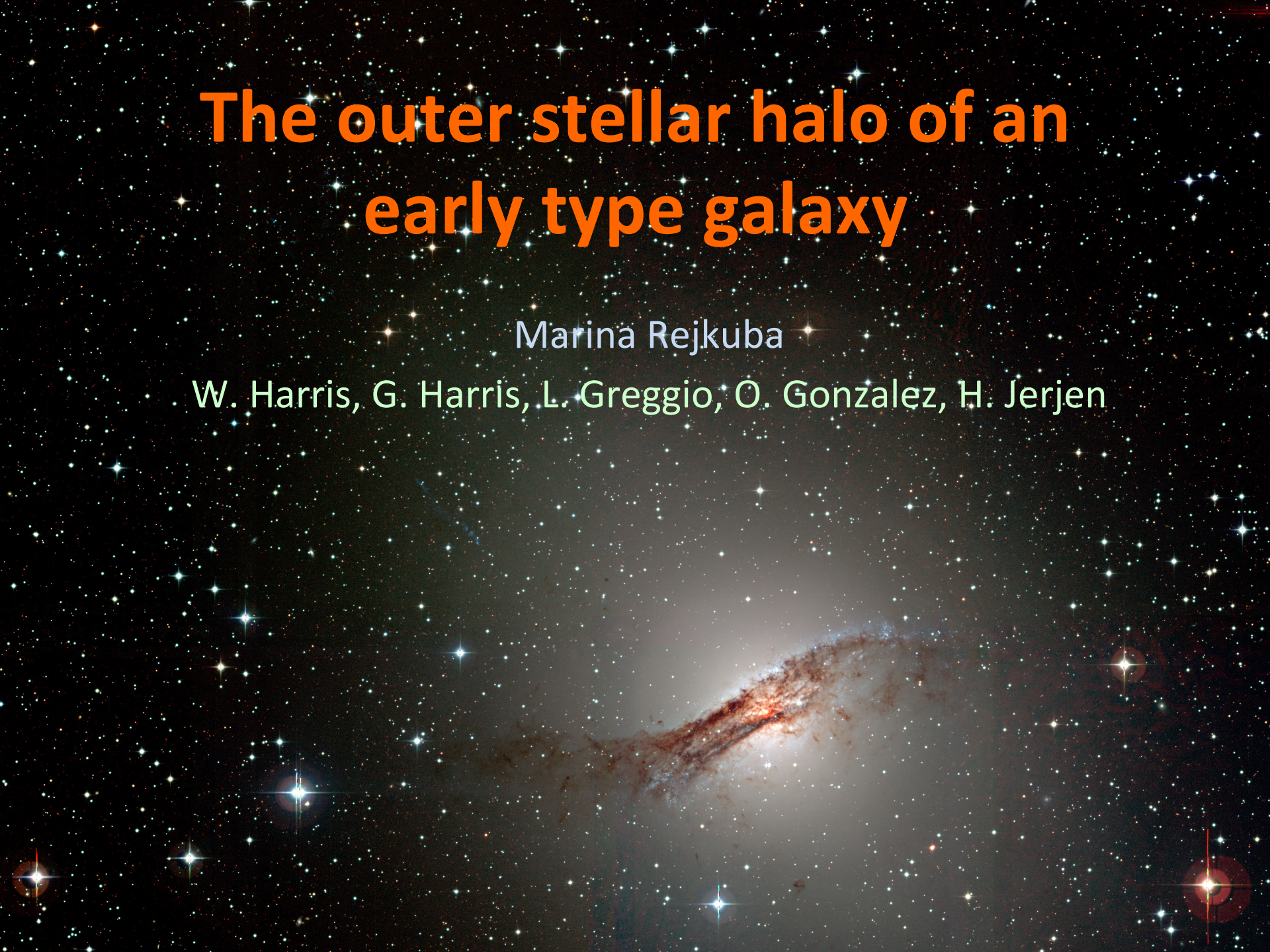


The outer stellar halo of an early type galaxy

Marina Rejkuba

W. Harris, G. Harris, L. Greggio, O. Gonzalez, H. Jerjen



Stellar Halos around galaxies

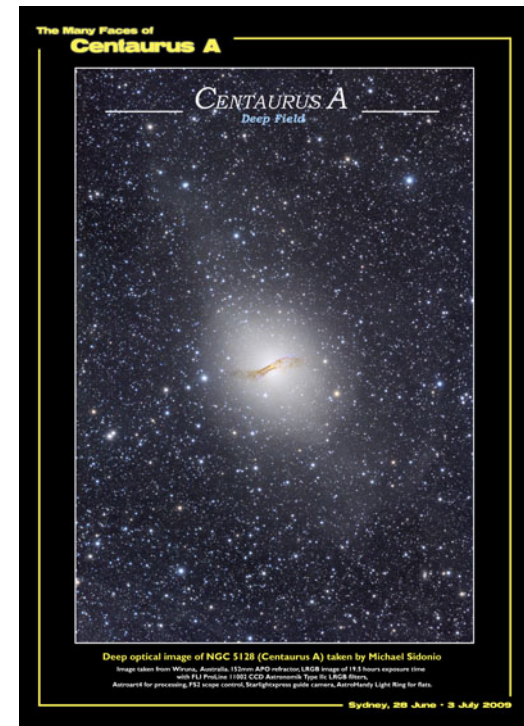
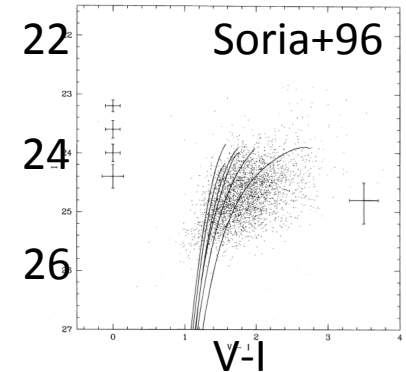
- Challenging observations
 - Red halos around disc galaxies (Lequeux+96; SDSS stacks: Zibetti +04, Bergvall+10; UDF Zibetti & Ferguson 2004)
 - Flat color gradients beyond ~ 40 kpc in ellipticals (SDSS stacks: Tal & van Dokkum 2011)
 - M49: Steep color gradient between 30-100 kpc and blue outer halo (Mihos+13)
 - Systematics? (Jablonka+10; de Jong 2008, Zaricksson+12)
- Resolved stars
 - Unambiguous detection of halo stars
 - Metallicity distribution from red giant branch color

