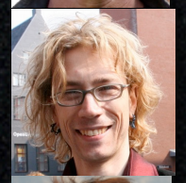
High-multiplex spectroscopy
for
resolved stellar populations
in
dwarf galaxies
after
DART

P. Jablonka
&
G. Battaglia

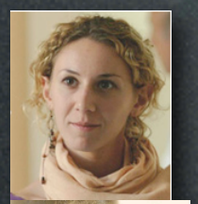
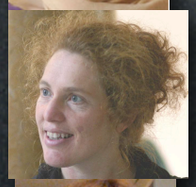
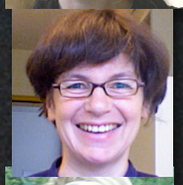
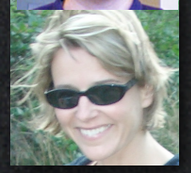
Recent observational results and open questions

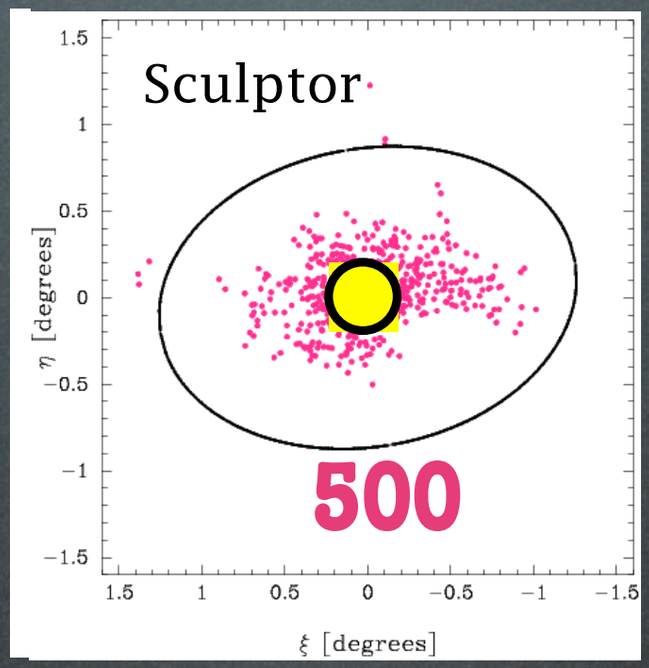
DART
Dwarf Abundances and Radial velocity Team

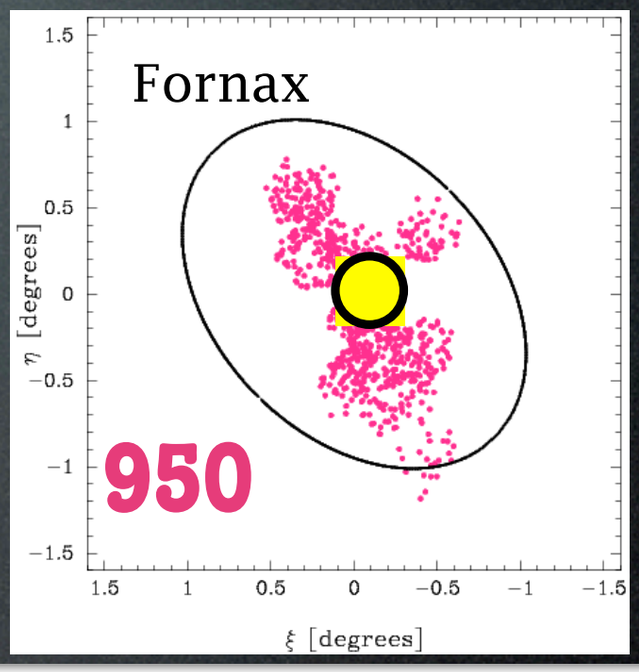


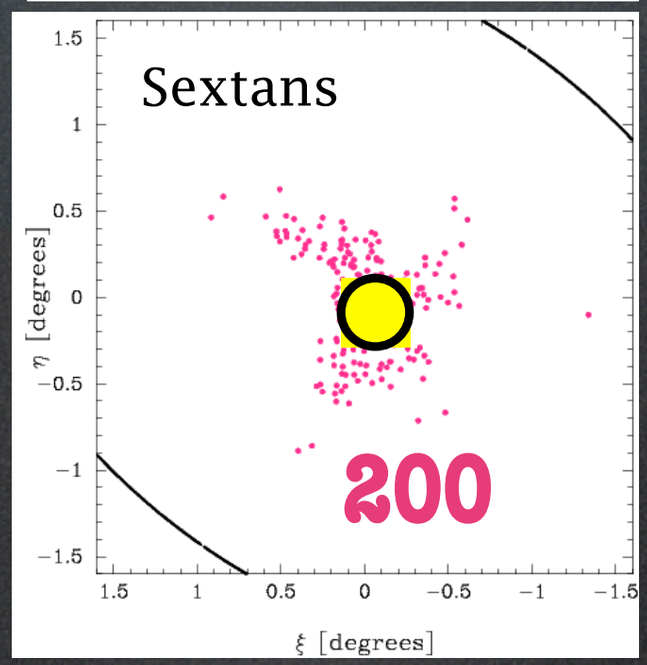



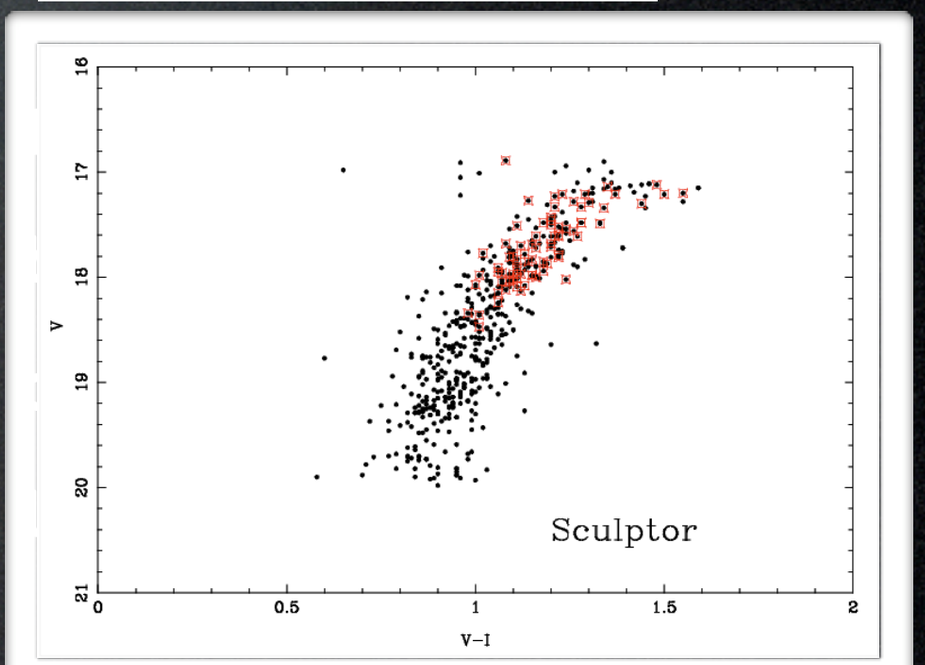
E. Tolstoy
G. Battaglia
A. Helmi
V. Hill
M. Irwin
P. Jablonka
B. Letarte
K. Venn
+
Y. Revaz
E. Starkenburg
T. De Boer







