

Constraining the Milky Way halo with thin streams

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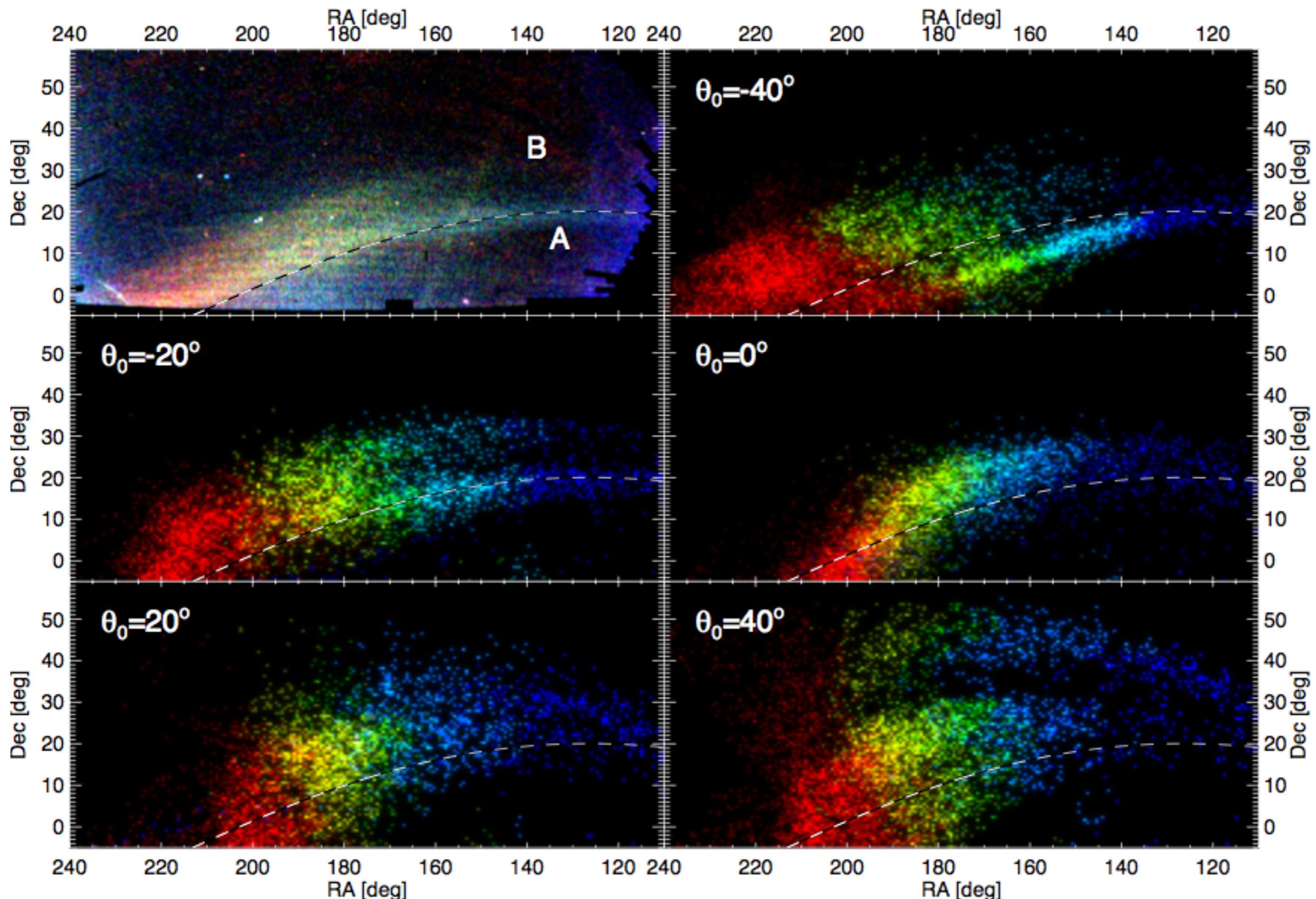
in collaboration with Justin Read,
George Lake and Kathryn Johnston



Sagittarius | Previous Work

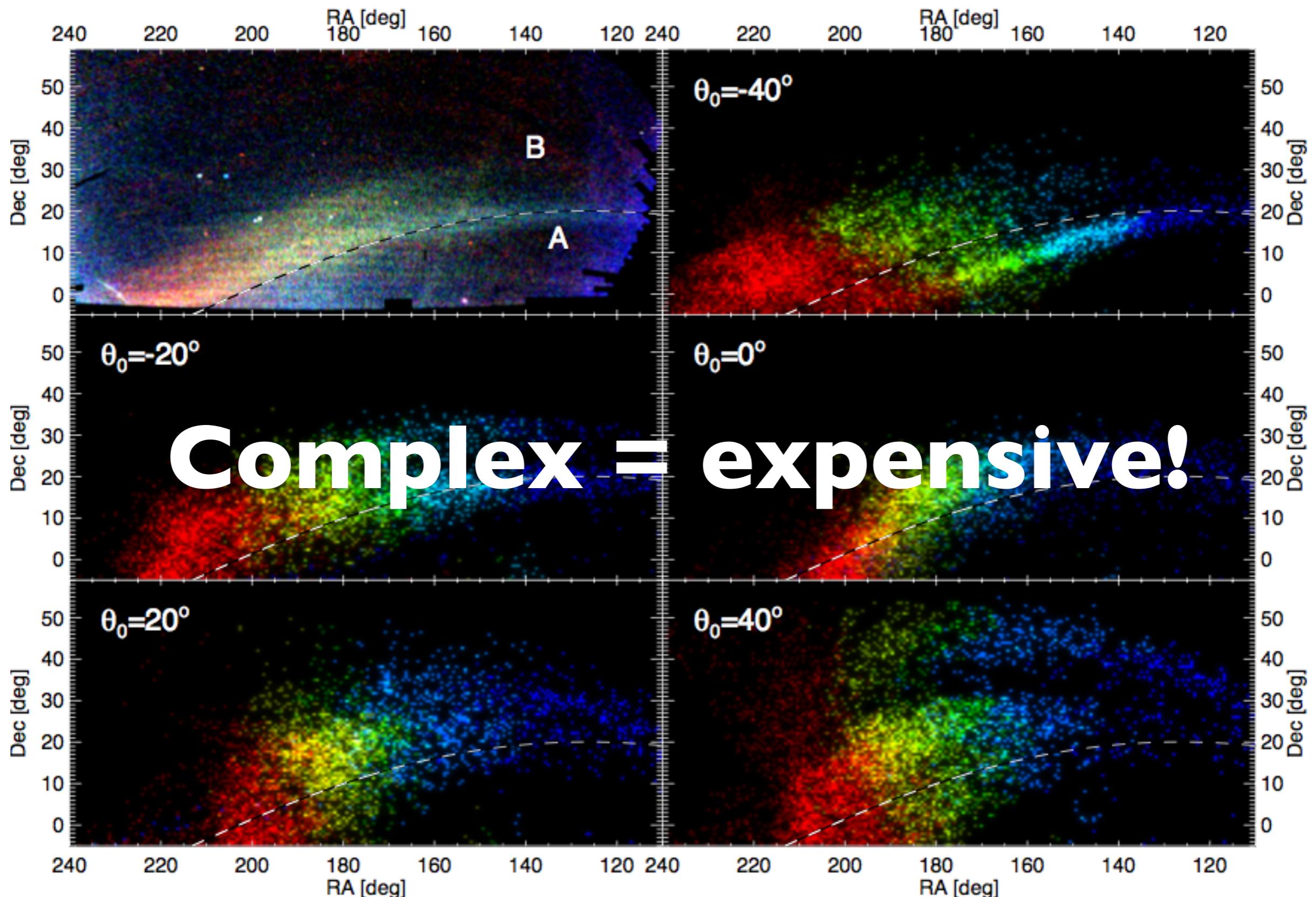
- Ibata 2001 - **spherical** halo
- Helmi 2004 - **prolate** halo, based on velocity data
- Johnston et al. 2005 - **oblate** halo, spatial distribution of M-stars
- Fellhauer et al. 2006 - **spherical** halo assume bifurcation = two different wraps
- Law et al. 2009/Law & Majewski 2010 - (mildly) **triaxial**, fitting position + radial velocity data

