An LBT view of faint Milky Way dwarf galaxies

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Hercules
Canes Venatici I
Leo T

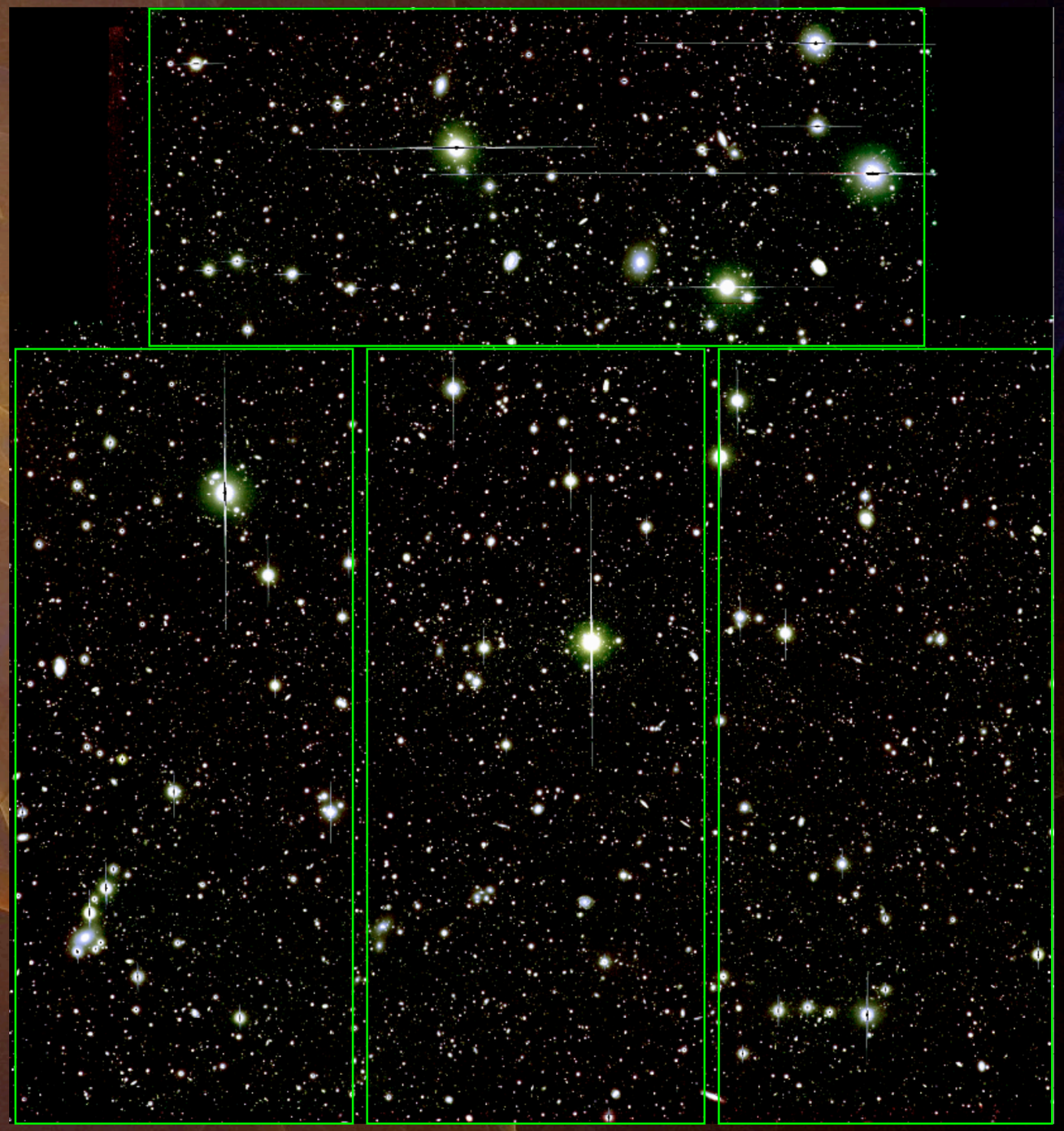
The Large Binocular Telescope Hill et al. (2006)

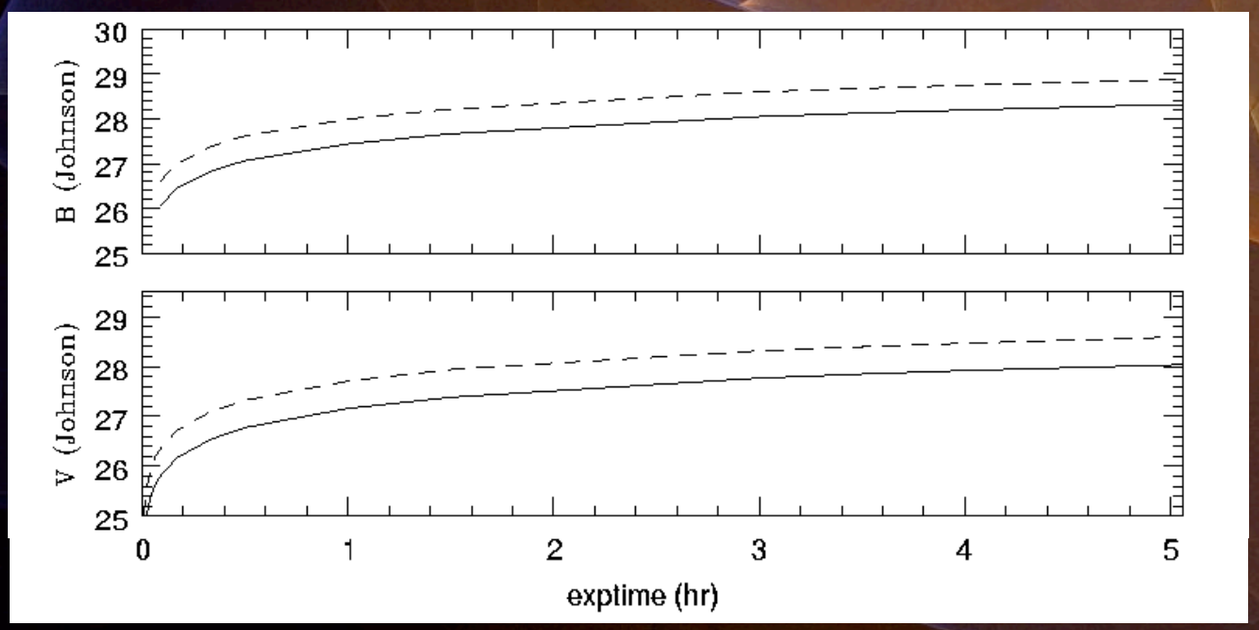
- Mt Graham Int. Obs., Arizona
- 2 x 8.4m mirrors on common mount → 11.8 m aperture
- First light:
  - Mirror 1 in October 2005
  - Mirror 2 in September 2006
- Currently ‘blue’ side fitted with Large Binocular Camera

