

Insights on the Andromeda satellite system: a deep view of the faintest of galaxies and what they can tell us about their host

Nicolas Martin (MPIA, Heidelberg)

- *PAndAS collaboration (PI: Alan McConnachie)*
- *Crystal Brasseur, Hans-Walter Rix, Andrea Macciò, Xi Kang*



from
Insights ~~on~~ the Andromeda satellite system: a
deep view of the faintest of galaxies and what
they can tell us about their ~~host~~
dwarf galaxy formation

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- PAndAS collaboration (PI: Alan McConnachie)*
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The PAndAS view of Andromeda

streams & dwarf galaxies

PAndAS

The Pan-Andromeda Archaeological Survey (2008–2011)

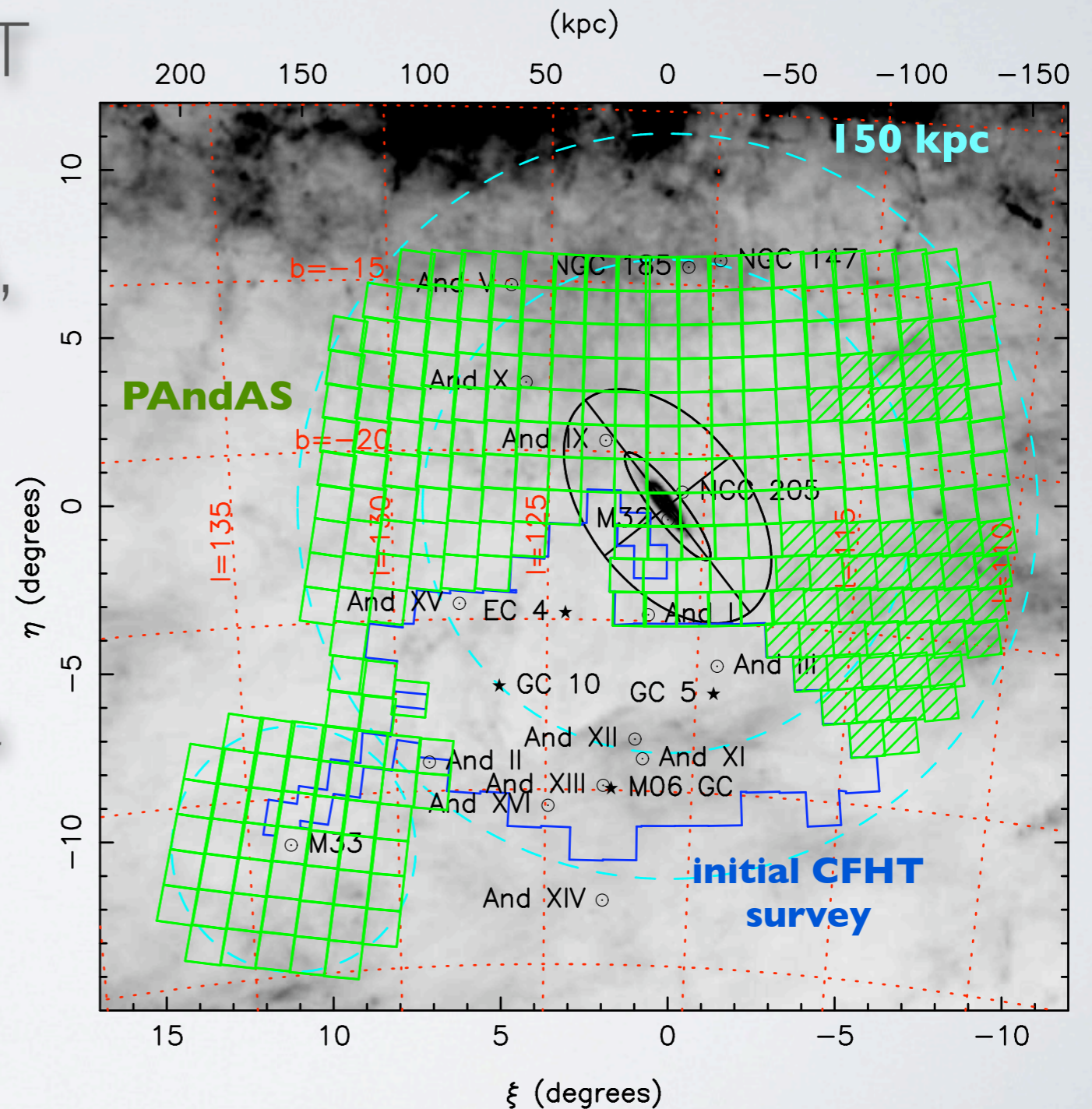
- Building on pilot M31 CFHT survey (Ibata, Martin et al. 2007)
- PI: Alan McConnachie (HIA, Victoria)
- CFHT large program
 - 220 hours over 3 years
 - 4m telescope on Mauna Kea
- MegaCam/MegaPrime
 - 1 deg² field of view
 - 2 bands (*g* & *i*)



