The Outer Halo of the Nearest Giant Elliptical

A VLT/VIMOS Survey of the Resolved Stellar Populations in Centaurus A to 85 kpc

ROYAL OBSERVATORY EDINBURGH

Denija Crnojević

THE UNIVERSITY of EDINBURGH

Collaborators:

A.M.N. Ferguson, M.J. Irwin, E.J. Bernard, N. Arimoto, P. Jablonka, C. Kobayashi

Giant ellipticals

- Cosmological context: build-up of giant ellipticals not fully understood

➢ two phase scenario: early in-situ star formation / cold accretion + (low?)-mass dry accretions (e.g. Naab et al. 07, 09; Kaviraj et al. 2009; Oser et al. 10, 12)

=> physical properties (gradients) in galaxies' outer halos = tracers of formation mechanisms

➢ only recently radii beyond effective radius starting to be probed – observationally demanding!

(e.g. Weijmans et al. 2009; Spolaor et al. 2010a,b; Coccato et al. 2010a,b; Tal & Van Dokkum 11; Greene et al. 2012; La Barbera et al. 2012, ...)

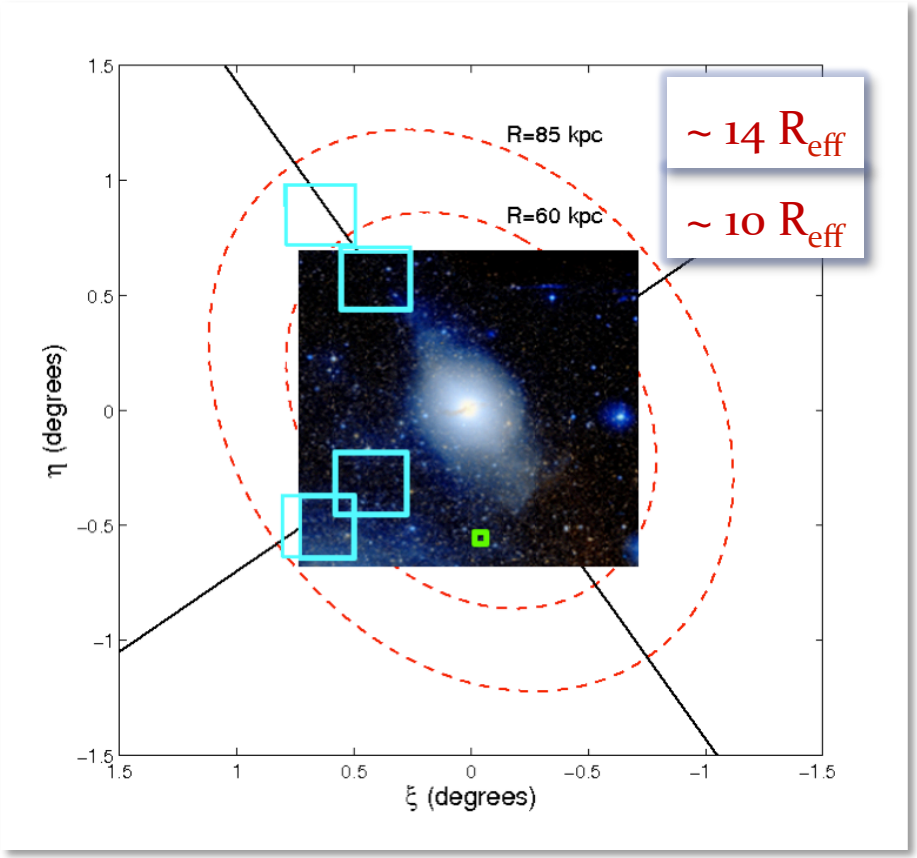
Centaurus A

- CenA: closest giant elliptical galaxy (M_V = -21.5, M~ 10^{12} $M_\odot$; e.g. Israel 98, Woodley et al. 10)
- "Peculiar": recent merger event, active nucleus, strong radio emission

  => need for large scale survey to understand evolution !