The Large Binocular Camera Blue

Giallongo et al. (2006)

- Wide-Field Imager
  - ★ Four 2048 x 4608 chips
  - ★ 0.23″/px ➙ 23′ x 23′ FoV
- 2 LBC to target blue and red simultaneously
- 5 min. exposure ➙ V~25.5
- First instrument on LBT

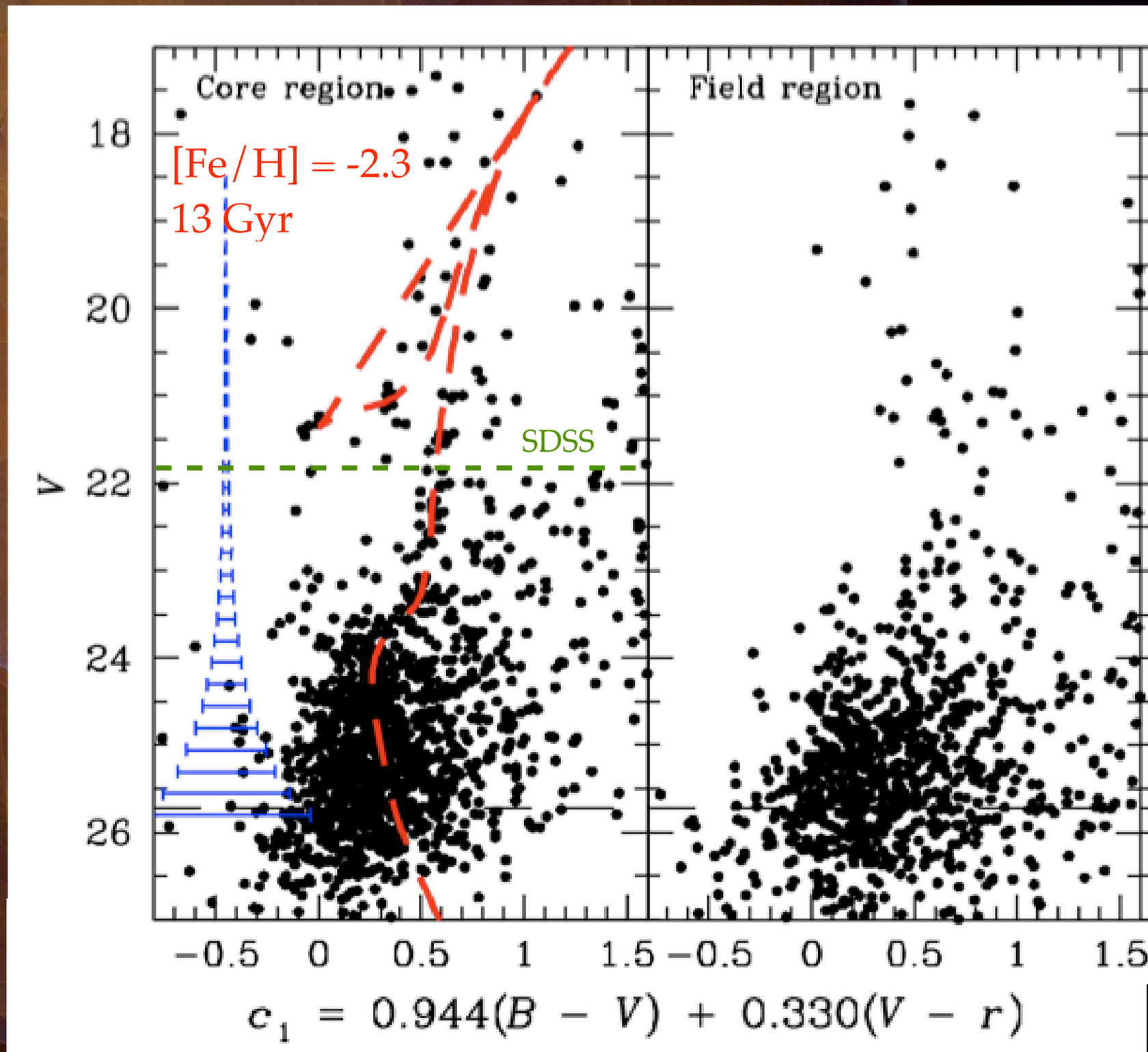




Hercules

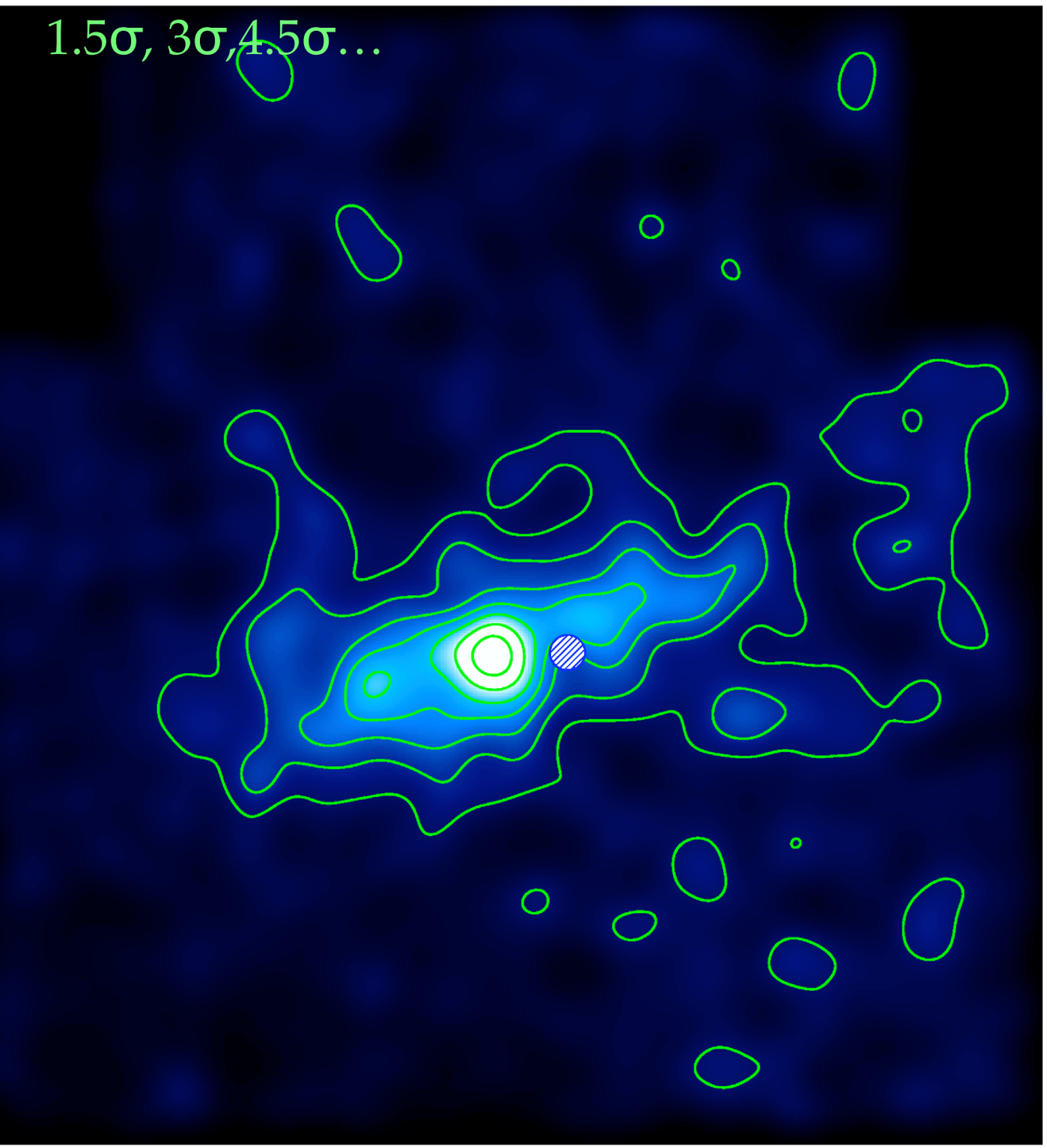