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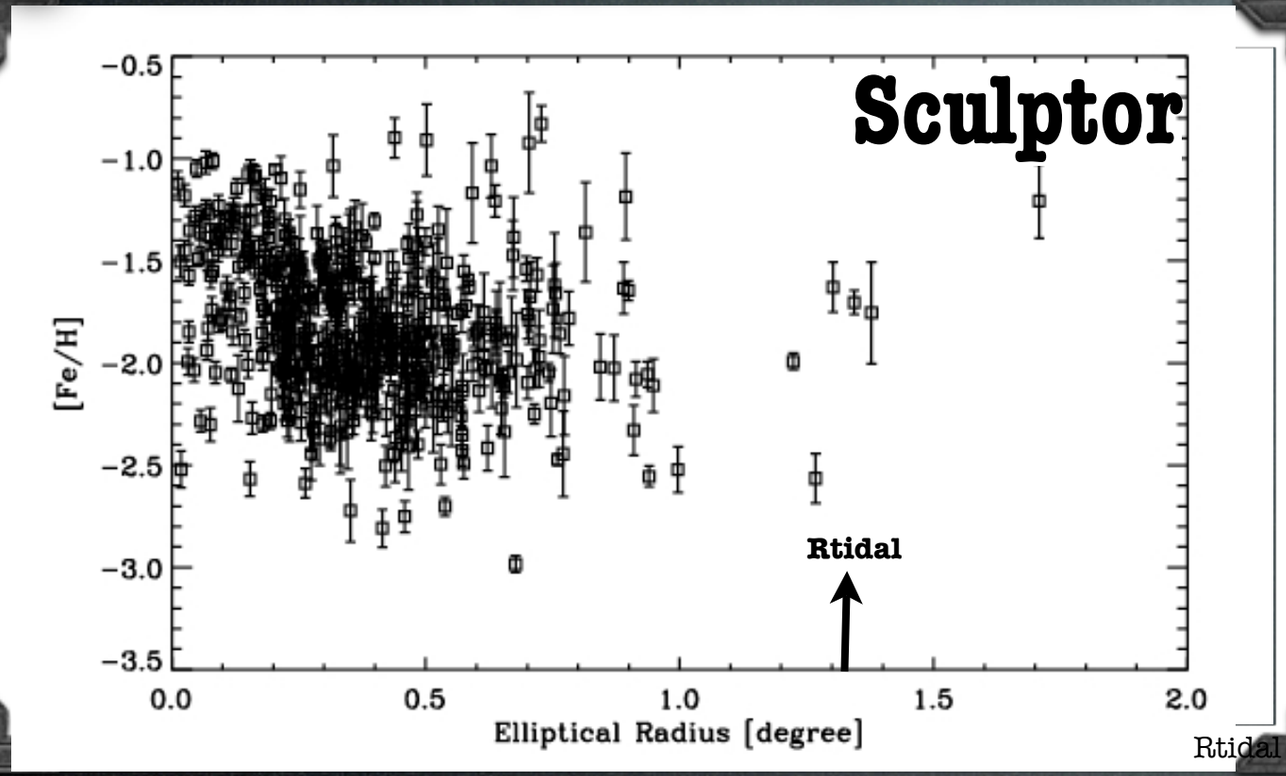
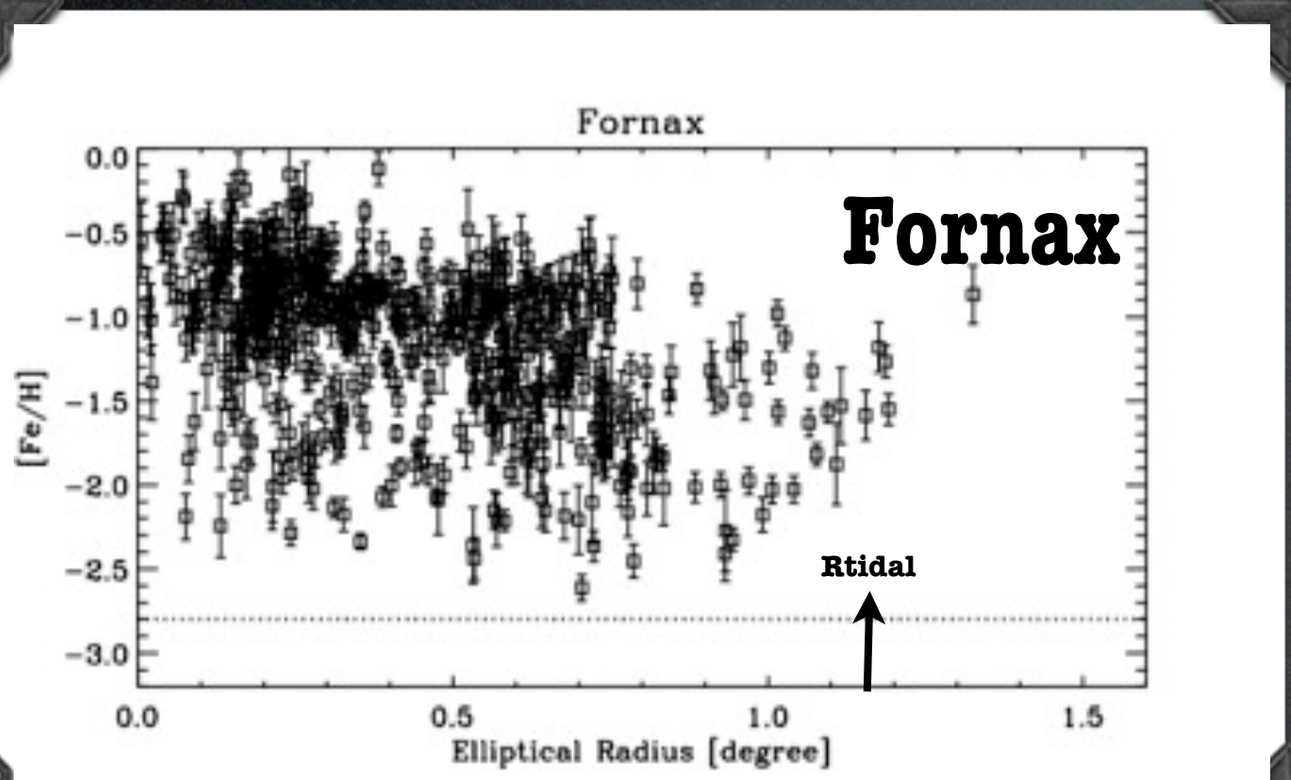


