

Information in stellar streams

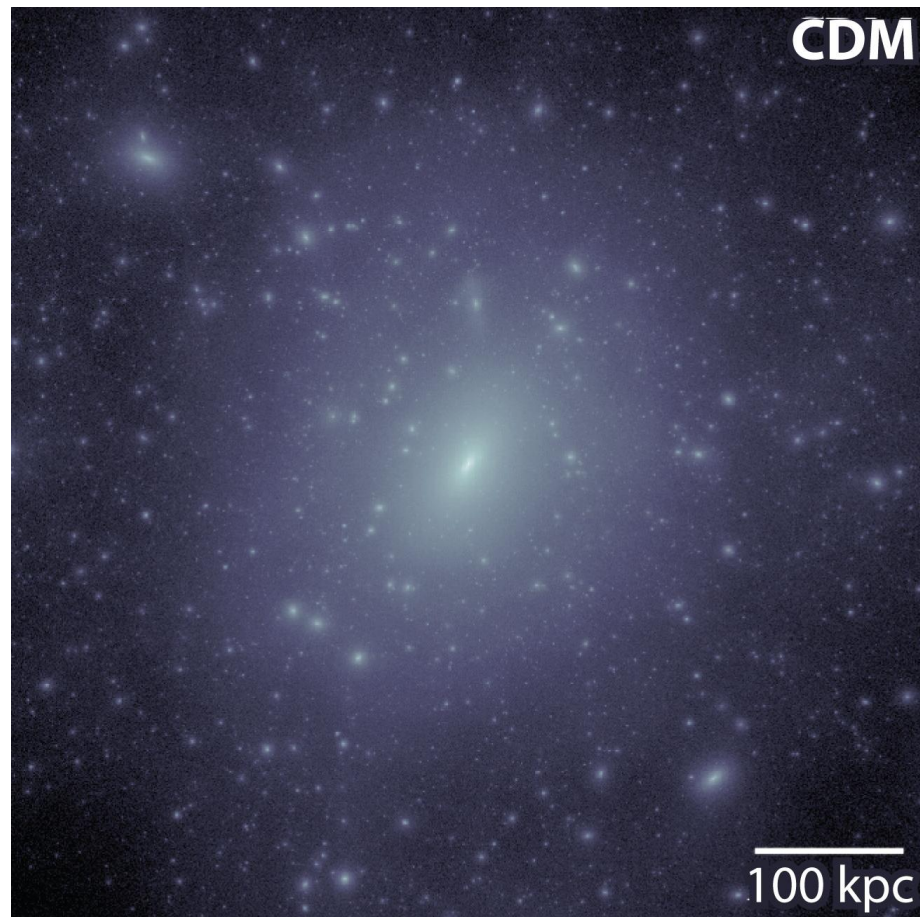
Ana Bonaca

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Center for Astrophysics

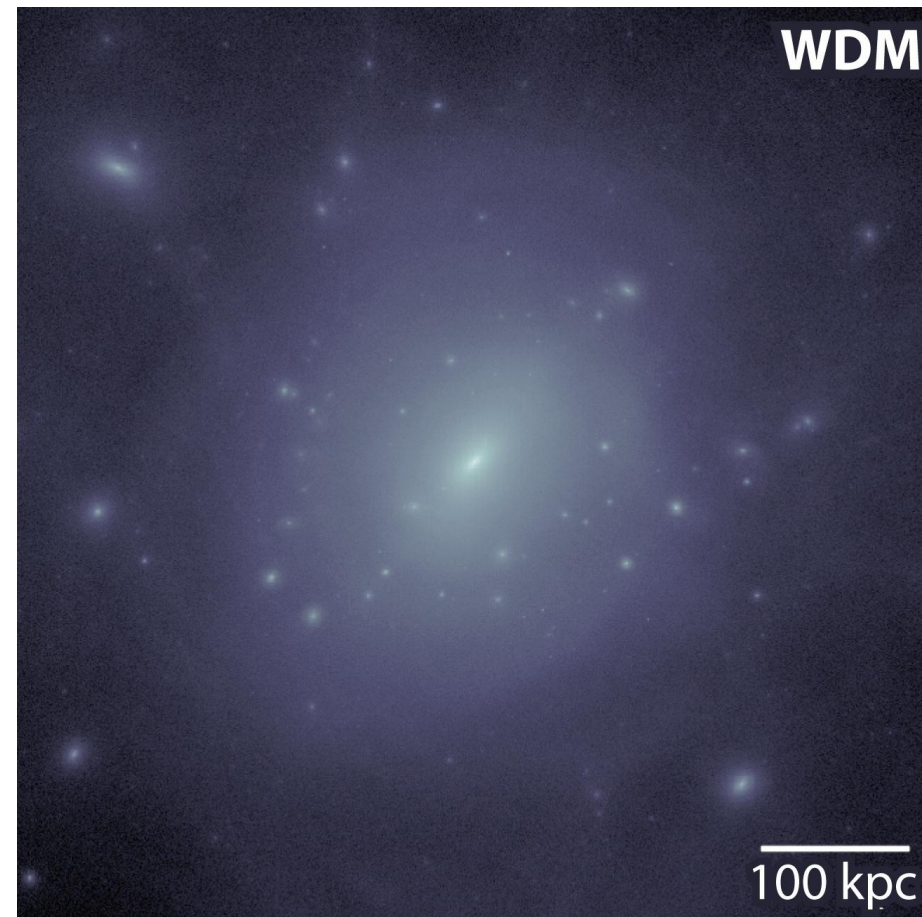
Dark matter models differ on small scales

Cold Dark Matter

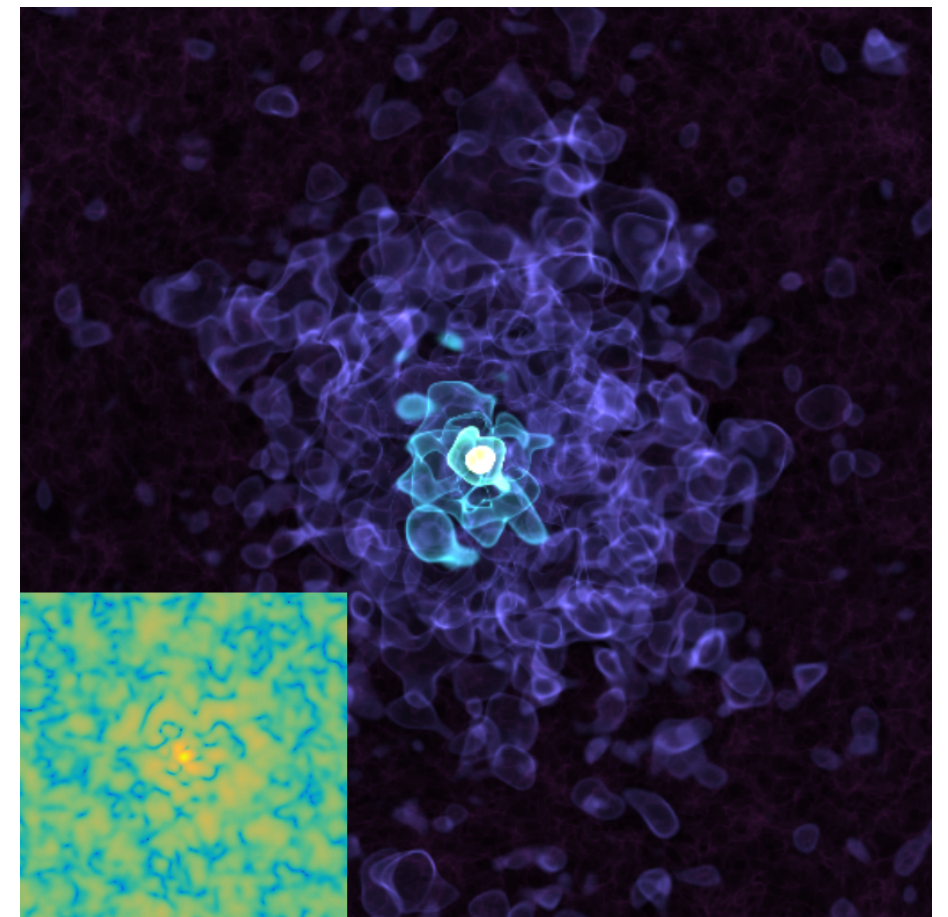


Bullock & Boylan-Kolchin (2017)