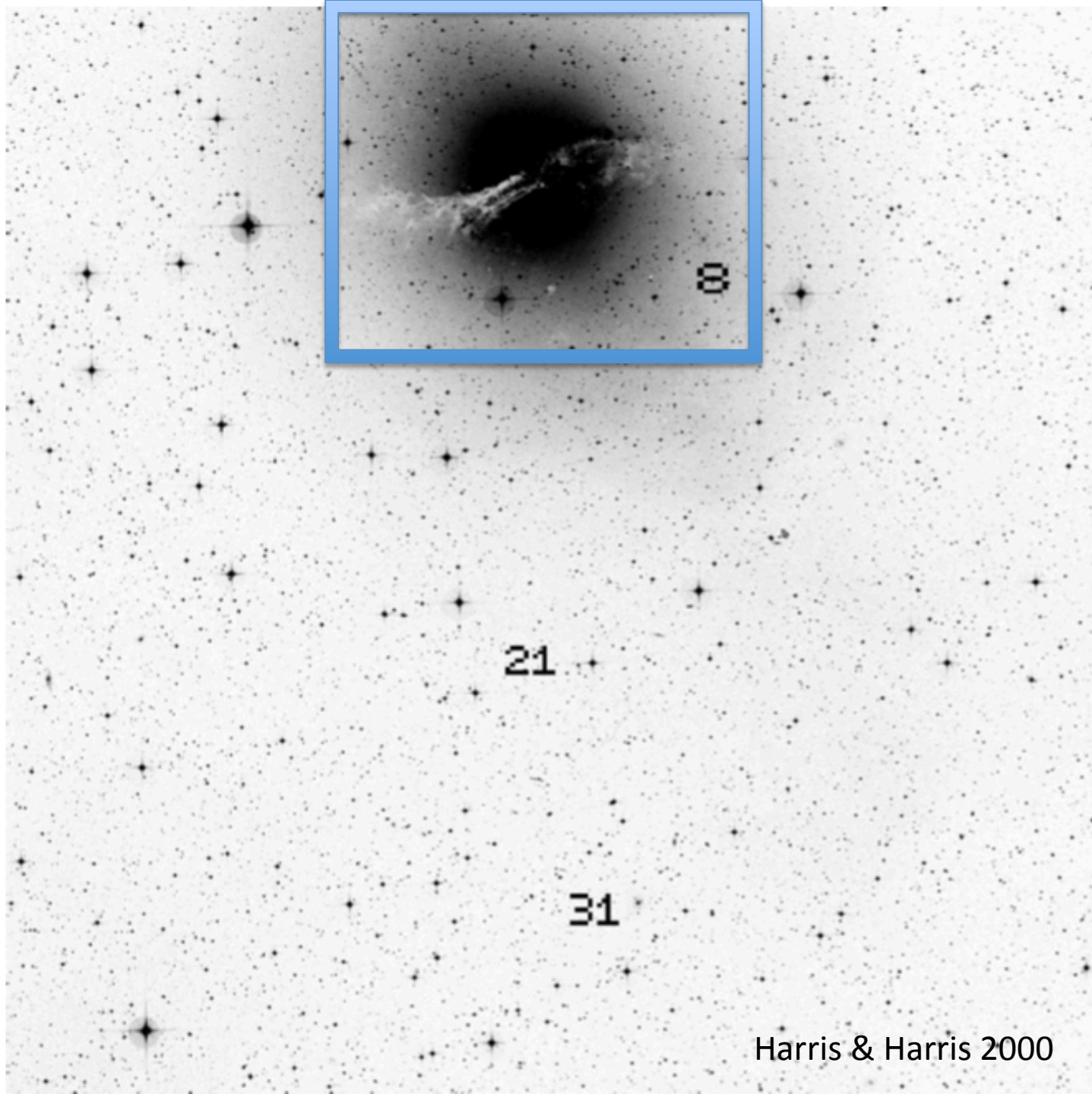
Motivation

- How far do galaxy halos extend?
or “Where do galaxies end?” (M. Shull, 2014)
 - halos along the QSO sightlines
 - galaxy abundance matching
- What are the properties of the halo stars?
 - tracing the assembly history of galaxies
 - ❖ surface density gradients
 - ❖ amount of sub-structure (accretion history)
 - ❖ metallicity gradients

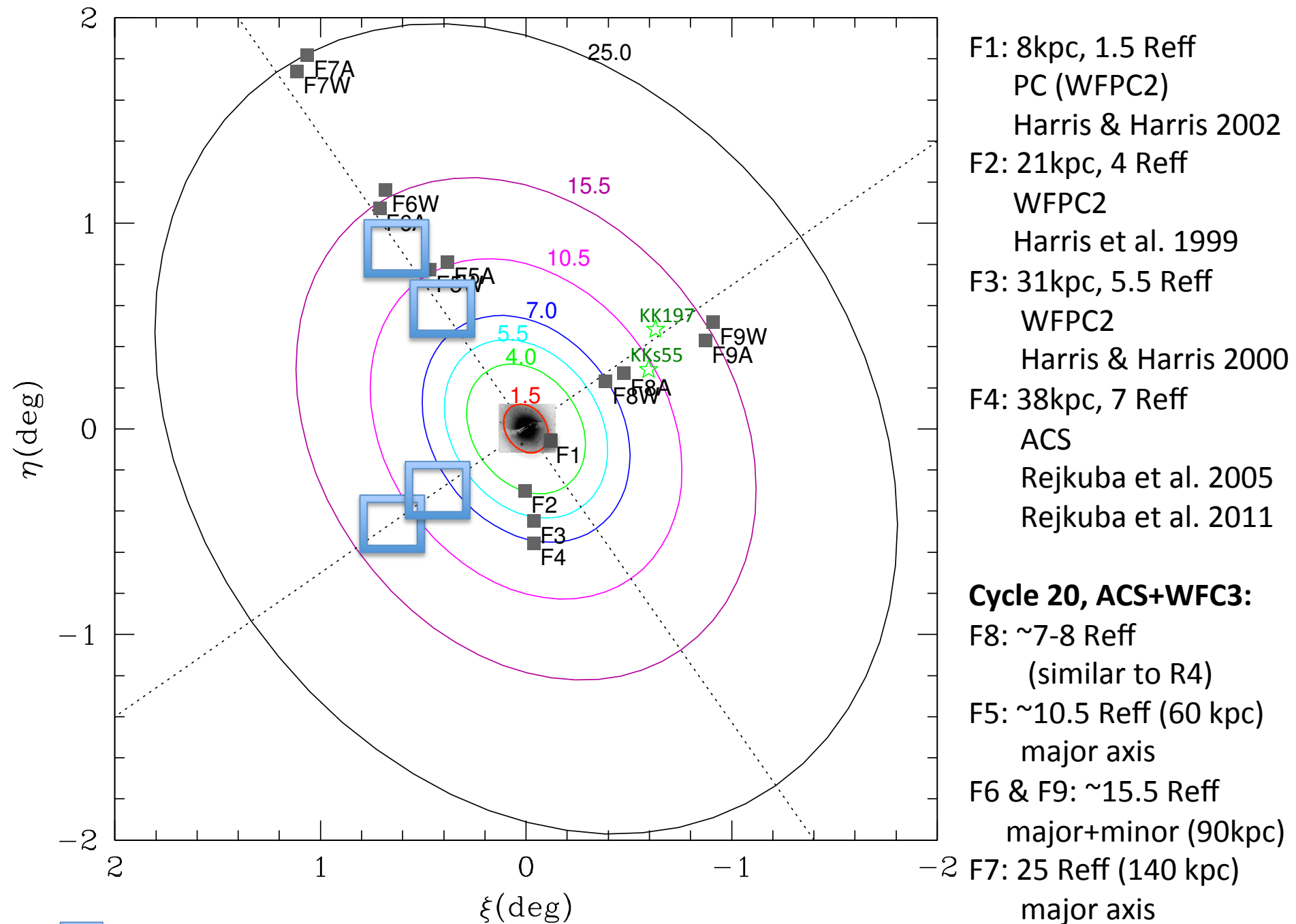
NGC 5128 (Centaurus A)

