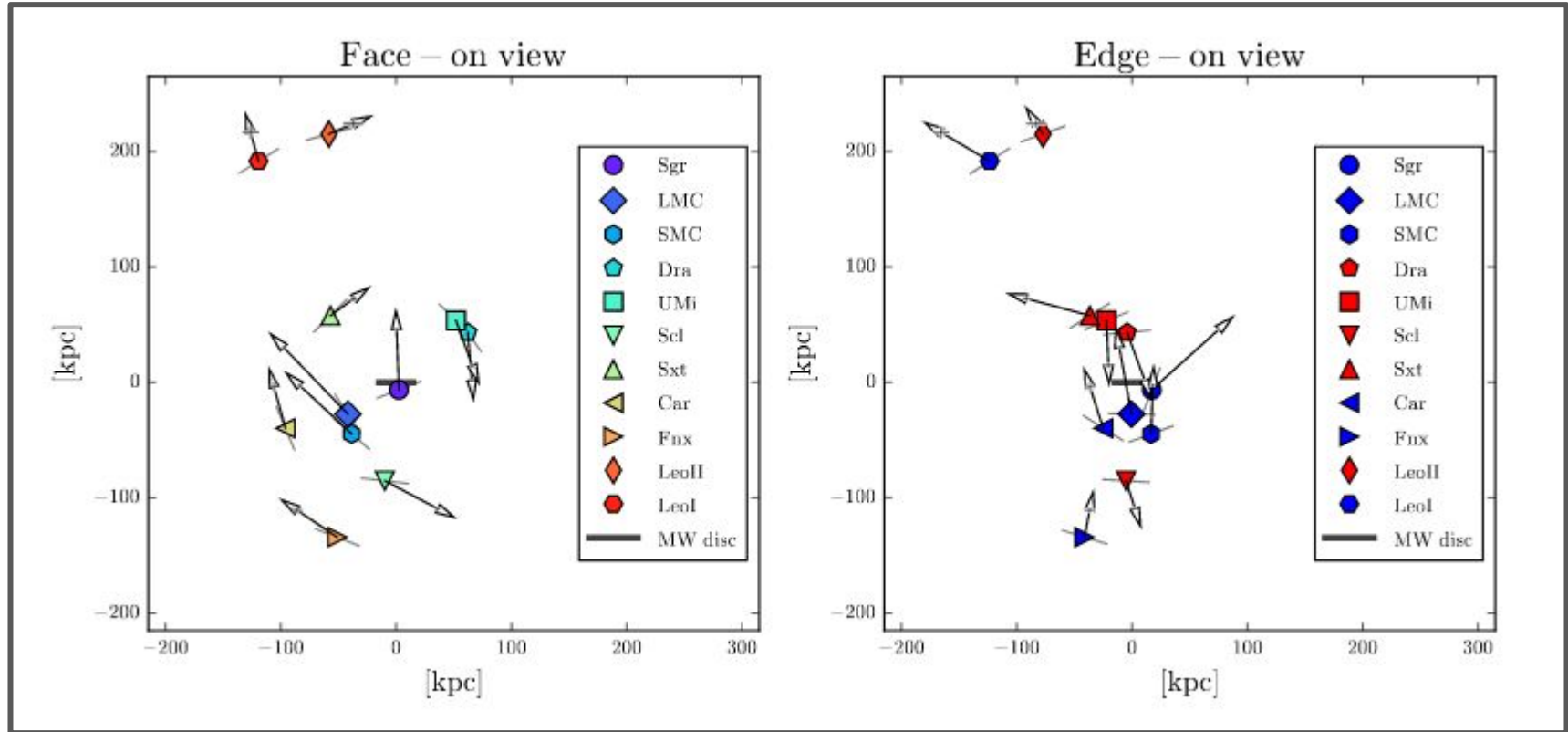


Garavito-Camargo+19, 20