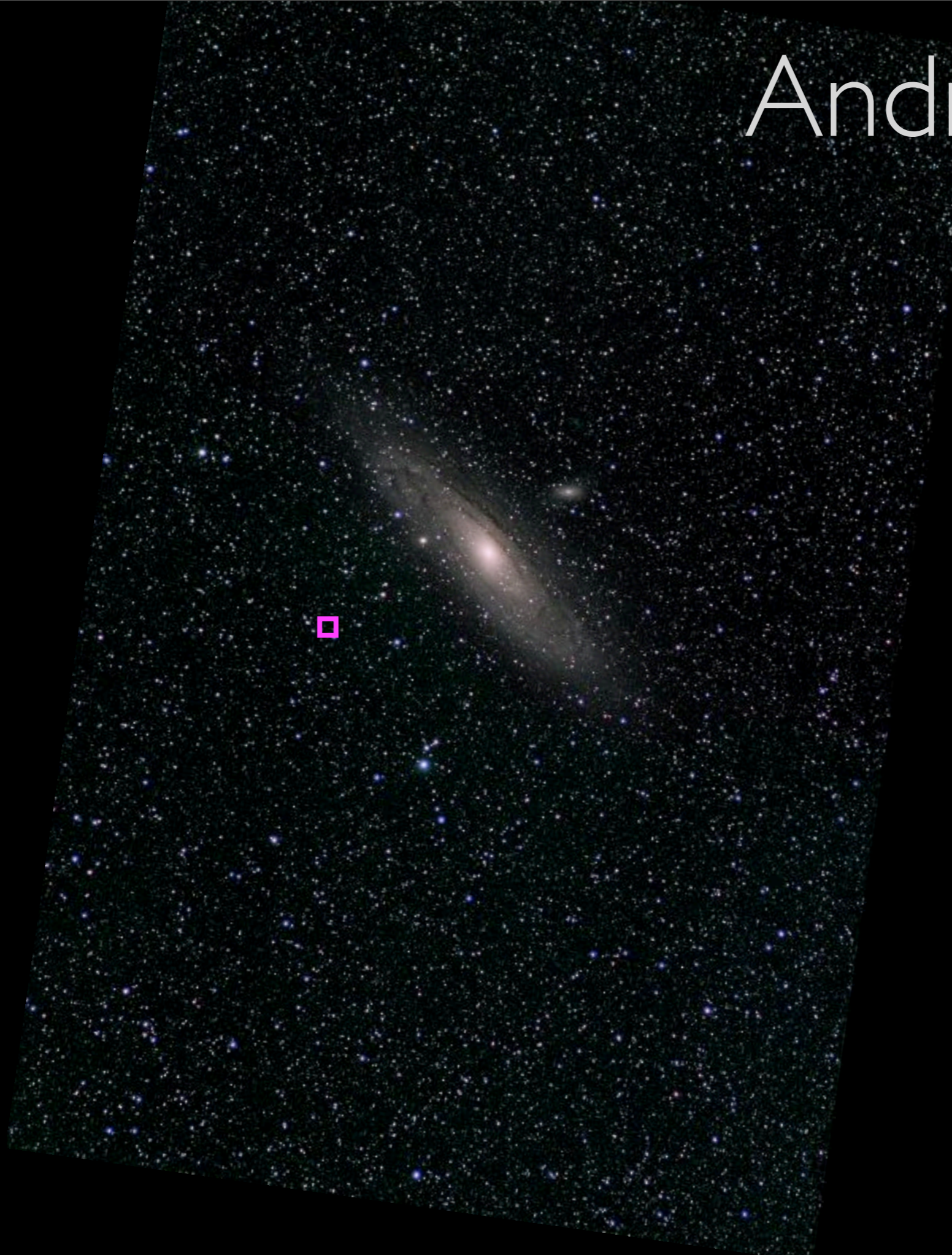
PAndAS

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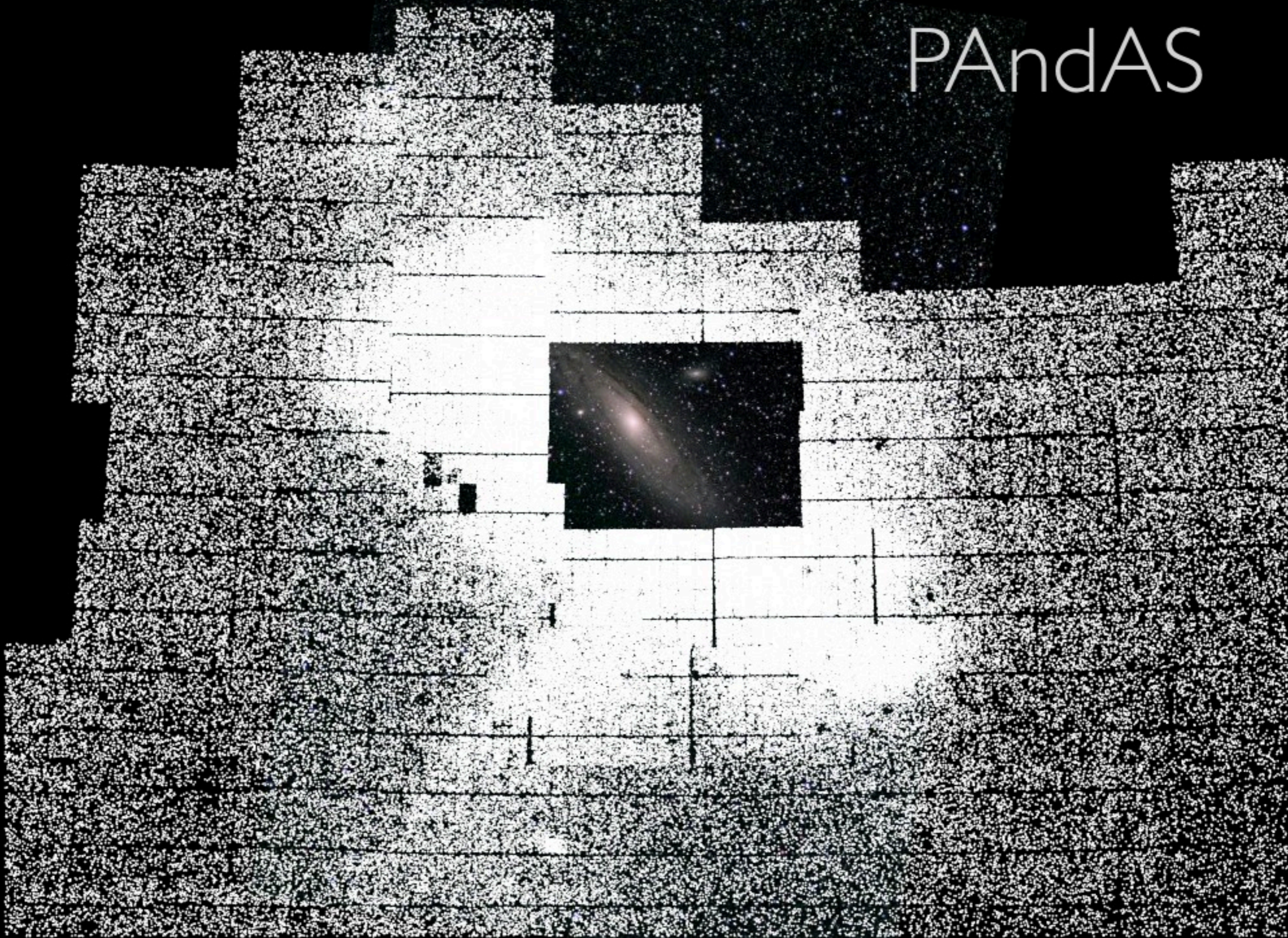
Andromeda