Rtidal



Tolstoy et al. 2004, Battaglia 2007

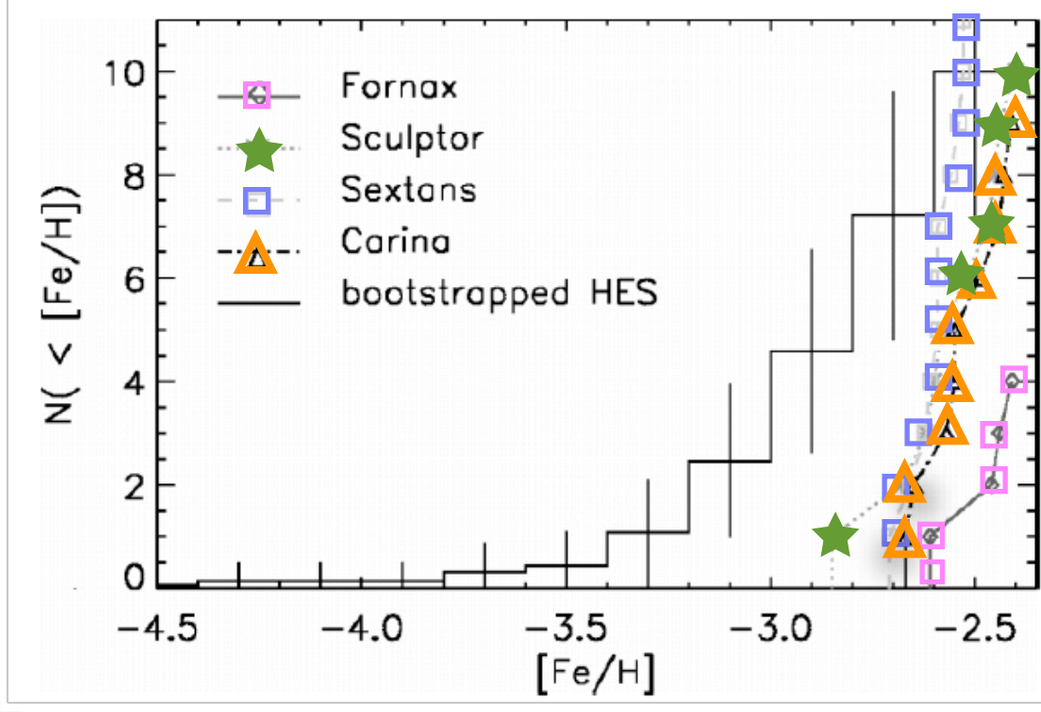
2 stellar components in Sculptor
3 stellar components in Fornax

Each stellar population component has a preferential spatial location and distinct kinematics.

The most metal-rich stars are more centrally concentrated and dynamically colder.

Battaglia et al. 2006

Recent observational results and open questions

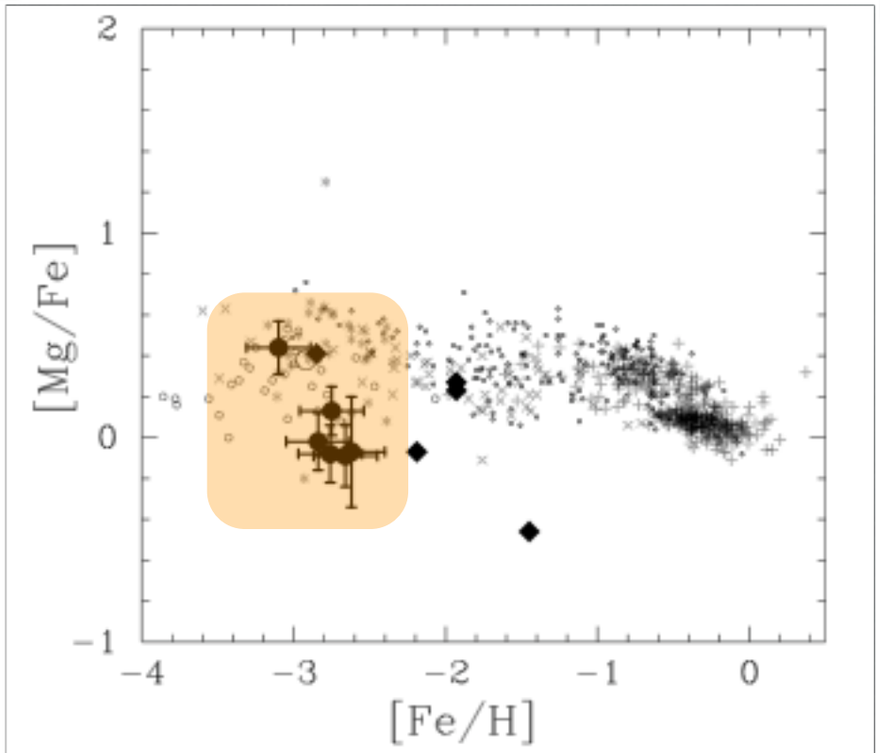


Helmi et al. 2006

The low metallicity tail of the dSphs seems to differ from that of the Milky Way halo.

This is a fundamental question for galaxy evolution, a test for ΛCDM, to be confirmed with high resolution spectroscopy

