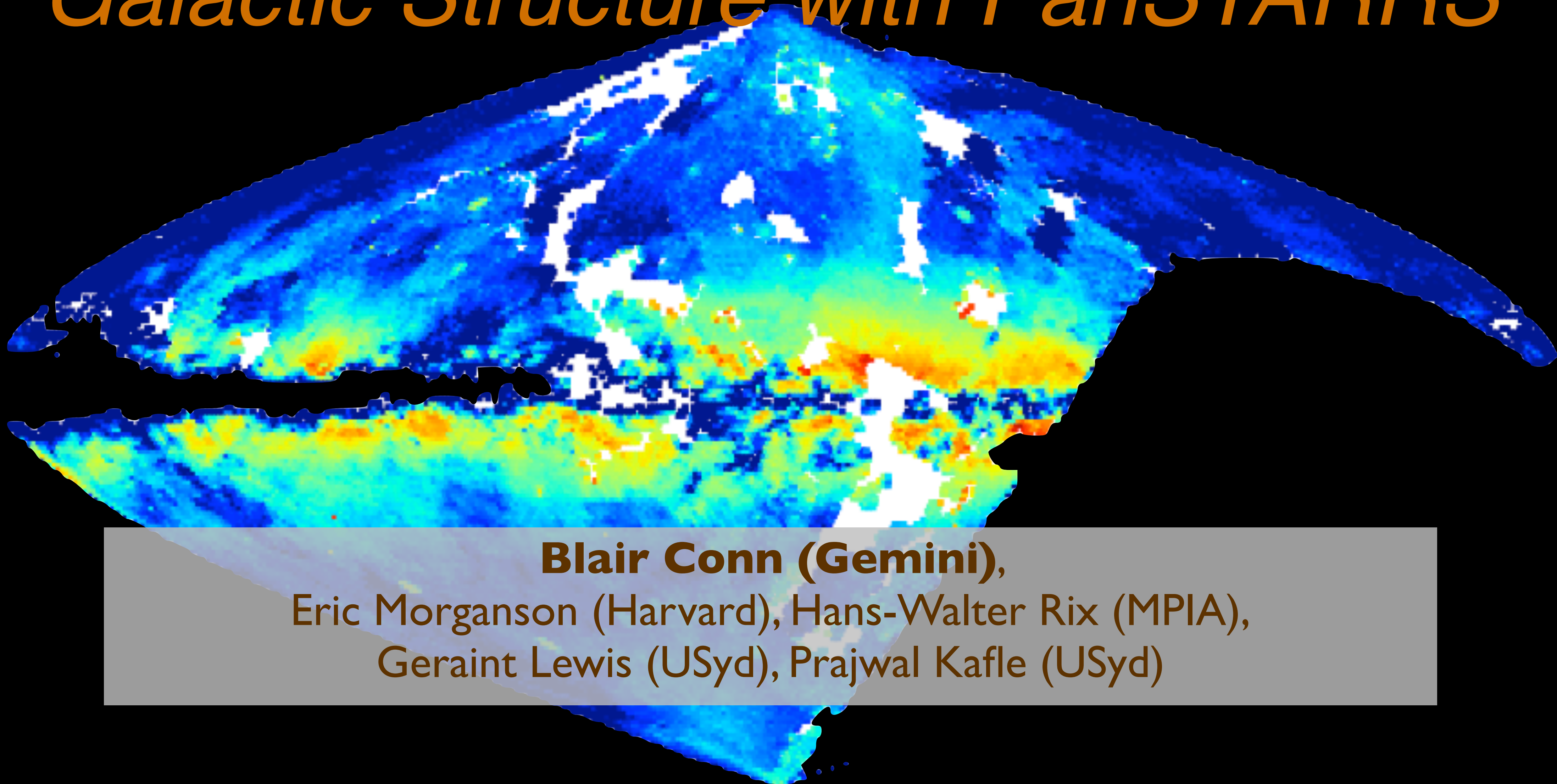


Galactic Structure with PanSTARRS



Blair Conn (Gemini),
Eric Morganson (Harvard), Hans-Walter Rix (MPIA),
Geraint Lewis (USyd), Prajwal Kafle (USyd)

Blair Conn - ESO Chile- November 2013

Overview

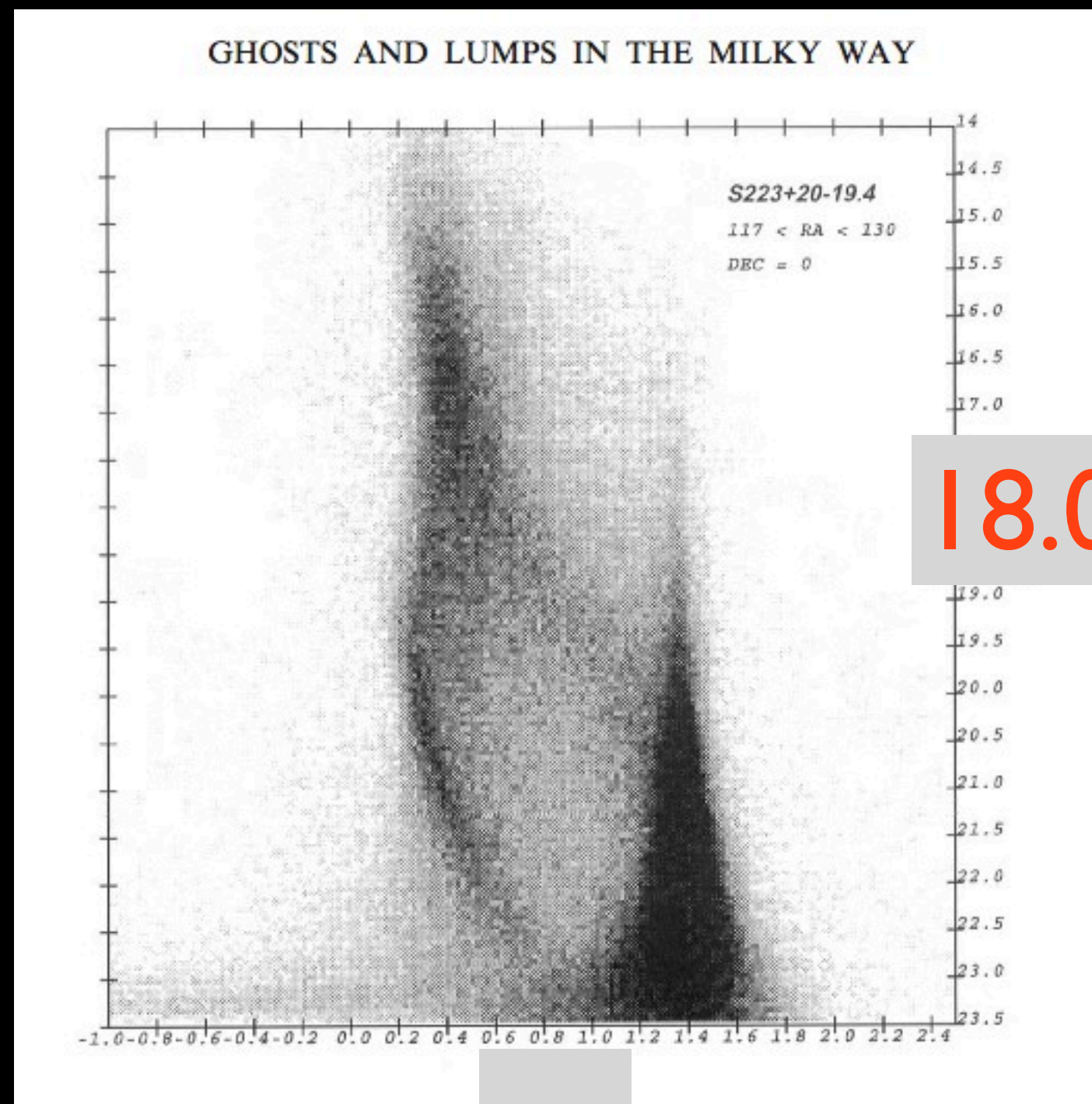
- Motivation
- Colour-Magnitude diagram fitting and its application
- The Galaxy: a vanilla model
- Quick Reminder of what is PanSTARRS
- ~~Show Results, Show Preliminary Results~~, Show data
- Conclusion

Overview

- Motivation
- Colour-Magnitude diagram fitting and its application
- The Galaxy: a vanilla model
- Quick Reminder of what is PanSTARRS
- Show data
- Conclusion

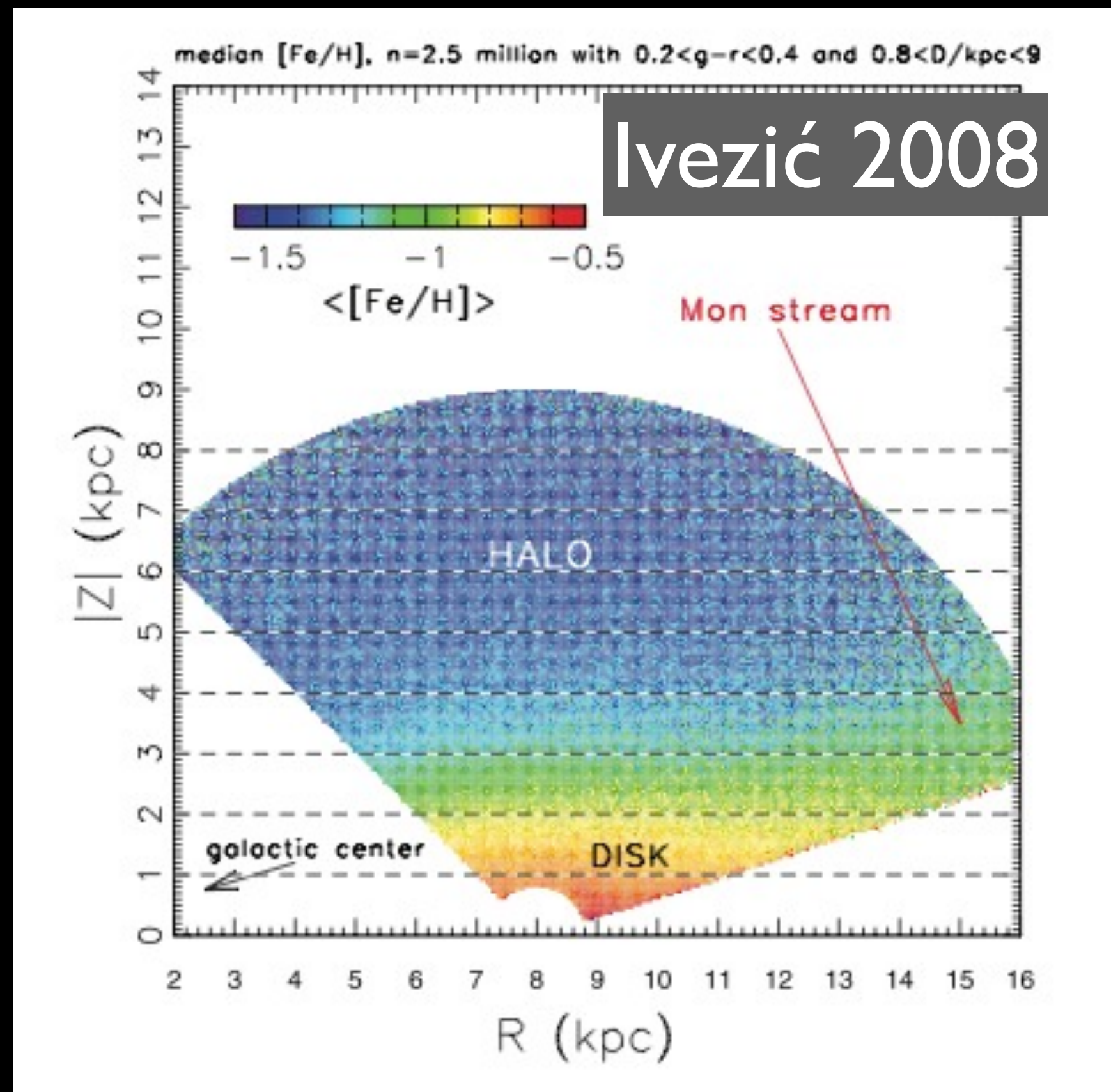
Motivation

Monoceros Overdensity and the Outer Disk



g-r

Newberg 2002

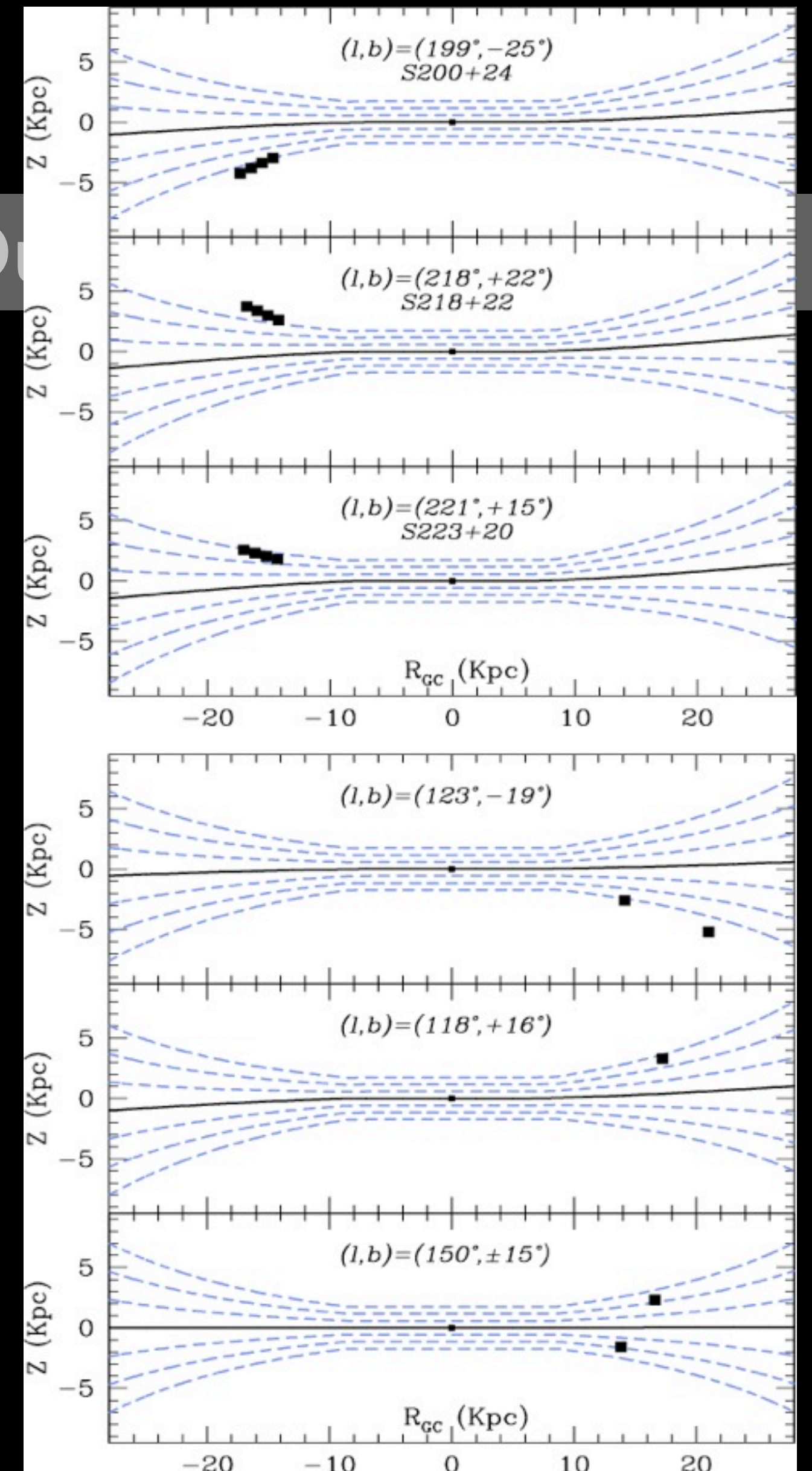
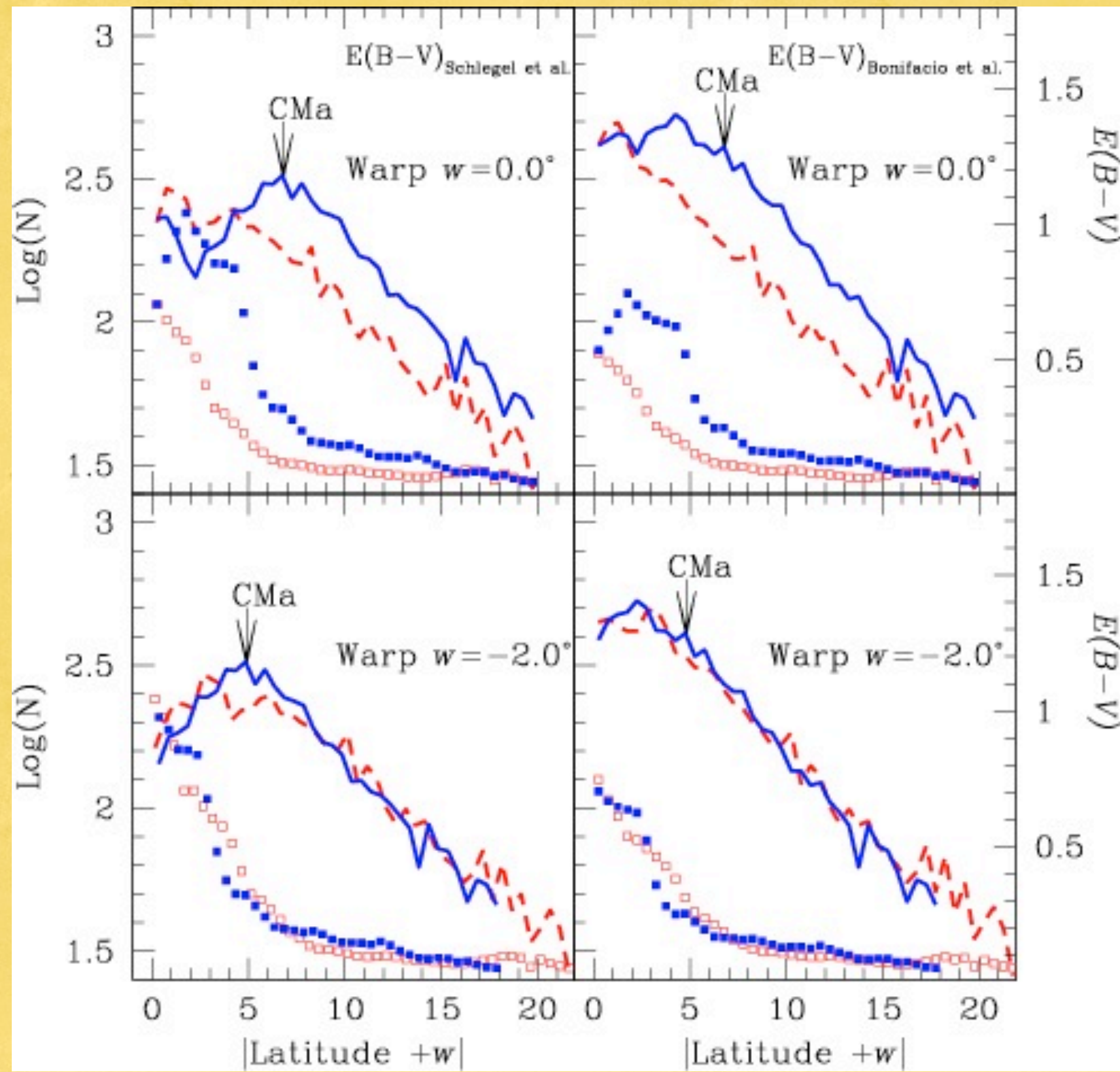


