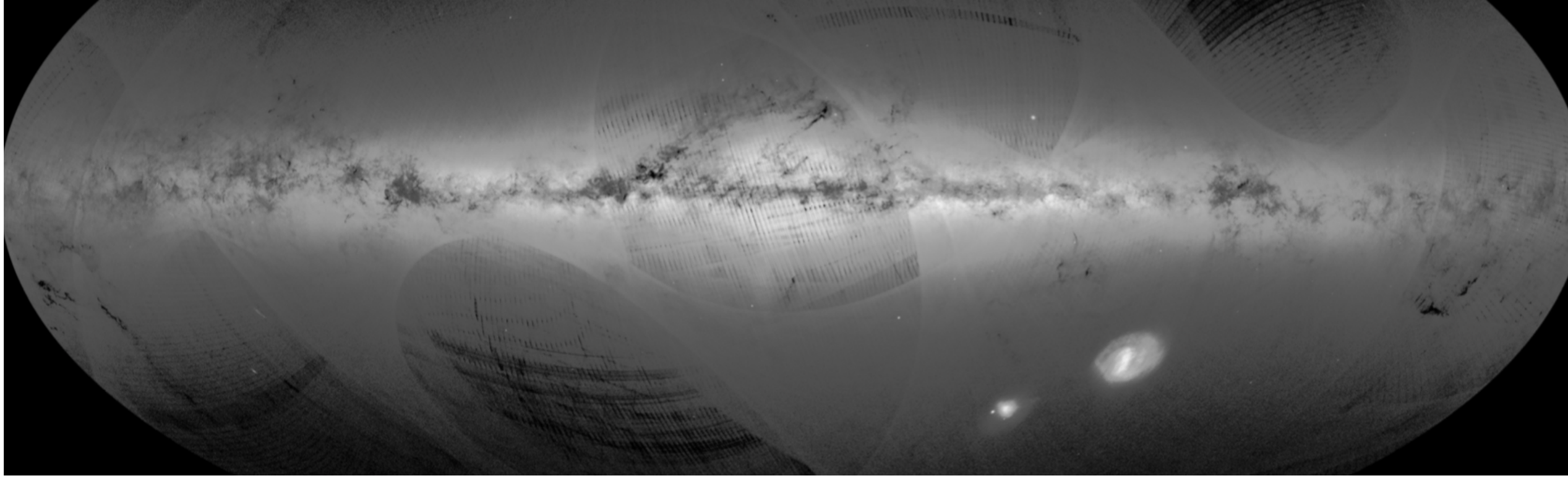


Mapping the Milky Way with LAMOST

刘 超 （国家天文台）
collaborated with 徐岩、王海峰、万峻辰、J. L. Carlin等

Liu et al. 2017, ArXiv:1701.07831

Outlines

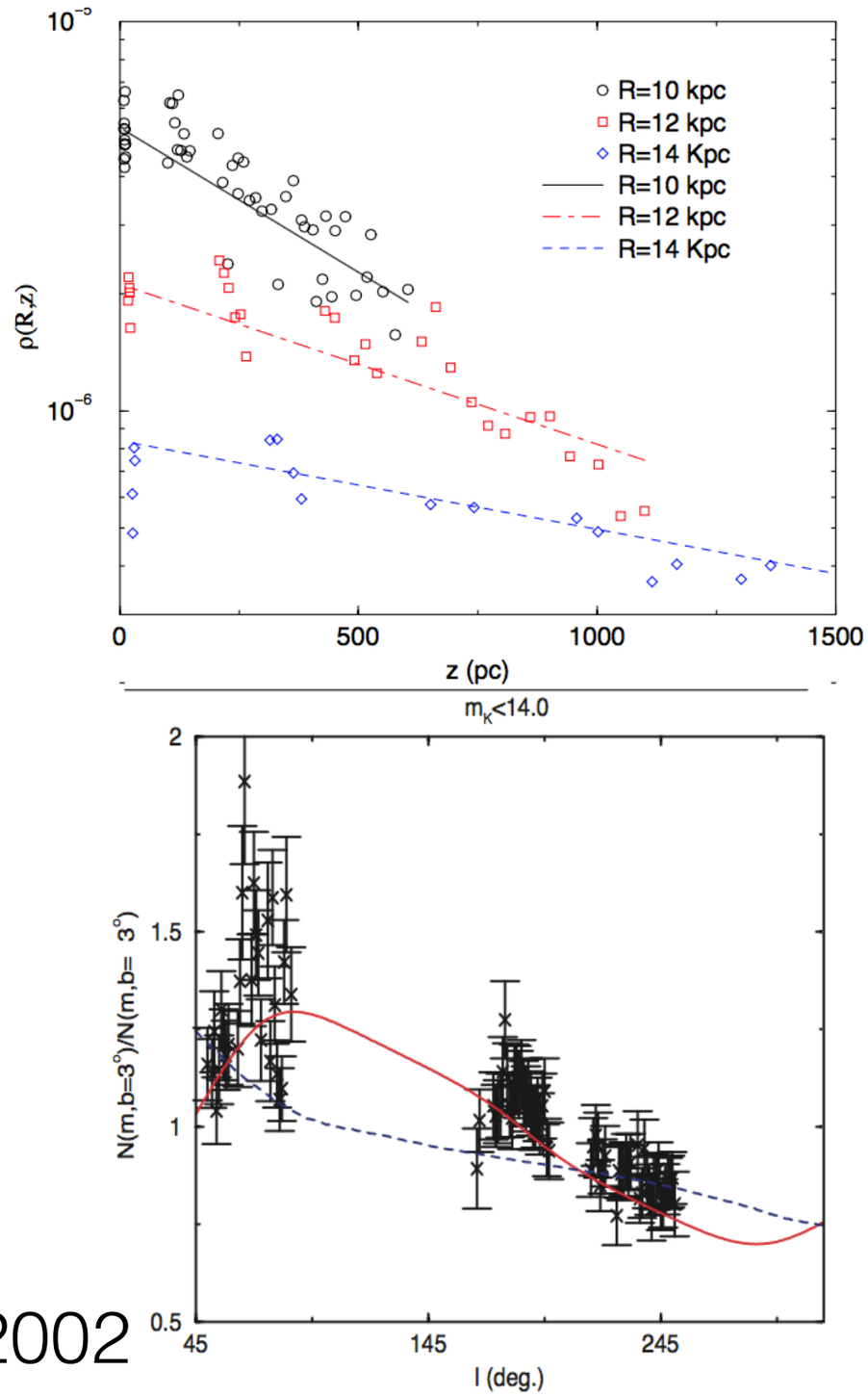
- Introduction of the Galactic structure
- Methodology
- Test & Validation of the method
- The disk
- The halo
- Conclusions

The Milky Way Disk

- Lopez-Corredoira et al. (2002)

- SDSS survey (Juric et al. 2008; Newberg et al. 2002)

- Halo profile (Watkins et al. 2009, Season et al. 2011, Xue et al. 2015)



Lopez-Corredoira et al. 2002

The Milky Way Disk

- Lopez-Corredoira et al. (2002)
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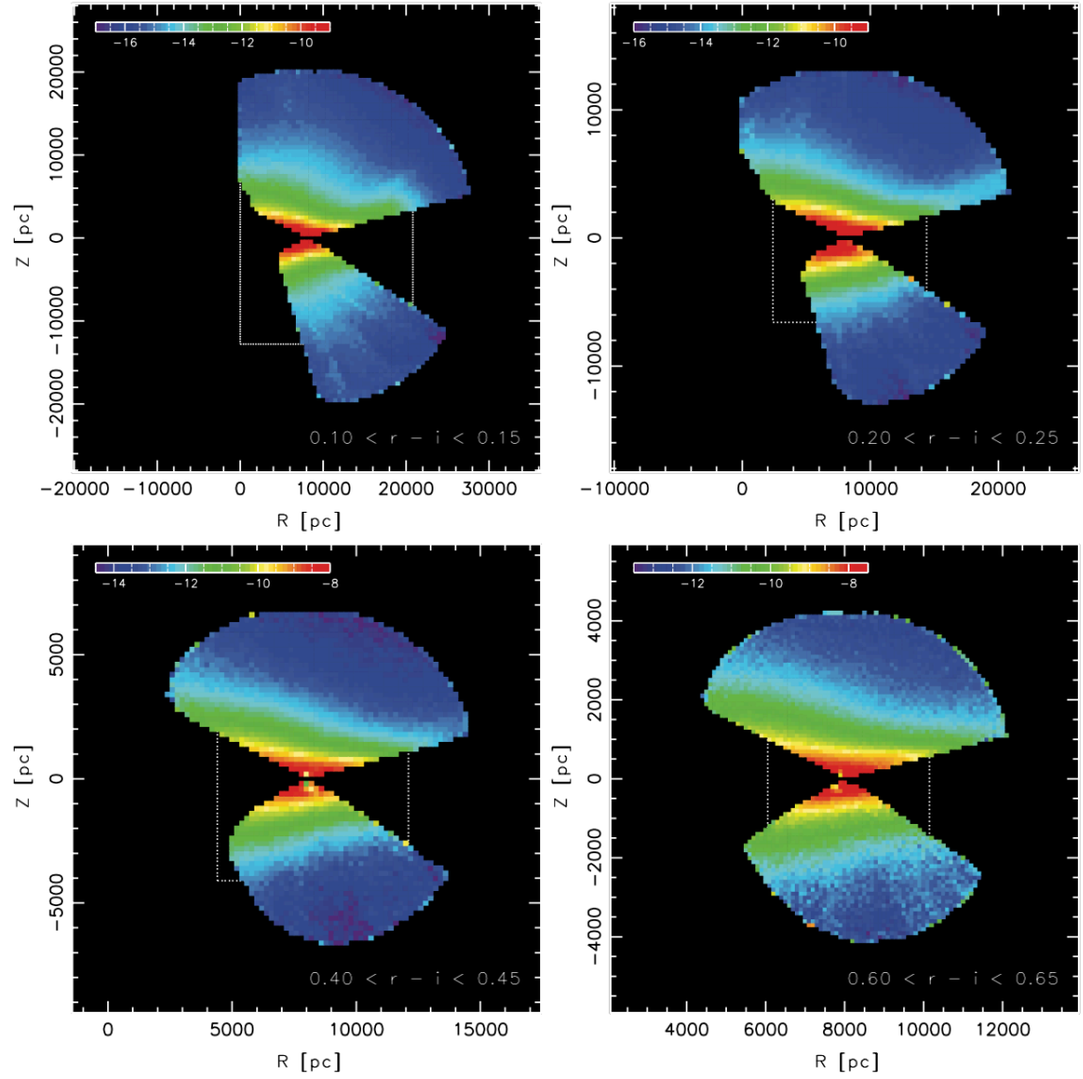