Sagittarius | Bifurcation



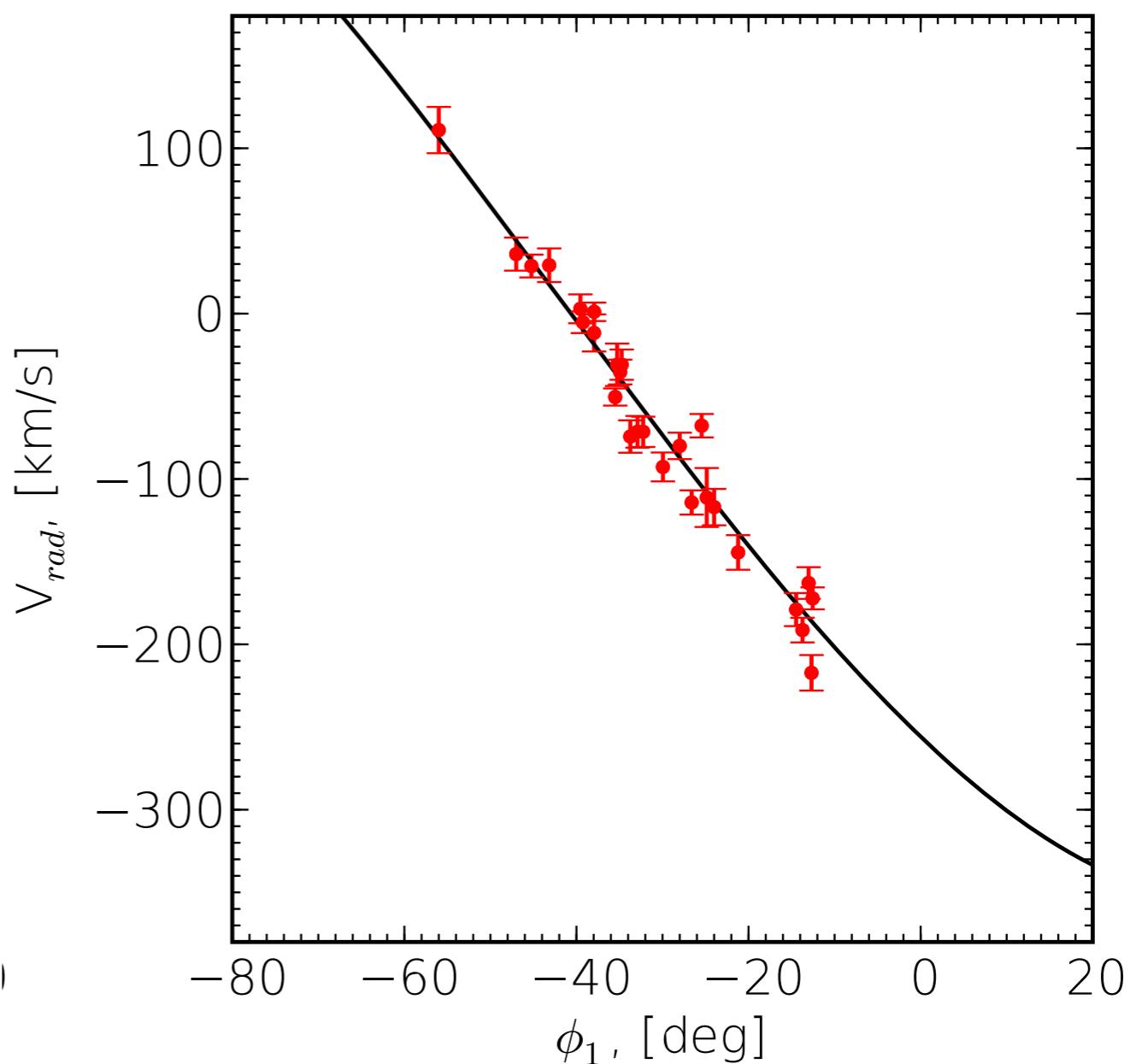
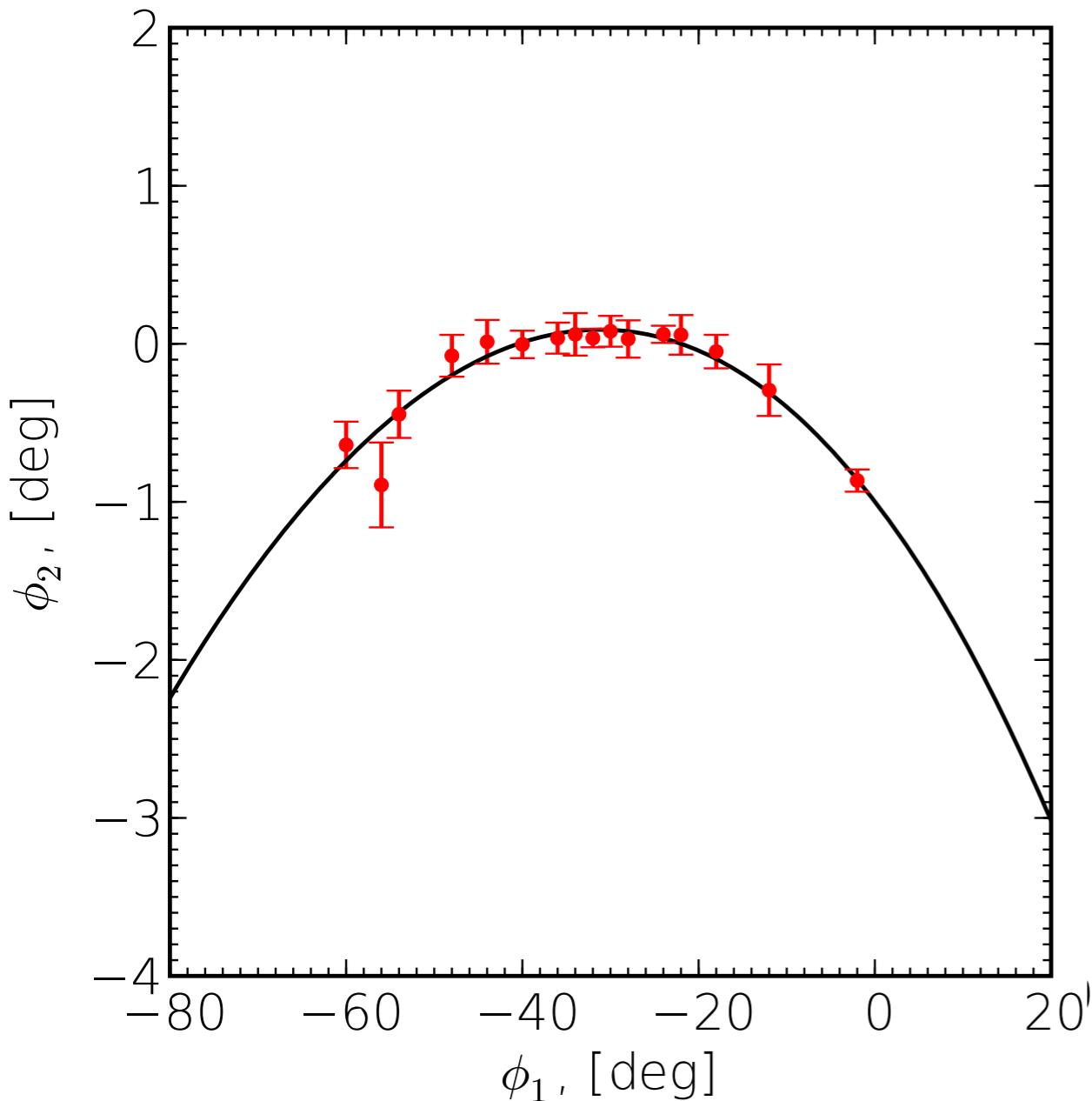
Penarrubia et al. 2010/2011