Andromeda

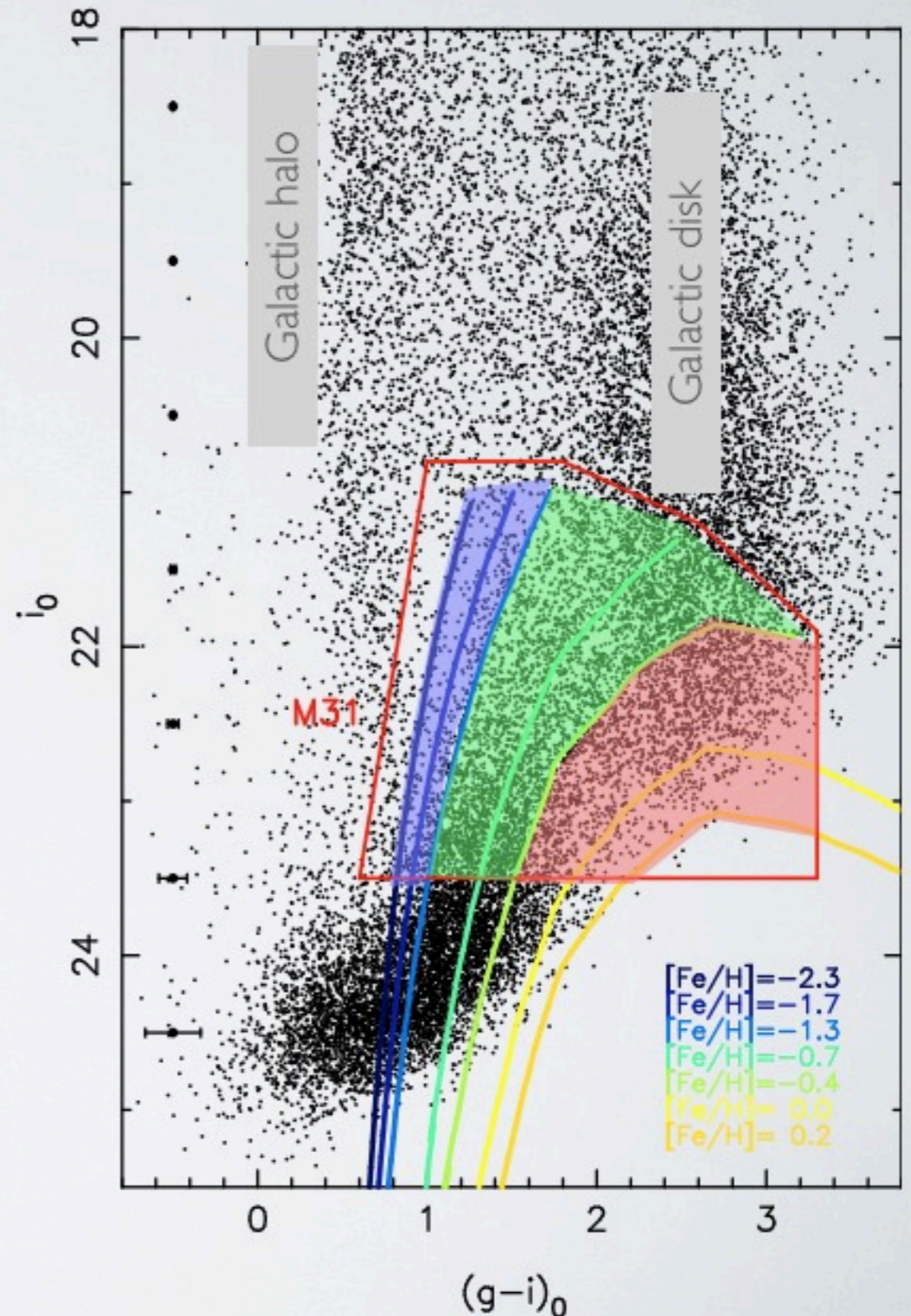


PAndAS



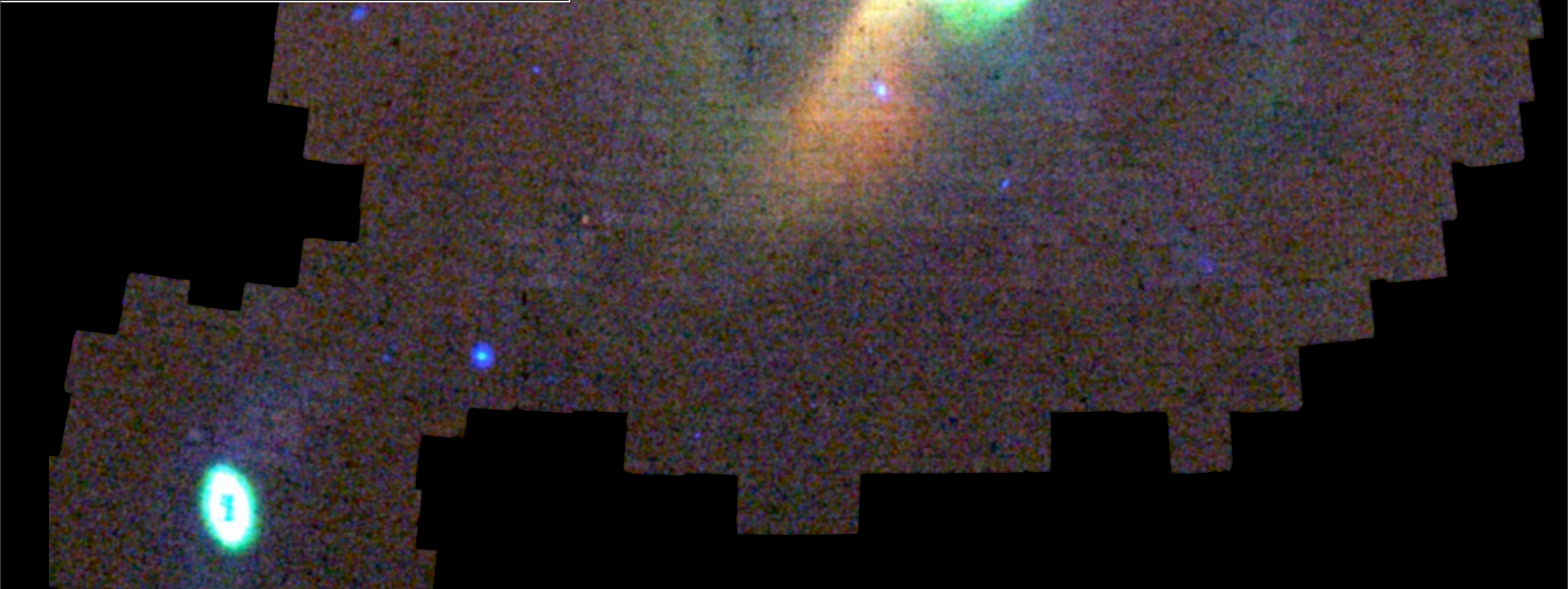
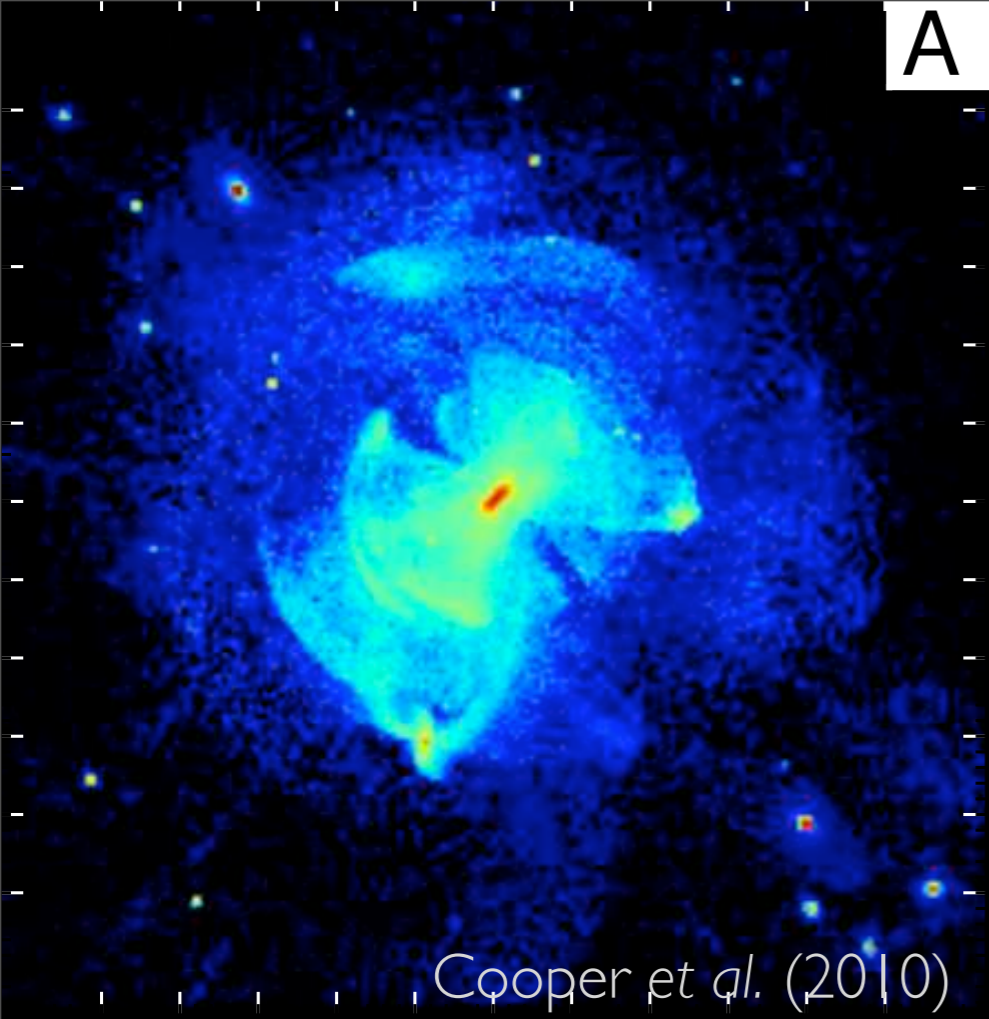
PAndAS data

- Observing 3 mag. below the tip of RGB
 - 0.5–0.8" seeing
 - ~20 min integration in g & i
 - S/N=10 depths
 - $g = 26.5$
 - $i = 25.5$
- 3×10^6 stars in the M31 selection box