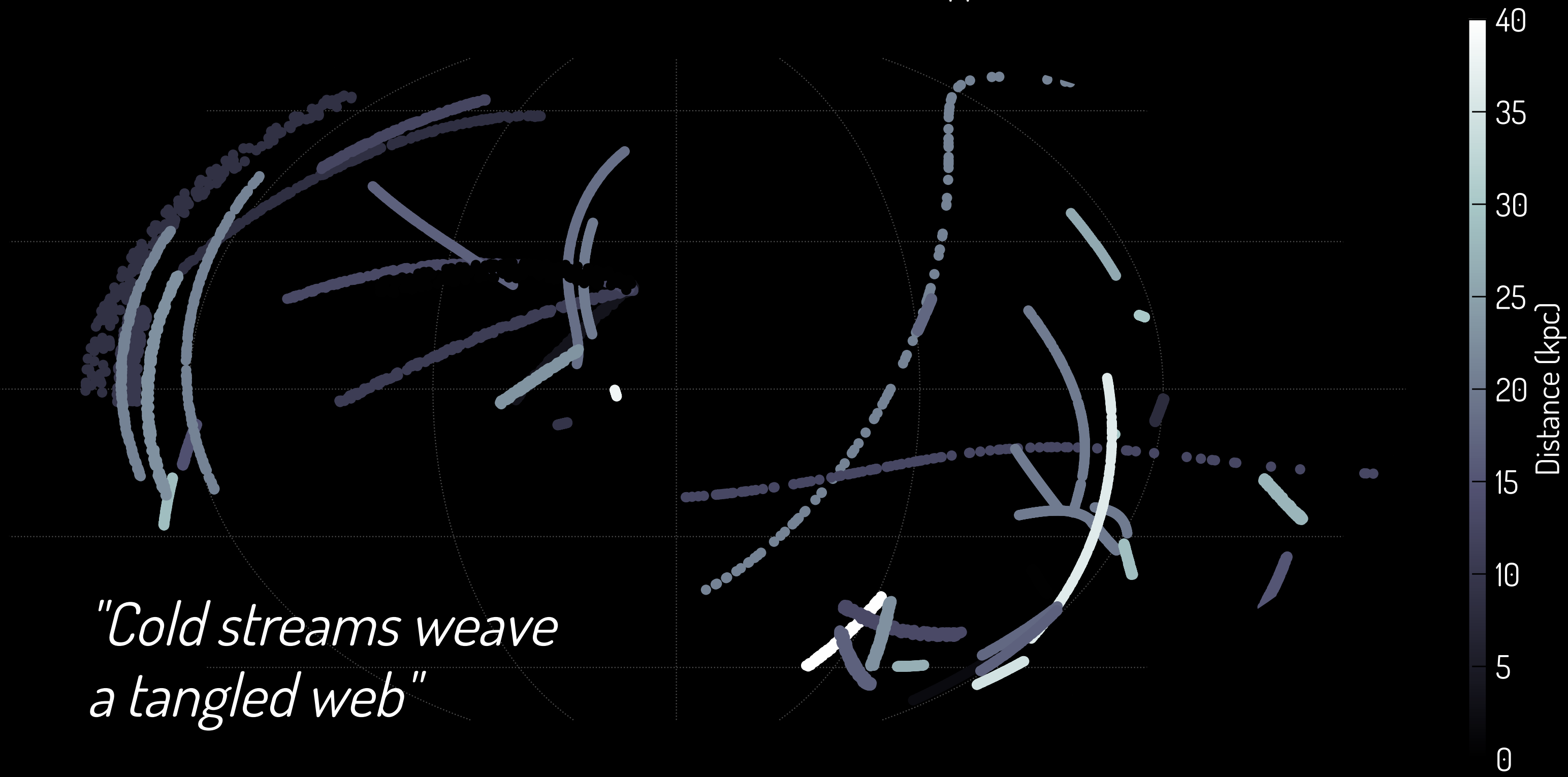
Warm Dark Matter



Bose-Einstein Condensate



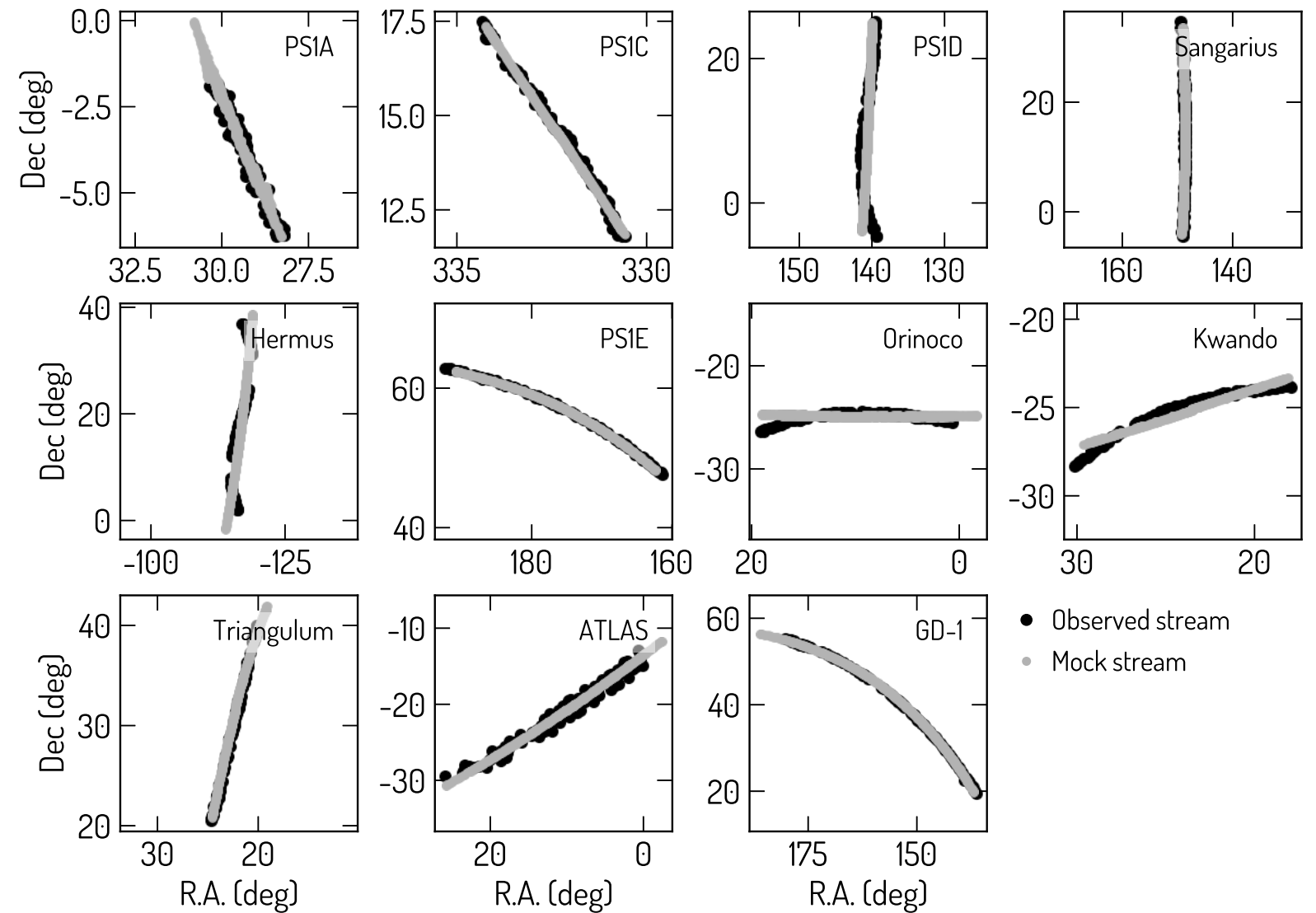
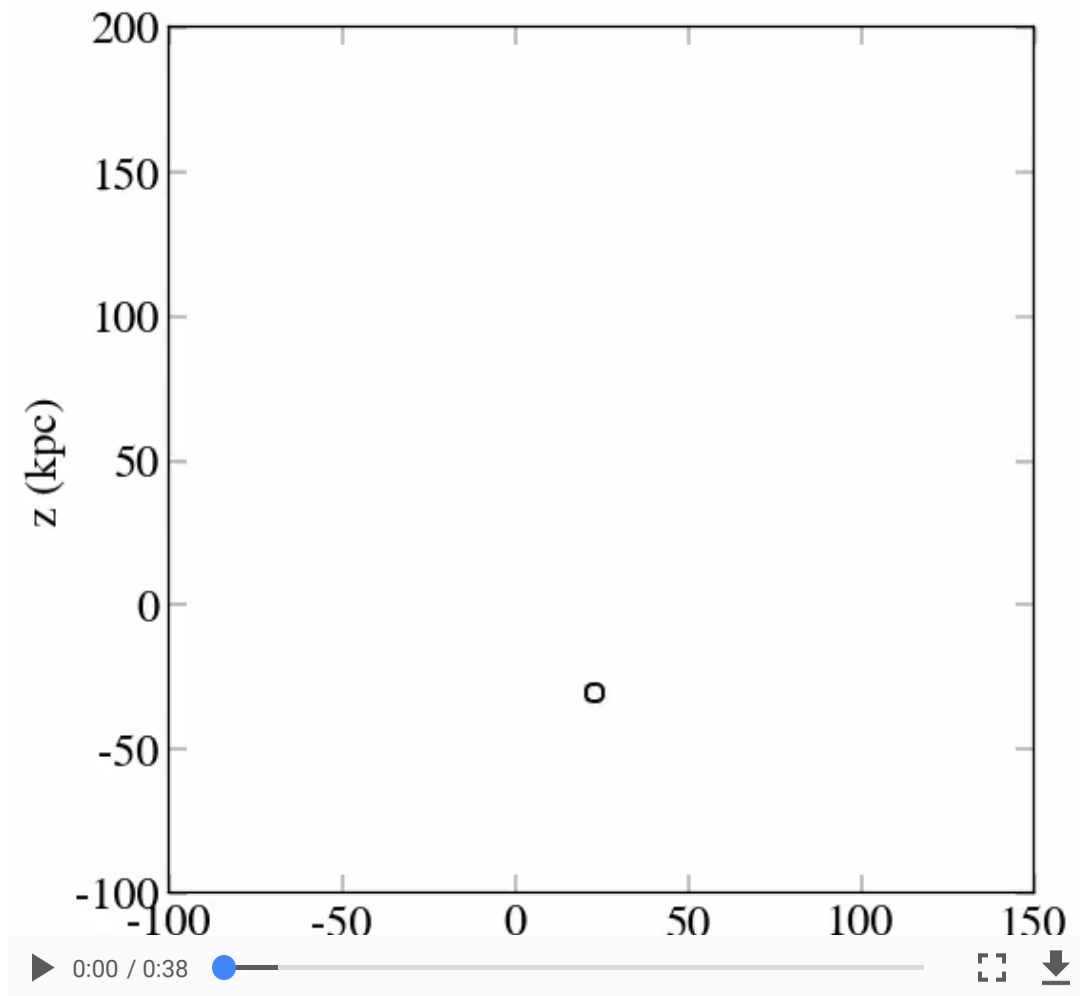
Mocz et al. (2017)