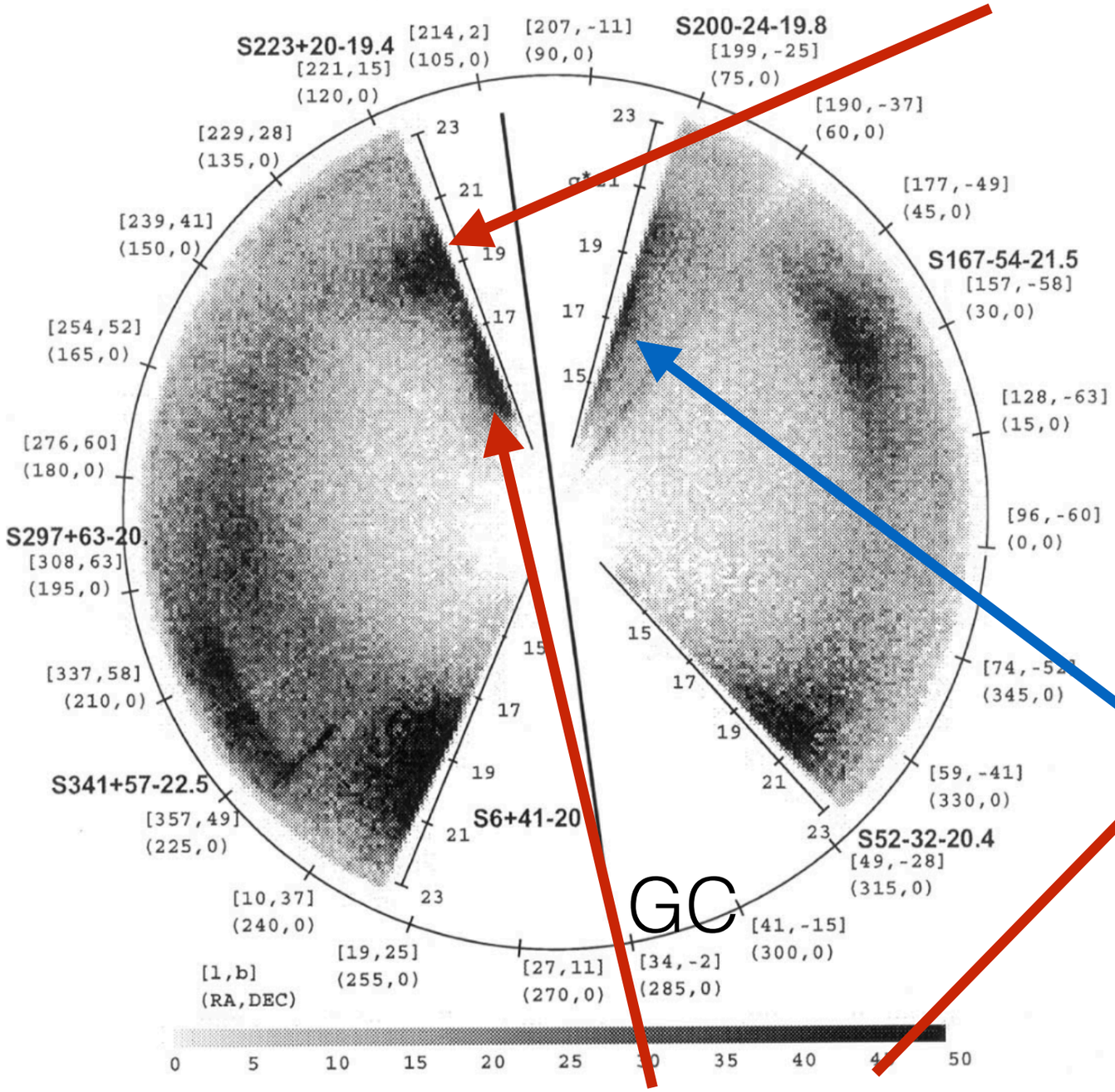
Juric et al. 2008

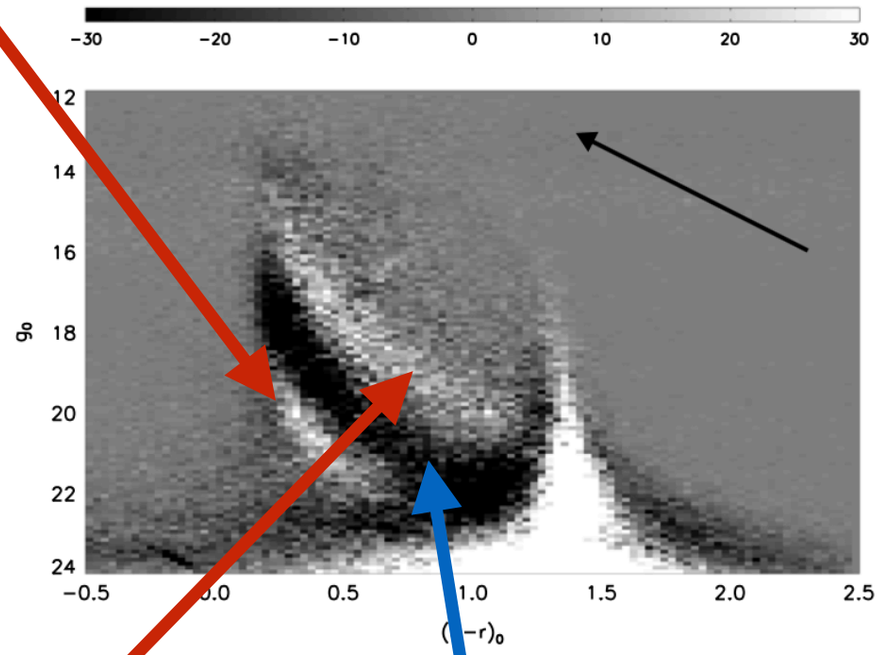
Newberg et al. 2002

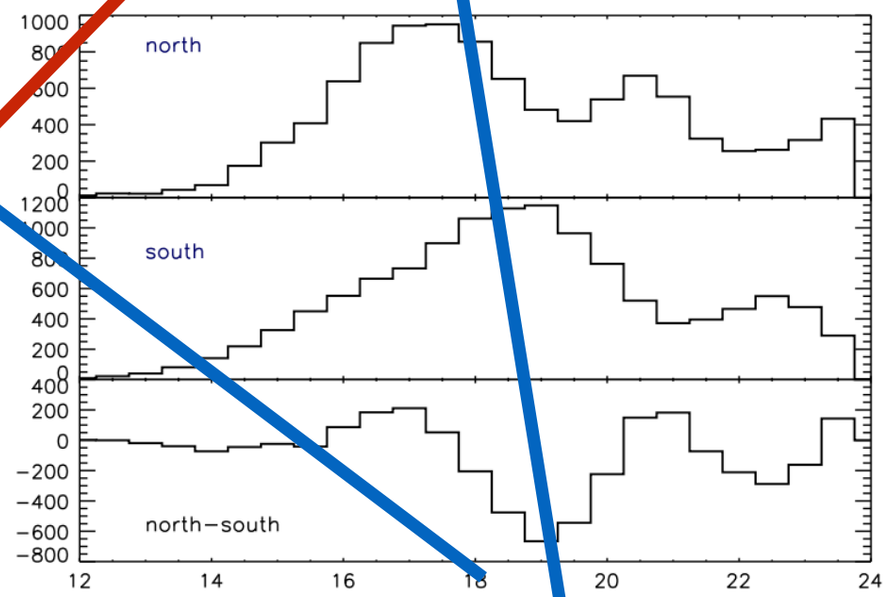
Xu et al. 2015

GAC

Monoceros ring







GC

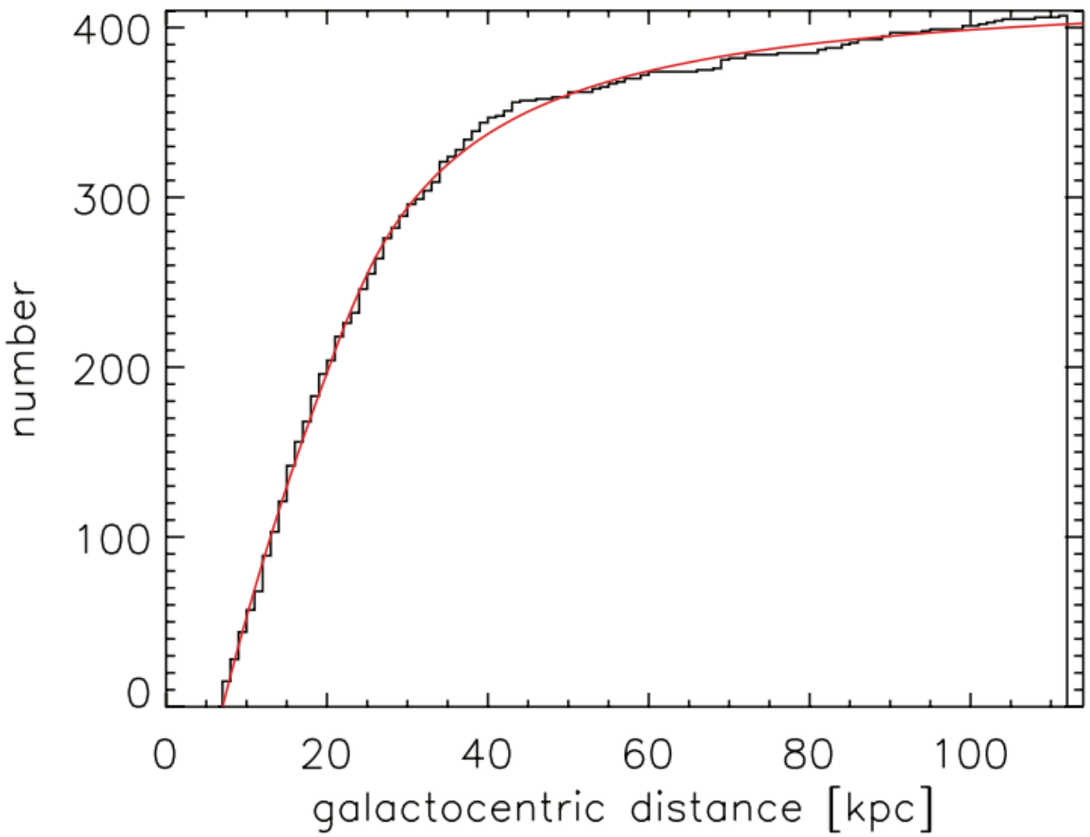
North Near overdensity

South Far overdensity

The Milky Way Halo

- Lopez-Corredoira et al. (2002)
- SDSS survey (Juric et al. 2008; Newberg et al. 2002; Xu et al. 2015)
- Halo profile (Watkins et al. 2009, Season et al. 2011, Xue et al. 2015)

Watkins et al. 2009



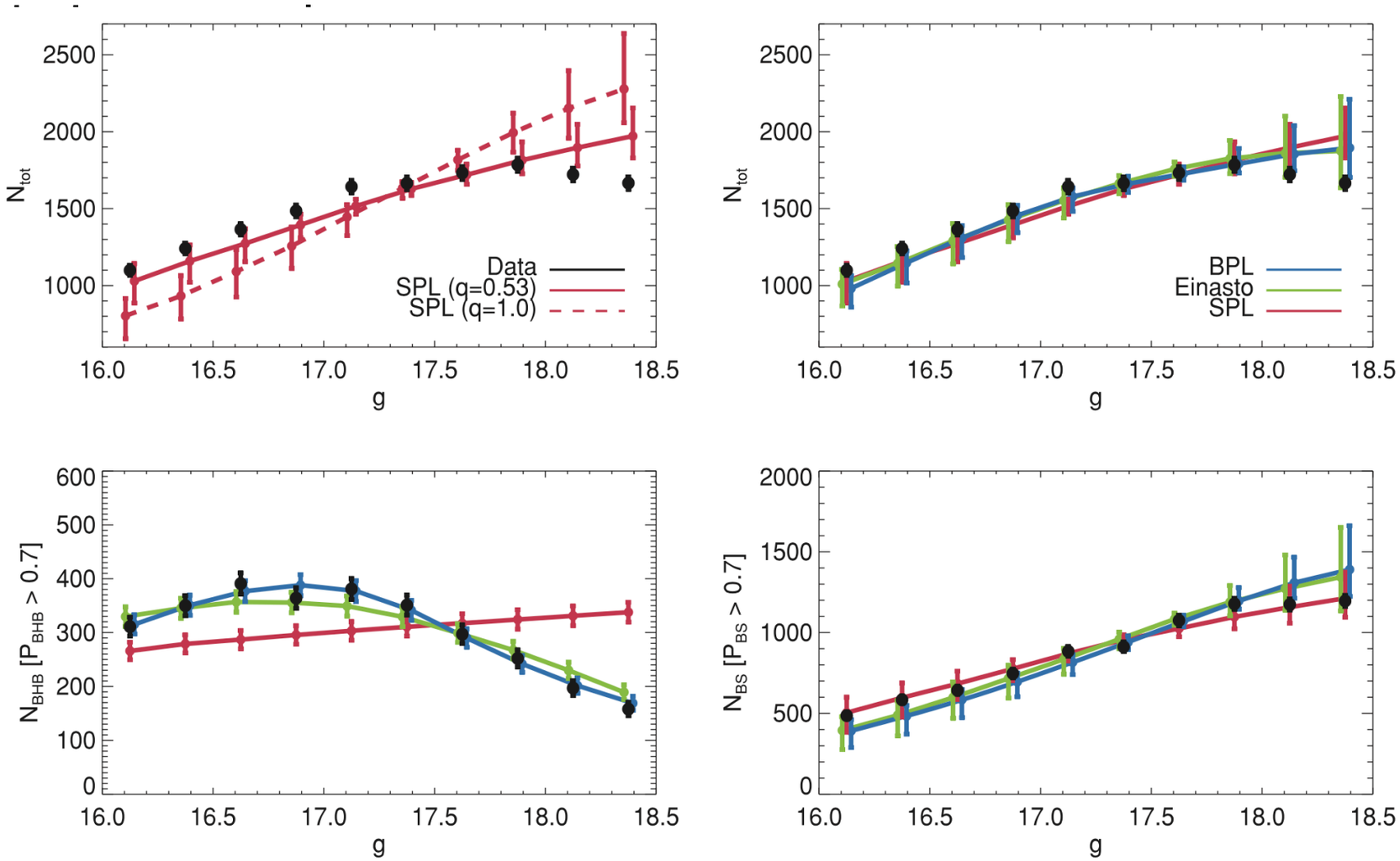
$$n(r) = 2.6 \begin{cases} \left(\frac{23\,\mathrm{kpc}}{r}\right)^{2.4} & \text{if } 5 < r \leq 23\,\mathrm{kpc}, \\ \left(\frac{23\,\mathrm{kpc}}{r}\right)^{4.5} & \text{if } 23 < r < 100\,\mathrm{kpc} \end{cases}$$

The Milky Way Halo

- Lopez-Corre
(2002)

- SDSS survey
2008; Newbe
2002; Xu et a

- Halo profile (
al. 2009, Sea
2011, Xue et al. 2015)



Deason et al. 2011

The Milky Way Halo

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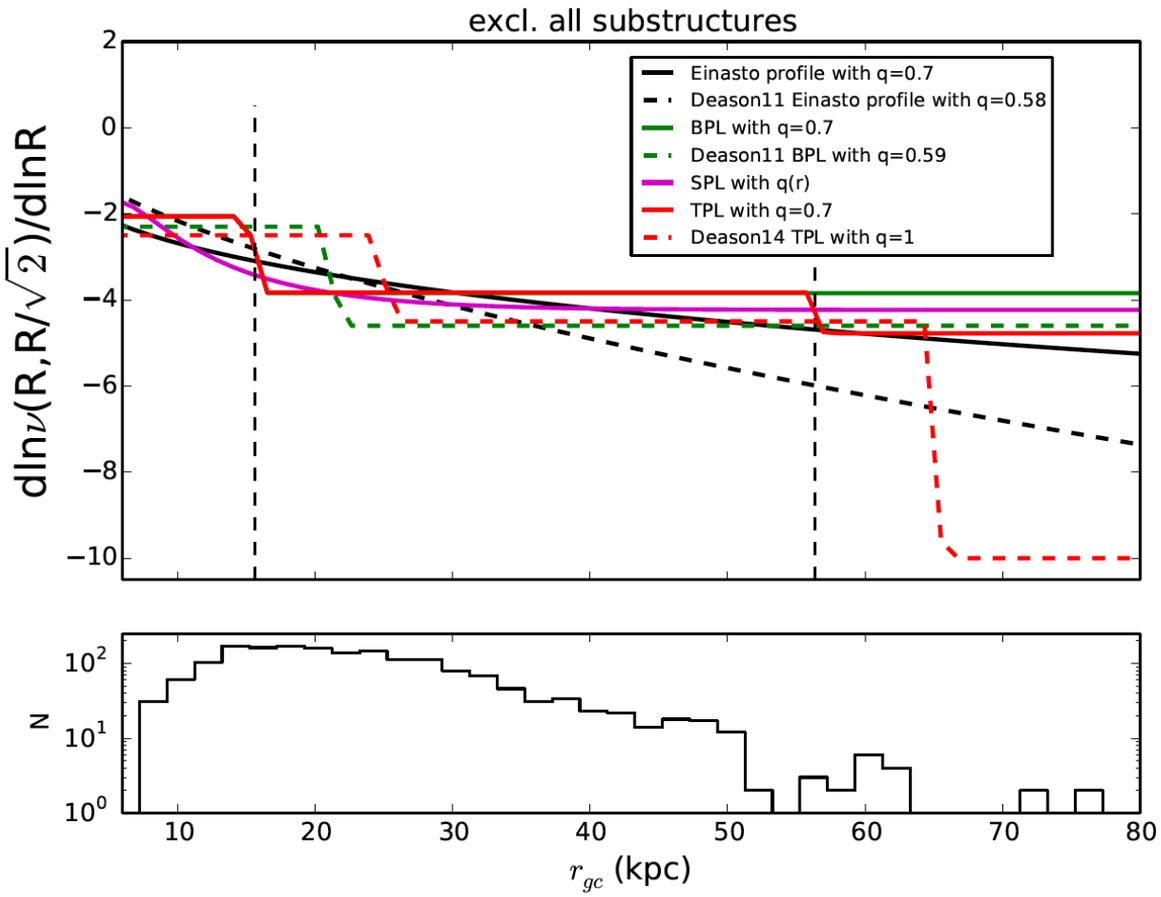
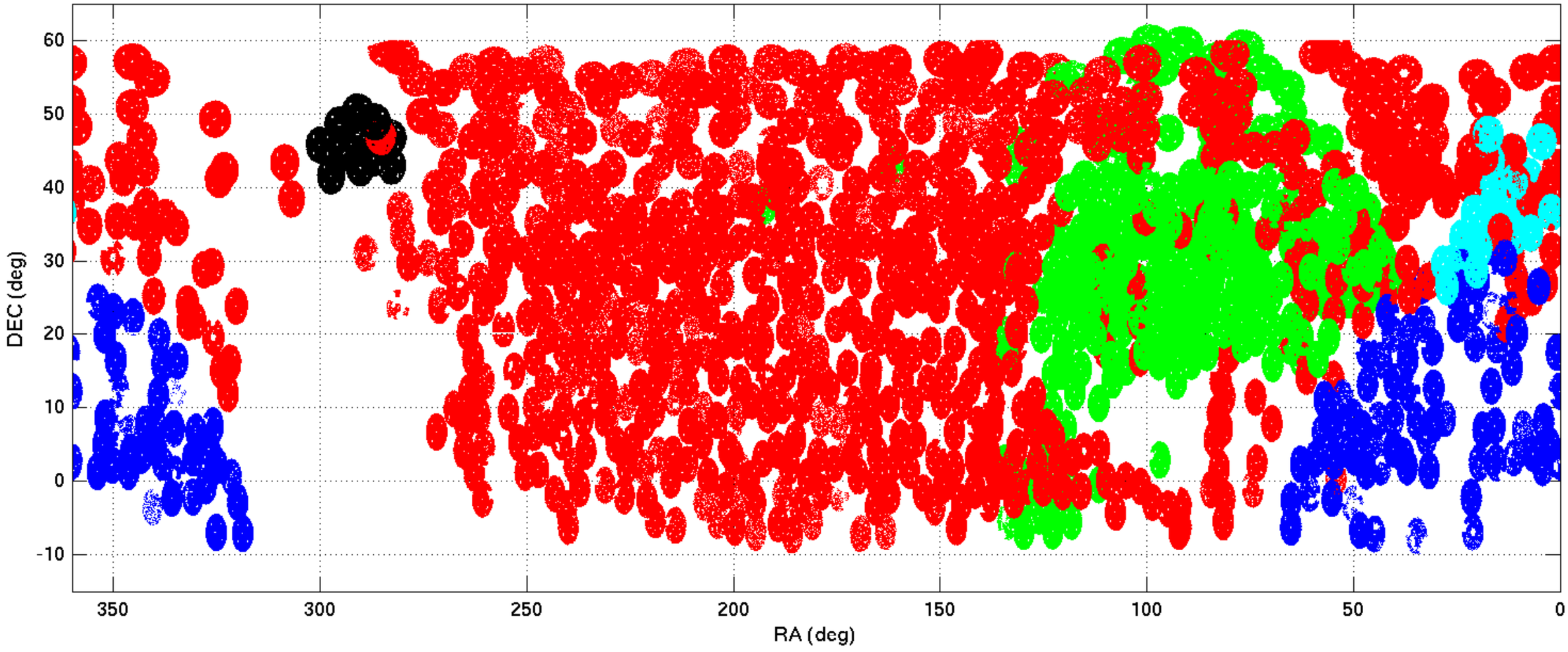
- SDSS survey (Juric et al. 2008; Newberg et al. 2002; Xu et al. 2015)
- Halo profile (Watkins et al. 2009, Season et al. 2011, Xue et al. 2015)