- Nearest giant elliptical galaxy (3.8 Mpc)
 - First early-type galaxy in which old stars were resolved in a halo with the HST (Soria et al. 1996)
 - Rosetta stone for early-type galaxy halo studies (Soria+96, Harris+99, Harris+Harris 00,02, Mould+00, Marleau+00, Rejkuba+01, 02, 05, 11, Crnojevic+13)
- But it is a recent merger...
 - Tidal features in ellipticals are common - 73% of local Universe gEs show tidal disturbance signature (Tal+09)
- Typical galaxy...
 - $M_V = -21.5$, $1.2 \times 10^{12} M_\odot$ (Peng+04)
 - AGN + Black hole not unusual (Neumayer 2010)



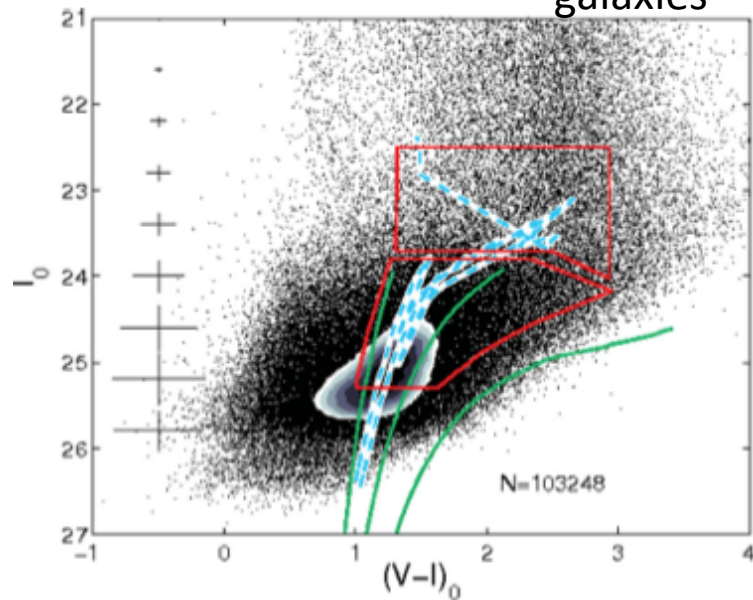


Harris & Harris 2000

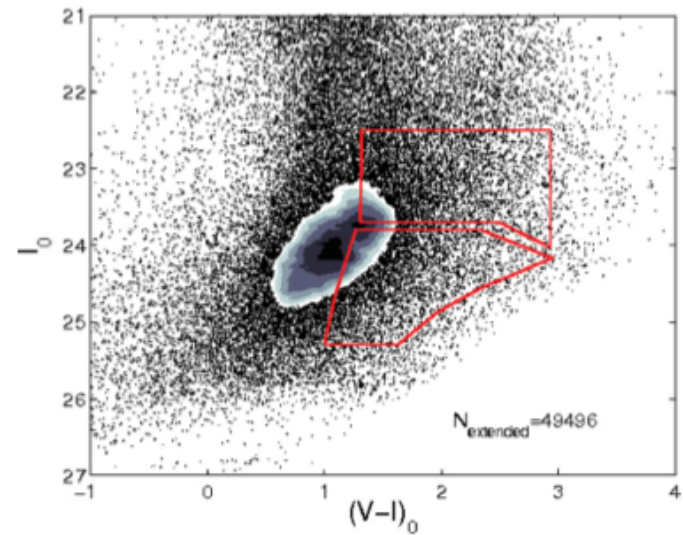


 Crnojević et al. 2013, VIMOS wide field study of NGC5128 halo

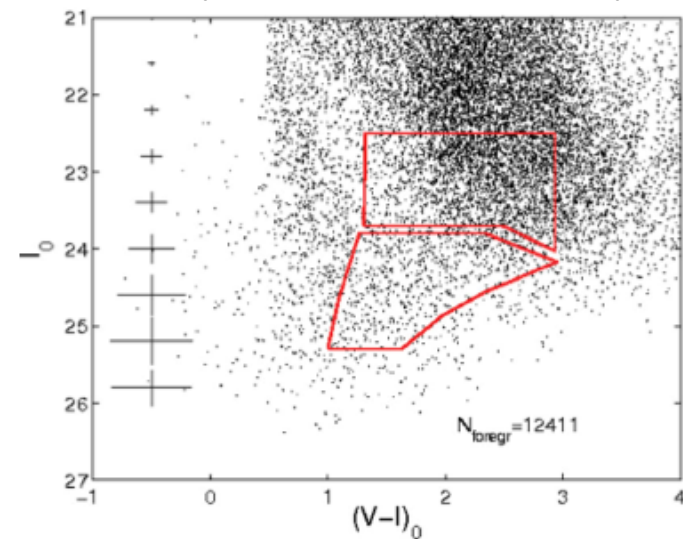
Cen A halo + foreground + background
MW
unresolved
galaxies