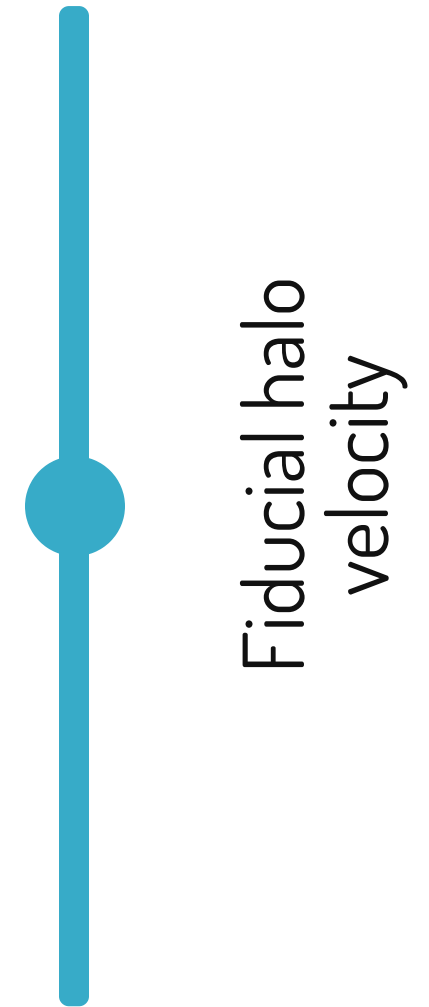
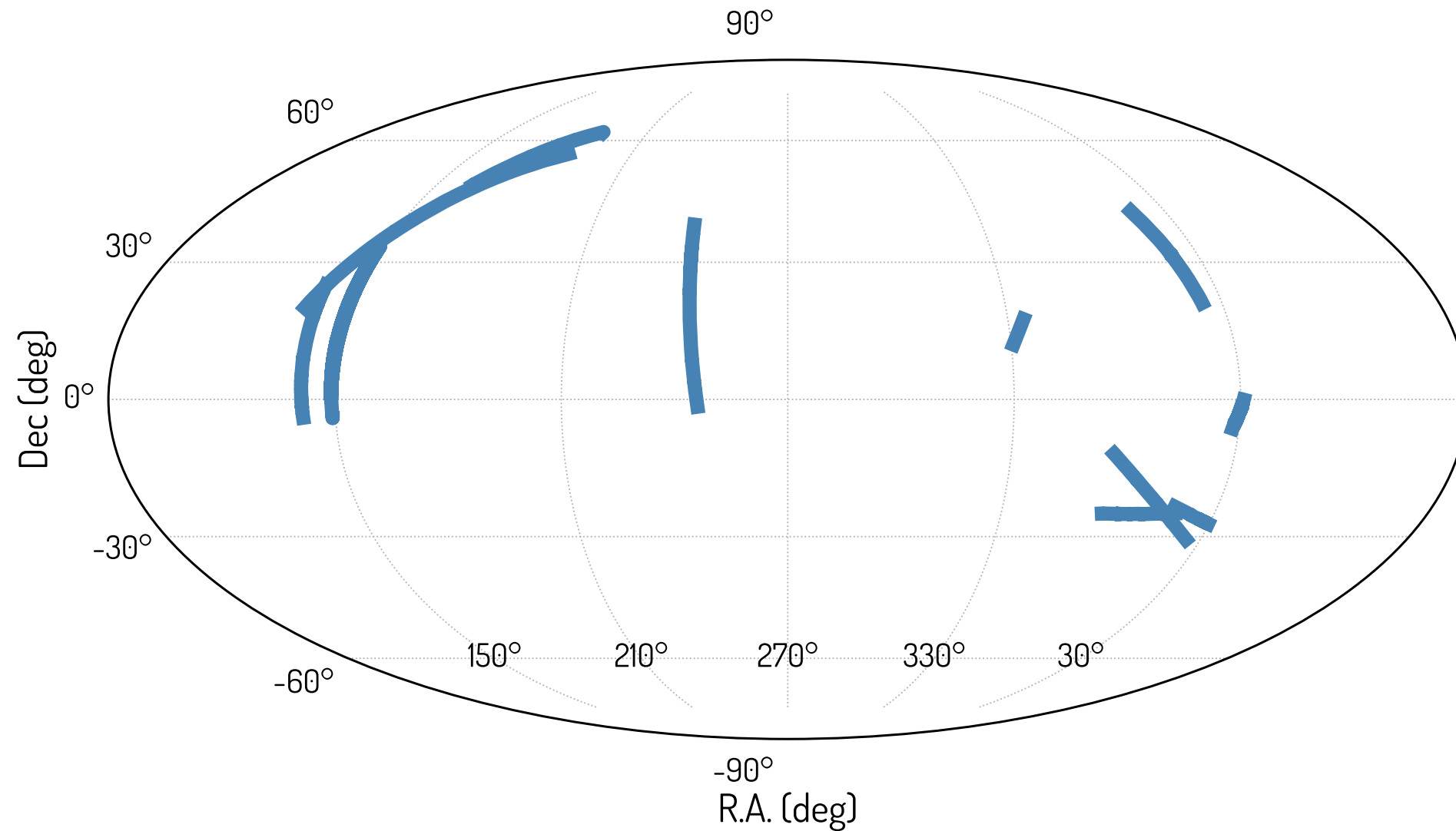
*"Cold streams weave
a tangled web"*