09

Motivation

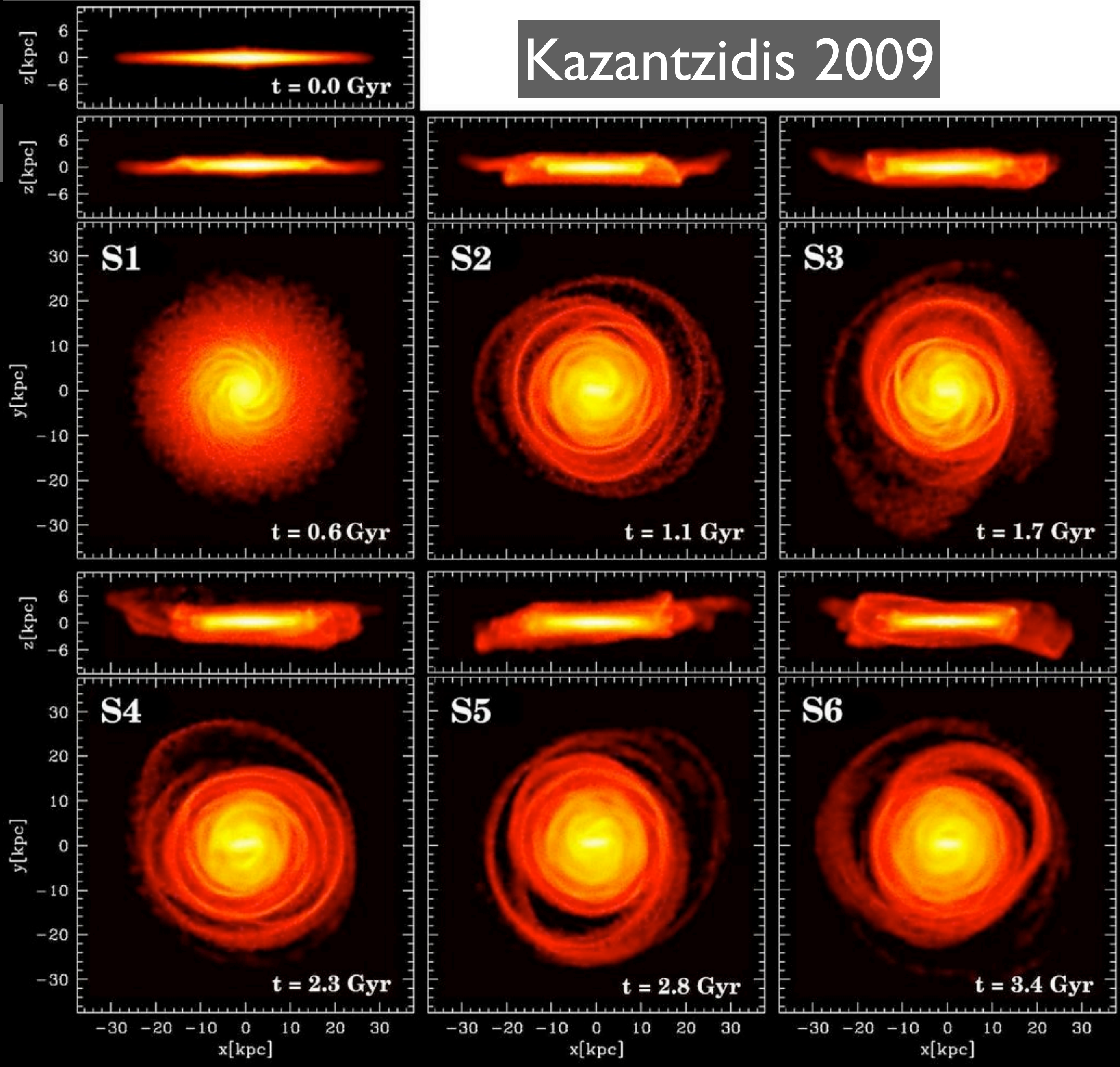
Monoceros Overdensity and the O

Momany 2004



It's the Warp/Flare!!

Kazantzidis 2009

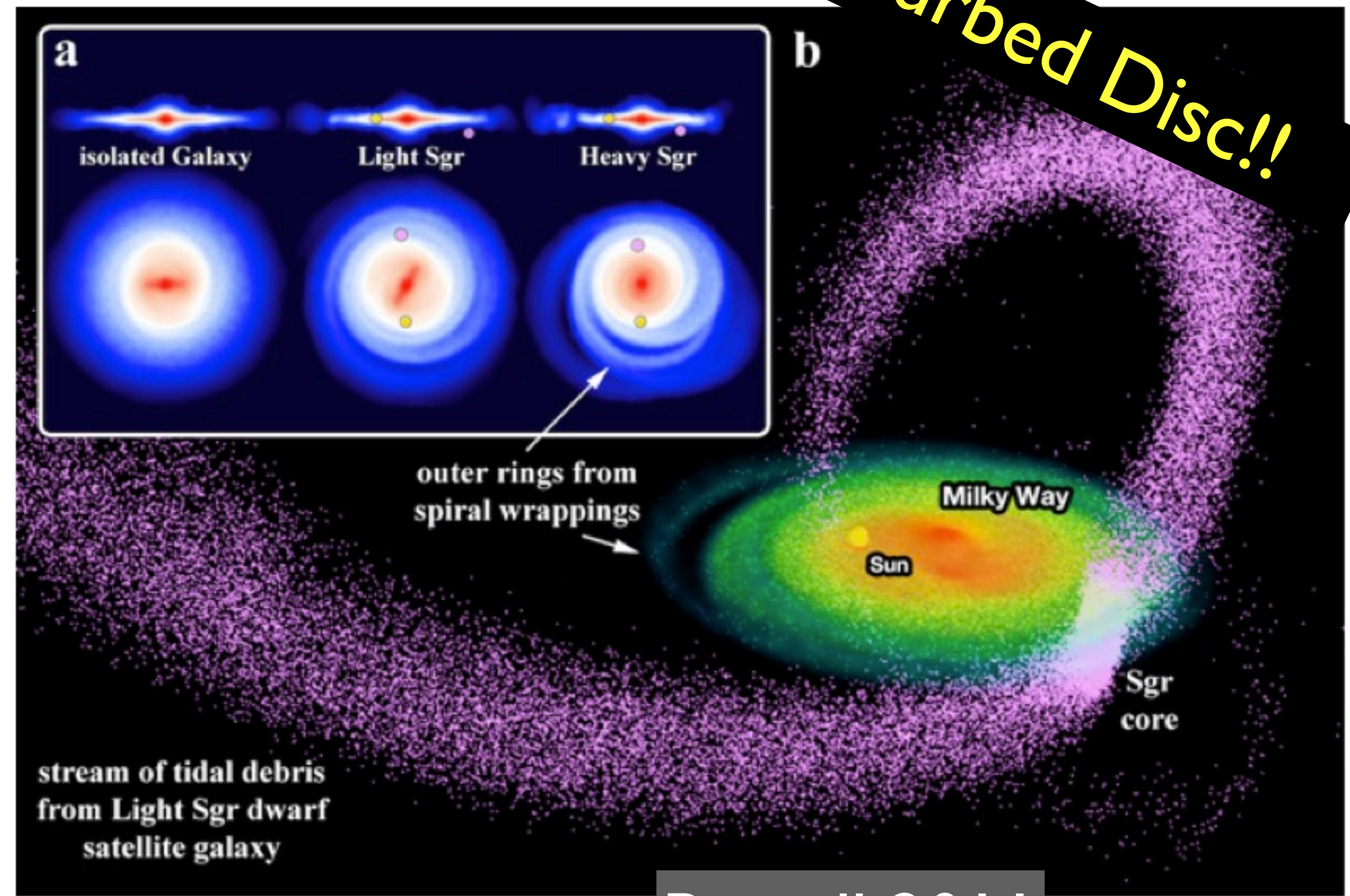
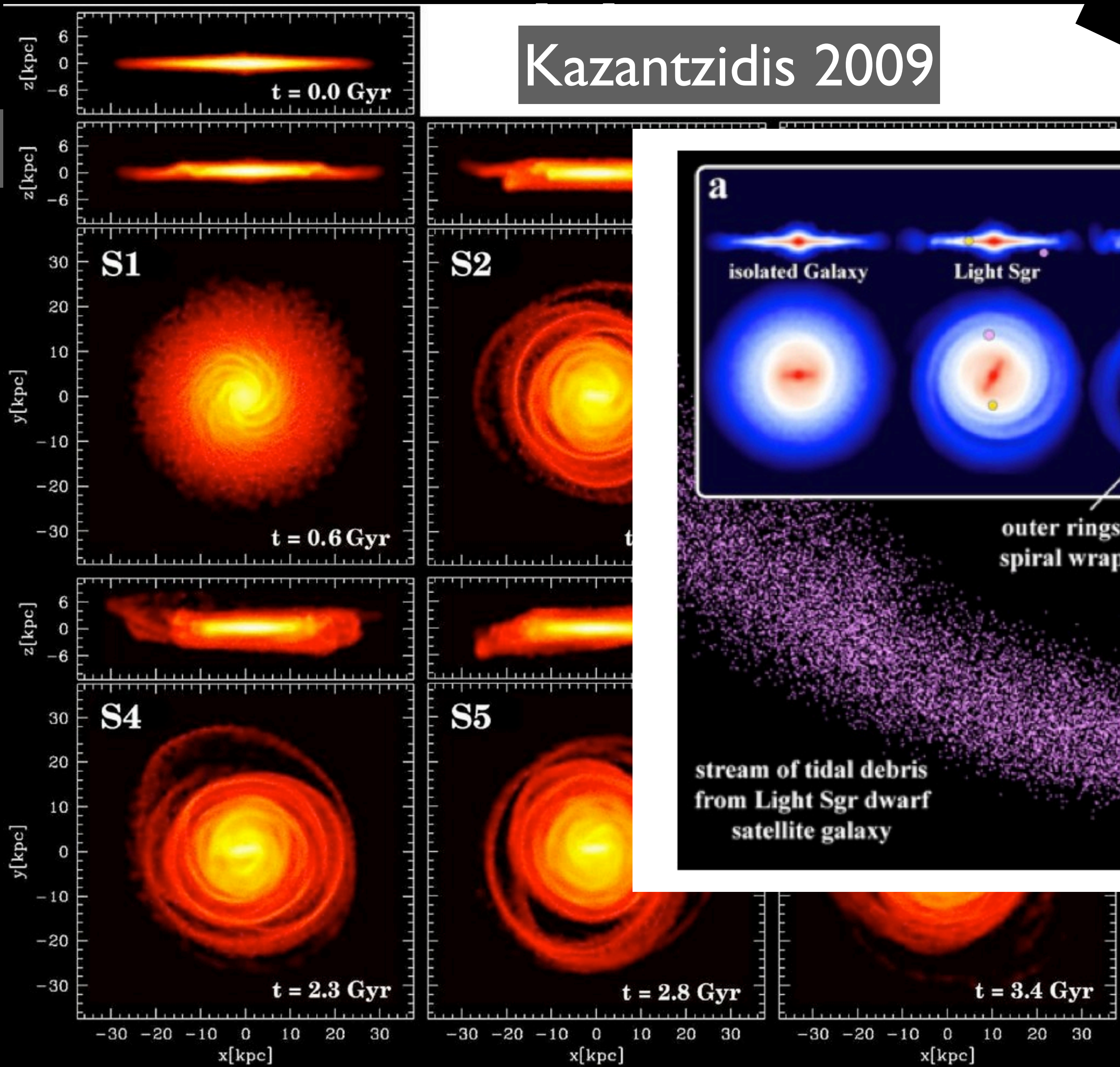


Outer Disc

It's a Perturbed Disc!!

Kazantzidis 2009

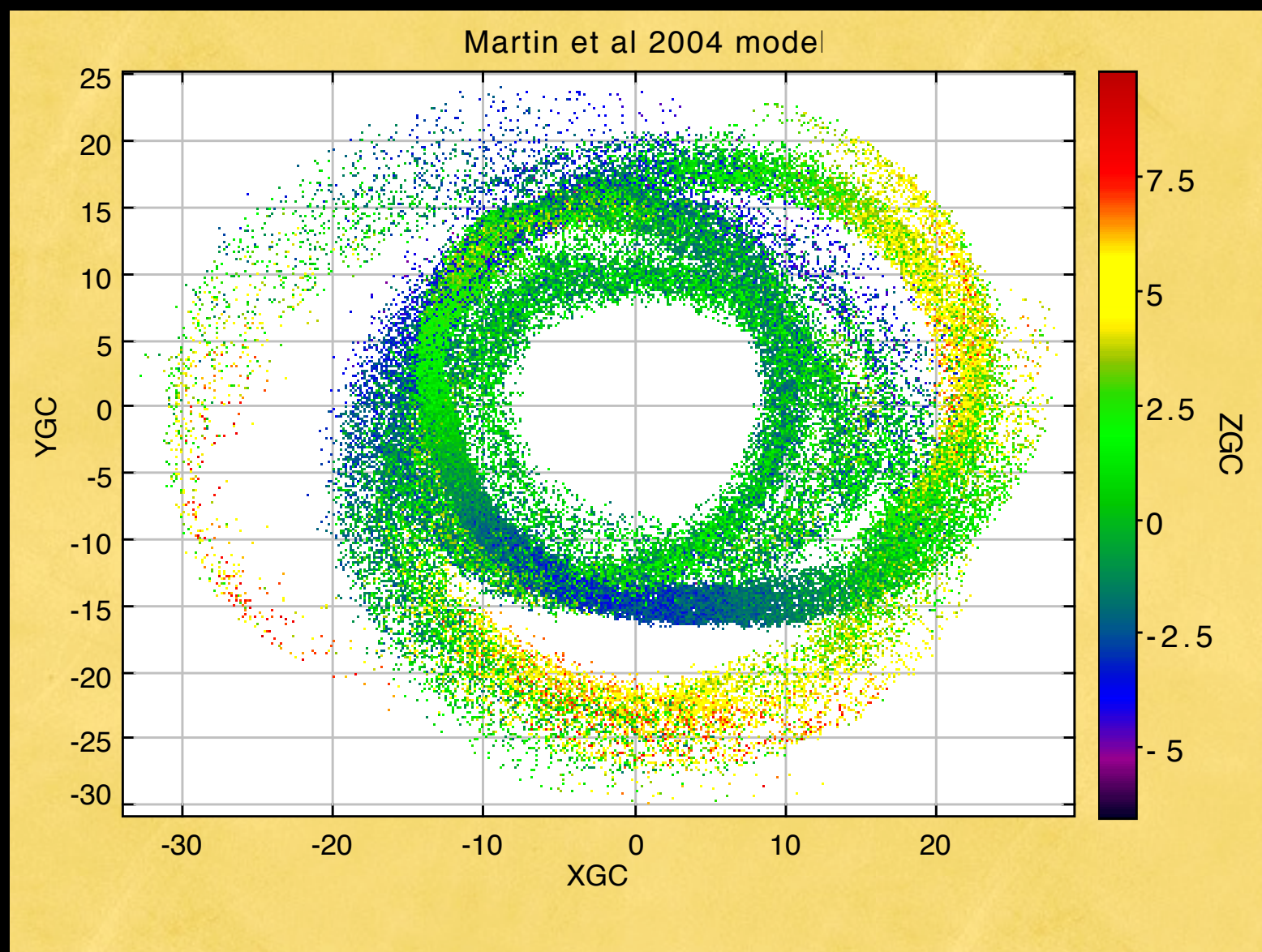
It's a Perturbed Disc!!



