

# Those who part the streams

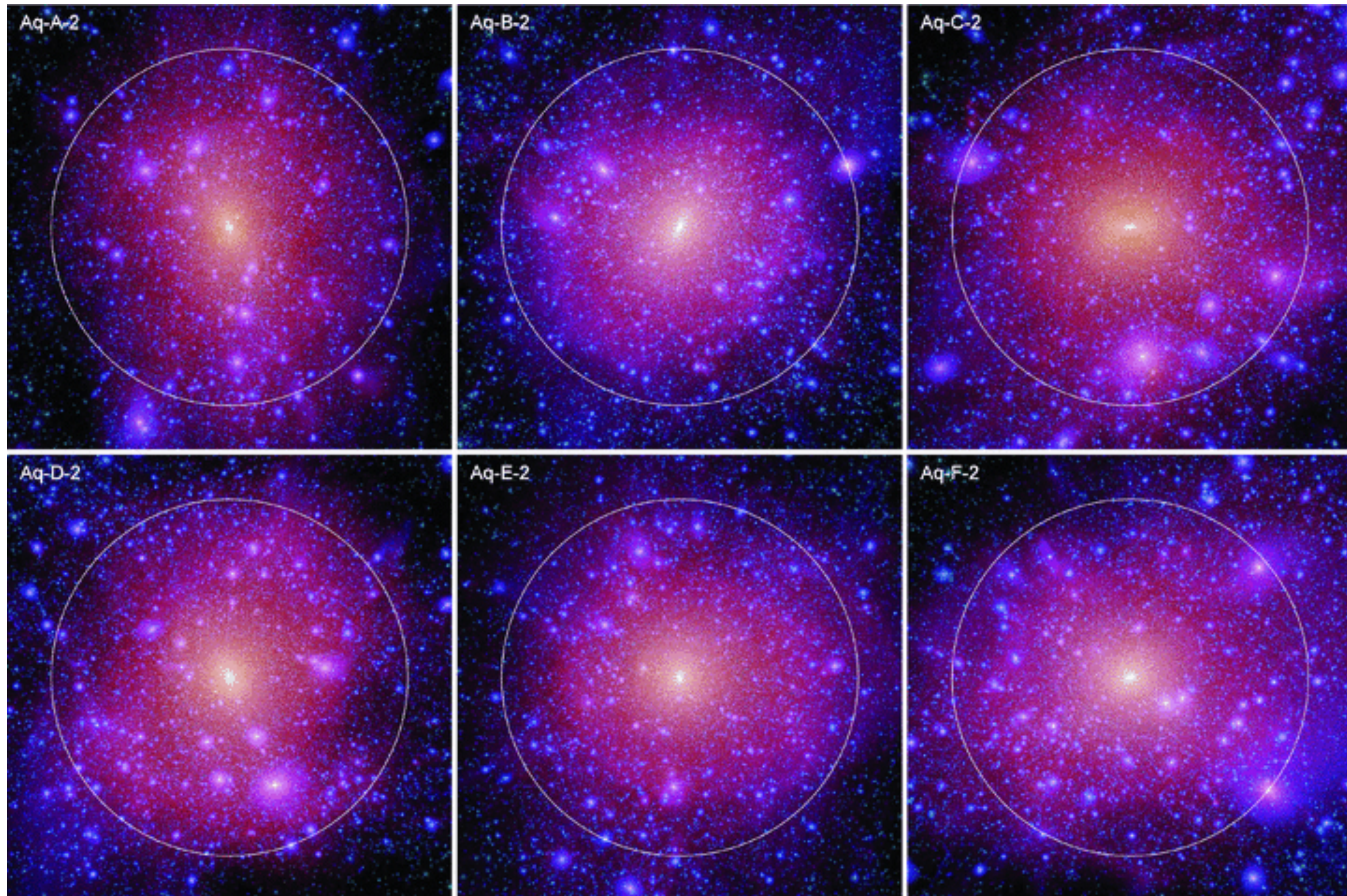
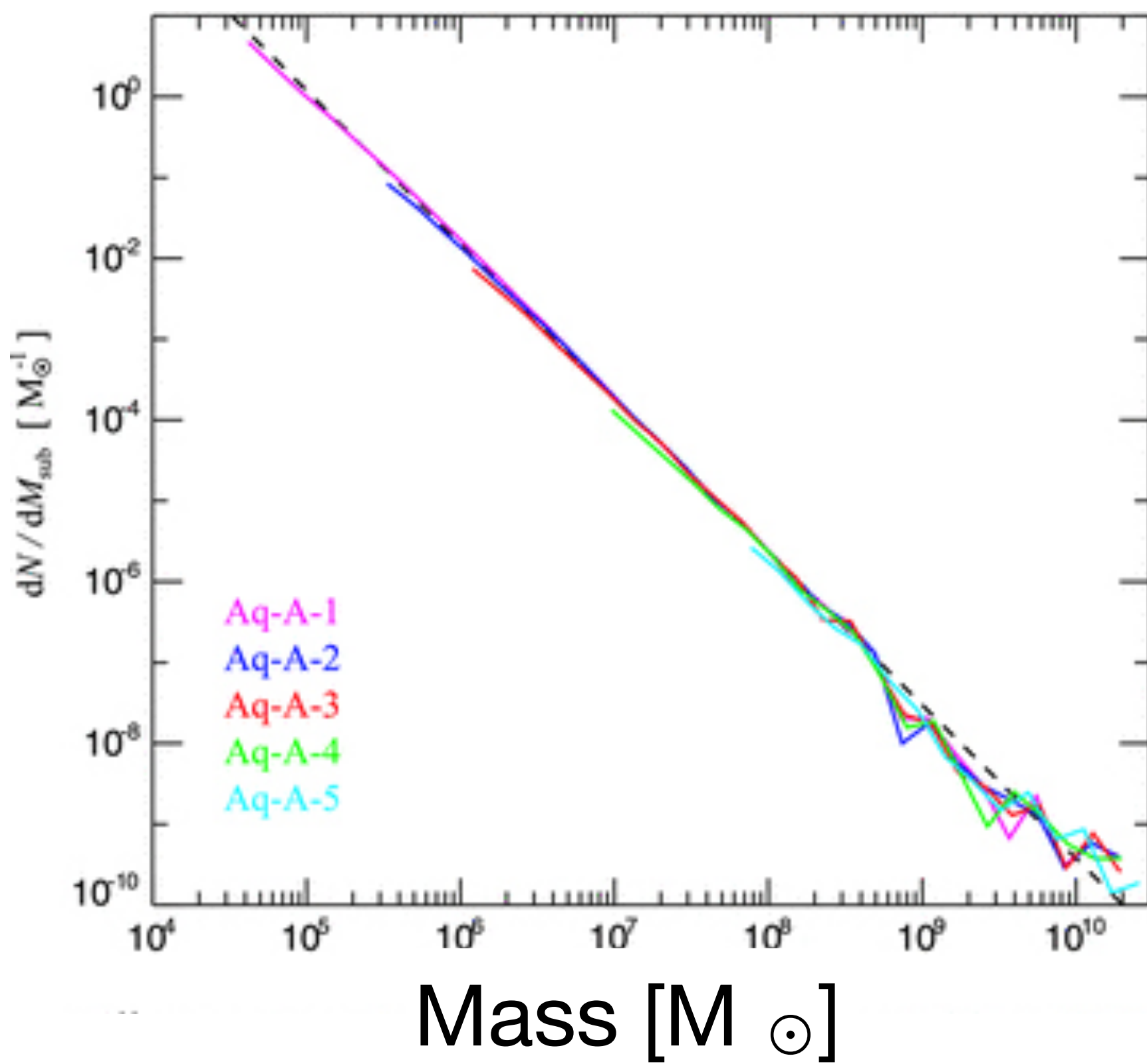
**A story of globular clusters and dark matter**

**Salvatore FERRONE. 2026 June 06**

**Di Matteo, P., Montuori, M., Ibata, R., Mastrobuono-Battisti, A., Pagnini, G.**

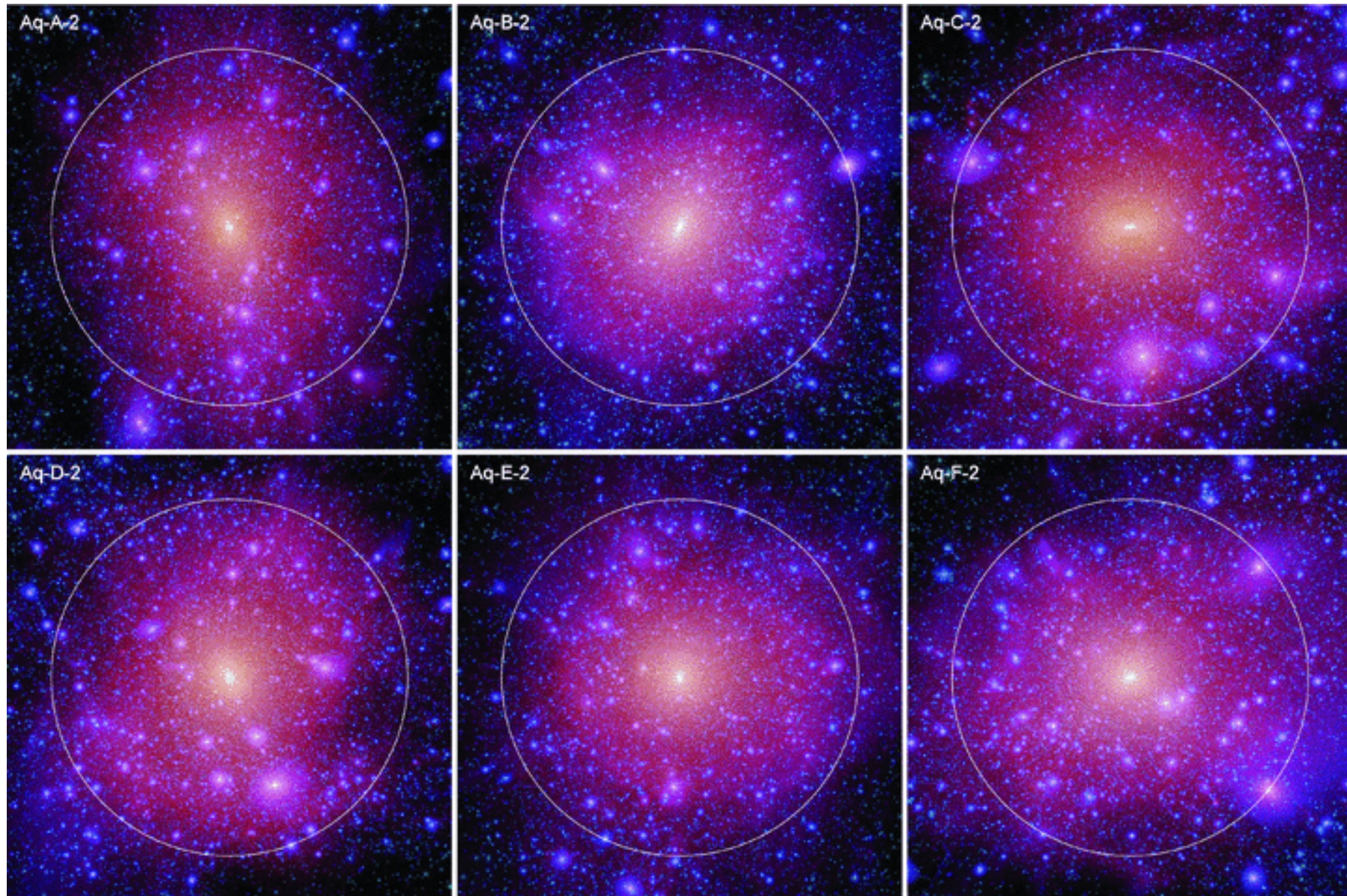
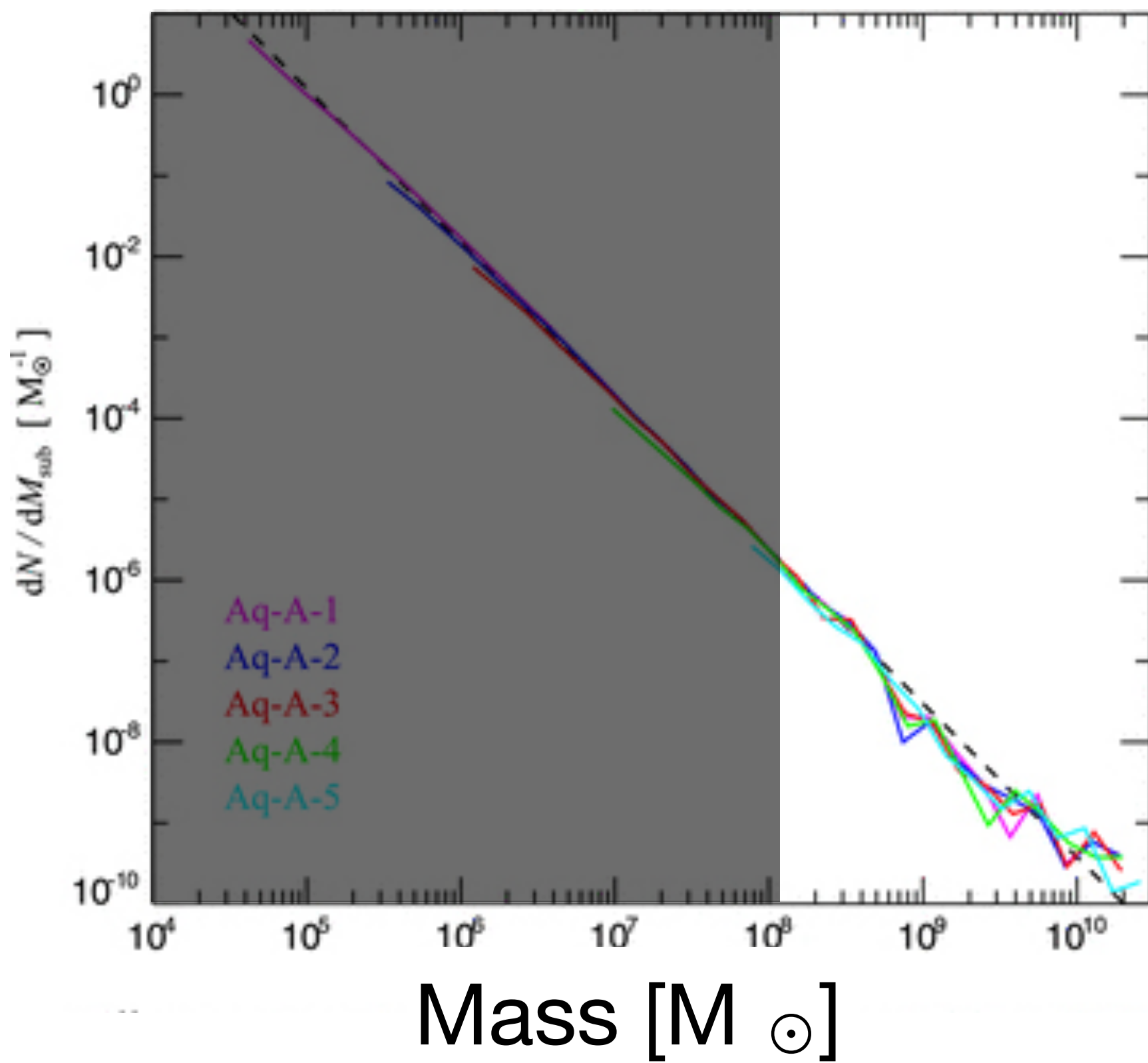
# Dark matter subhalos