Recent observational results and open questions



Aoki et al. 2009

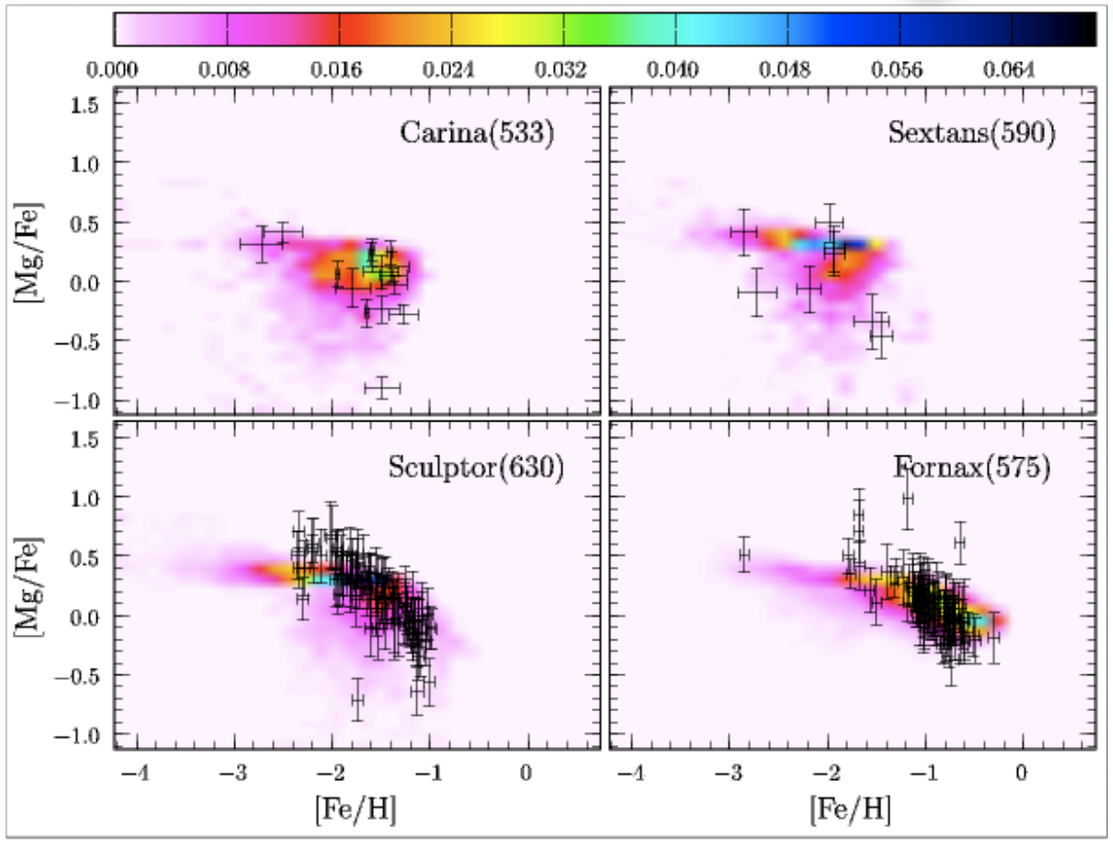
Surprising spread in [Mg/Fe] at low metallicity, result of only a few nucleosynthesis events.

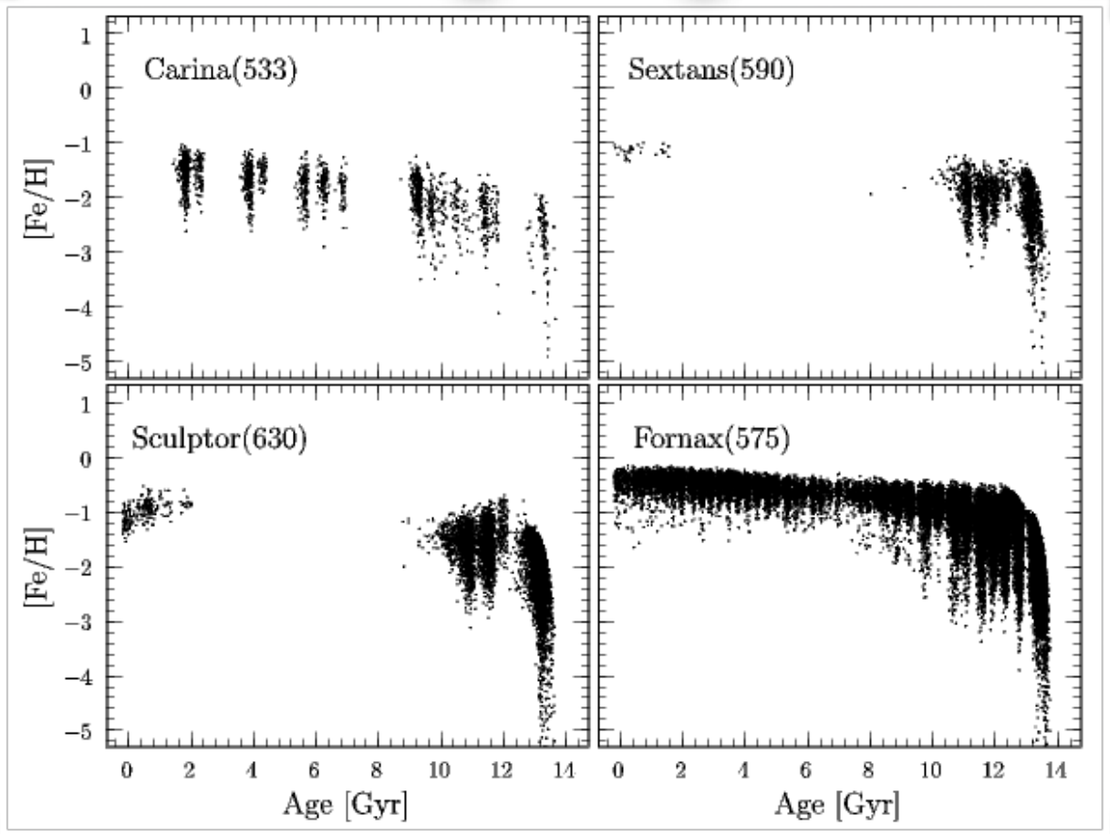
SNIa are not expected to contribute much at [Fe/H] < -2.5 Moreover, Ba is low, implying no significant contribution of intermediate-mass AGB stars that yields heavy neutron-capture elements by the s-process.

Conclusion: The spread is due to the contribution of SNe II with different masses.

How is that representative of the full galaxy SF history ?
A statistical meaningful sample of stars is needed.

Recent modeling results and open questions





Star formation occurs in series of peaks.