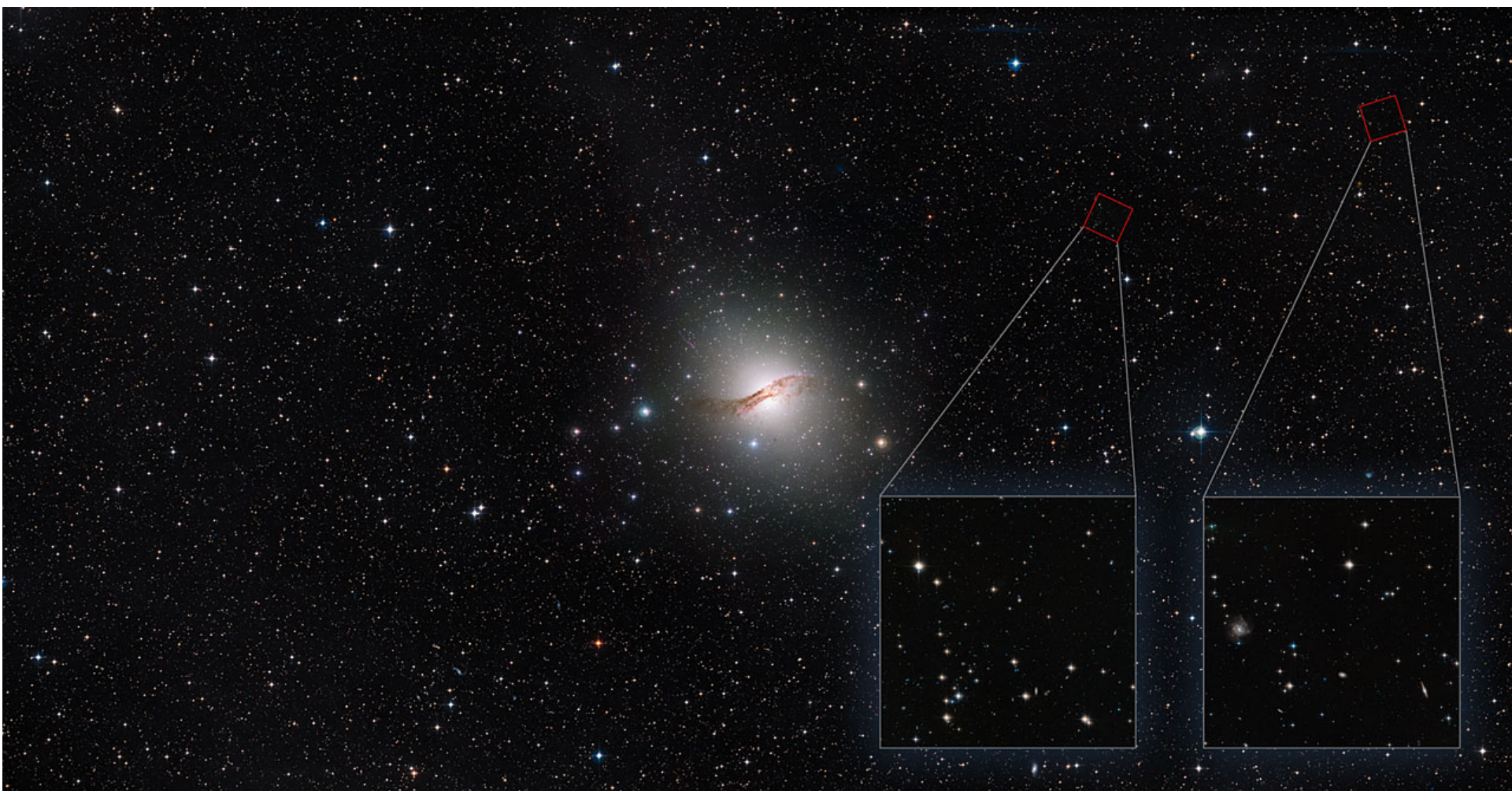
extended sources

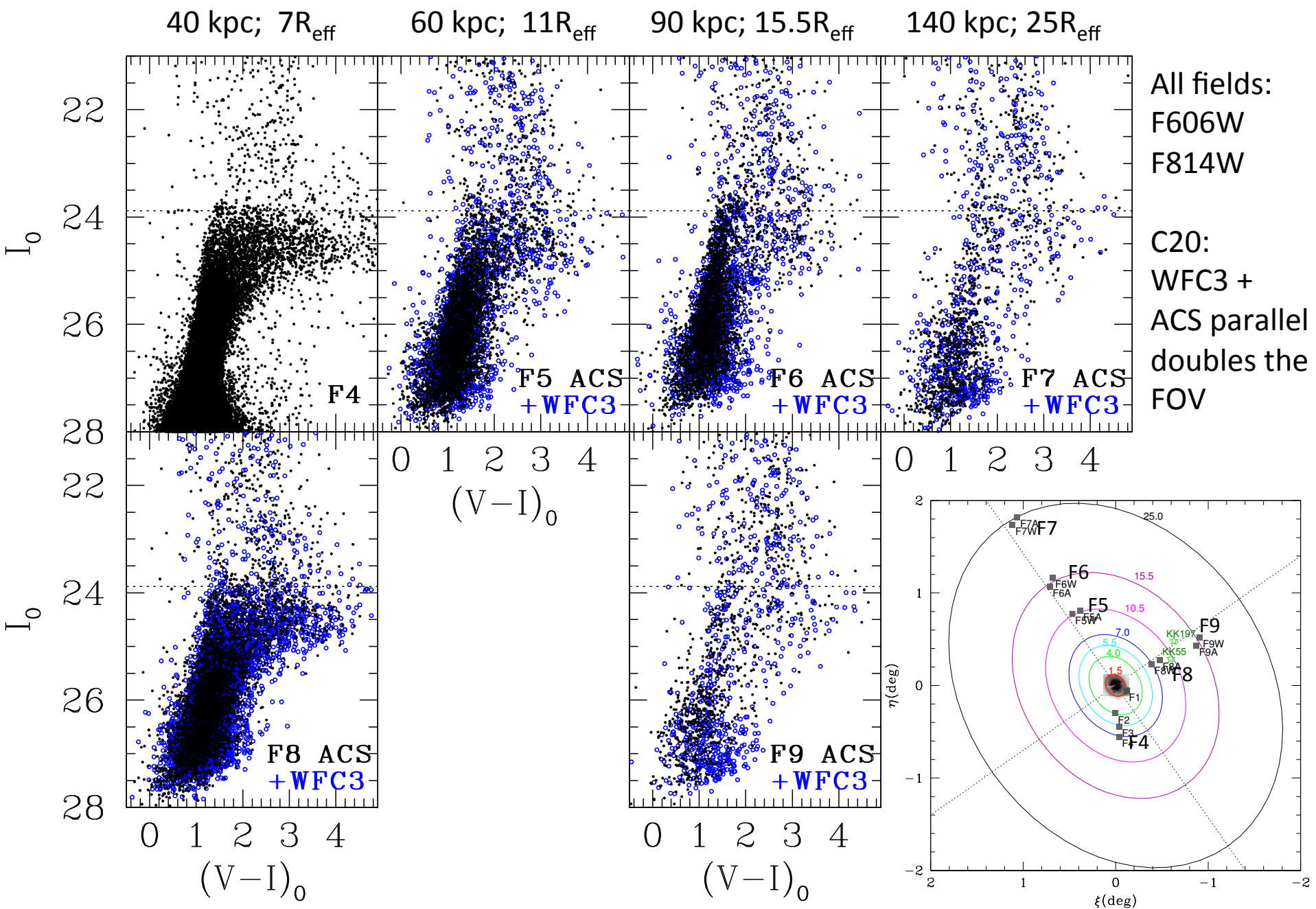


MW foreground
(Besancon simulation)