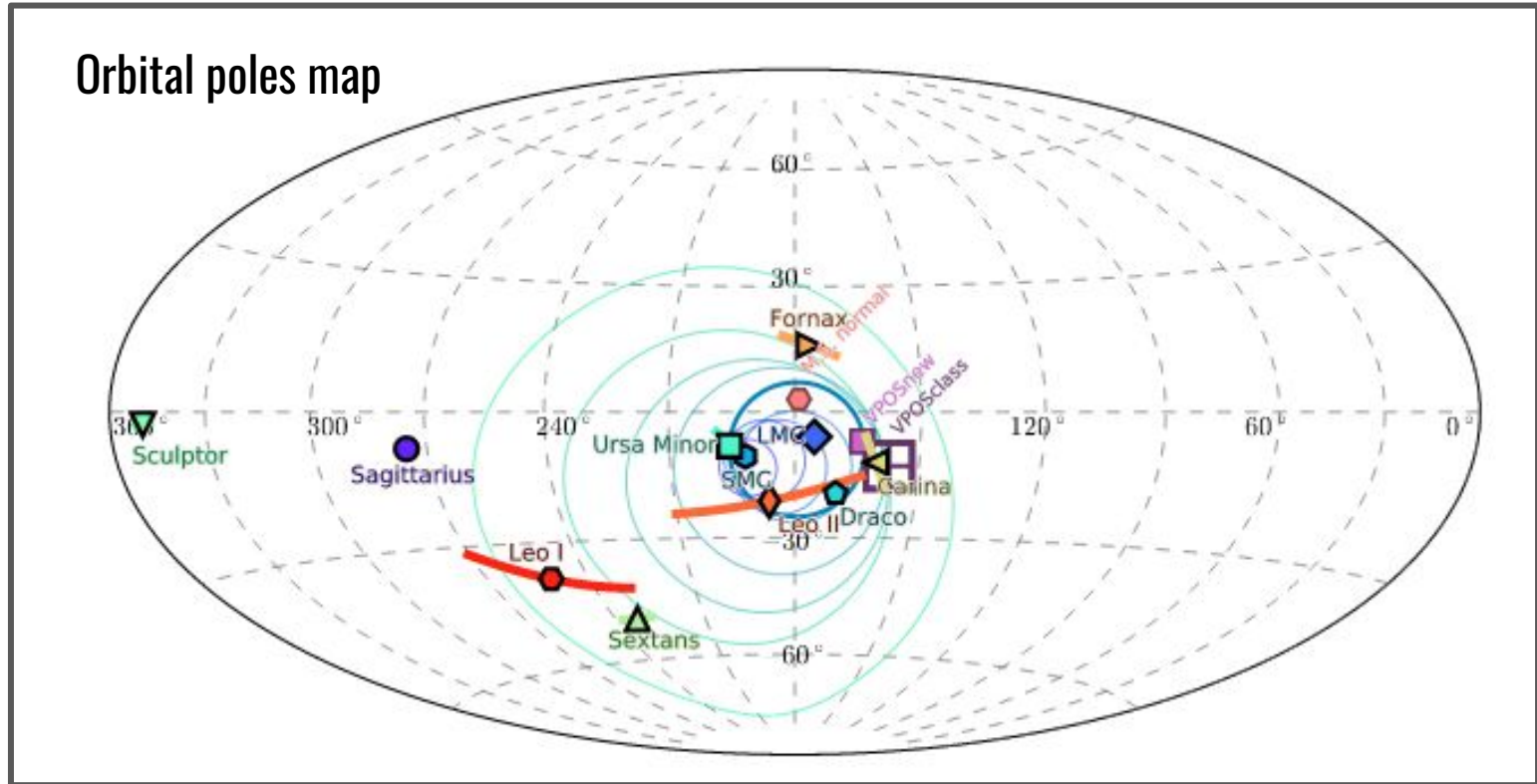


Petersen & Peñarrubia 20

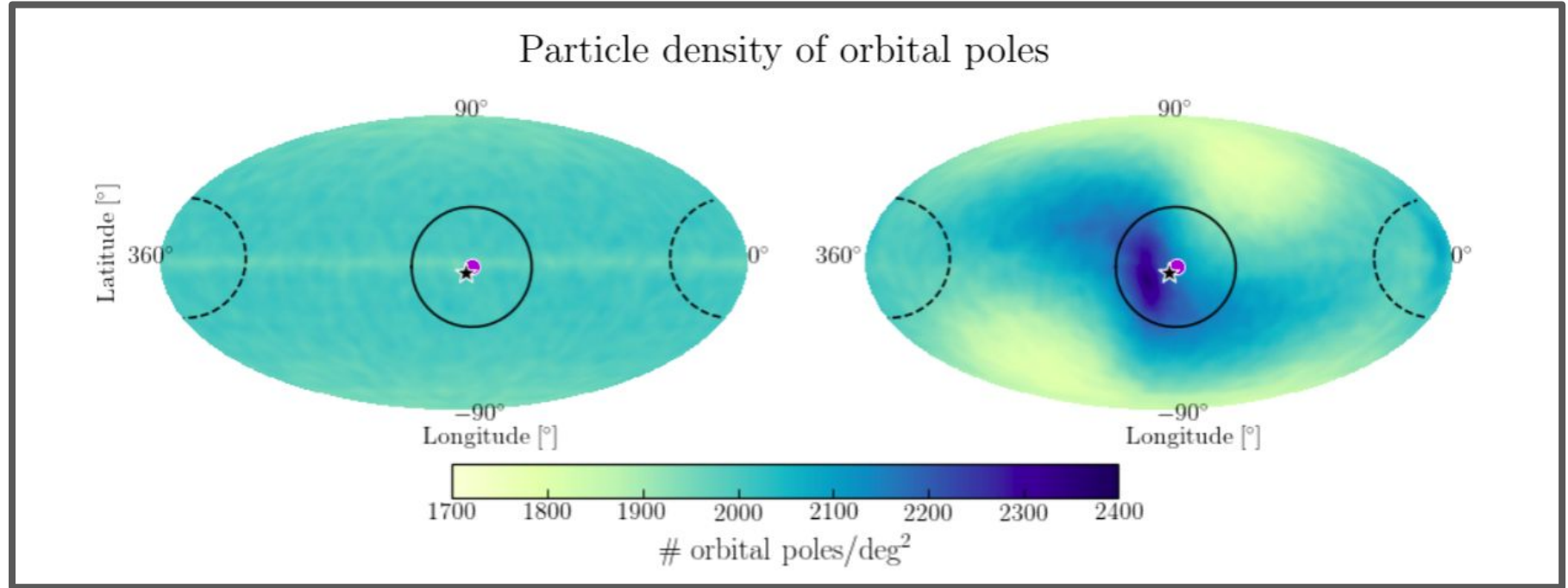
The MW planes of satellites: 11 satellites are moving in a thin plane