Springel et al. 2008



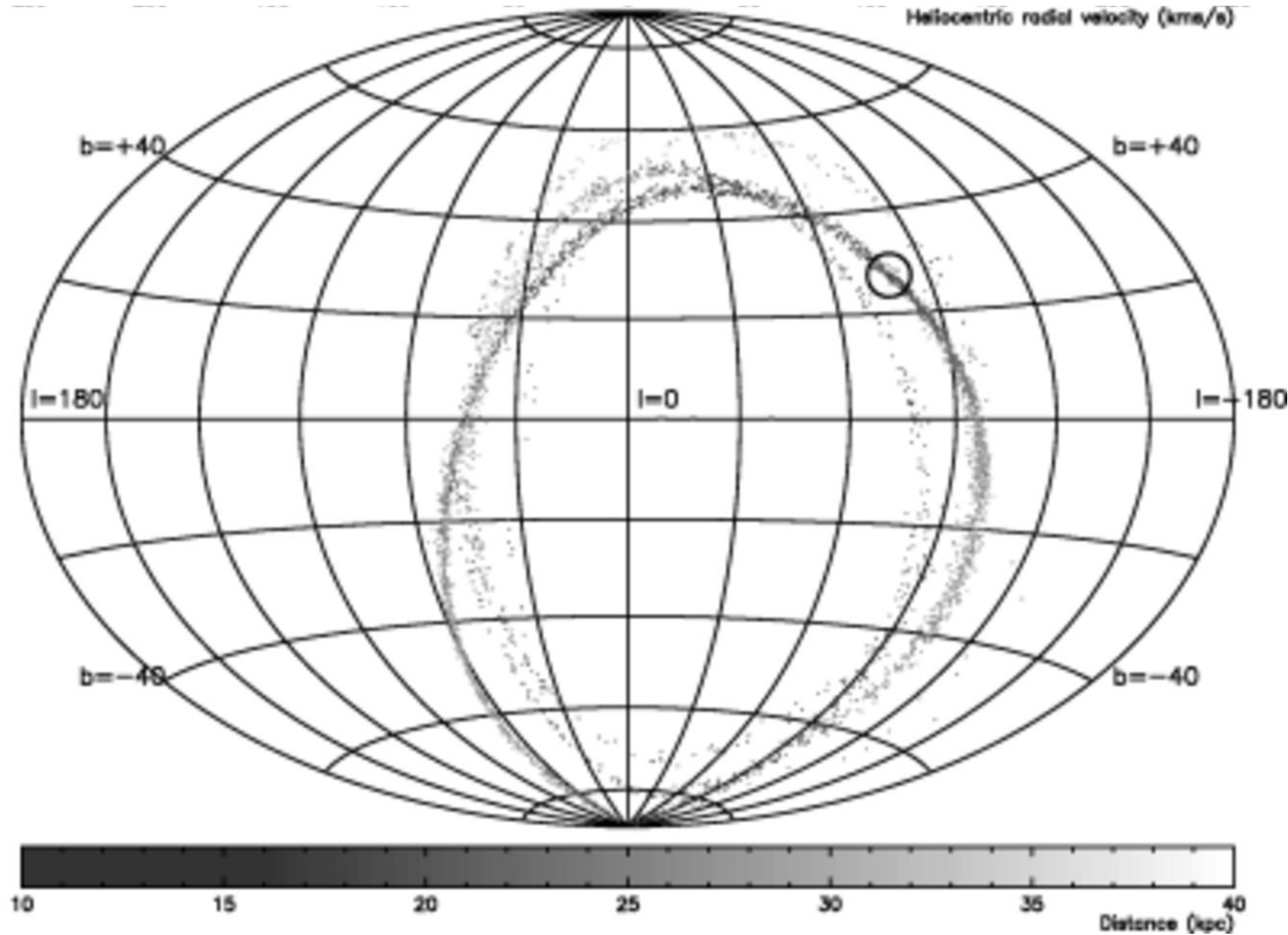
# Dark matter subhalos

Springel et al. 2008



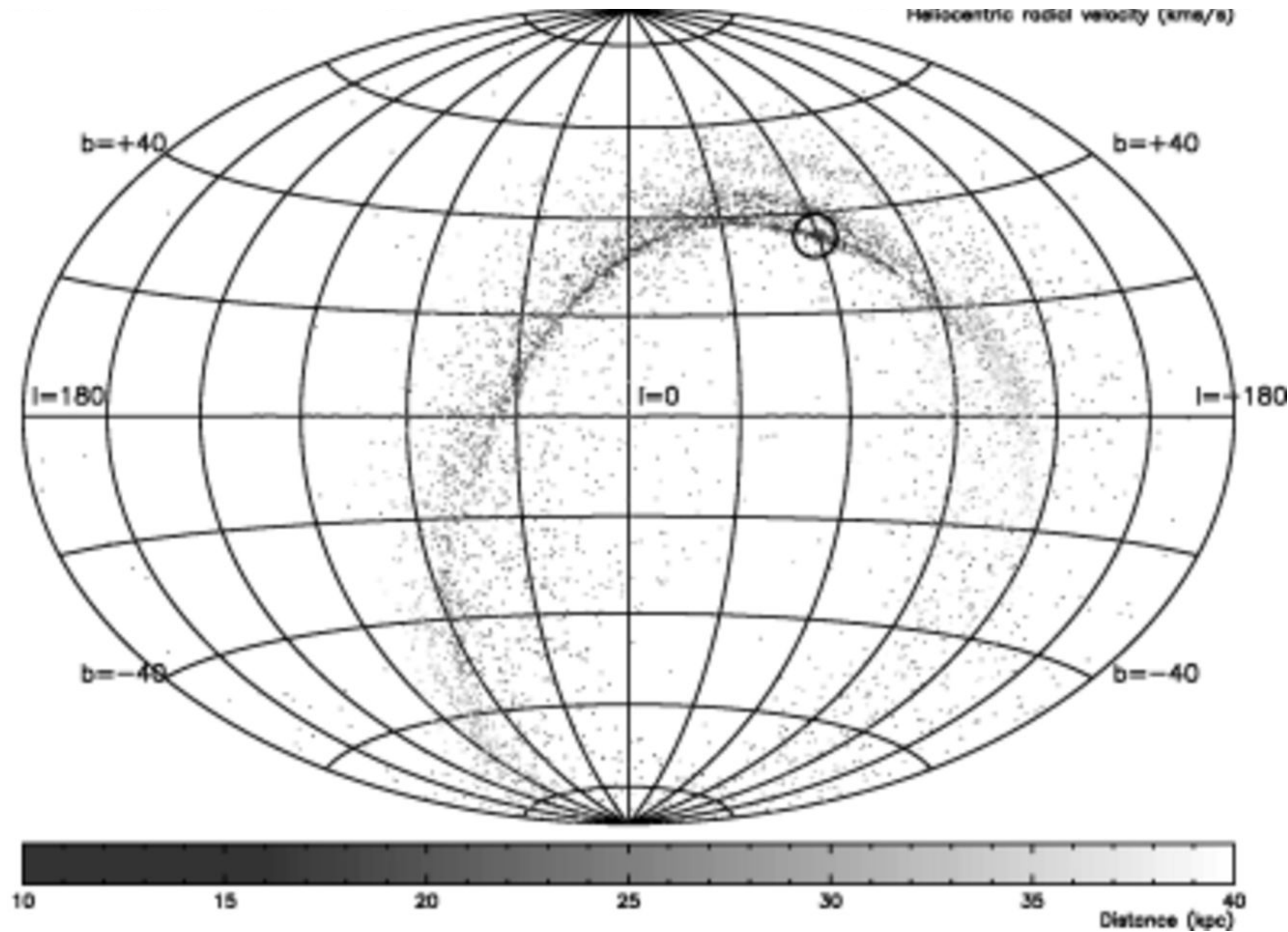
# Stream heating

Ibata et al. 2002



# Stream heating

Ibata et al. 2002



# Gaps in stellar streams

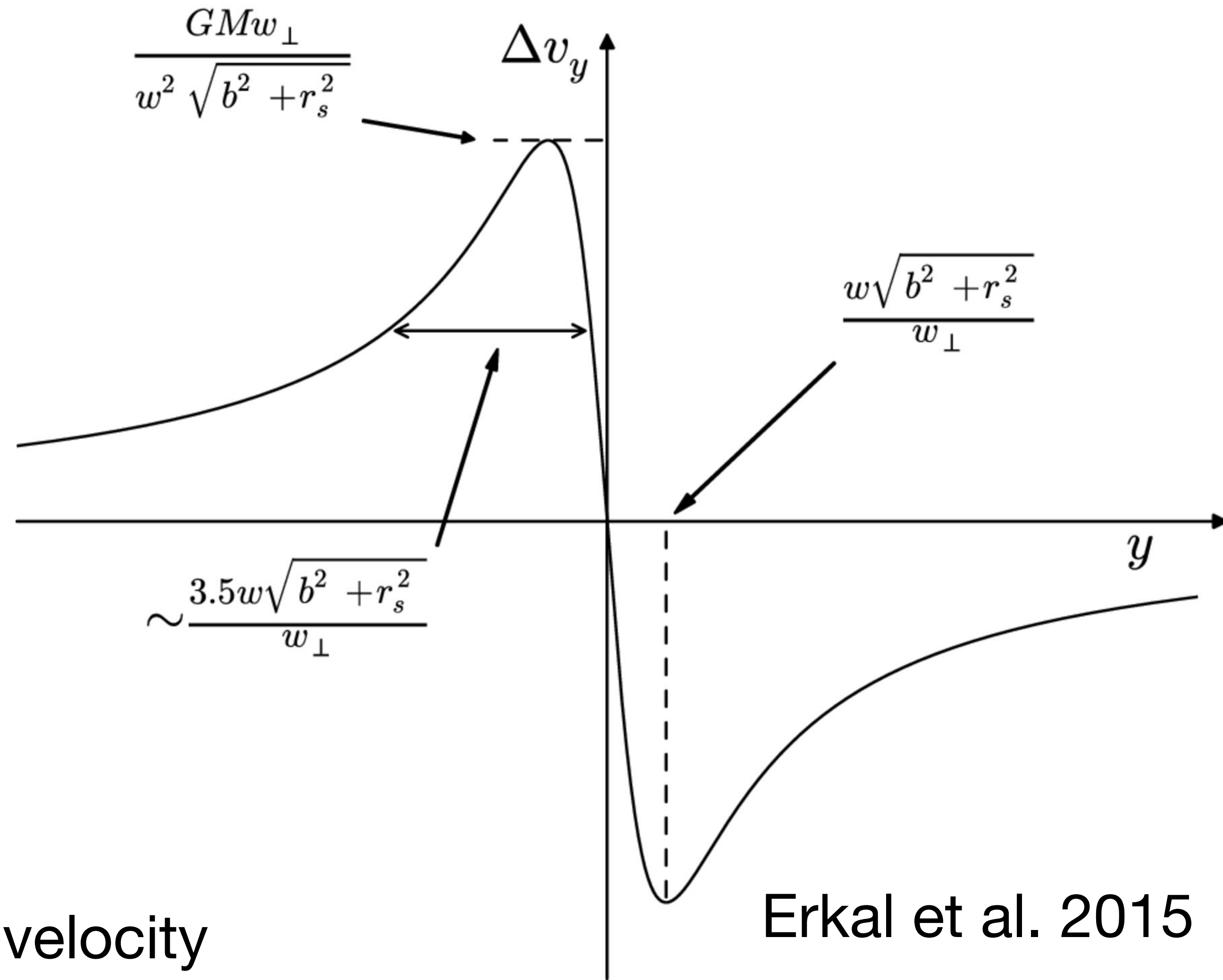
Gravitational flybys

$$\Delta v_y = \frac{GM}{bv}$$

Impactor mass  $\downarrow$   $GM$