Sagittarius | Bifurcation



Penarrubia et al. 2010/2011

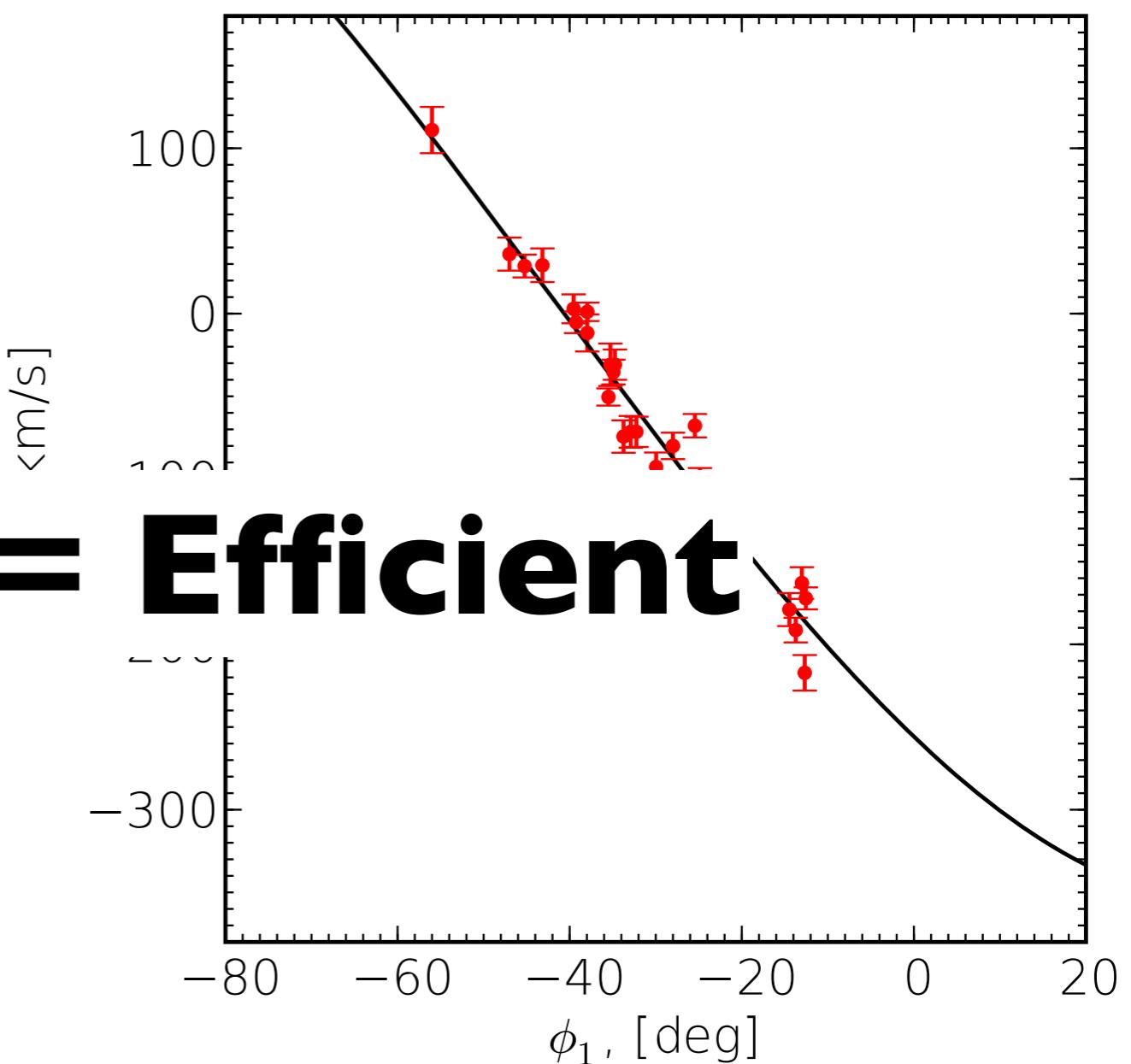
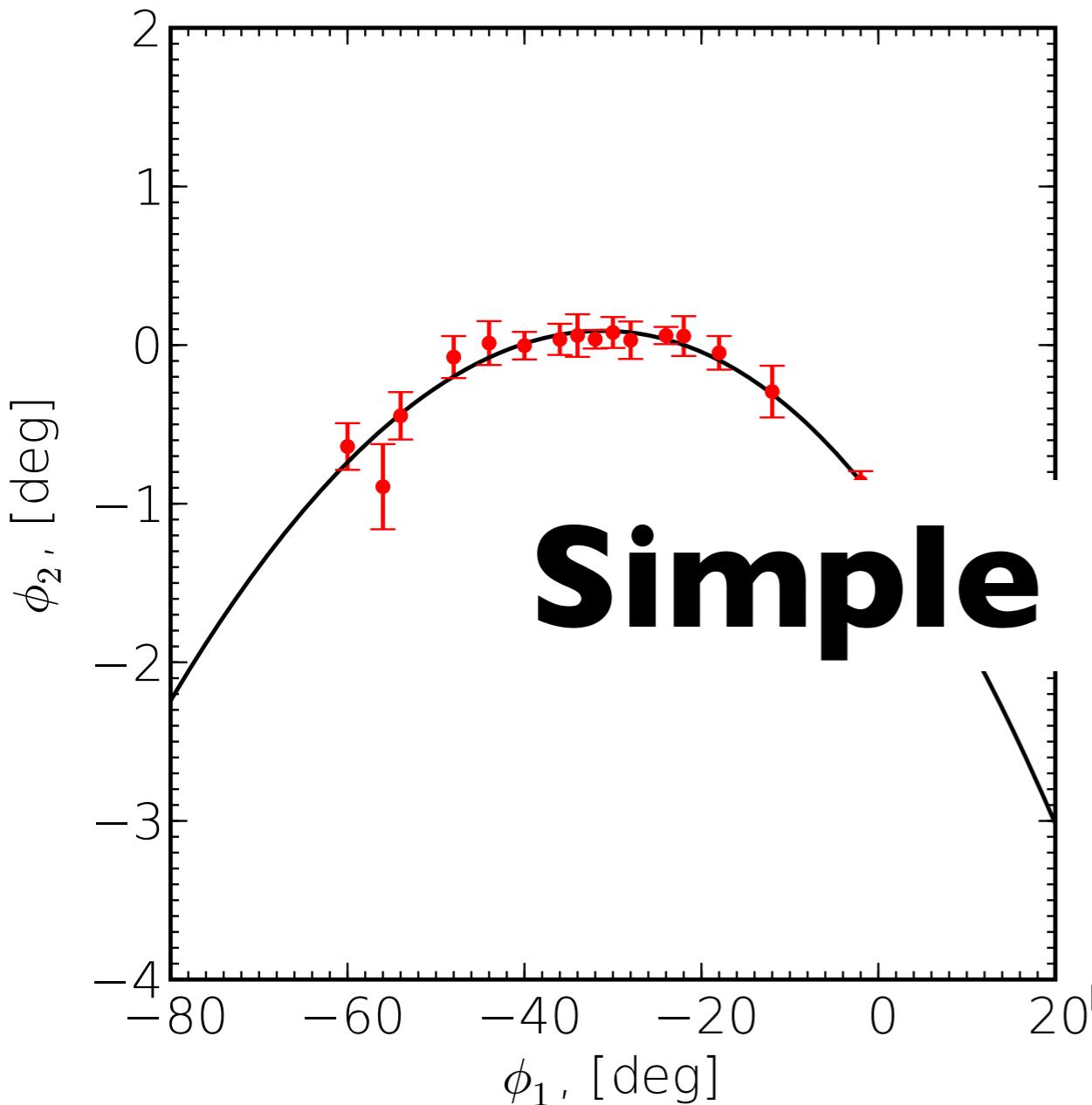
Alternatives | Previous Work



GDI; Koposov et al. 2010

also Newberg et al. 2010, Willett et al. 2009

Alternatives | Previous Work

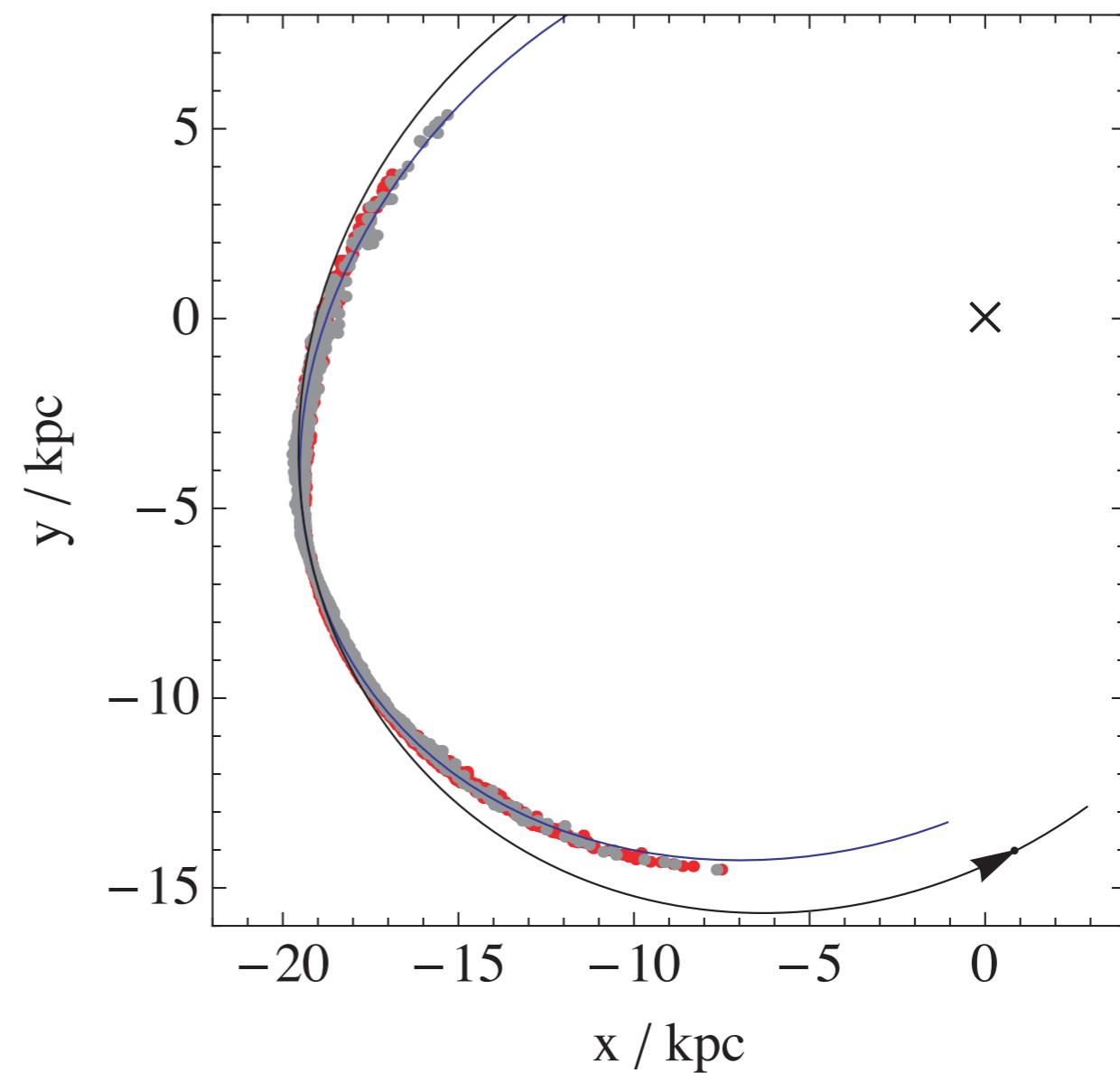
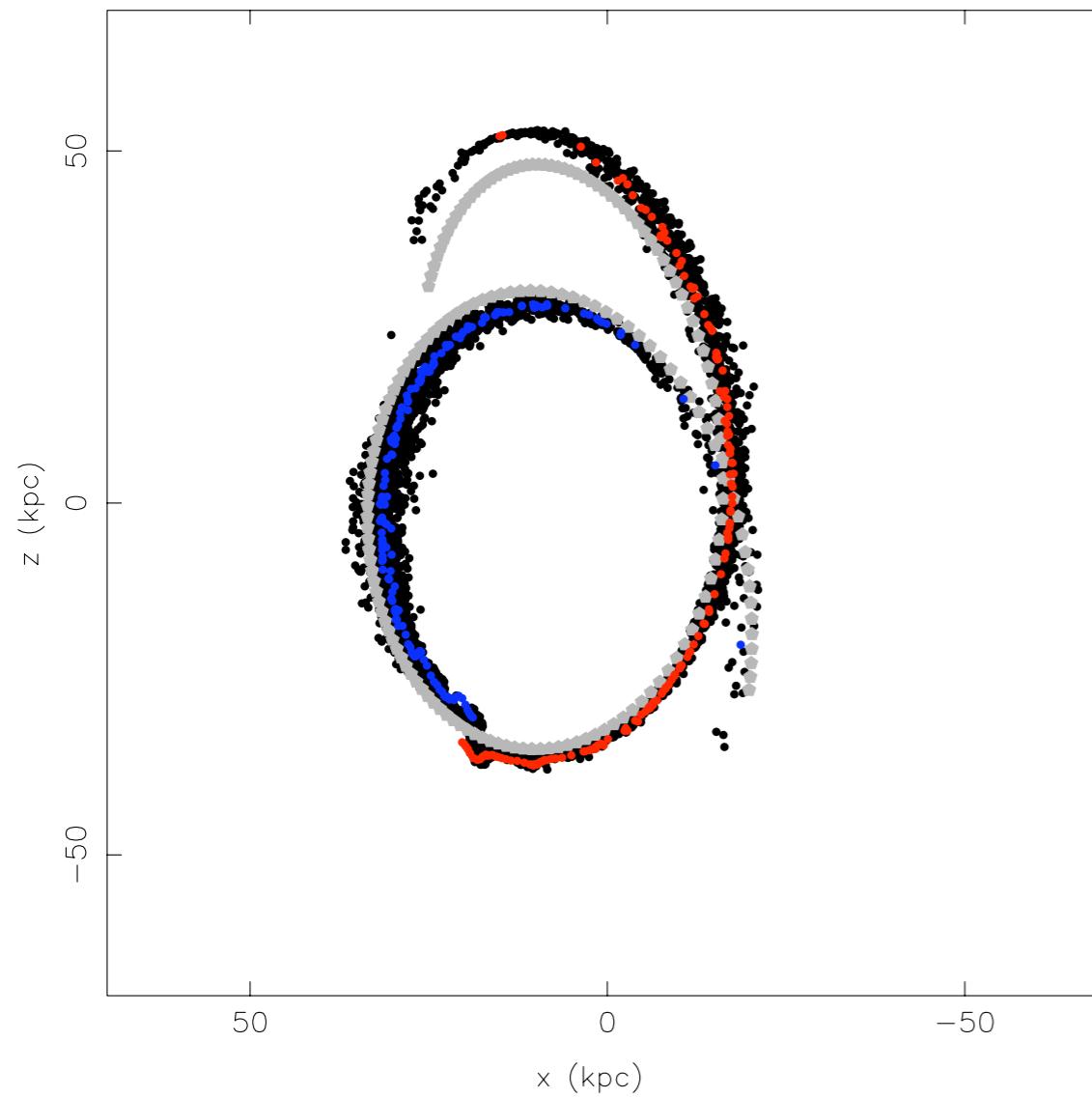