Centaurus A

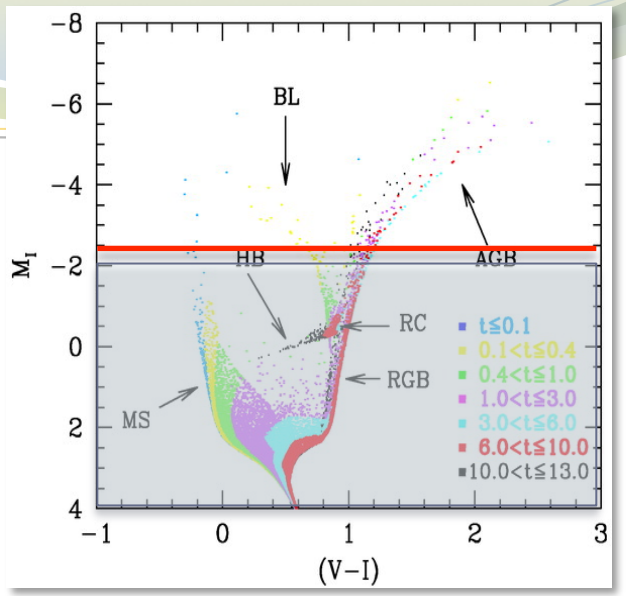
- VIMOS @ VLT : first large scale survey of resolved stellar populations in CenA remote outer halo (VIMOS@VLT), out to ~85 kpc !

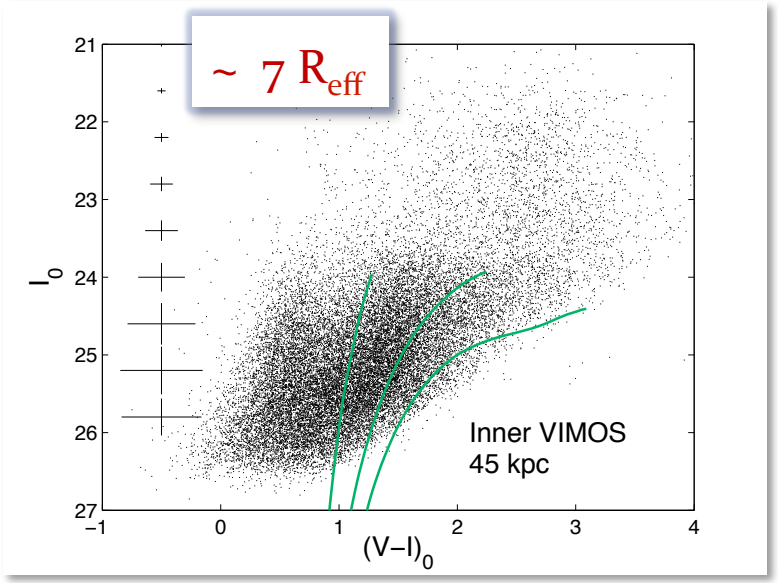


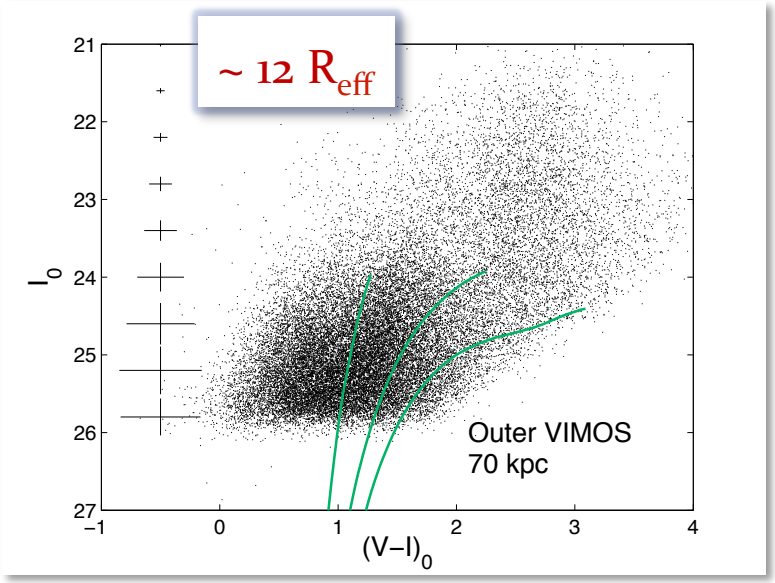
Crnojević, Ferguson, Irwin, et al. 13, MNRAS, 432, 832

Centaurus A

- old red giant branch detected out to
  ~14 R_{eff} (major axis) / ~11 R_{eff} (minor axis)







