The Digitized Sky Survey

The outer stellar halo of NGC 3115

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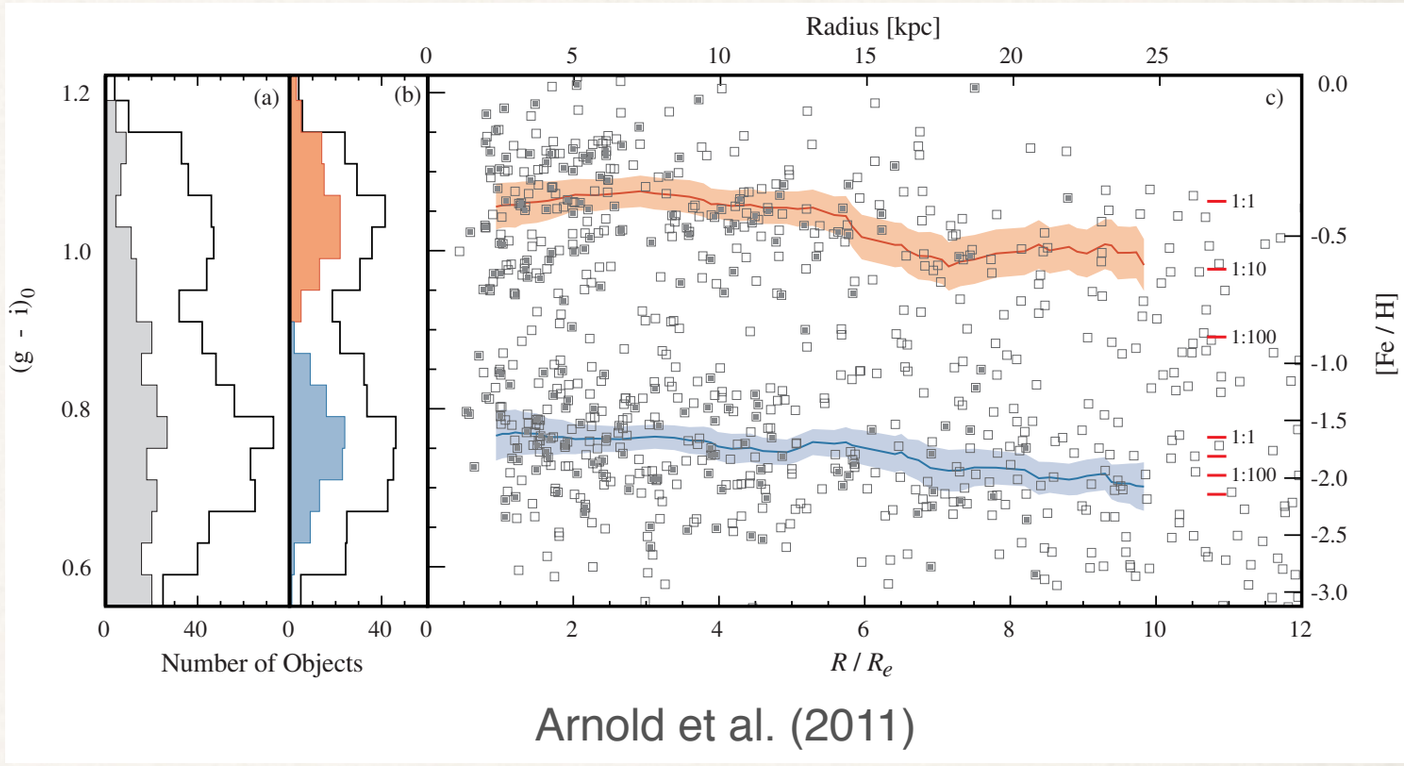
Overview

- Resolved photometry of RGB stars in NGC 3115's halo
  - HST observations
  - CMDs & Metallicity distribution
    - Radial trends
- Comparison to globular clusters & their use as bright chemo-dynamical tracers of stellar populations
- Comparison to other galaxy halos

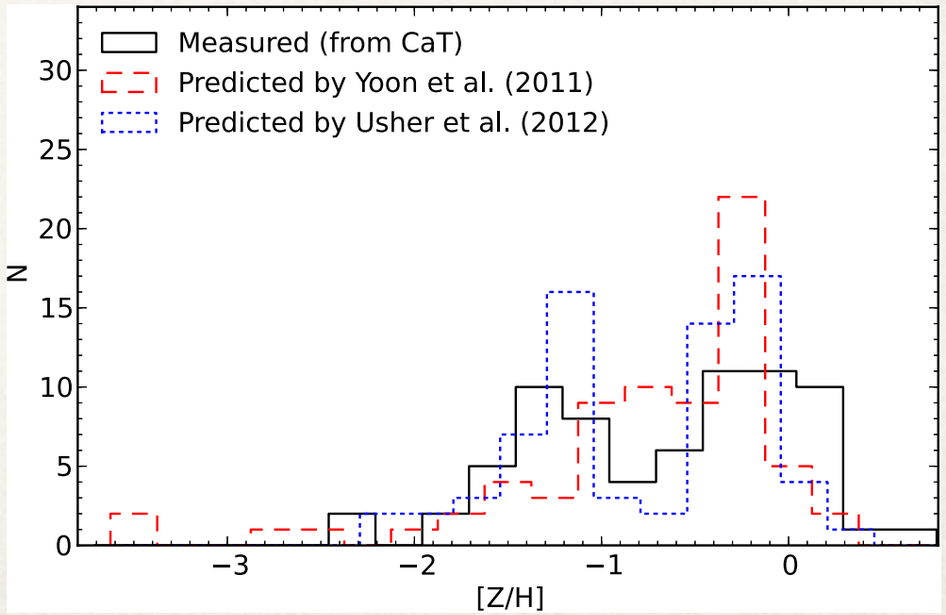
Why NGC3115?

- Quite nearby (d = 10.2 Mpc)
- Early-type galaxy (S0)
- stellar mass ~ 10^{11} M_o

- Has a strongly bimodal globular cluster (GC) system & GCs are thought to trace the underlying stellar population.
  - a strongly bimodal GC system suggests there should be a corresponding bimodal stellar population
  - We target the region where metal-poor GCs start to dominate
  - Are GCs good tracers? We can test this.