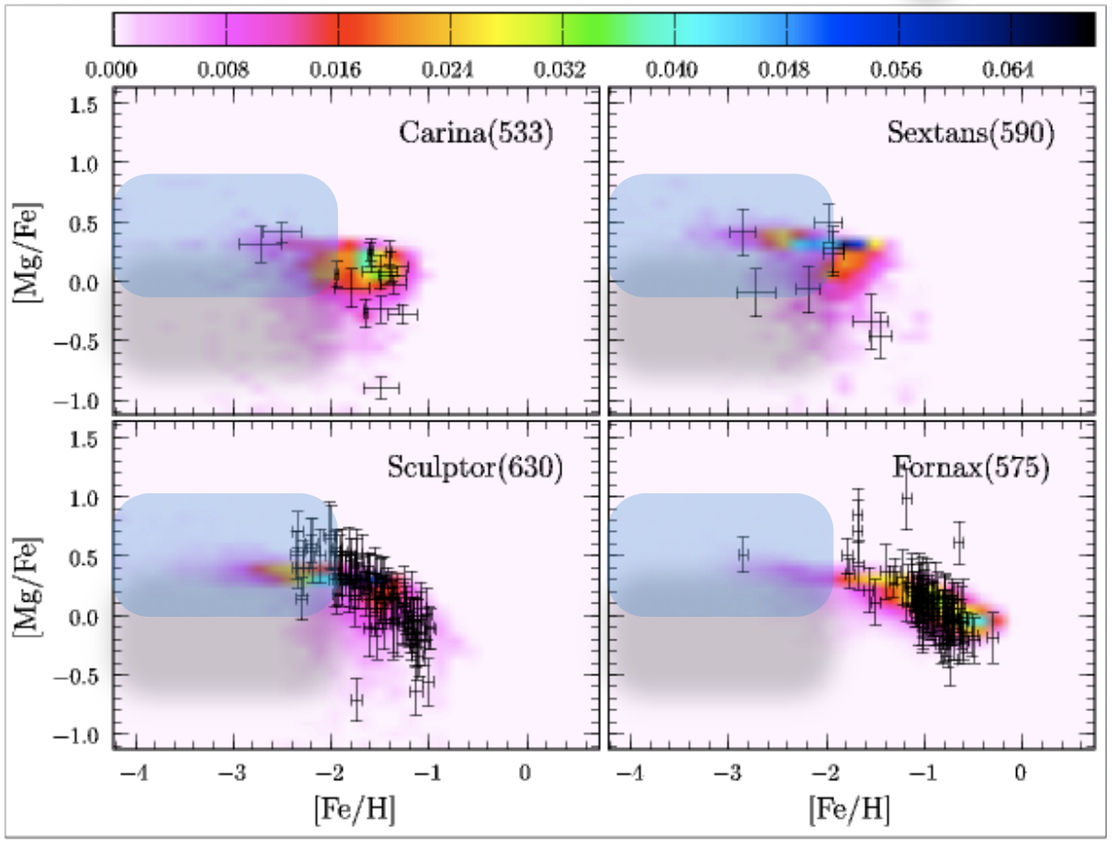
Fornax and Carina are examples of high and low frequencies.

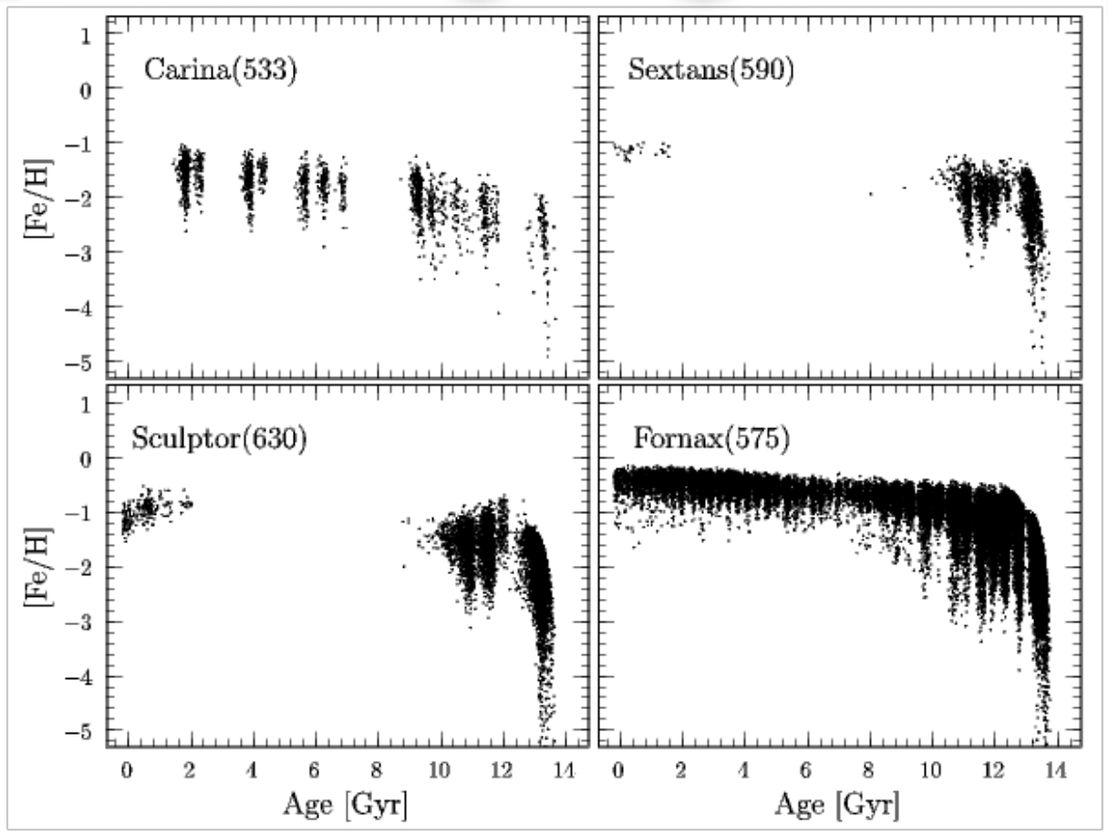
Revaz et al. 2009

Large samples at high resolution are required to identify the stellar density peaks in the abundance ratio diagrams.

Investigation at low metallicity is mandatory to tackle the question of spread in abundance ratio in the early stages of galaxy evolution. This implies to sample the outer galactic regions