A sample of mock streams is similar to the known Galactic streams

Generative model for stellar streams

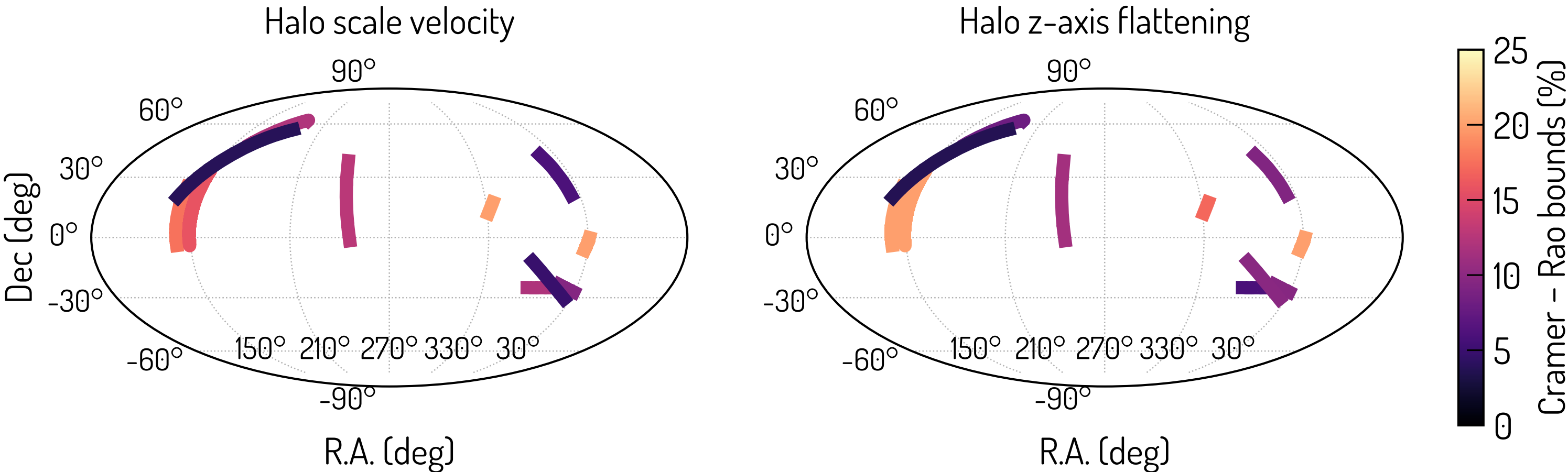


Different streams are differently sensitive to halo parameters

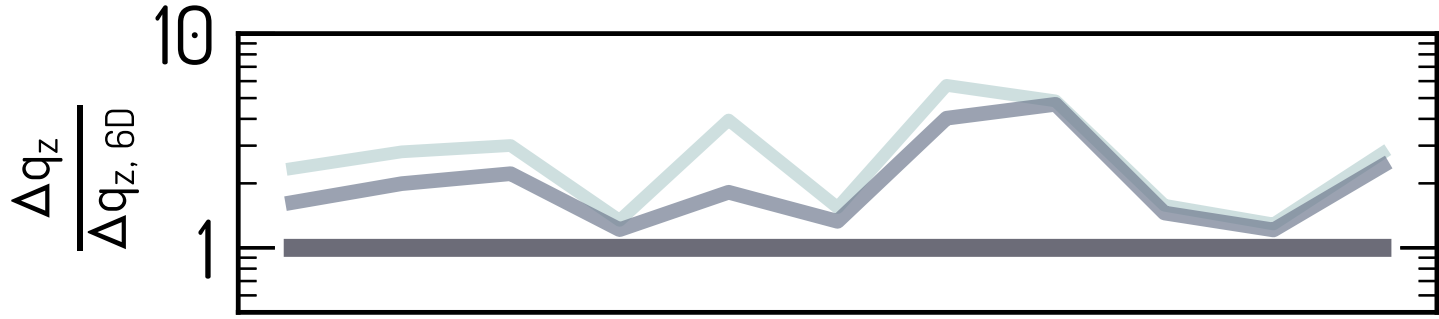
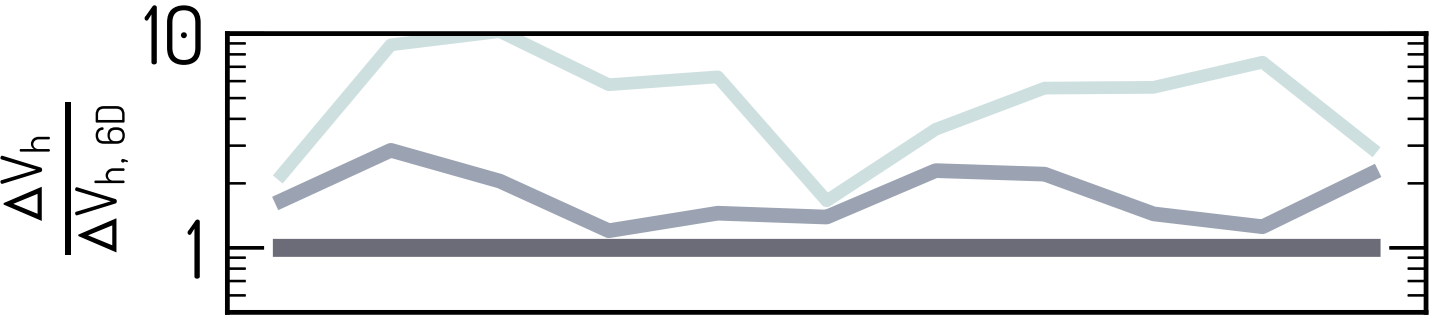
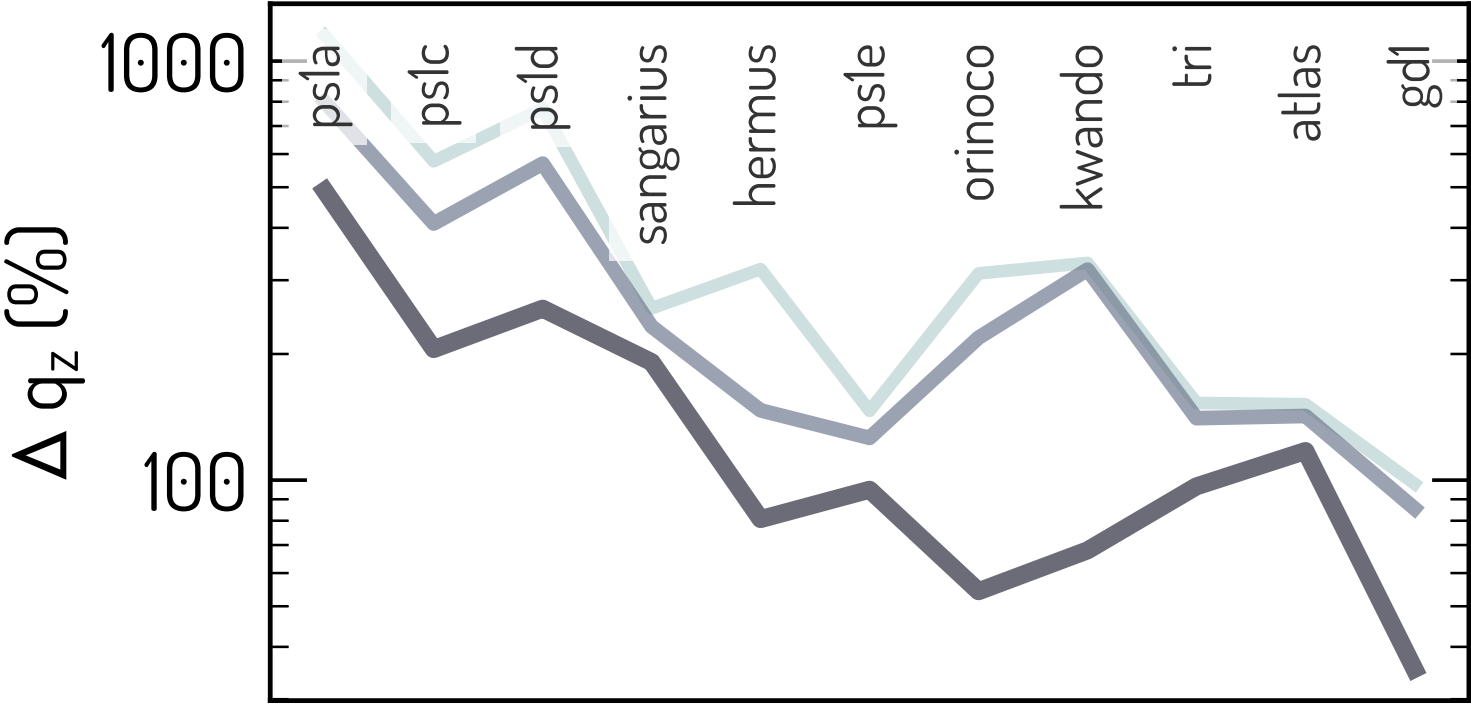
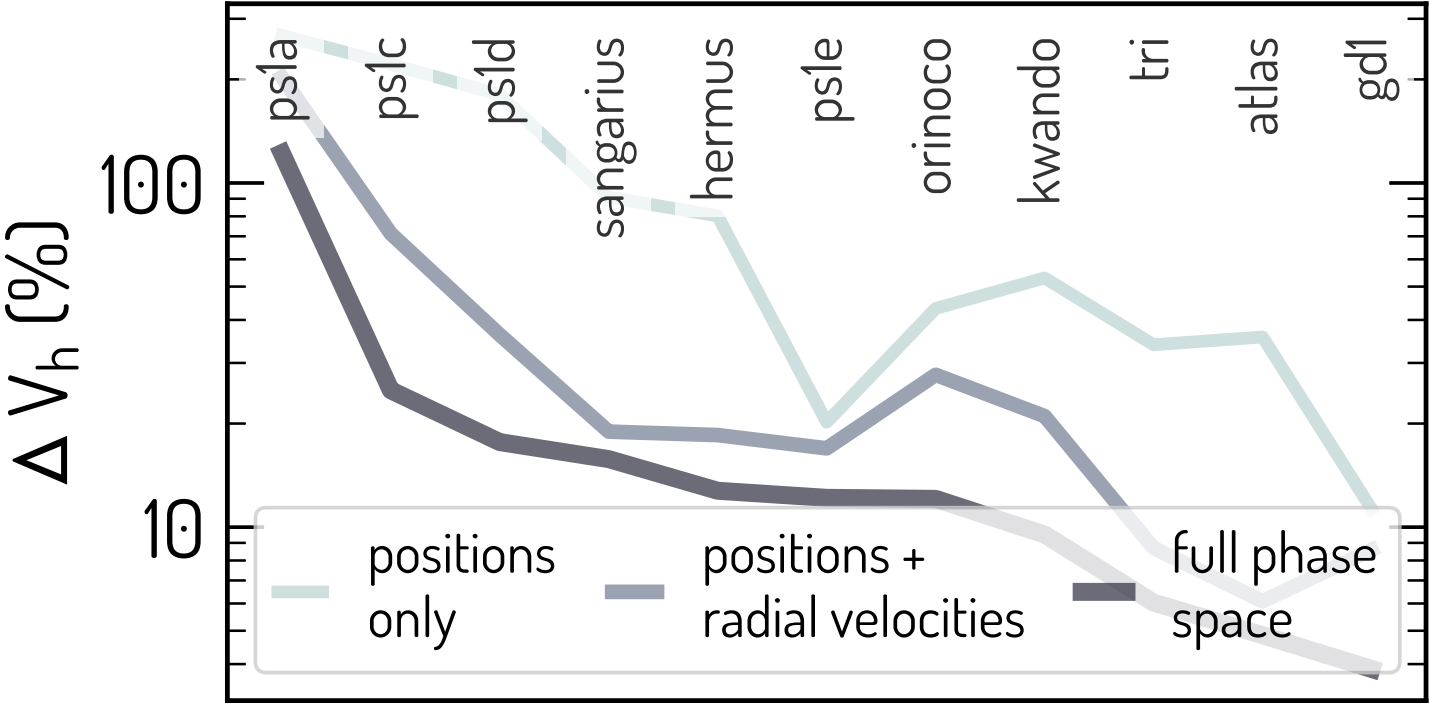


The total (Fisher) information streams provide depends on their sensitivity to halo parameters and observational uncertainties (Bonaca & Hogg, arXiv:1804.06854).