Arnold et al. (2011)



Brodie et al. (2012)

NGC3115 observations

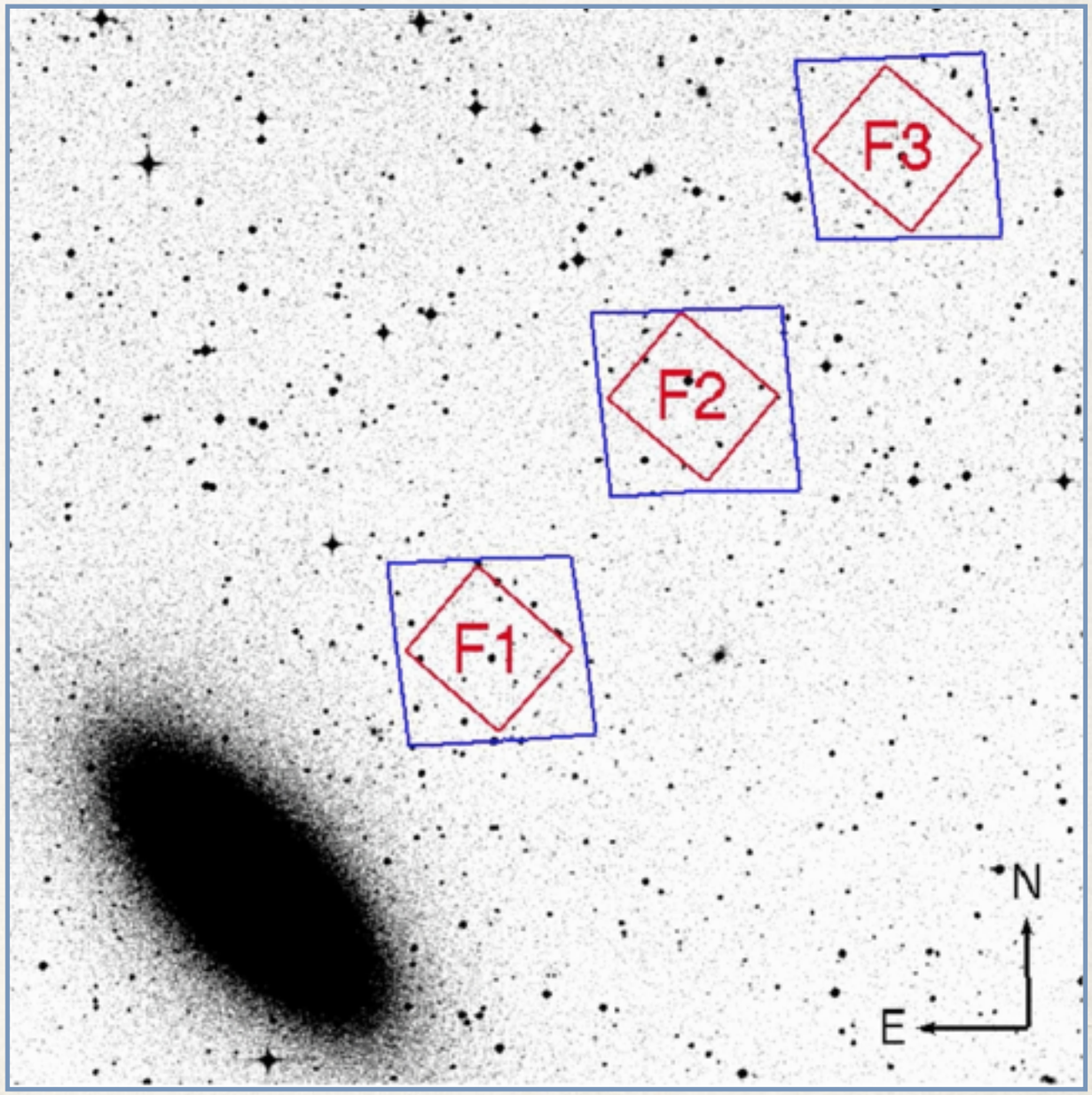
- Three HST fields:

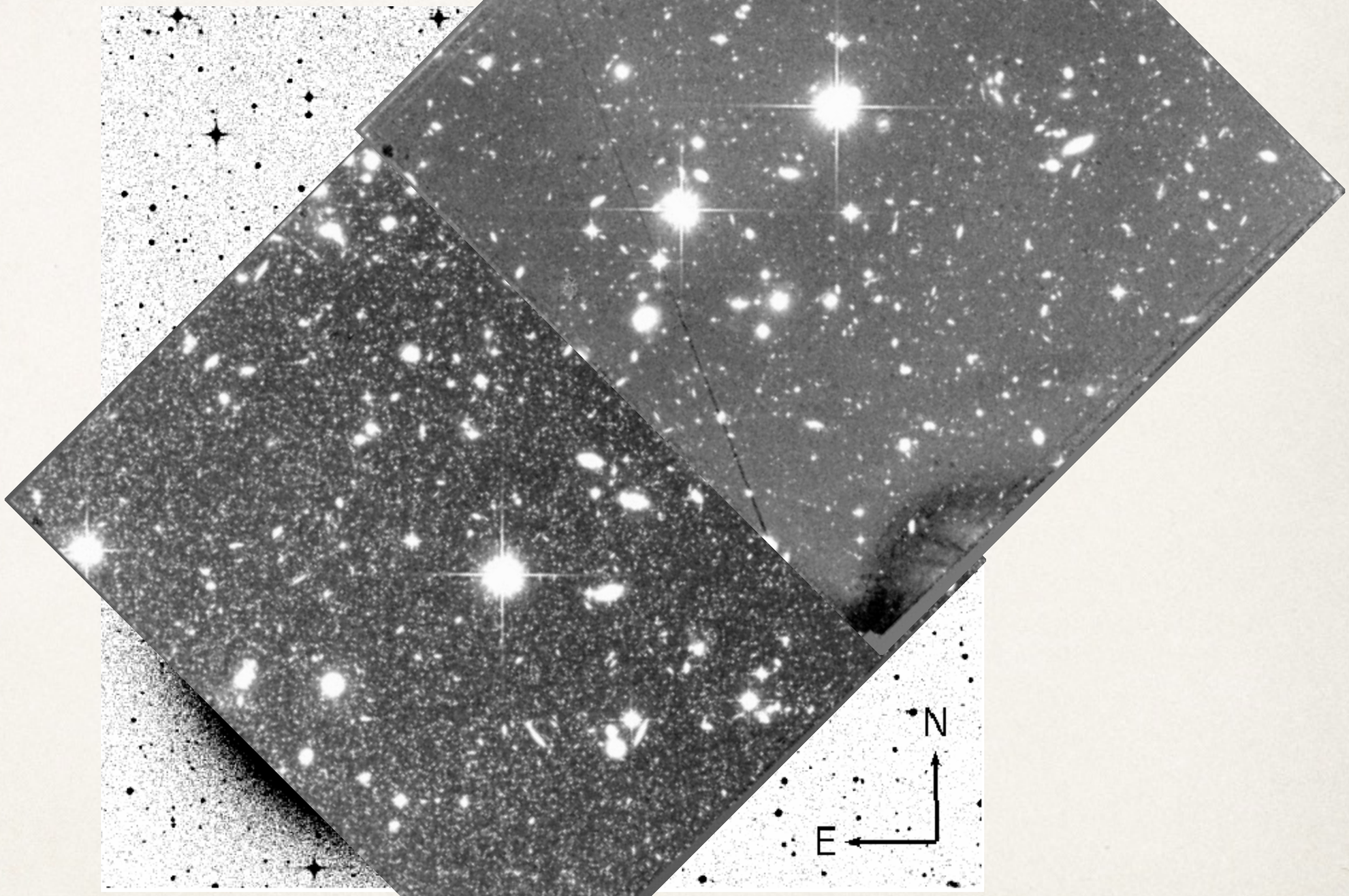
  @ 19, 37, 54 kpc

- Two filters:

  ACS **F606W** (V band)

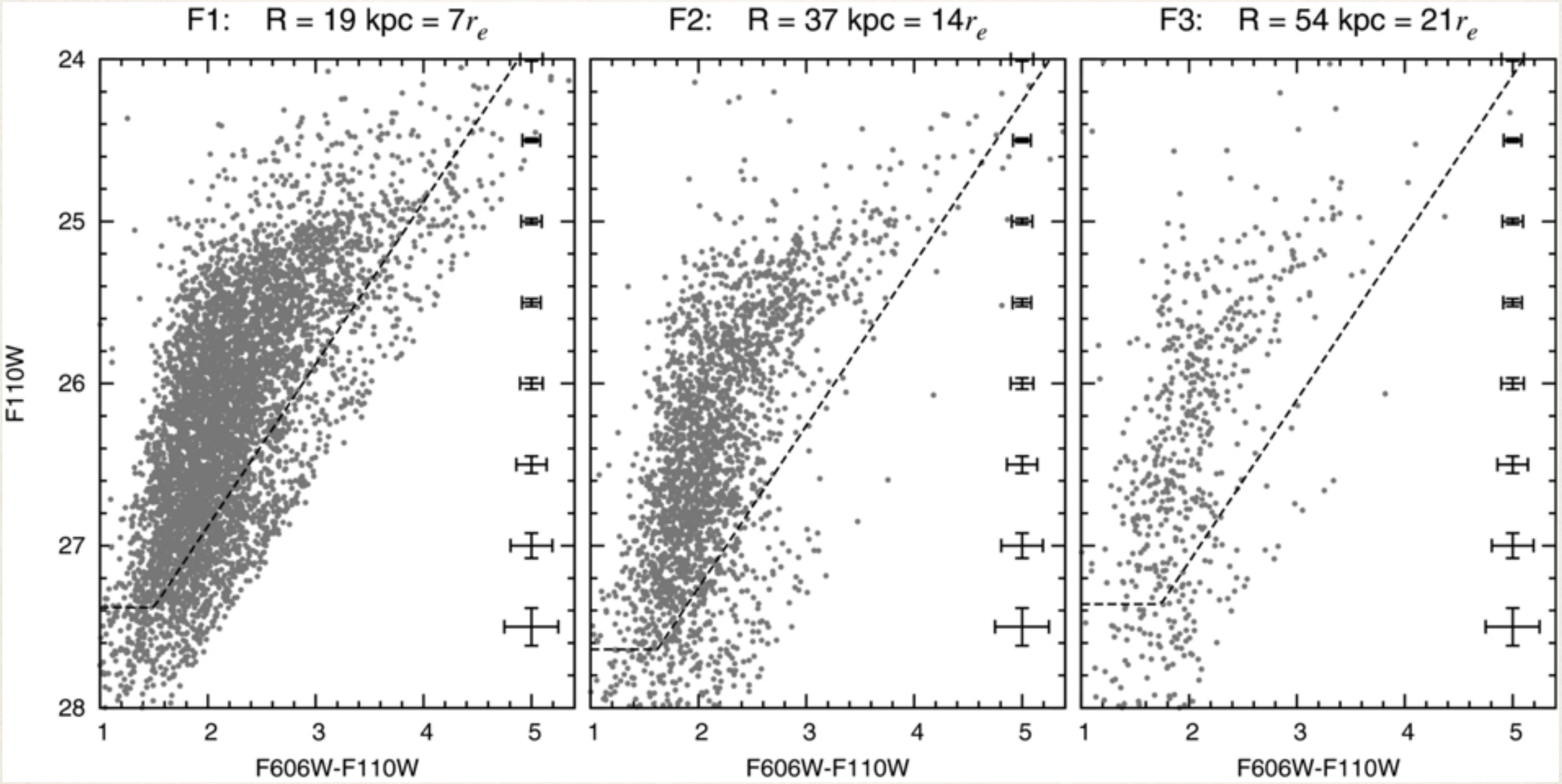
  WFC3-IR **F110W**
  (spans Y & J bands)