Impact parameter  $\nearrow$   $b$

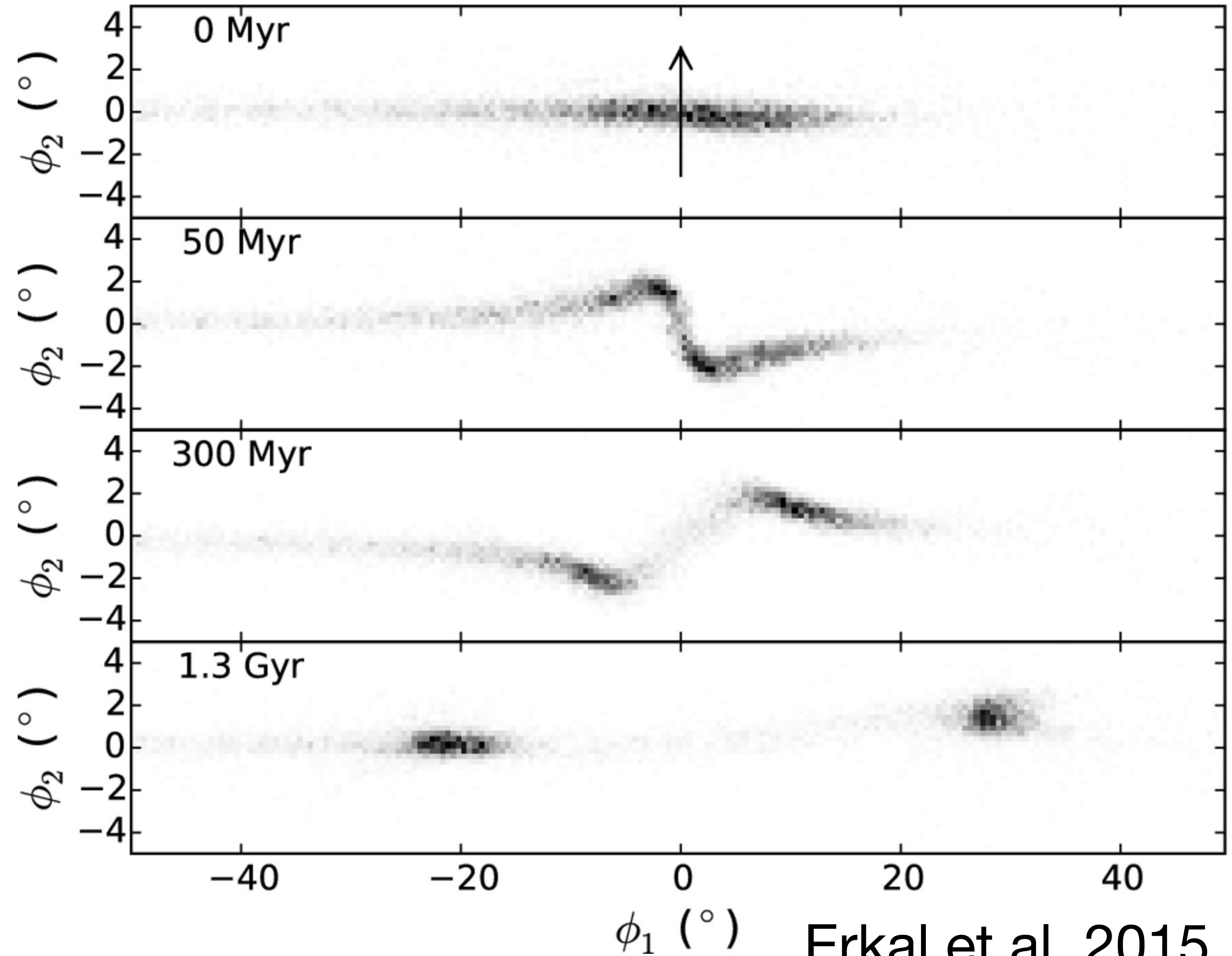
Relative velocity  $\nwarrow$   $v$



Erkal et al. 2015

# Gaps in stellar streams

Gravitational flybys



Erkal et al. 2015

# Inferring impacts from Dark Matter Subhalos

## A degenerate problem

### Impactor properties

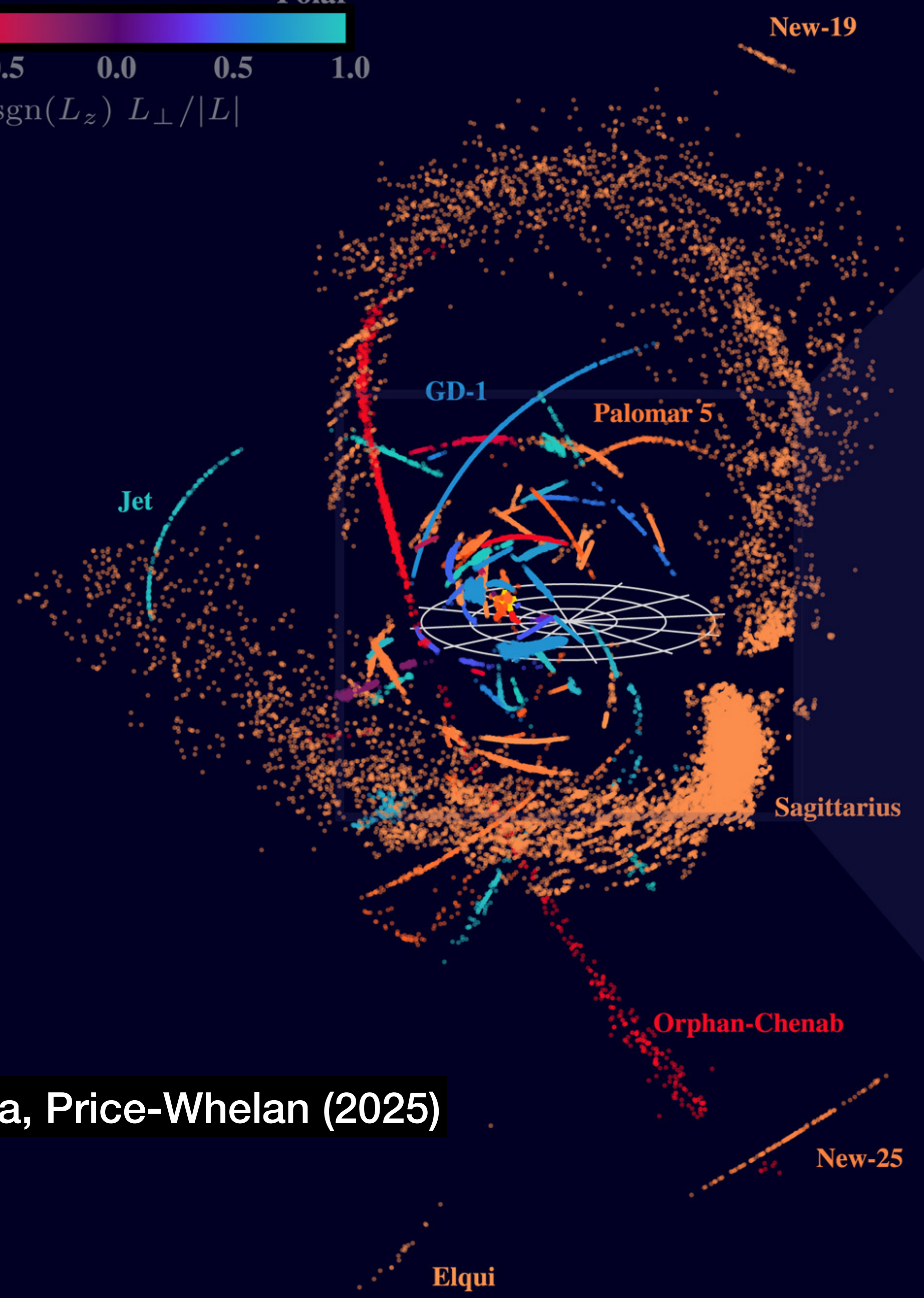
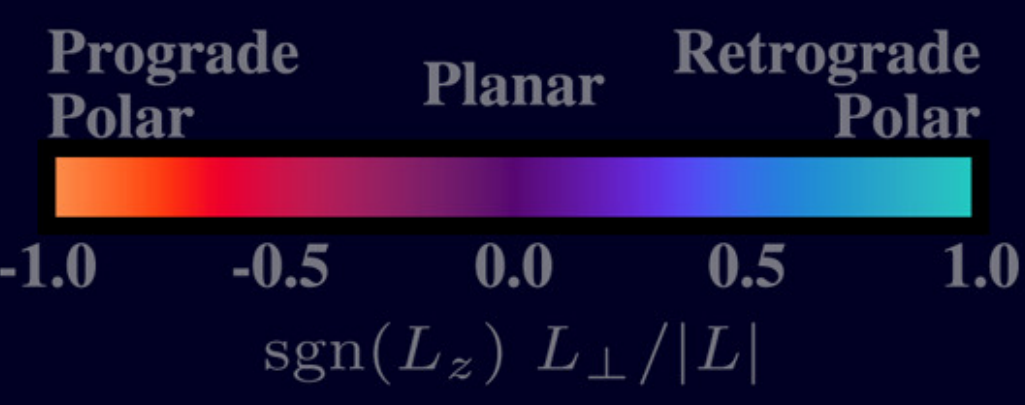
- (2)
- Mass
  - size