Purcell 2011

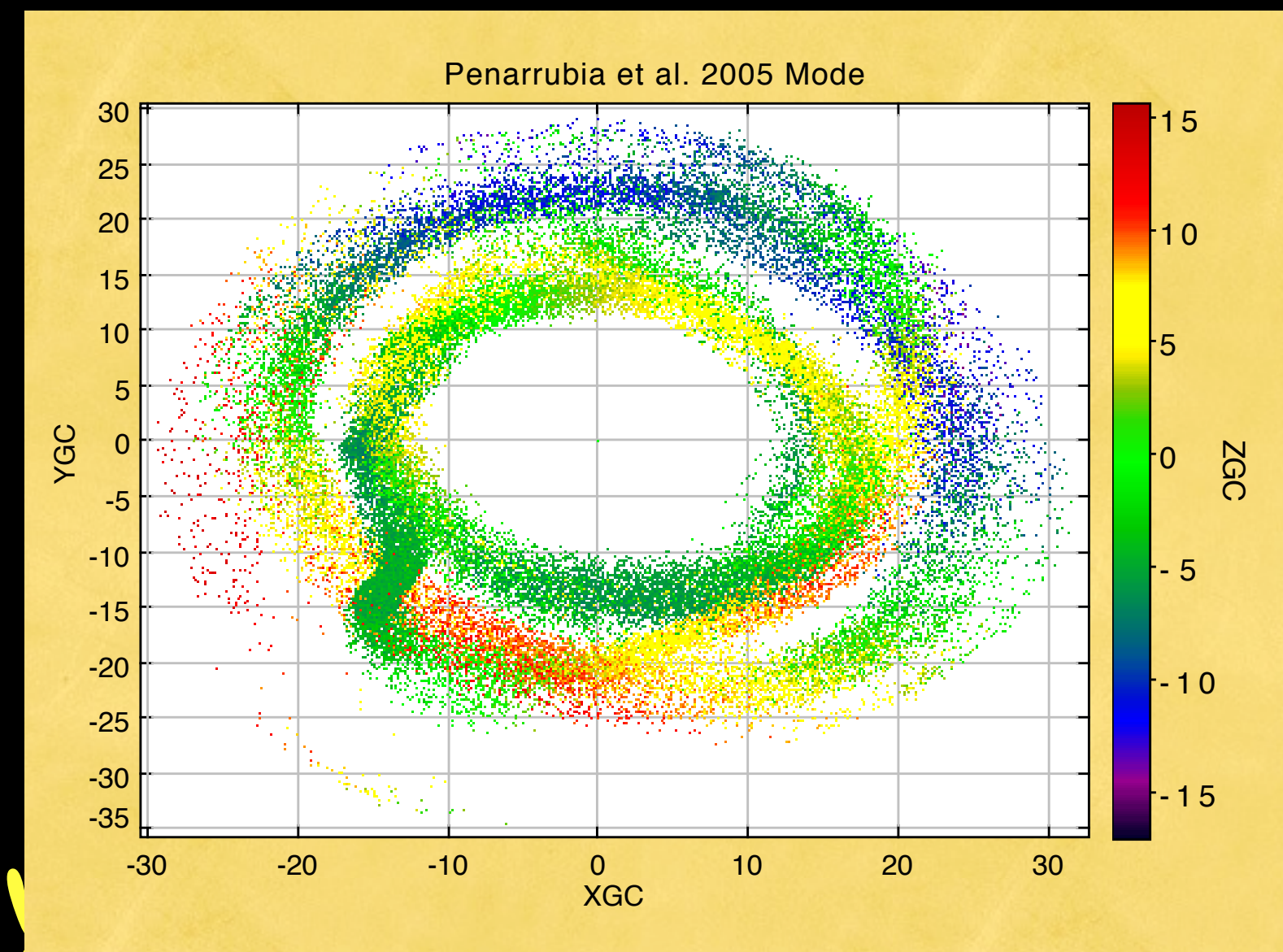
Motivation

Monoceros Overdensity and the Outer Disk



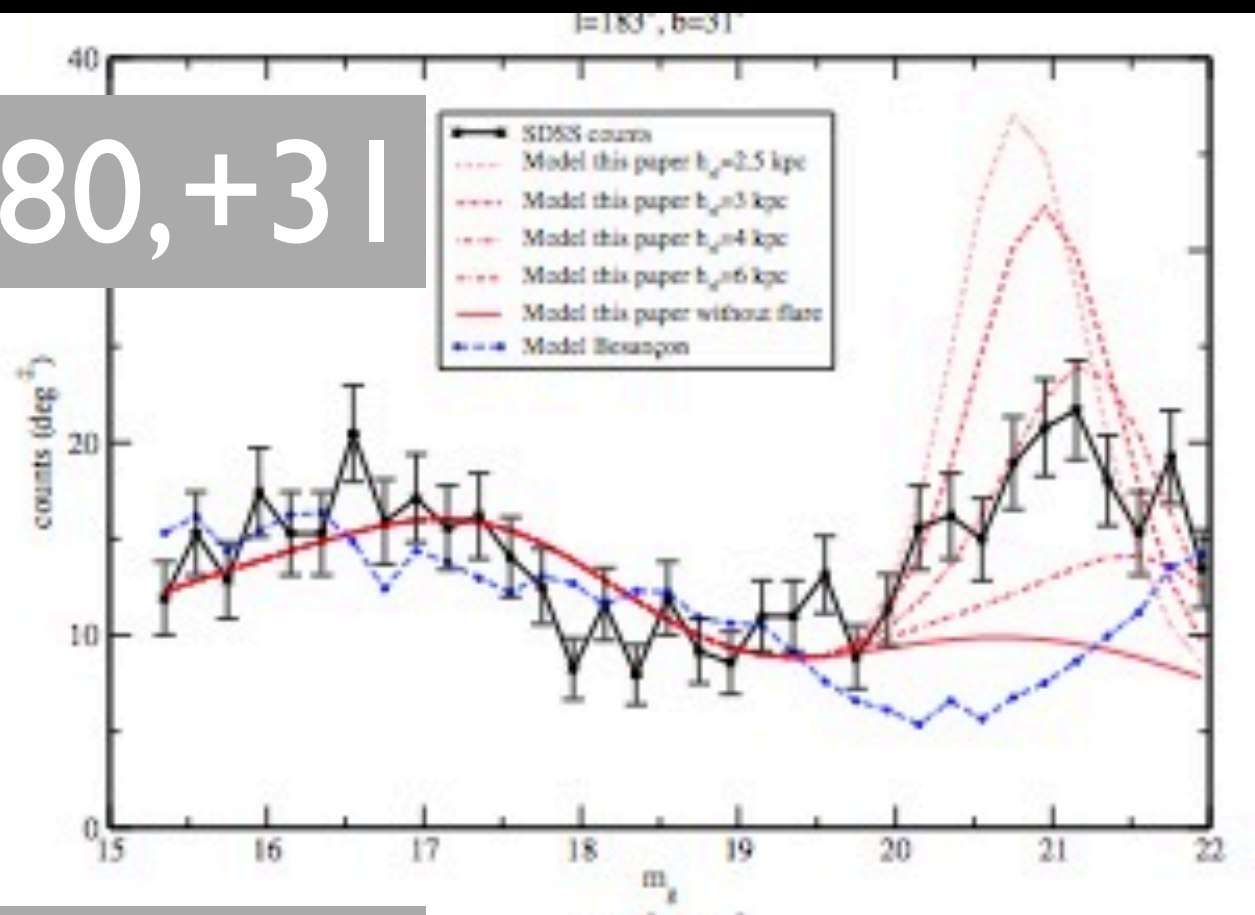
Martin 2004

It's a Tidal Stream!