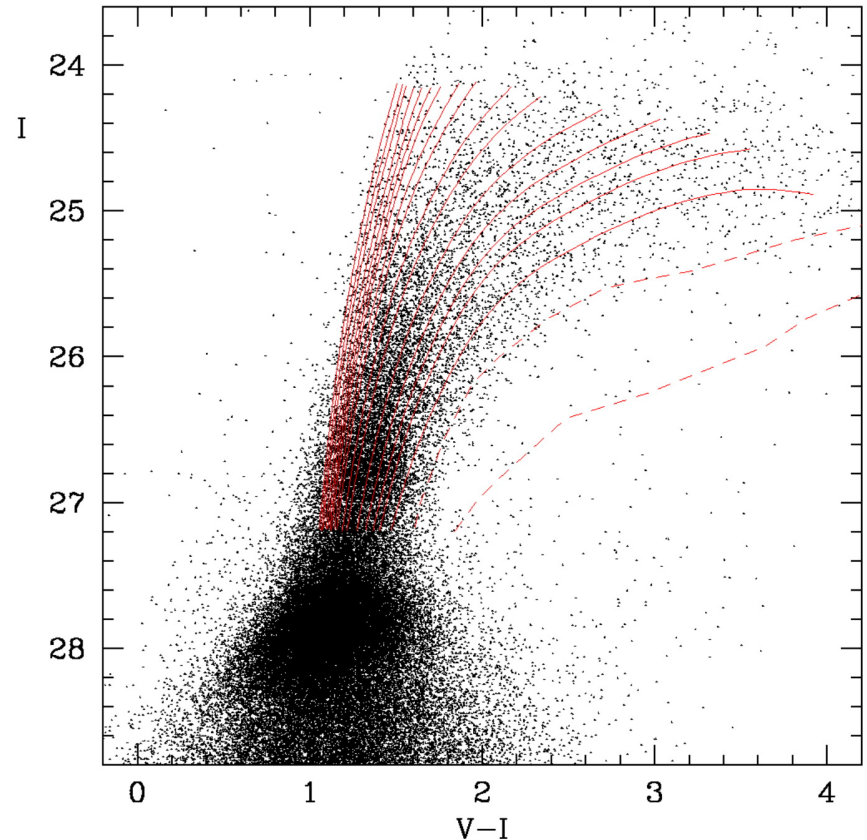
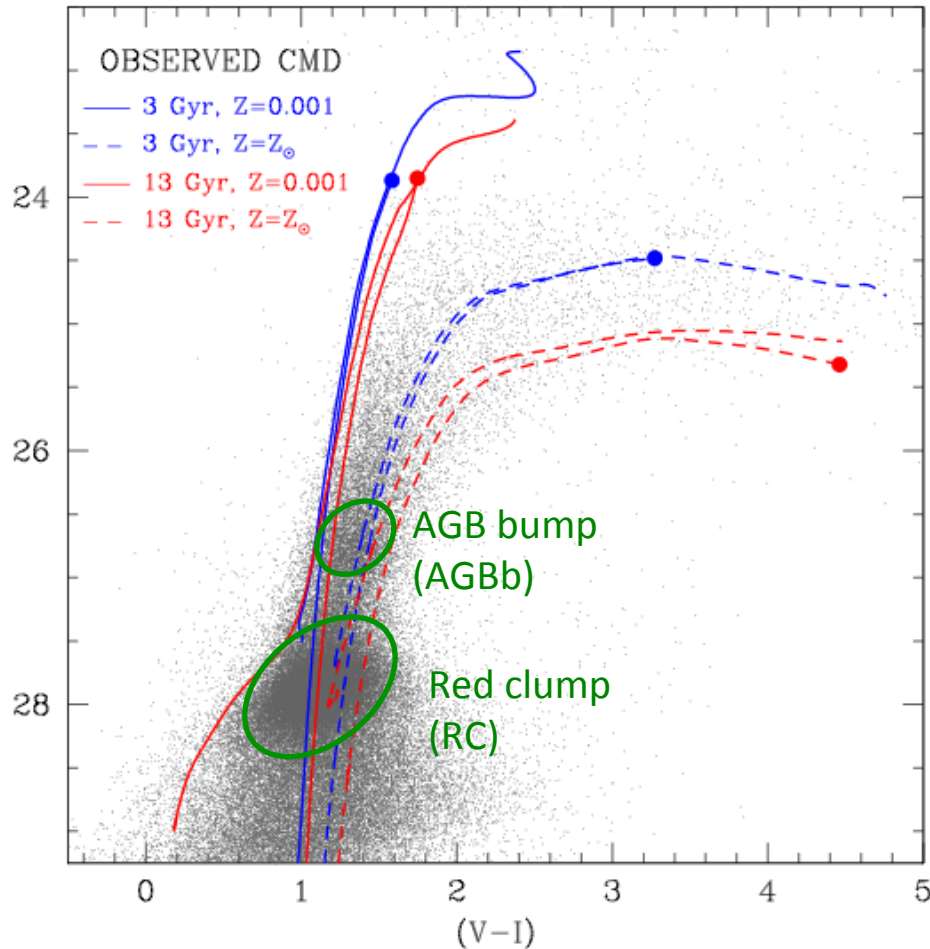