DSS image of NGC 3115
HST WFC3-IR images

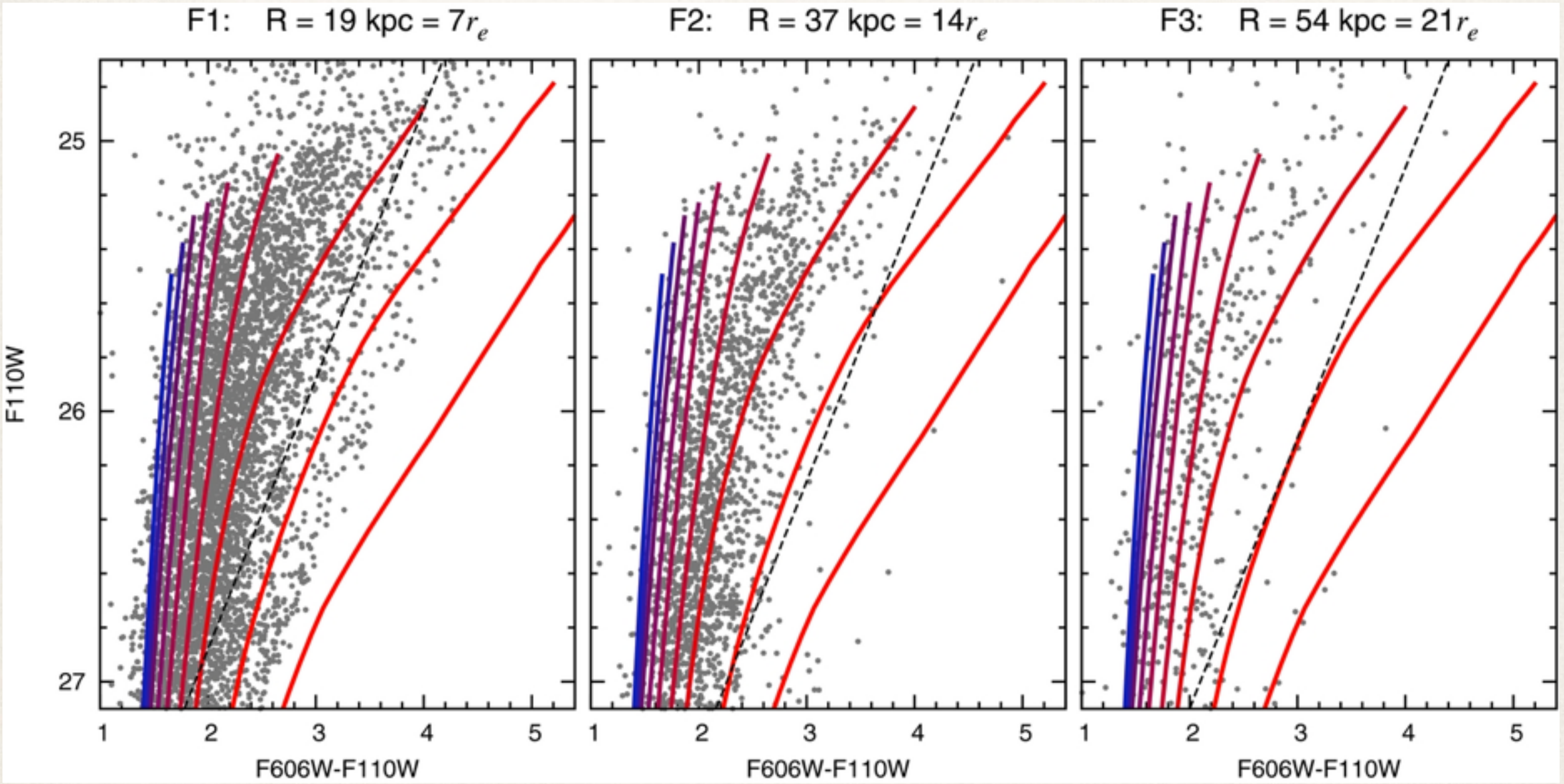
The observed CMDs



$7r_e$ $14r_e$ $21r_e$

galactocentric radius (along minor axis)

Dartmouth isochrones (Dotter ea. '08)