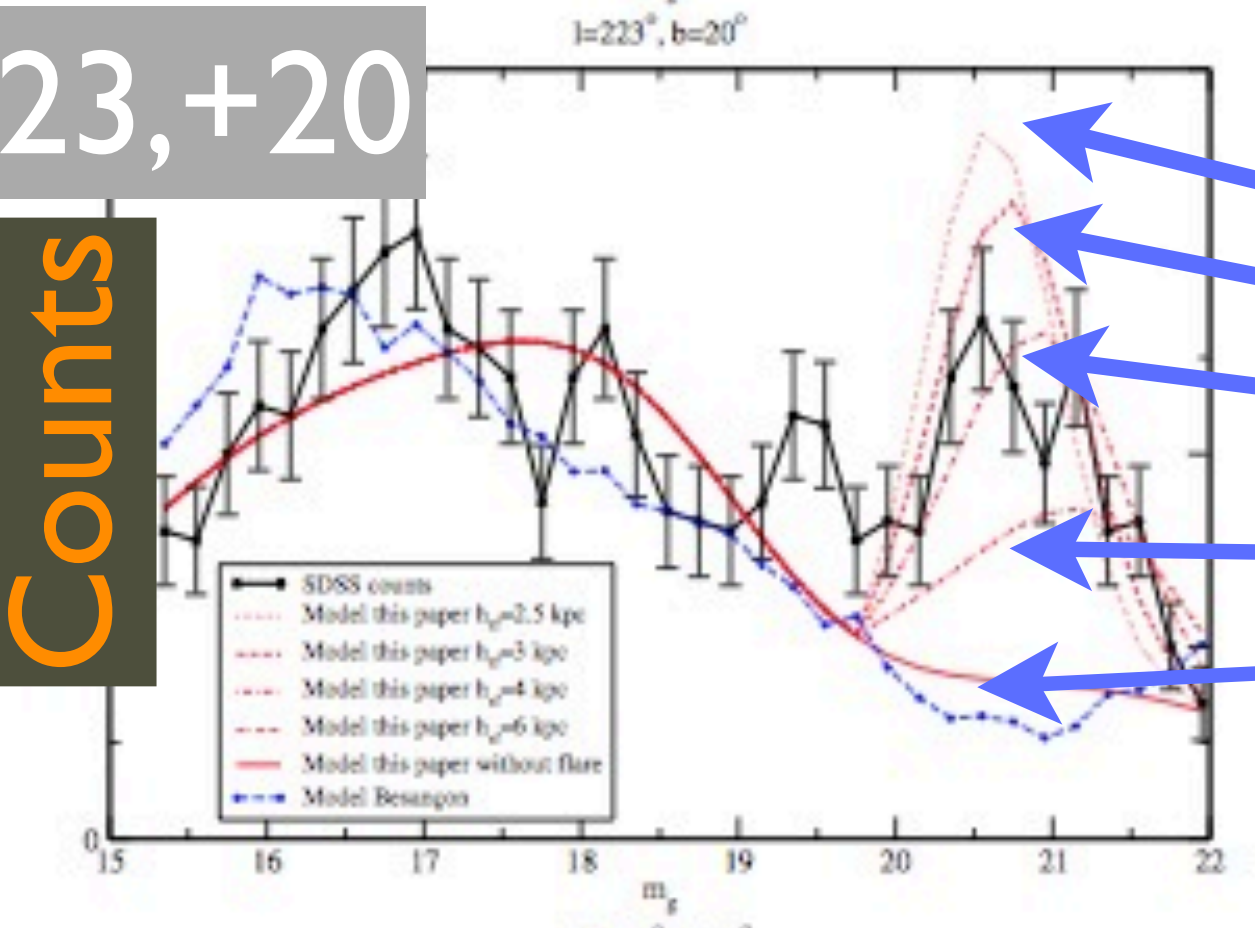
Peñarrubia 2005

180,+31

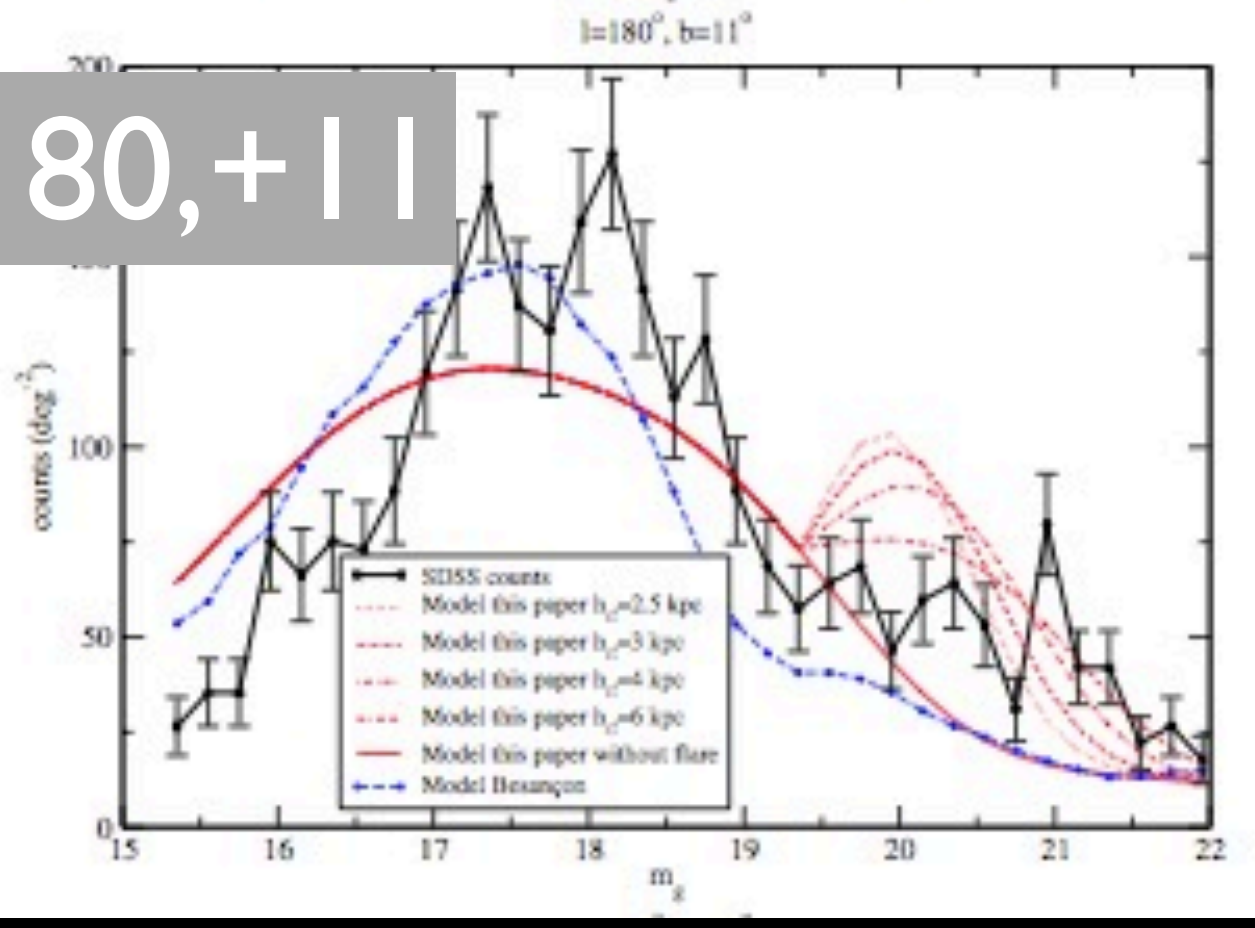


223,+20

Counts



180,+11



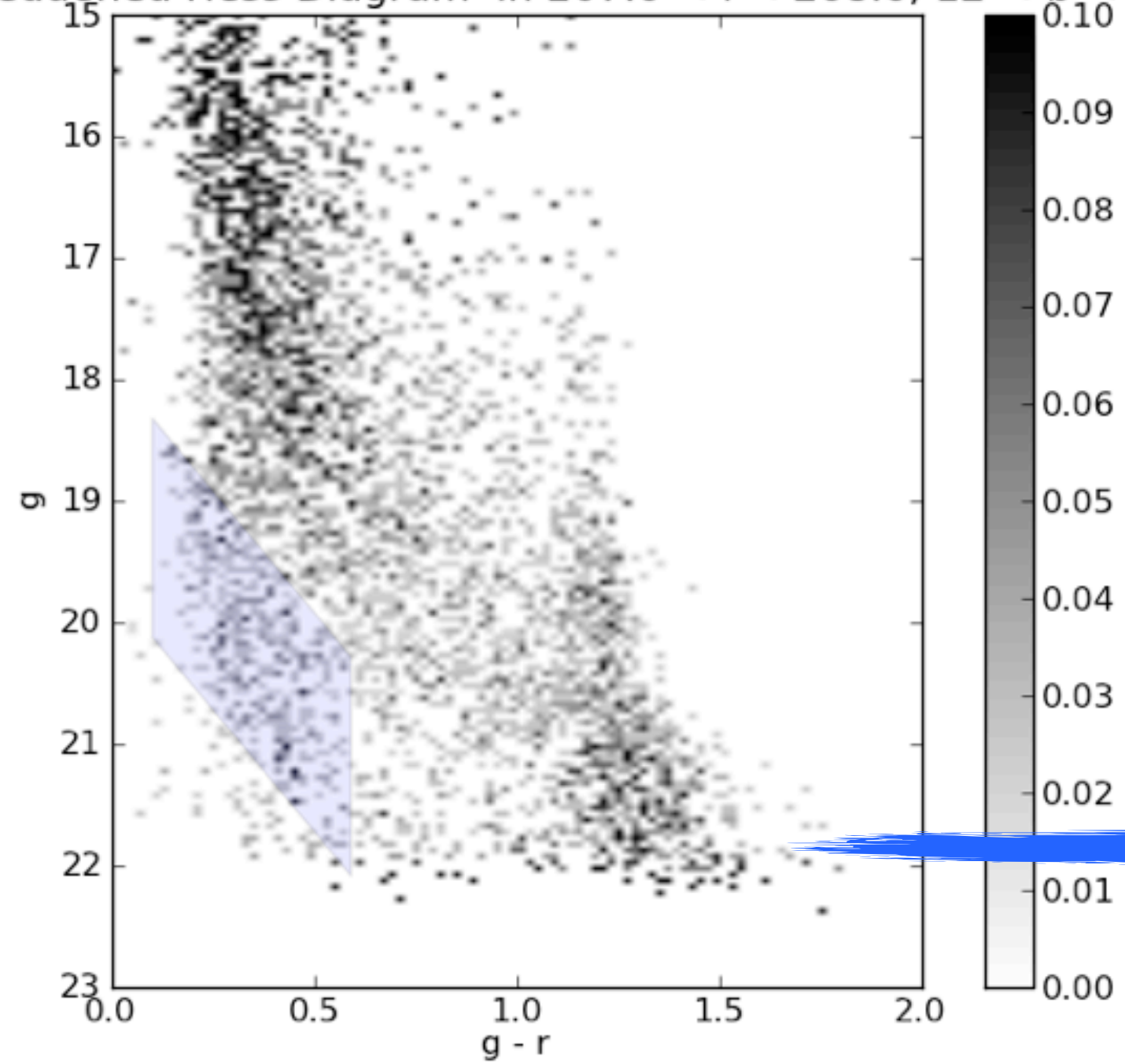
Different Models of the Galactic Flare

Hammersley 2011

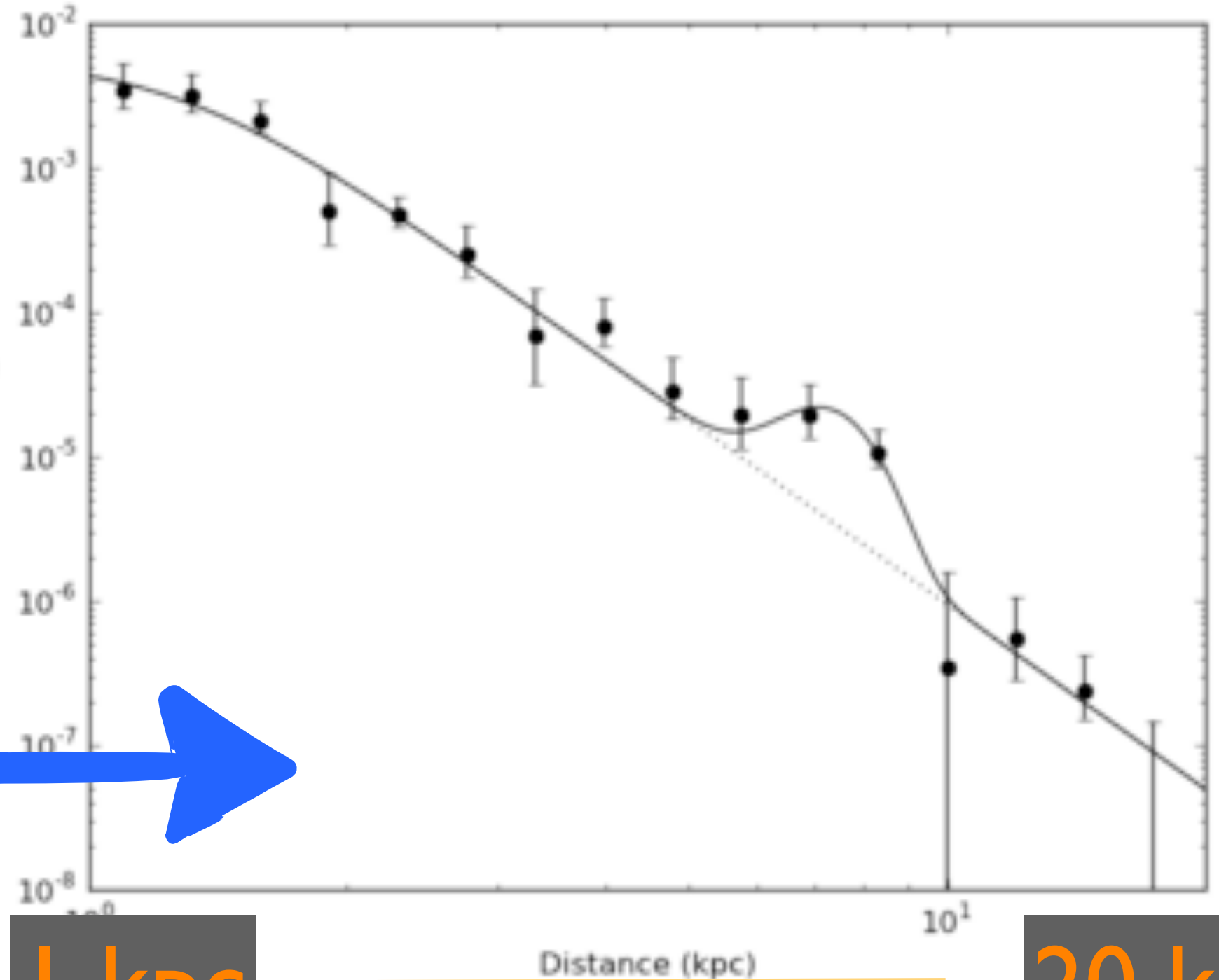
CMD Fitting

PanSTARRS

g r Dereddened Hess Diagram in $207.0 < l < 208.0, 12 < b < 13$



Density



1 kpc