Recent modeling results and open questions





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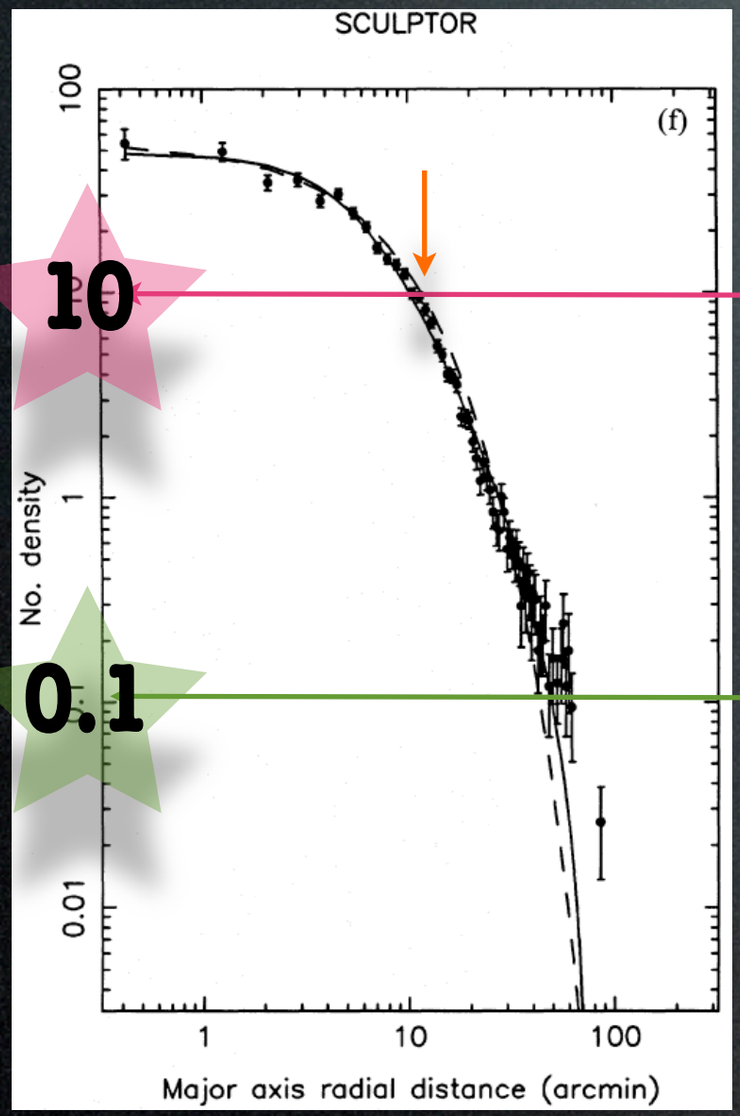
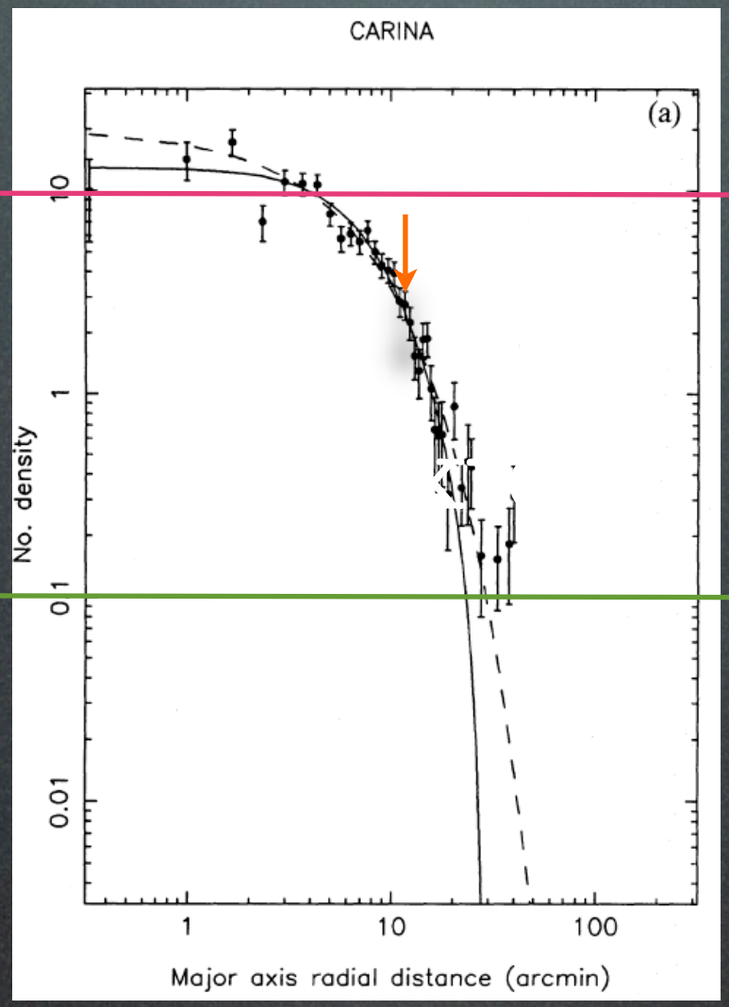
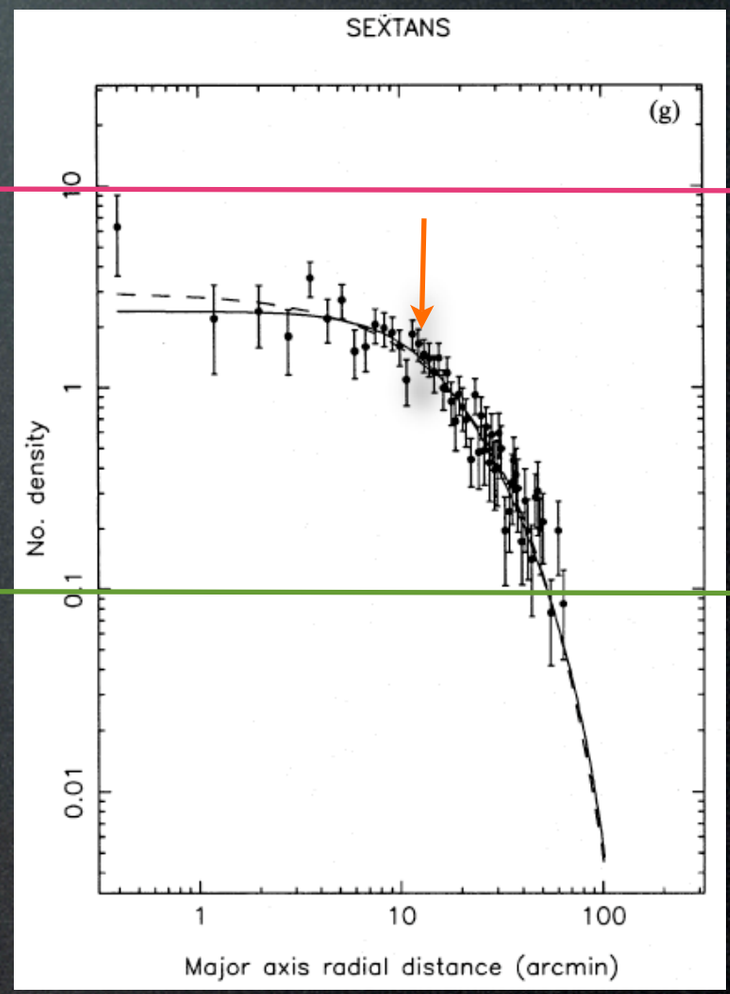
Status