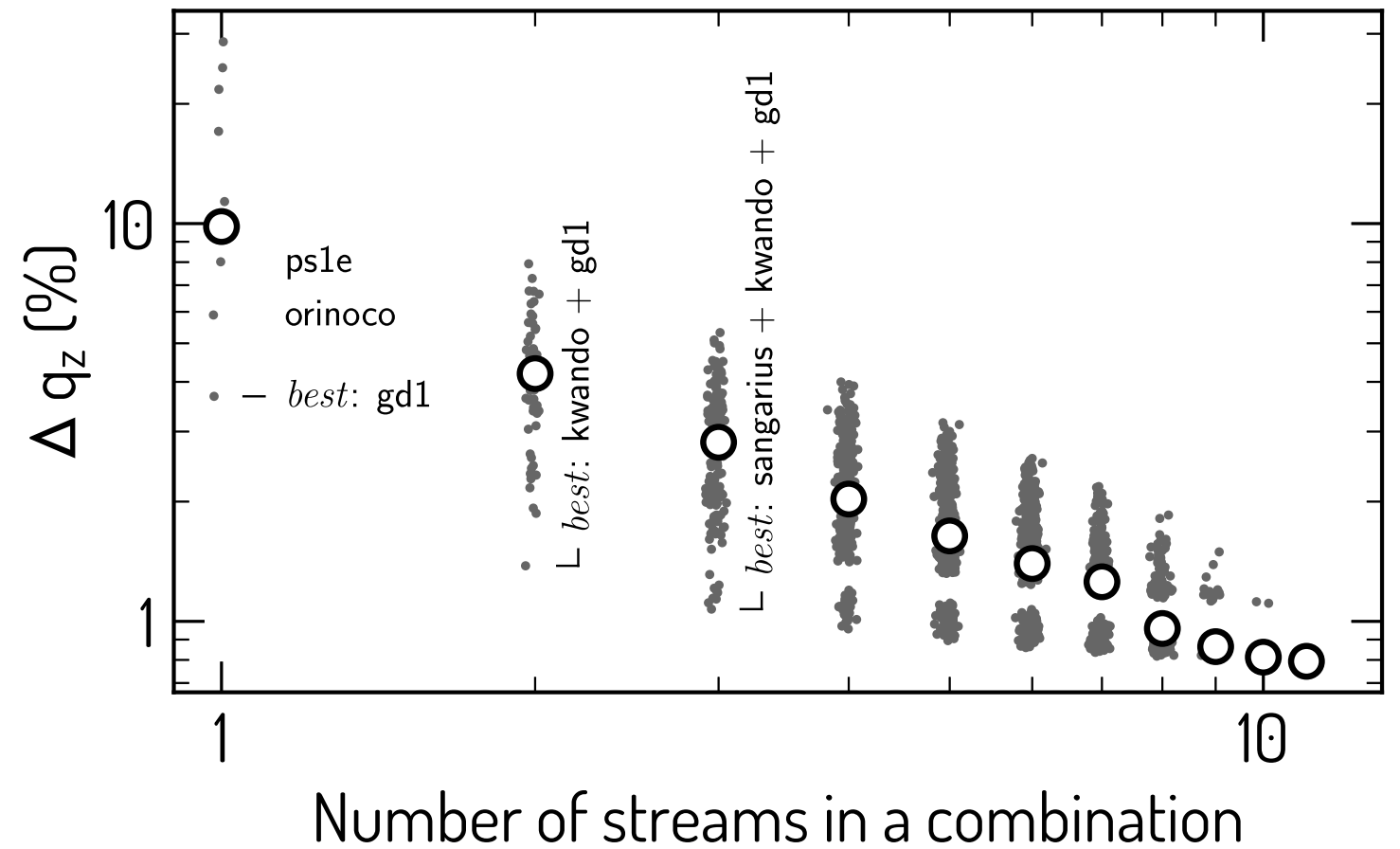
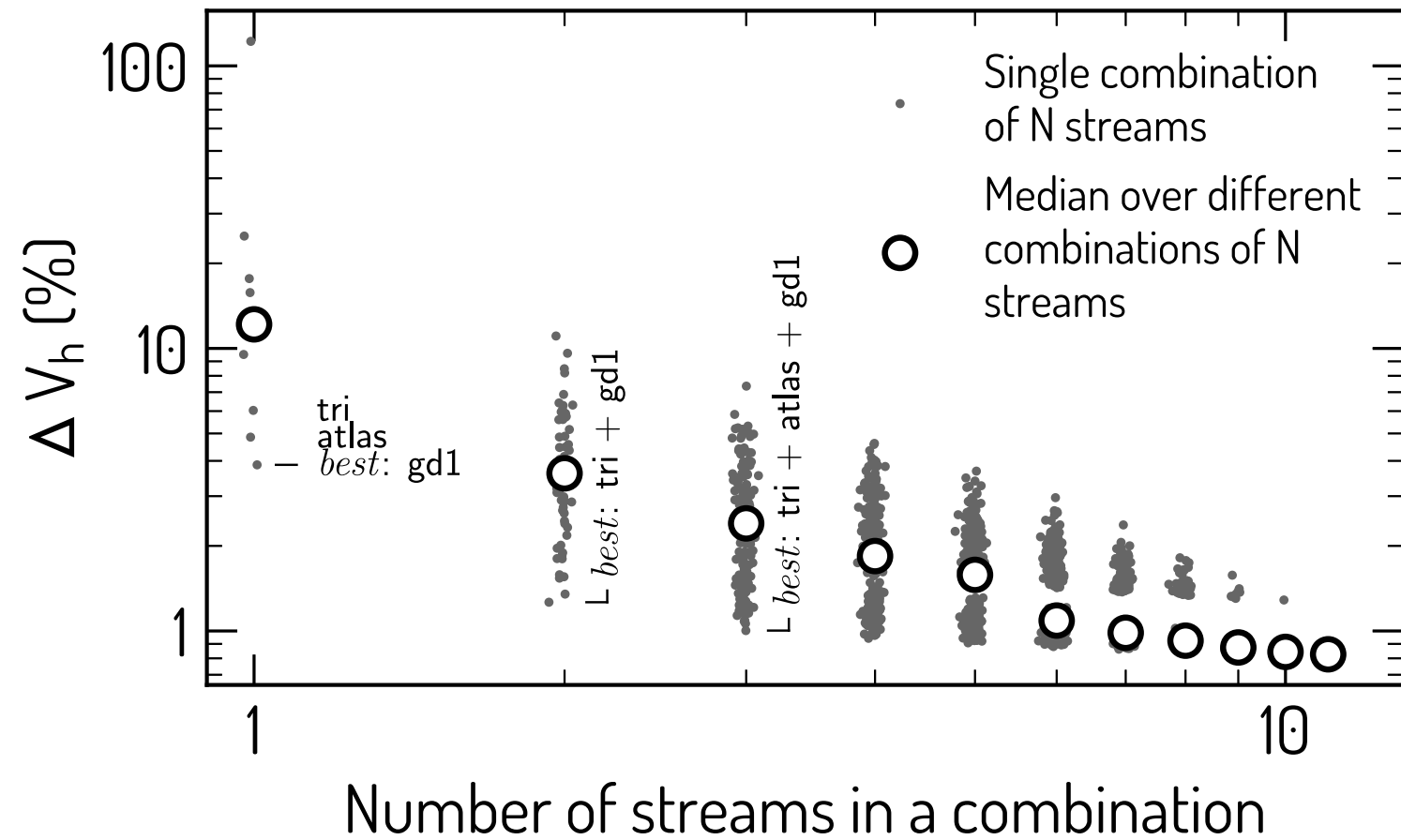
Different streams measure different aspects of the Galactic halo