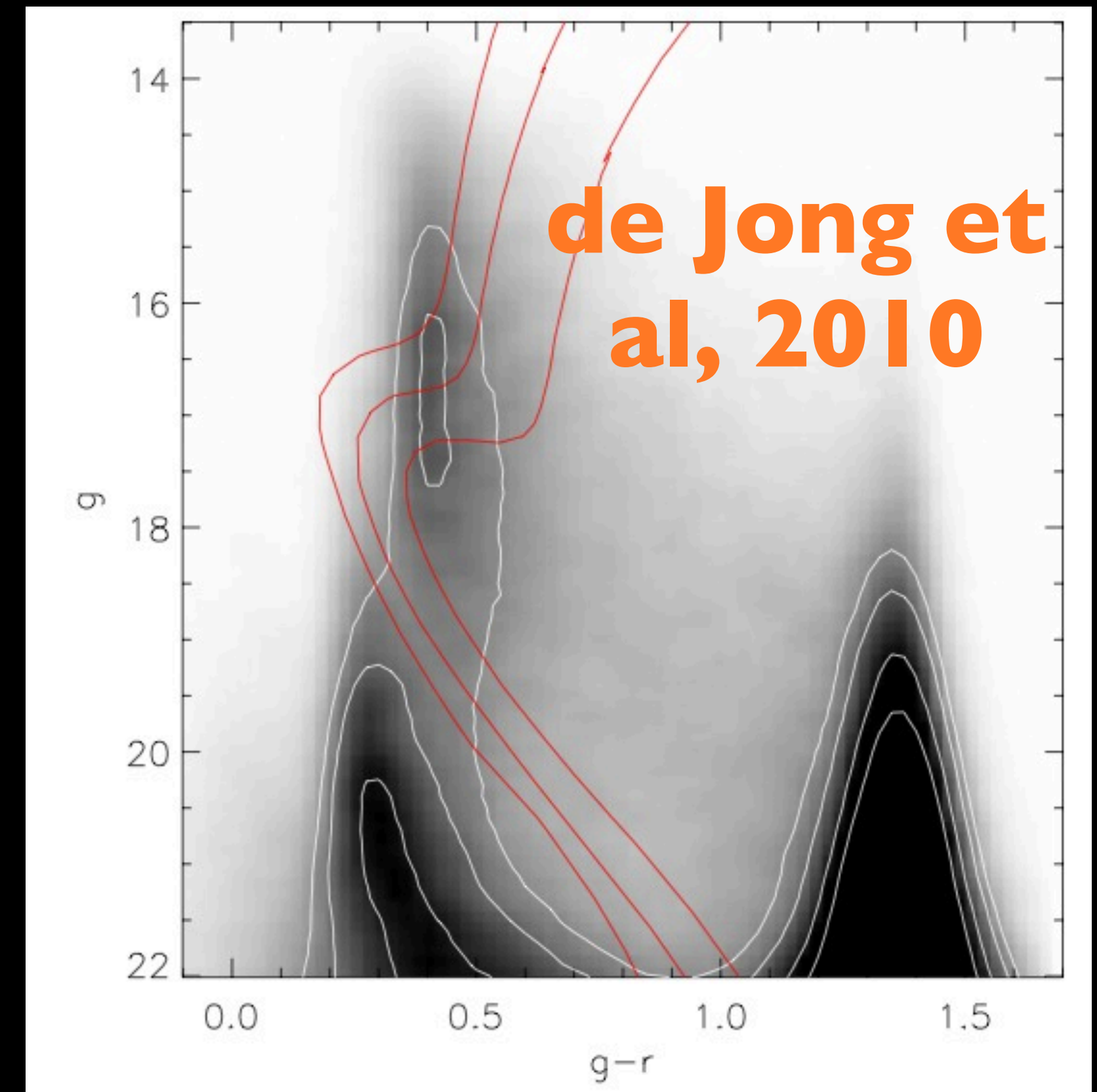
Distance

20 kpc

CMD Fitting

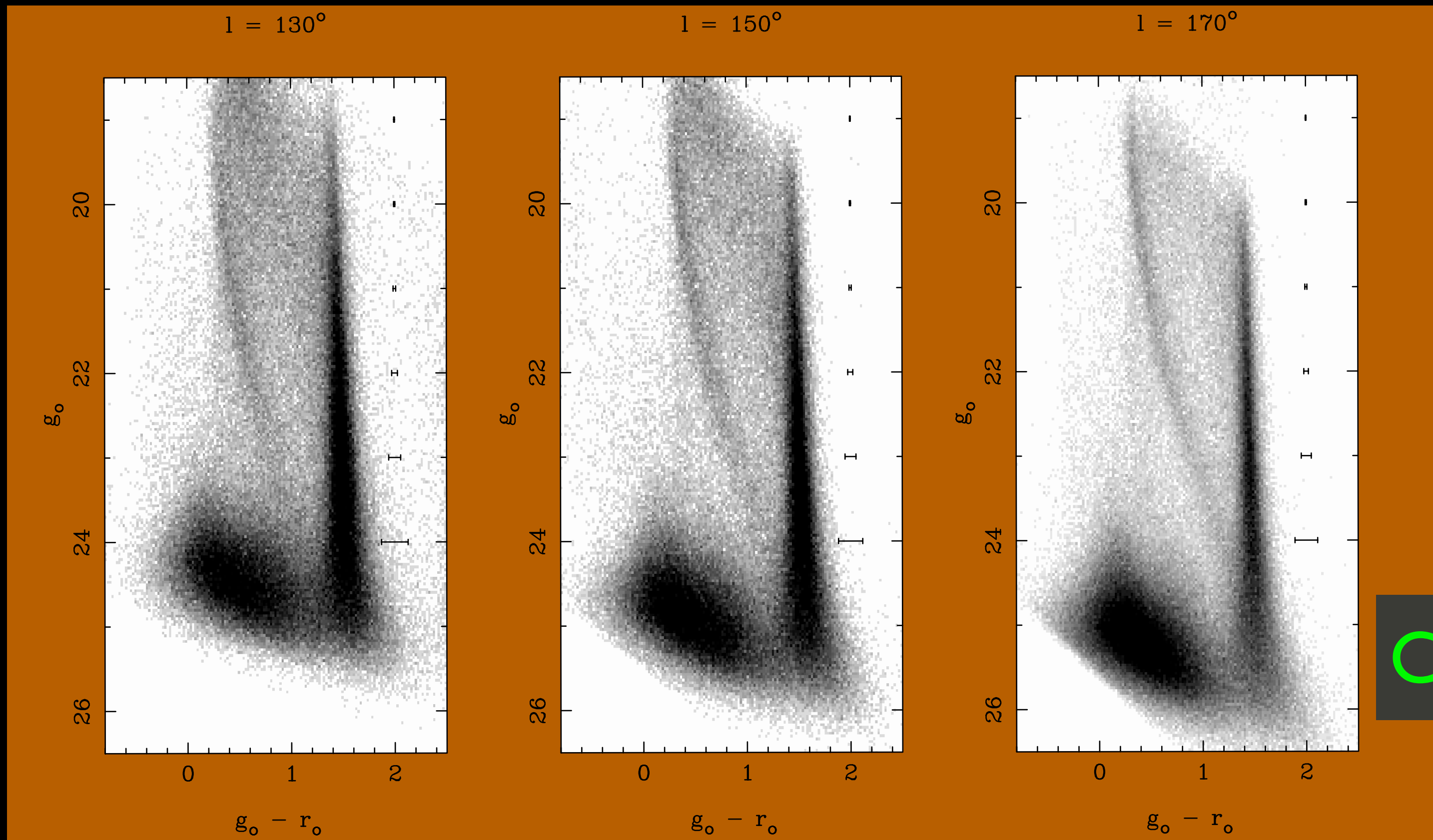
MATCH

**Using a
Star Formation History
Code
in Reverse**



CMD Fitting

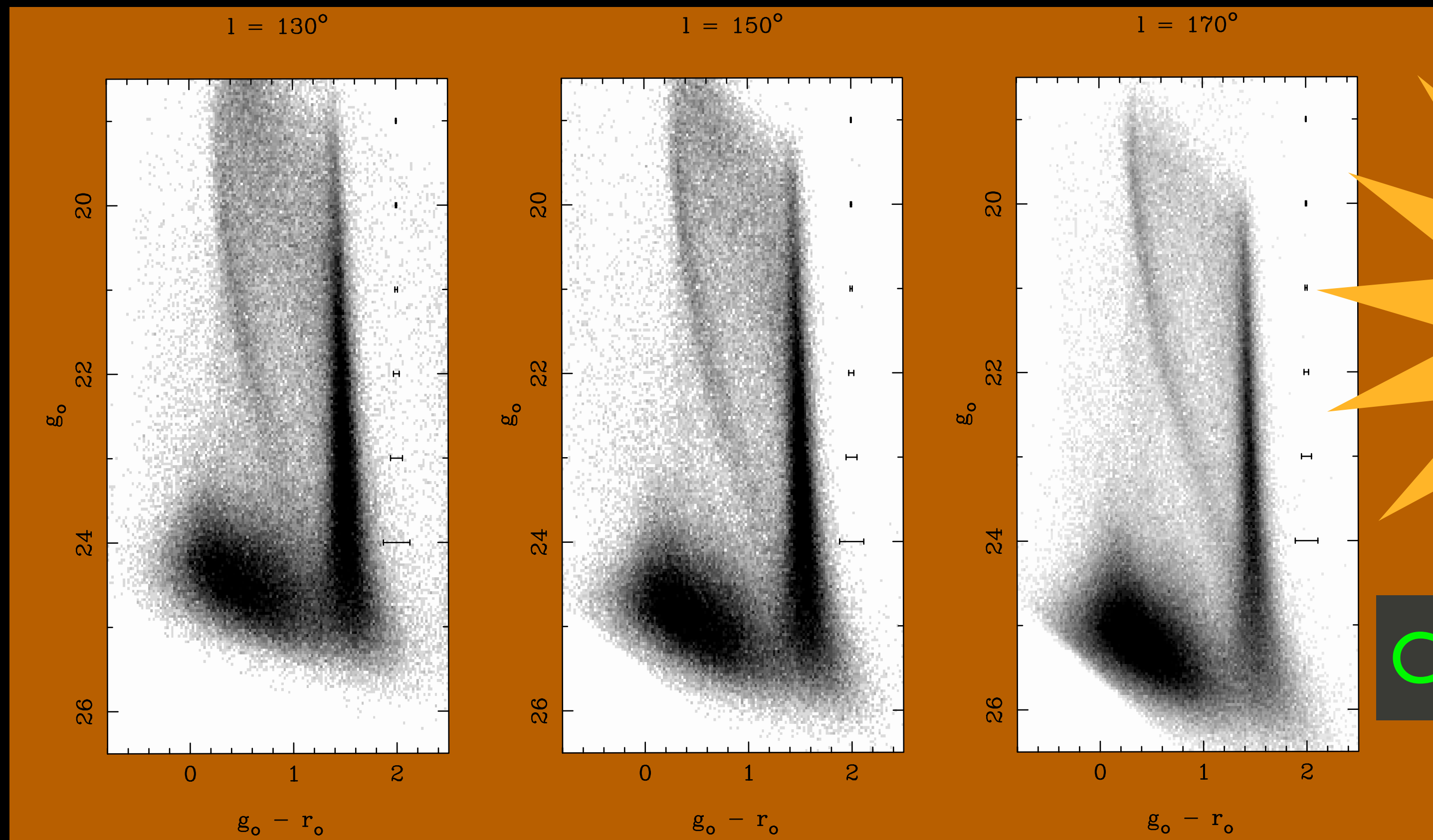
SUBARU



Conn et al, 2012

CMD Fitting

SUBARU



Catalog available!!

Conn et al, 2012

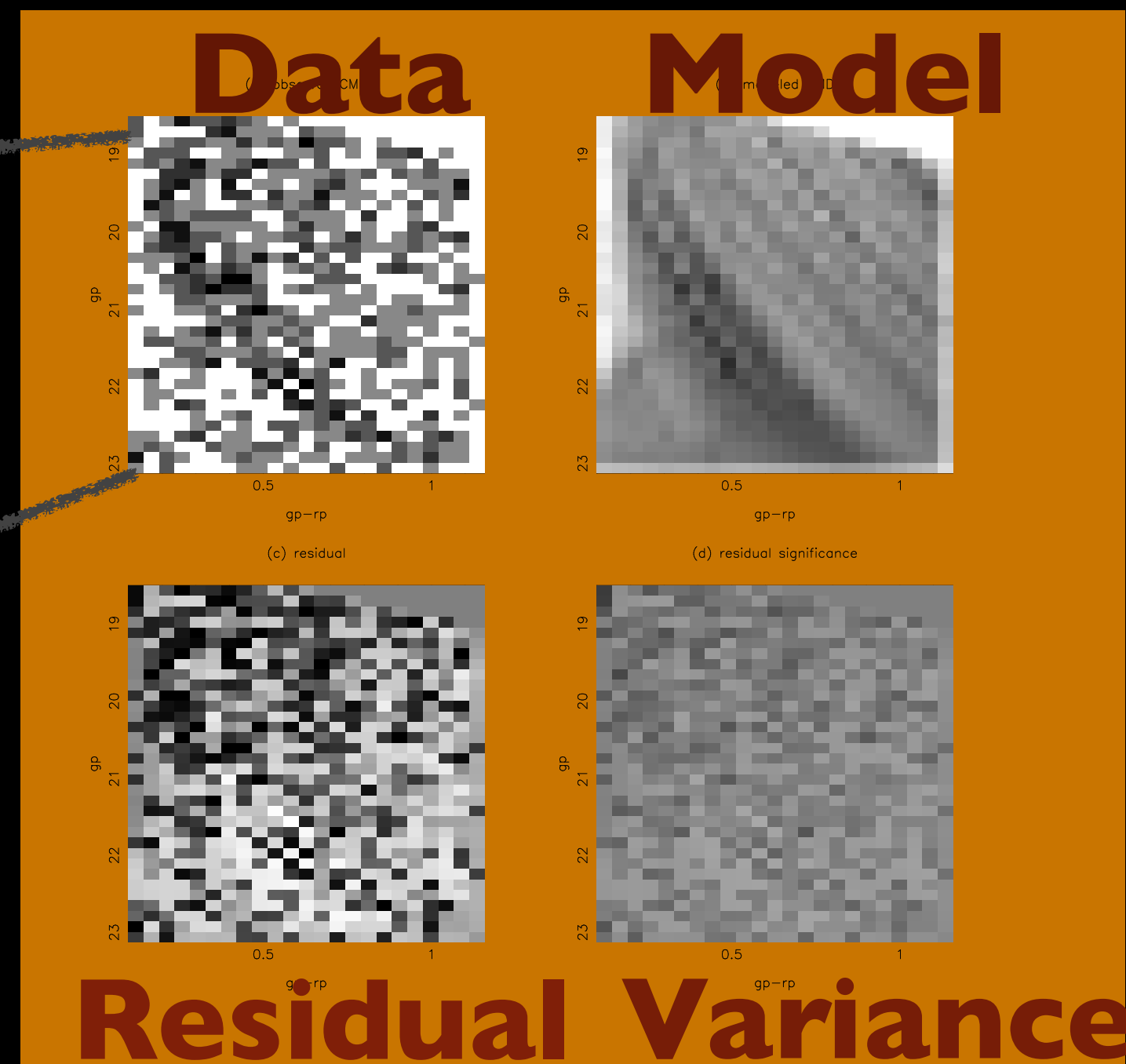
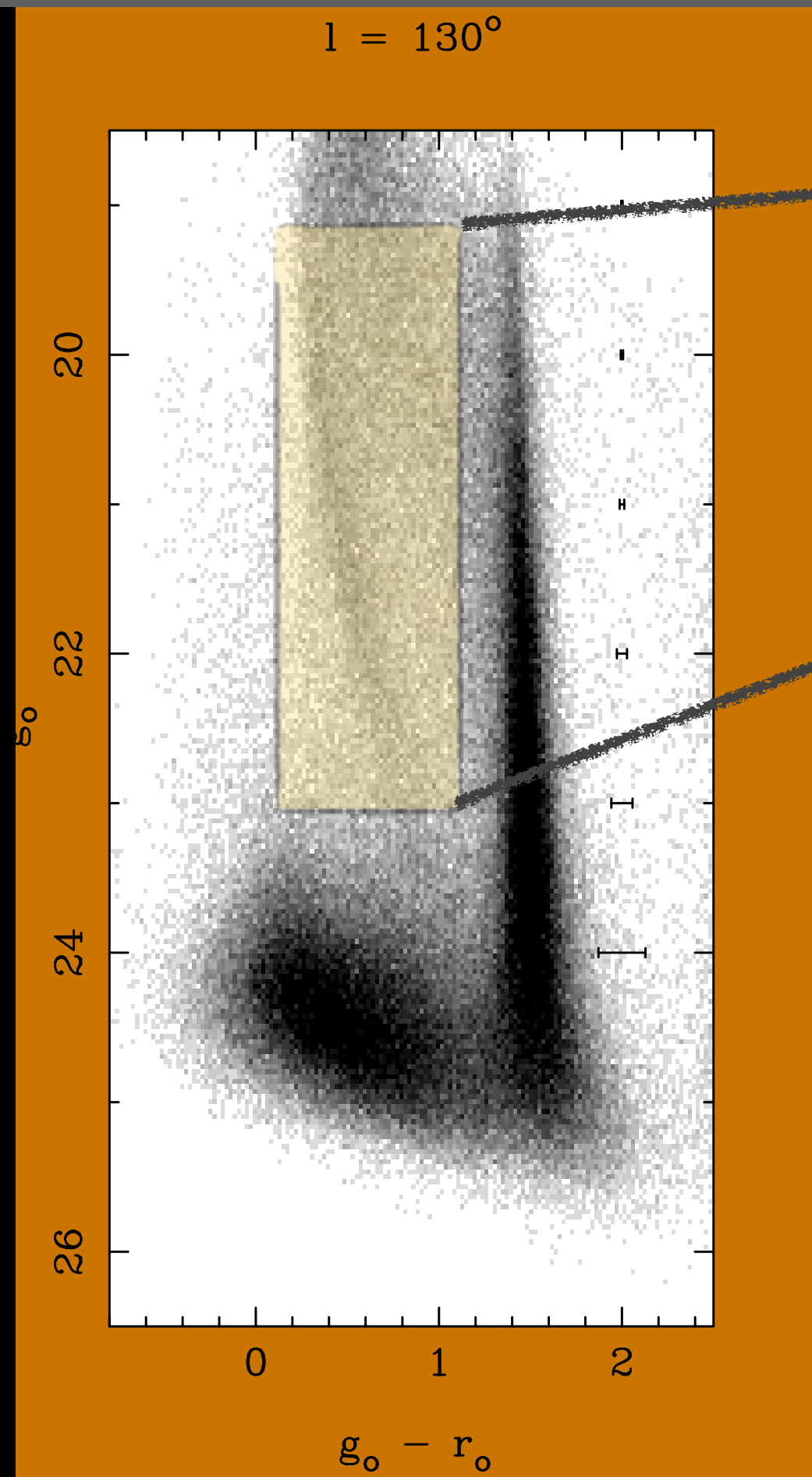
Blatant Self Reference