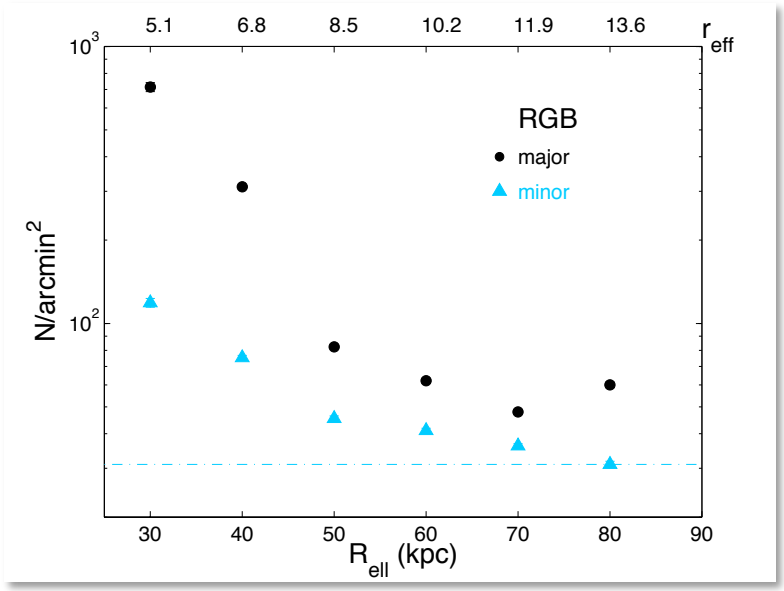
Centaurus A

- old red giant branch detected out to

  ~14 R_{eff} (major axis) / ~11 R_{eff} (minor axis)

- prominent stellar overdensity along major axis at R < 10 R_{eff} (in both old and intermediate-age populations)

  -> faint tidal debris from recent merger event ? change in ellipticity ?