### Impact Geometry

- (5)
- Impact parameter
  - Perpendicular velocity
  - Parallel velocity
  - Angle
  - Time since impact

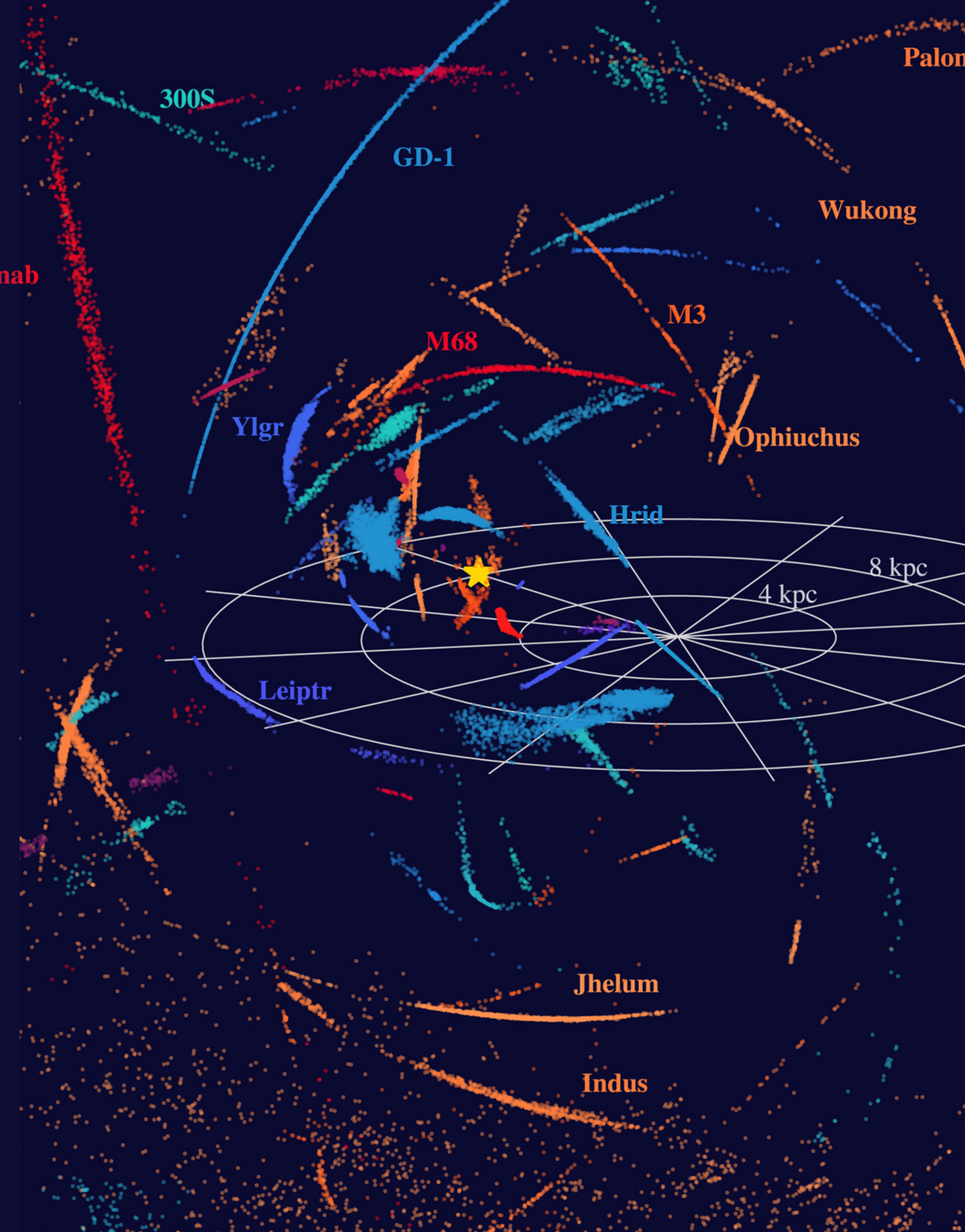
### Gap observables

- (2)
- Gap width
  - Density contrast

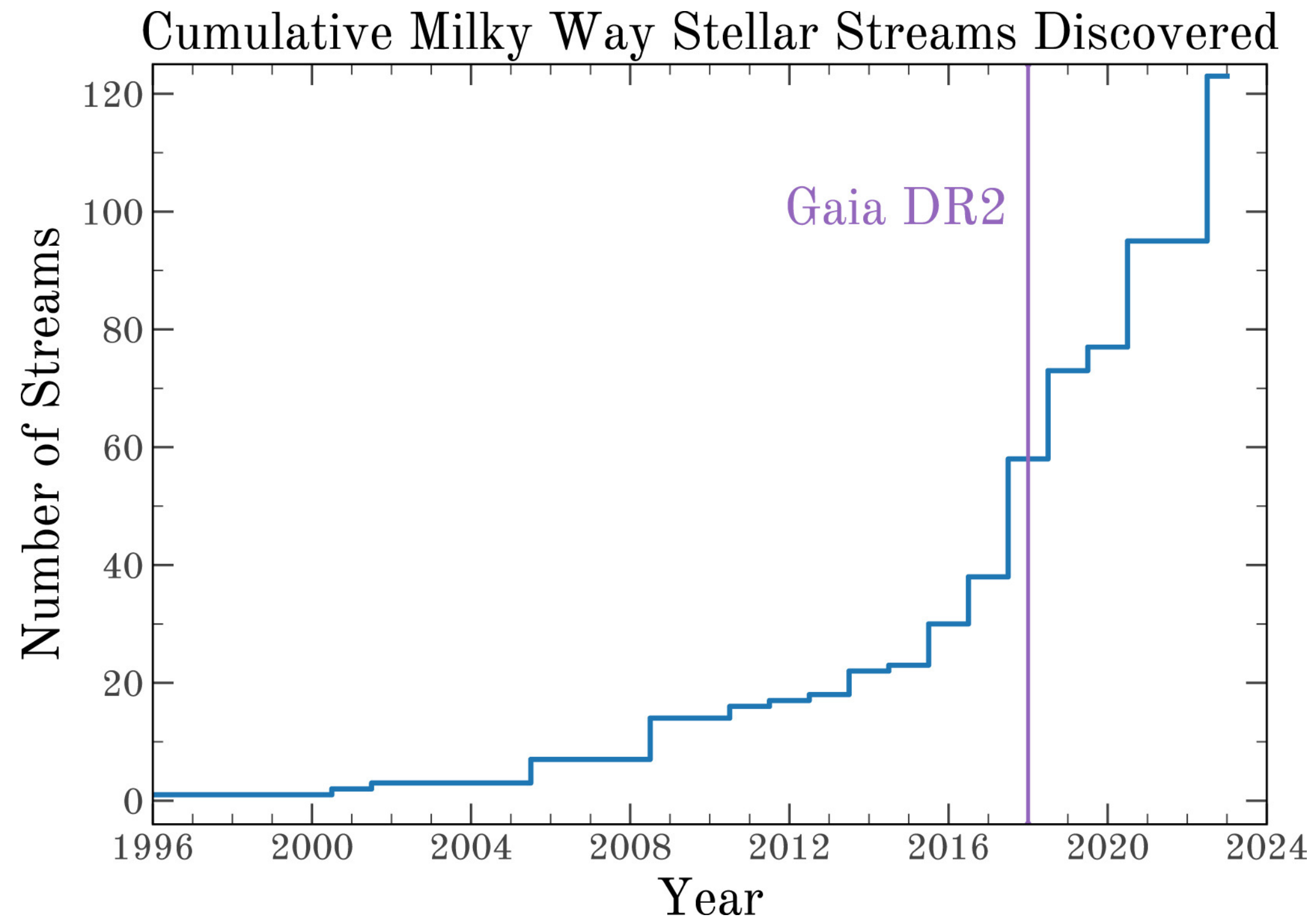