Coleman et al. (2007)

- Belokurov et al. 06:
  - ★ M_V = -6.0
  - ★ D = 140 kpc
- Simon & Geha 07:
  - ★ $v_{r,\,gsr}$ = 145 km/s
  - ★ σ = 5.1 km/s
  - ★ [Fe/H] = -2.3
- LBC:
  - ★ 30′ *B*, 20′ *V*, 20′ *r*
  - ★ 50% comp. at V~25.5
  - ★ seeing 0.8 – 1.1″

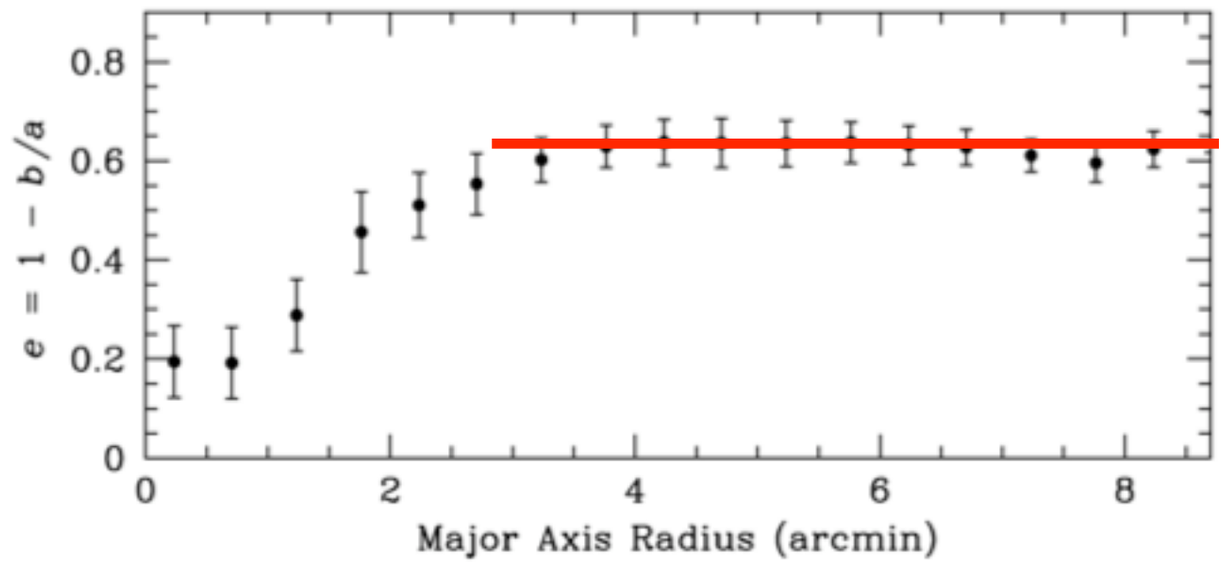


Hercules

Coleman et al. (2007)