Crnojevic et al. 2013
VIMOS@VLT: photometry from the ground





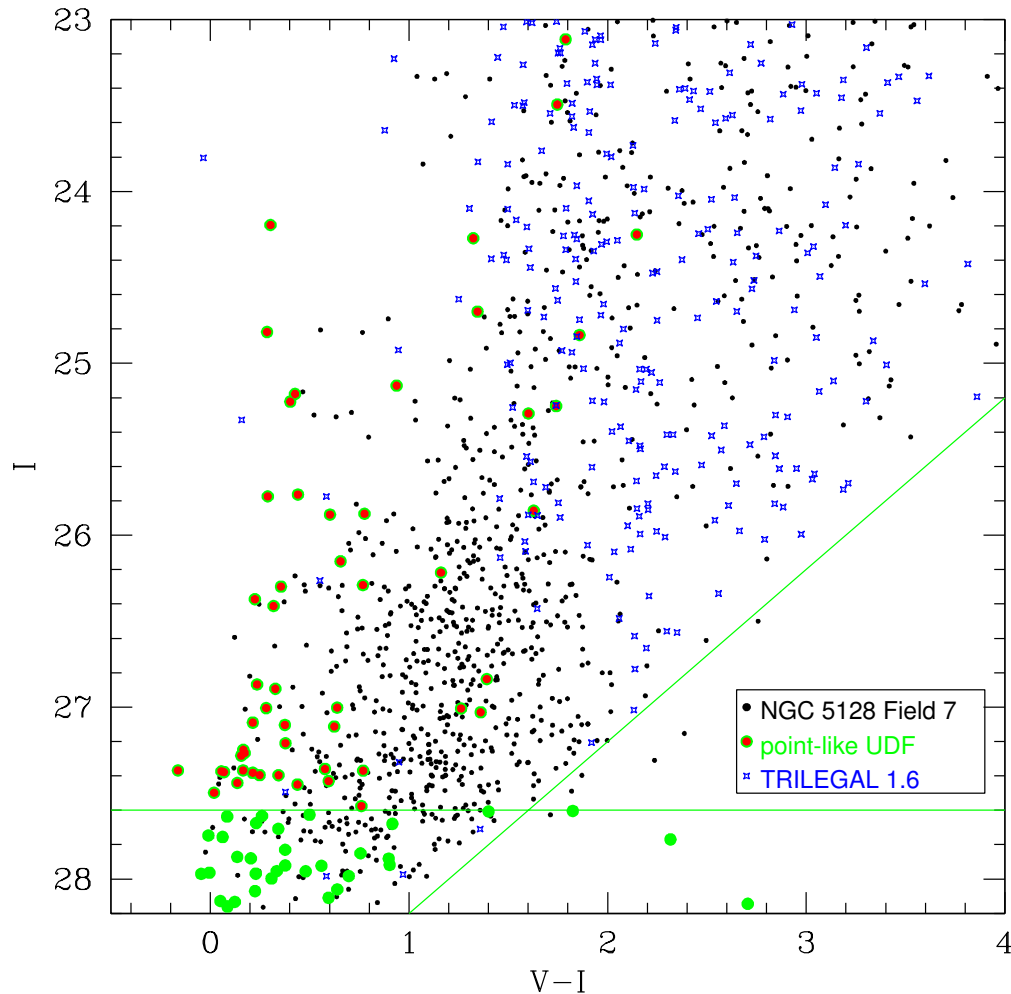
Old red giant stars in the halo



Observed vs. simulated CMDs

Best fit: 70-80% old 12 ± 1 Gyr + 20-30% 2-4 Gyr population

Foreground + background contamination



Field 7 (140 kpc; 25 Reff)

observations:

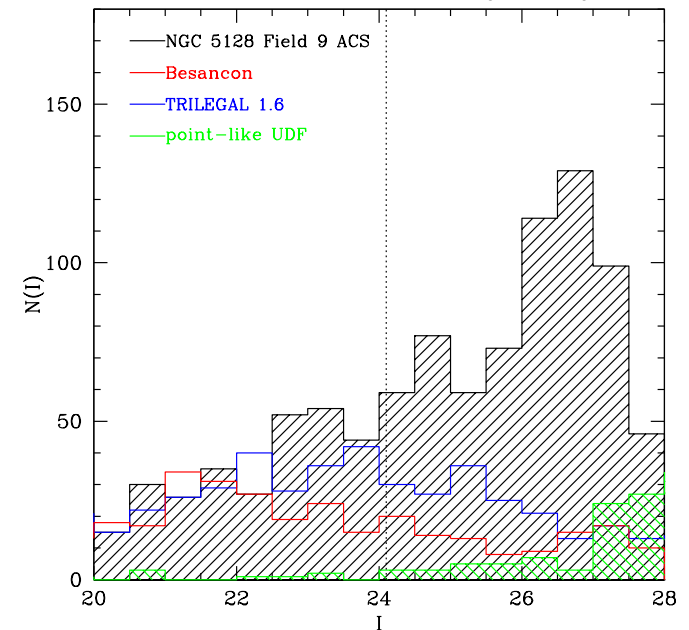
ACS: 806 stars ($I > 24$)

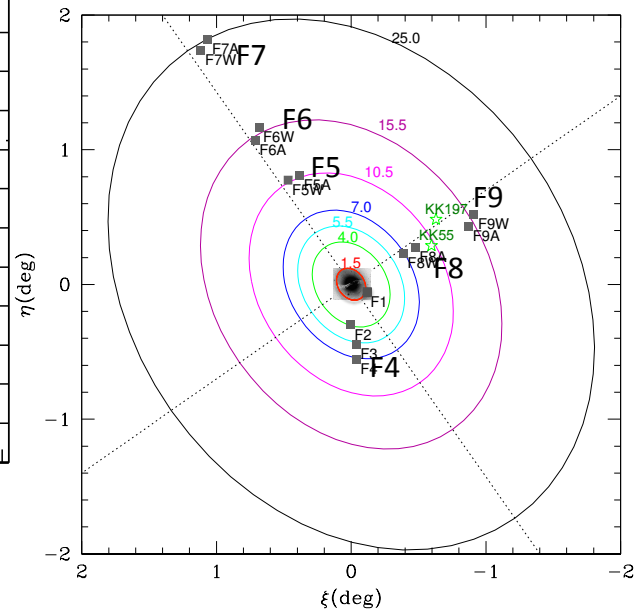
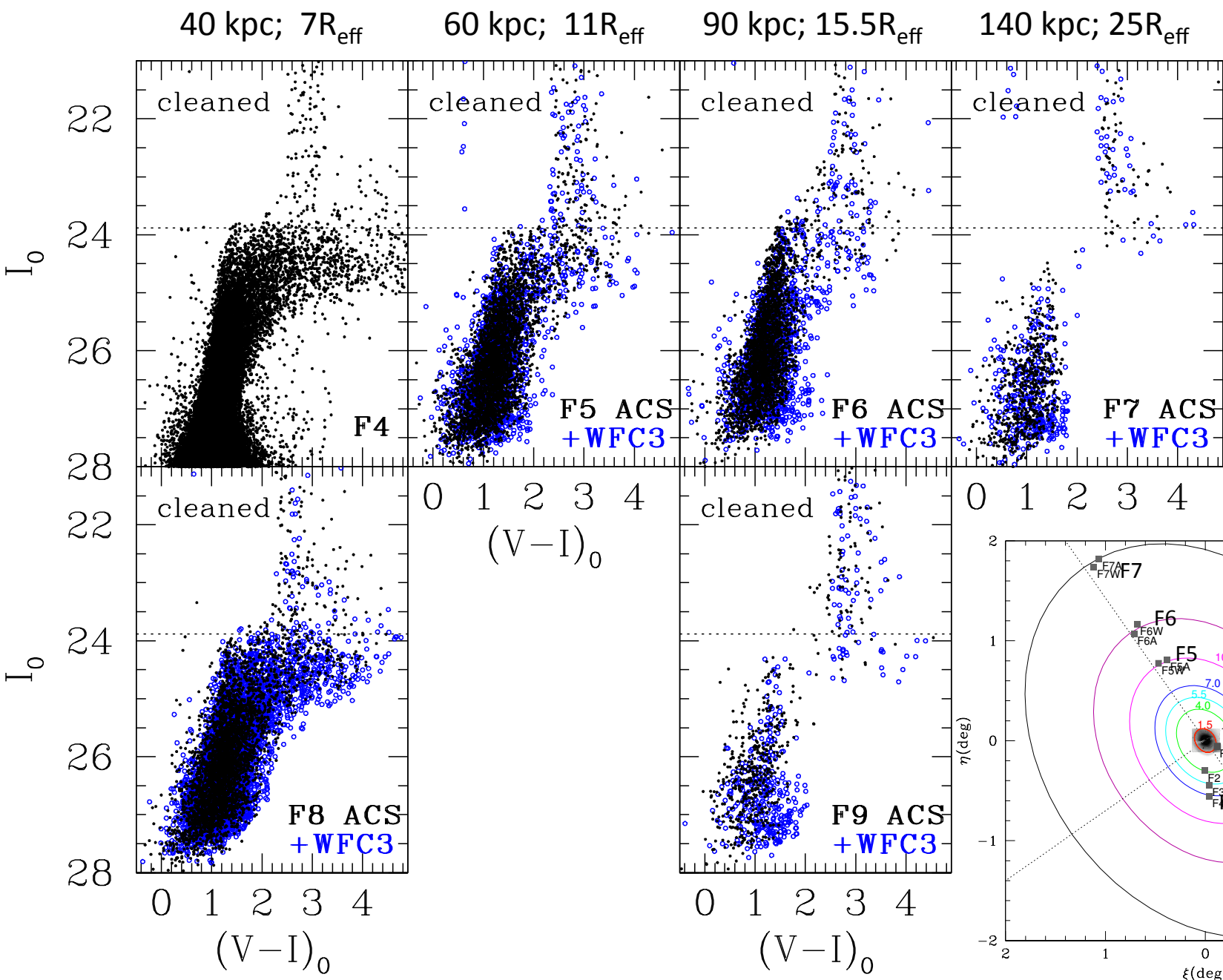
WFC3: 480 stars ($I > 24$)