 dc@roe.ac.uk

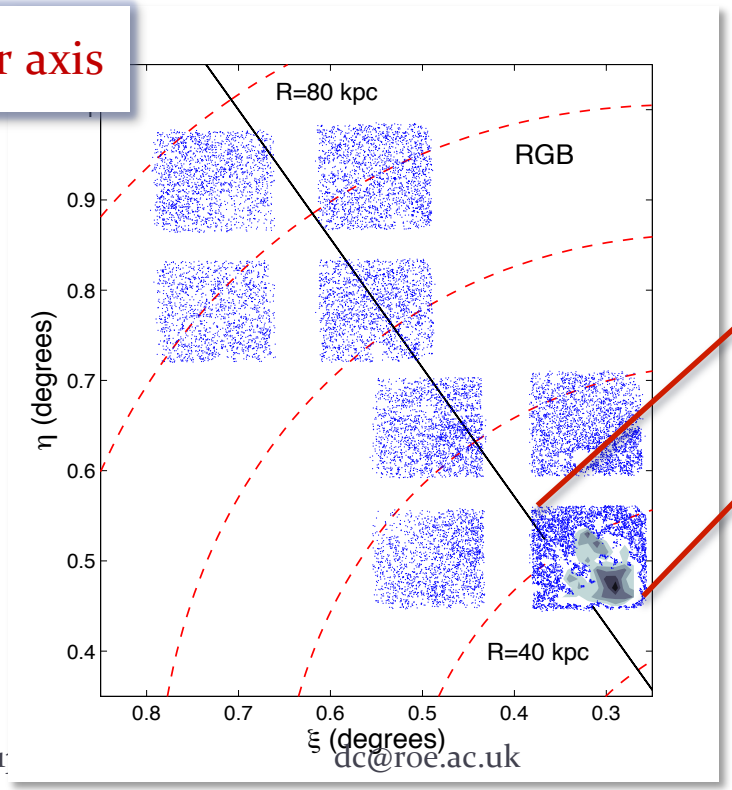
Centaurus A

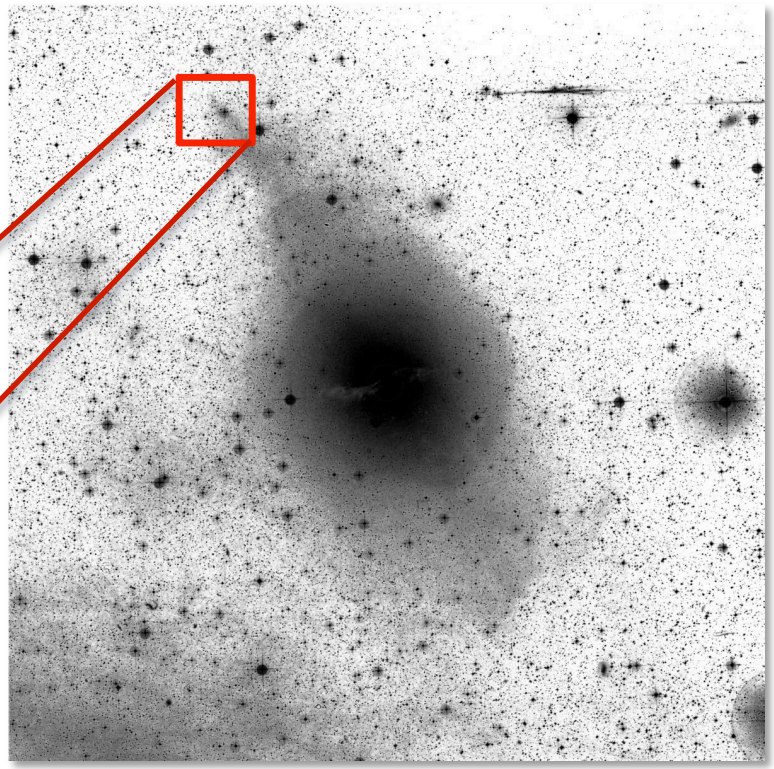
- old red giant branch detected out to

  ~14 R_{eff} (major axis) / ~11 R_{eff} (minor axis)

- prominent stellar overdensity along major axis at R < 10 R_{eff} (in both old and intermediate-age populations)

major axis

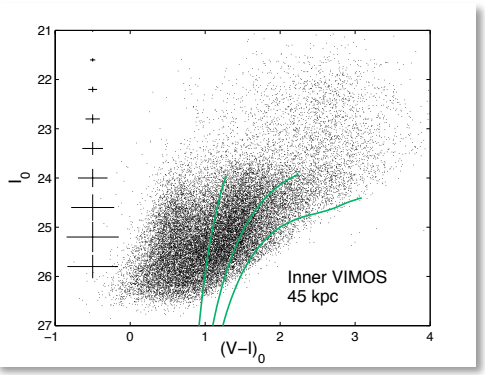




dc@roe.ac.uk

Centaurus A

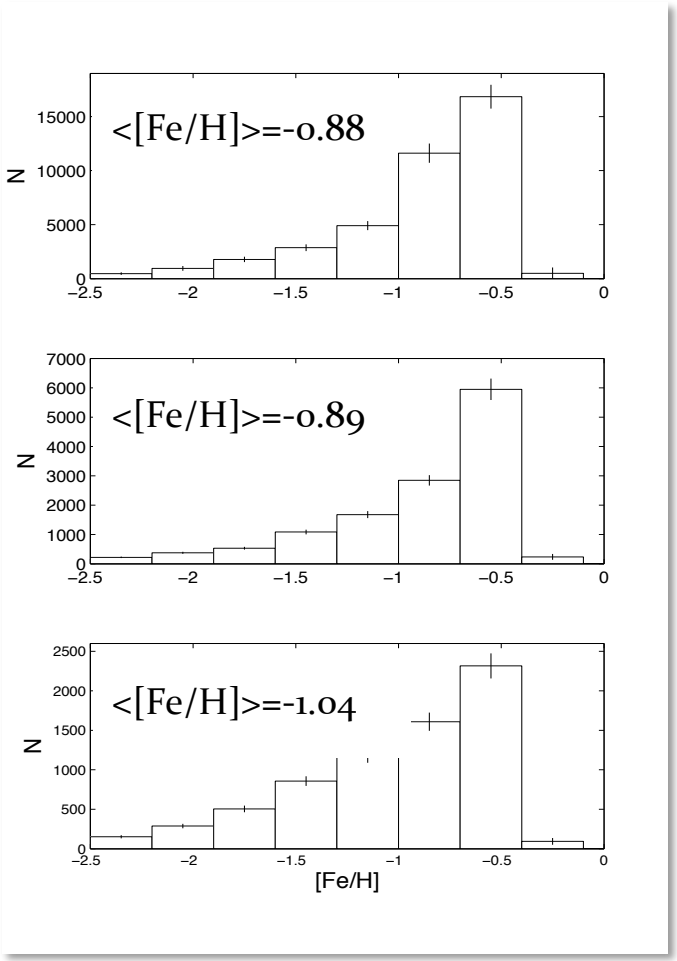
- photometric metallicity distribution functions -> shallow metallicity gradient (~ 0.2 dex; see also Harris et al. 99/00/02/07, Rejkuba et al. 05/11)