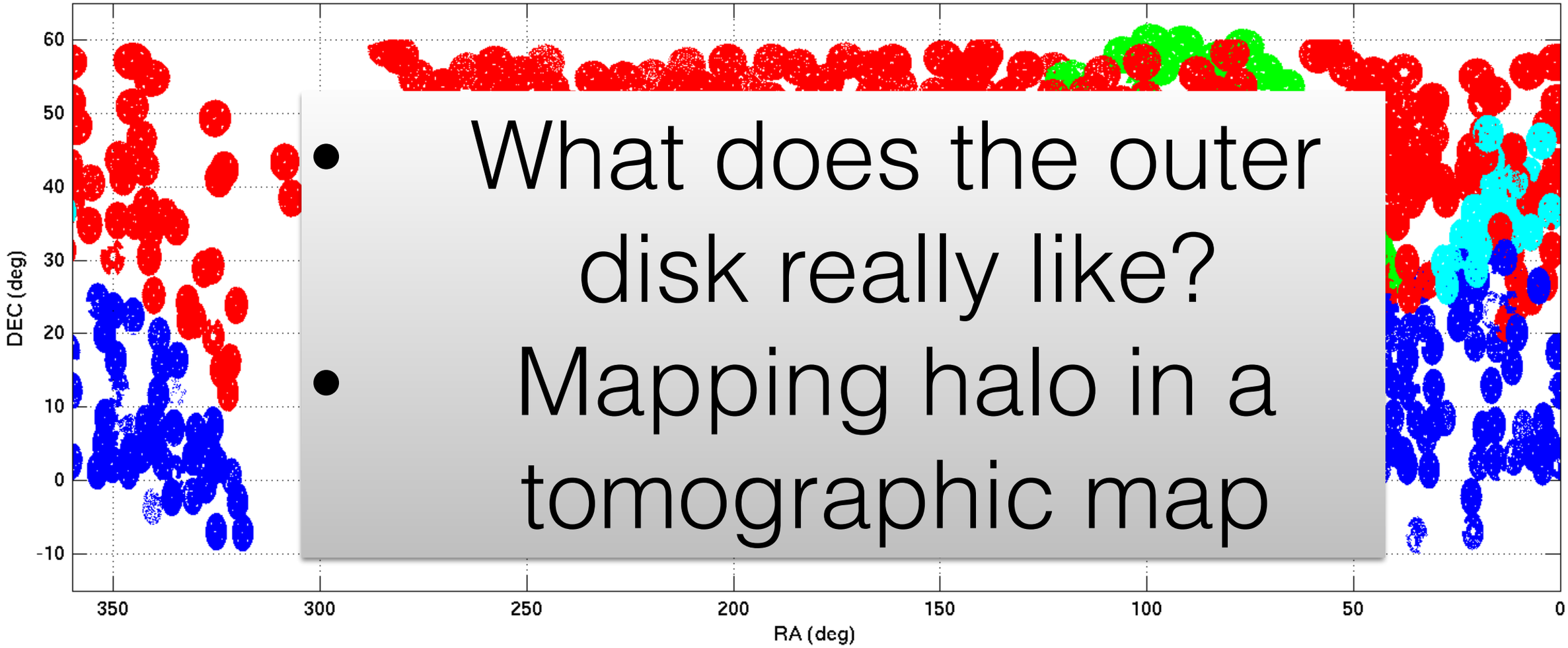


Xue et al. 2015

LAMOST survey



LAMOST survey



- What does the outer disk really like?
- Mapping halo in a tomographic map

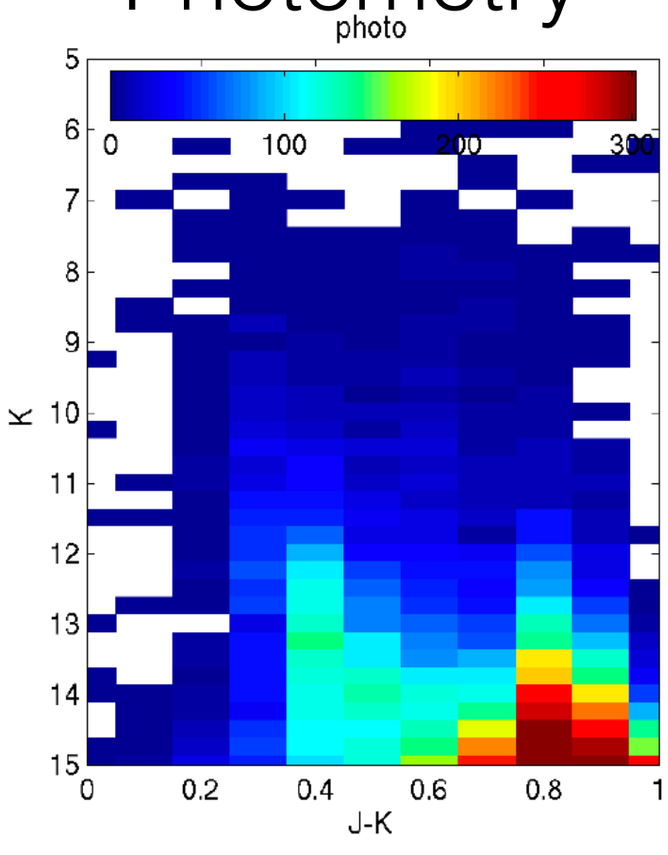
Methodology

$$p_{ph}(D|c,m,l,b) = p_{sp}(D|c,m,l,b).$$

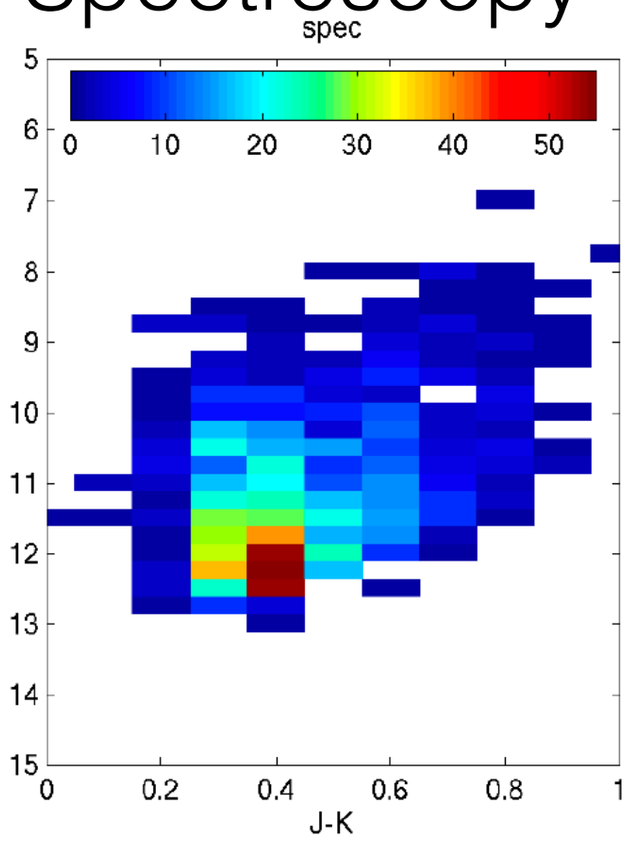
$$\nu_{ph}(D|c,m,l,b) = \nu_{sp}(D|c,m,l,b)S^{-1}(c,m,l,b),$$

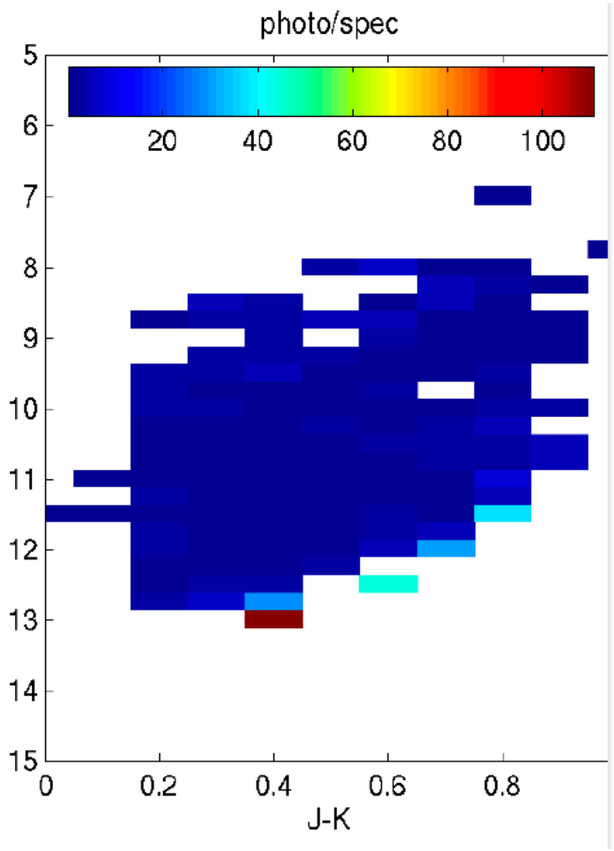
$$S(c,m,l,b) = \frac{\int_0^\infty \nu_{sp}(D|c,m,l,b)\Omega D^2 dD}{\int_0^\infty \nu_{ph}(D|c,m,l,b)\Omega D^2 dD}$$