Kinematic information is crucial for mapping the Galaxy with streams



Jointly, stellar streams constrain the Galaxy exquisitely

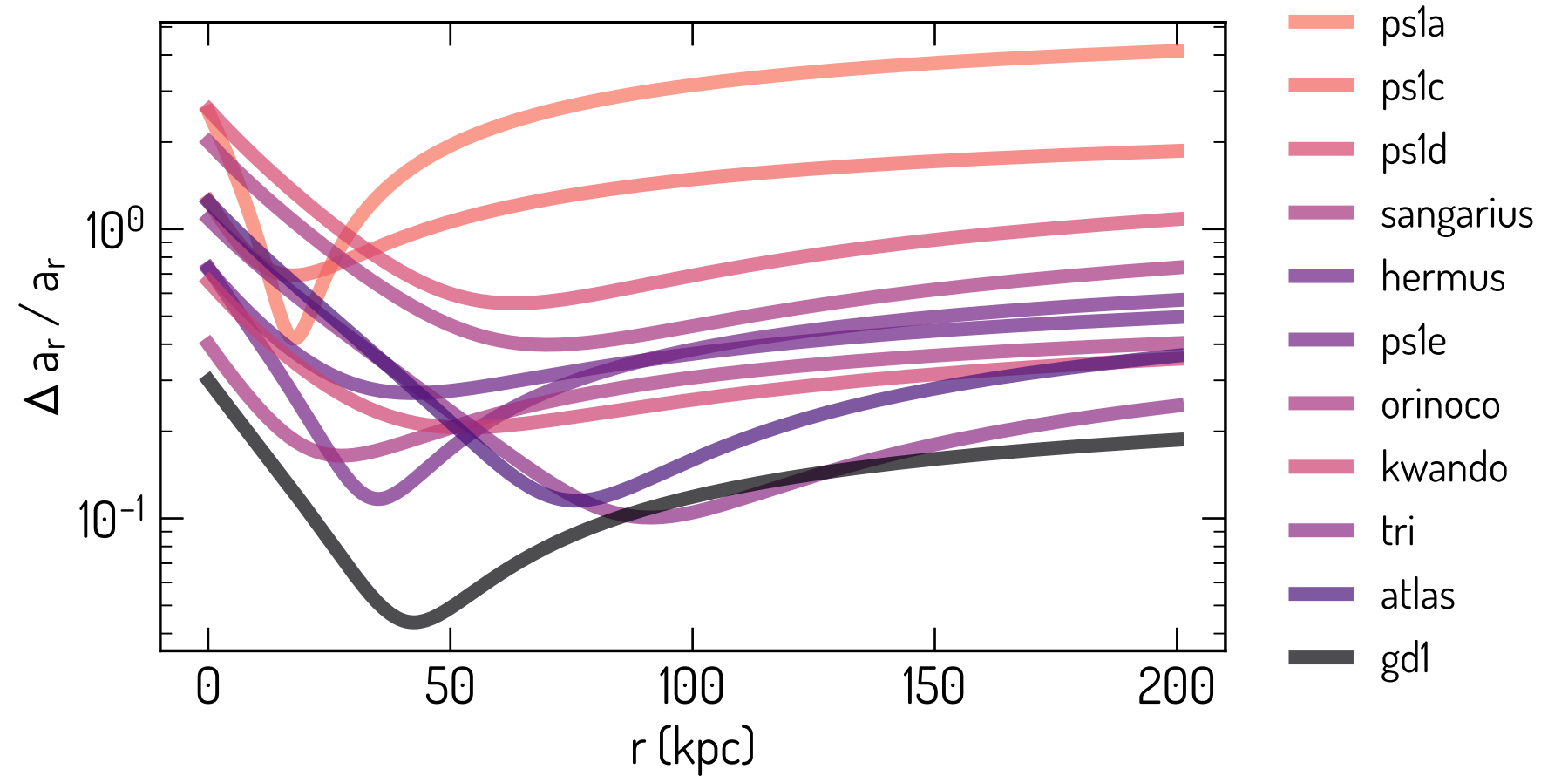


The information streams provide is spatially localized in the Galaxy

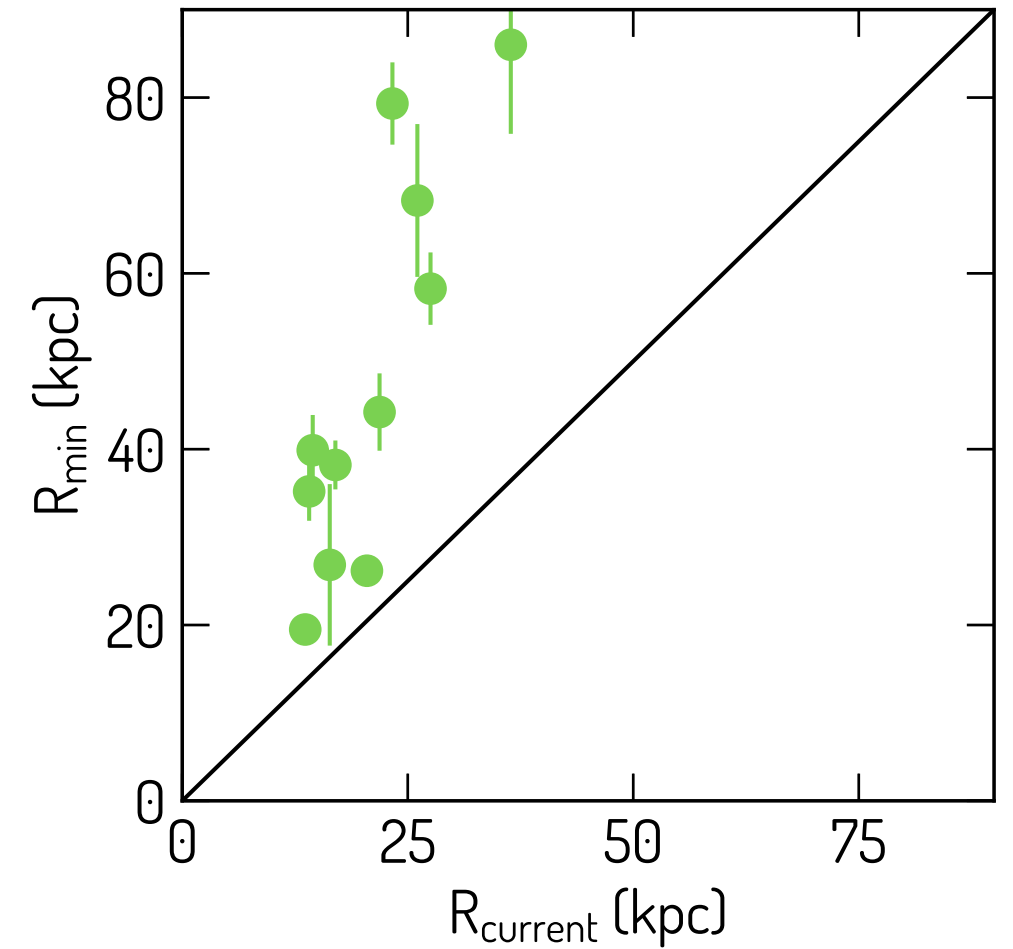
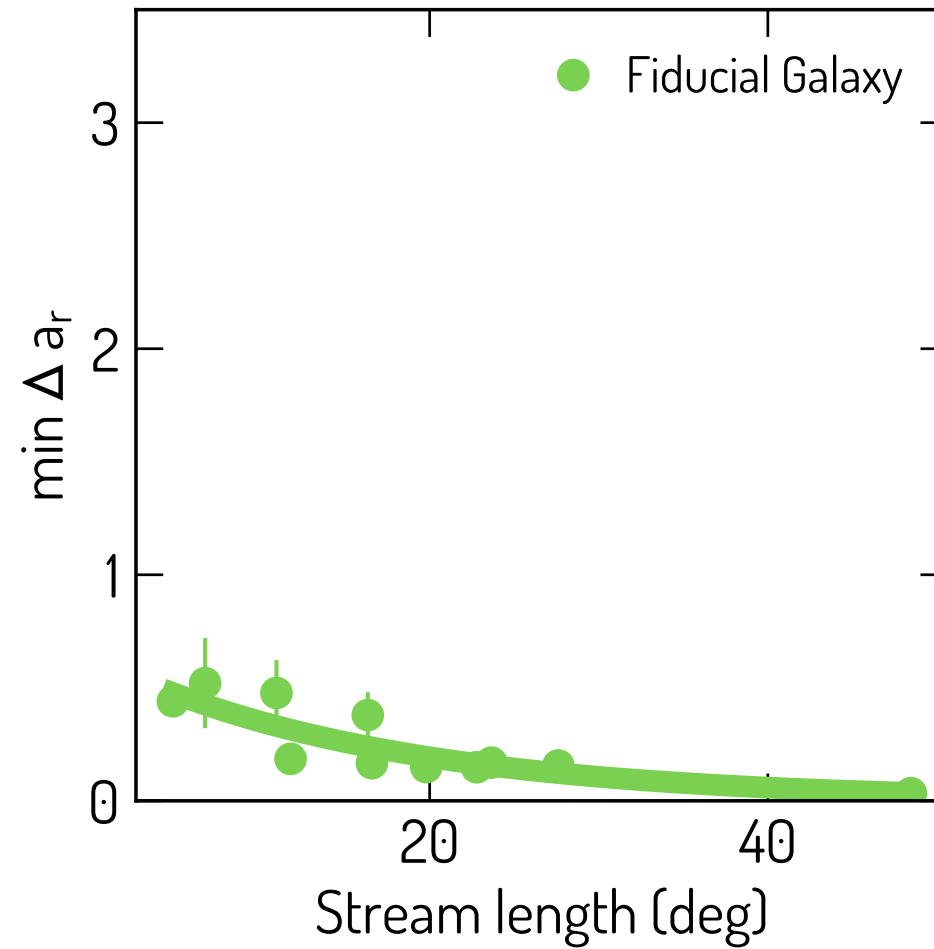
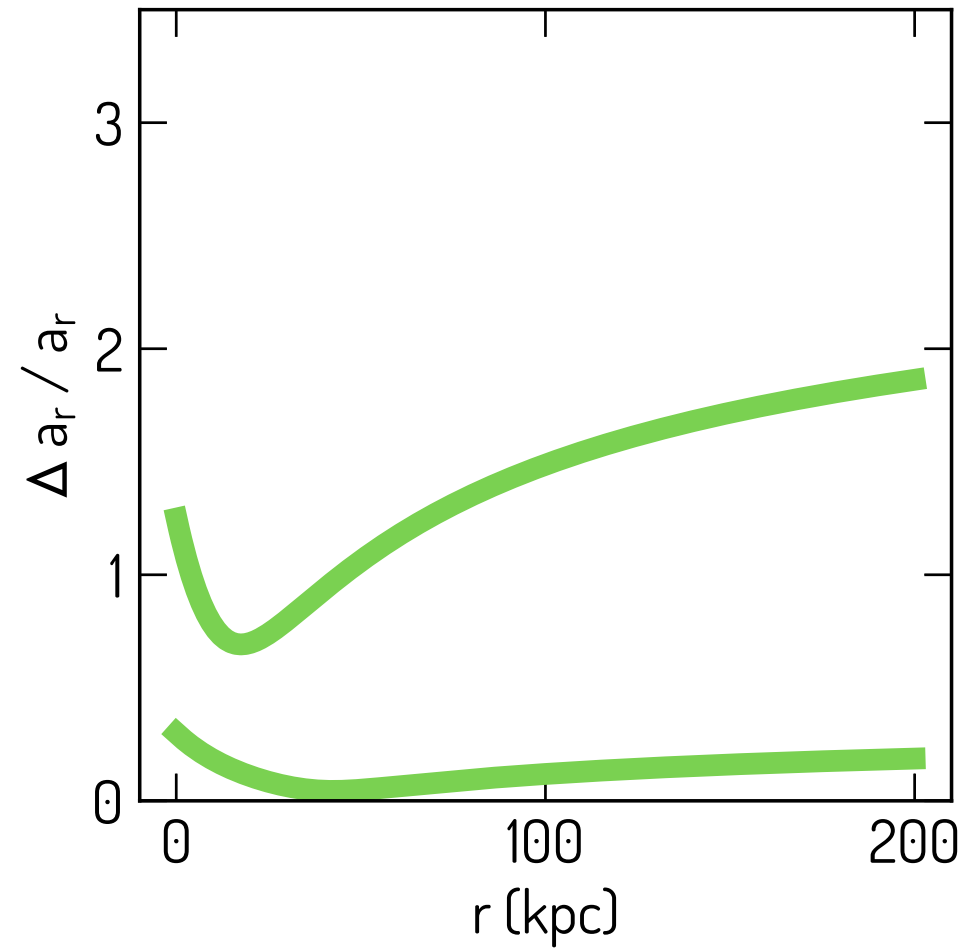
Stream potential constraints propagate on the radial acceleration:

$$a_r(r) = \frac{GM(<r)}{r^2}$$

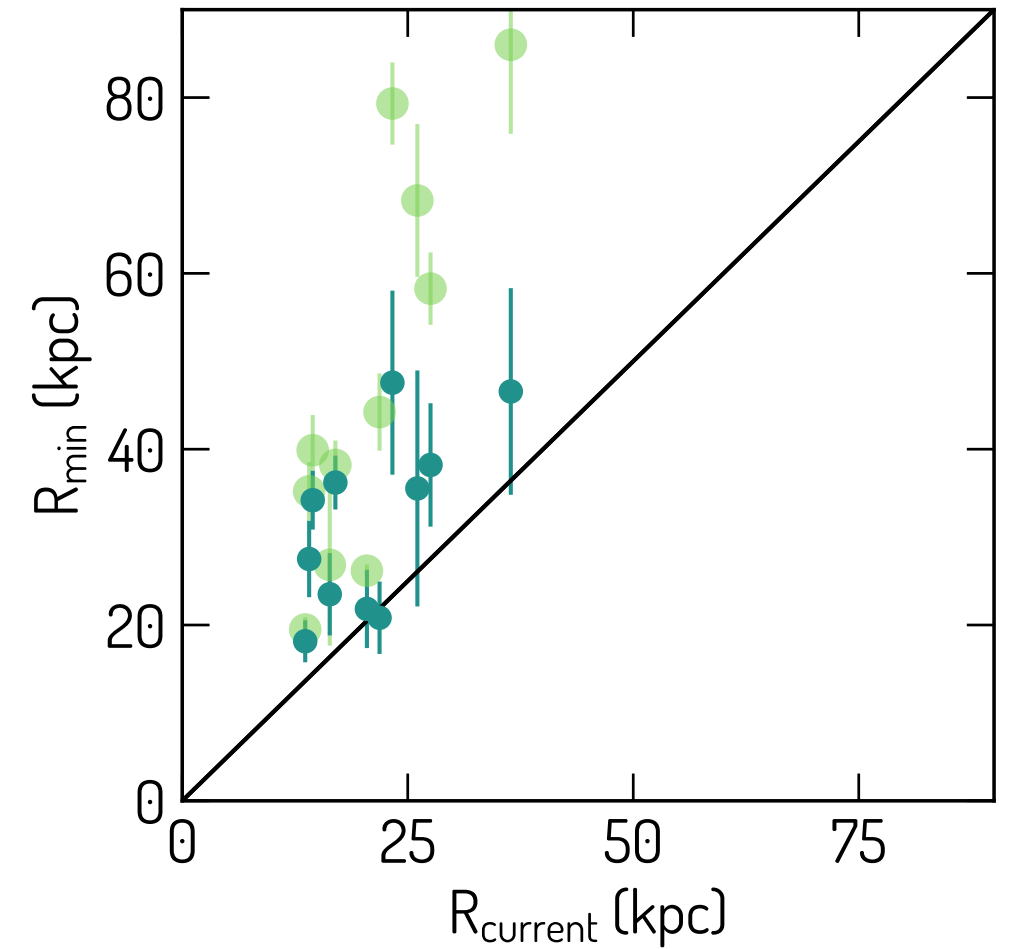
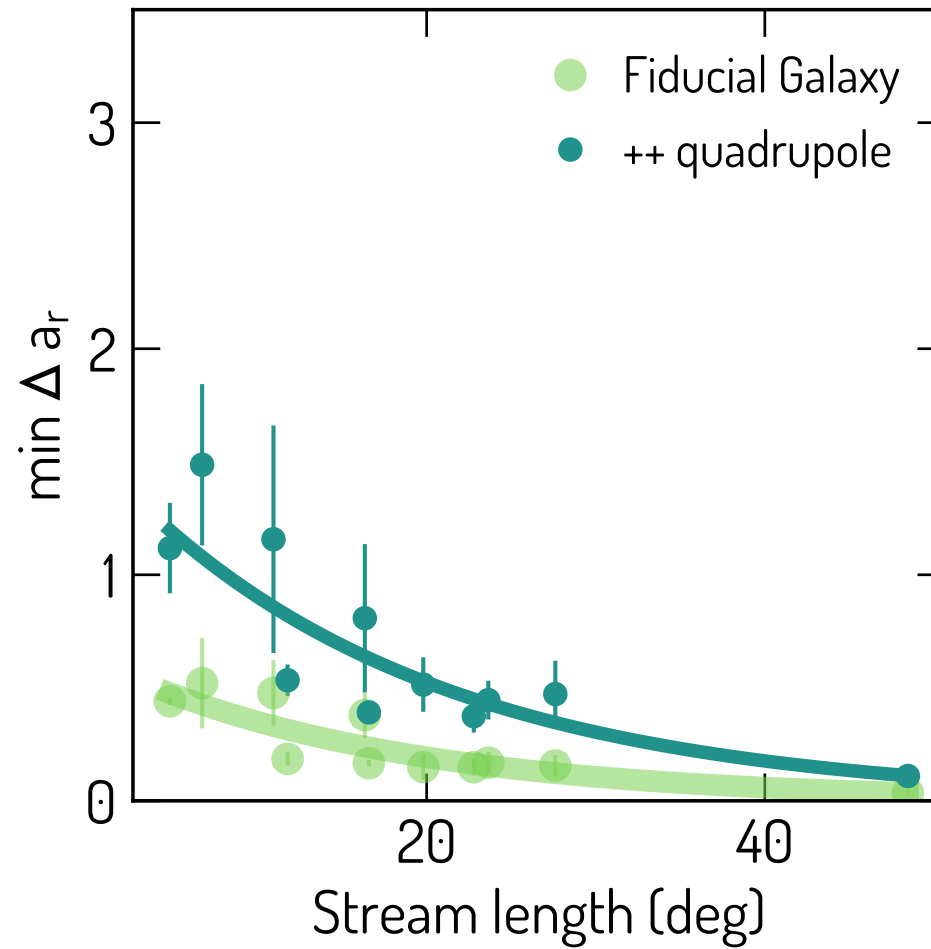
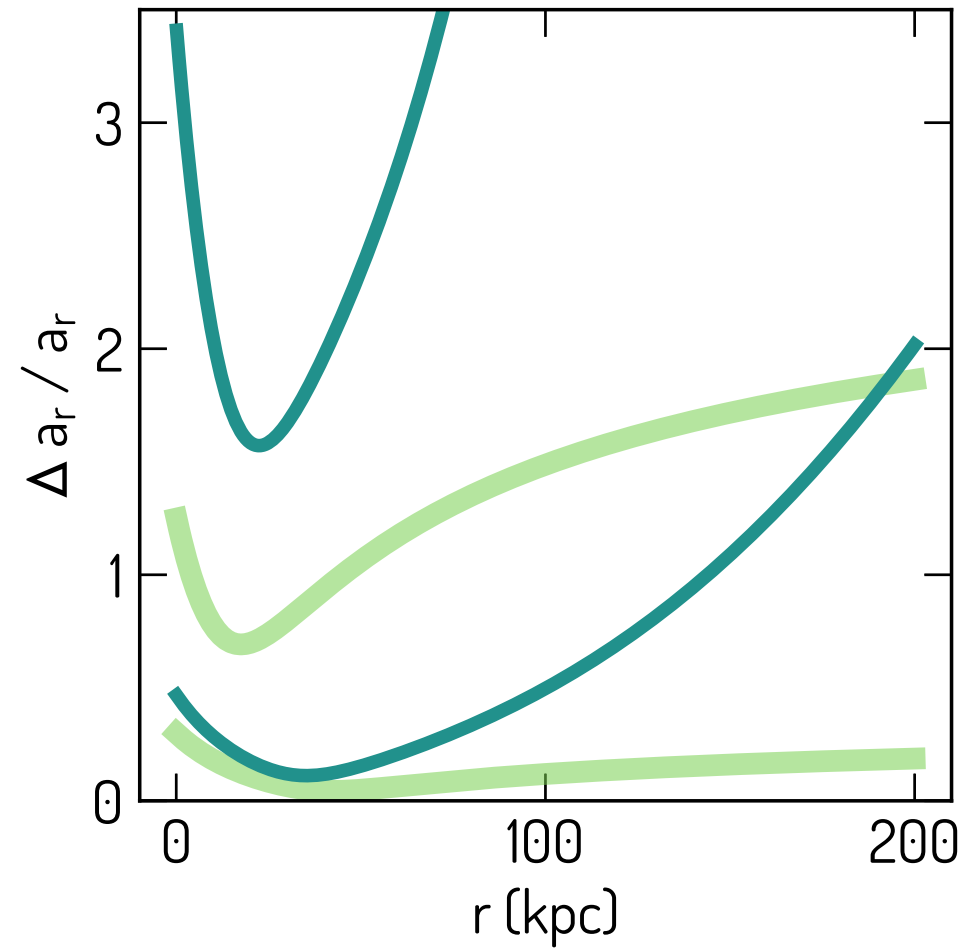
(radial acceleration \approx enclosed mass)