Free Collisional Ring galaxy!!
Conn et al 2011



CMD Fitting

SUBARU



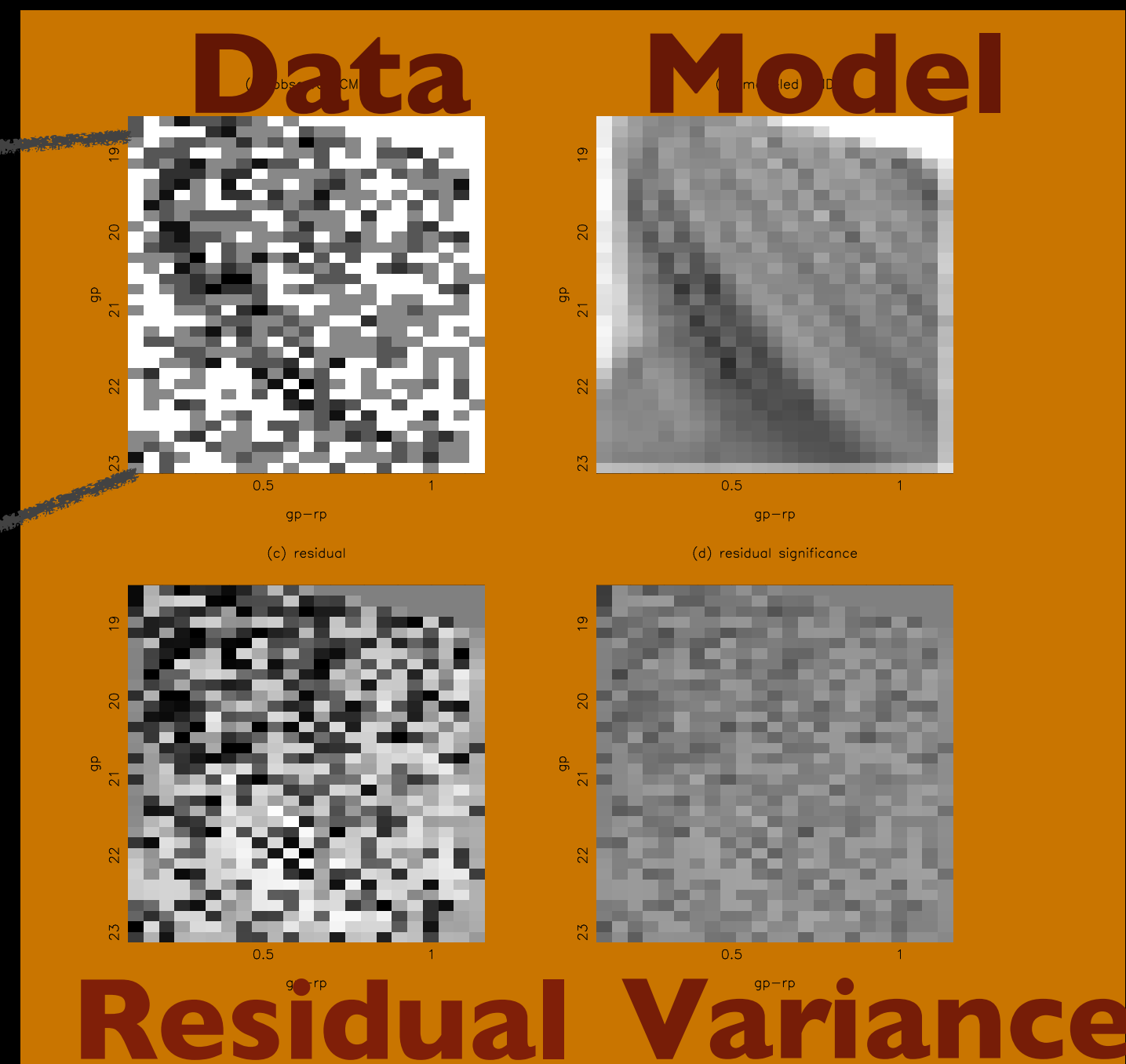
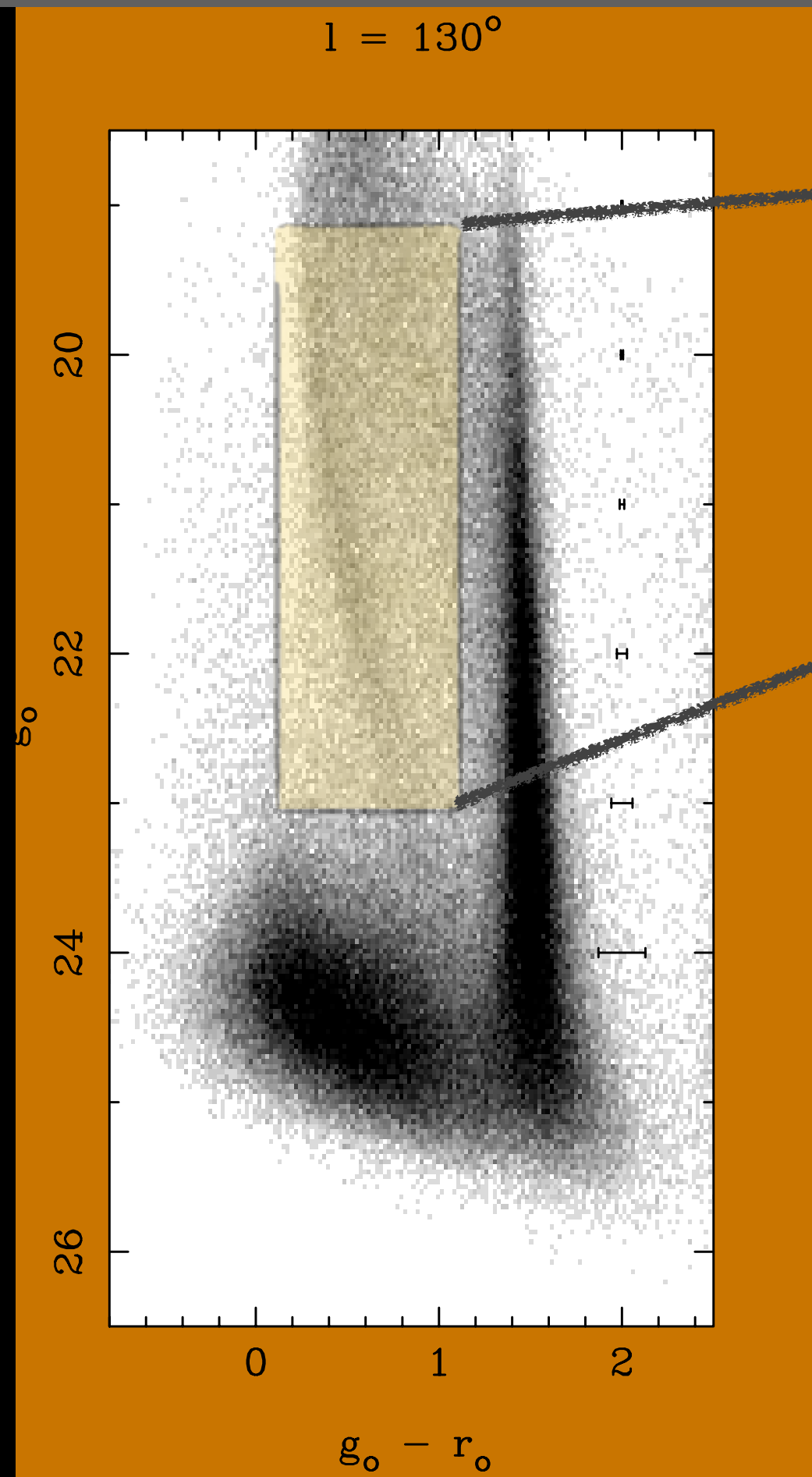
Inputs:

- **Photometry + Errors**
- **Magnitude Completeness**
- **Extinction Estimate**

Collisional Ring Galaxy modelling Smith et al, 2012

CMD Fitting

SUBARU



Inputs:

- **Photometry + Errors**
- **Magnitude Completeness**
- **Extinction Estimate**

Collisional Ring Galaxy modelling Smith et al, 2012

Galactic Models

Exponential Disks

$$\rho_{\text{total}} = \rho_{\text{thin}} + \rho_{\text{thick}} + \rho_{\text{halo}}$$

$$\rho_{\text{thin}} = A \left[\frac{h_{z,\text{thin},\odot}}{h_{z,\text{thin}}(R)} \right] \exp \left[-\frac{R - R_{\odot}}{h_{R,\text{thin}}} \right] \exp \left[-\frac{|z|}{h_{z,\text{thin}}(R)} \right]$$

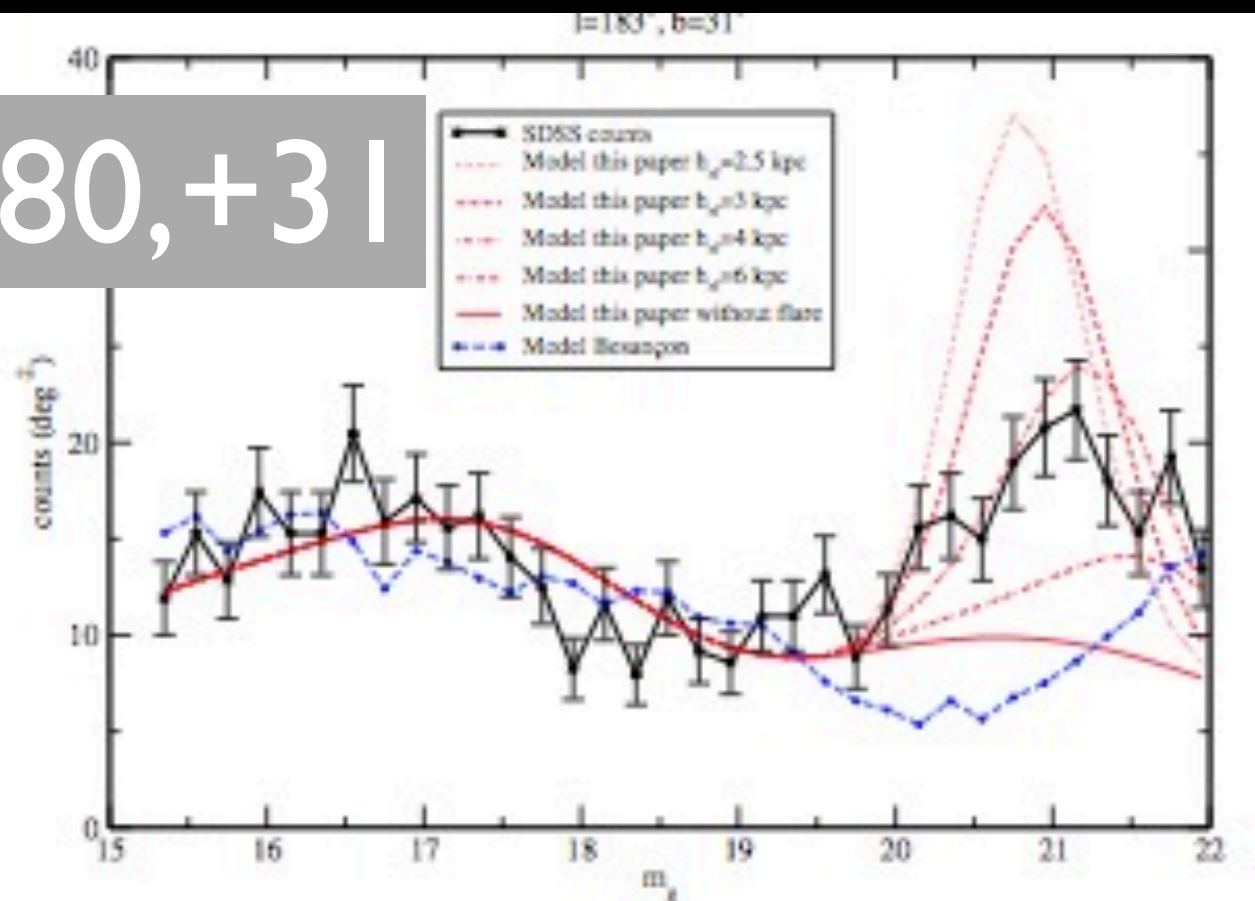
$$\rho_{\text{thick}} = 0.09A \left[\frac{h_{z,\text{thick},\odot}}{h_{z,\text{thick}}(R)} \right] \exp \left[-\frac{R - R_{\odot}}{h_{R,\text{thick}}} \right] \exp \left[-\frac{|z|}{h_{z,\text{thick}}(R)} \right]$$

$$\rho_{\text{halo}} = 1.4 \times 10^{-3} A \frac{\exp \left[10.093 \left(1 - \left(\frac{R_{\text{sp}}}{R_{\odot}} \right)^{1/4} \right) \right]}{\left(R_{\text{sp}} / R_{\odot} \right)^{7/8}}$$

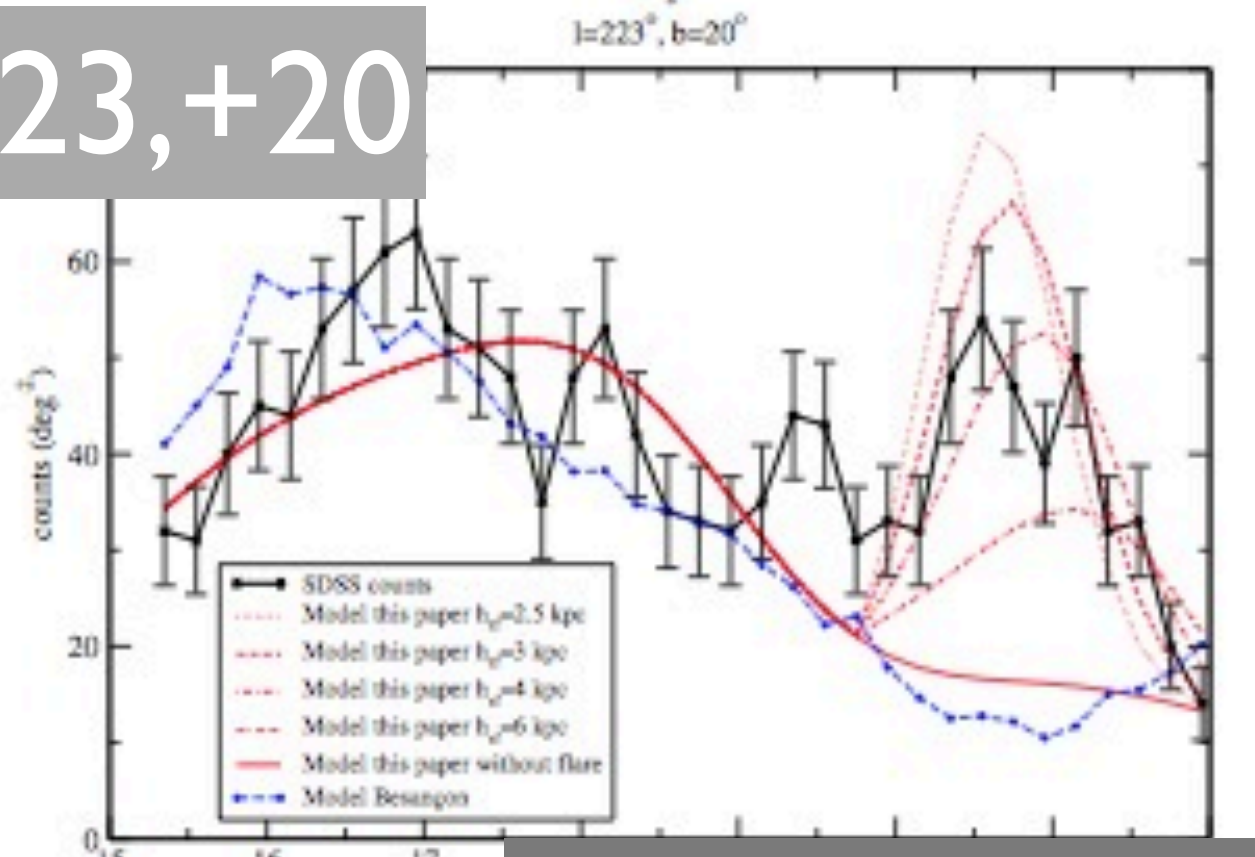
$$h_{z,\text{thin/thick}}(R) = \begin{cases} h_{z,\text{thin/thick},\odot}, & R \leq R_i \\ h_{z,\text{thin/thick},\odot} \exp \left(\frac{R - R_i}{h_{rj}} \right), & R > R_i \end{cases}$$

