

S19A-QI060

Subaru Near-Field Cosmology Survey

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Subaru Near-Field Cosmology Survey (SNFC; S19A-QI060)

Cover 7 nearby disk galaxies with HSC 2 or 4 pointings each with g,i-bands
S19A-S20B 10 nights HSC Queue + S21A 1n, S21B 2.1n carry-over

Elucidate the dependence of stellar halos and thick disk properties in late-type galaxies based on the homogeneous observations/reductions/analyses

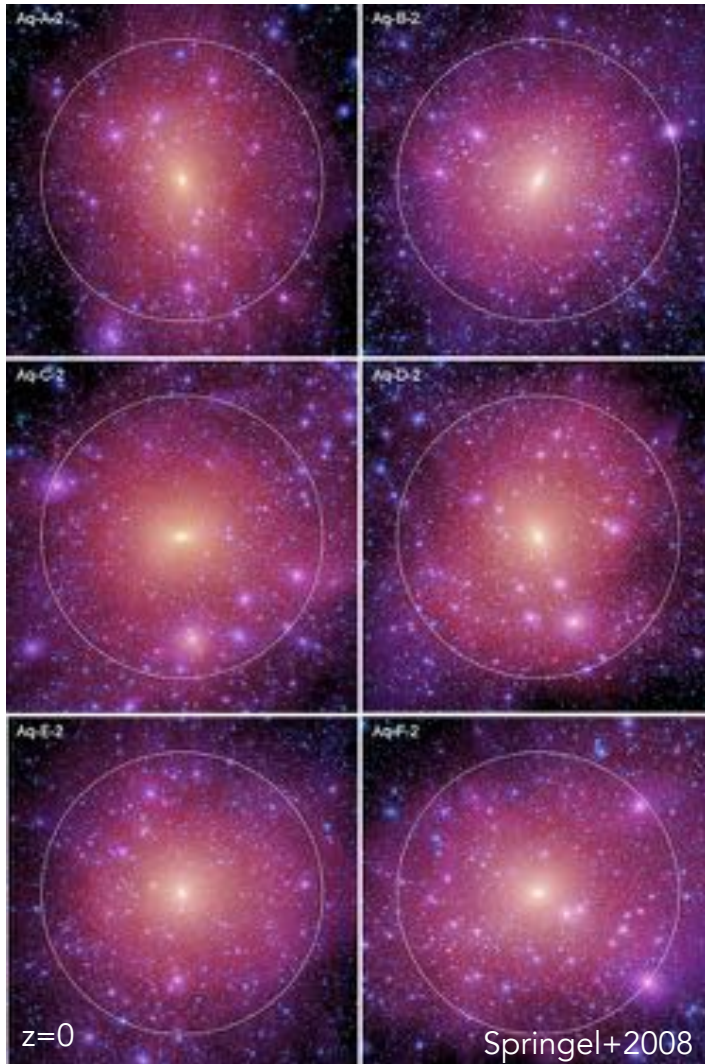
For individual galaxies:

- Verify stellar halo and thick disk existence and reveal their stellar populations
- Search new satellites, (sub-)structures, GCs, outlying young stellar systems
- Radial metallicity distributions of old population by RGB colors