Simple = Efficient

GDI; Koposov et al. 2010

also Newberg et al. 2010, Willett et al. 2009

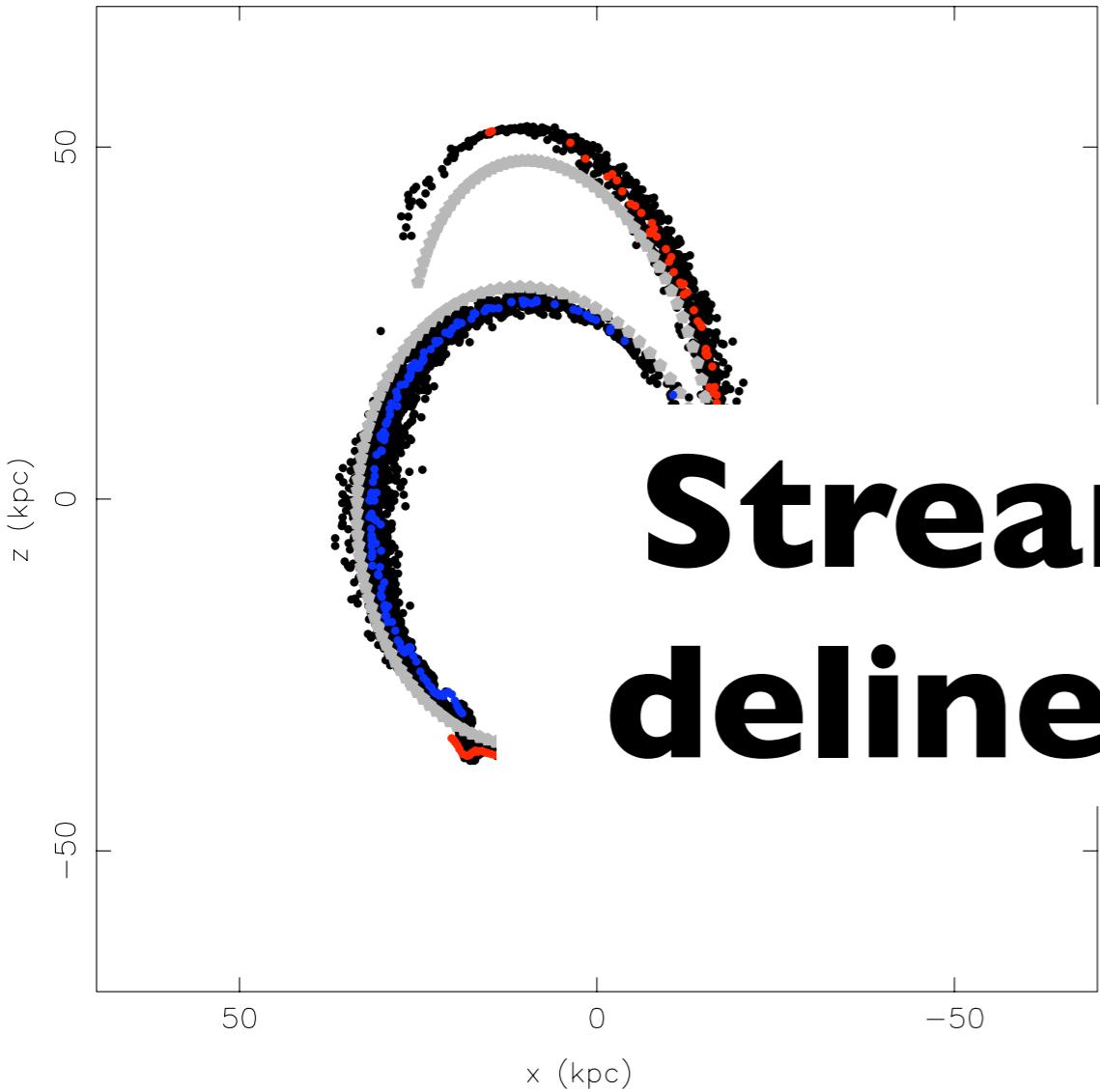
Alternatives | Previous Work



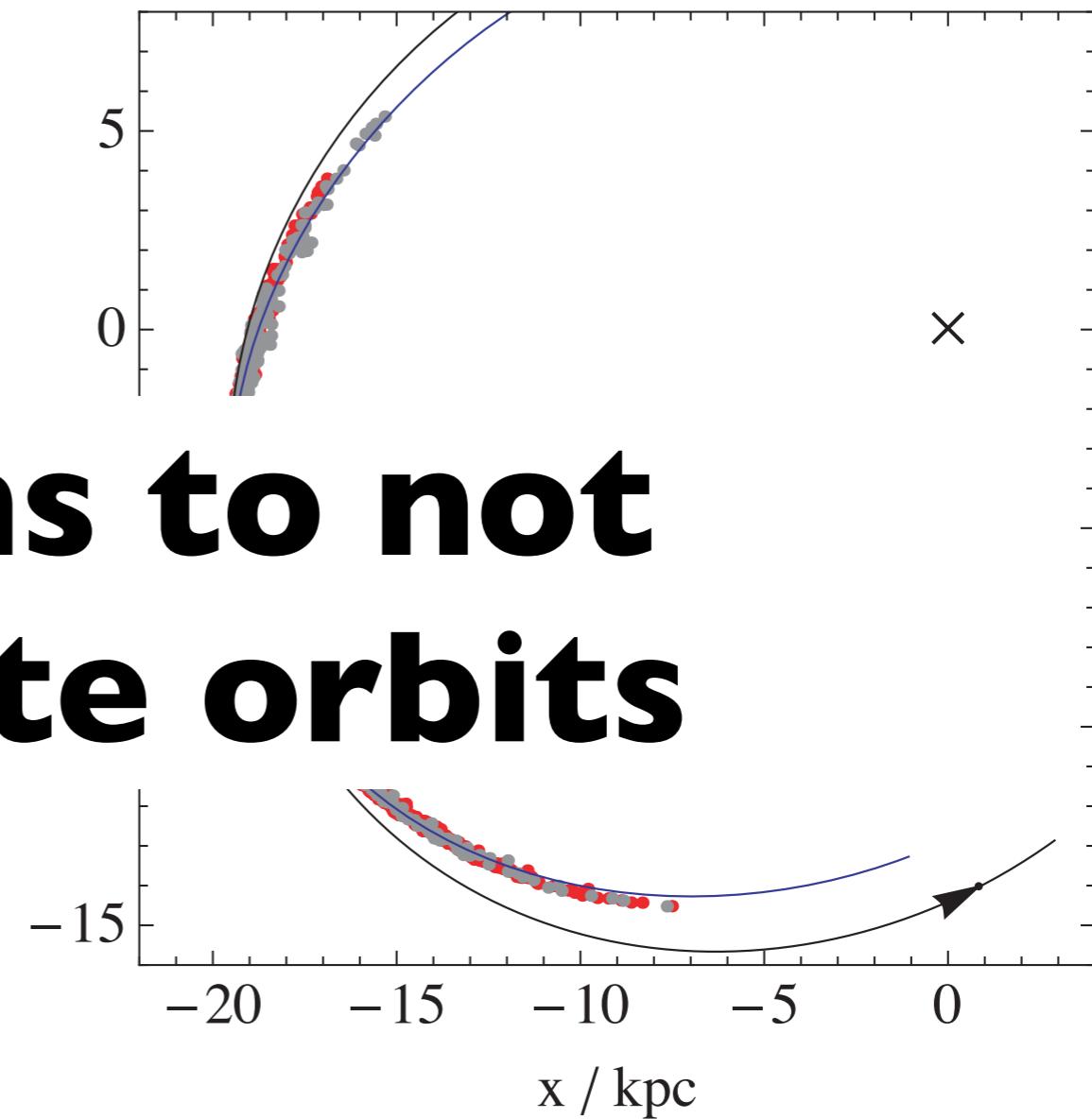
Varghese et al. 2011

Eyre & Binney 2011

Alternatives | Previous Work



**Streams to not
delineate orbits**



Varghese et al. 2011

Eyre & Binney 2011