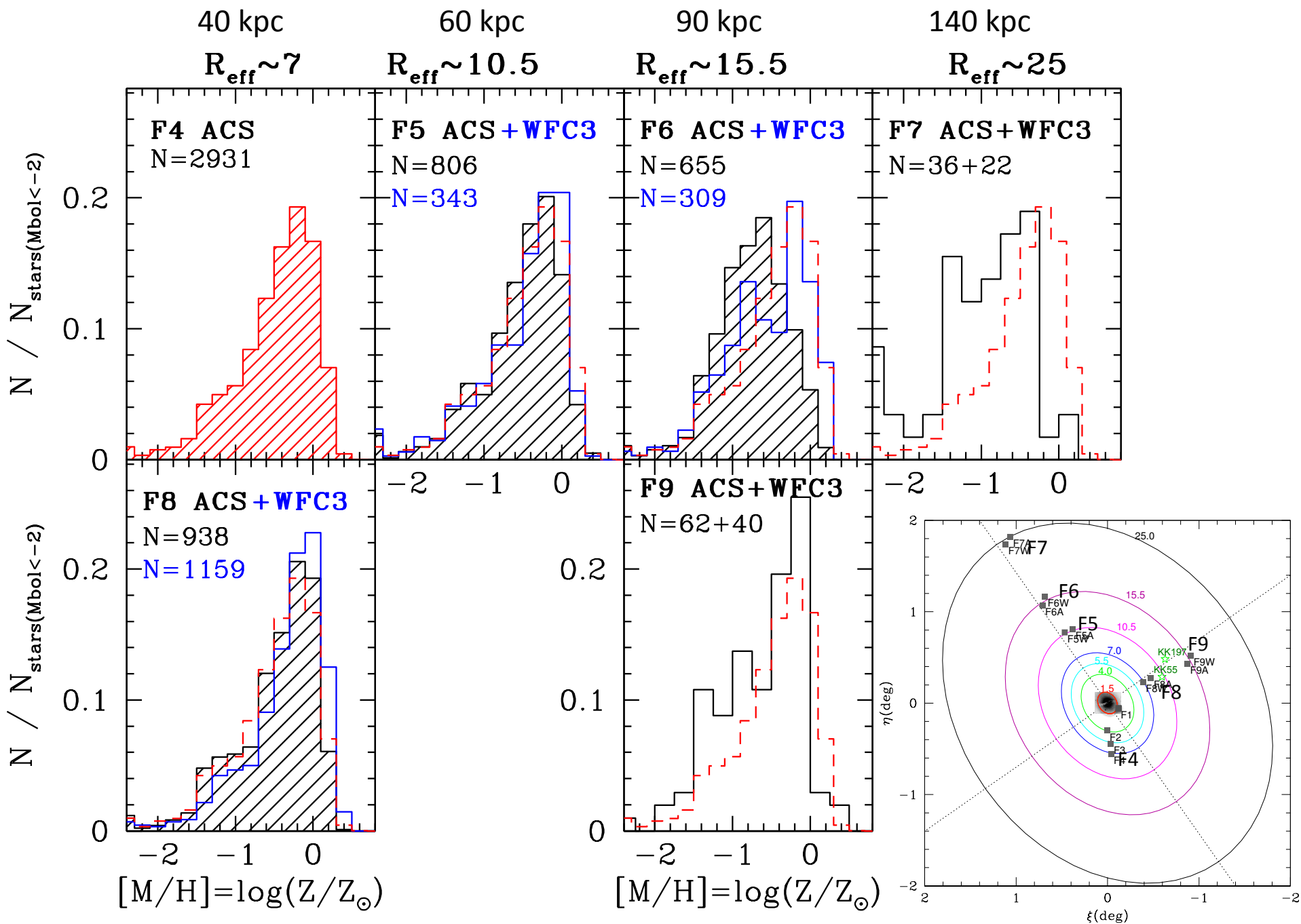
MW foreground simulation:

TRILEGAL 383+224 ($I > 24$)

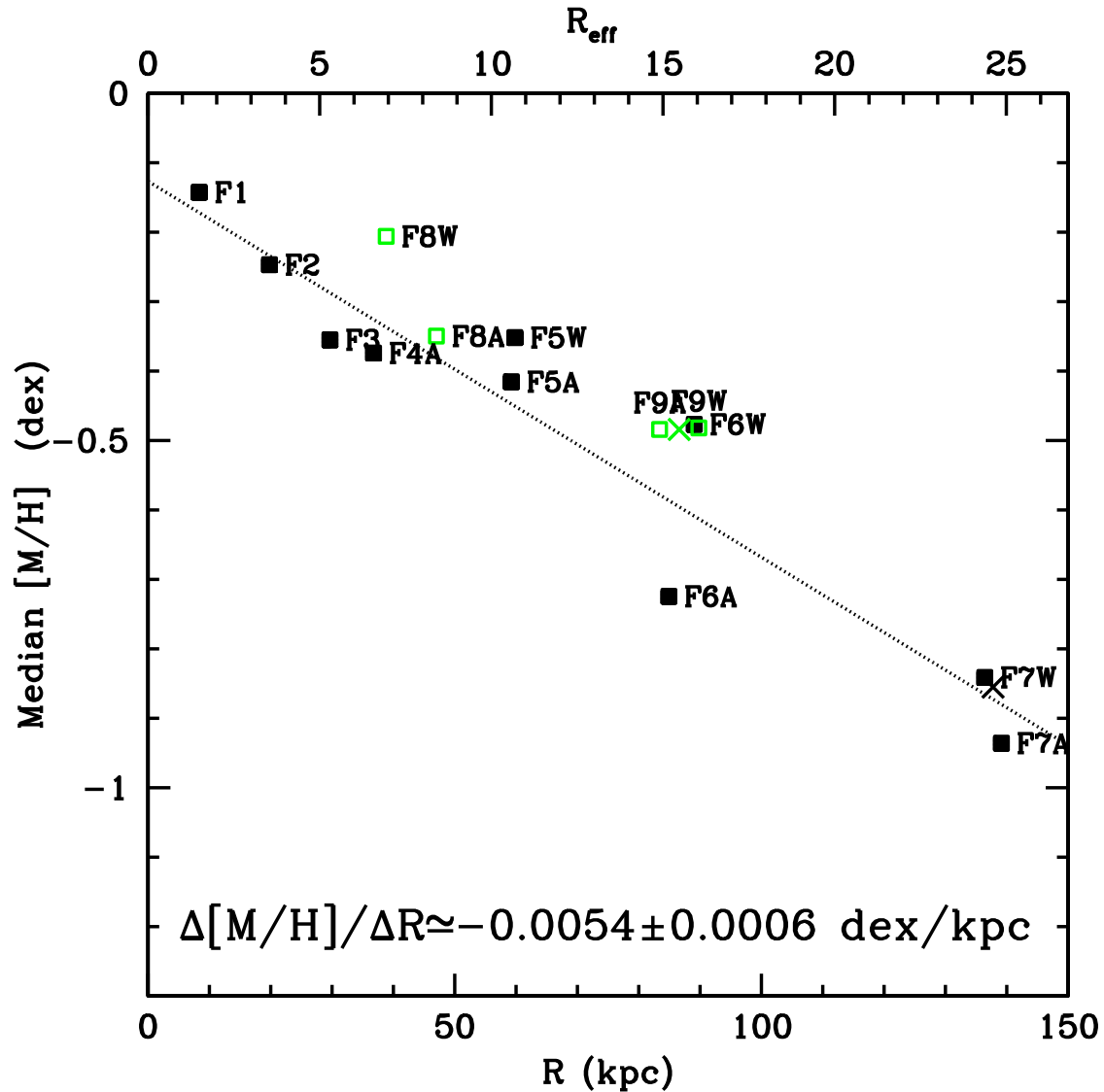
Besancon 103+68 ($I > 24$)