A

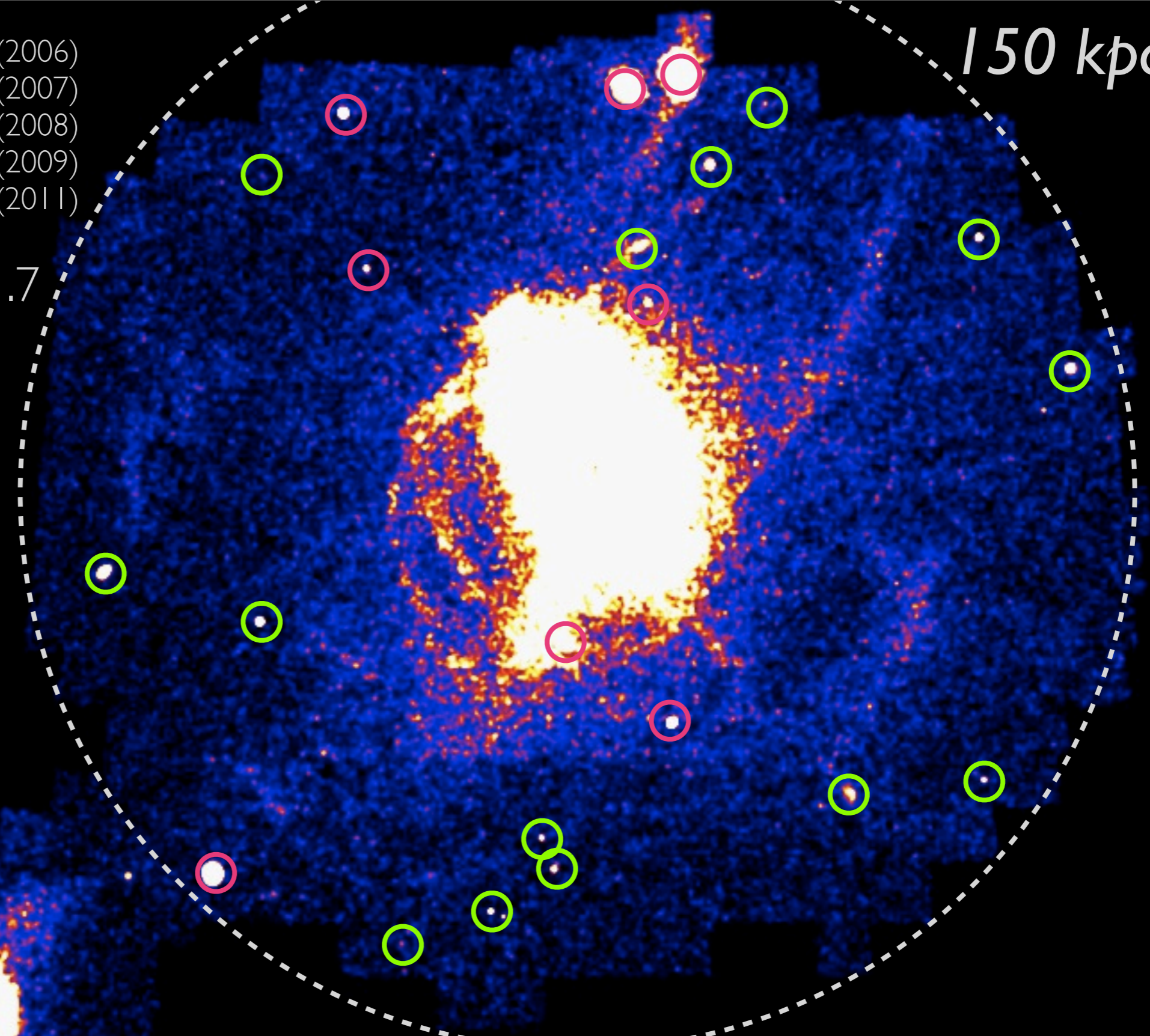
PAndAS



Martin et al. (2006)
Ibata, Martin et al. (2007)
McConnachie et al. (2008)
Martin et al. (2009)
Richardson et al. (2011)

$[\text{Fe}/\text{H}] \sim -1.7$

150 kpc



6 dSphs (2004) → 25 dSphs (now;
2 SDSS + 15 PAndAS)
+ deep follow-up

What sets the size of faint galaxies?

Brasseur, Martin, Rix, Macciò & Kang (ApJ, submitted)
ArXiv:1106.5500

A MW/M31 satellite discrepancy?

● M31 dSph appear larger at given luminosity (McConnachie & Irwin 2006)

● Different formation?

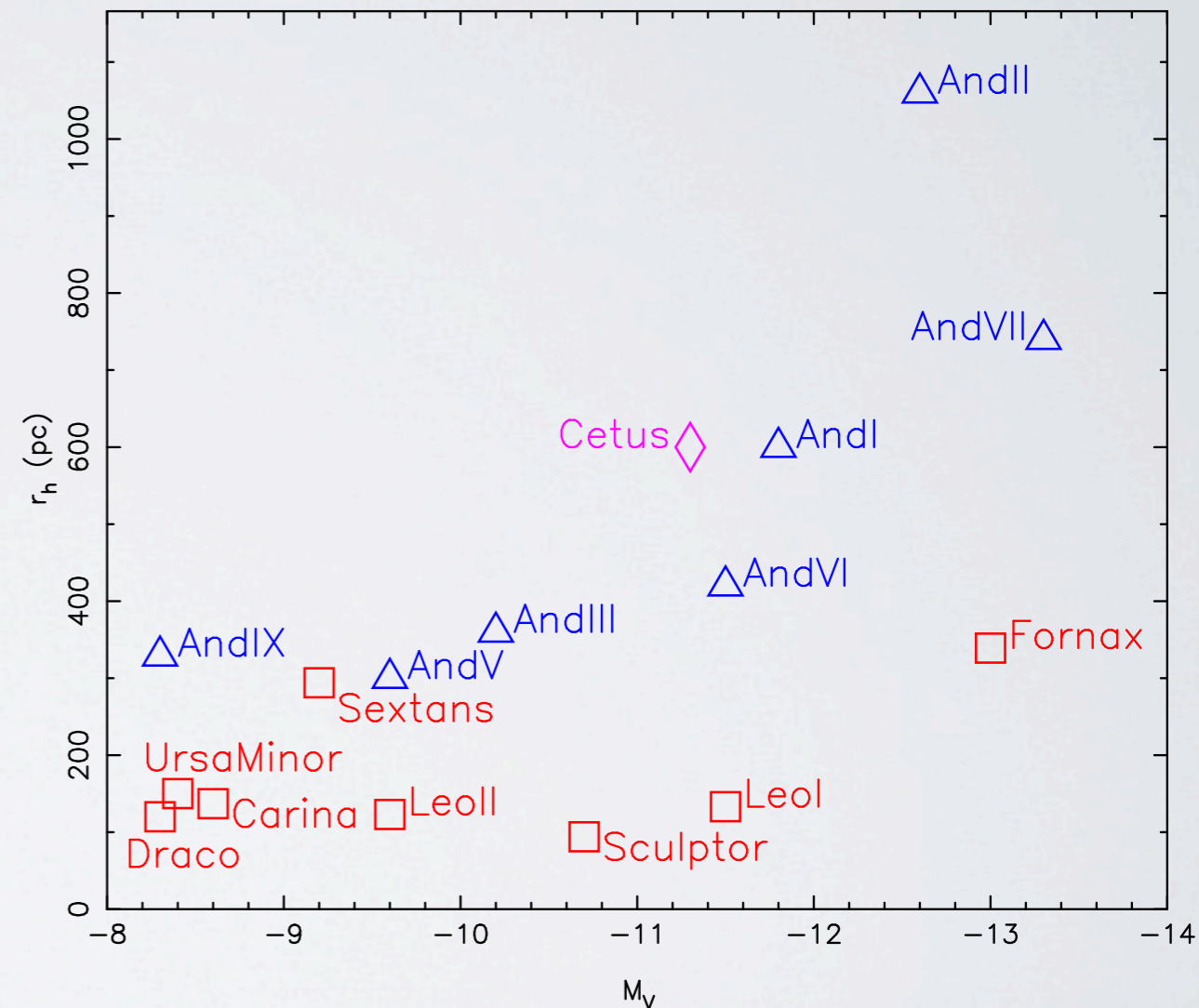
- Consequence of different DM halo mass?

no impact on r_h - M_V

- Consequence of different formation time?