$$R_{\text{sp}} = \sqrt{R^2 + 2.52z^2}. \quad (2)$$

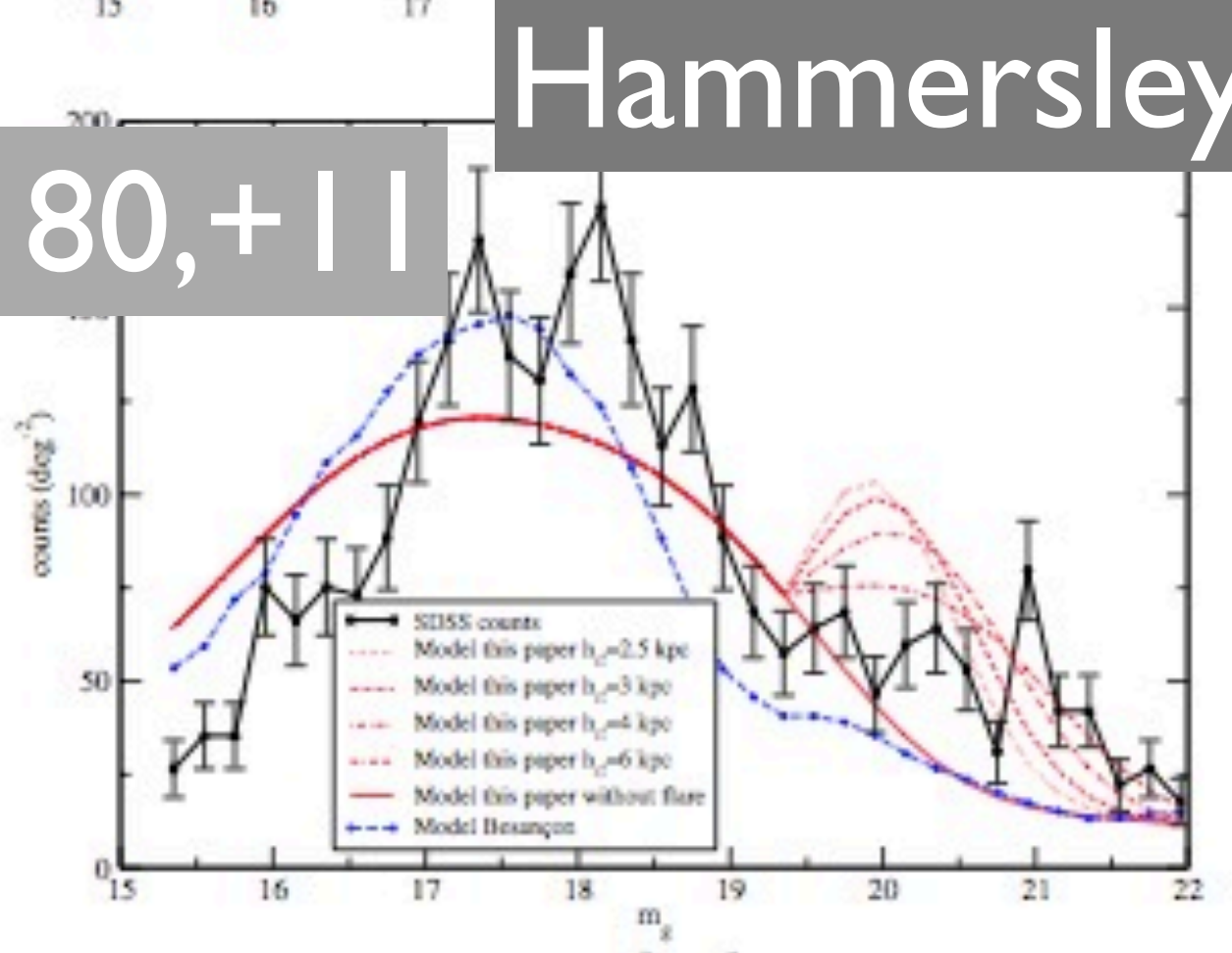
180,+31



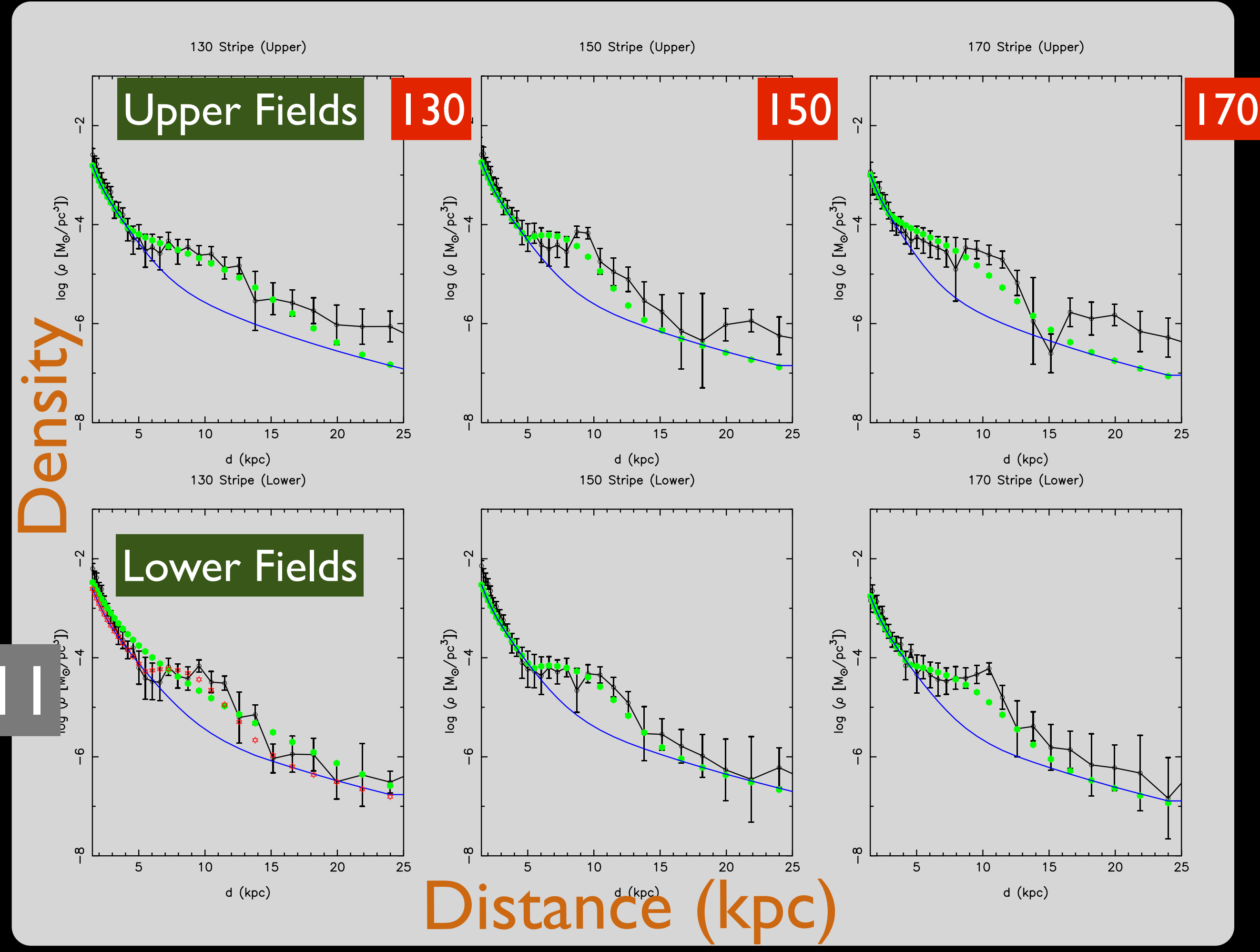
223,+20



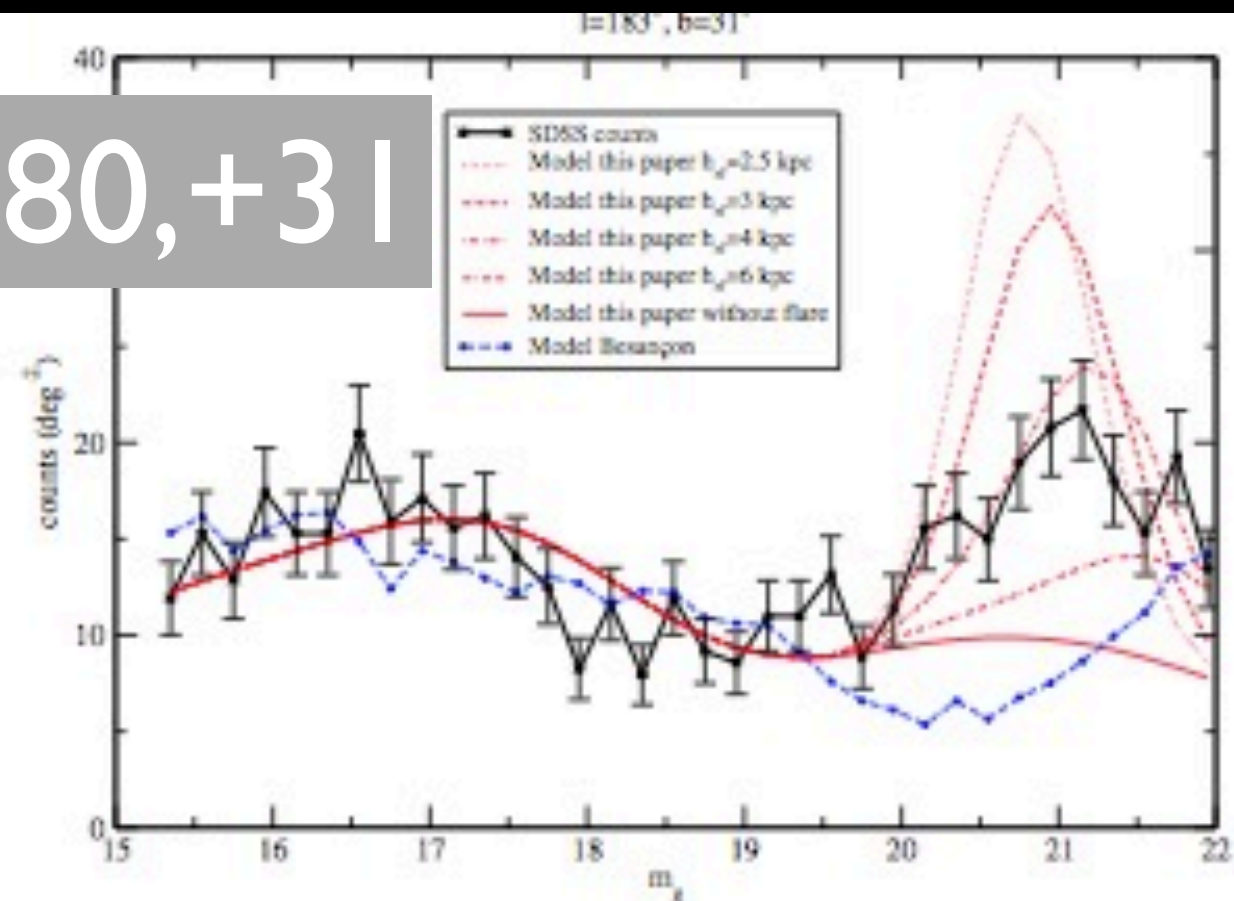
180,+11



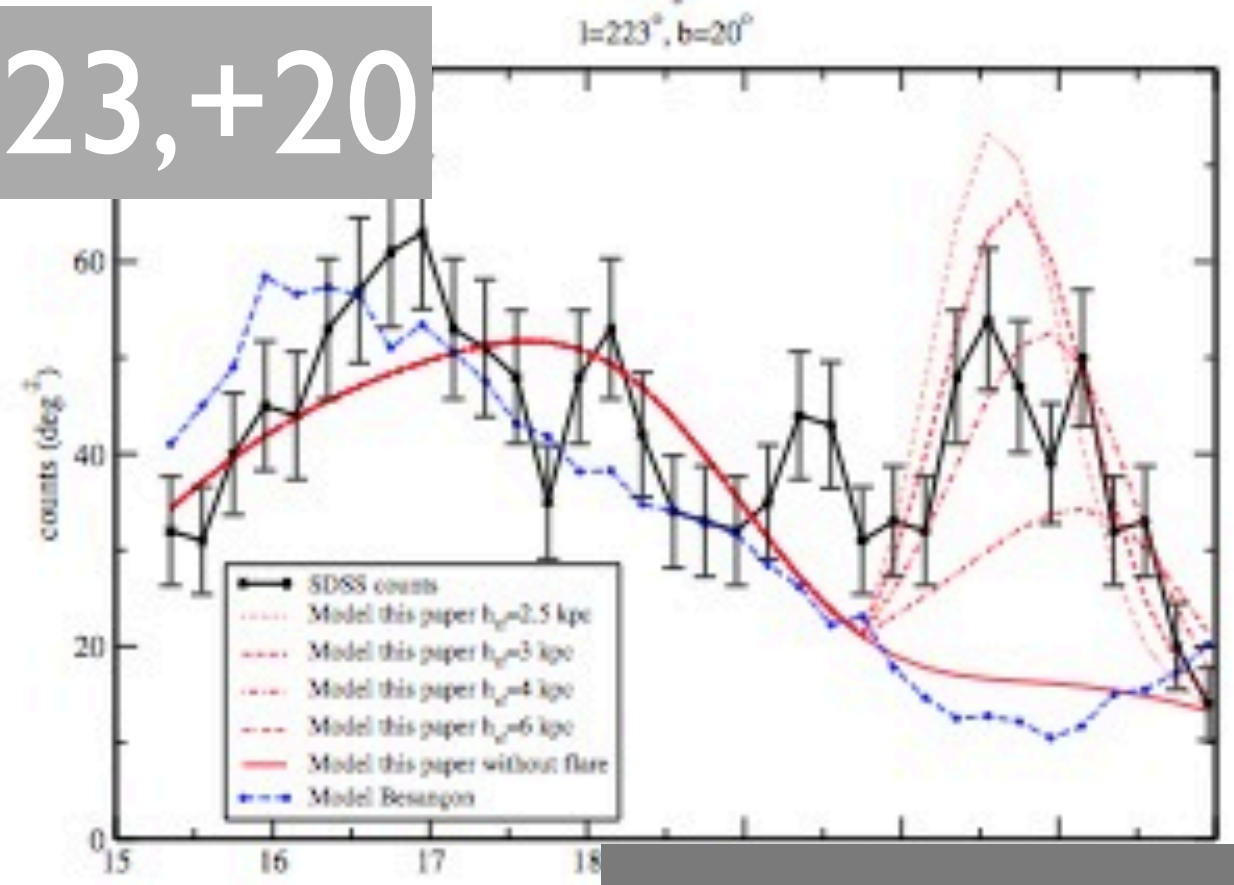
Hammersley 2011



180,+31

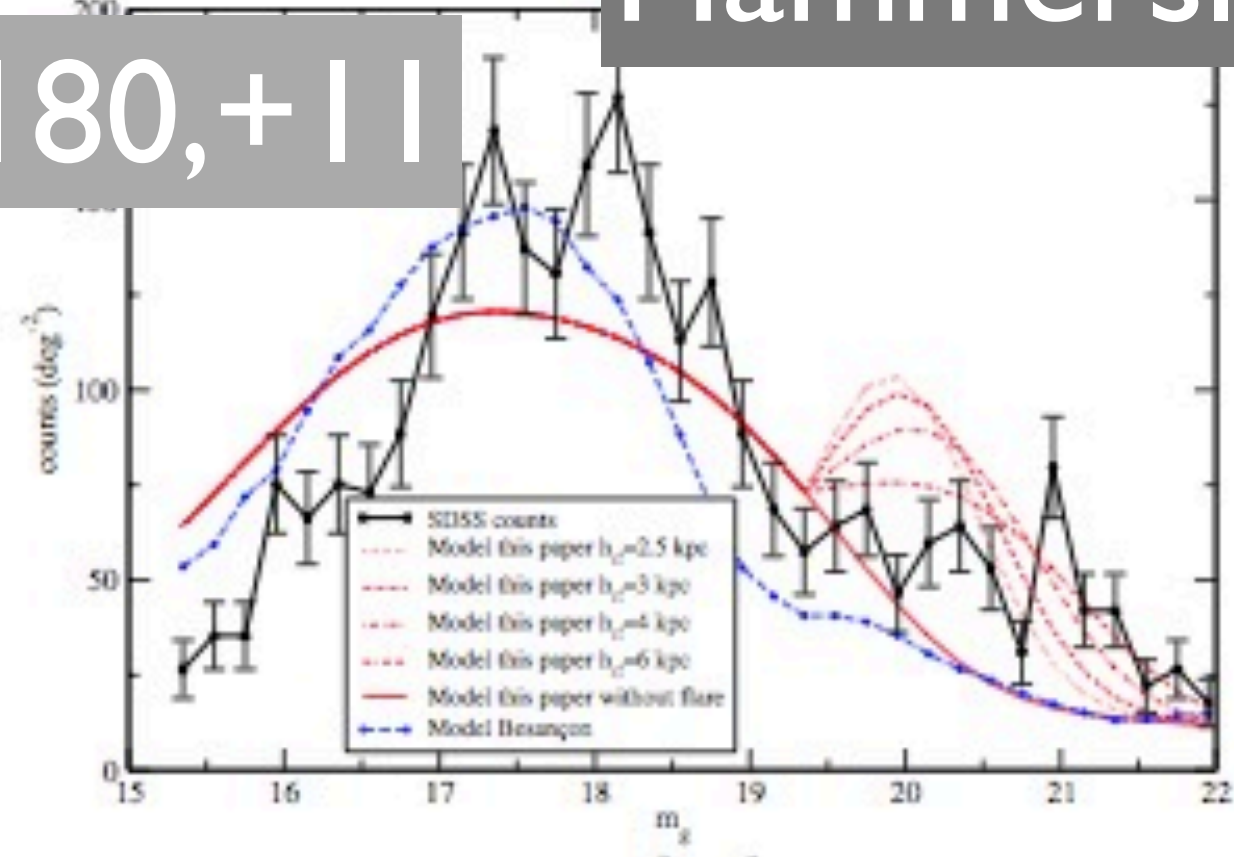


223,+20



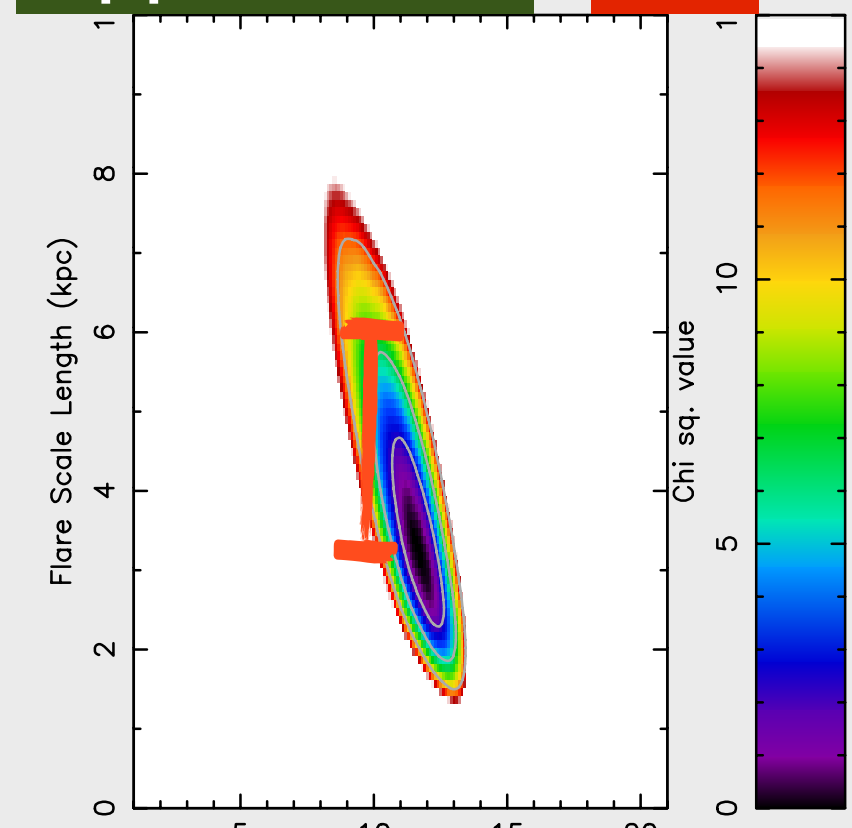
Hammersley 2011

180,+11



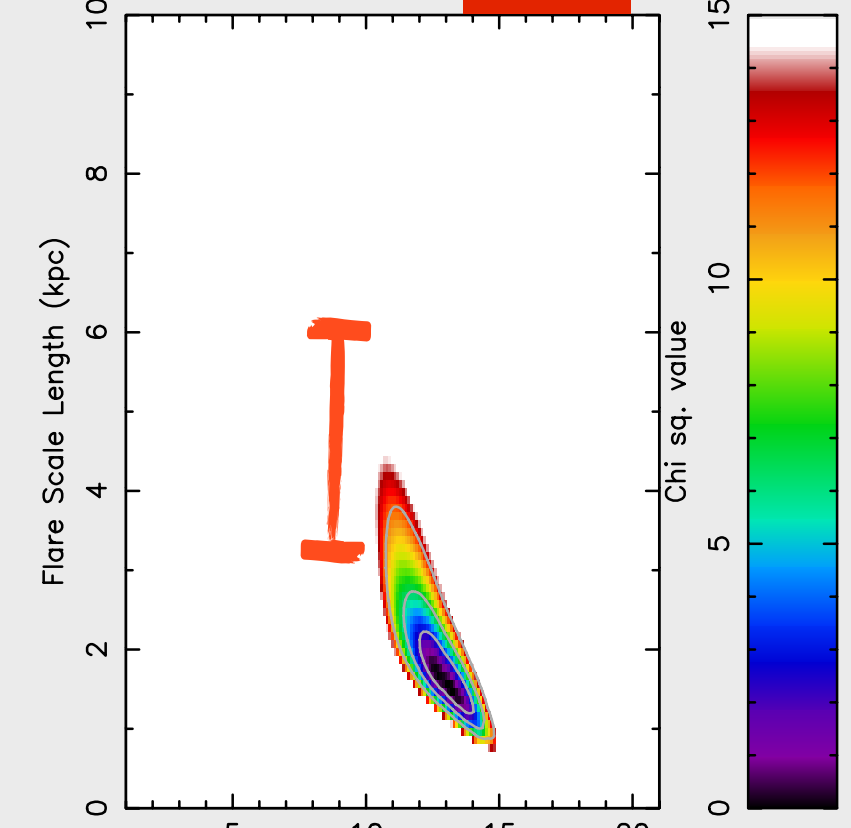
Upper Fields

130



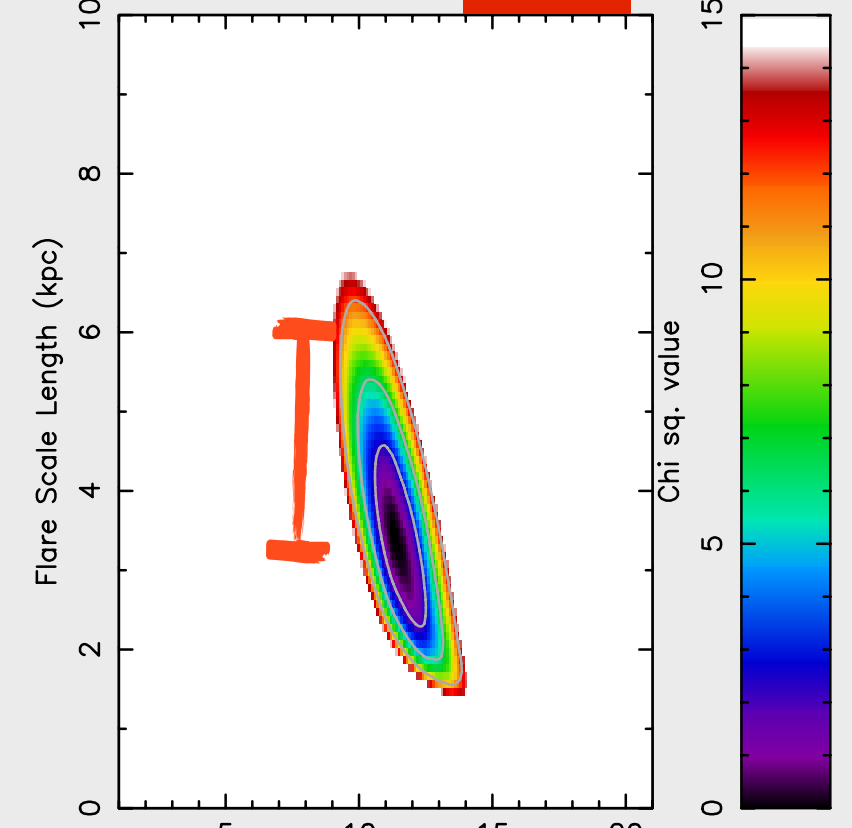
150 Stripe (Up)

150

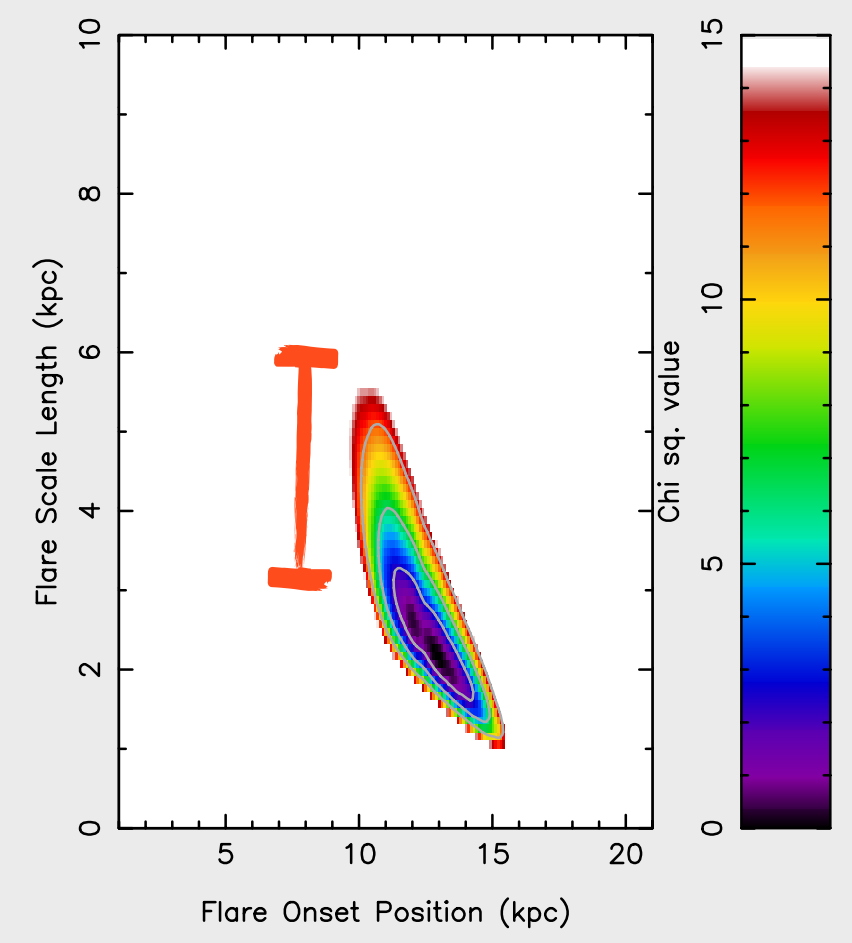
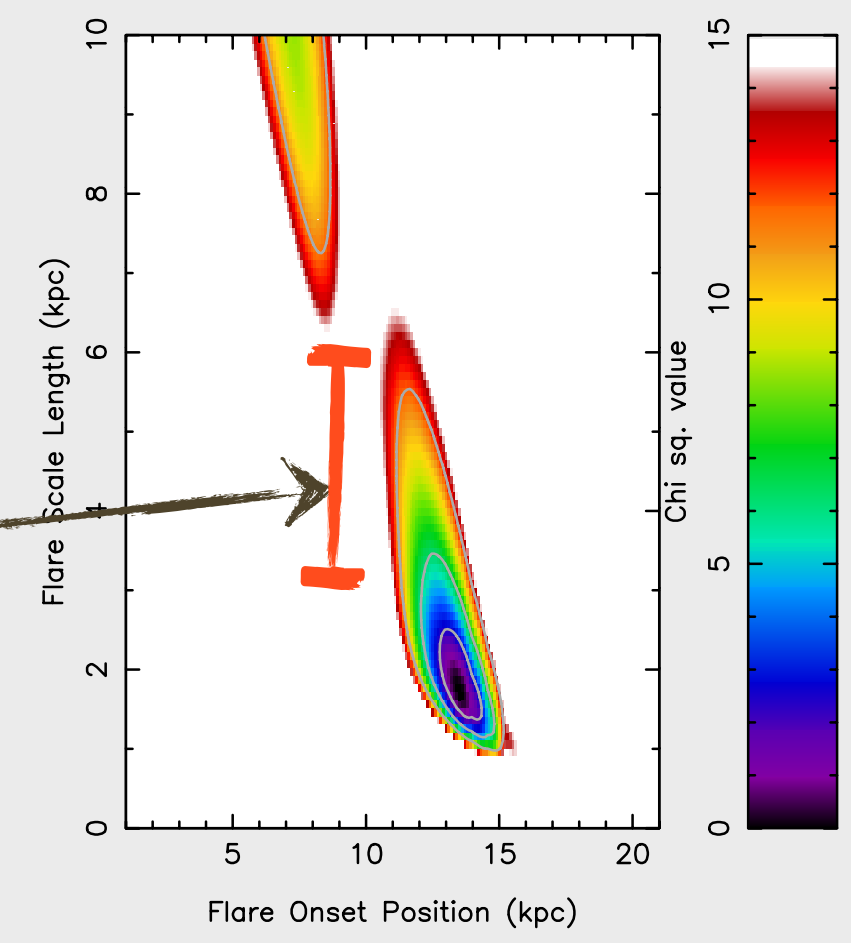
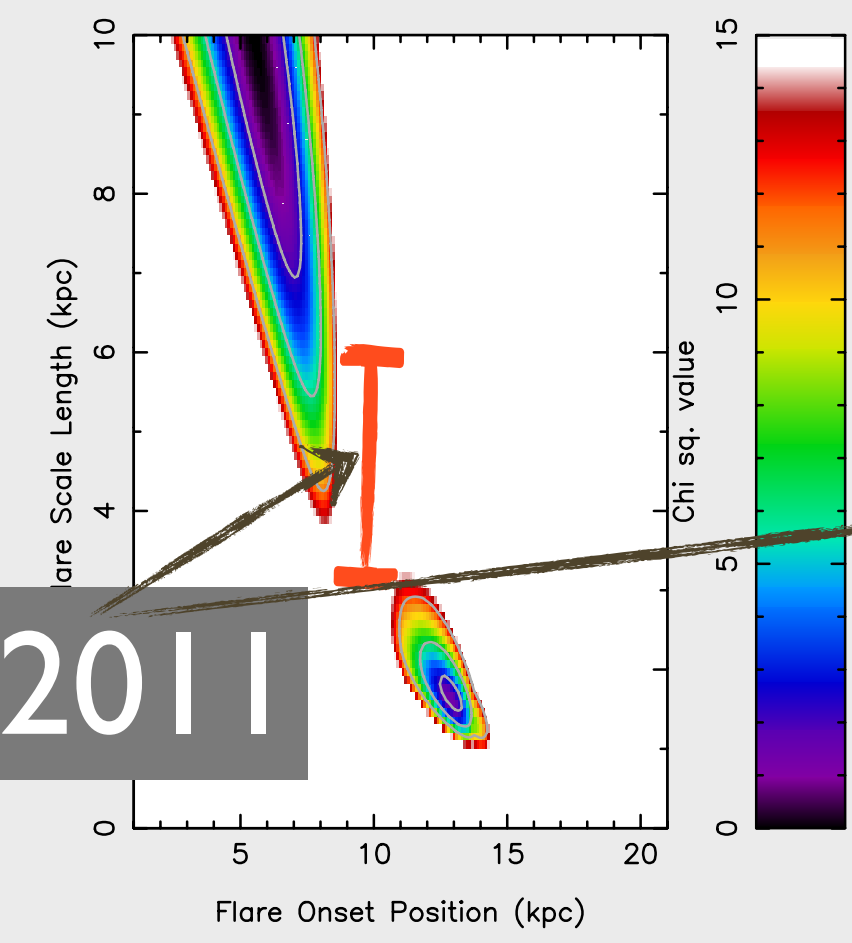