**Bonaca, Price-Whelan (2025)**

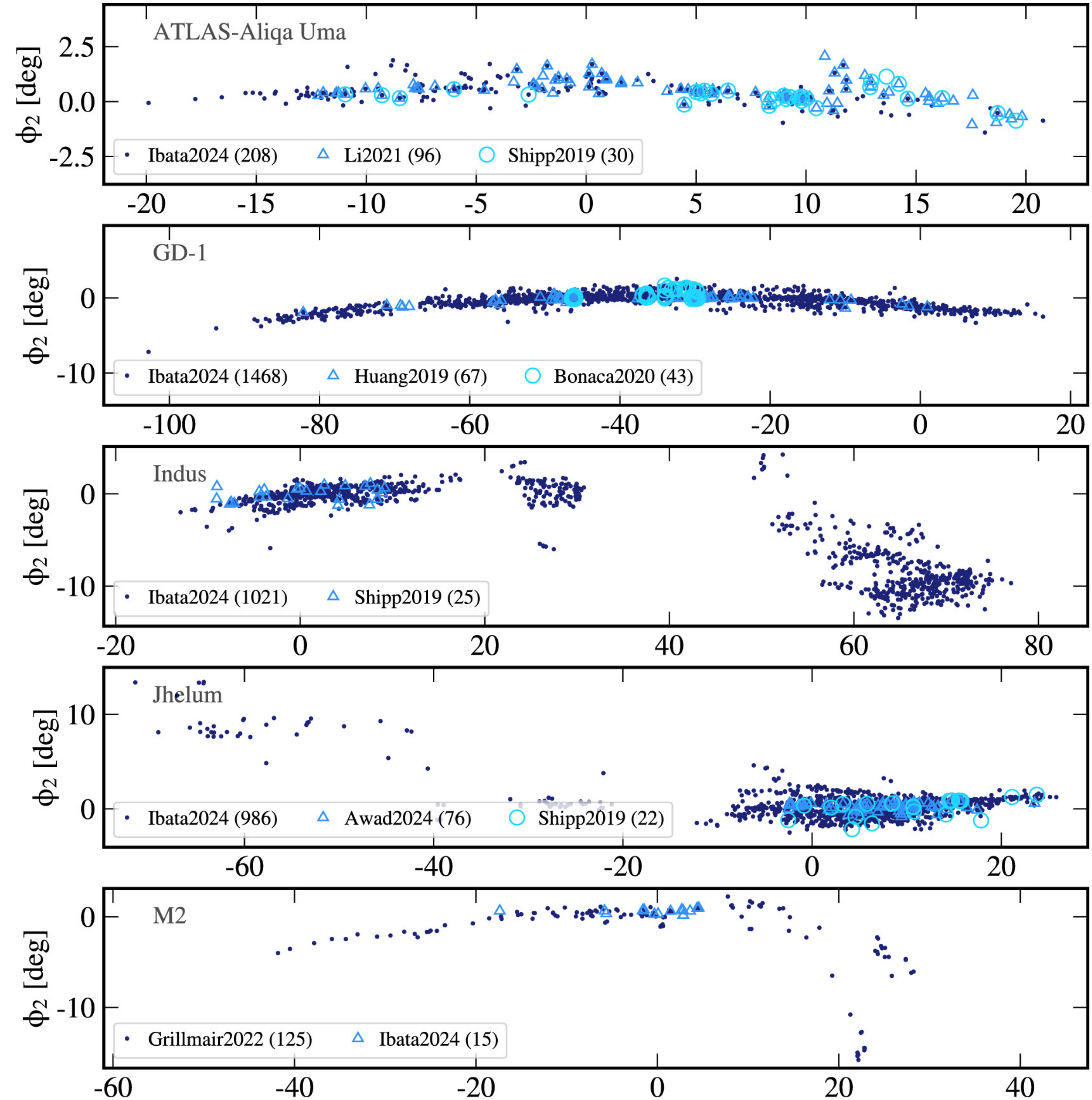
Orphan-Chenab



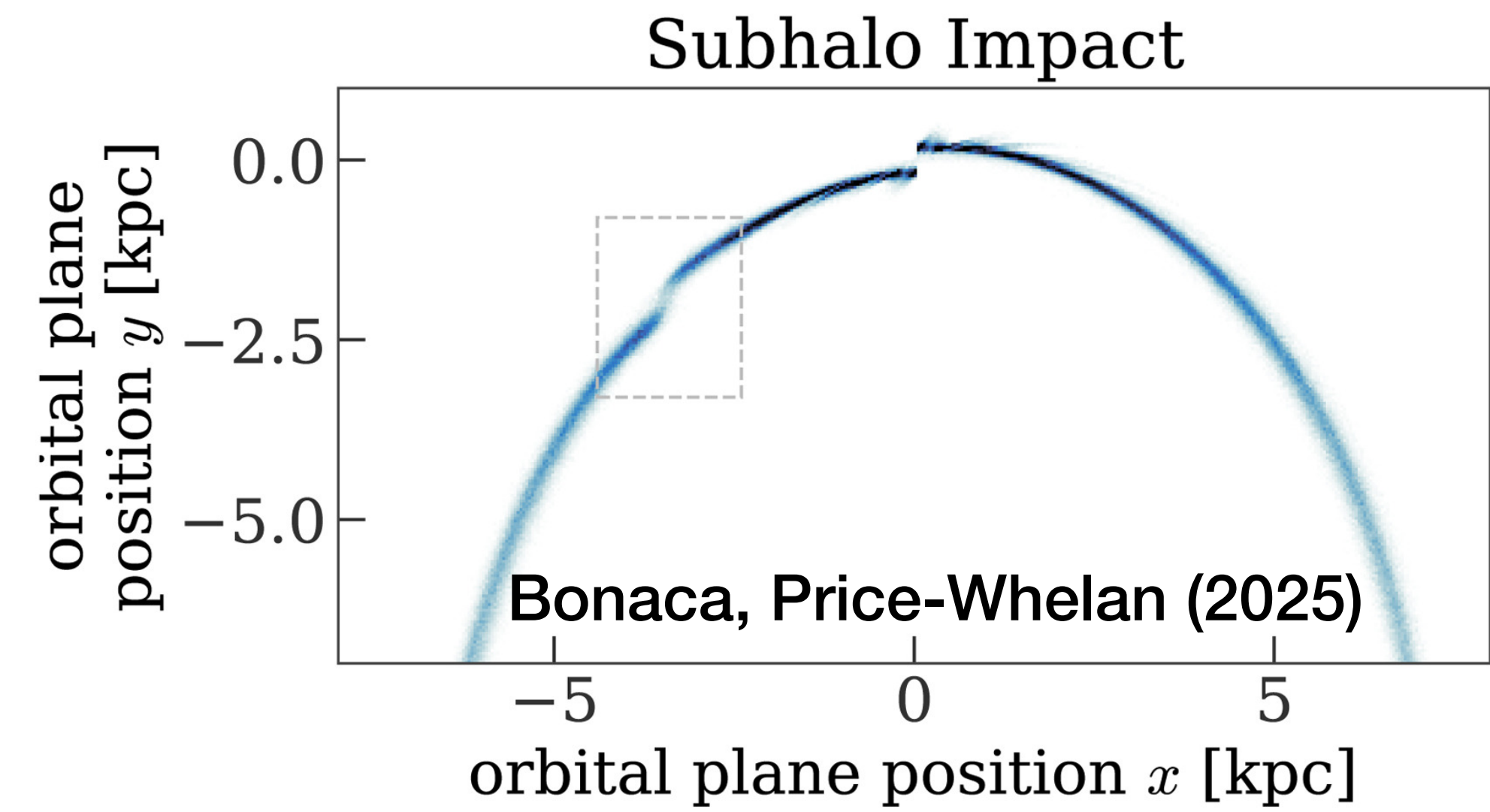
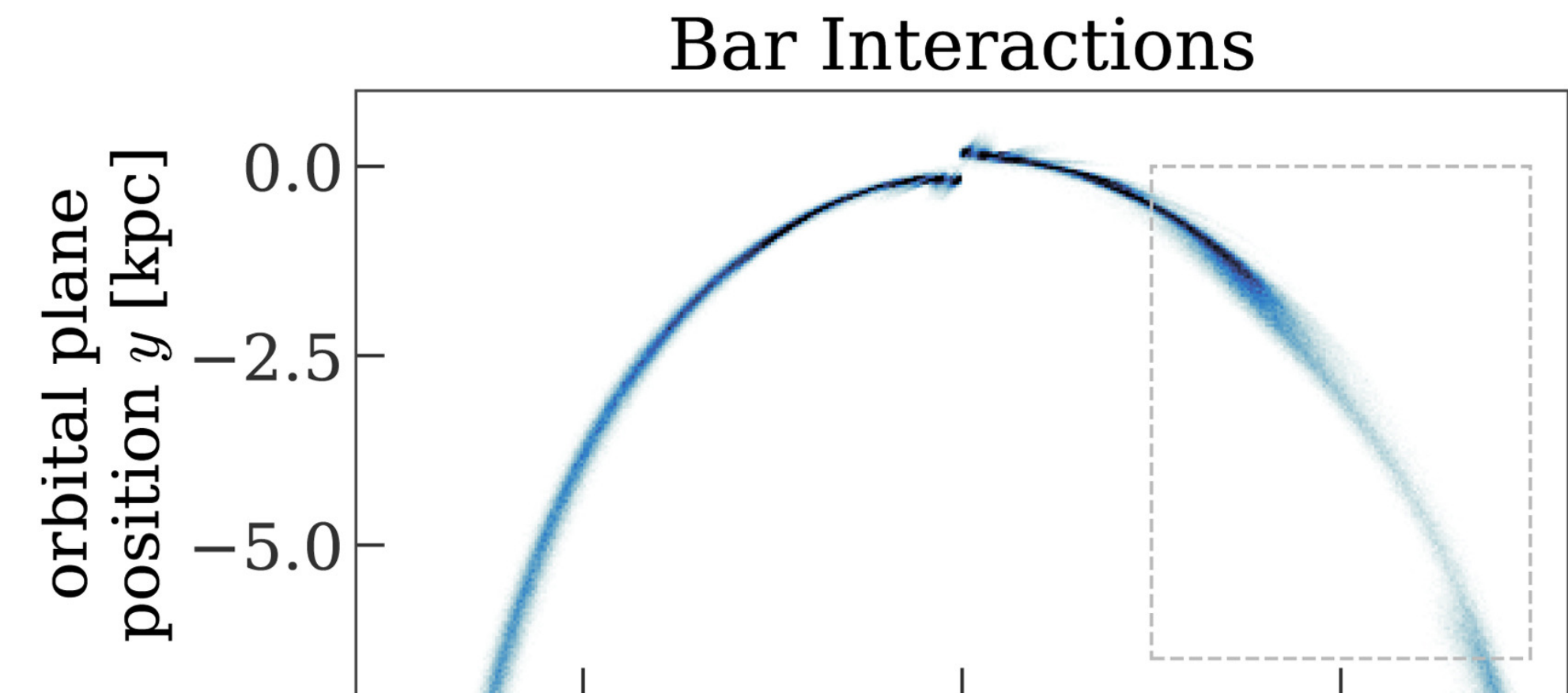
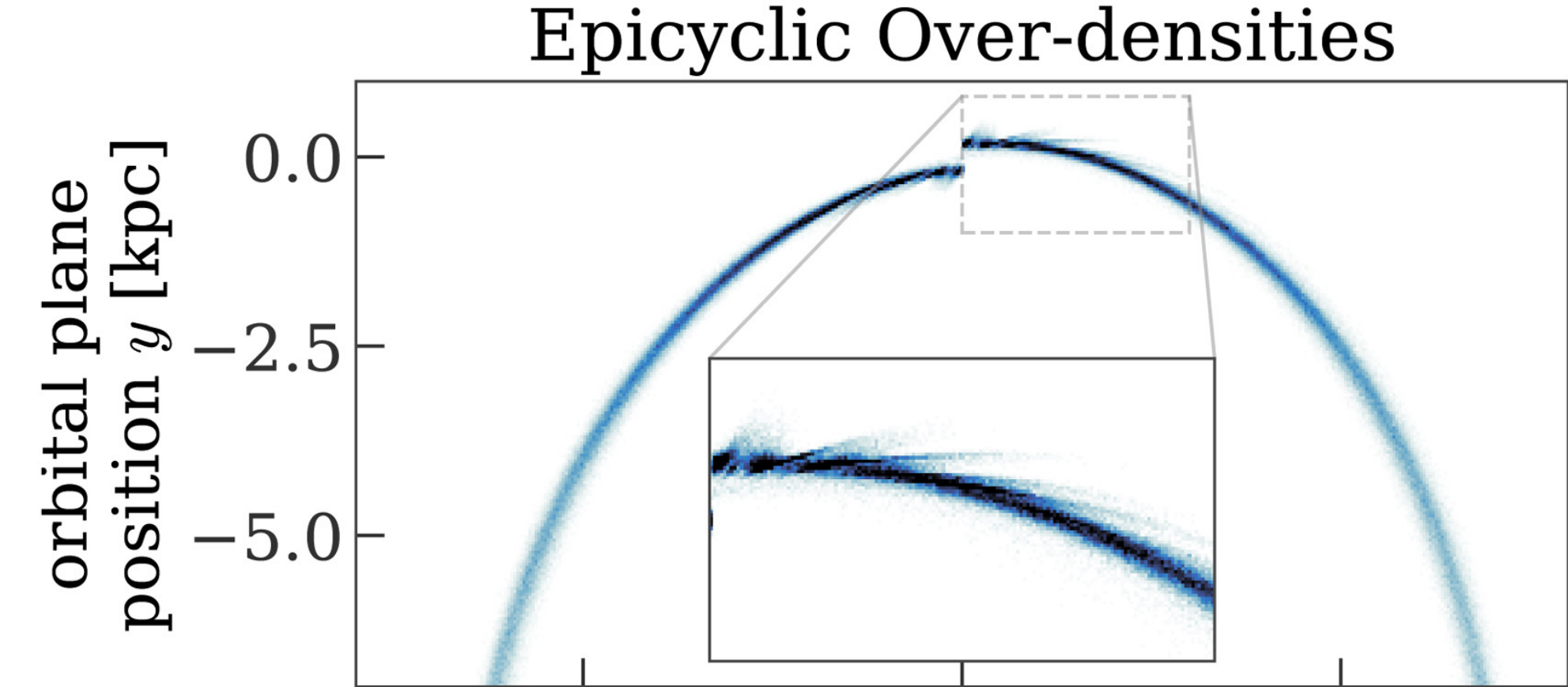
# Milky Way streams



Bonaca, Price-Whelan (2025)