- ***Very flat***, axis ratio ~ 3:1



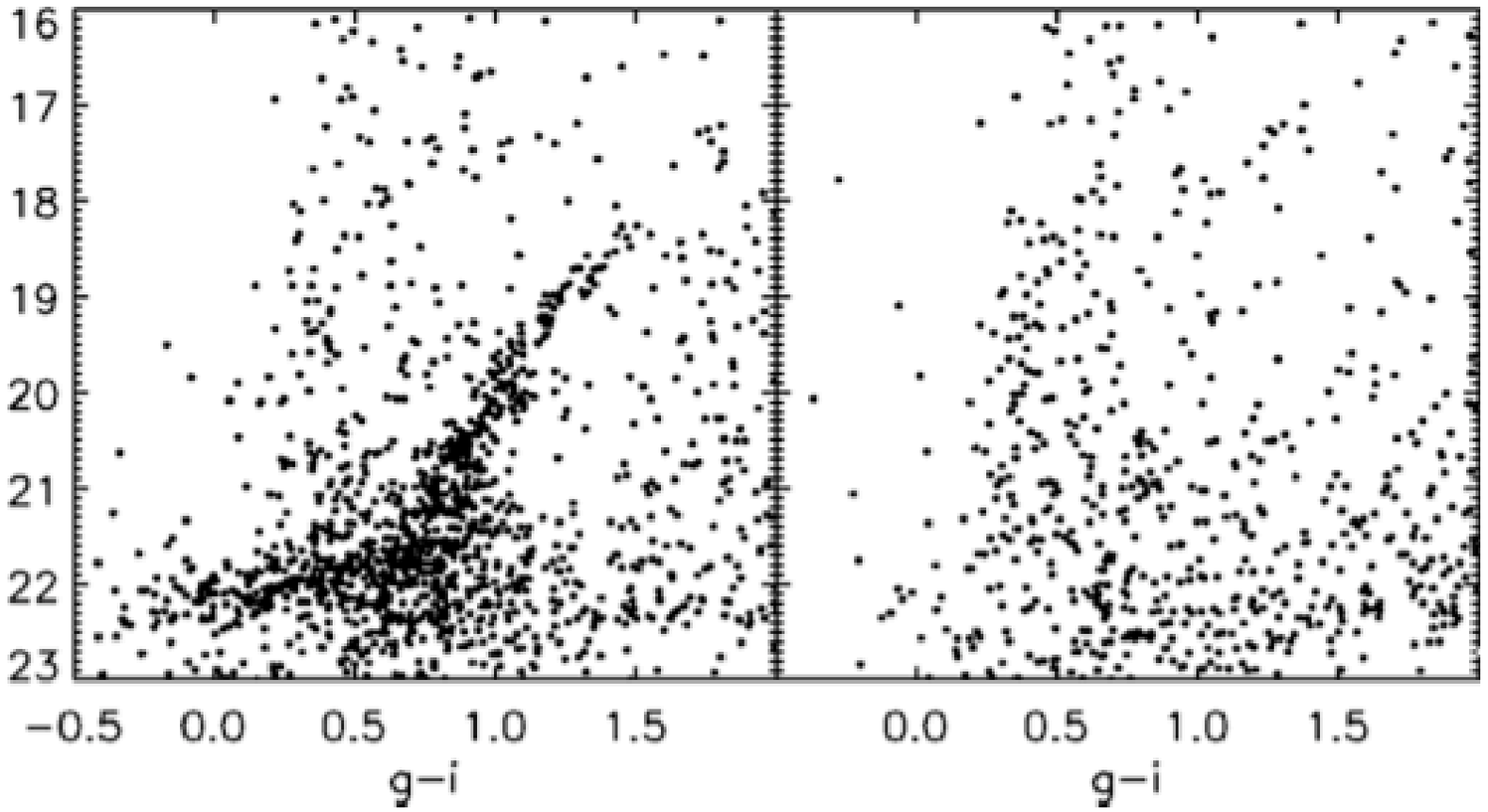
- CMD fitting:
  - ★ 132 ± 12 kpc
  - ★ [Fe/H] = -2.1 ± 0.2
  - ★ 13 ± 3 Gyr
  - ★ r_h = 168 ± 11 pc