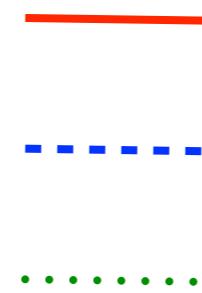
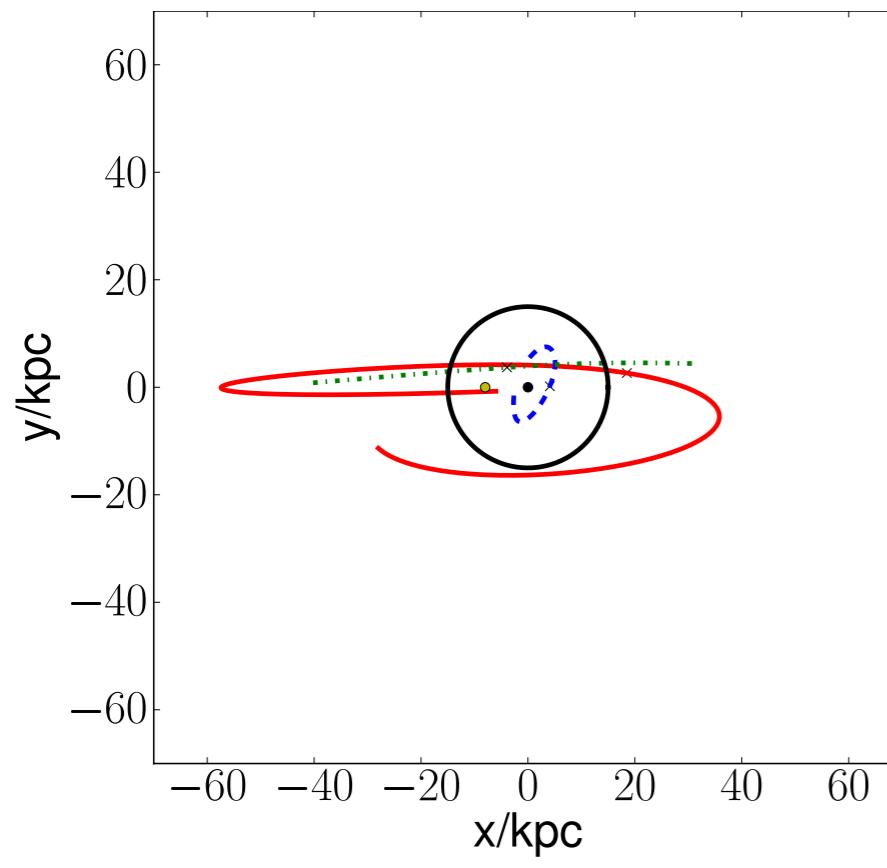
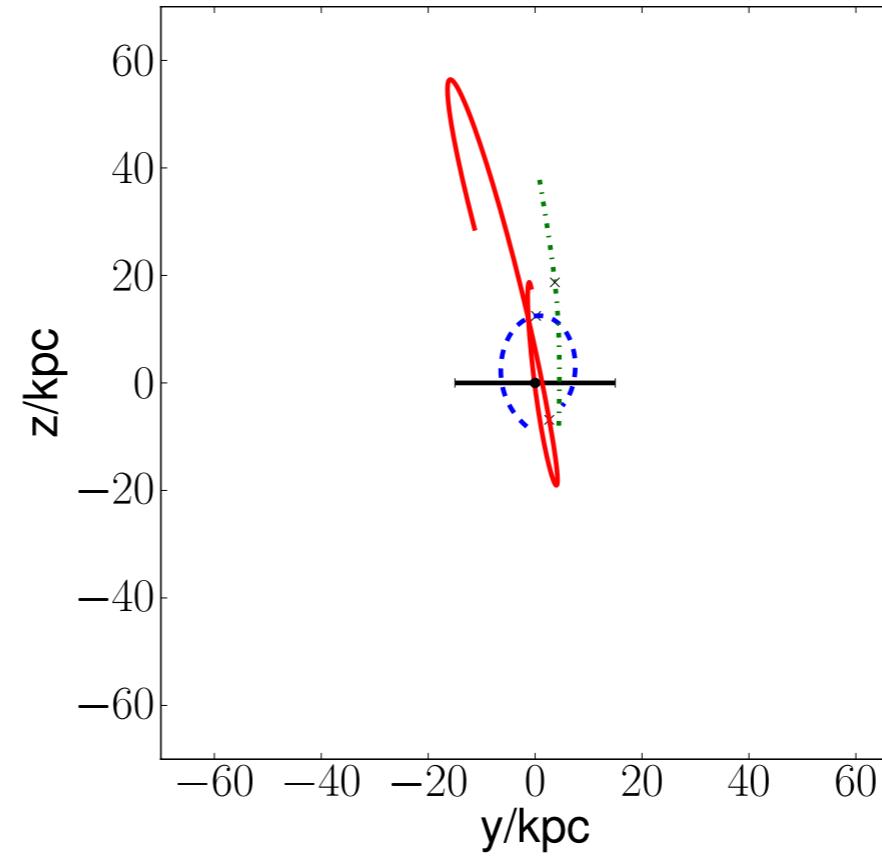
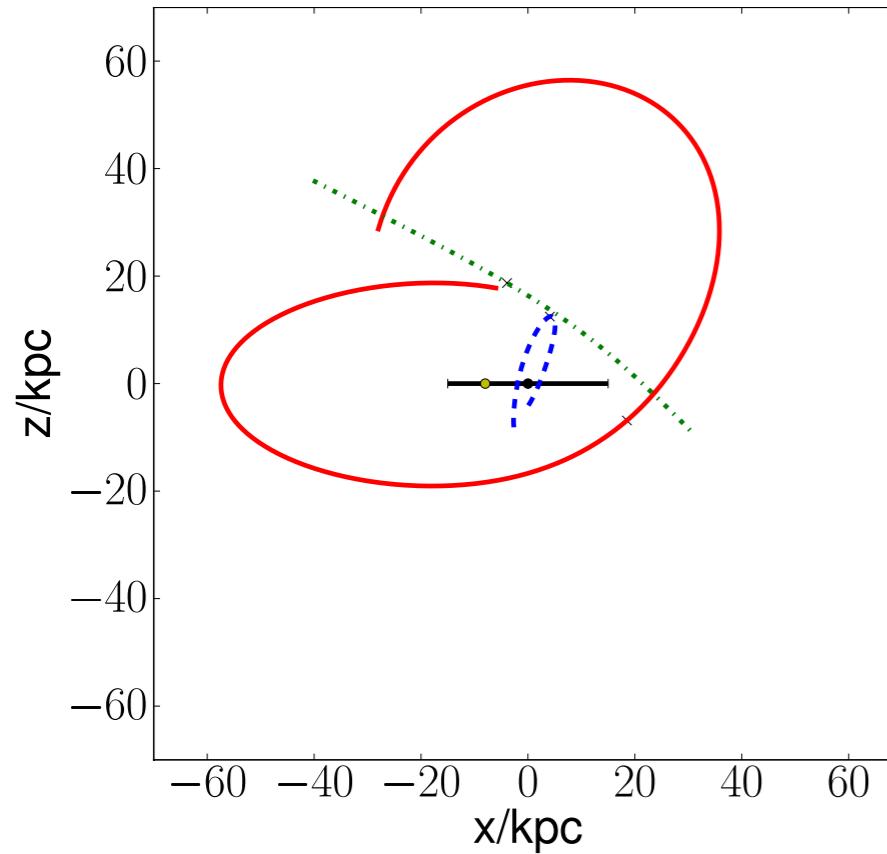
Alternatives | This Work

- ‘thin stream approximation’ =
**stream-orbit-offset significantly less
than errors:**
 - **(half) the stream width**
 - **radial velocity dispersion**
 - **distance + proper motion
measurement errors**