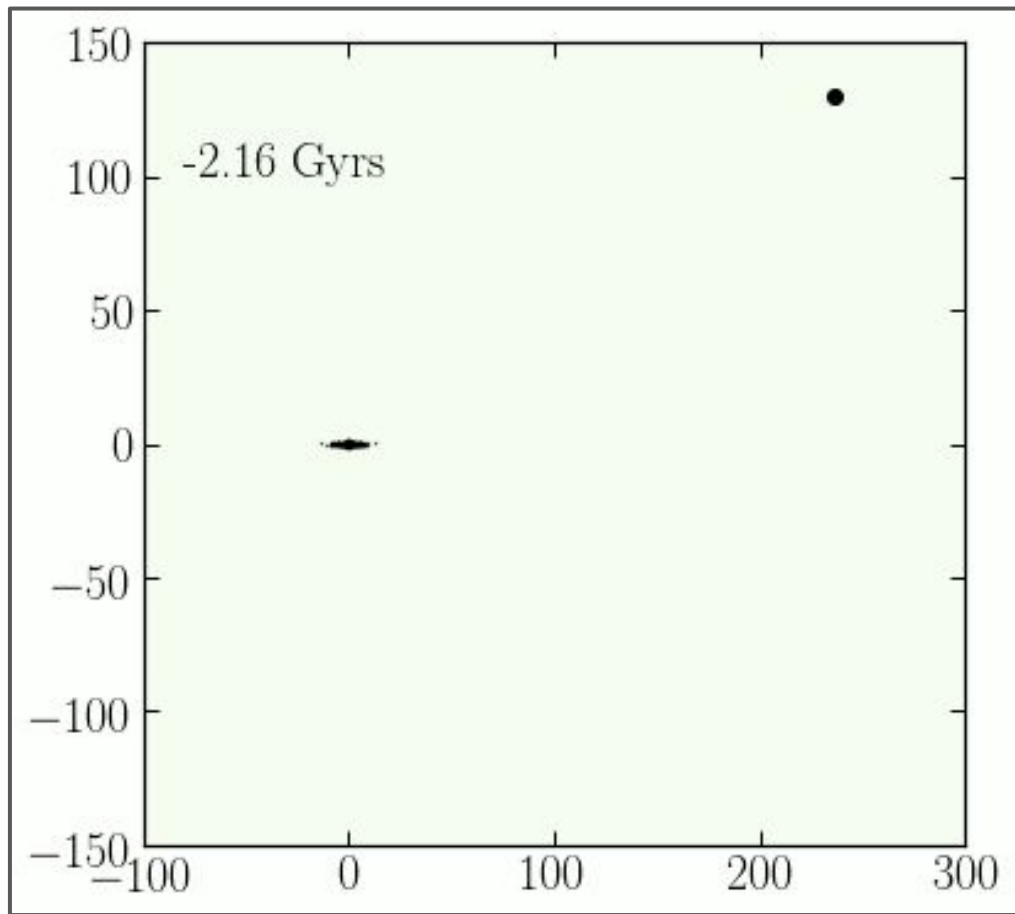


The MW planes of satellites: 11 satellites are moving in a thin plane



The LMC induces a concentration of orbital poles in the halo of the milky way

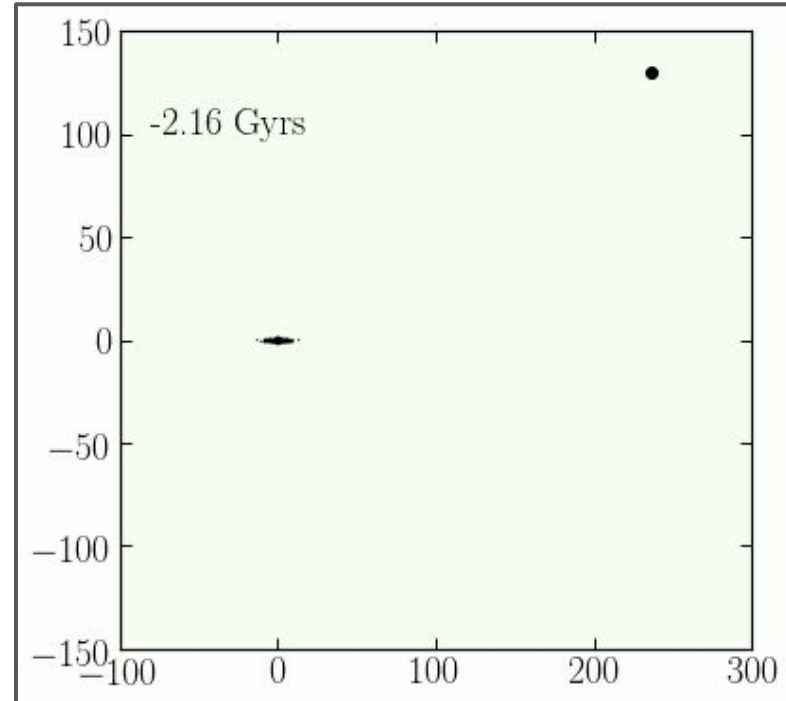




Garavito-Camargo, 2019, 2020a

The wake is a transient structure in the galaxy whose live time is shorter than the dynamical time of the galaxy

- Wakes can't be modelled using equilibrium models
- Wake morphology could depend on the nature of dark matter.