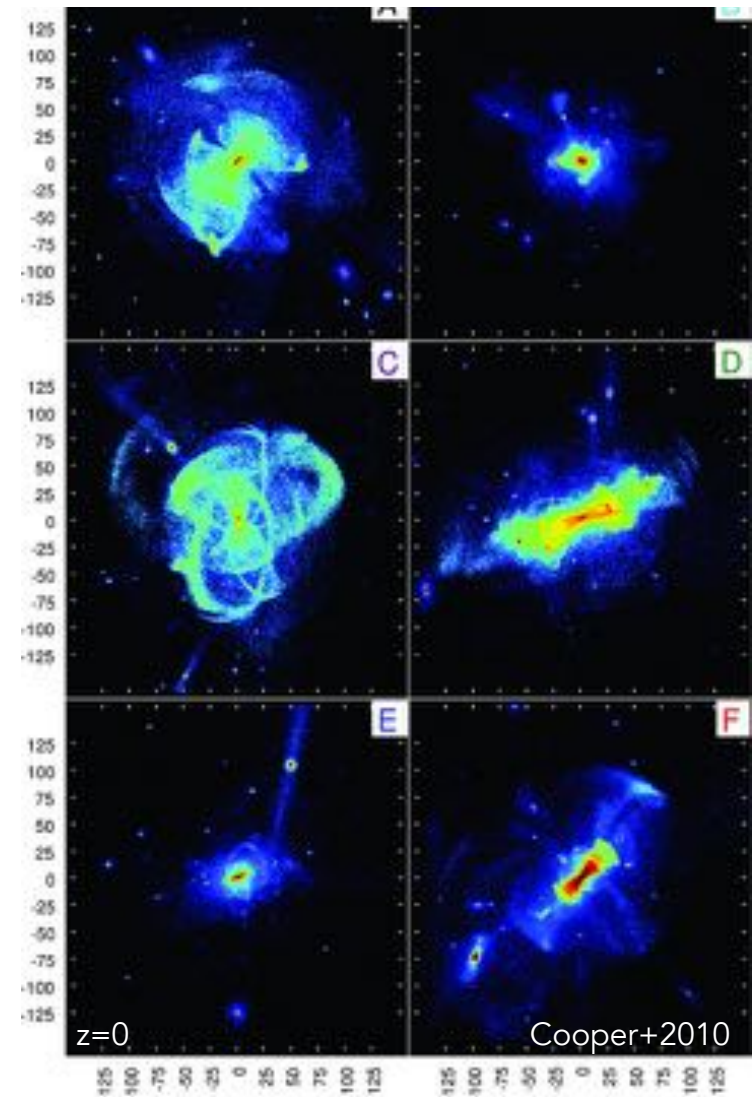
Using all target galaxies + existing samples:

- Clarify the dependence of stellar halos and thick disk properties in late-type galaxies on the luminosity/morphology/environment.
 - Compare halo radial profiles (power-law like MW, M31, M81?)
 - Thick disks of edge-on targets (N247, N253, N4244, N4236)
- Address the missing satellite problem with LFs/MDFs of satellites
- halo-to-halo scatter of the satellite abundance?