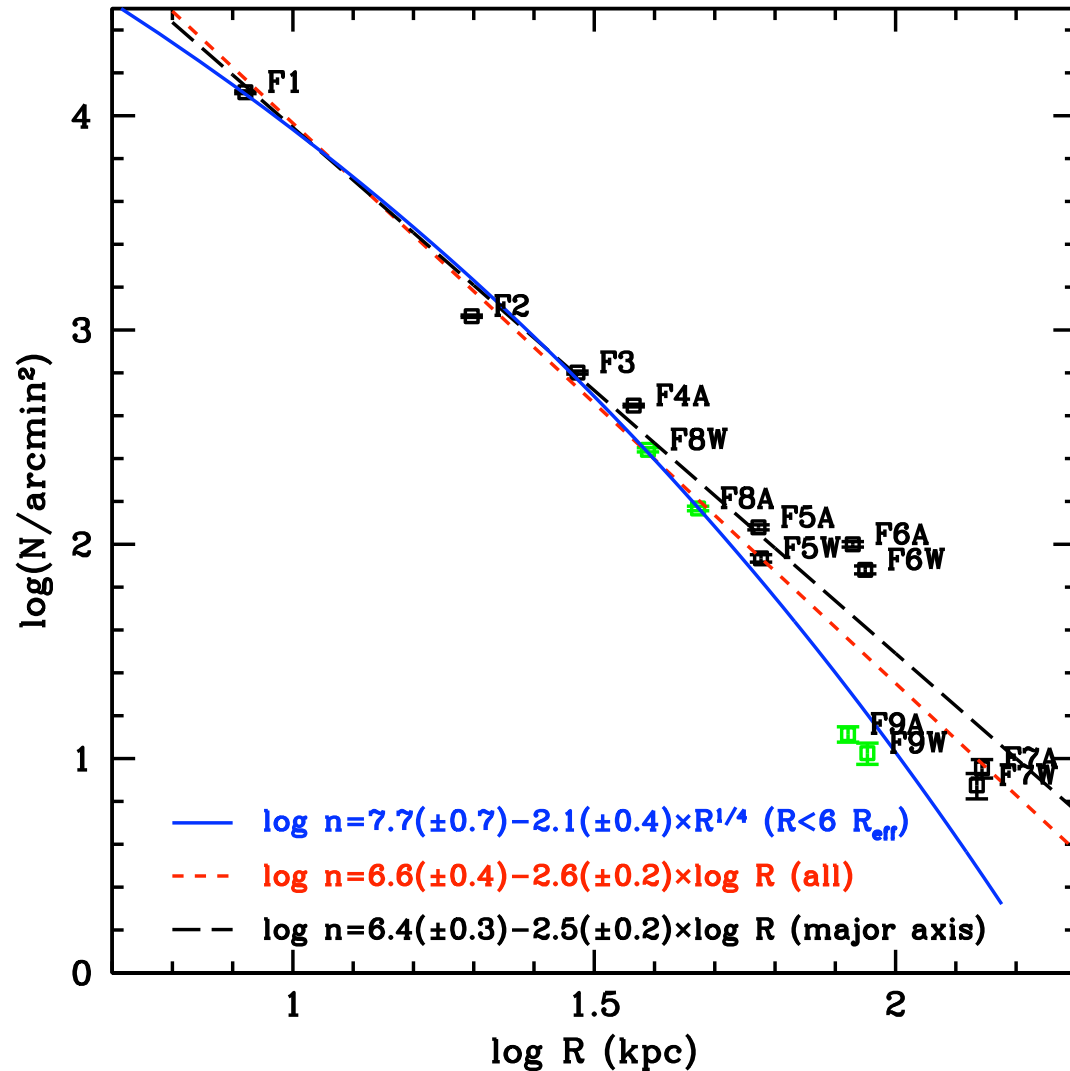




Halo Metallicity Gradient



Stellar Density Gradient



Summary

- The bulk of the NGC5128 halo stars formed at redshift $z \gtrsim 2$
- Fast chemical enrichment: 11-12 Gyr old stars have super-solar metallicity
- Metallicity and stellar density gradients mapped to 25 Reff
- Halo extends over the entire surveyed area:
 - 140 kpc along the major axis
 - elongated halo
 - high average metallicity

Rejkuba, Harris, Greggio, Harris, Jerjen, & Gonzalez, 2014, ApJ, 791, L2



Baryons at Low Densities: the Stellar Halos around Galaxies

Published: 10 Oct 2014

ESO Workshop, ESO Headquarters, Garching, Germany, 23–27 February 2015

Stellar halos are ubiquitous in luminous galaxies, but their low surface brightness hampers detailed study in distant galaxies. With the advent of large cameras and surveys, several late- and early-type galaxies have revealed similar low luminosity extended structures. These halos have complex morphologies with multiple stellar components, kinematics and substructures indicating the merger history. The halo morphologies resemble the density maps from cosmological simulations of galaxy formation in a hierarchical Universe.

<http://www.eso.org/sci/meetings/2015/StellarHalos2015.html>

Registration open