Photometry

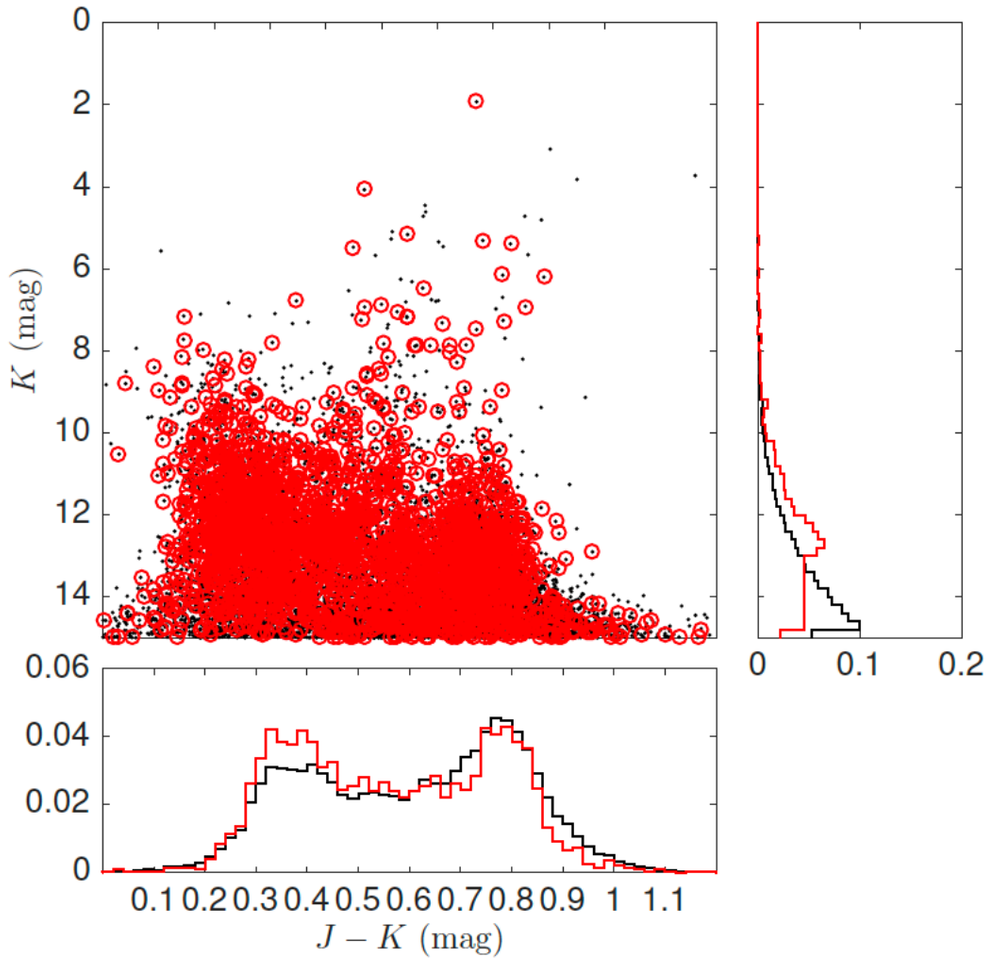


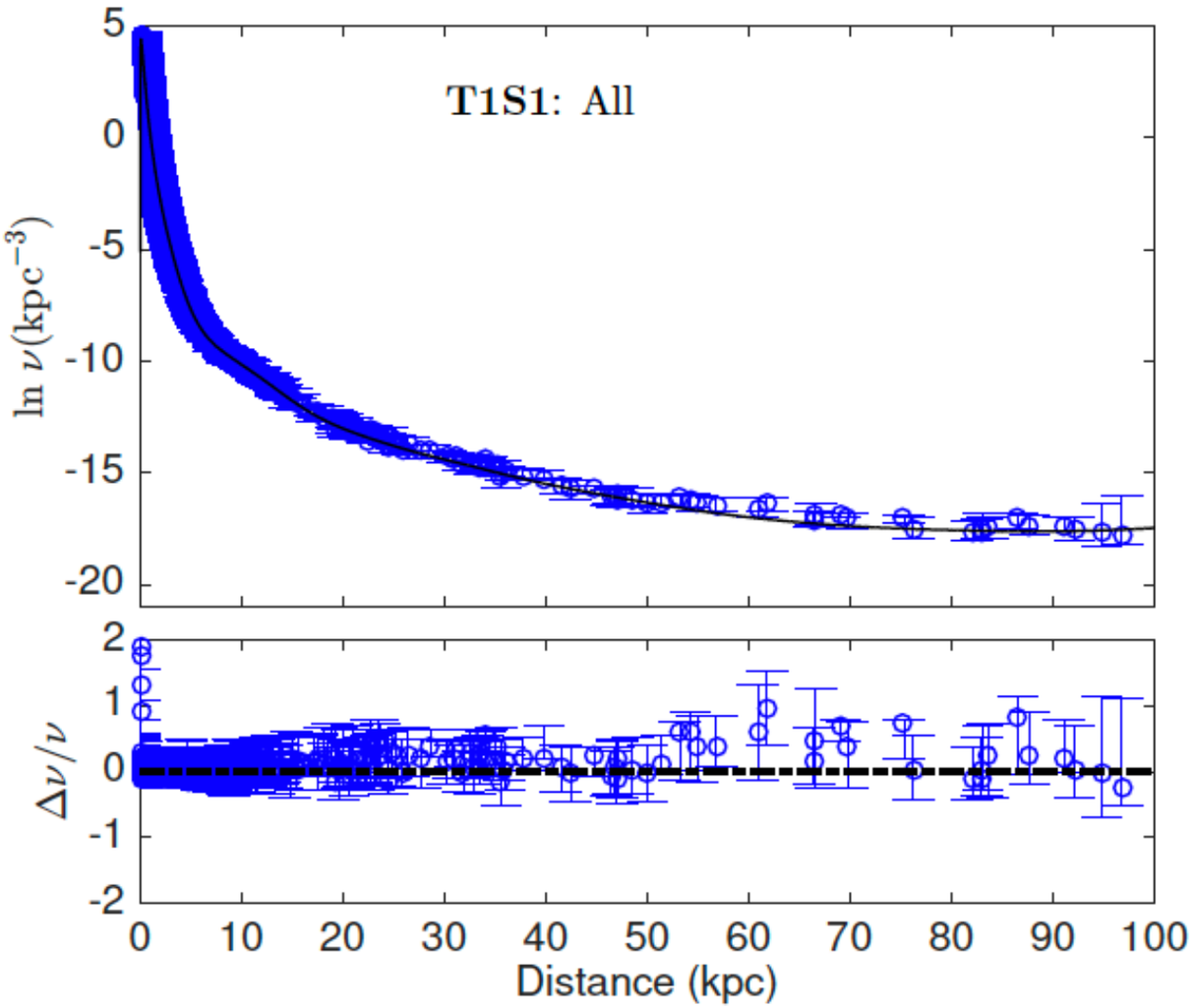
Spectroscopy



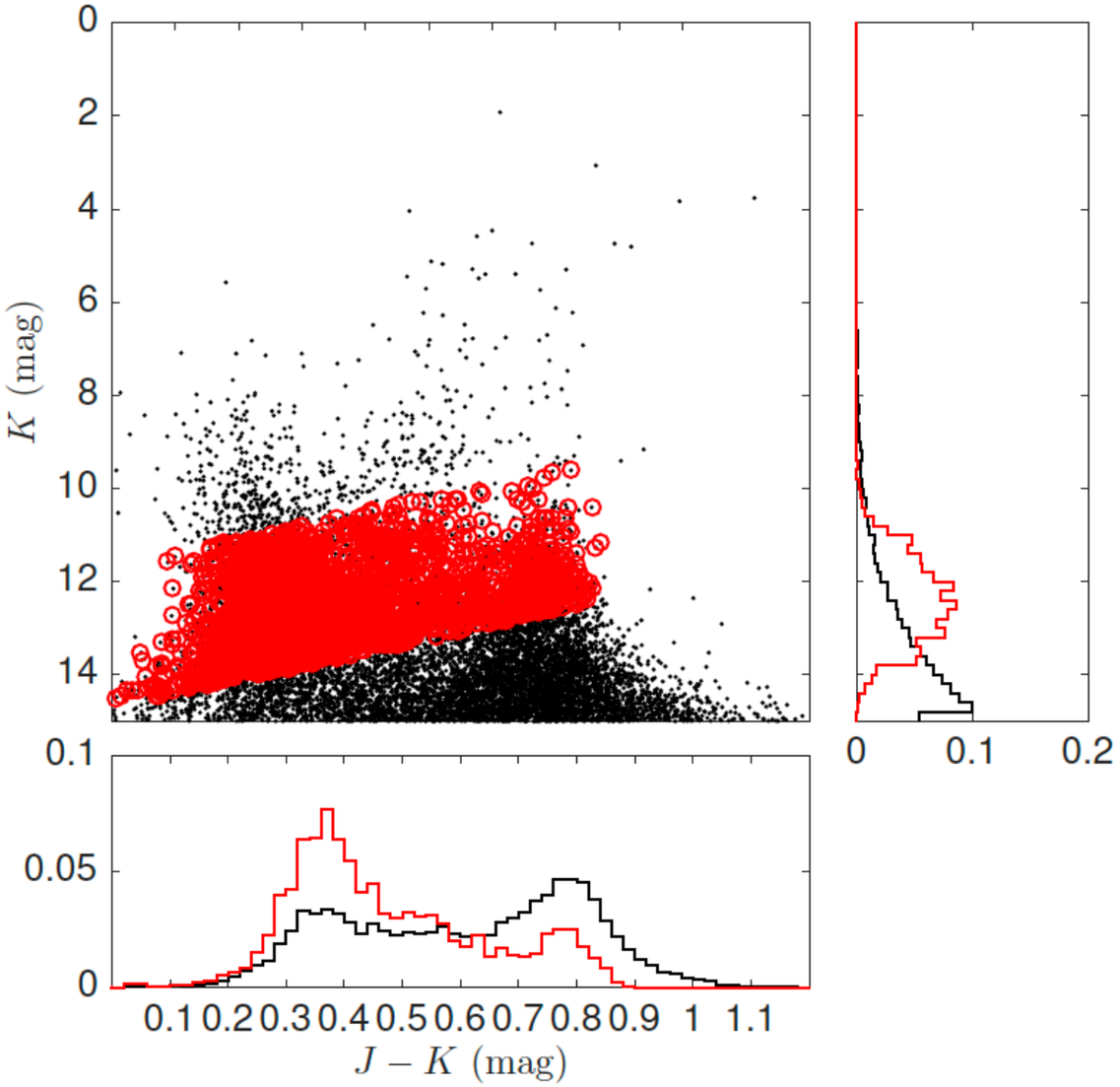


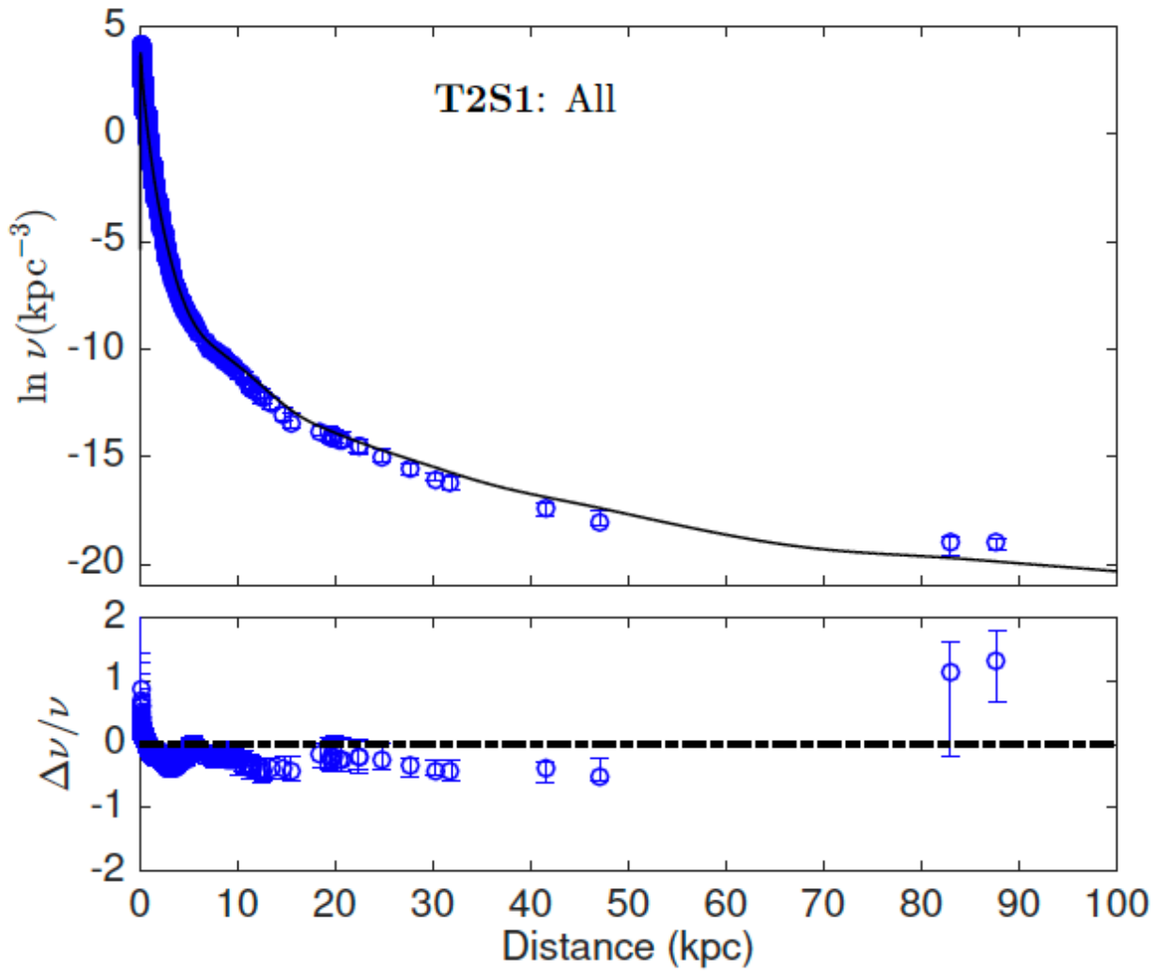
Validation with mock data

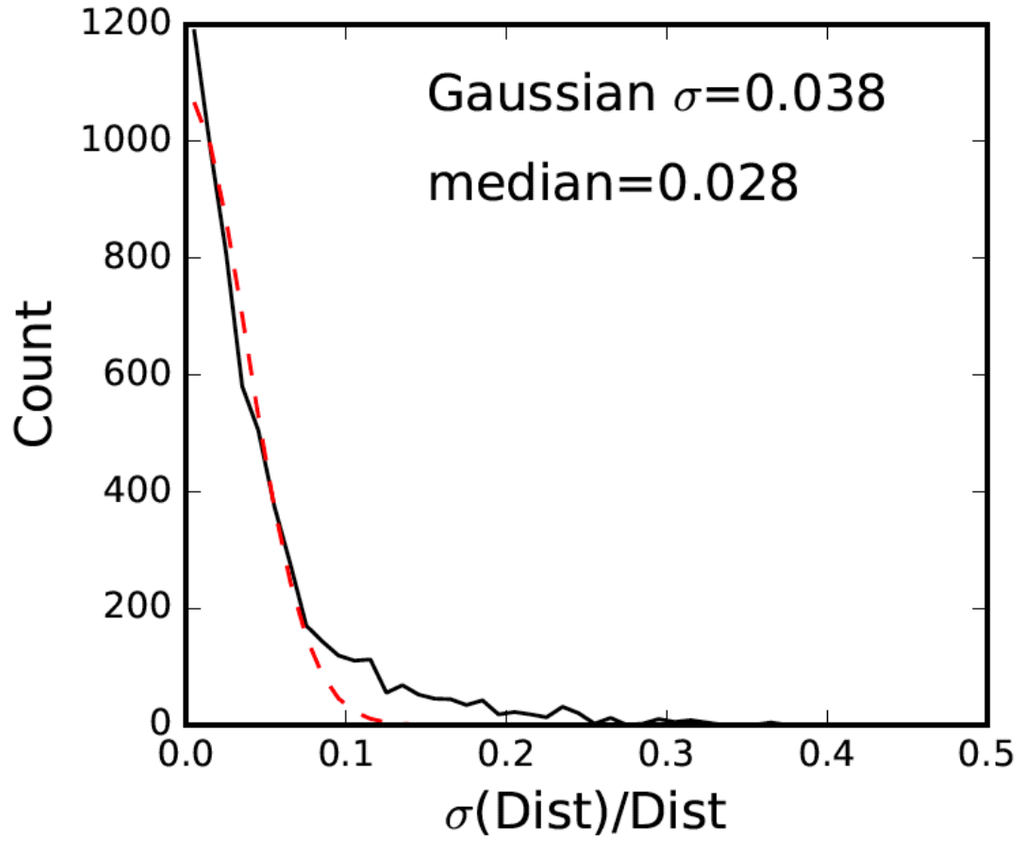




Validation with mock data



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σ(Dist)/Dist
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400
600
800
1000
1200
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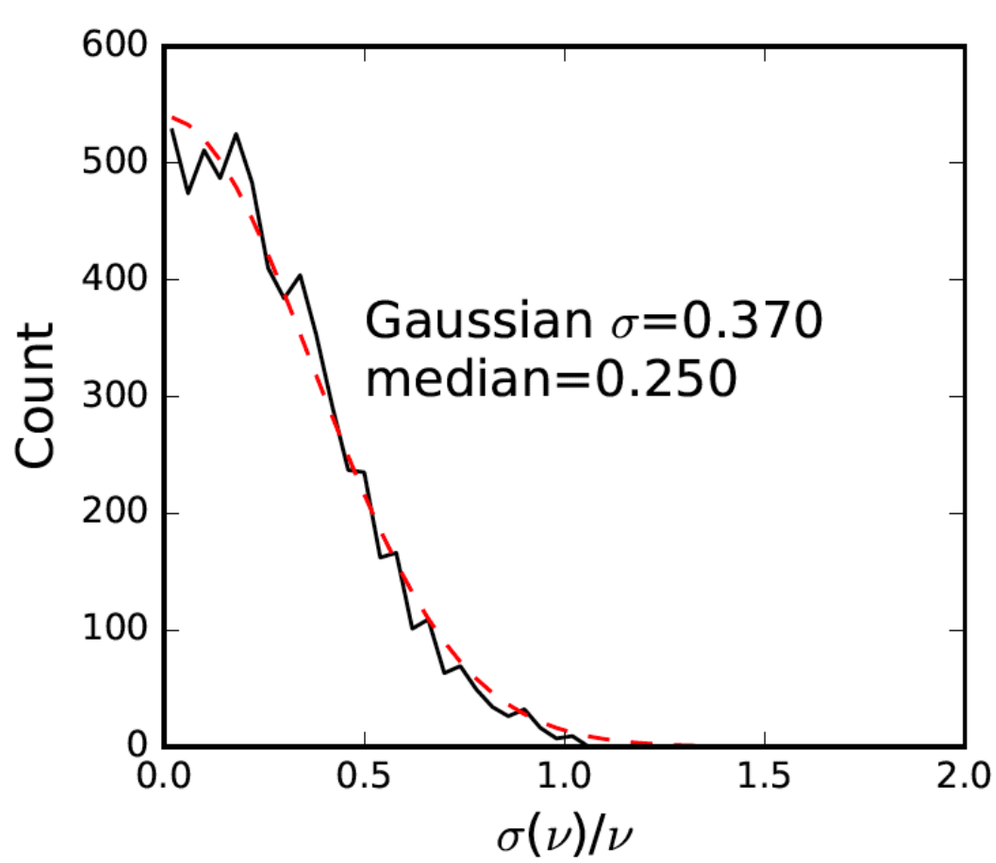
0.1
0.2
0.3
0.4
0.5


Gaussian σ=0.370
median=0.250
Count
$\sigma(\nu)/\nu$
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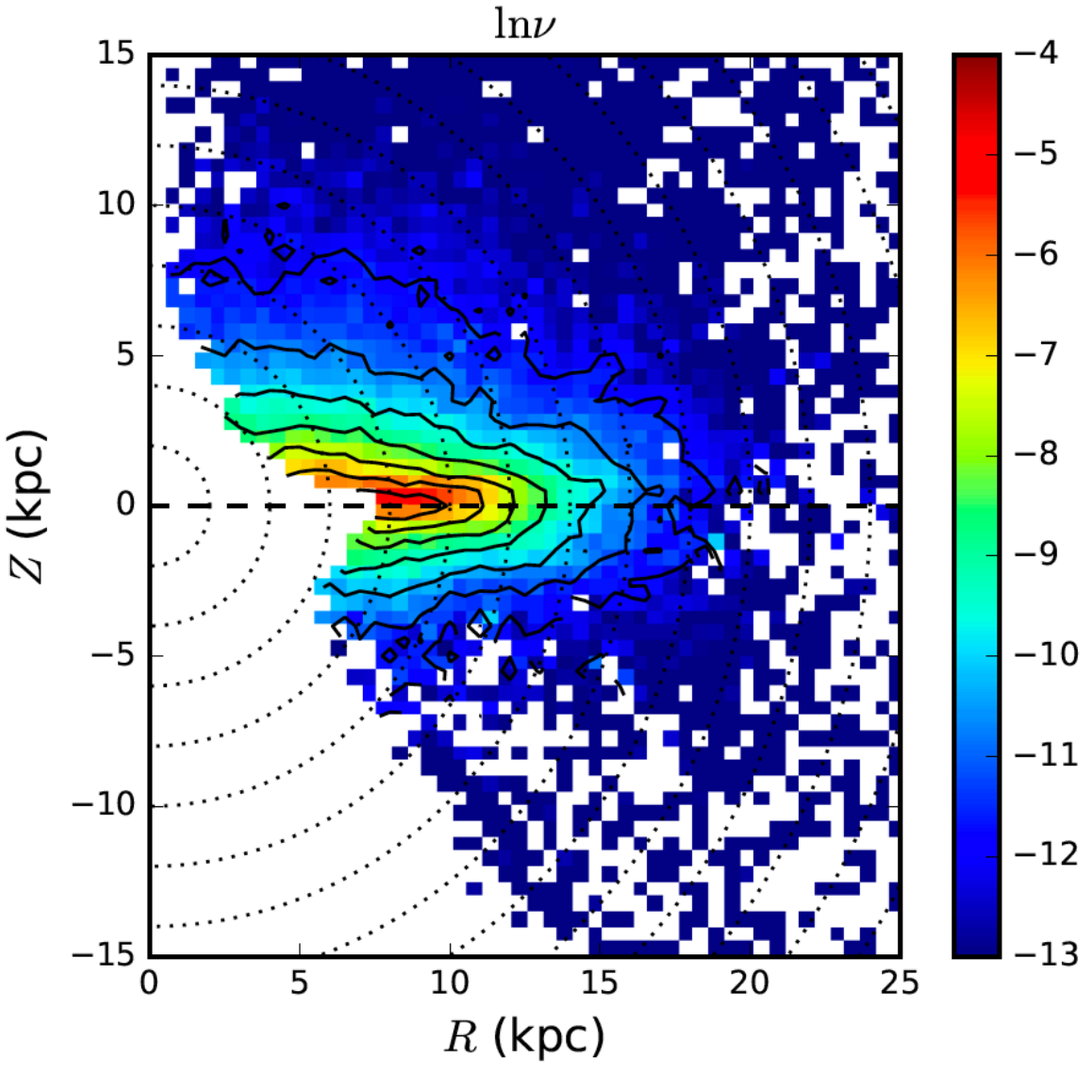
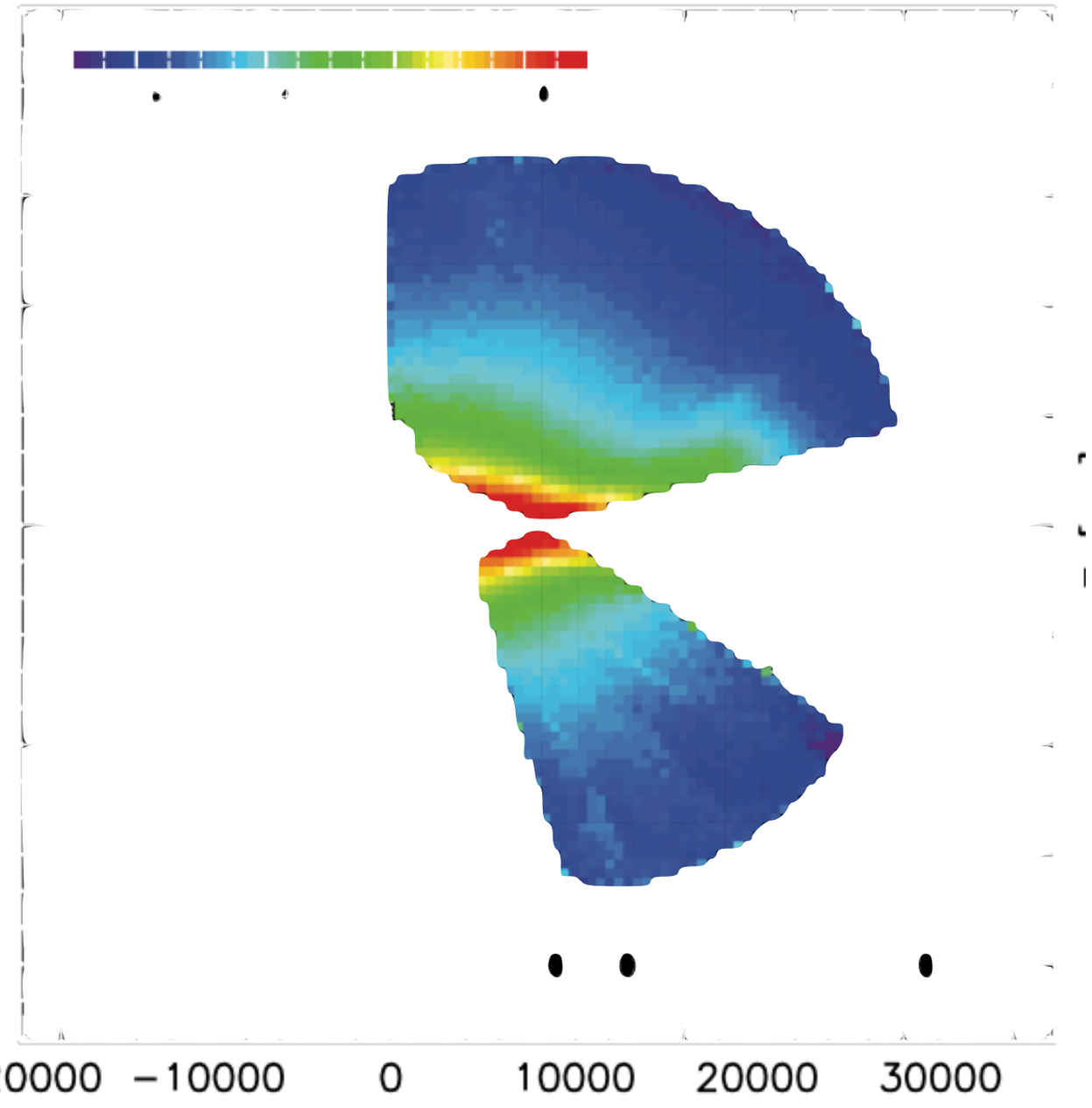
300
400
500
600
0.0
0.5
1.0
1.5
2.0