Thin Streams | Criteria

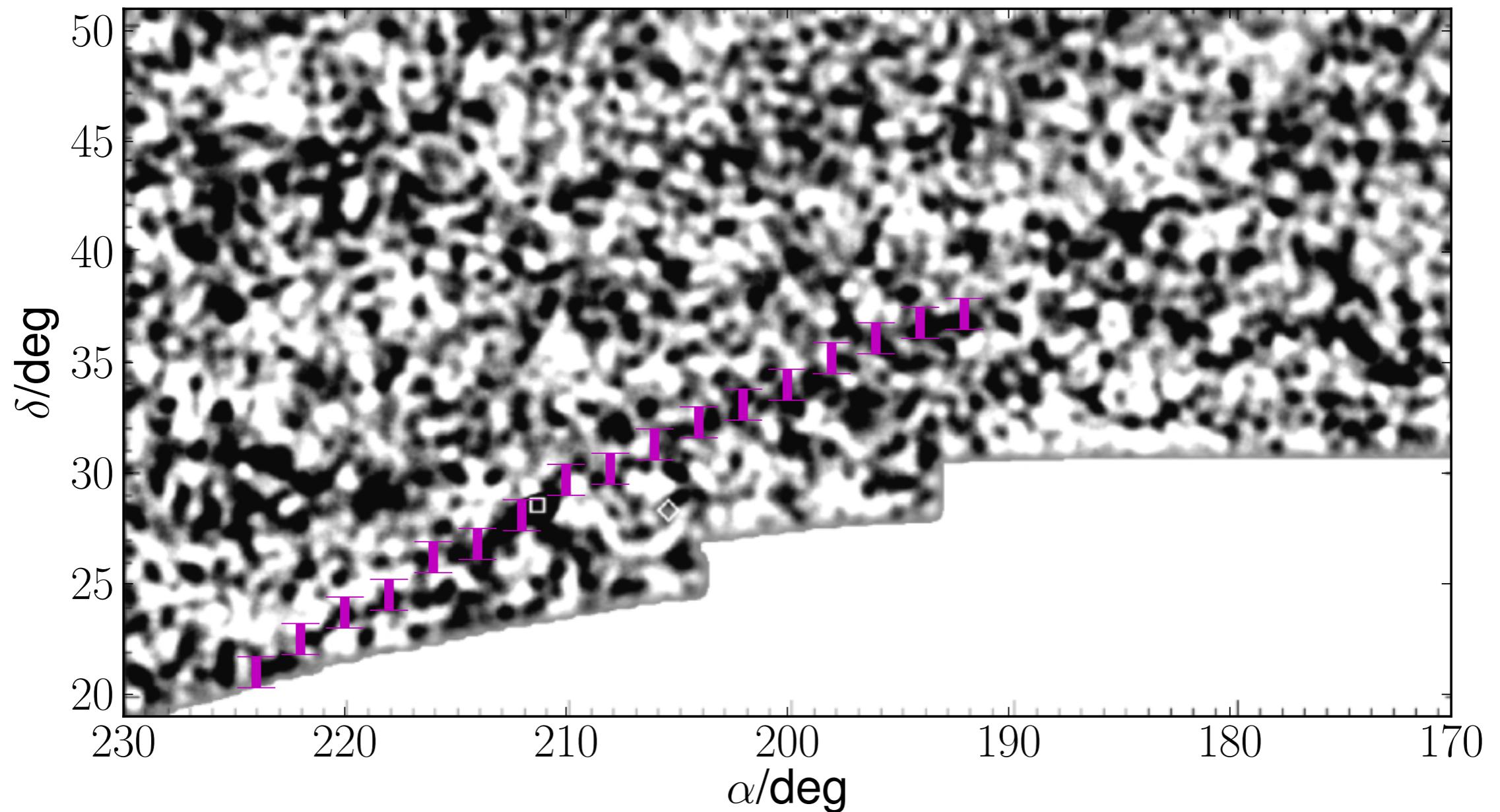
- **Globular cluster stream** $M \leq 10^5 M_\odot$
- **Low eccentricity; no cloudy morphology**
- **advantageous orbital alignment**
- **High inclination with respect to the disc** $\gtrsim 45^\circ$
- **Distant from the disc** $d \gtrsim 10 \text{ kpc}$
- **more?**