From Irwin & Hatzidimitriou 1995 : nb per arcmin²





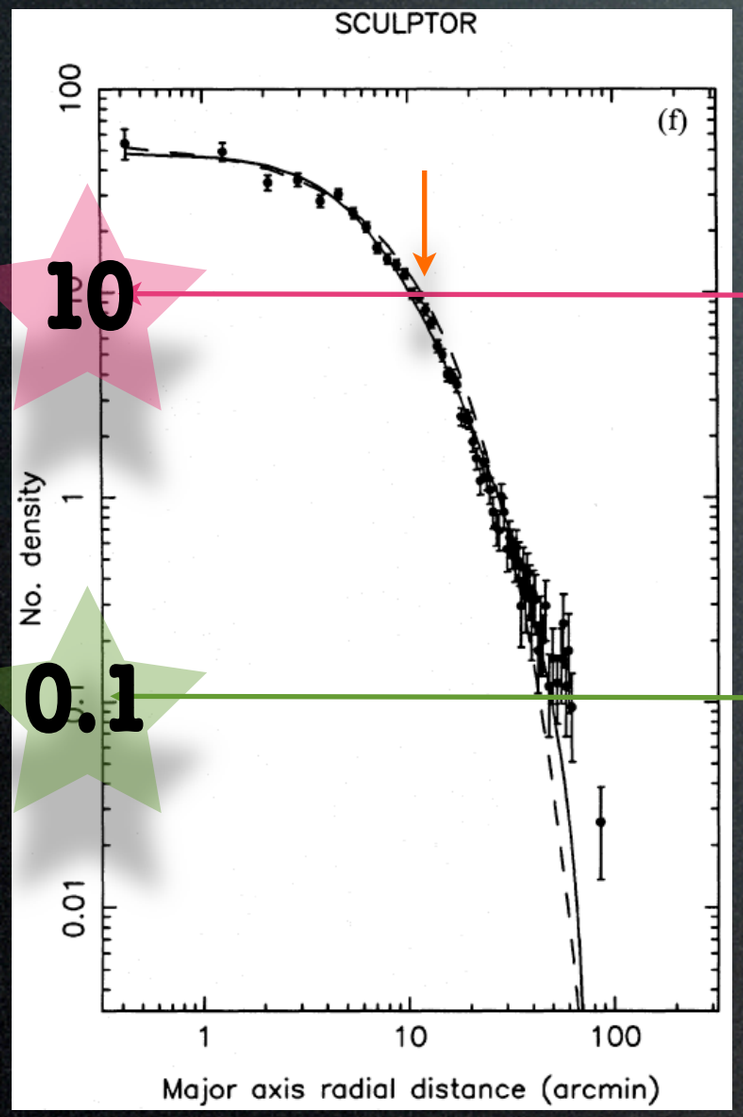


10

0.1

Status

RGB stars at V< 20 mag



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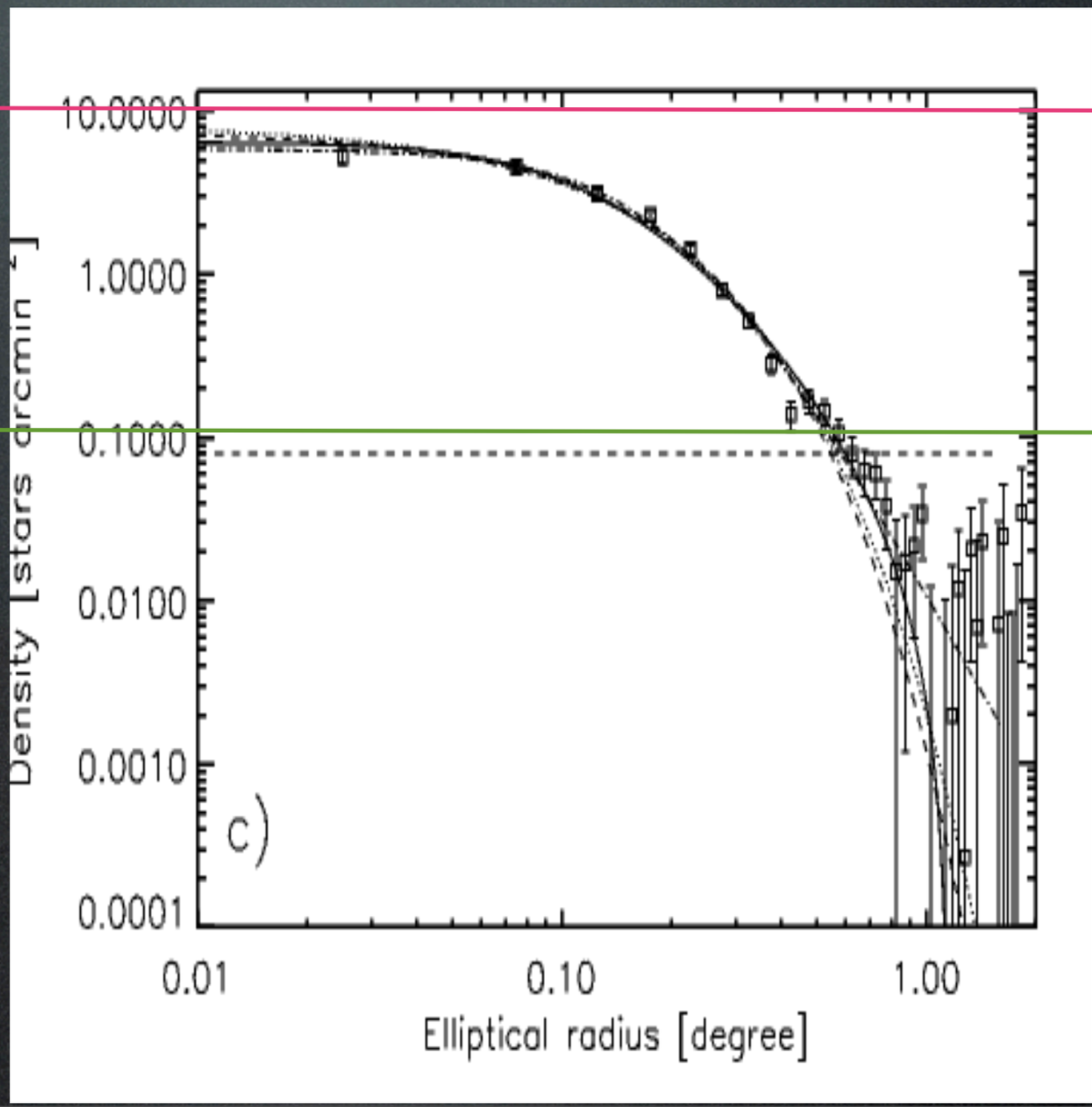
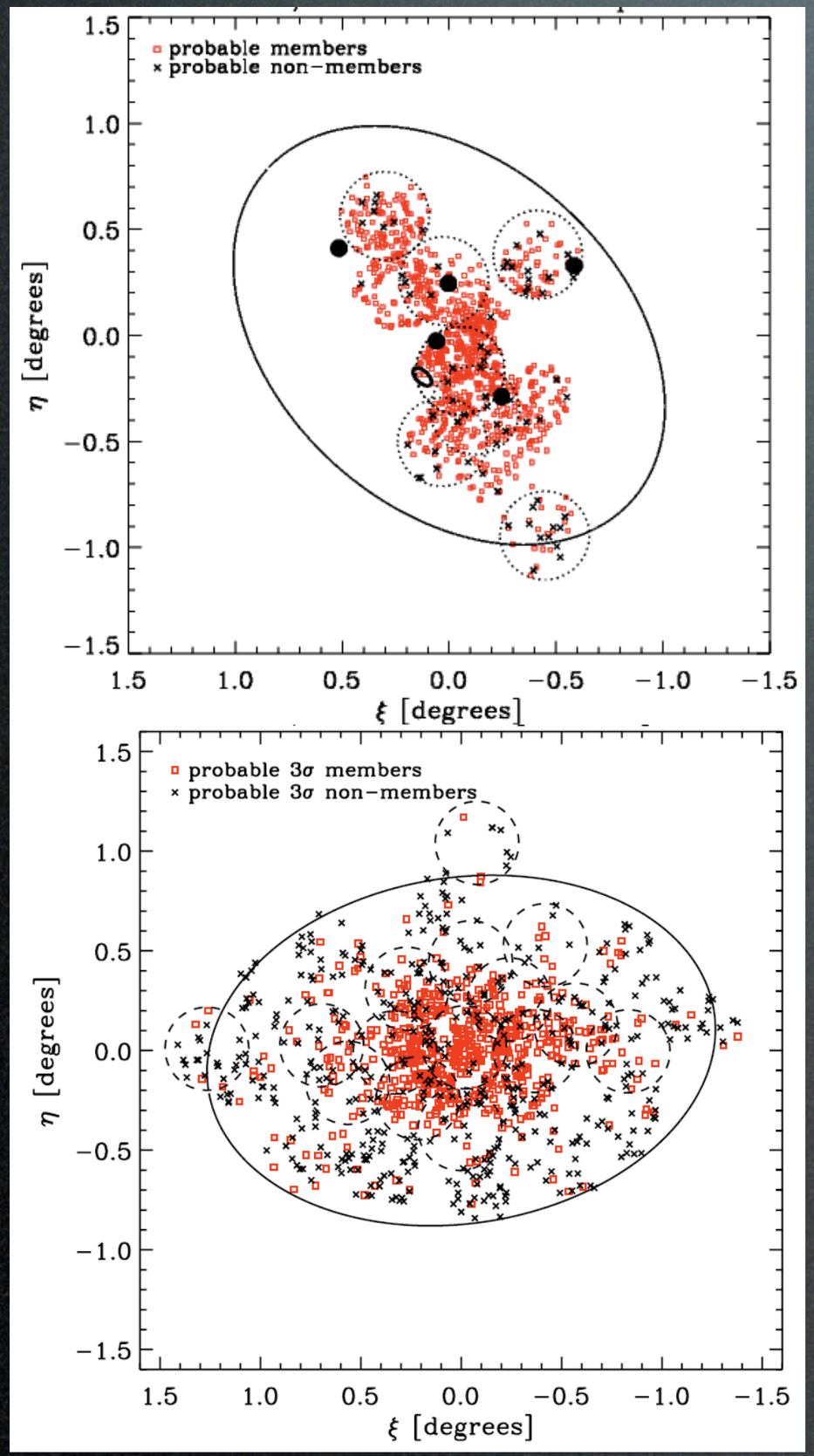