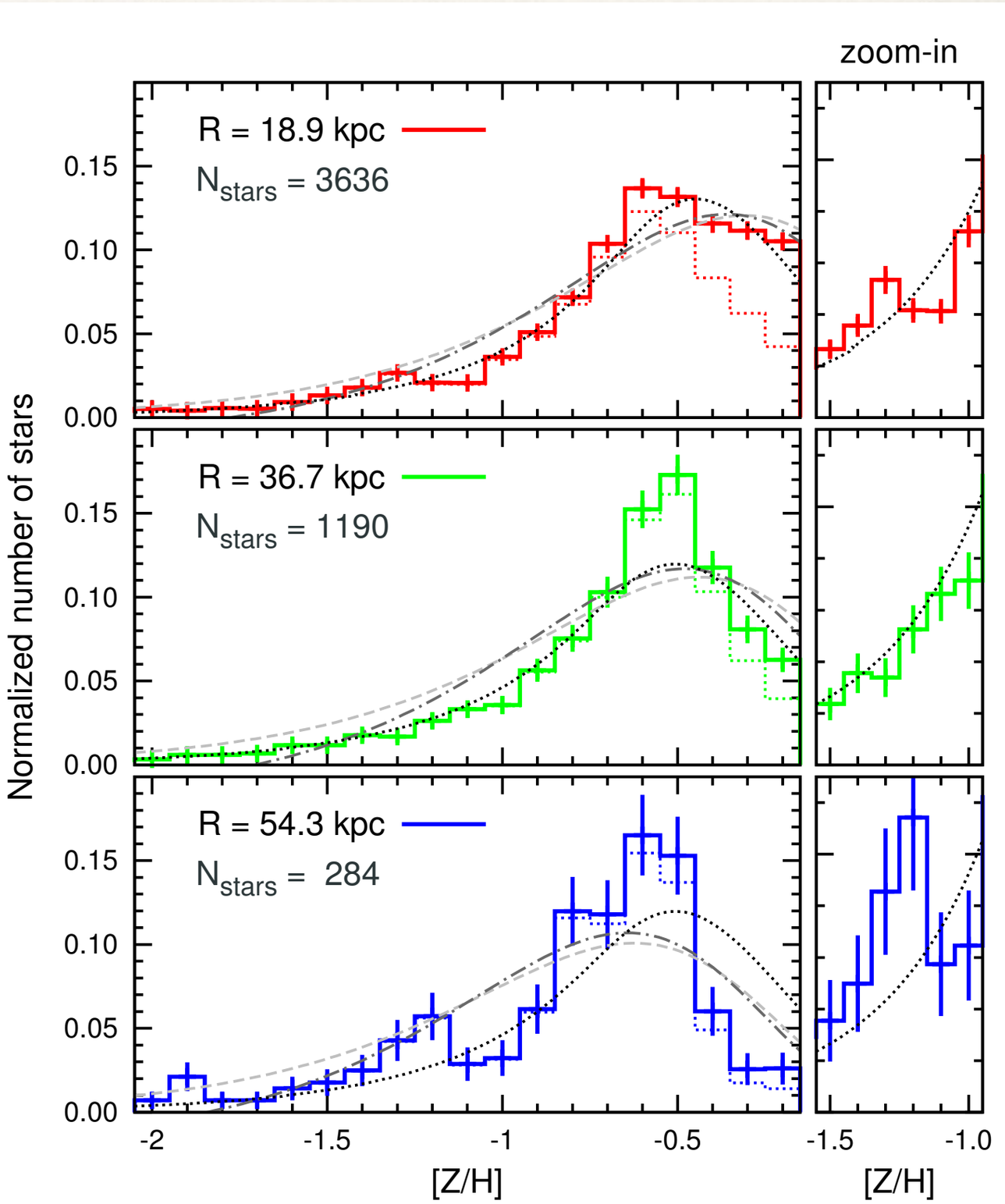


10 Gyr, $[\alpha/\mathrm{Fe}] = 0.4$, $[\mathrm{Z/H}]$ = -2.2, -1.9, -1.6, -1.3, -1.0, -0.7, -0.4, -0.1, +0.2

MDF of NGC3115's stellar halo

- Quite an enriched population at all radii, peaked at [Z/H] ~ -0.5 to -0.65

- Metal-poor population observed, peaked at [Z/H] ~ -1.3

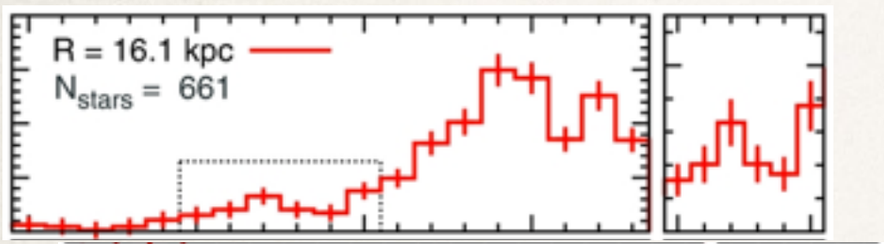


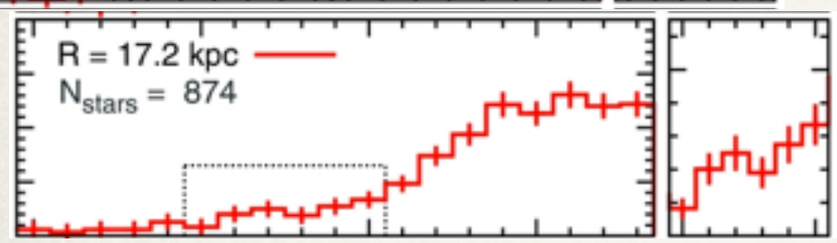
Radial variations

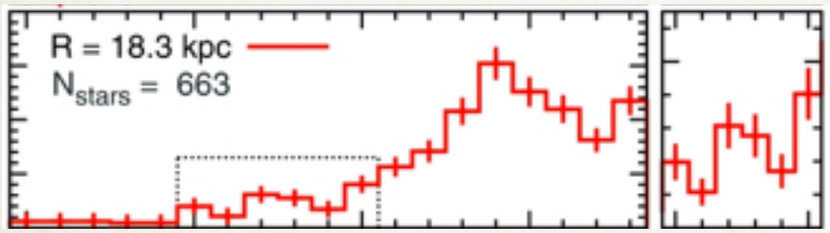
&

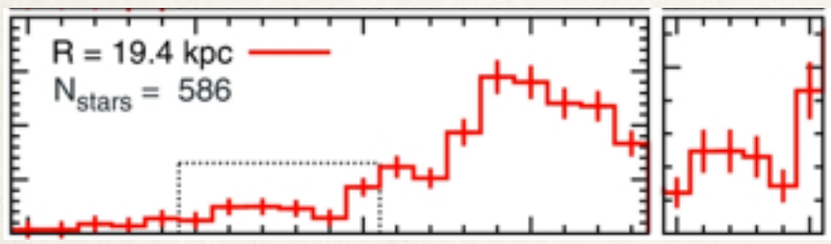
Comparison to the globular cluster system