major axis

~ 7 R_{eff}

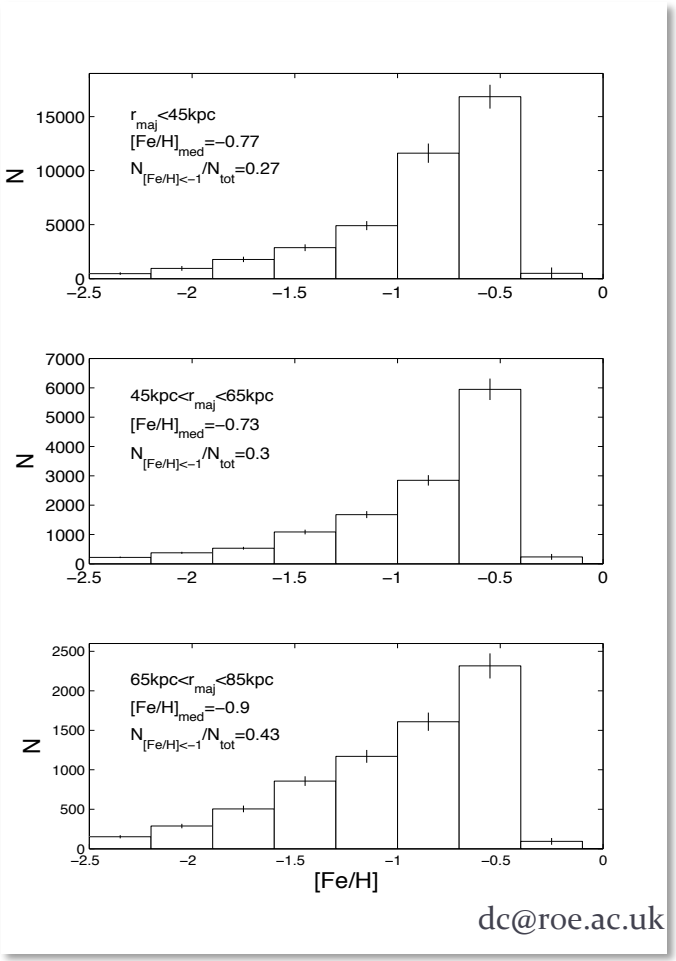
~ 14 R_{eff}



 dc@roe.ac.uk

Centaurus A

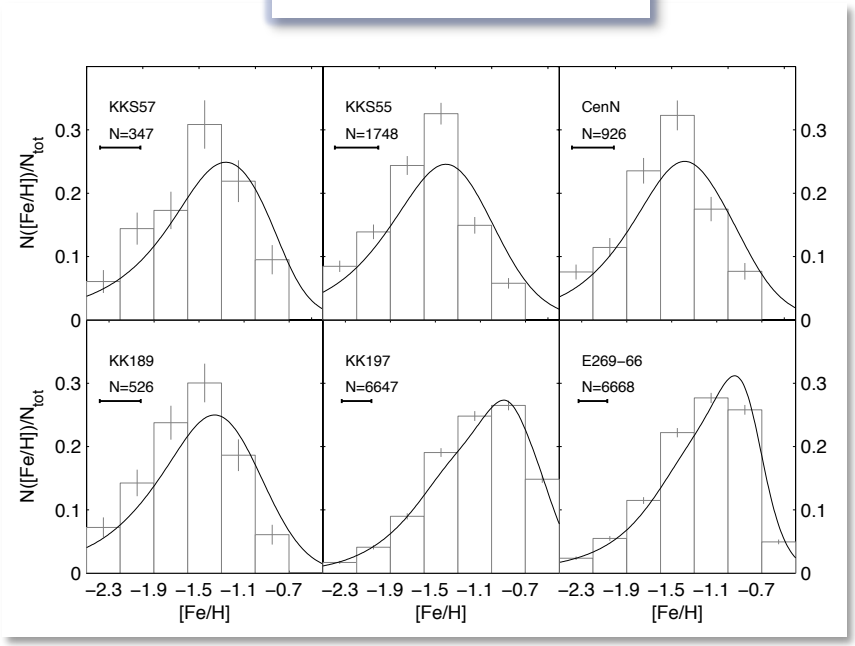
- photometric metallicity distribution functions -> shallow metallicity gradient (~ 0.2 dex; see also Harris et al. 99/00/02/07, Rejkuba et al. 05/11)



?

$= \sum$

dwarf satellites



dc@roe.ac.uk

Centaurus A

- photometric metallicity distribution functions -> shallow metallicity gradient (~ 0.2 dex; see also Harris et al. 99/00/02/07, Rejkuba et al. 05/11)

→ models predict few mergers with ~1:5 mass ratio, consistent with our results

→ metallicity break to be expected at even larger distances ?

→ need tailored simulations to dissect formation history of Cen A's halo ! (e.g., Kobayashi 04)

Summary

- Key observables for ellipticals' evolution => galaxy outskirts
- CenA : closest giant elliptical, unique target for large radii studies
- first large scale survey of resolved stellar populations in CenA outer halo
  1. ***larger extent than expected / ever probed in individual elliptical***
  2. ***first resolved large scale substructure***
  3. ***mild metallicity gradient out to the furthermost radius probed***

Crnojević, Ferguson, Irwin, et al. 13, MNRAS, 432, 832

dc@roe.ac.uk