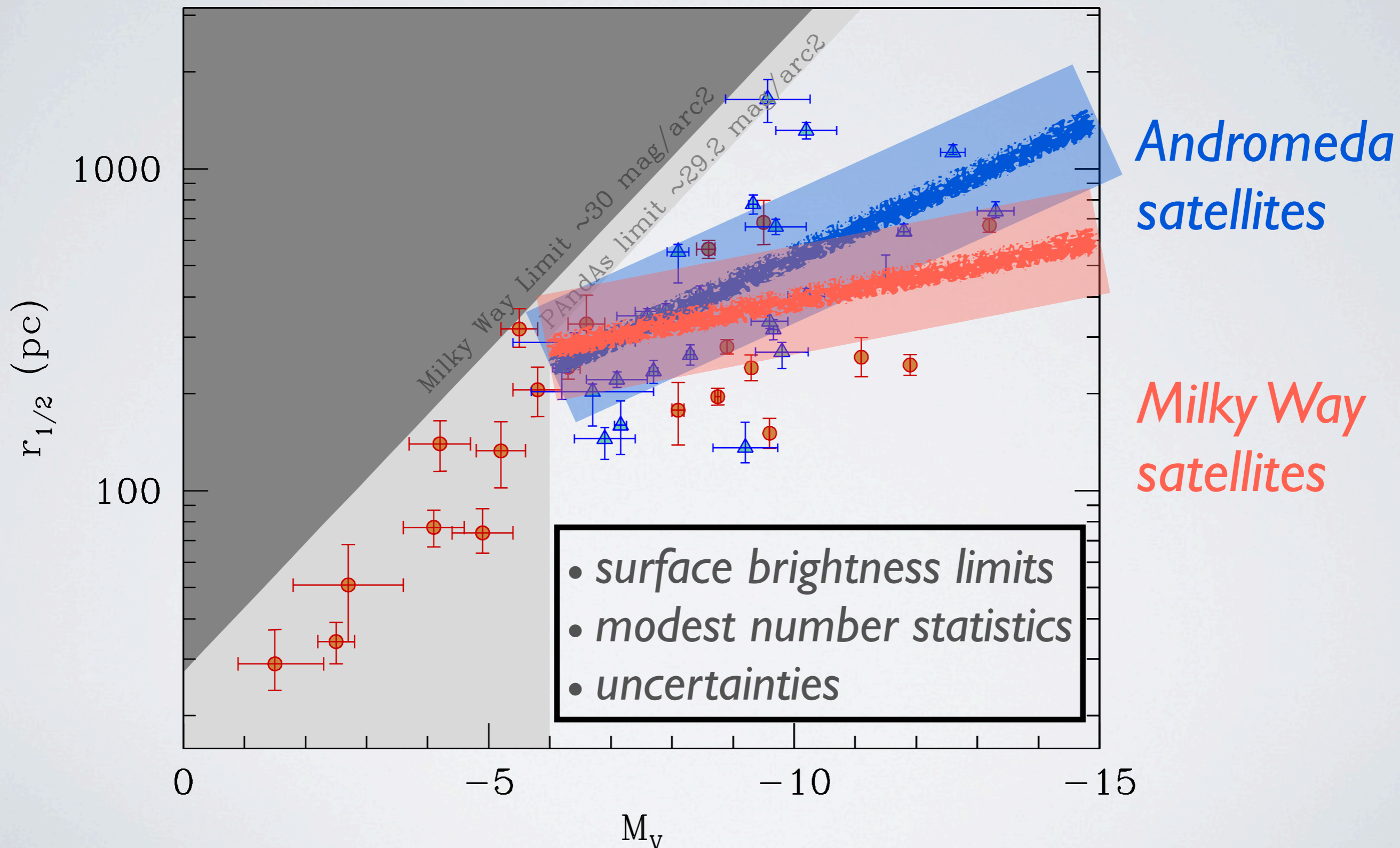
no impact on r_h - M_V

- Consequence of M31's disk being more massive, tides? (Peñarrubia et al. 2010)

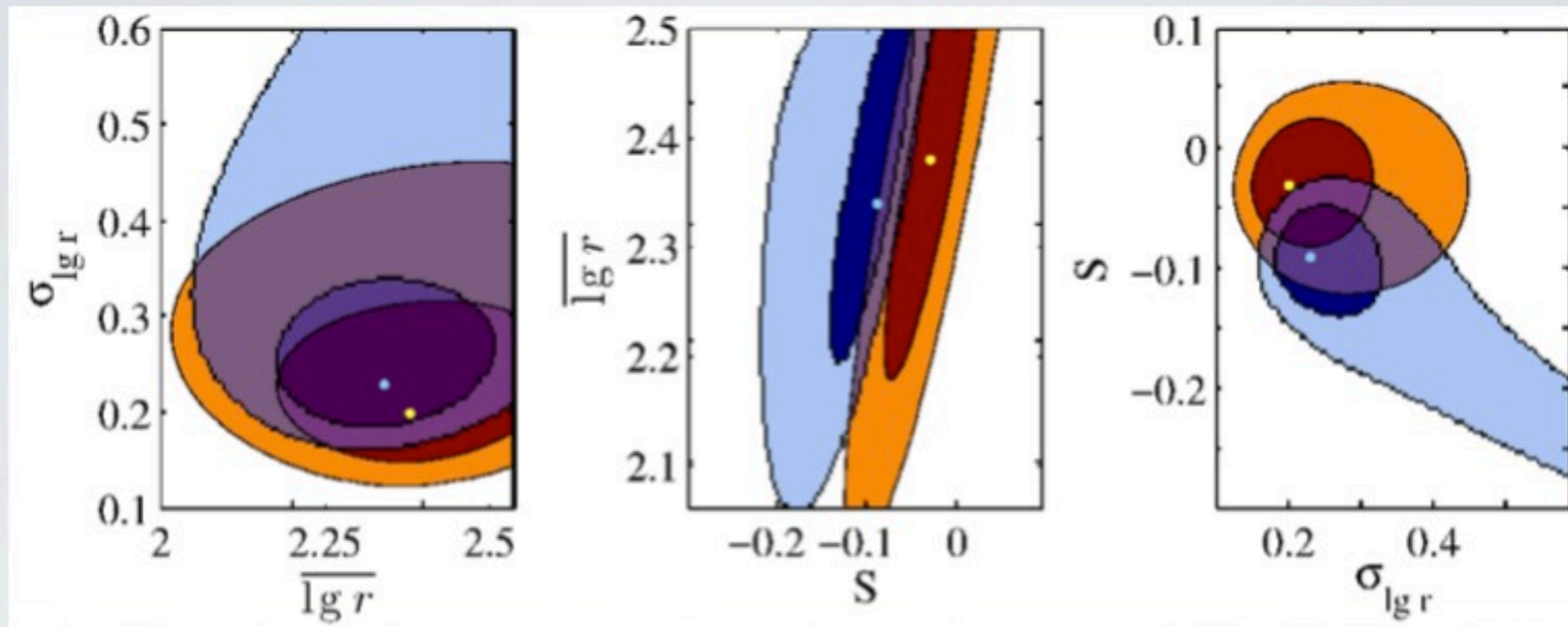


The size of faint galaxies

Brasseur, Martin *et al.* (2011)