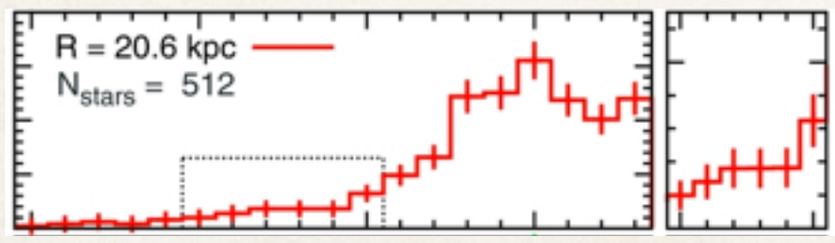
Radial variations

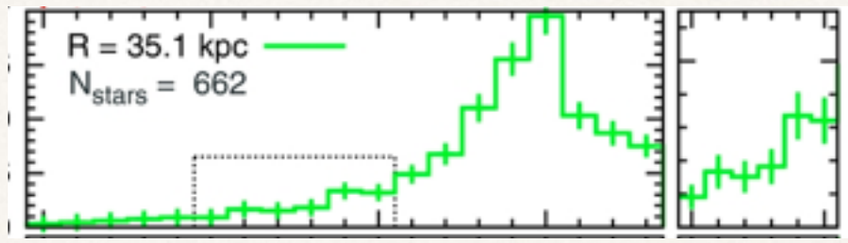


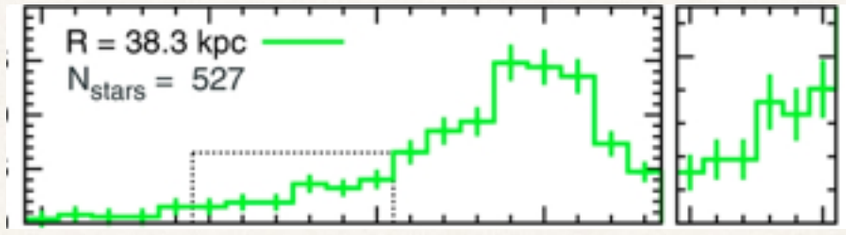


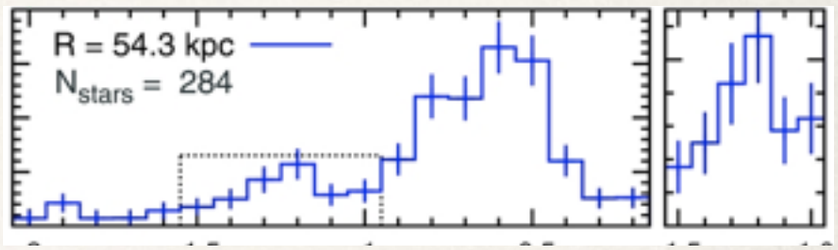








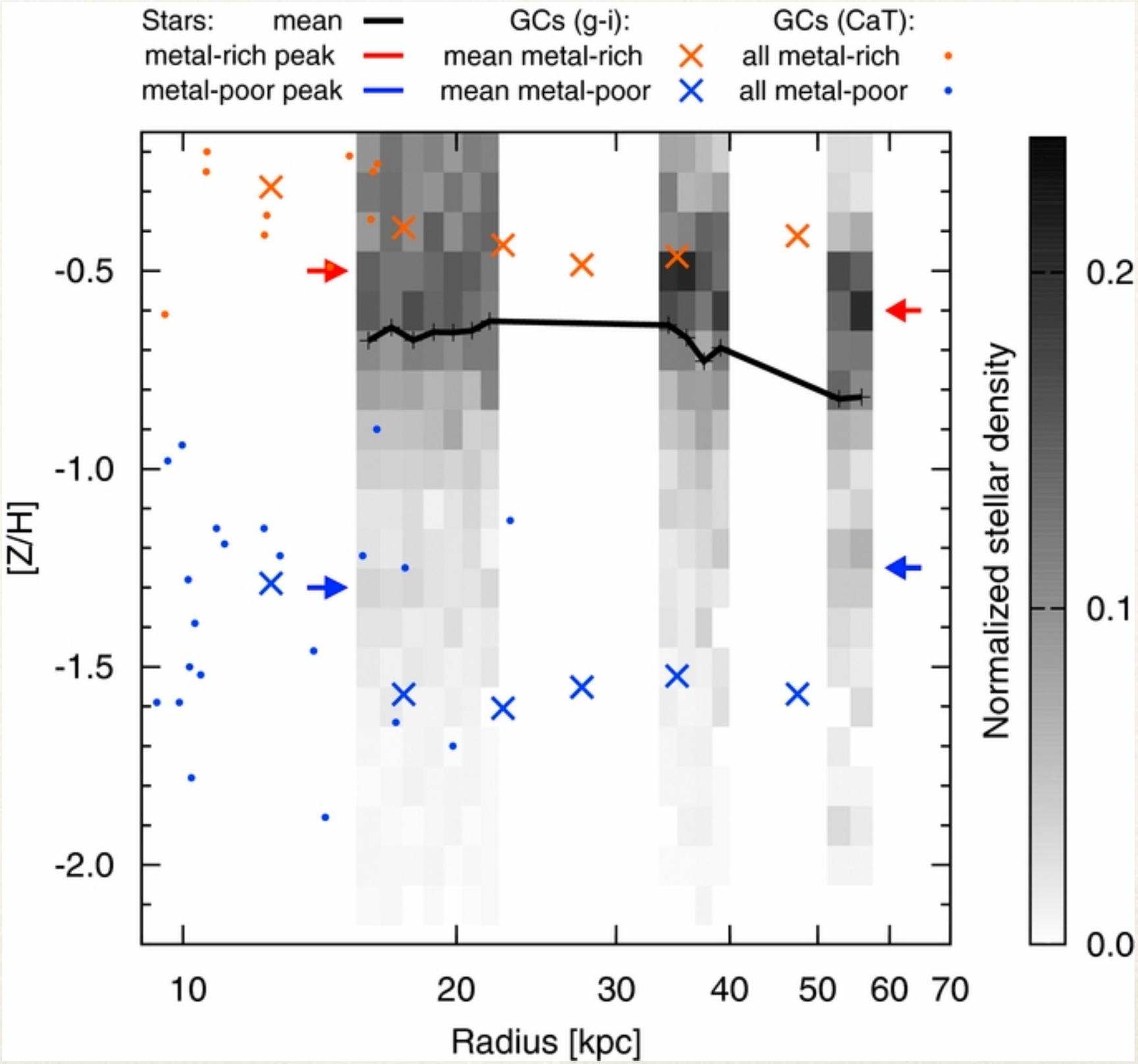




$7r_e$ $14r_e$ $21r_e$

19 kpc 37 kpc 54 kpc

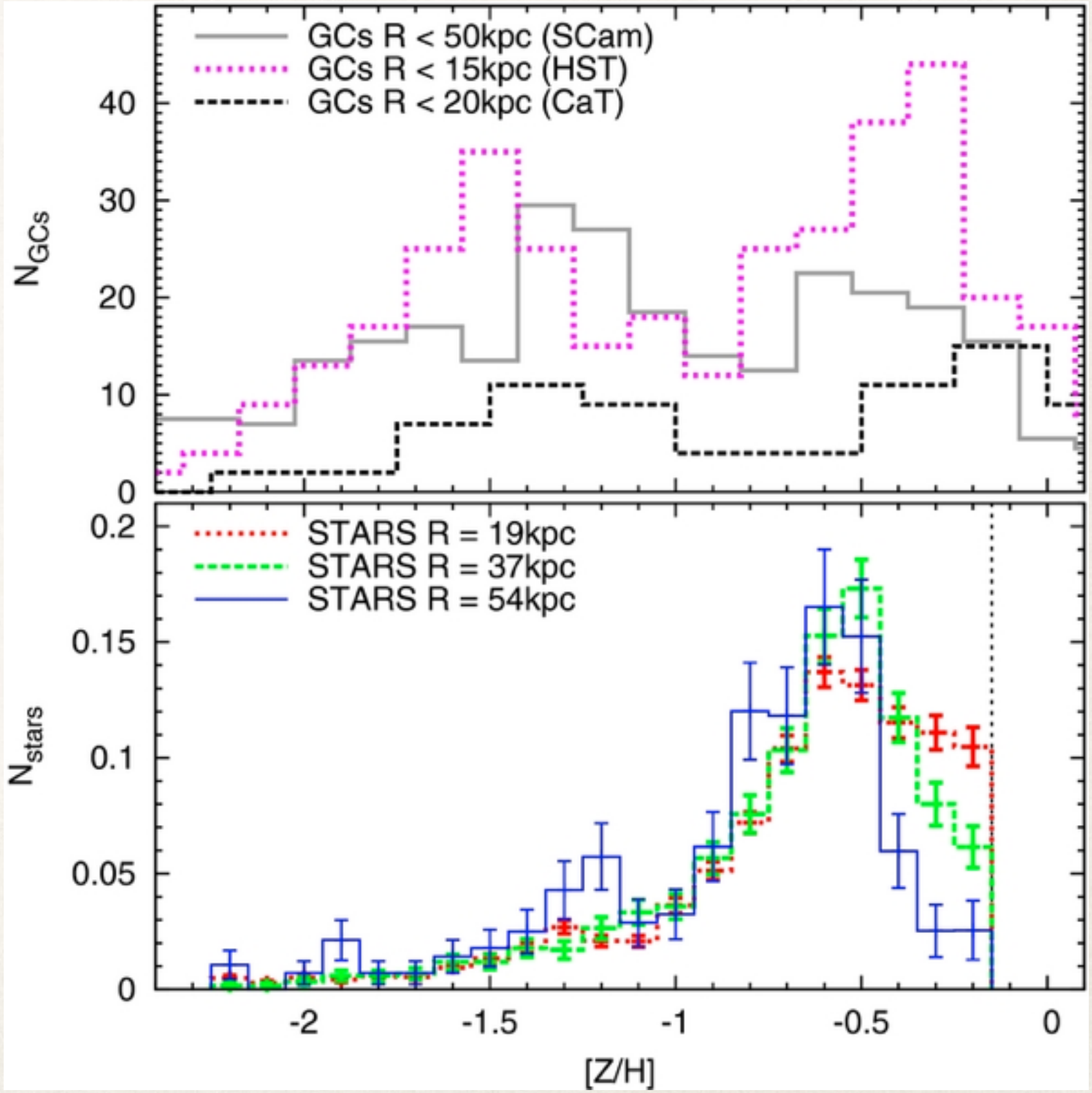
Radial variations



GCs vs. Halo stars

- Metal rich and poor populations are similar

- Metal poor GCs are much higher fraction of the halo than stars.