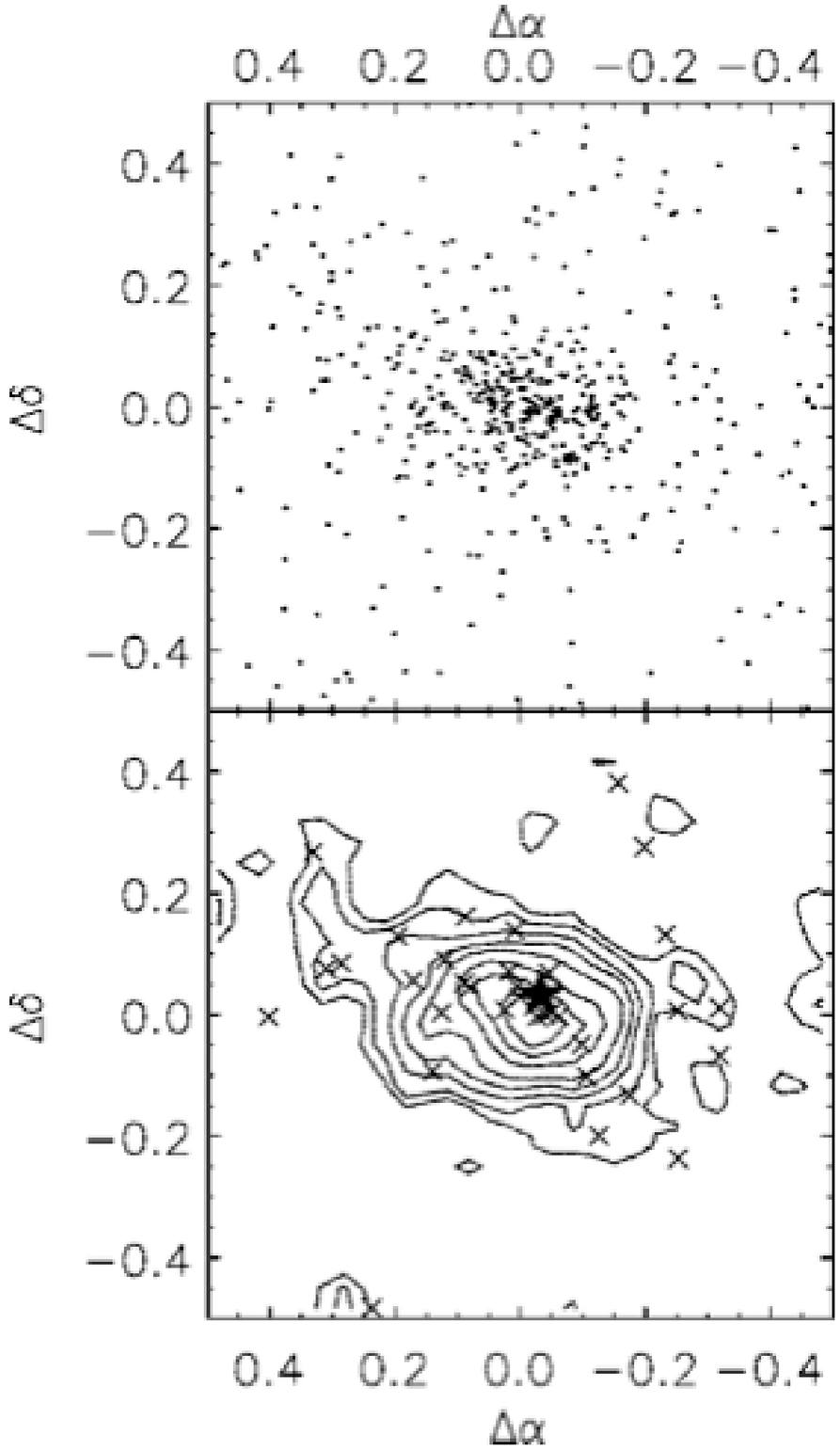
M_V = -7.9

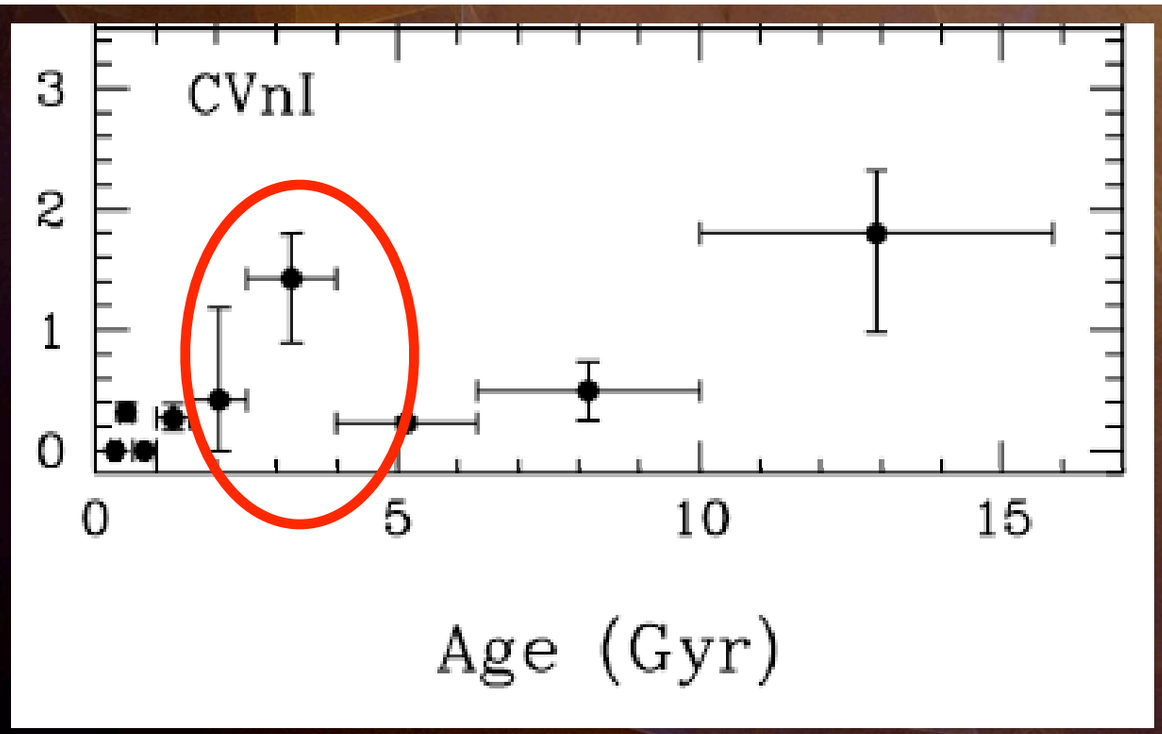
D = 220 kpc

Canes Venatici I (SDSS)

Zucker et al. (2006)





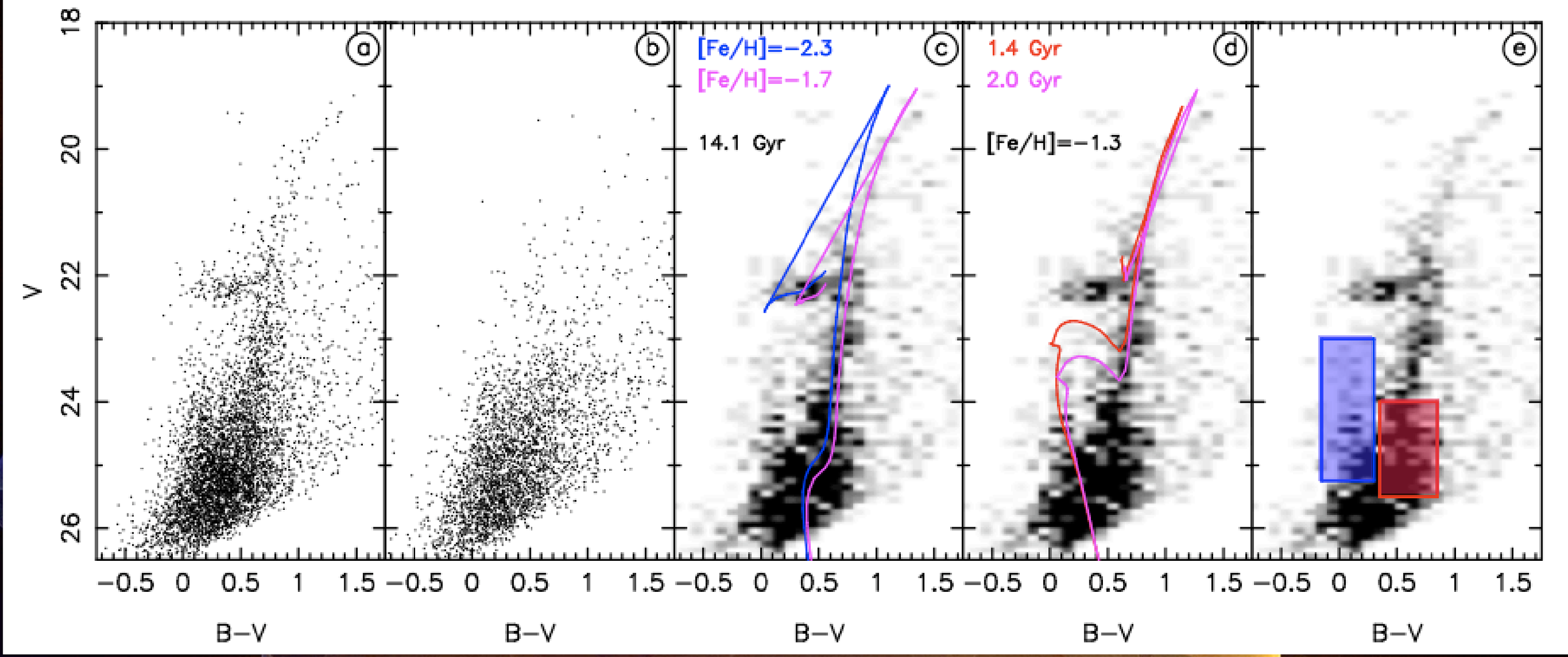


de Jong et al. (2007a)