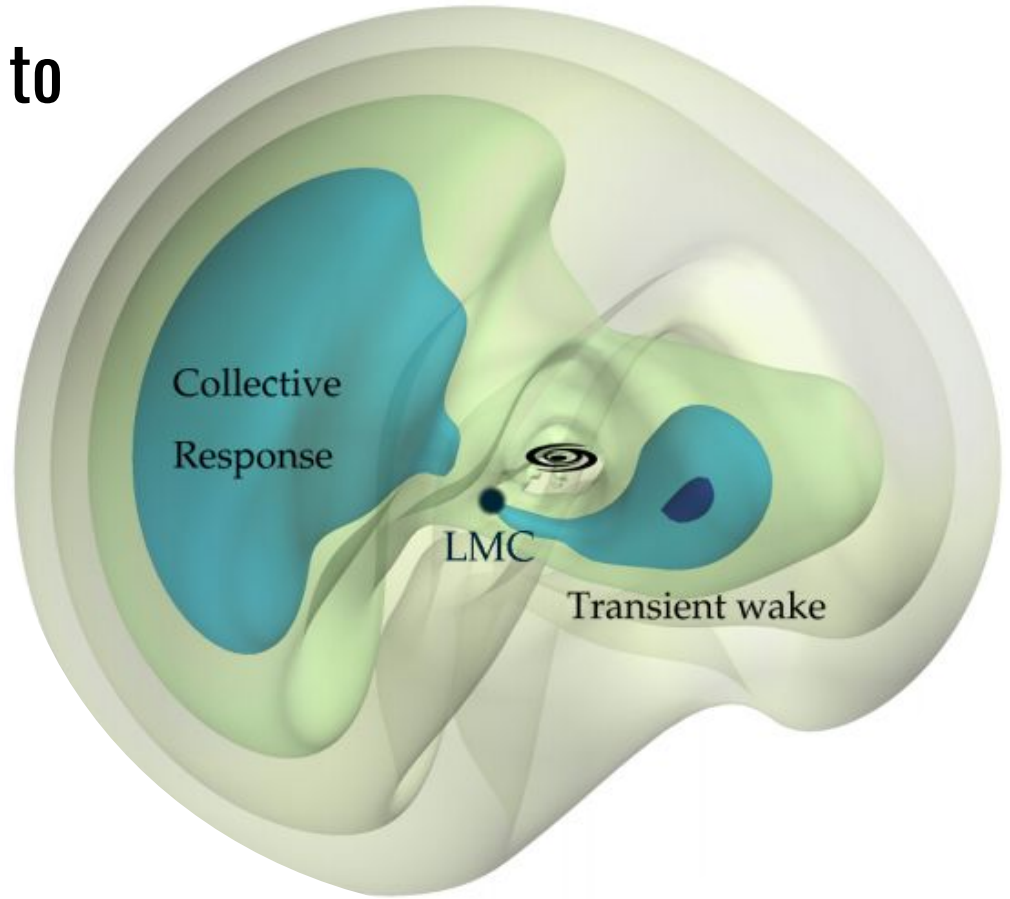


* At high satellite velocities

Garavito-Camargo, 2019, 2020a

MW's DM halo response due to the passage of the LMC:

1. Formation of the DM wake responsible for dynamical friction
2. COM displacement inducing a strong dipole (Collective response)



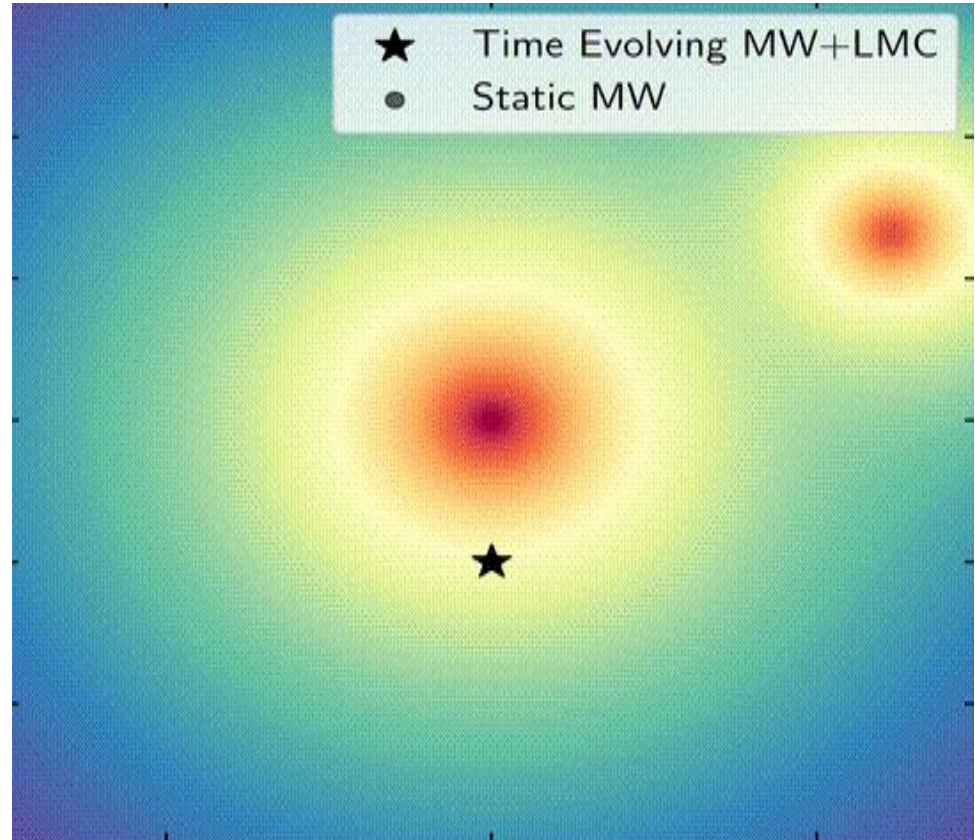
Time-dependent models of the MW-LMC will allow to integrate orbits of halo tracers