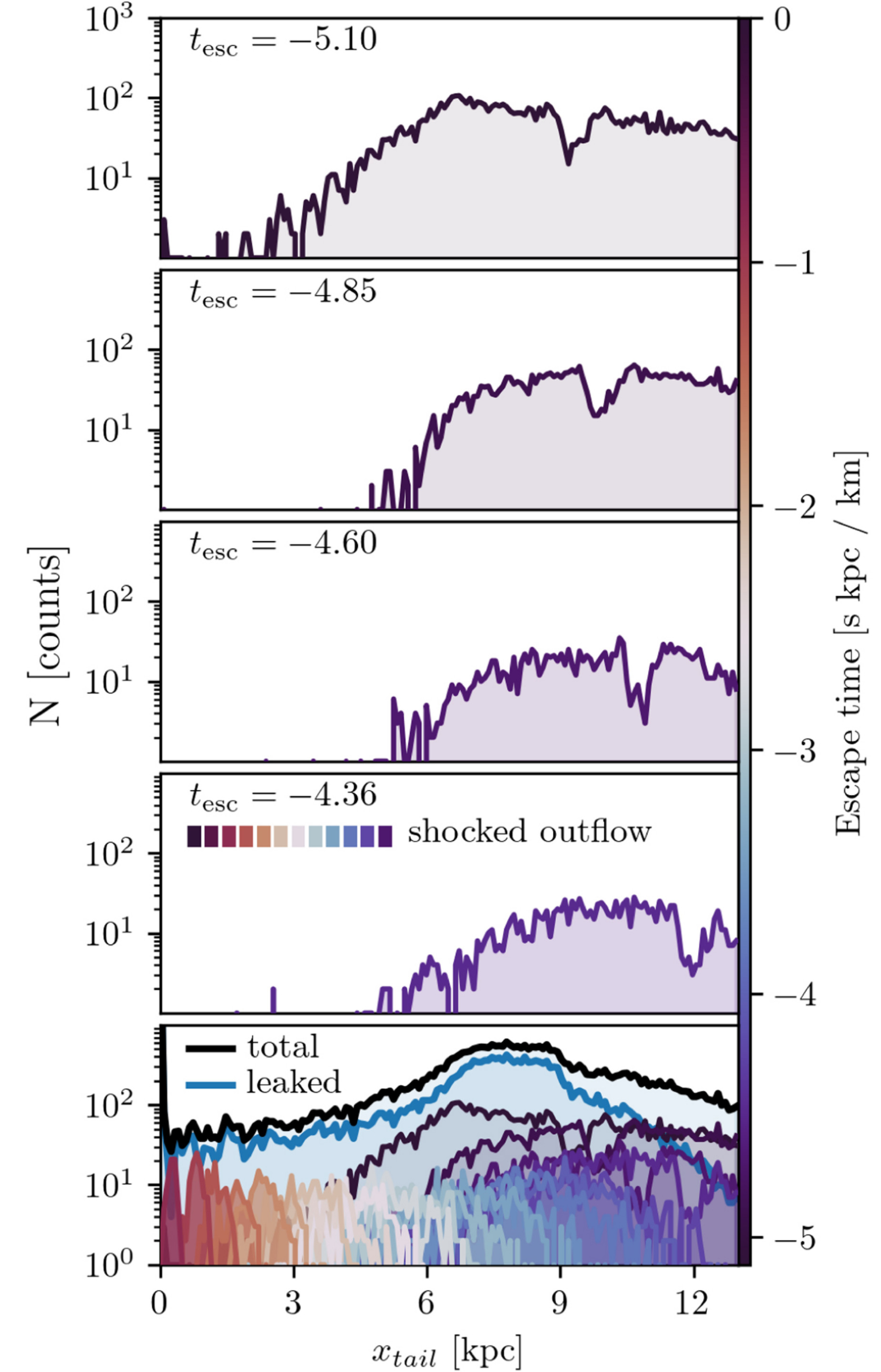
# Gaps from various processes



# Ferrone et al. 2025

## Can globular clusters cause gaps?

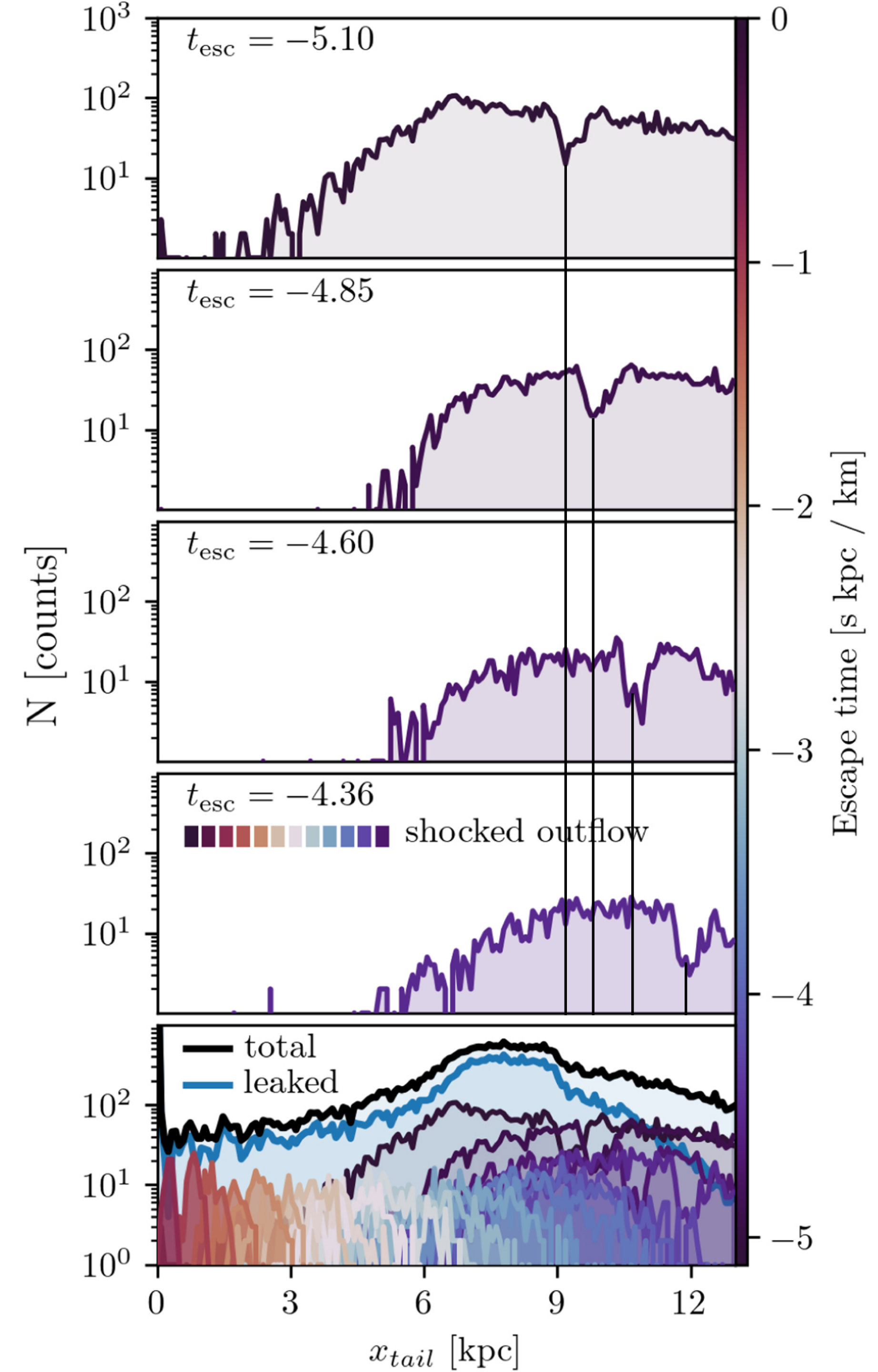
Gap decoherence mechanism



# Ferrone et al. 2025

## Can globular clusters cause gaps?

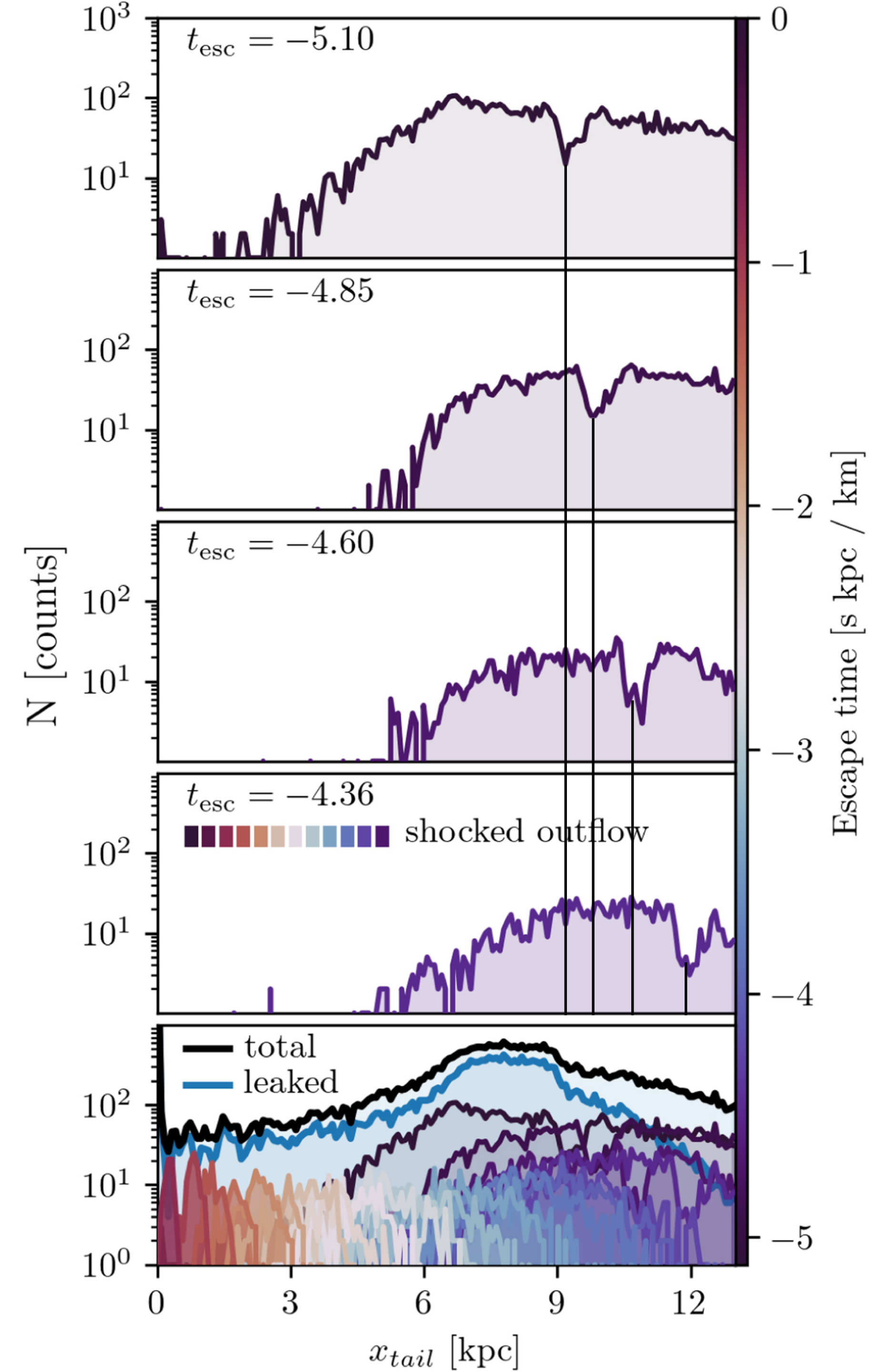
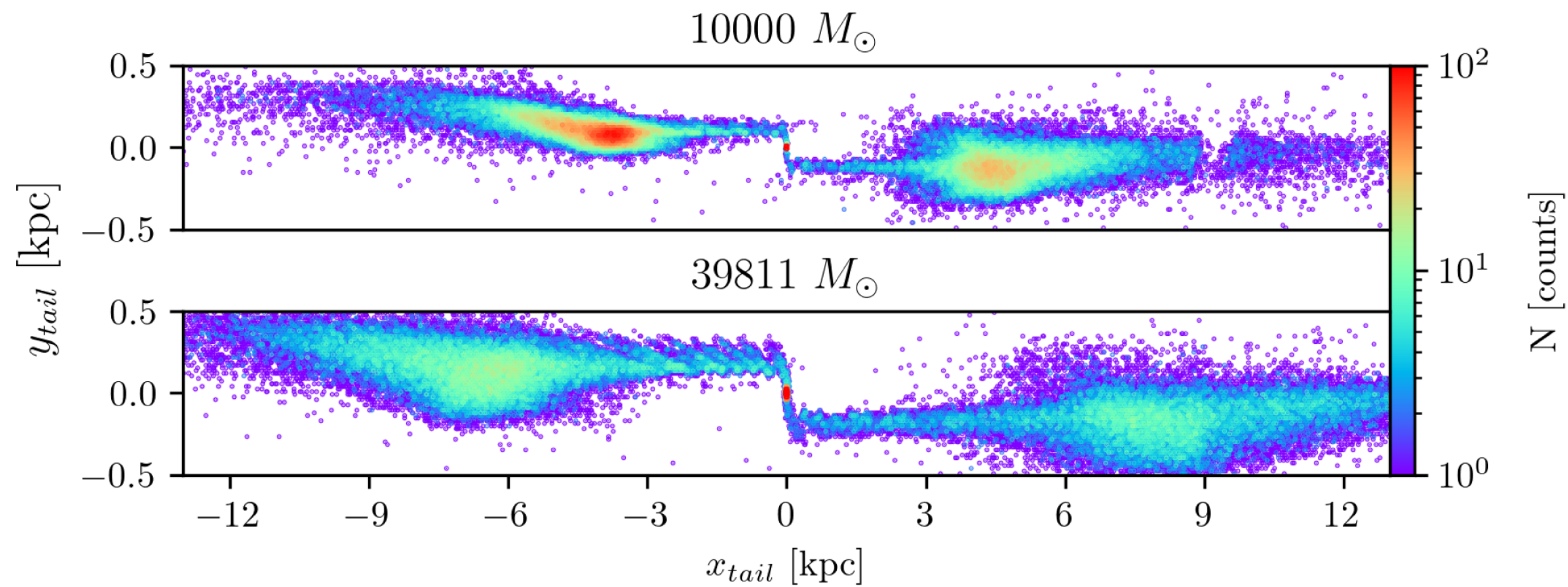
Gap decoherence mechanism