No global difference in the size of MW/M31 satellites

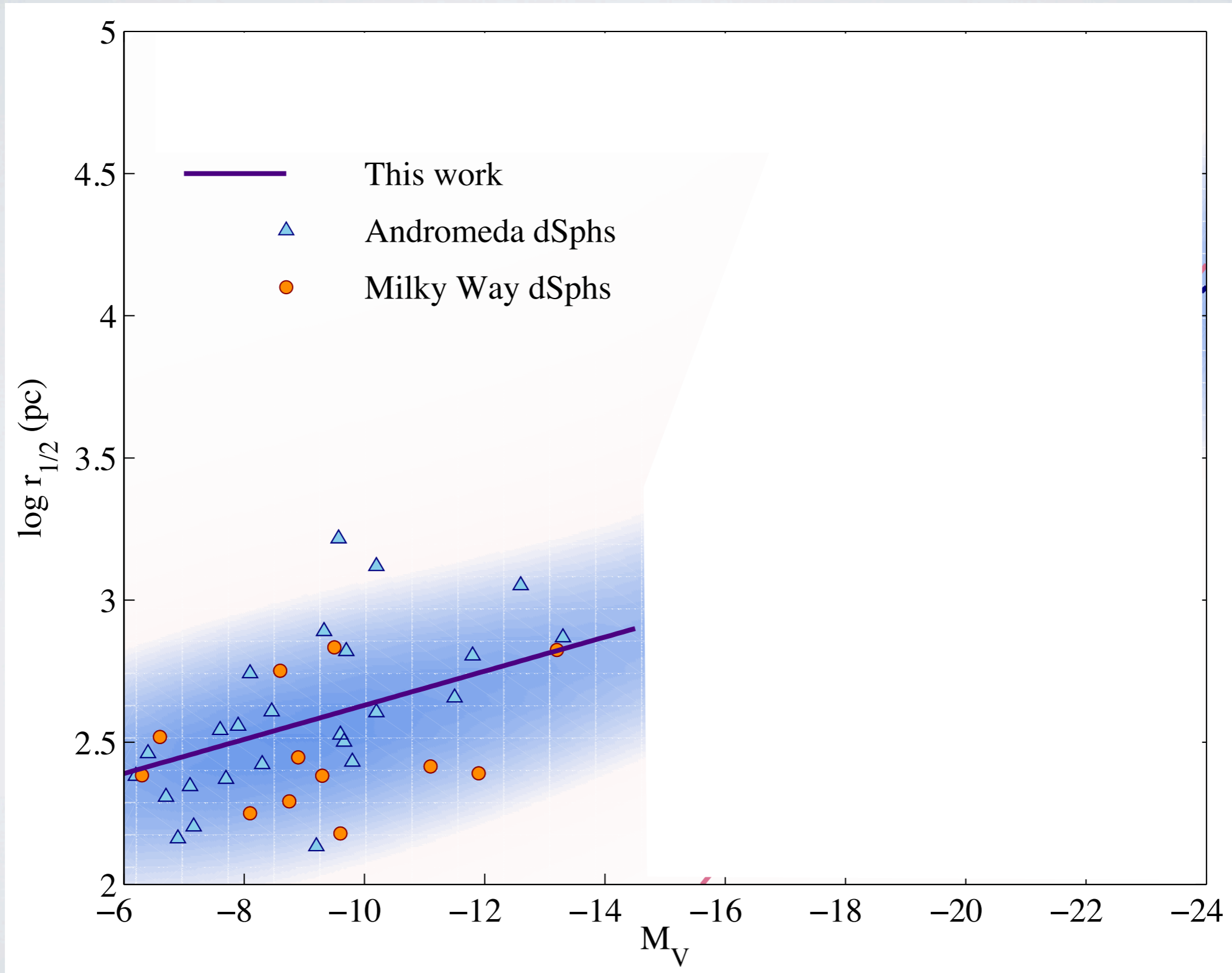


● When accounting for:

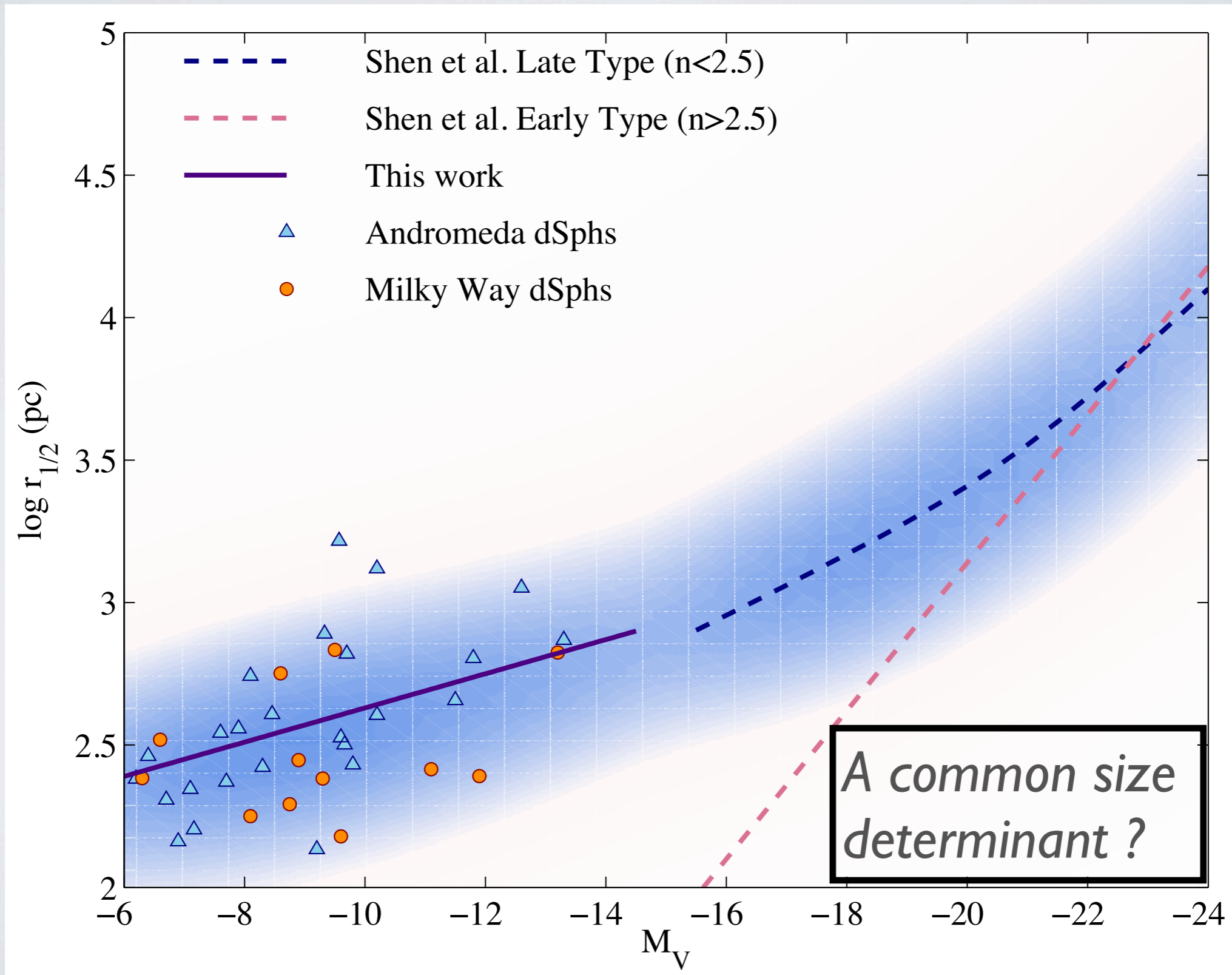
- dSph detection limits (PAndAS + SDSS)
- uncertainties
- sampling