Stellar density profile

Metal-rich [Z/H] > -0.95

Metal-poor [Z/H] < -0.95

Best fit power laws 15 - 55 kpc:

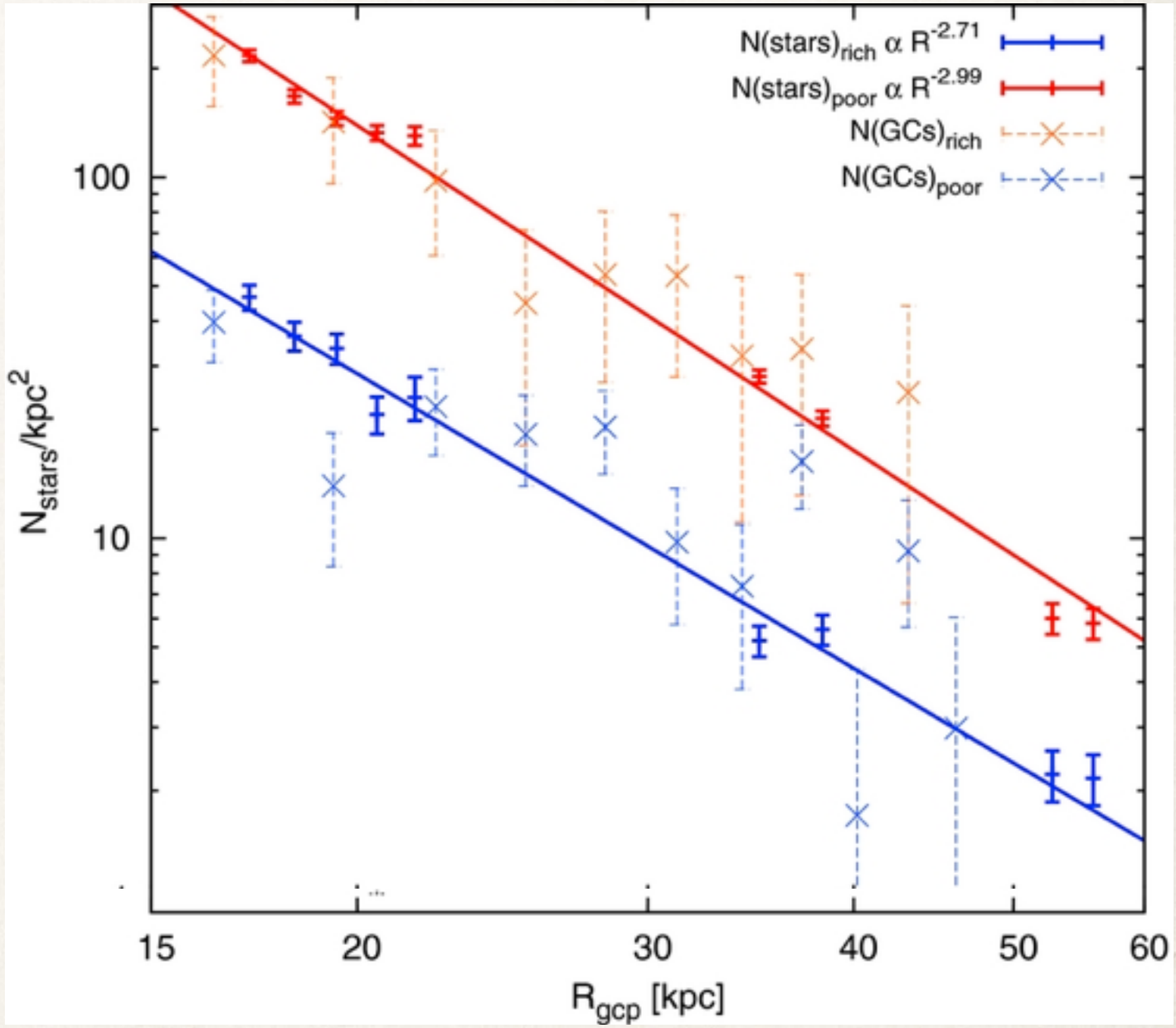
α_{rich} = -2.7

α_{poor} = -3.0 (flatter)

The metal poor component:

Stellar halo mass = 2 x 10^{10} $M_\odot$

(14% of total stellar mass)