The disk

Juric et al. 2008

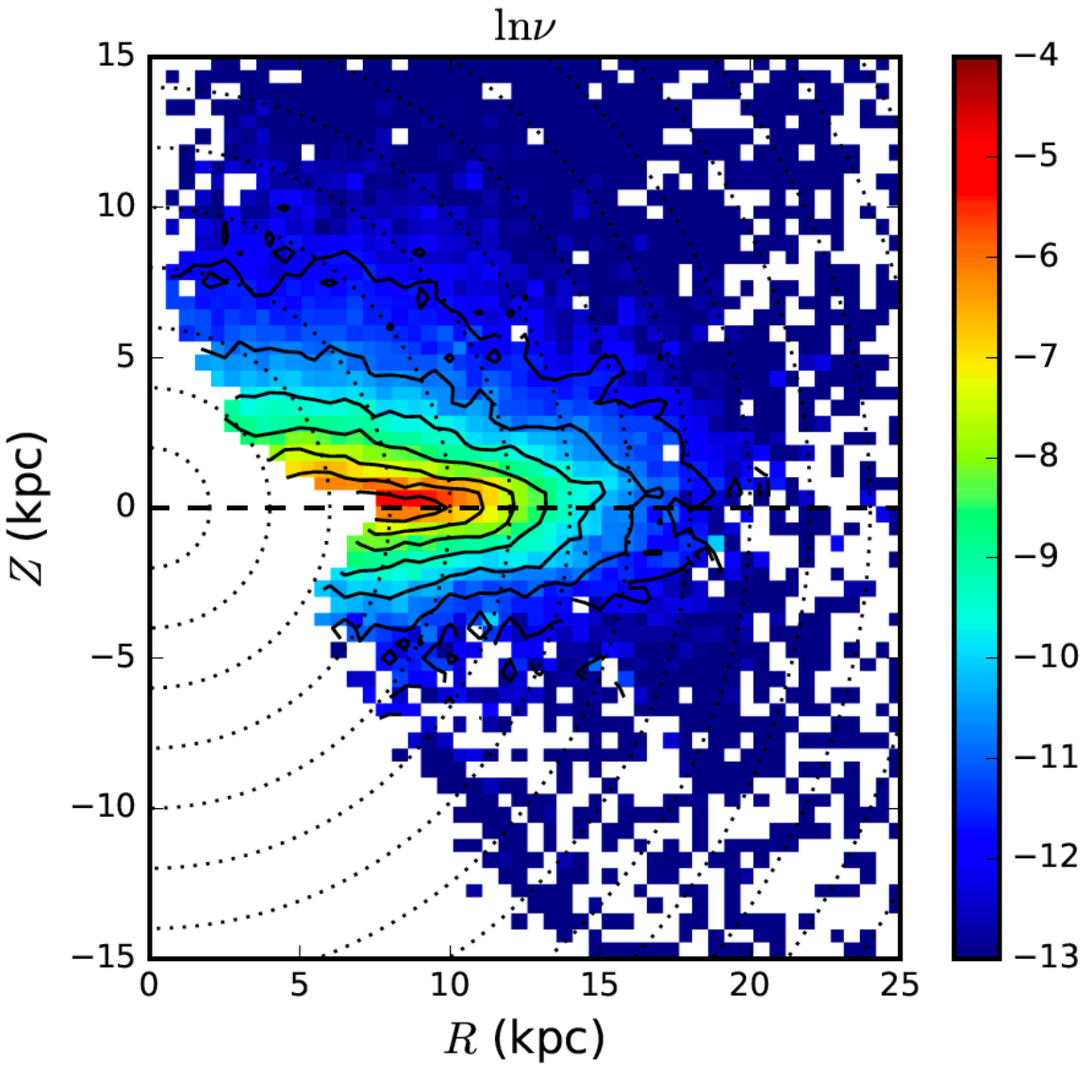


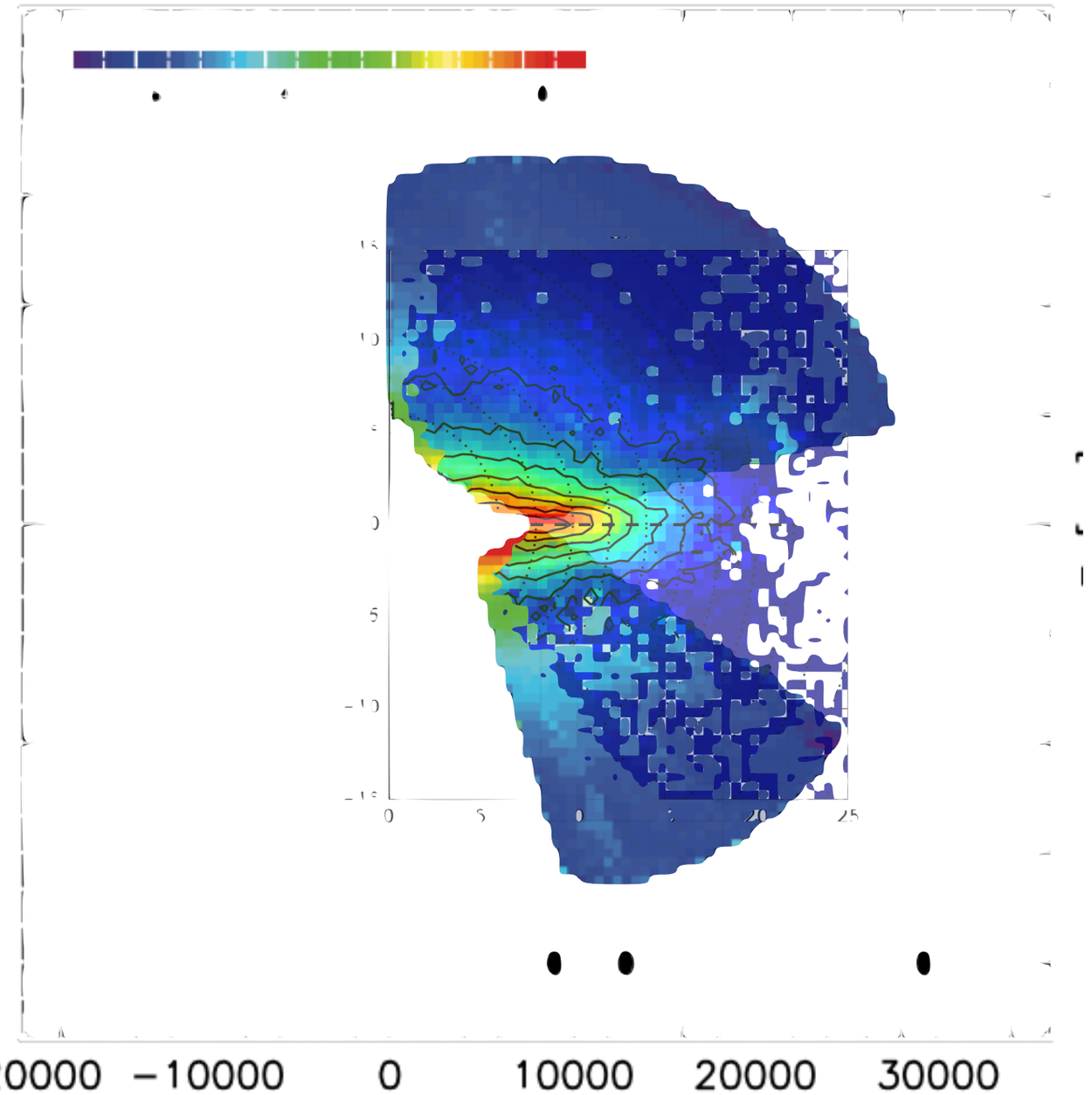


~22000 RGB stars from DR3 with MK<-3.5mag

The disk

Juric et al. 2008





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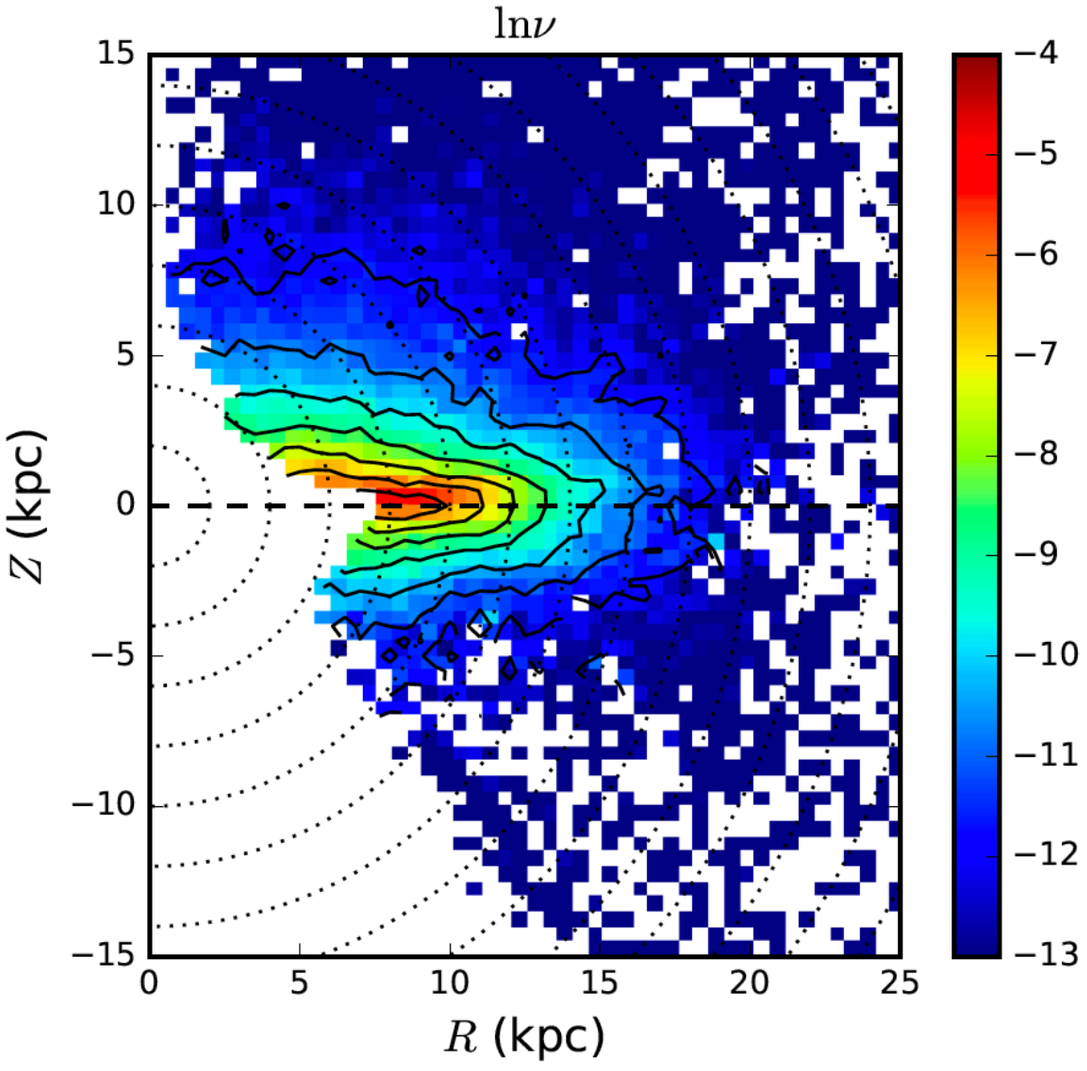
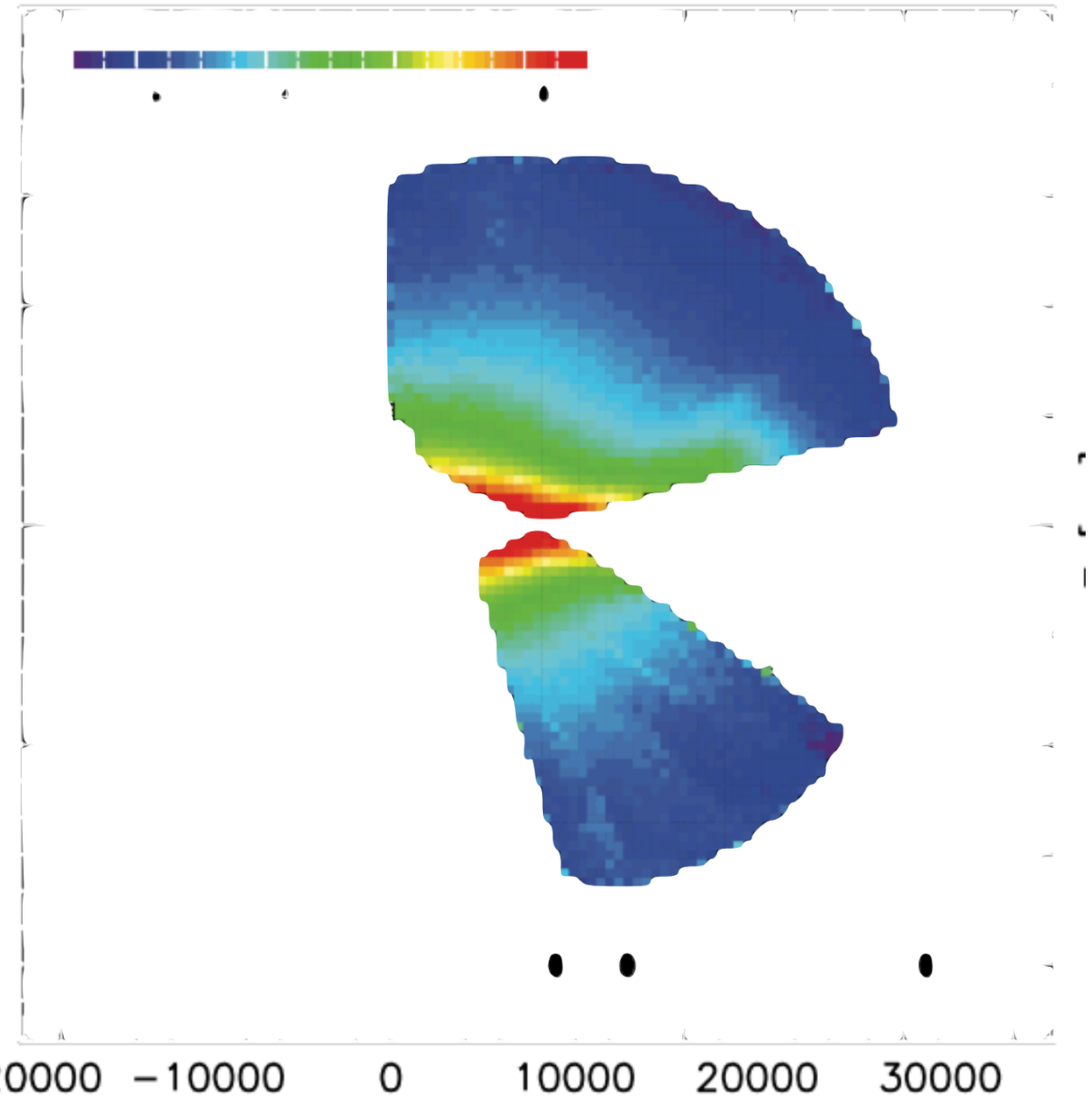
The disk