Size-luminosity relations of Milky Way and M31 dSphs are similar!

The Local Group dSph size-luminosity relation



The Local Group dSph size-luminosity relation



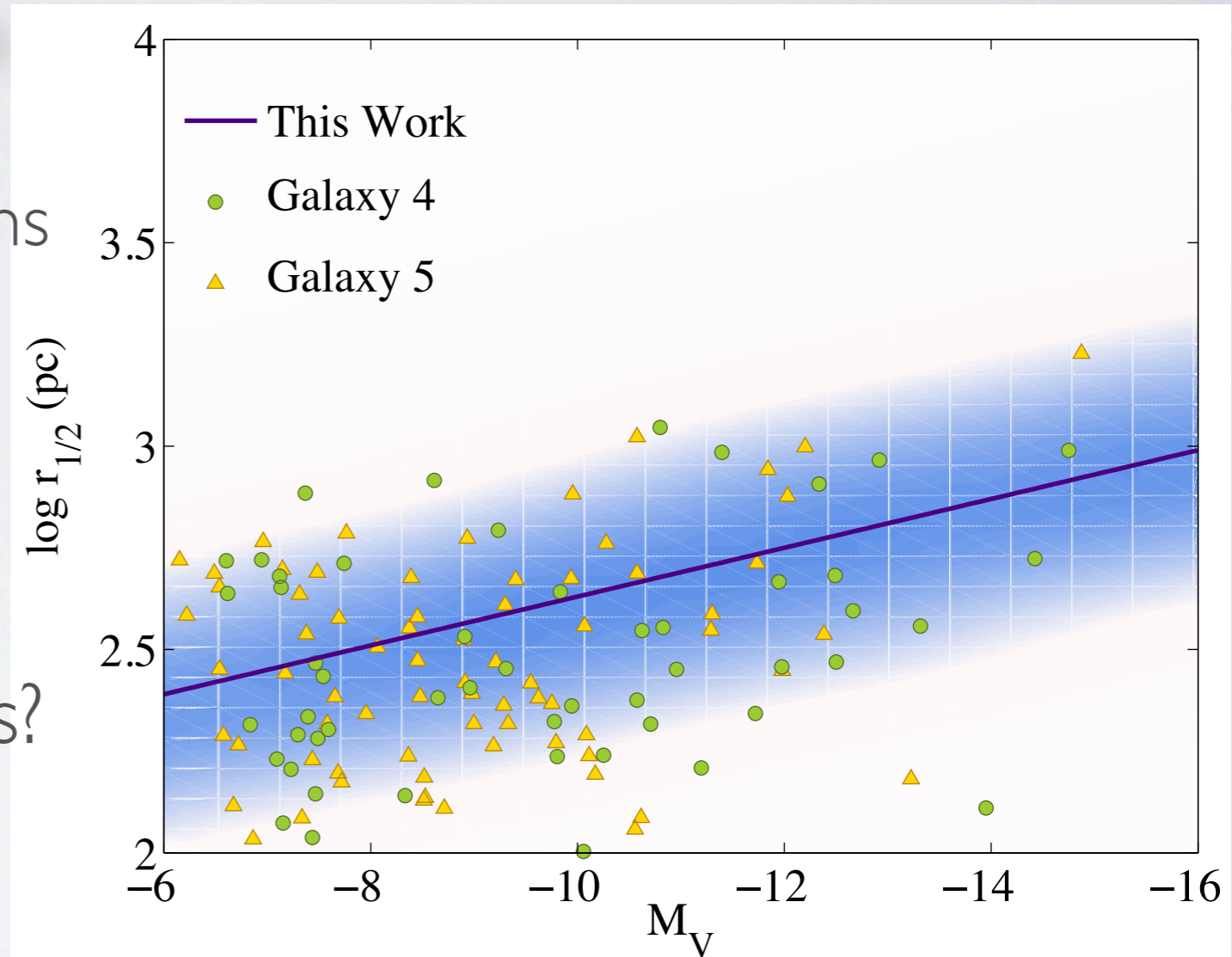
A common size determinant?

© Shen *et al.* 2003: size of late-type galaxies explained by angular momentum (Mo, Mao & White 1998)

- hierarchical formation → angular momentum to baryons
- baryons collapse → disk
- disk angular momentum → size

© Does it work here for dSphs?

Yes!



Strongly suggests that angular momentum arguments and cosmological framework play a role in setting the size of dSphs

Summary

● PAndAS

- *galaxy formation in action*
- exceptional view of a satellite system:
6 → 25 dSphs

● The size of faint galaxies

- *no difference between M31/MW satellite size-luminosity relations*
- good agreement with more massive late-type → angular momentum arguments explanation?
- *evidence of rotation? thrashed small disk galaxies?*