Thin Streams | Orientation



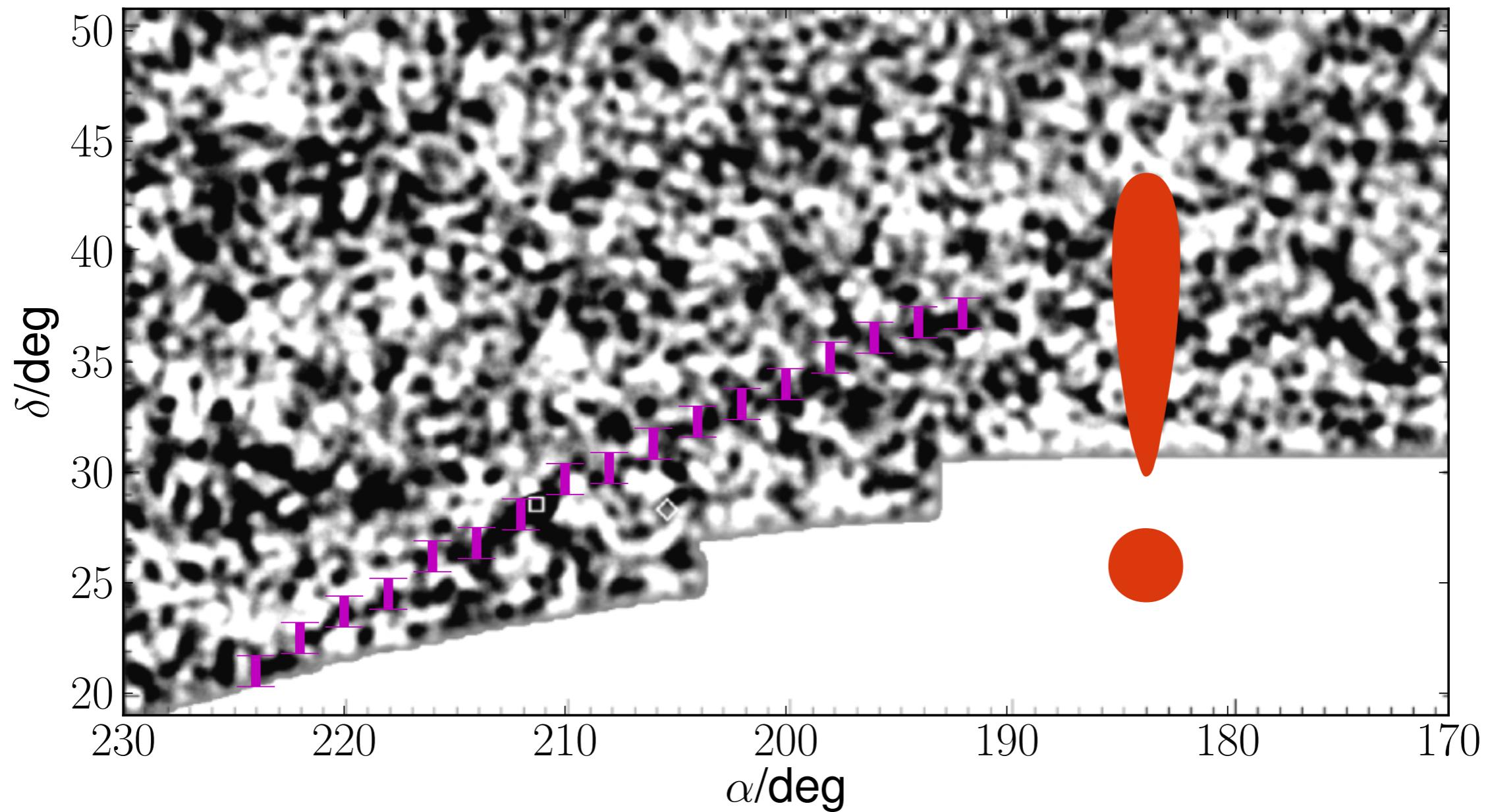
Sagittarius
Pal 5
NGC 5466

Thin Streams | NGC 5466



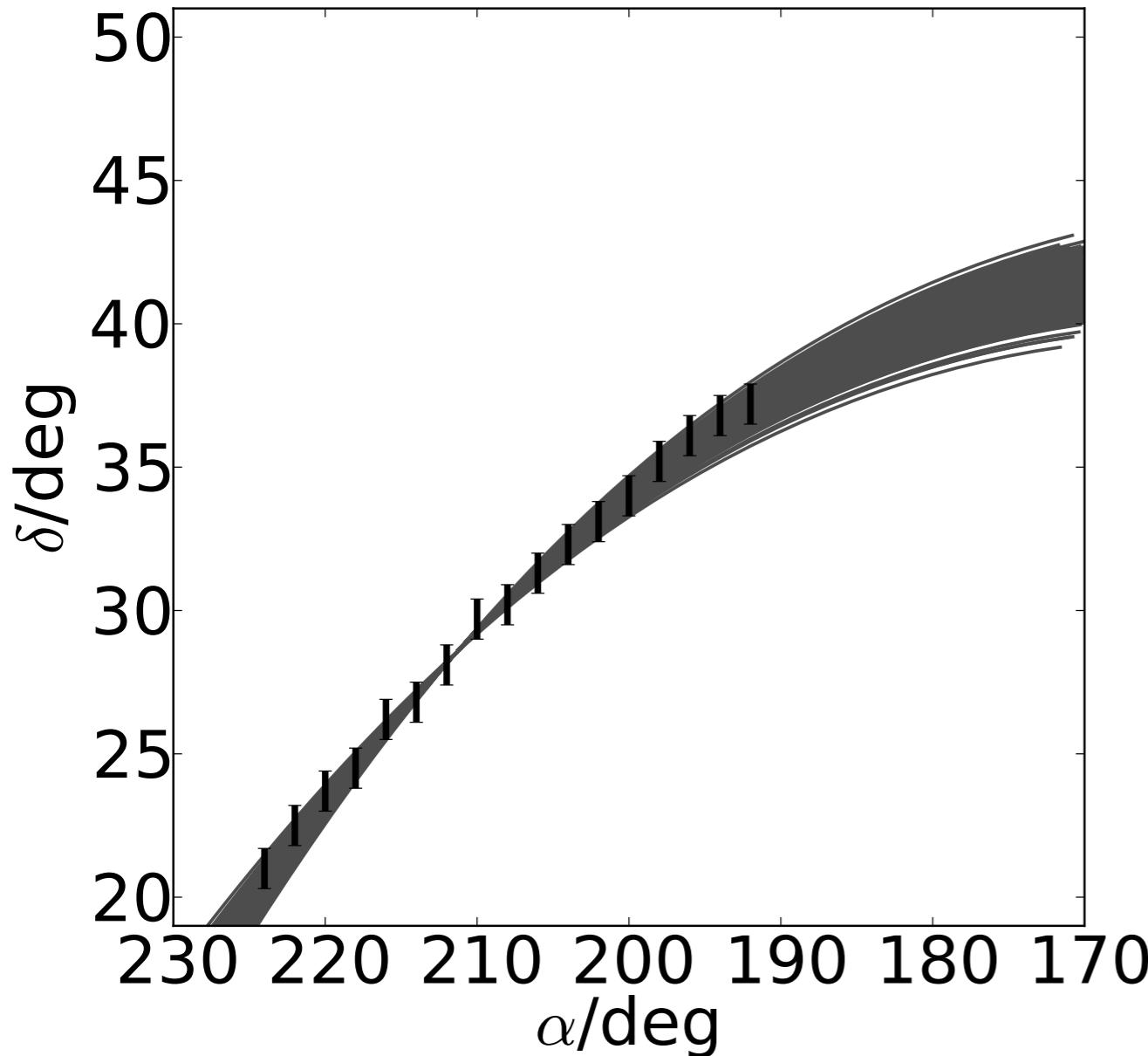
Grillmair & Johnson 06

Thin Streams | NGC 5466



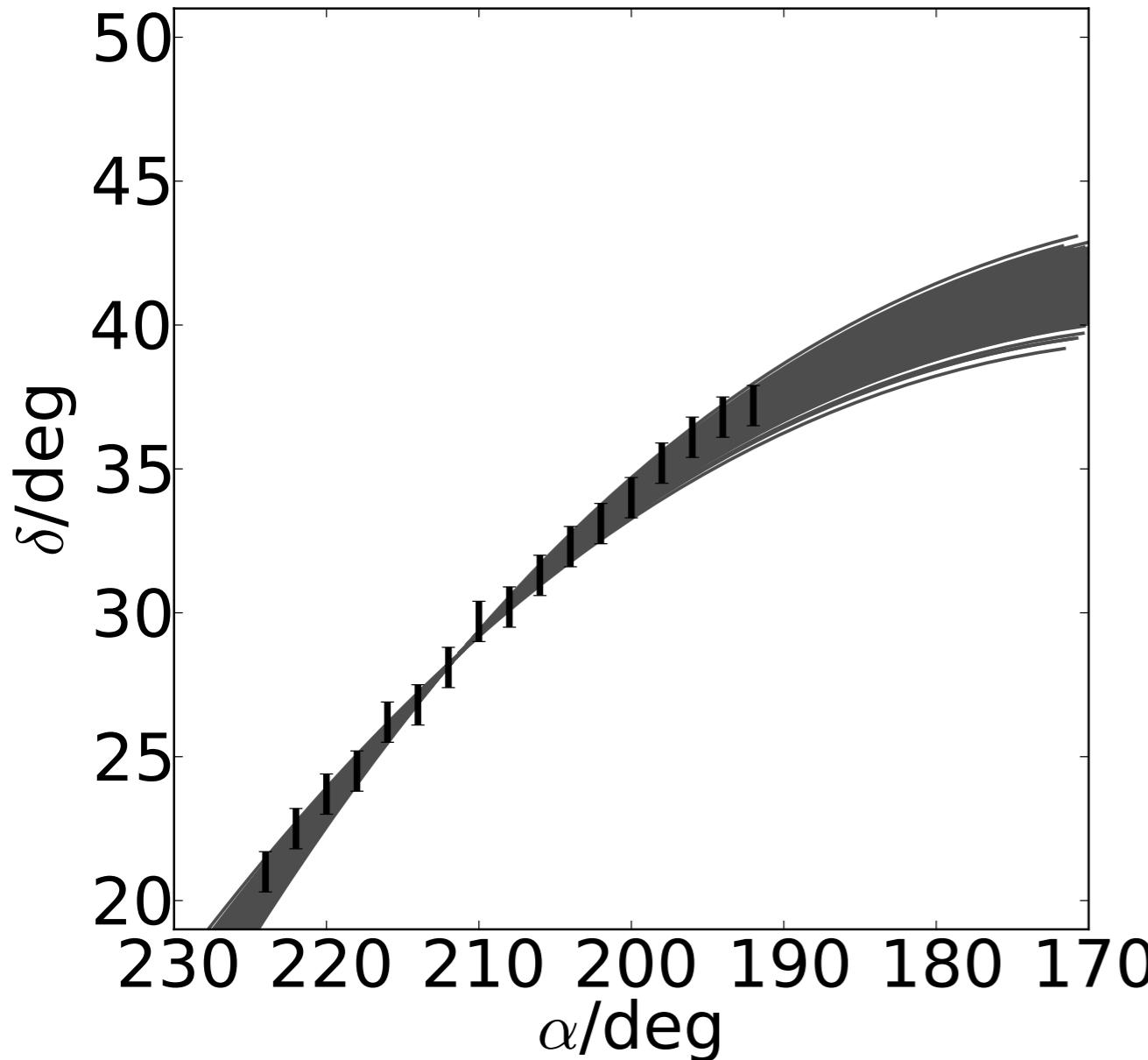
Grillmair & Johnson 06

Thin Streams | NGC 5466

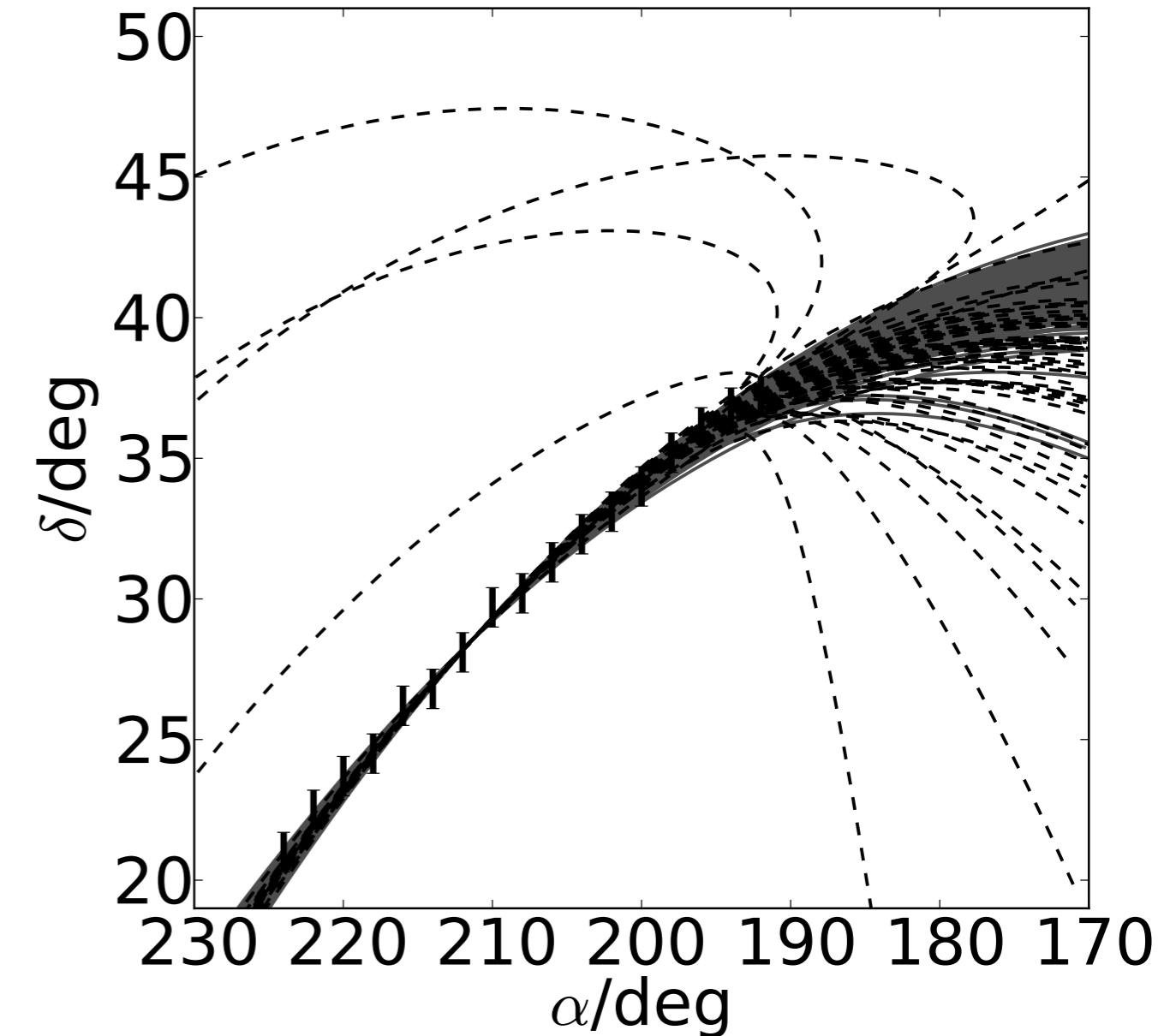


**Spherical/Prolate
Halo**

Thin Streams | NGC 5466

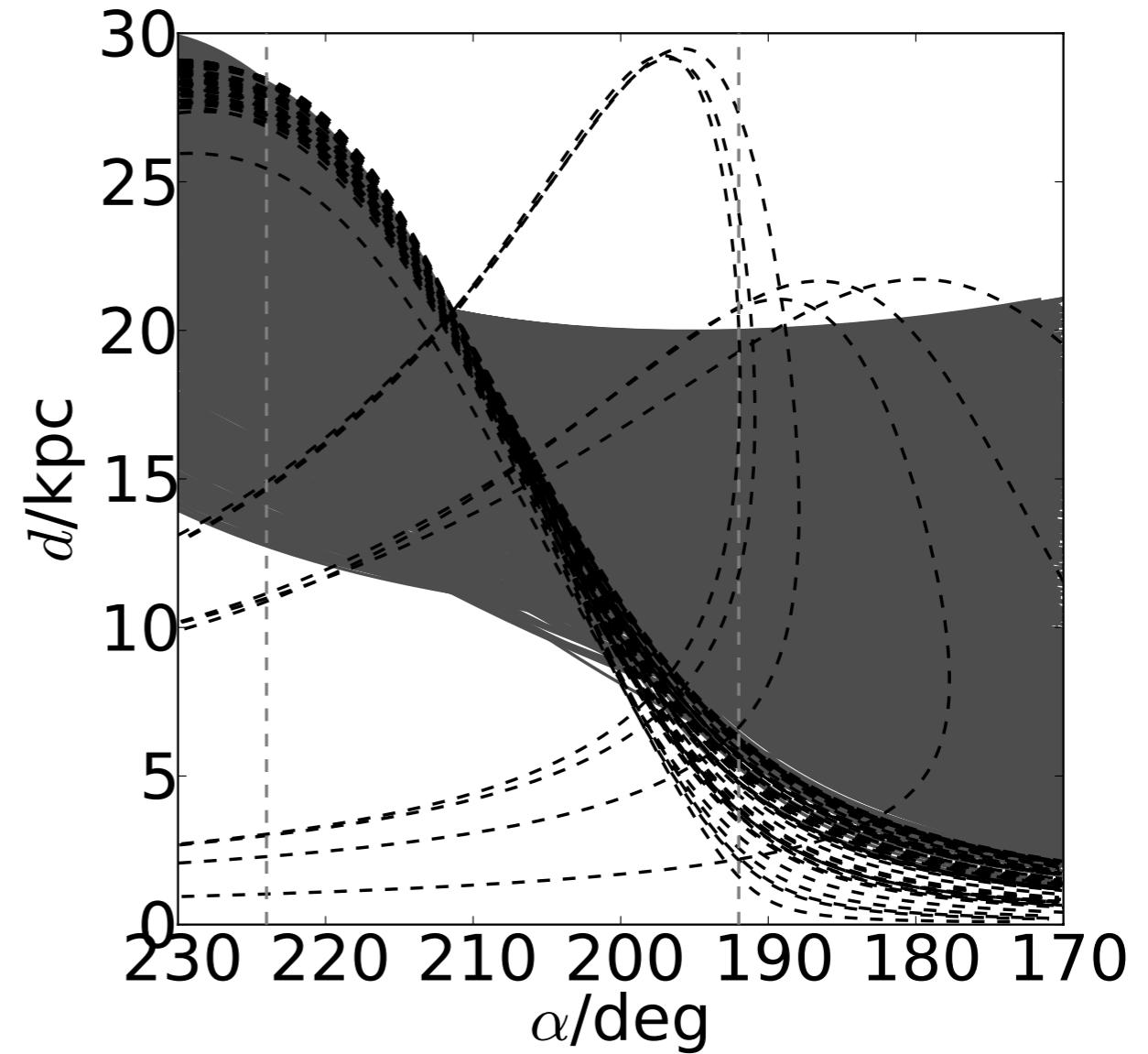
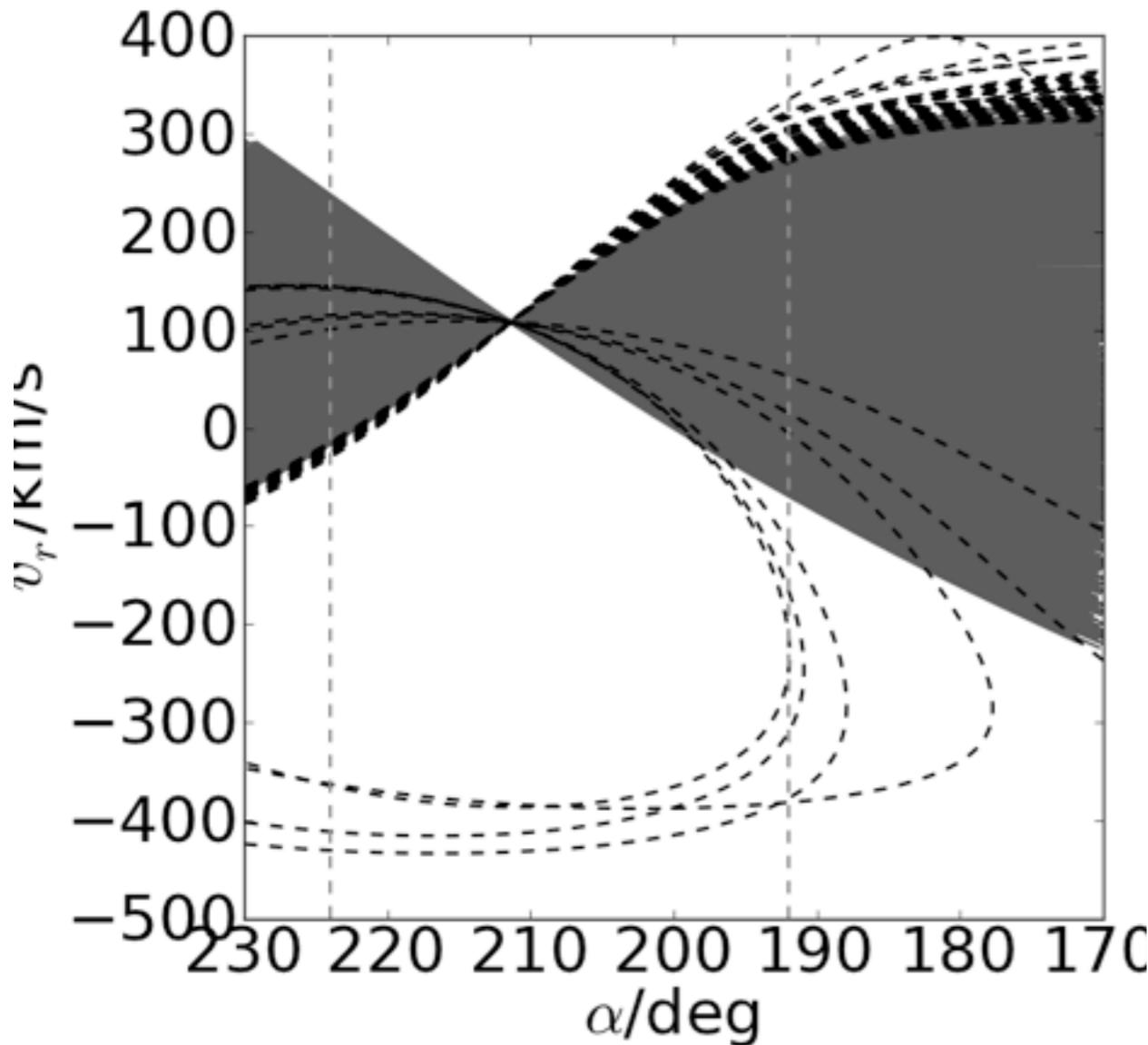


**Spherical/Prolate
Halo**



**Oblate/Triaxial
Halo**

Thin Streams | NGC 5466



Lux et al. 2012, submitted to MNRAS

Thin Streams | Summary

- So far Sagittarius provides the best constraints on the MW halo shape
- Thin streams promise a simpler approach
- However, the current data is not constraining
- Serendipity: NGC 5466 promises a new way to constrain the MW halo shape

Subhaloes going Notts

How well
can we
recover
subhaloes?

a workshop on finding subhaloes in cosmological simulations
in
Dovedale, Nottingham (UK)

14/05/2012 – 18/05/2012

more information and registration at
<http://popia.ft.uam.es/SubhaloesGoingNotts>



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