Juric et al. 2008





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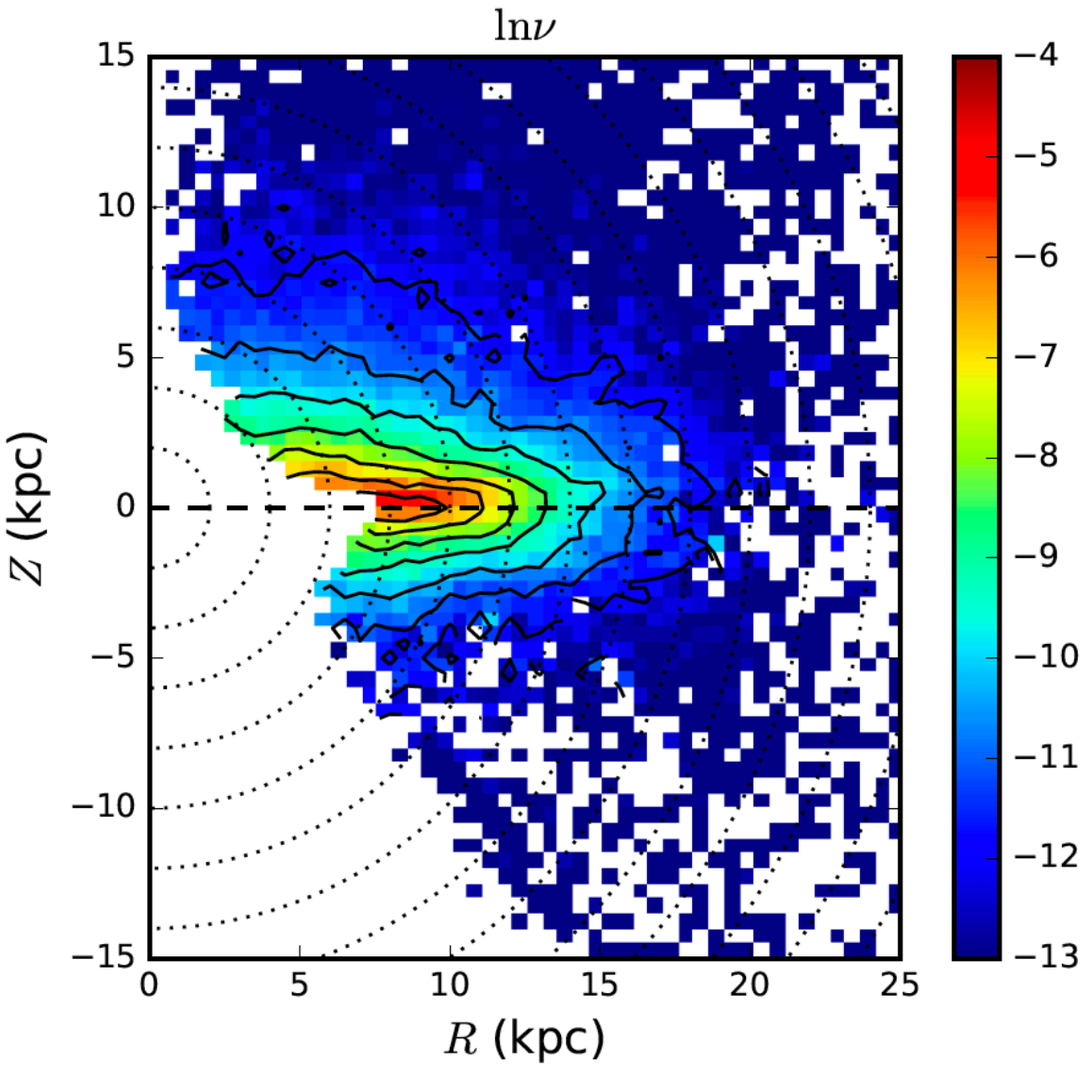
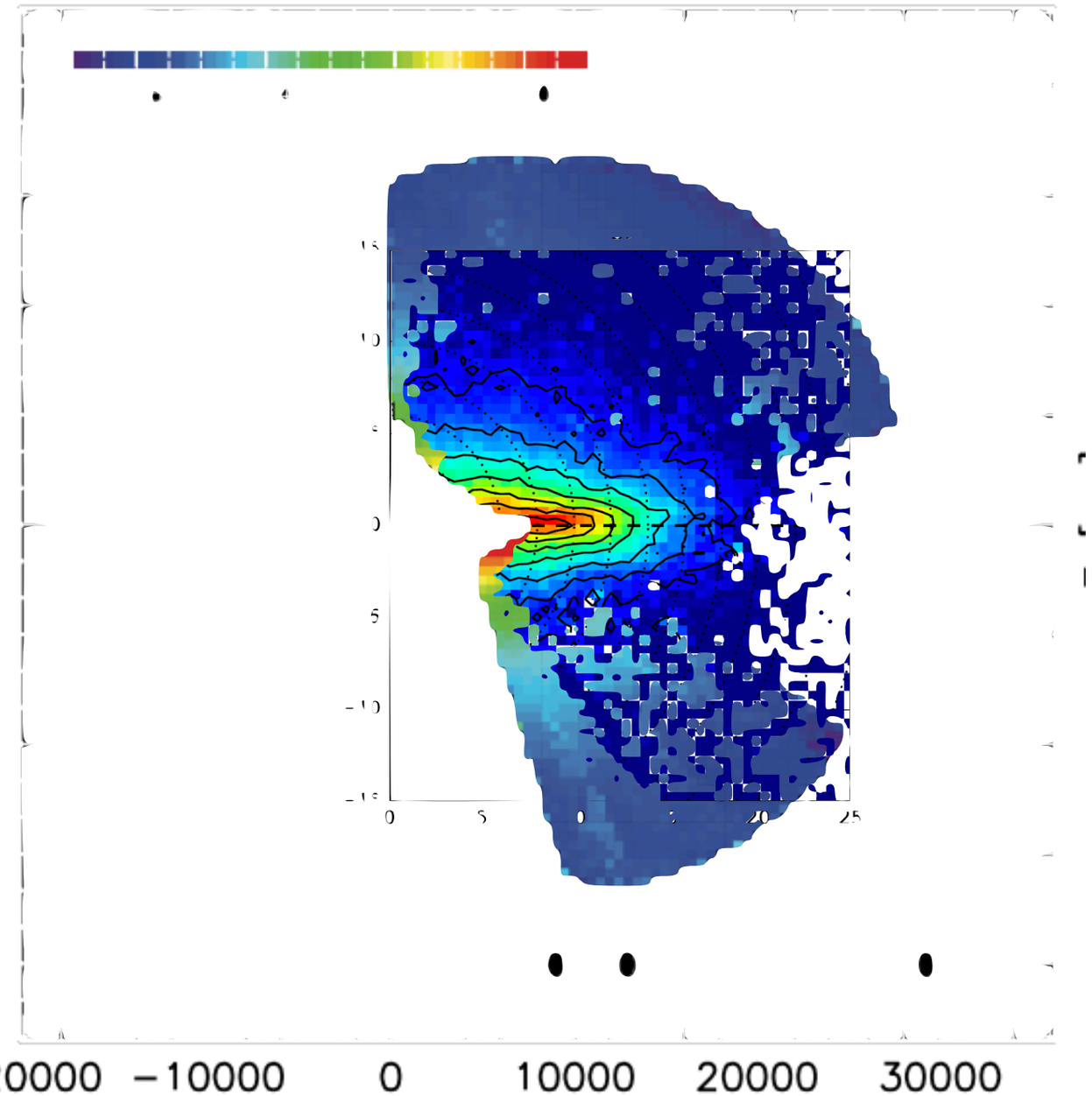
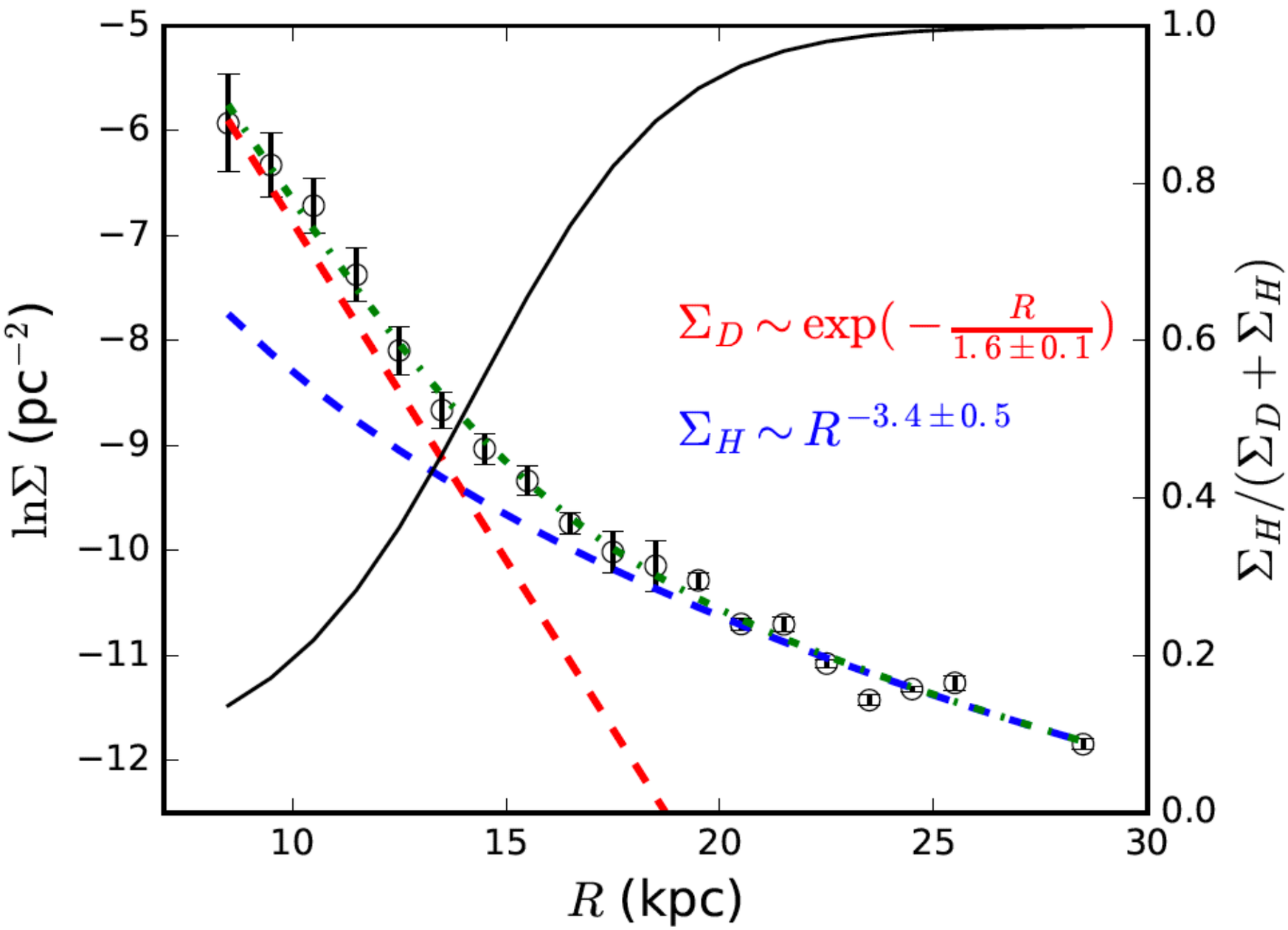