170 Stripe (Up)

170



Lower Fields



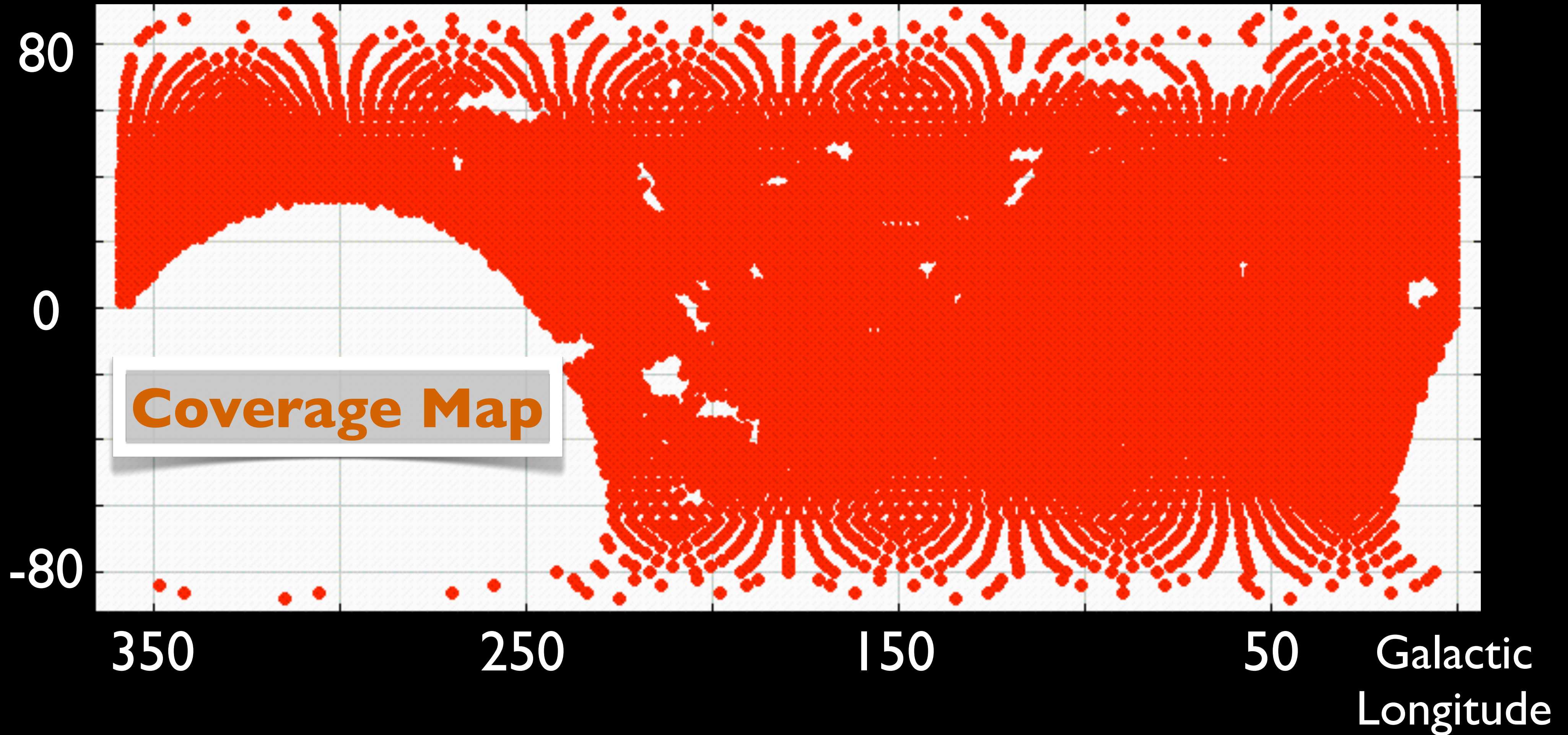
Flare Onset

Flare Scale Length

PanSTARRS

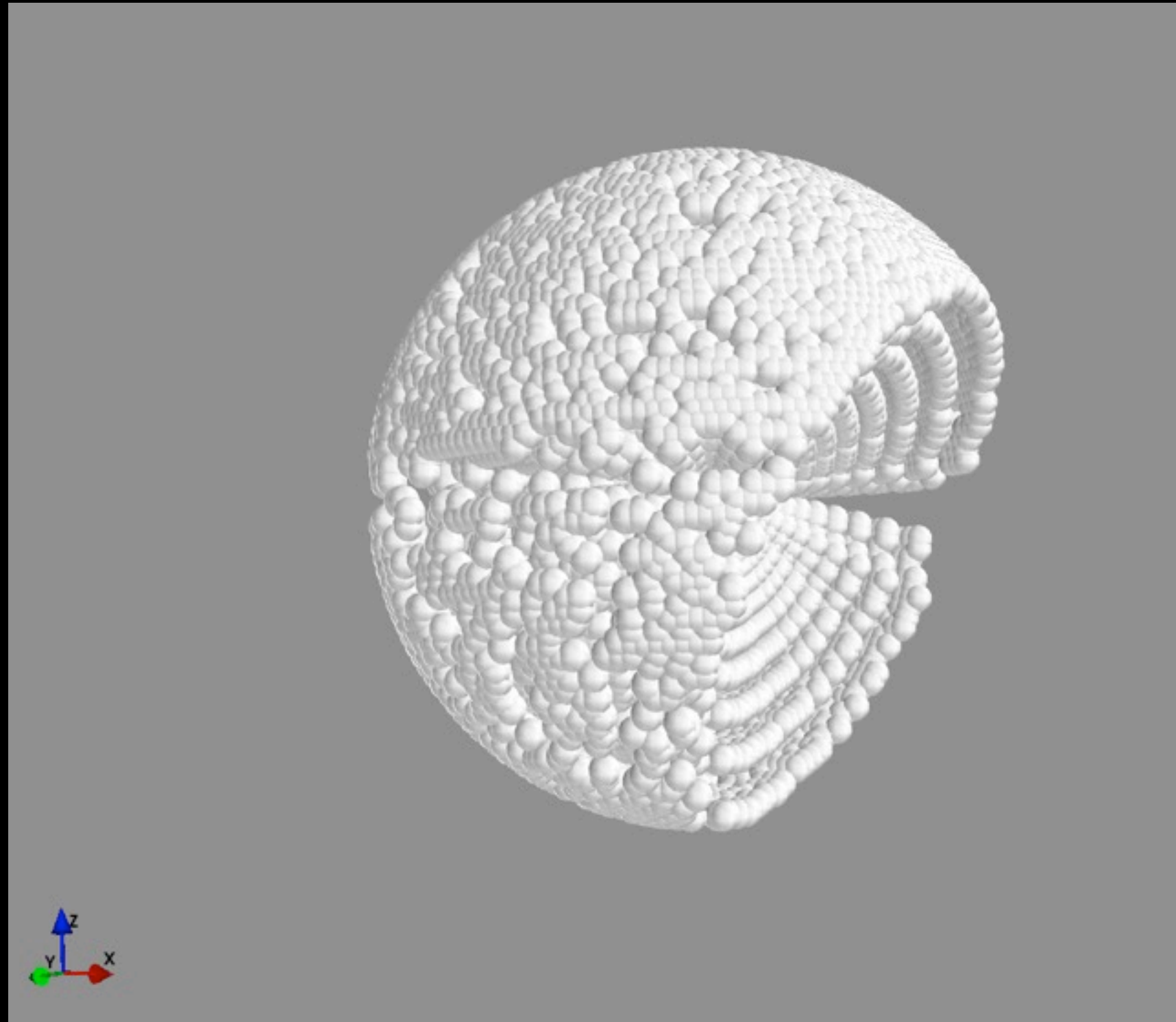
Galactic
Latitude

Survey Footprint

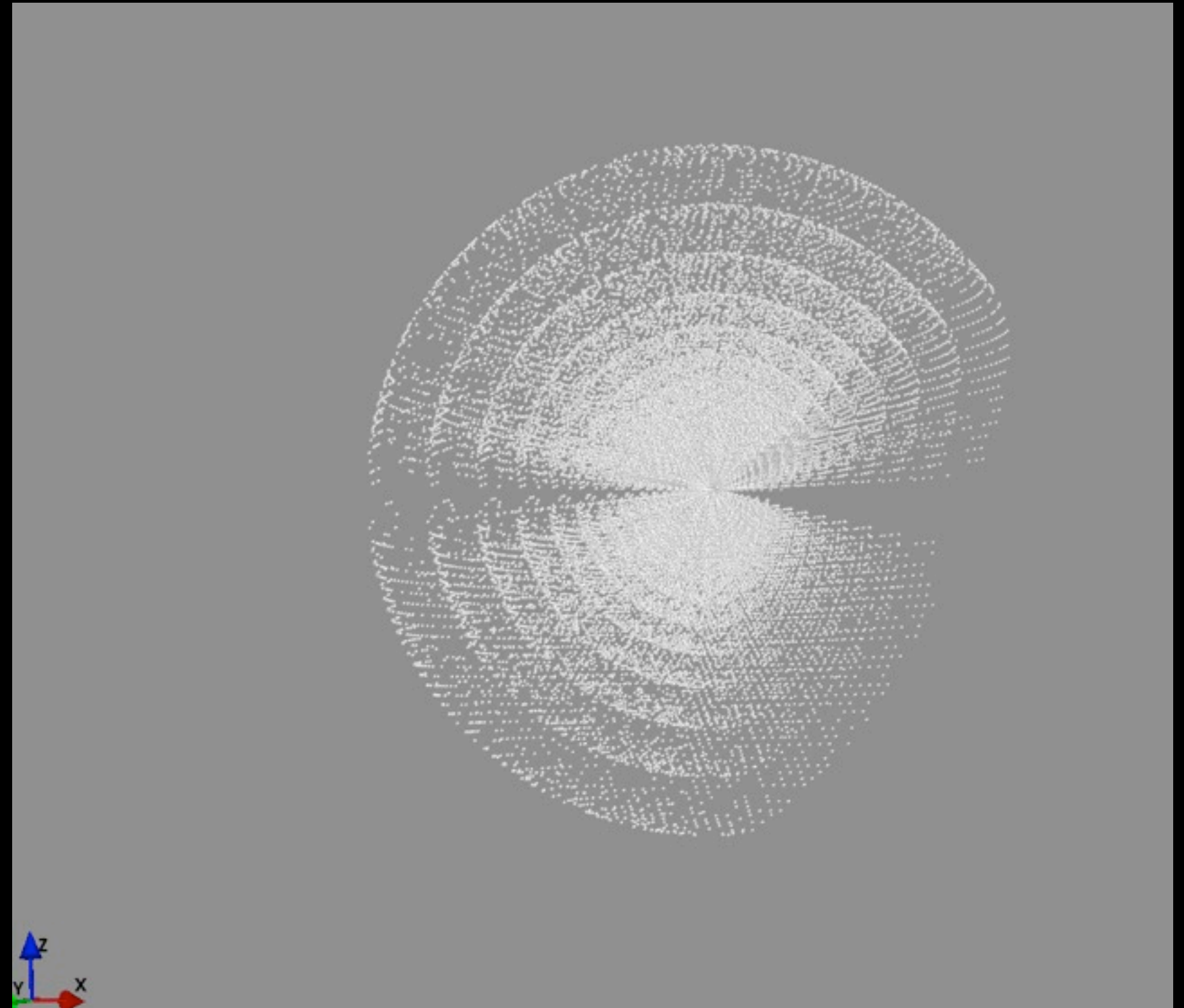


PanSTARRS

Survey Footprint



40 kpc



40 kpc

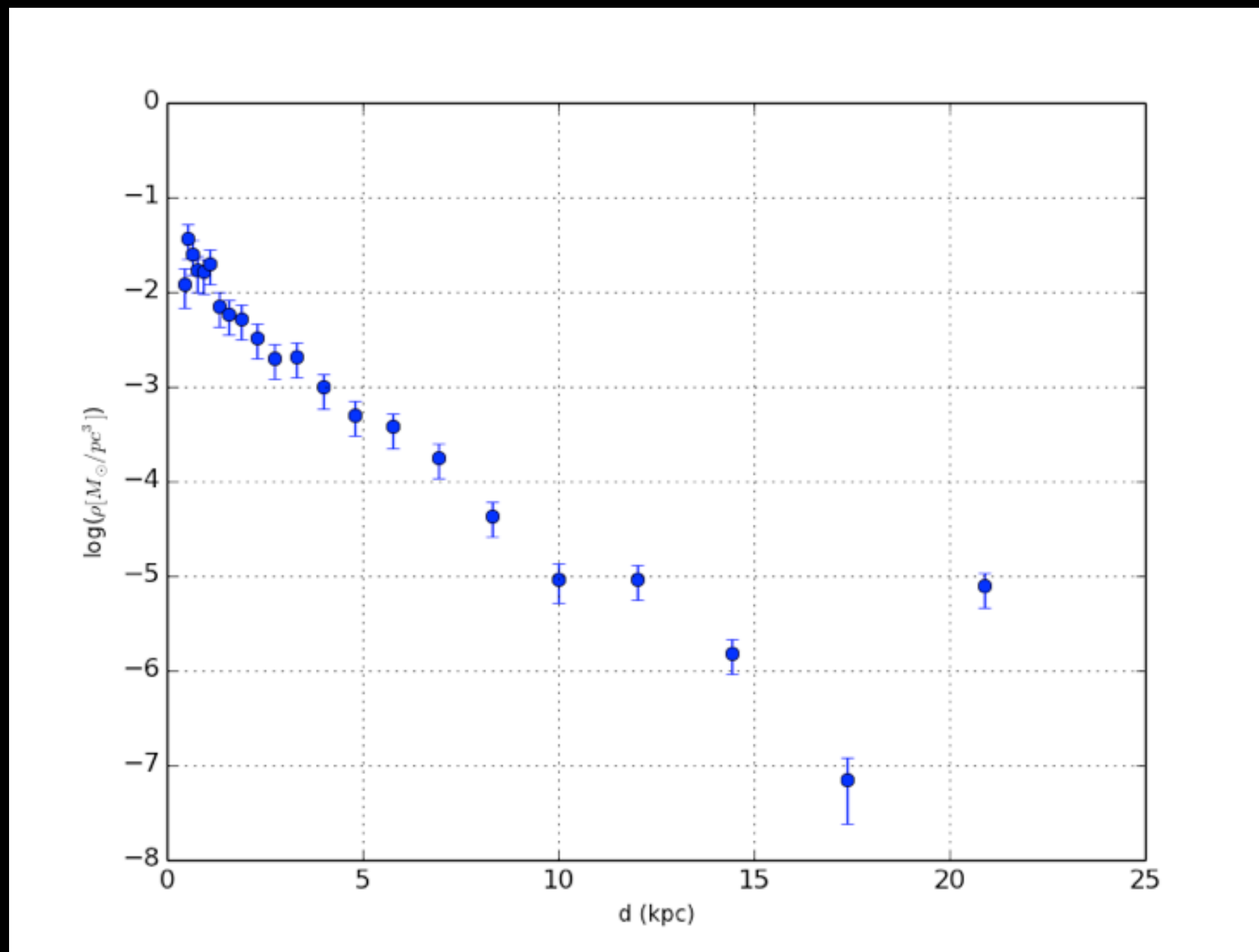
PanSTARRS

Density profiles

$\log(\text{density (Msun/pc}^3))$

-1

-8



0

Distance (kpc)

25

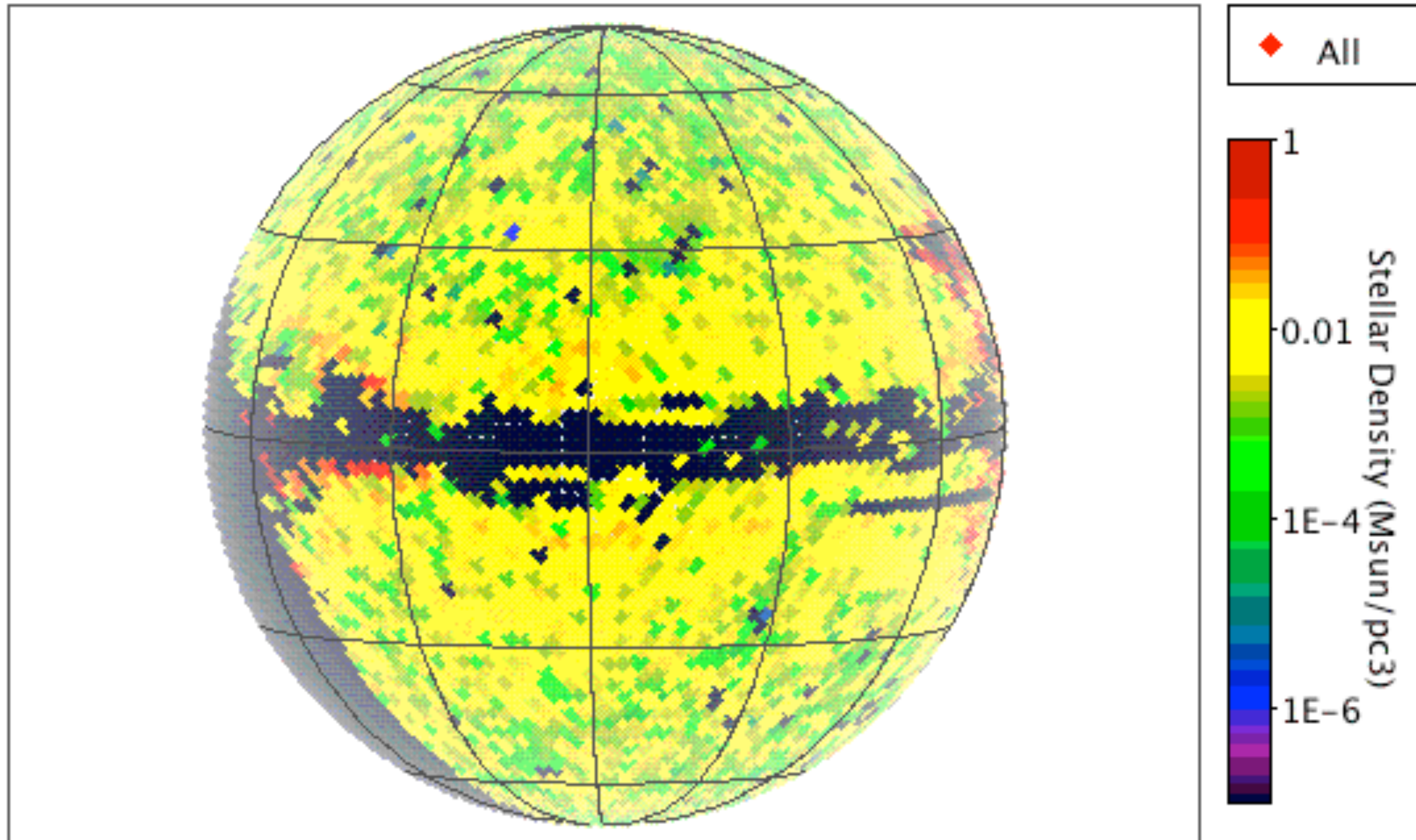
~7500 lines of sight

~160,000 density measurements

PanSTARRS

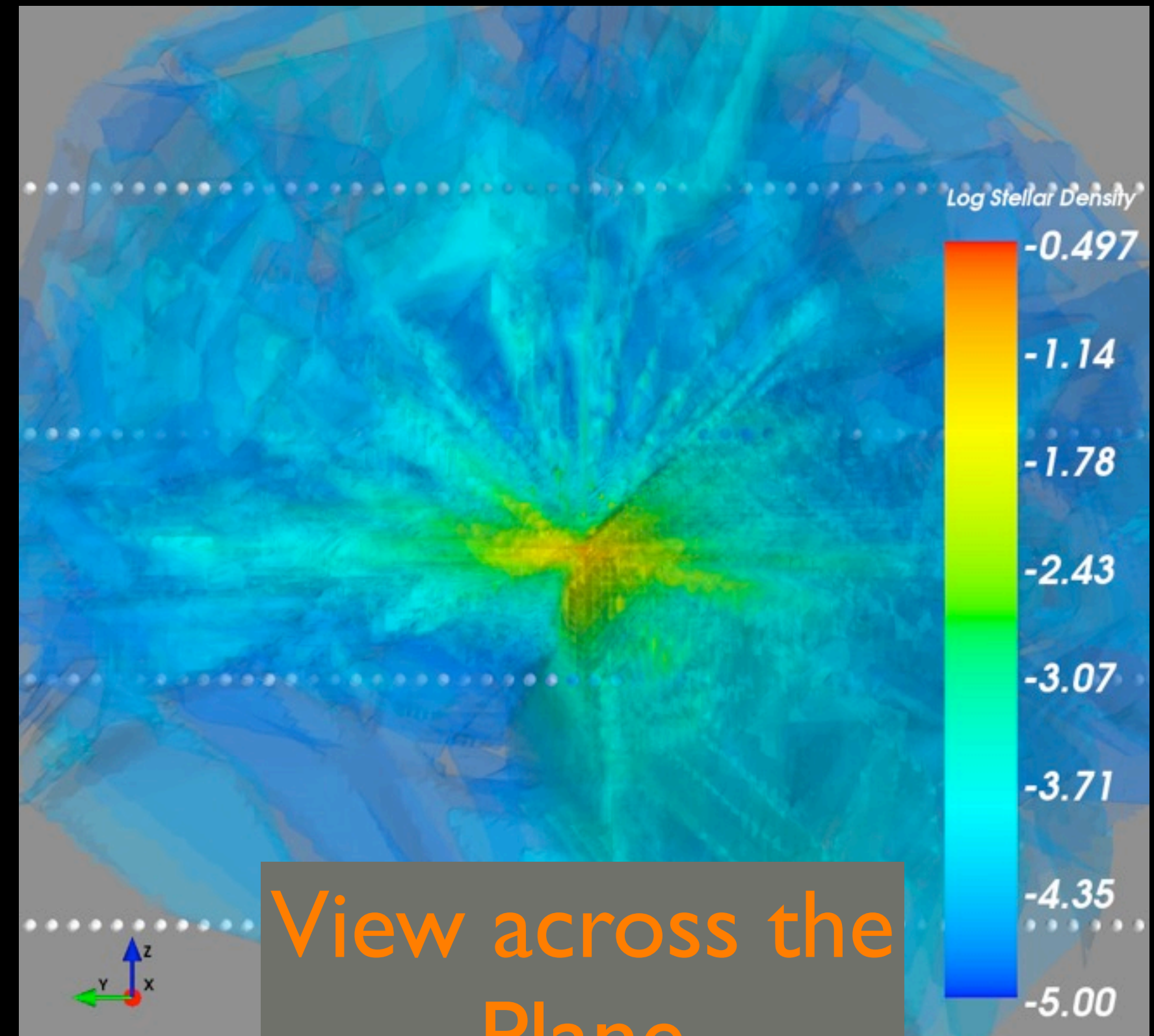
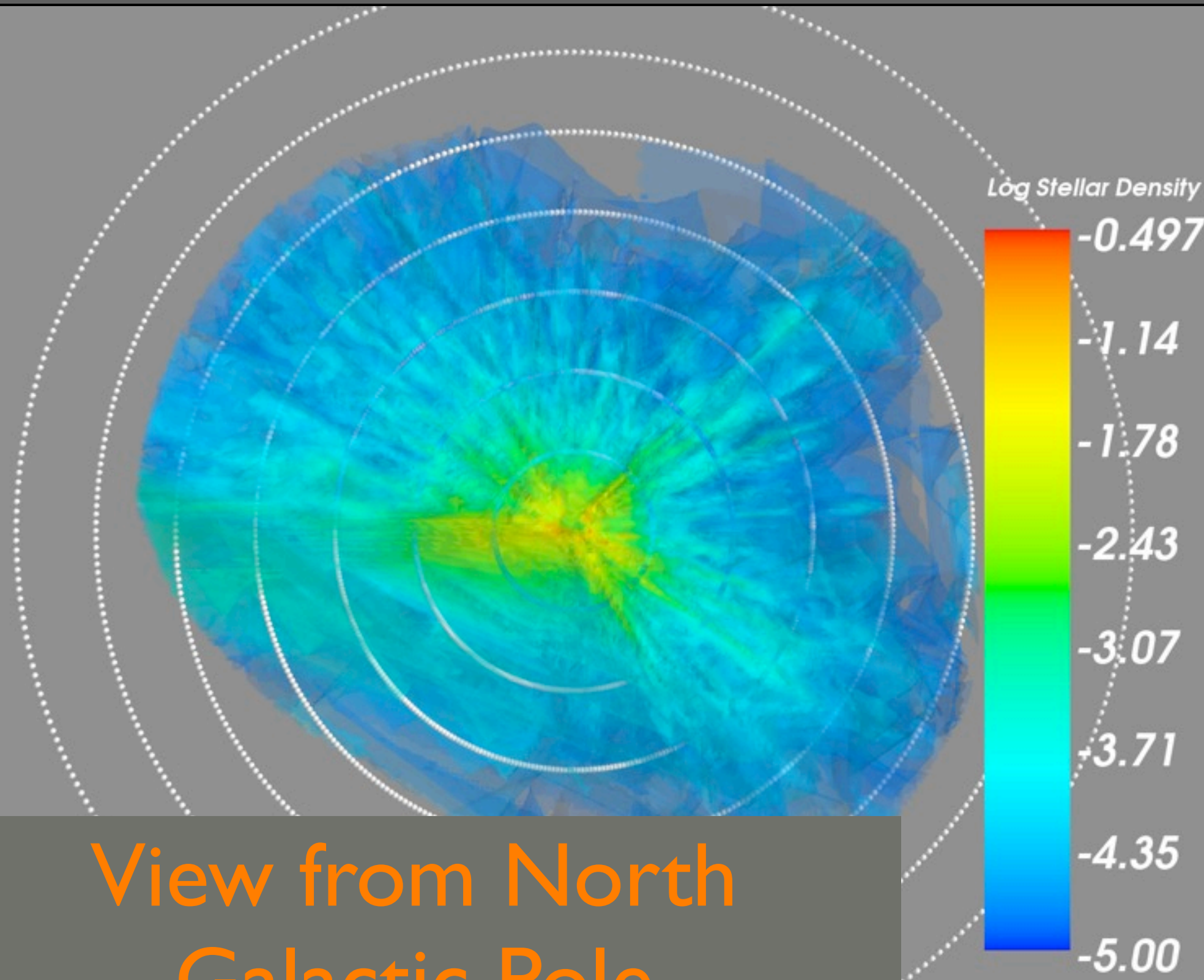
Density profiles

436 pc



PanSTARRS

Density profiles



Conclusion

- CMD fitting allows stellar density profiles of the Milky Way to be generated
- PanSTARRS with its enormous coverage including going so close to the Plane is the best opportunity to study the Disk and Halo
- A new density model of the MW has been generated with 160,000 measurements
- New insights into the outer disk and halo will be uncovered, ... watch this space.