Status

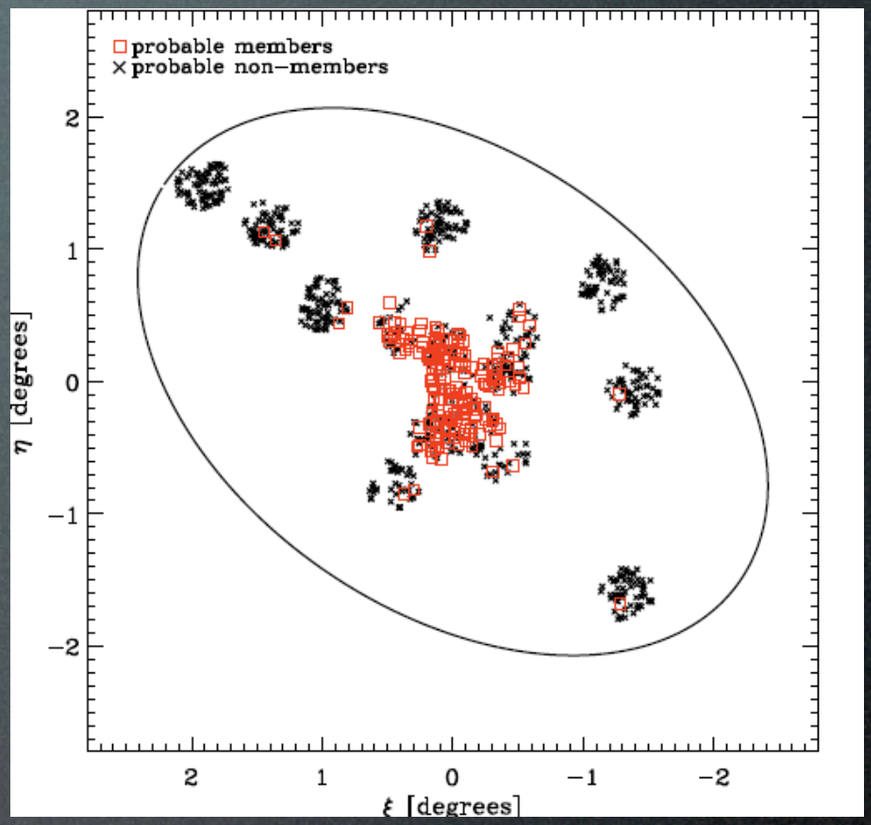
Fnx

138 kpc



85 kpc

Scl



Sex

86 kpc

- **New Faint dSph (SDSS) and how many more ?**

Status

Flames FoV : 25 arcmin

Giraffe : 21 hours per field (534-696nm): HR10, HR13, HR14
Fe,O, Mg, Al, Si, Ca, Sc, Ti, Mn, Eu, Ba, La, Y, Cr, Li
Resolution between 20000 and 25000
For an average S/N =40 at V=18.5mag

UVES : FLAMES+UVES(580) (450-750nm), 8 hour star for S/N=40

- Blue λ range (400-500nm) needed (FeI at low-Z)

+

- For 100 stars @ [Fe/H]<-2.5, 10 fields for Fornax and Sculptor $\Rightarrow$ 560h

Requirements

Local Group dSphs gives unique access to nucleosynthesis conditions in external galaxies and offer precise tests to galaxy evolution scenarios. They need :

- ☑ **Large wavelength coverage at once: 400-900nm**
- ☑ **Medium to High resolution : 20 000 to 45 000**
- ☑ **High efficiency (S/N)**
- ☑ **100 - 200 fibers over 1-2 degrees**

Requirements

- Large wavelength coverage at once: 400-900nm
- Minimum resolution : 20 000
- High efficiency (S/N)