~22000 RGB stars from DR3 with MK<-3.5mag

The disk

See Wang Haifeng's talk for more quantitative analysis



The disk

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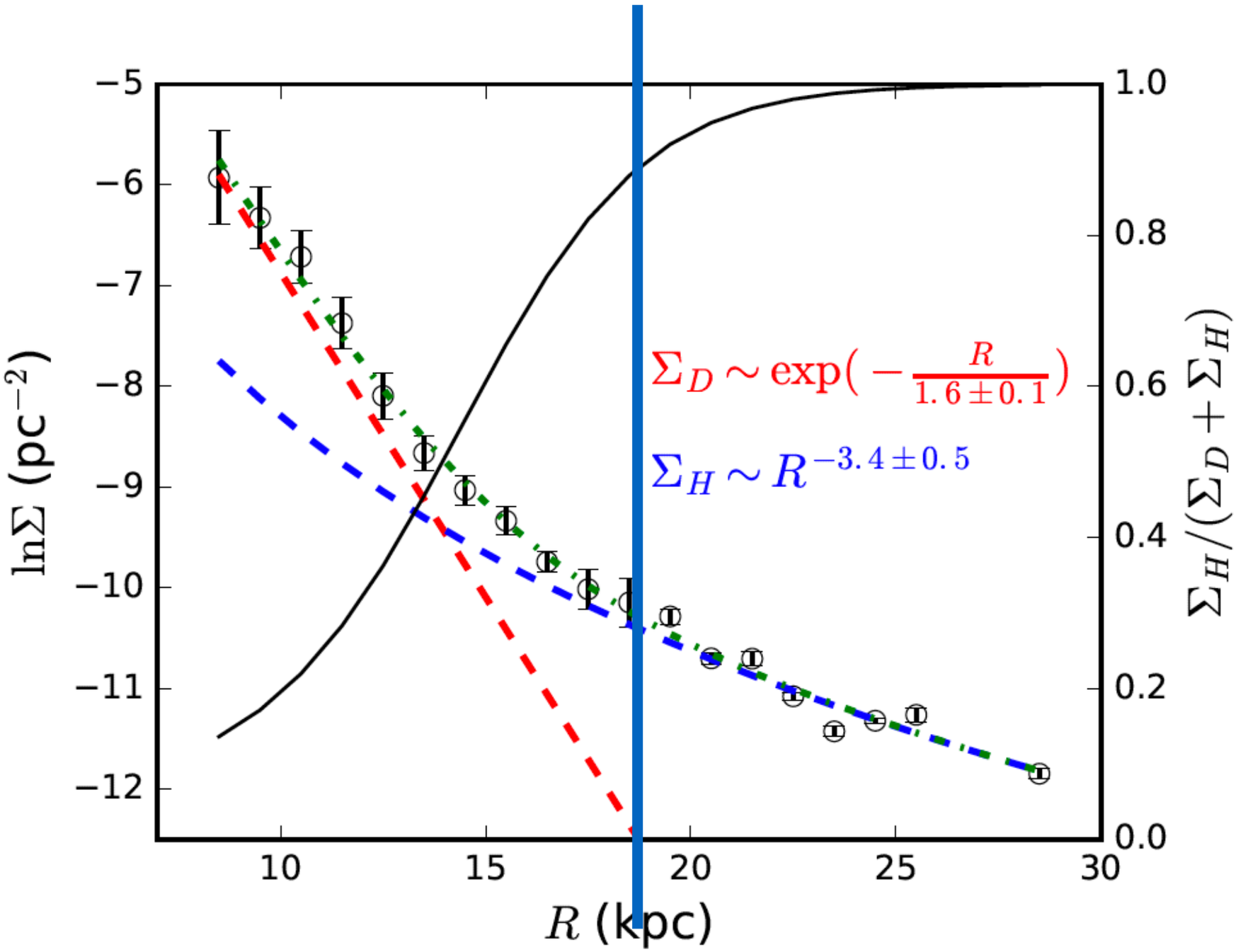
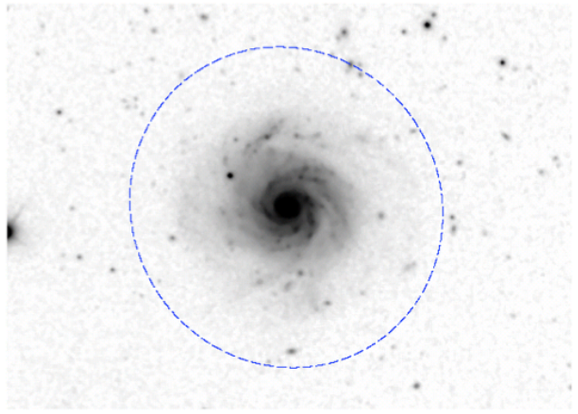
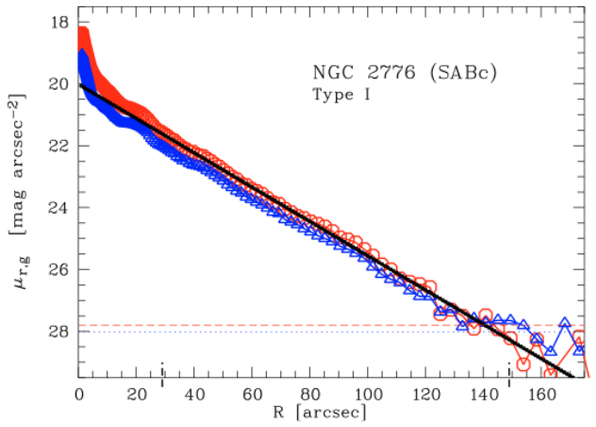
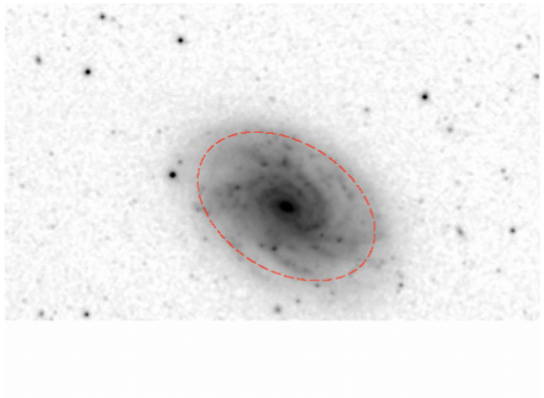
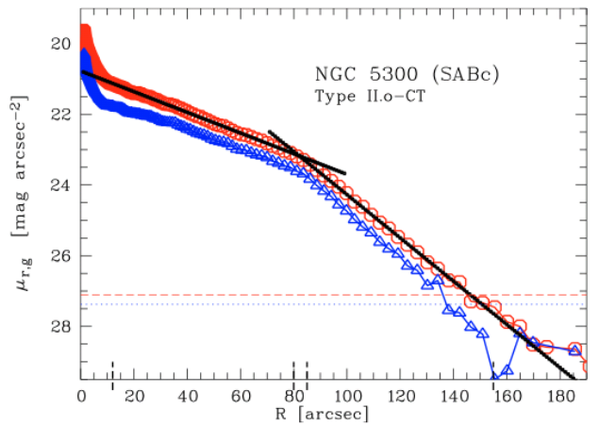
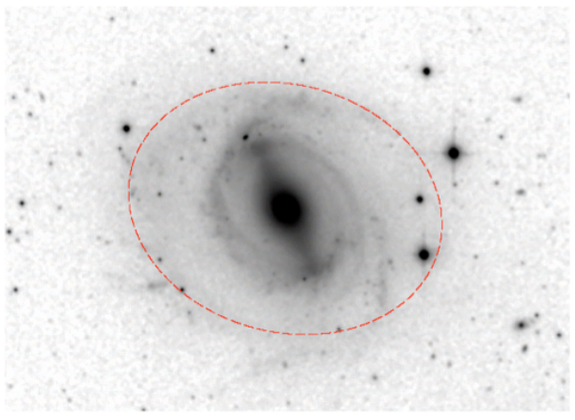