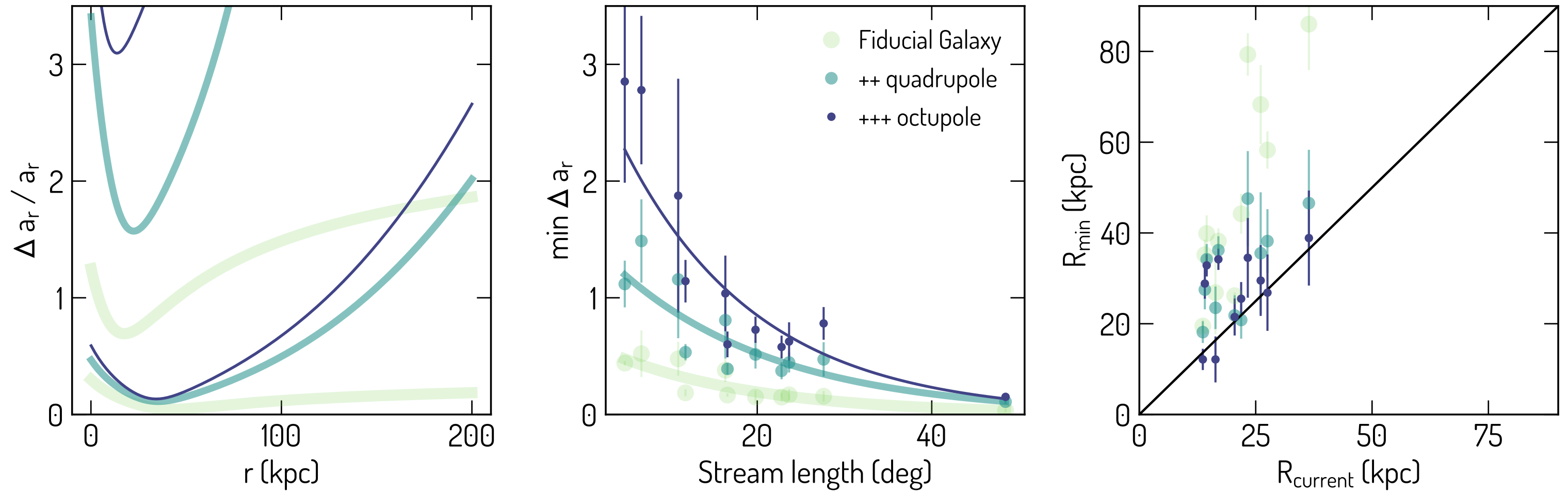
Intrinsically, streams measure the total mass within current position



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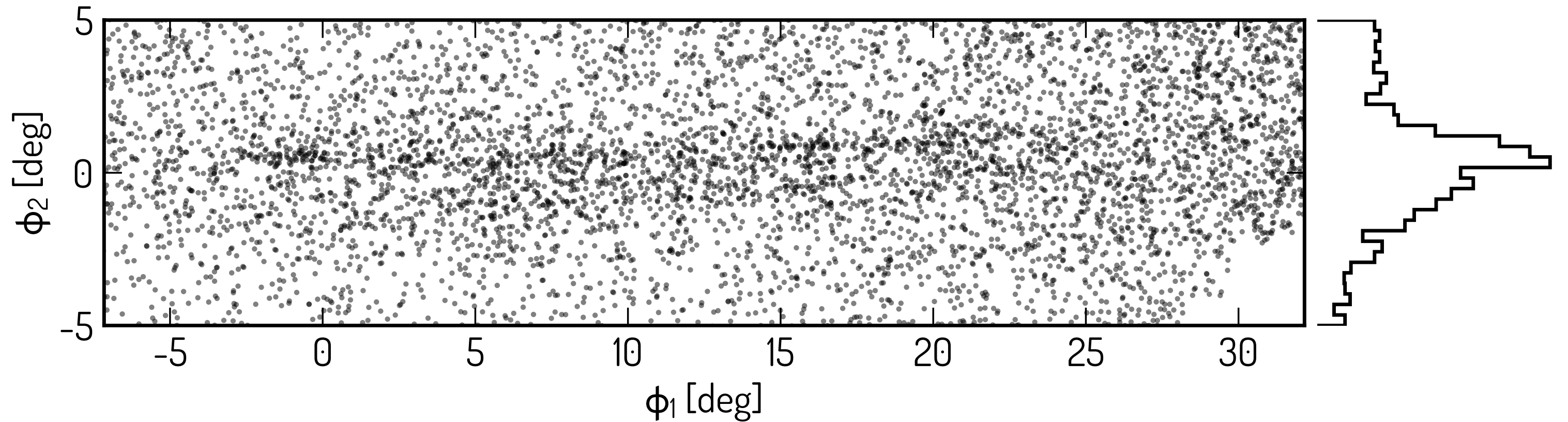
Intrinsically, streams measure the total mass within current position



(when the halo model is sufficiently flexible)

In detail, streams are more than a one-dimensional track

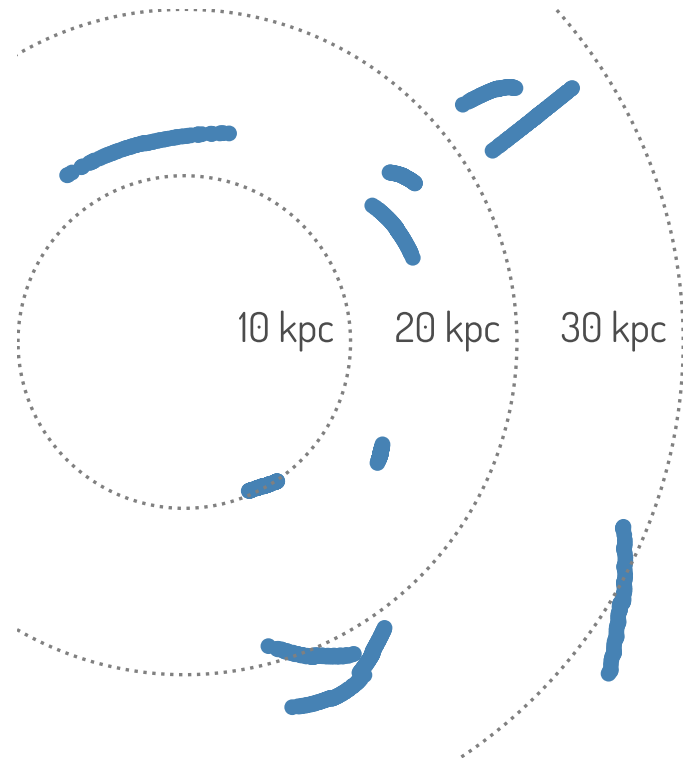
Bonaca et al. (in prep)



Upon Gaia proper motion selection, Jhelum stellar stream reveals an unusual density structure.

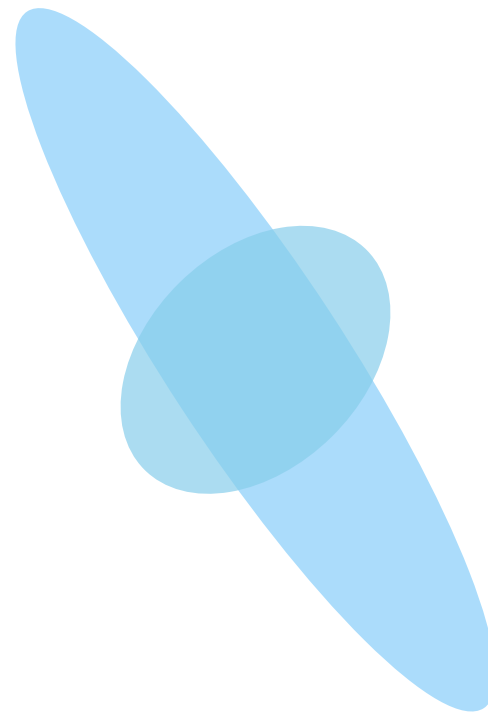
The role of stellar streams in near-field cosmology:

Streams measure the local acceleration



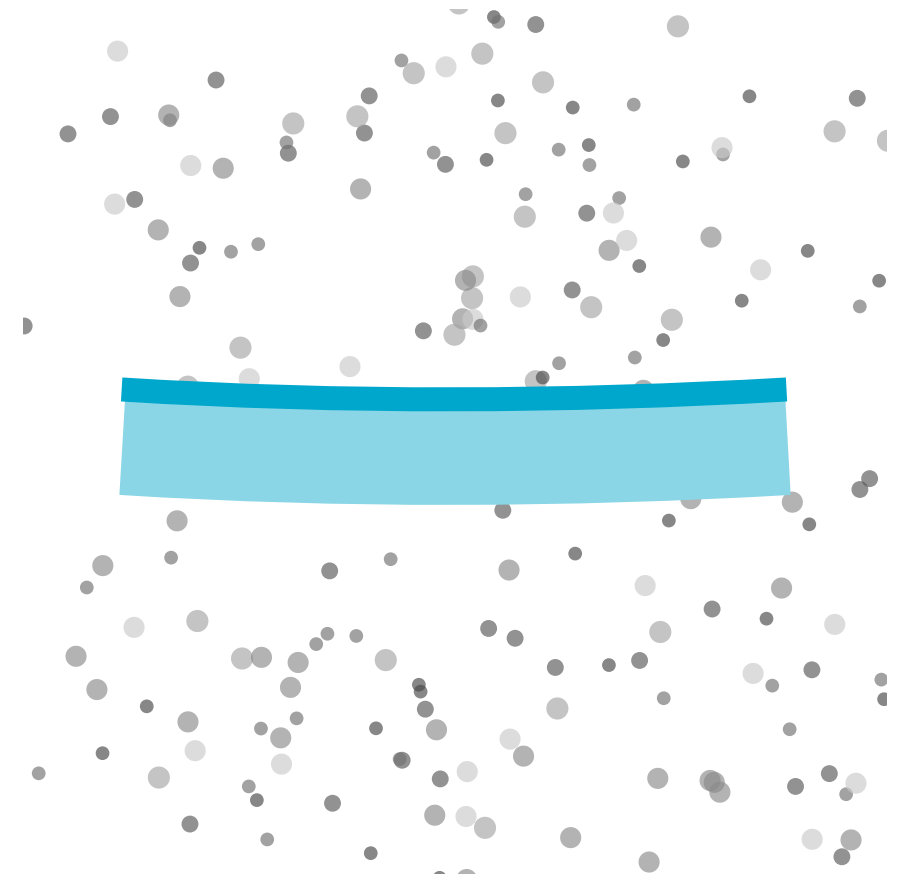
To map the Galaxy everywhere —
we need streams everywhere!

Streams can forecast constraints on the potential



Tool for planning observations, in time for the *decadal survey*.

Streams can also diagnose complex interactions



Density structure of streams is a window into their *orbital history*.