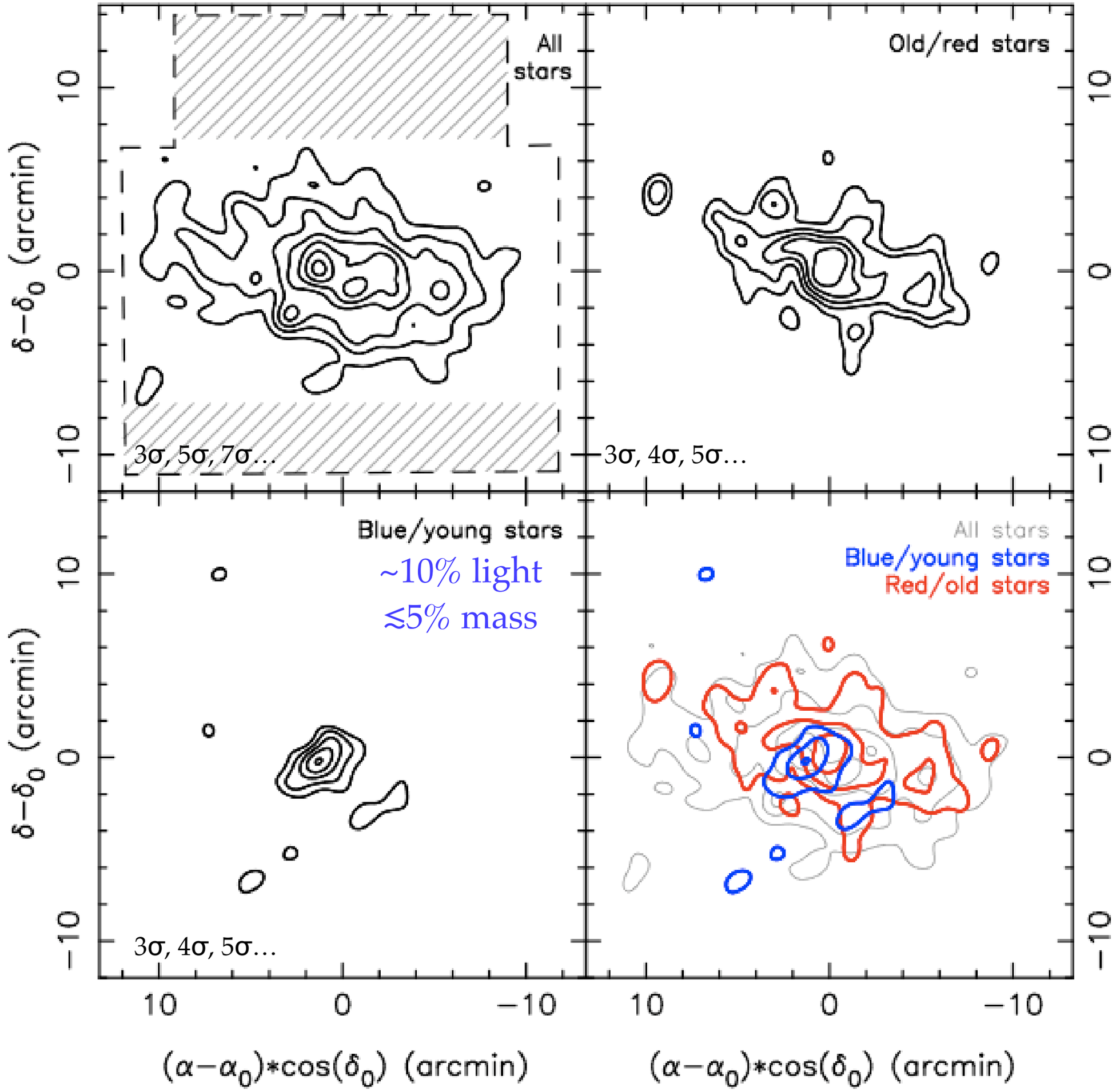
CVnI – the LBT view

Martin et al. (2007a)