# Ferrone et al. 2025

## Can globular clusters cause gaps?

Gap decoherence mechanism



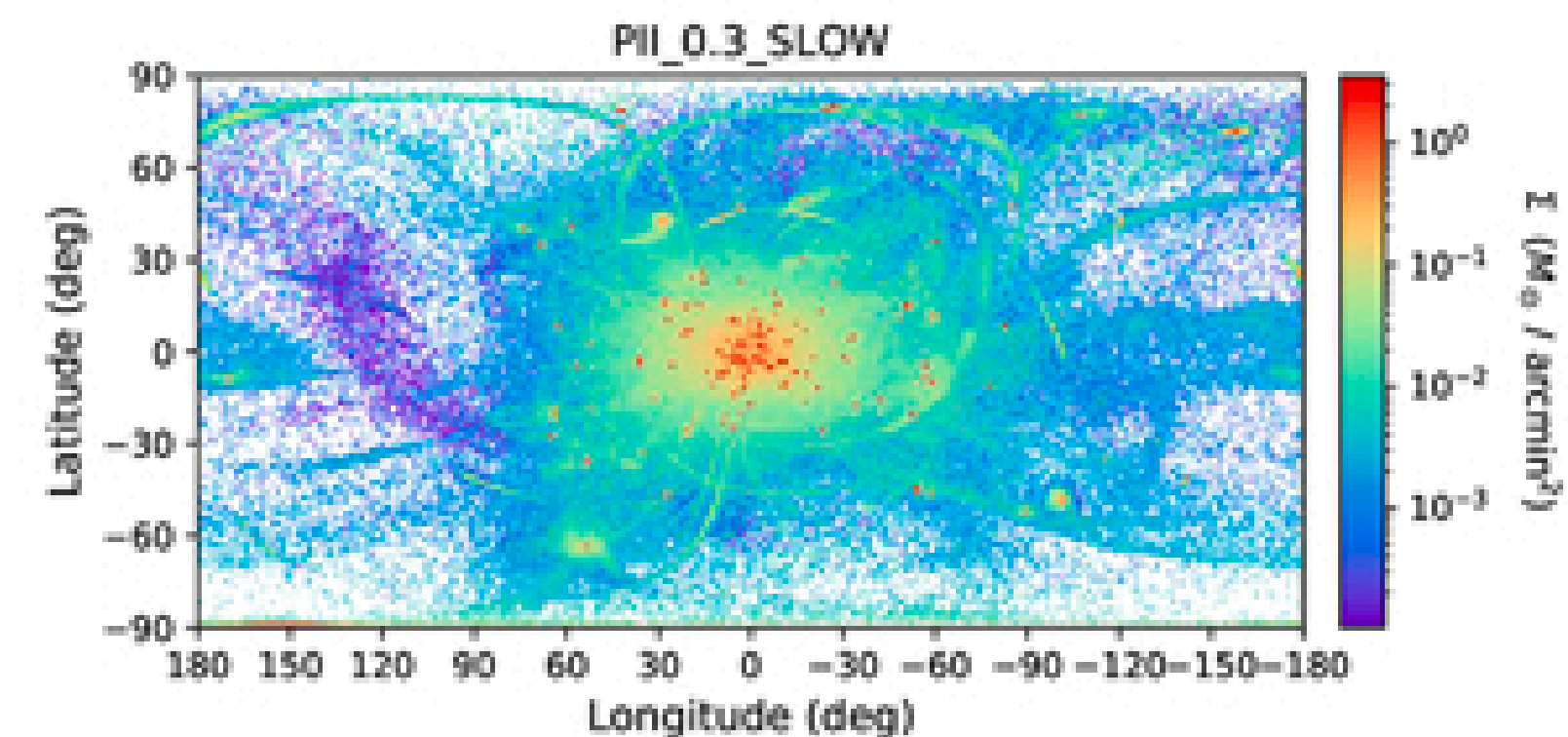
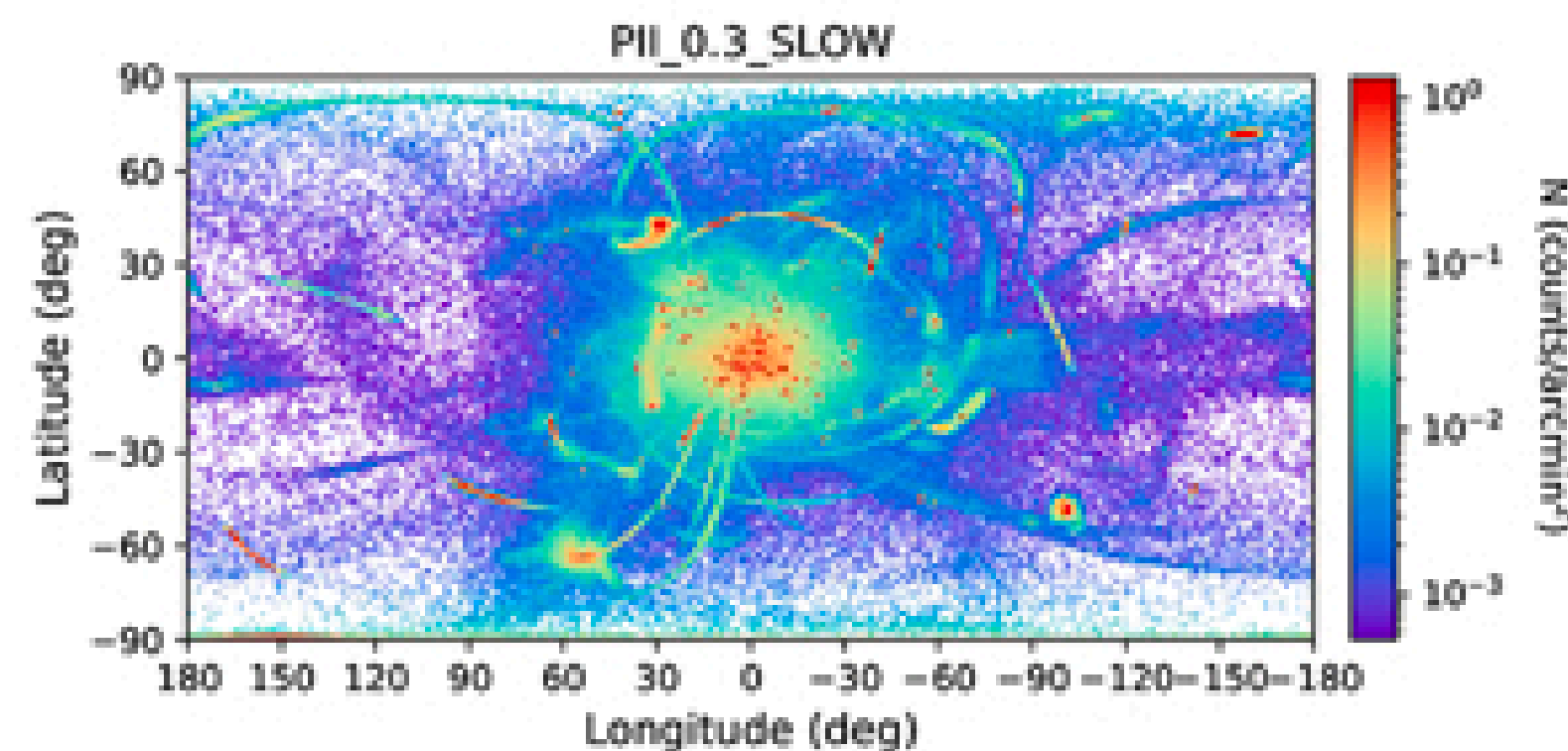
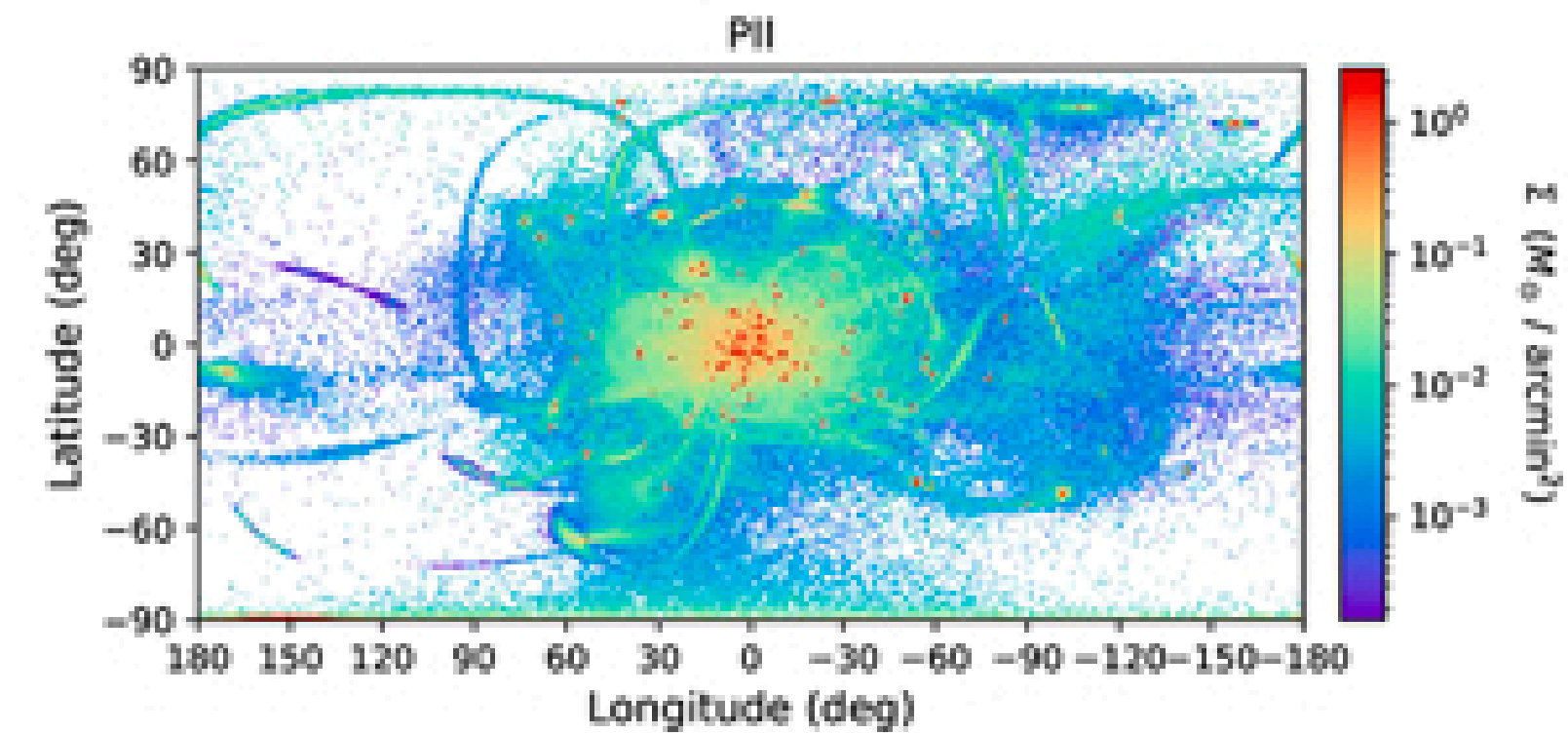
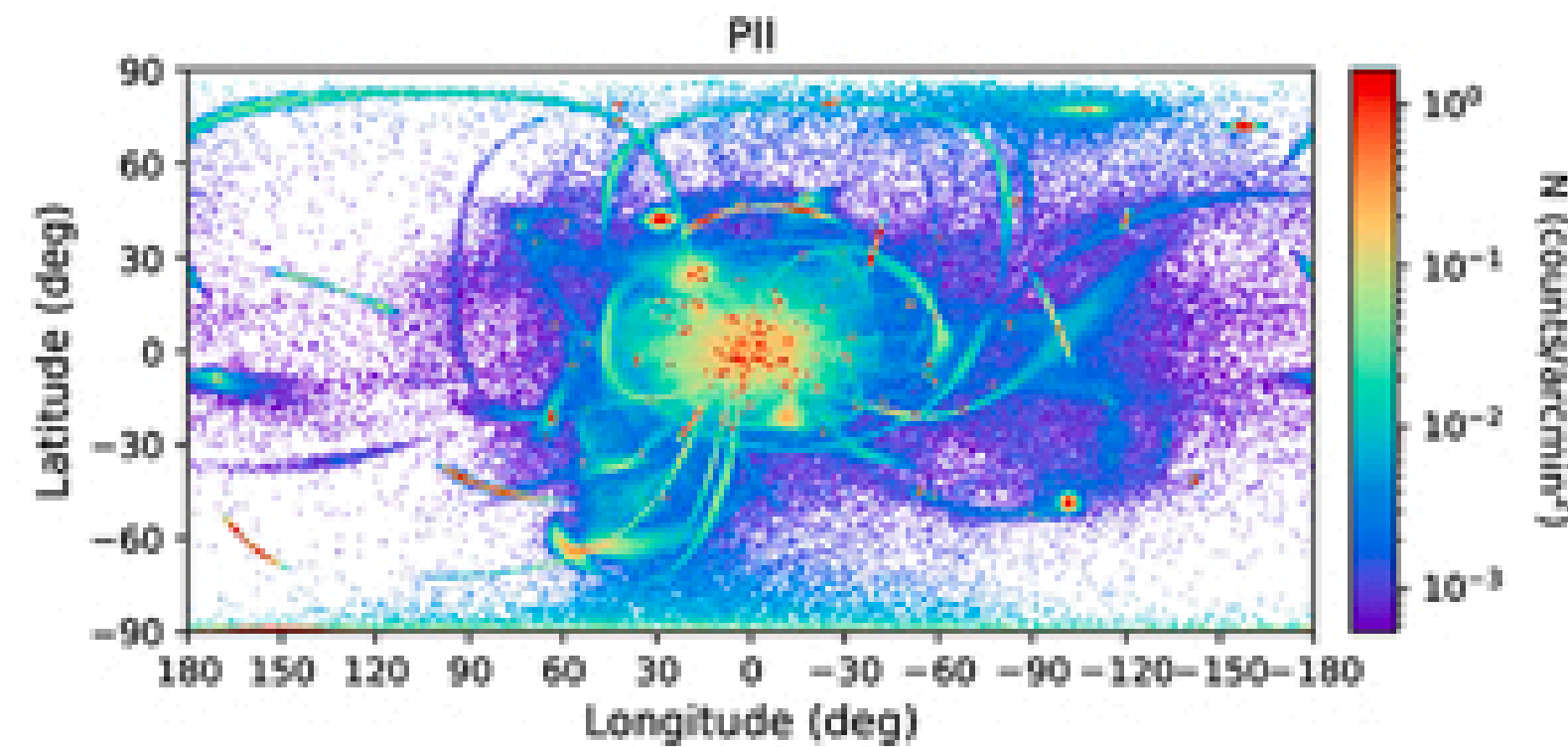
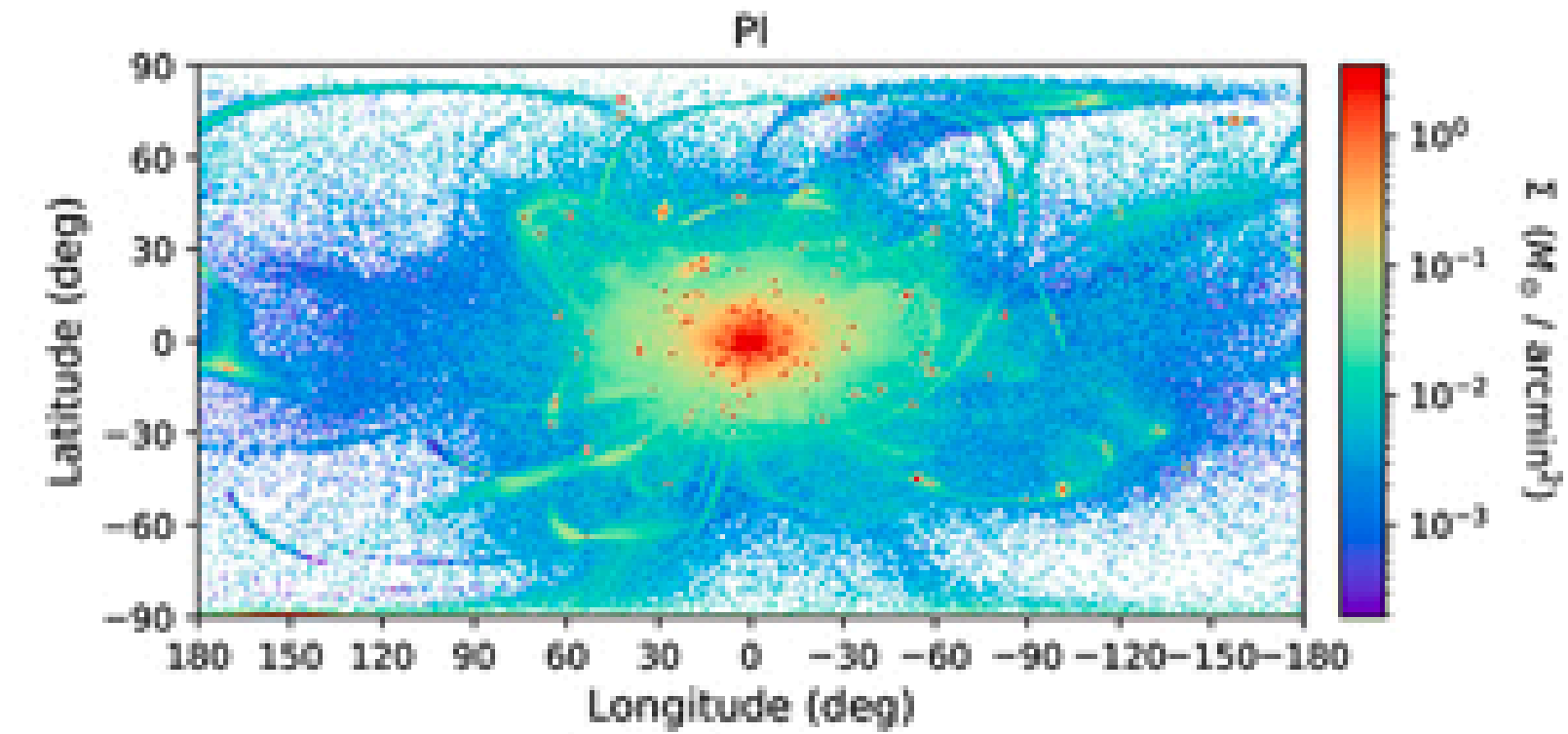
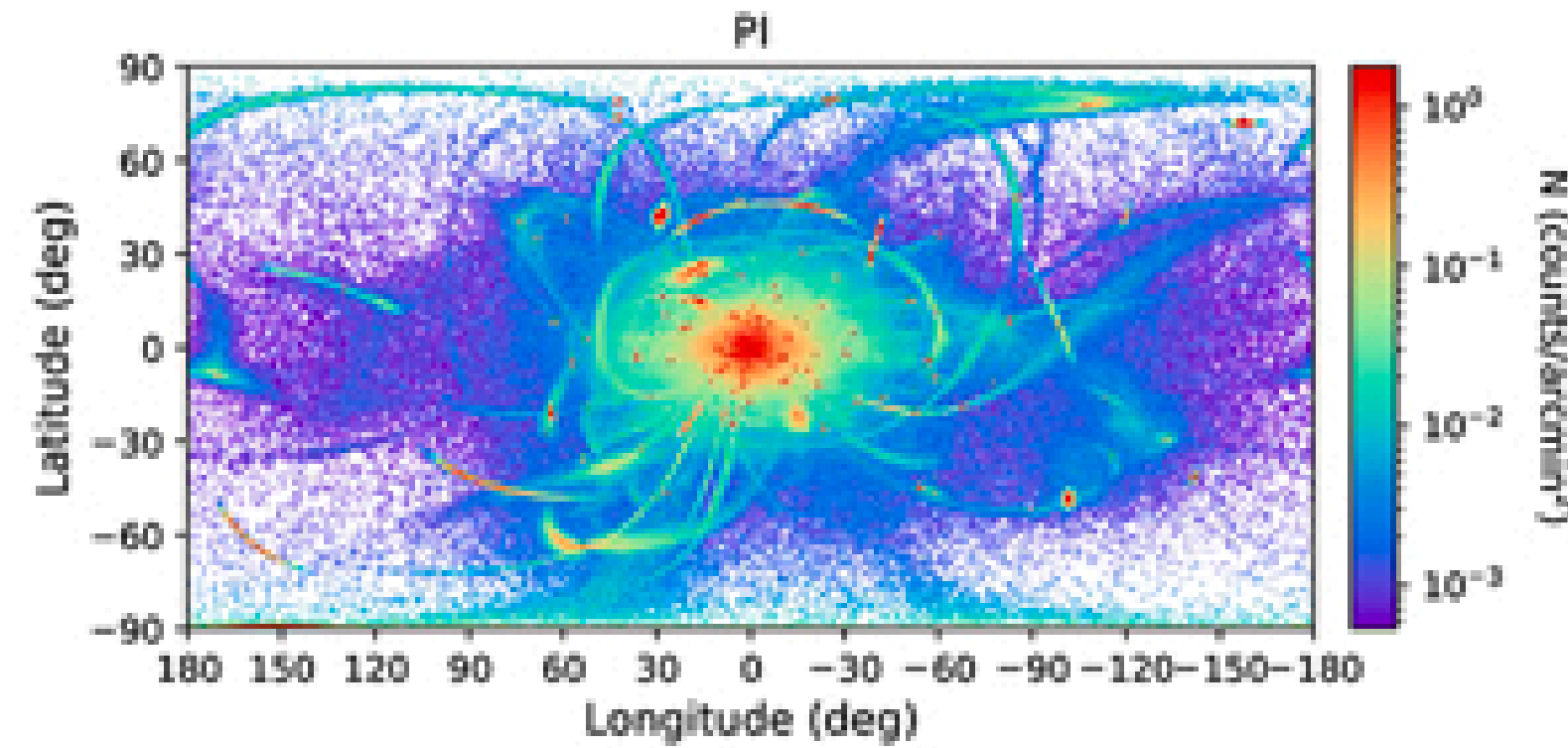
# Ferrone et al. 2023

## Data base

[etidal-project.obspm.fr](http://etidal-project.obspm.fr)

## GC Stream catalogue

- 3 galactic potentials
- 150 globular clusters
- 50 realizations



# Conclusion and on going work

## Two-year fellowship

- How to handle gap degeneracy for dark matter inference?
- Creating an improved stream catalog
- Thesis online:
- [salvatore-ferrone.github.io/phd-thesis-ferrone/](https://salvatore-ferrone.github.io/phd-thesis-ferrone/)



Thank you for your attention