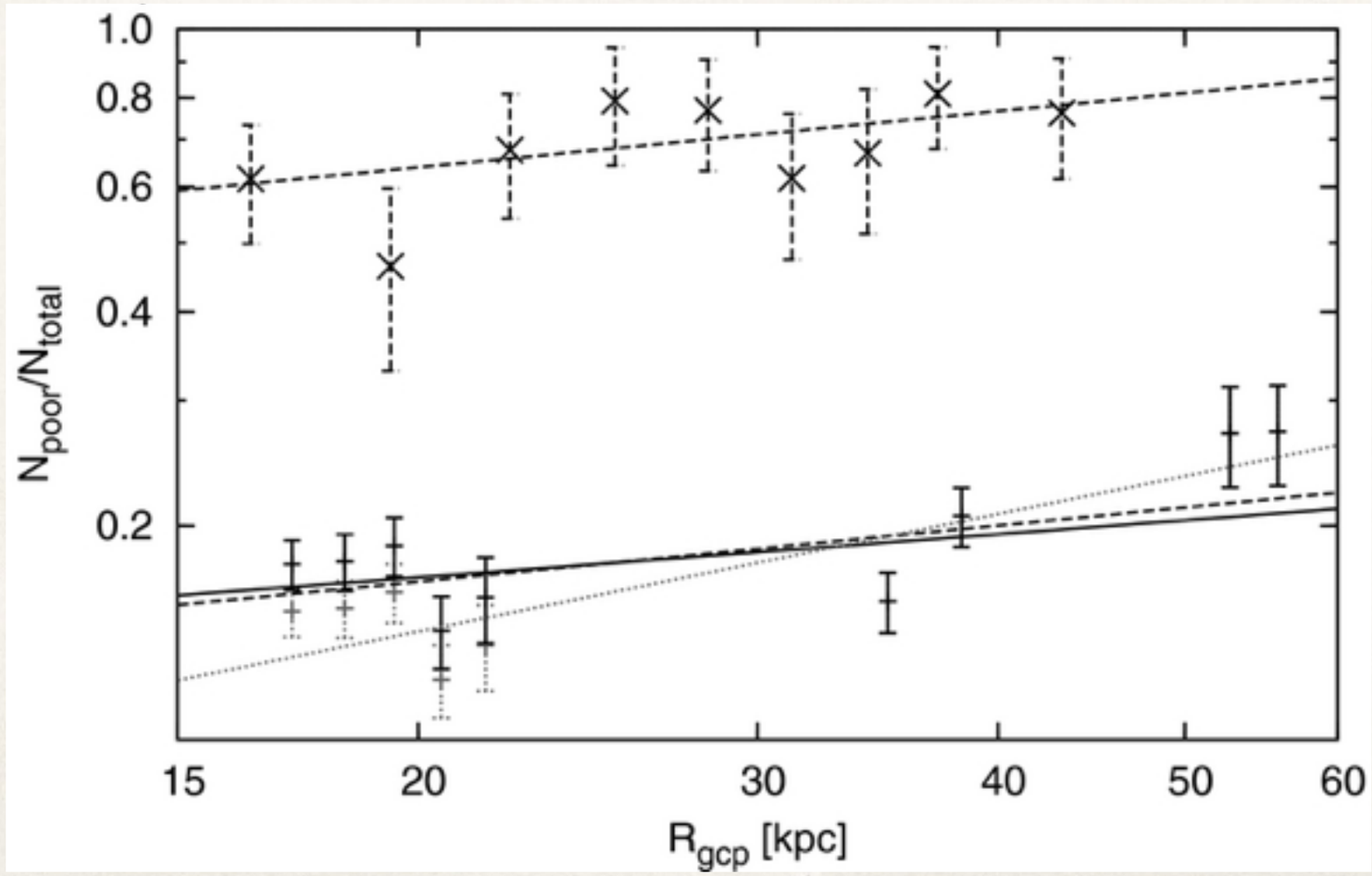


Stellar density profile

Ratio of metal-poor to -rich stars increases with radius

- similar variation observed with the GCs

Fraction of metal-poor GCs much larger than ratio of metal poor stars

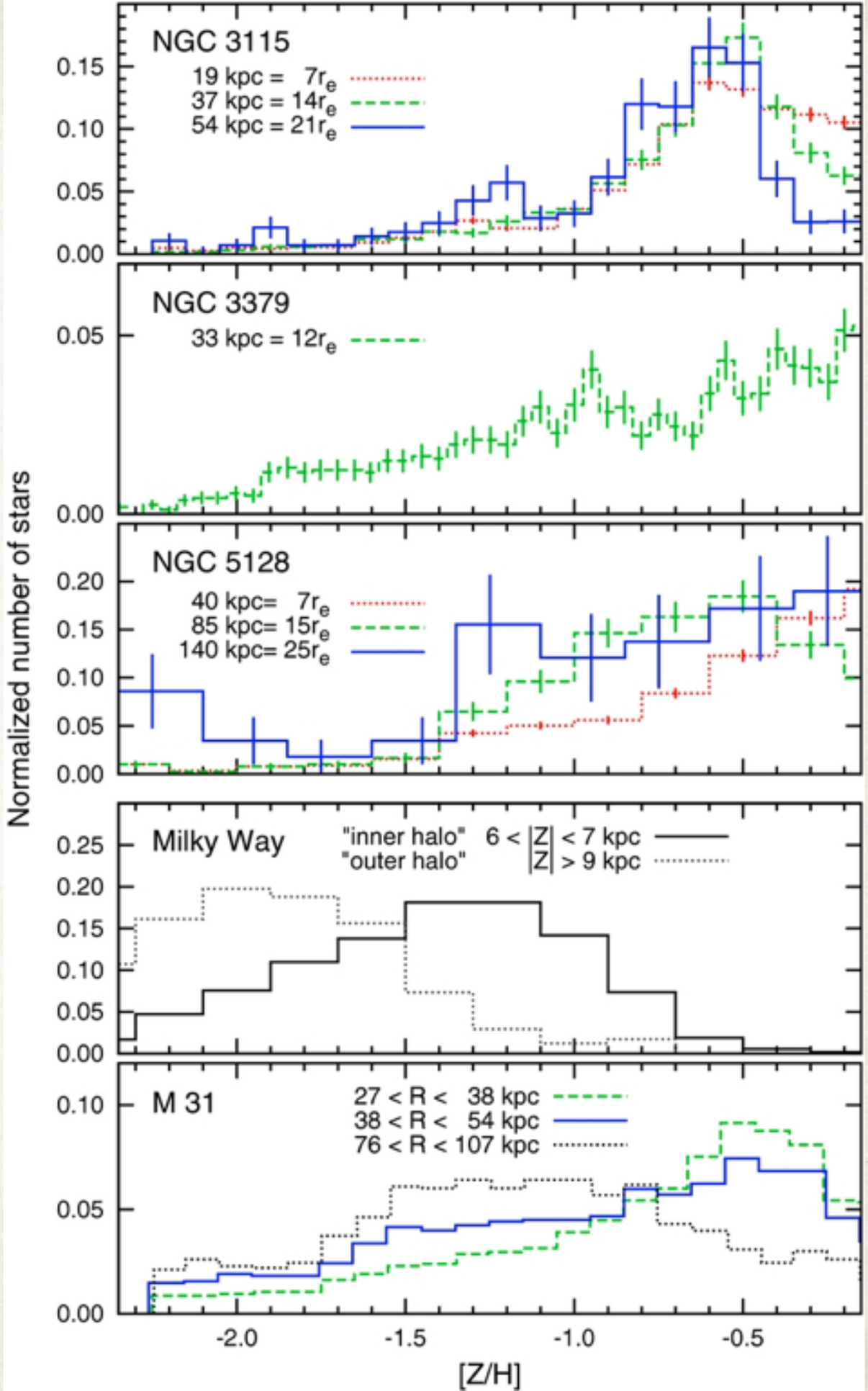


GCs

Stars

Comparison to other galaxies

- Other stellar halos:
  - NGC3379 (Harris ea. ’07)
  - NGC5128 (Rejkuba ea. ’14)
  - Milky Way (Carollo ea. ’10)
  - M31 (Ibata ea. ’14)



Summary: NGC 3115's halo

- From 15 - 60 kpc (6 - 23 r_e) we find:
  - the peak in the MDF decreases from [Z/H] -0.5 to -0.65 and the mean metallicity decreases from -0.65 to -0.8
  - a distinct lower metallicity population in two of the fields, peaked at [Z/H] ~ -1.3
  - the metal-poor population has a flatter profile than the metal-rich
- The metal-poor "halo" population's mass estimated as 2×10^{10} $M_\odot$ (14% of the total mass)
- The metal-rich and -poor GC density profiles and metallicities are consistent with the underlying stellar population (but ratios are different).
- We only sample a small region of the halo - it's important to compare such work with surface brightness photometry to investigate substructure.