within r_{hb}



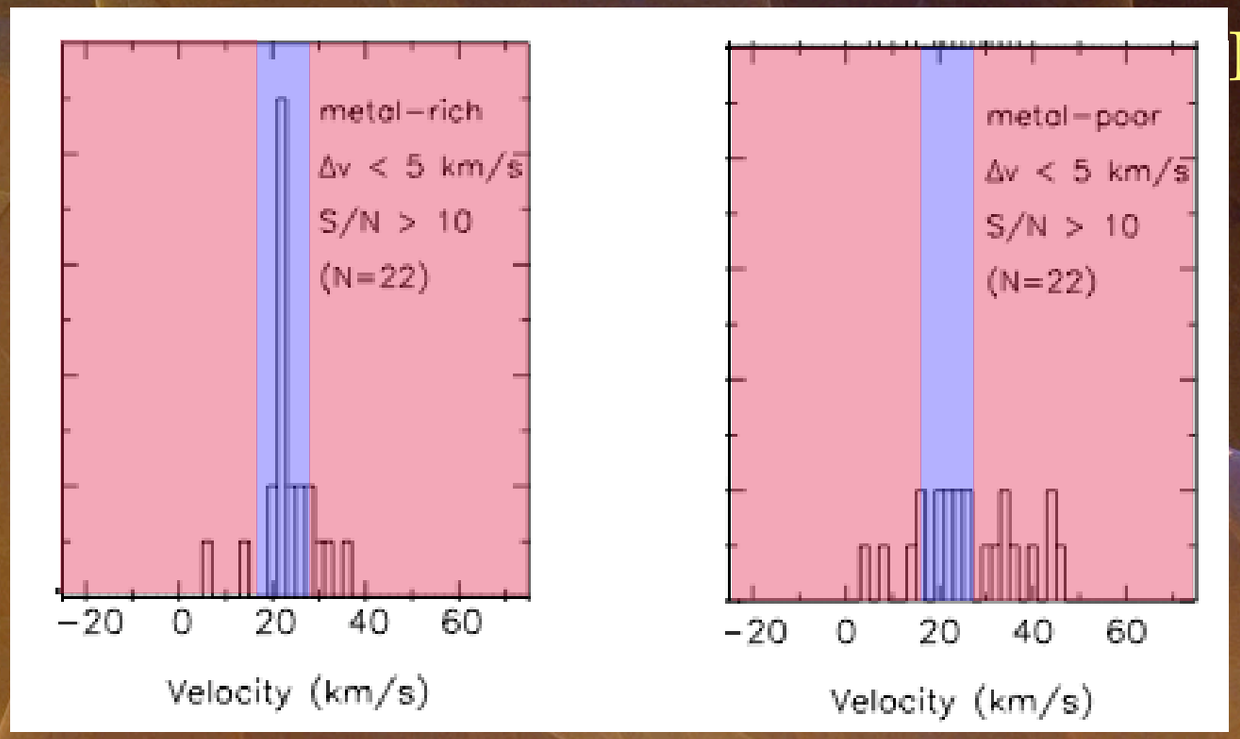
Sven Geier '08


All stars
Old/red stars
Blue/young stars
All stars
Blue/young stars
Red/old stars
~10% light
≲5% mass
3σ, 5σ, 7σ…
3σ, 4σ, 5σ…
3σ, 4σ, 5σ…
δ−δ0 (arcmin)
(α−α0)*cos(δ0) (arcmin)
10
0
−10

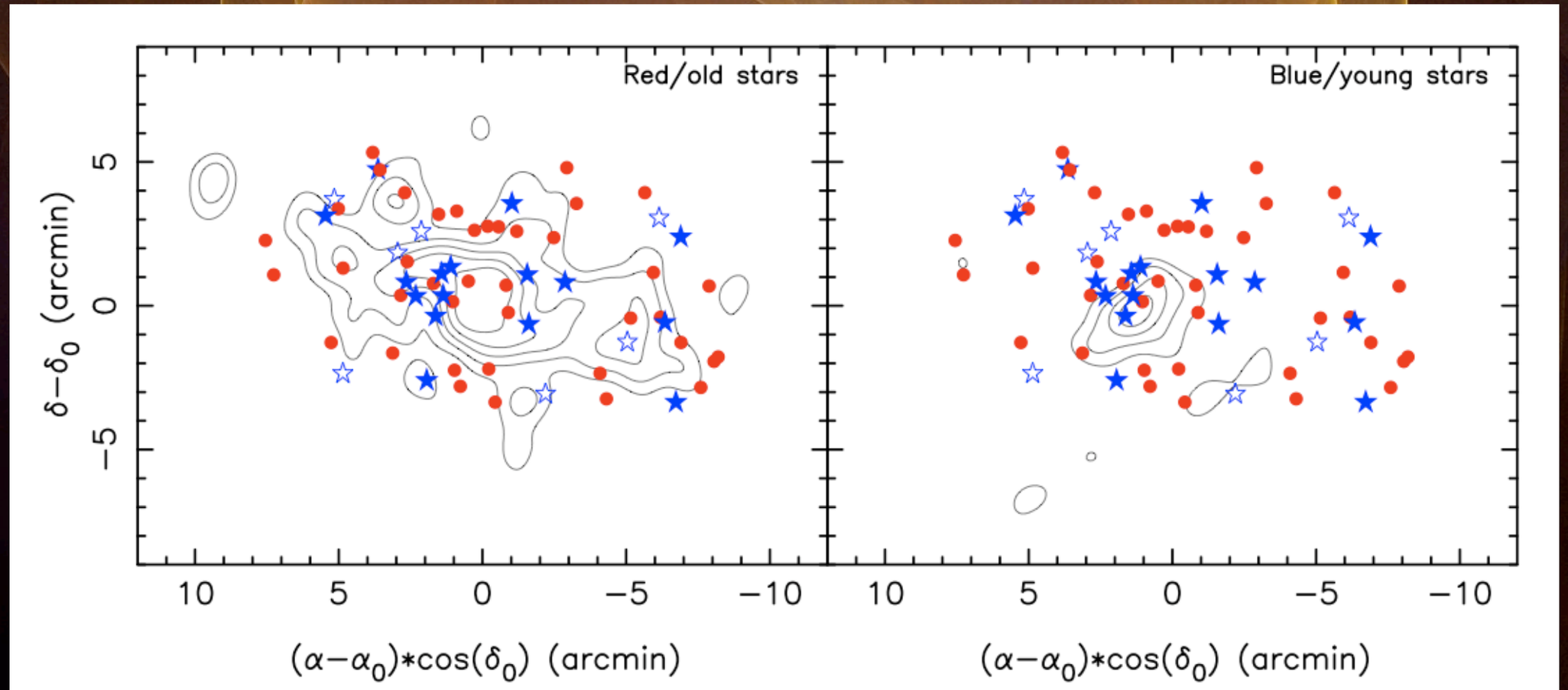
Canes Venatici I (Spectro)

Ibata et al. (2006)
Martin et al. (2007a,b)

- Old >10 Gyr pop
- Metal-poor(er) [Fe/H]~-2.0
- Extended
- Hot (σ~10 km/s)