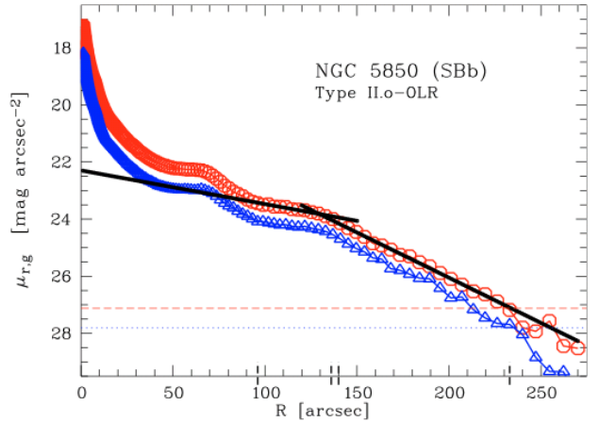


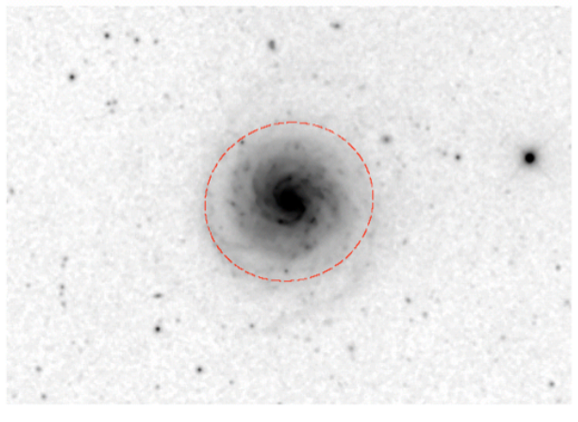


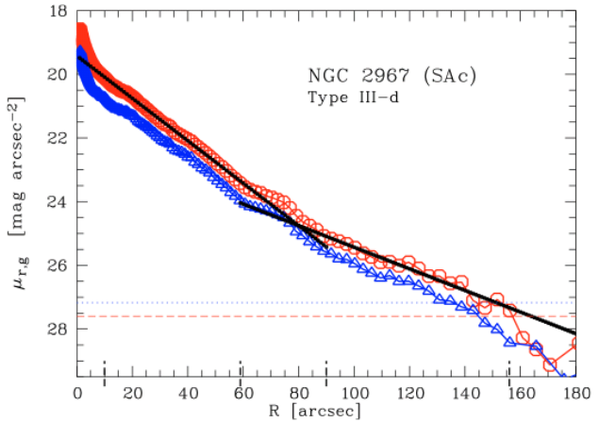






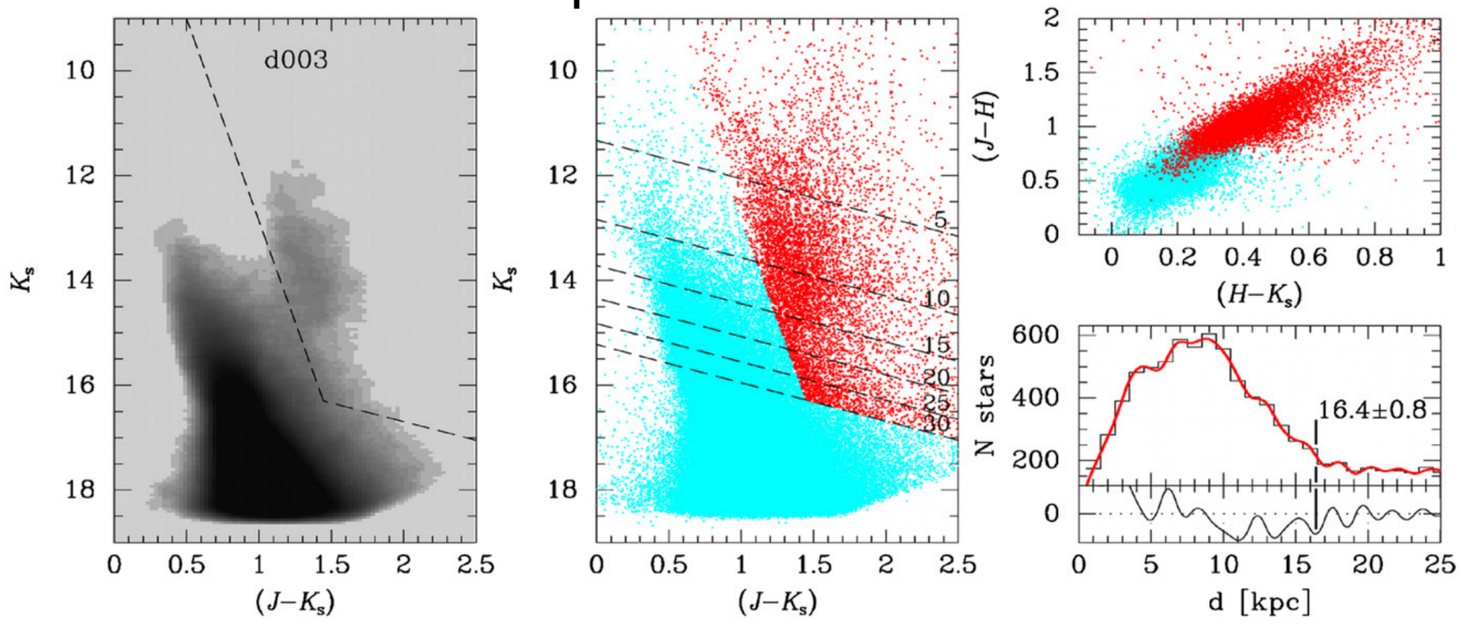






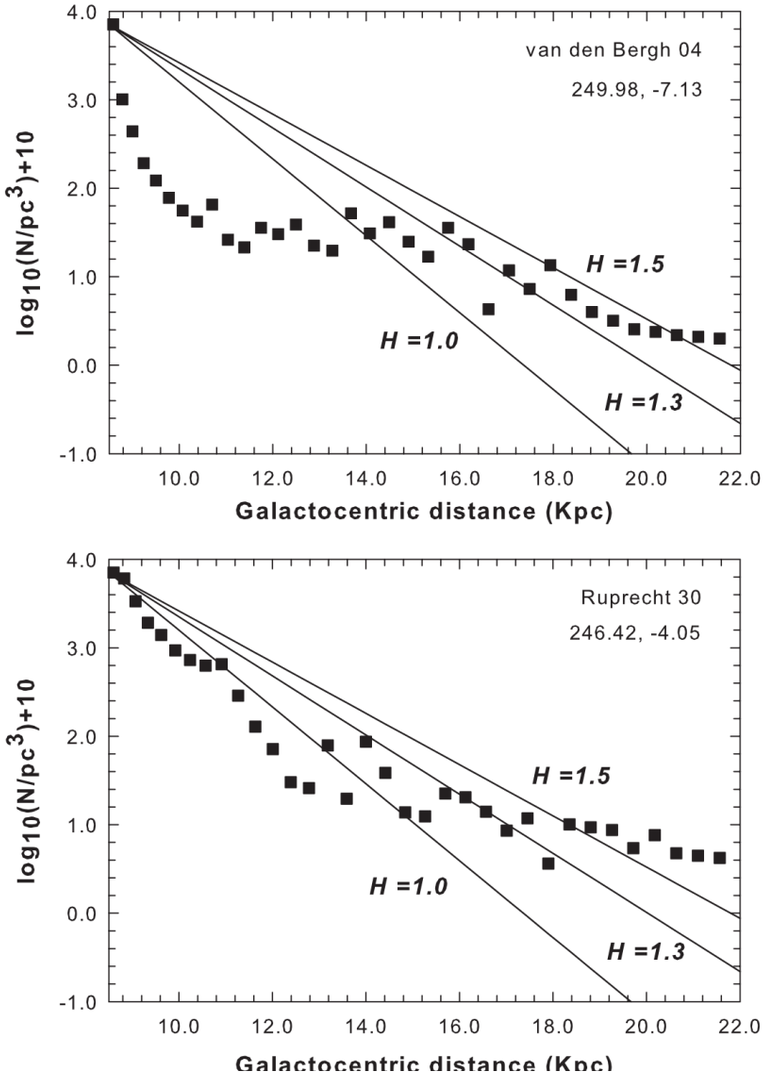
Pohlen & Trujillo 2006

Red clump stars



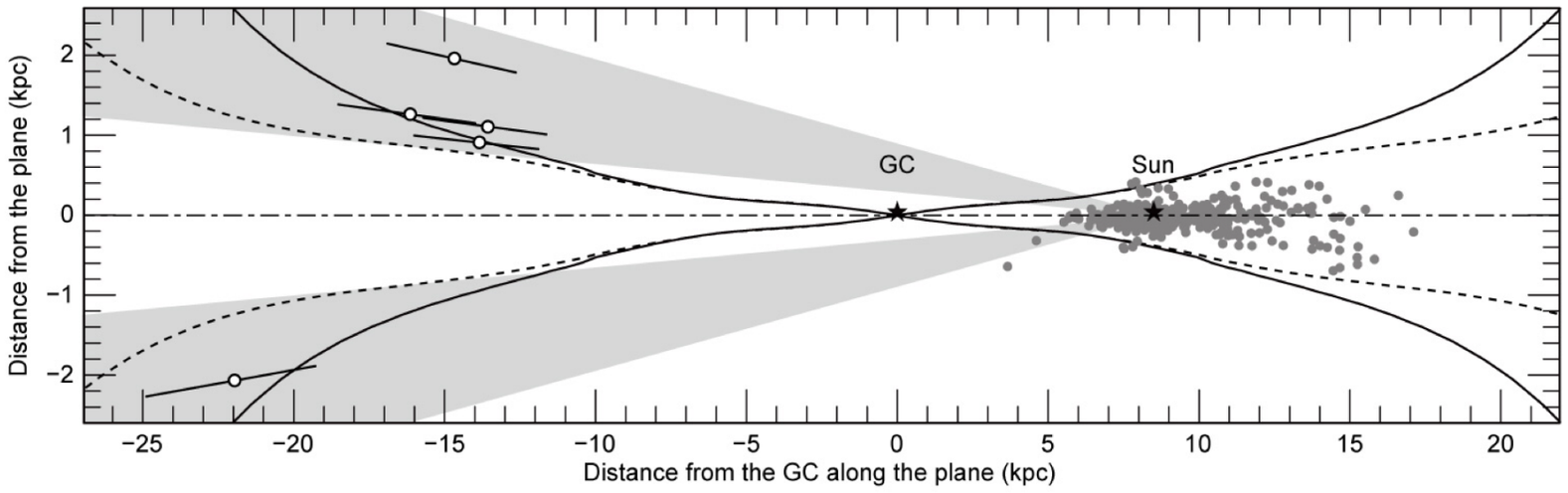
Minniti et al. 2011

Carraro et a. 2010



OB stars

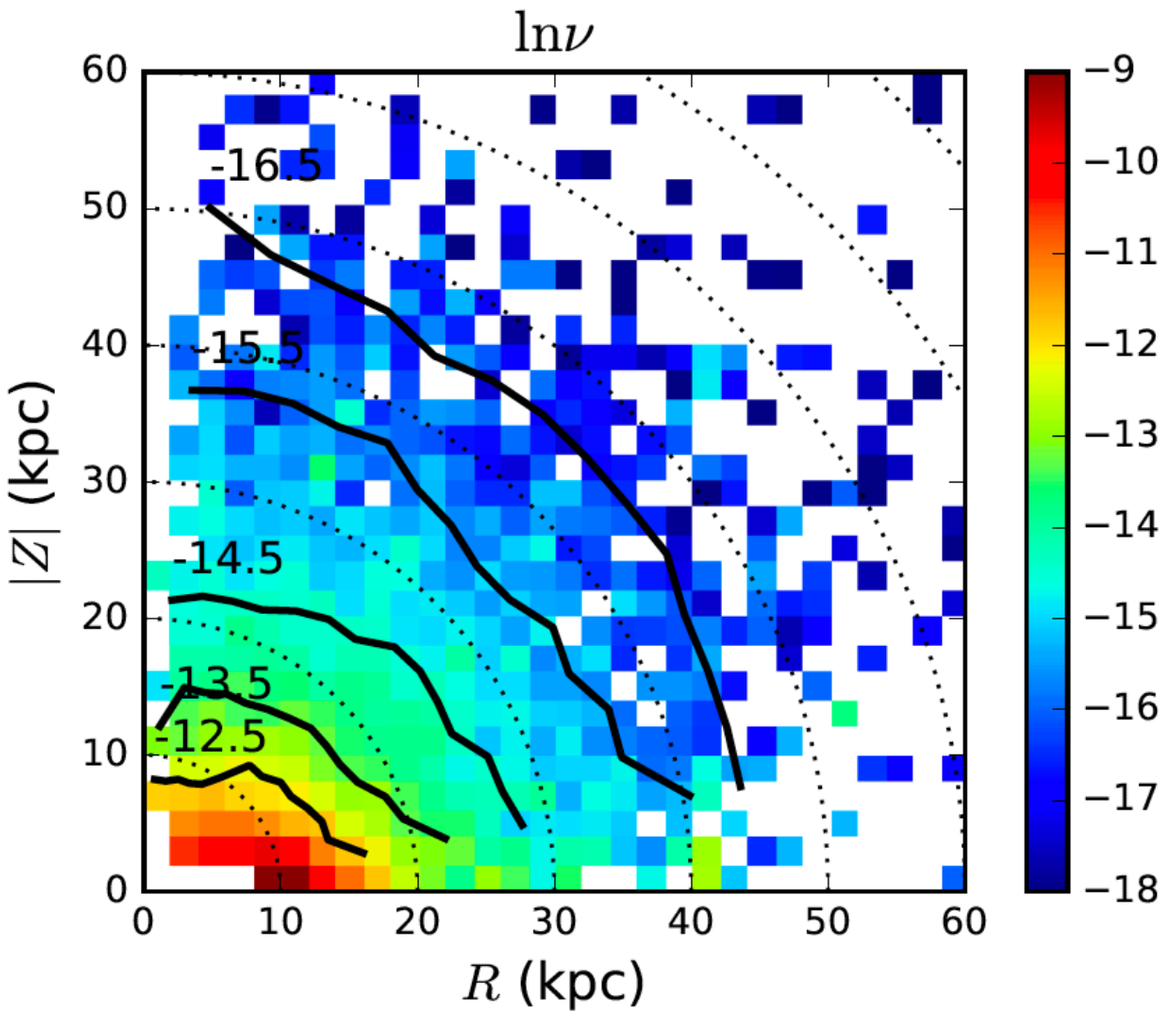
Feast et al. 2014 Natur.

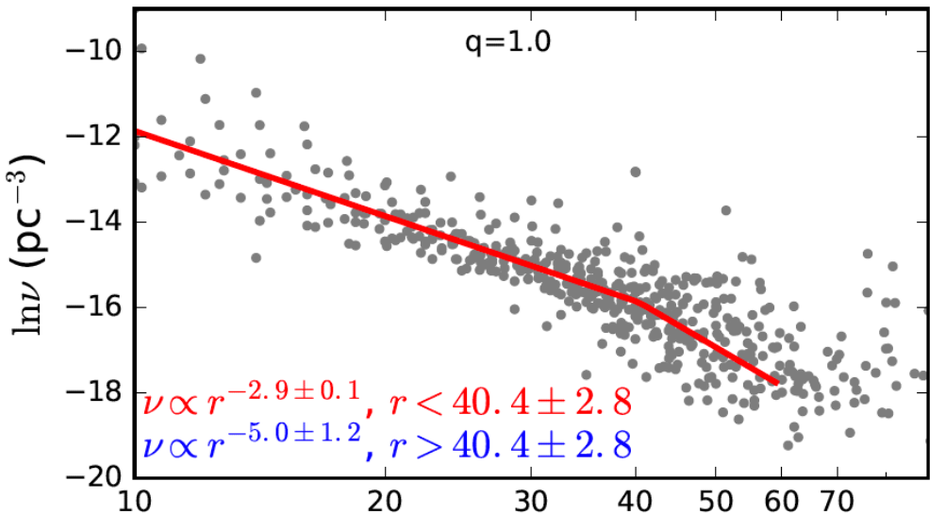


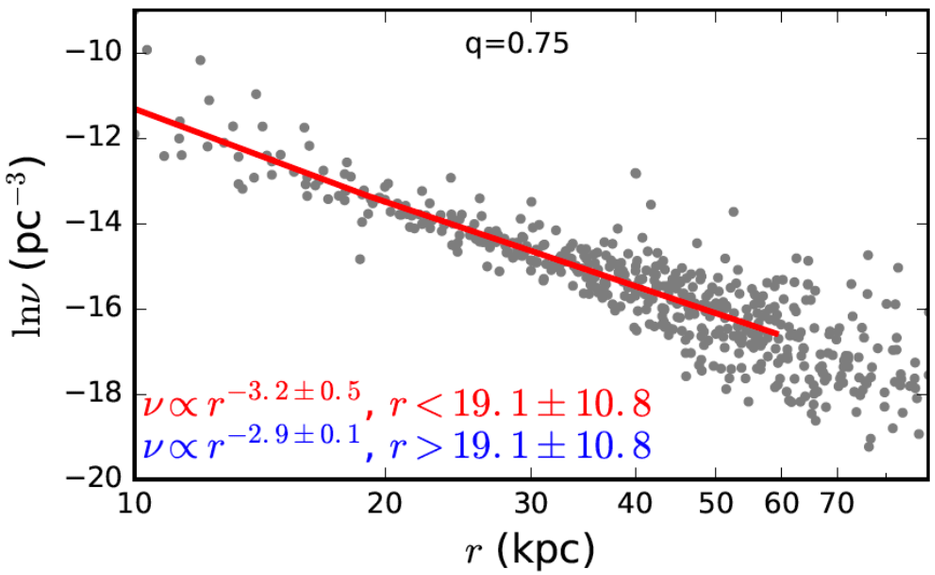
Cepheids

The halo

See Xu Yan's talk for more quantitative analysis







5000+ RGB stars from DR3 with [Fe/H]<-1dex and MK<-4

Conclusions

- The stellar density for a certain stellar population can be well reconstructed from LAMOST data

- We find that the Galactic disc does not truncate within R=19 kpc, but exponentially extends to larger R and, finally, smoothly transition to the stellar halo at R~20-25 kpc

- The best fit of the scale length with the red giant stars is 1.6±0.1 kpc

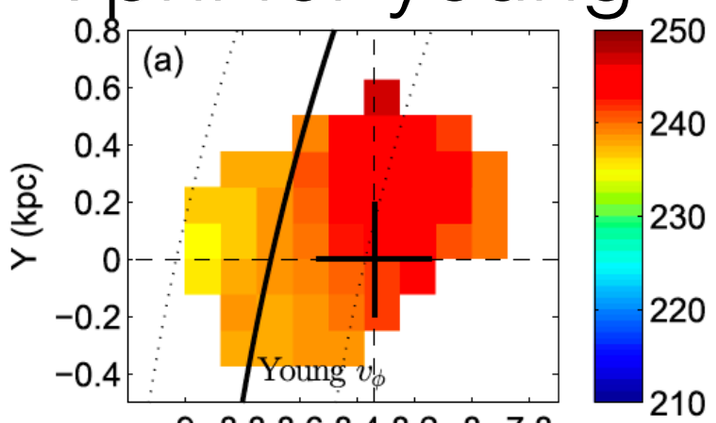
- We directly show from the tomographic map that the stellar halo is quite oblate within 20 kpc and gradully becomes spherical beyond r=30 kpc

Other works

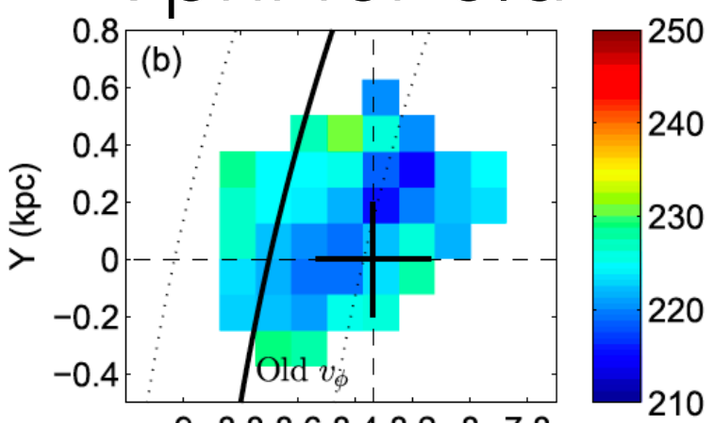
- Mapping the local arm with kinematics of young stars from LAMOST-TGAS data (Liu et al. 2017 ApJ 835, L18)

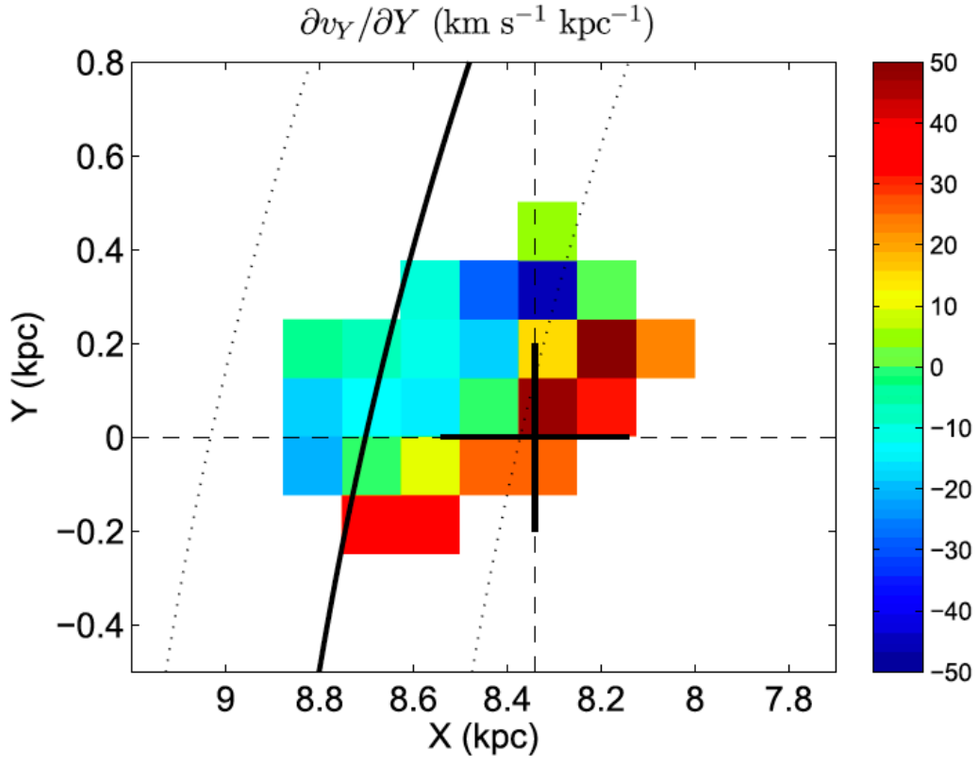
- Mapping the kinematics of the stellar warp (Liu et al. 2017, IAUS321, ArXiv: 1702.02232)

Vphi for young



Vphi for old





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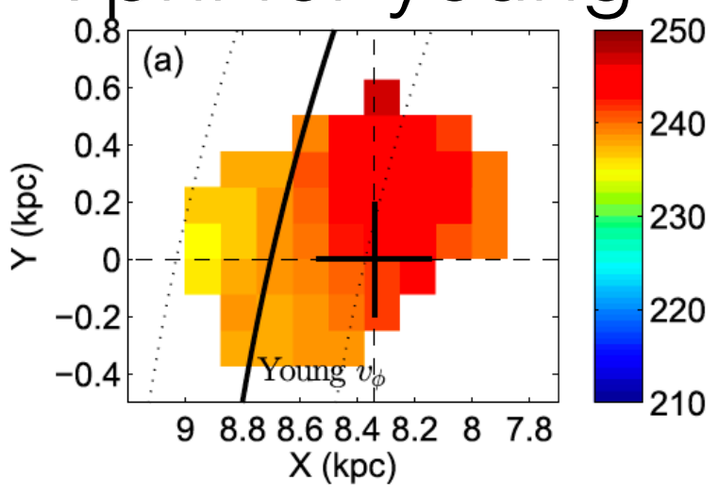
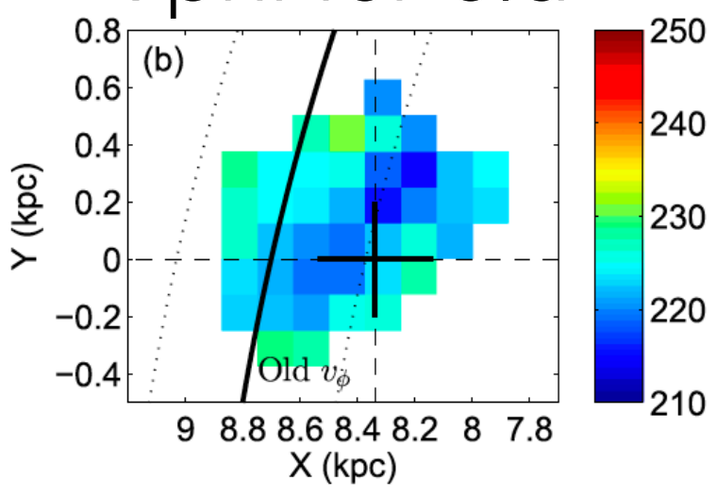
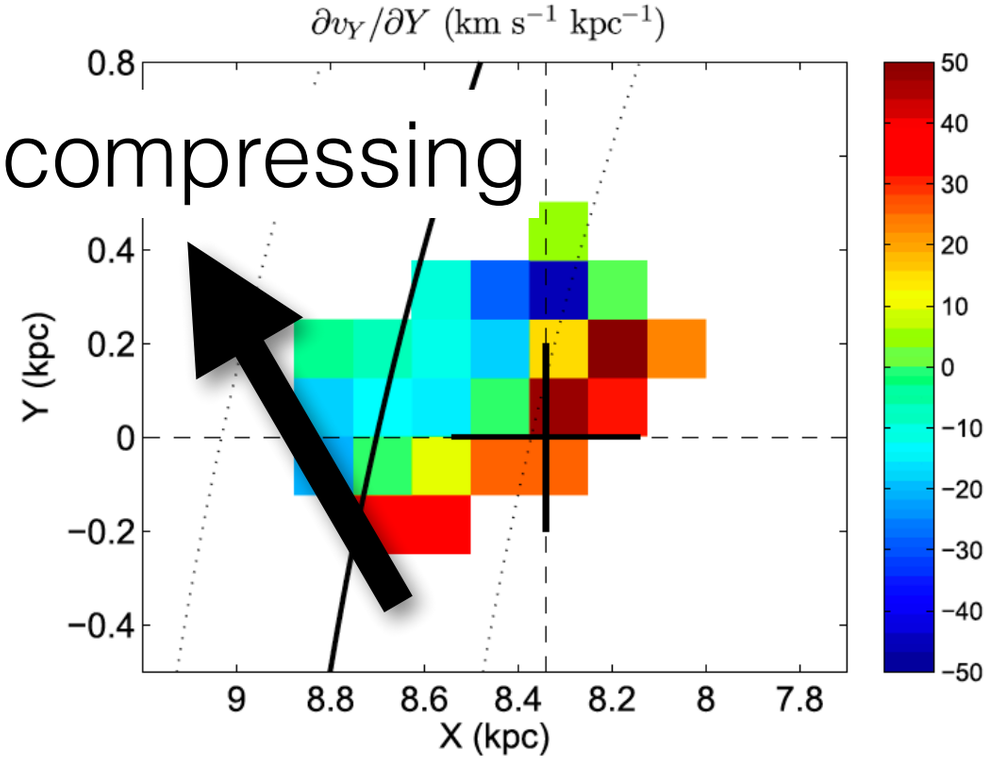


Vphi for old



star is compressing



Other works

- Mapping the local arm with kinematics of young stars from LAMOST-TGAS data (Liu et al. 2017 ApJ 835, L18)

- Mapping the kinematics of the stellar warp (Liu et al. 2017, IAUS321, ArXiv: 1702.02232)