Capture the halo response of the MW, wake, CUSP motion, and the distortions of the LMC

Very efficient orbit integration: Each orbit take few seconds in a laptop

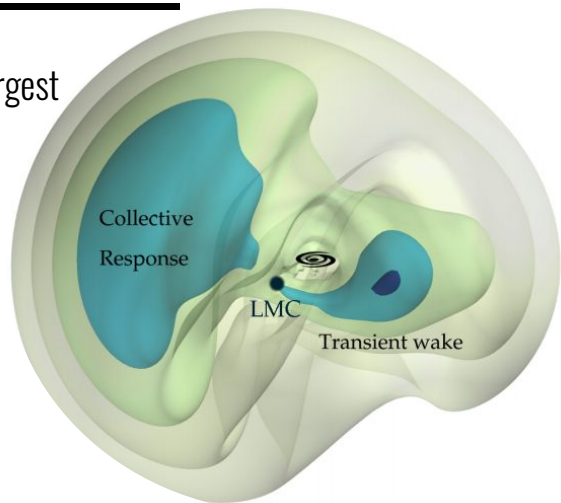
Publicly available in Gala

<https://gala-astro.readthedocs.io/en/latest/>

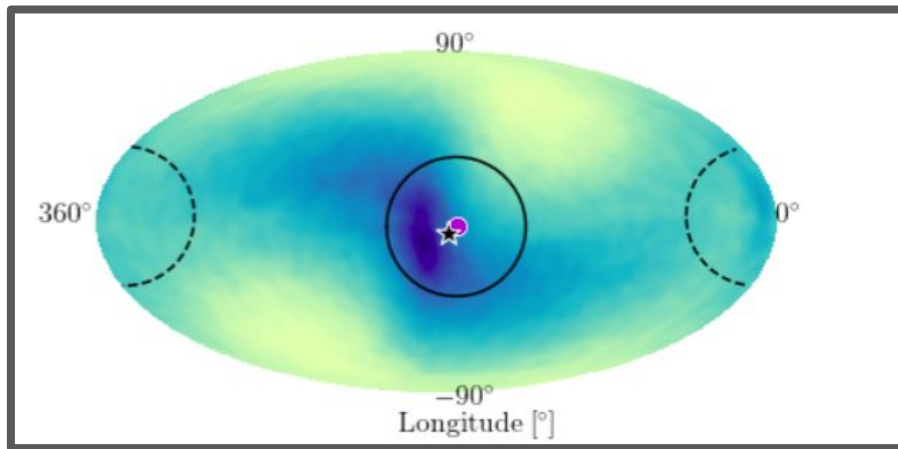


Conclusions:

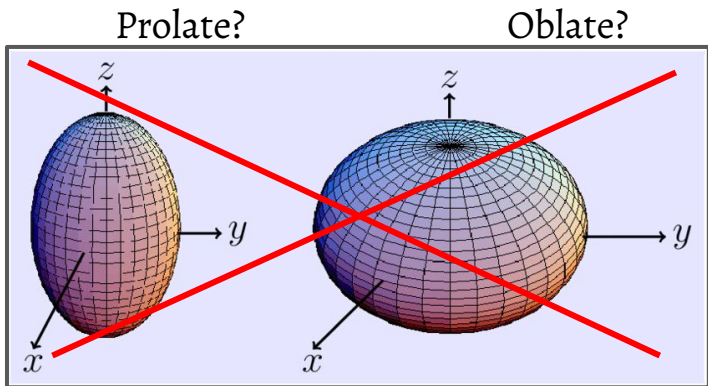
1. LMC the largest perturbation of the outer halo



2. COM displacement and reflex motion must be taken into account to interpret observational results > 30 kpc



3. The MW's halo shape is not axisymmetric! Caution when comparing with cosmo sims



4. Time-dependent models of the MW-LMC are needed!
Basis Function Expansion are a powerful solution