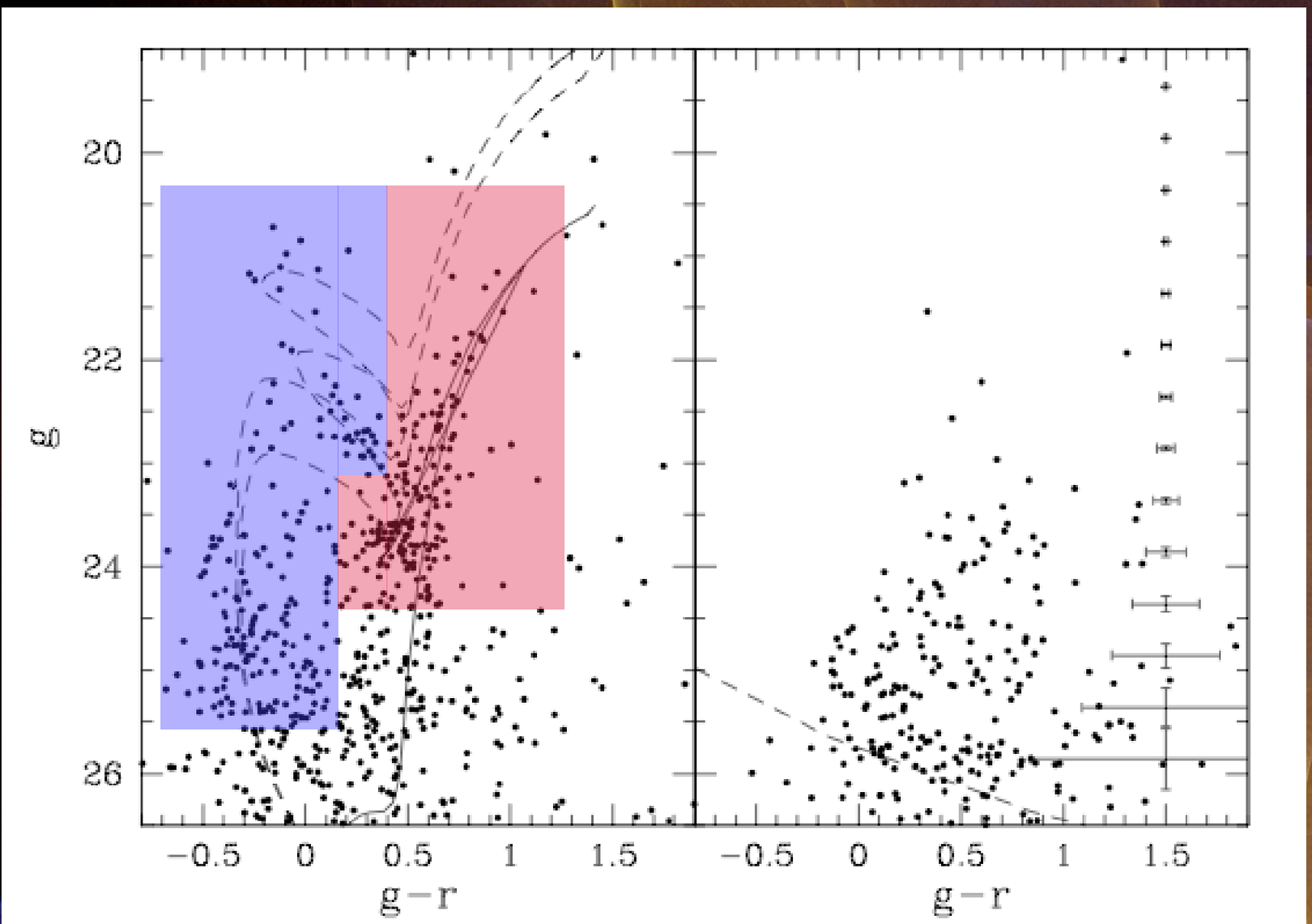


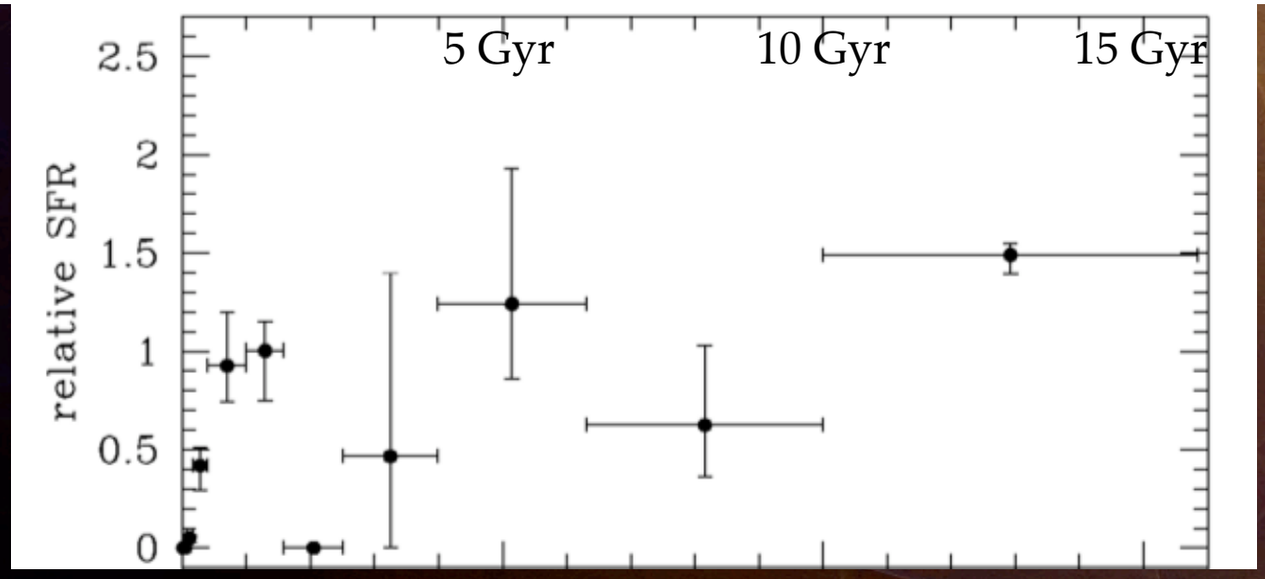
- Young ~2 Gyr pop
- Metal-rich(er) [Fe/H]~-1.5
- Spatially confined
- Cold (σ<2 km/s)



Leo T

de Jong et al. (2007b)





- Light:
  - ★ 65% old pop.
  - ★ 35% young pop.
- Young pop less extended
  - ★ young $r_{hb} = 104 \pm 8$ pc
  - ★ old $r_{hb} = 148 \pm 16$ pc

Questions

- How can Hercules be so flat?
  - ★ Disk-like?
    - *but* $\sigma = 5.1$ km/s
  - ★ Tidal distortion?
    - seen in some dwarf galaxies (UMi, Sgr…) and tentative (2 σ) detection of clumps in SDSS
    - *but* $\sigma = 5.1$ km/s → $R_{peri} \sim 8$ kpc → very elliptical orbit (especially with $v_{r,gsr} = 145$ kms/s)
  - ★ Triaxial halo?
- CVnI & Leo T look pretty much like brighter galaxies (young to intermediate stars)
  - ★ Is there a minimum mass to retain gas?
    - Leo T: 0.8×10^7 $M_\odot$, CVnI: 2.7×10^7 $M_\odot$ (Simon & Geha mass estimates)
  - ★ Cold pop in CVnI?
    - star cluster formed 2Gyr ago? survival time?
    - ~~is there still gas in CVnI?~~ → $< 3 \times 10^4$ $M_\odot$