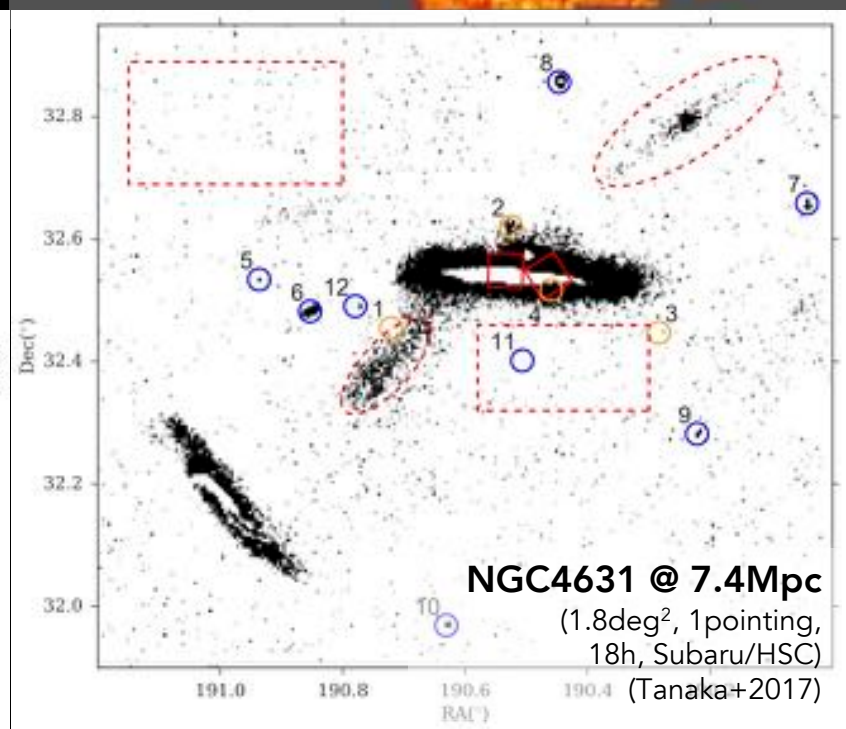
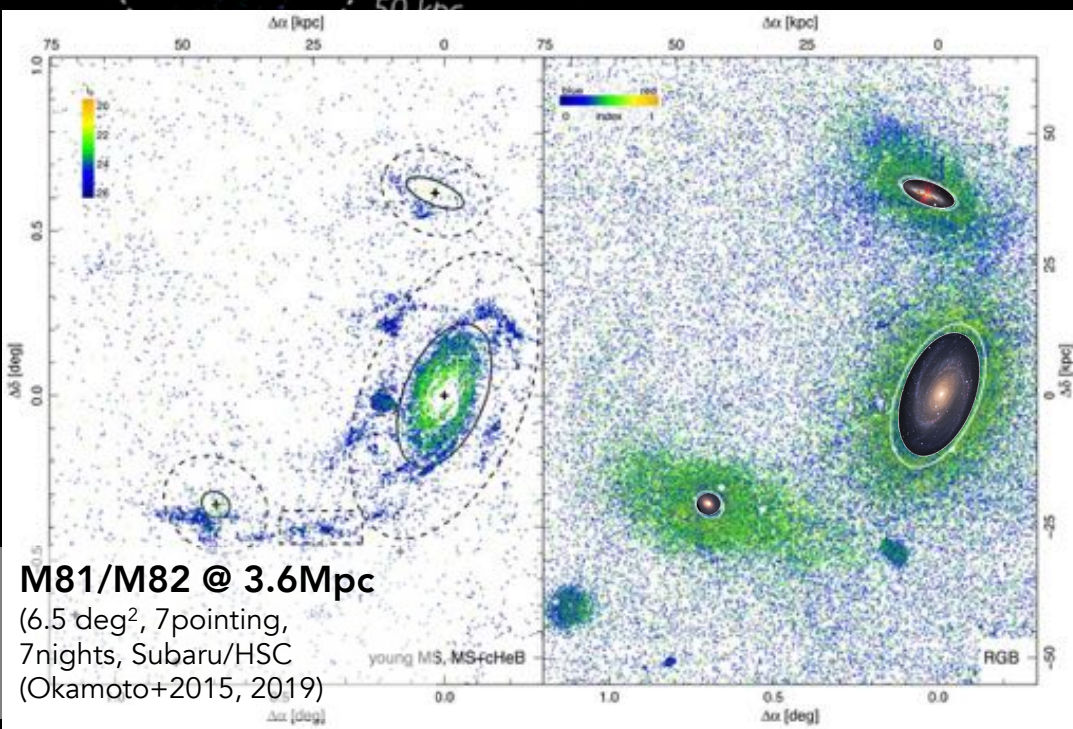
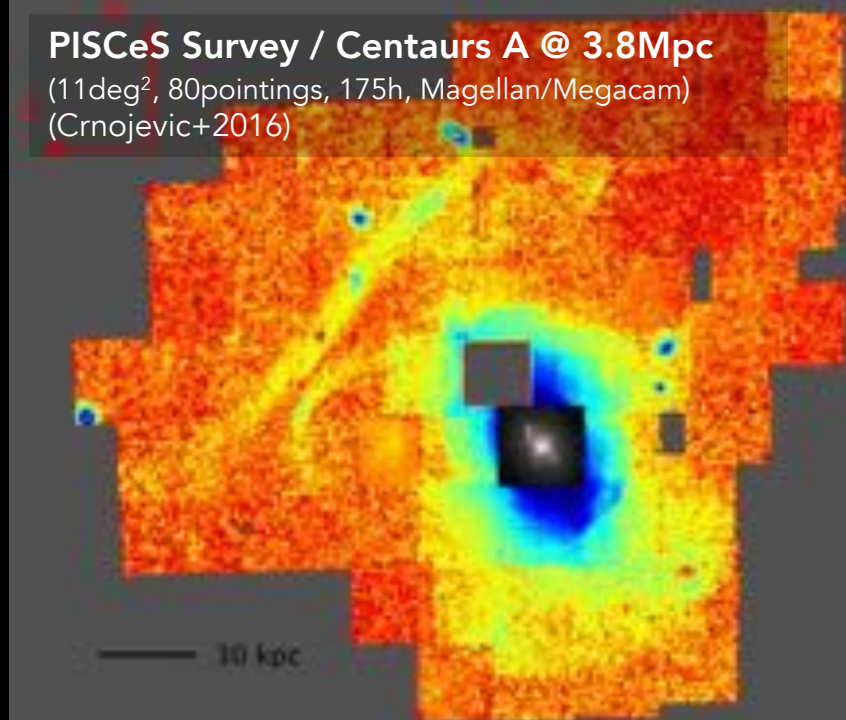
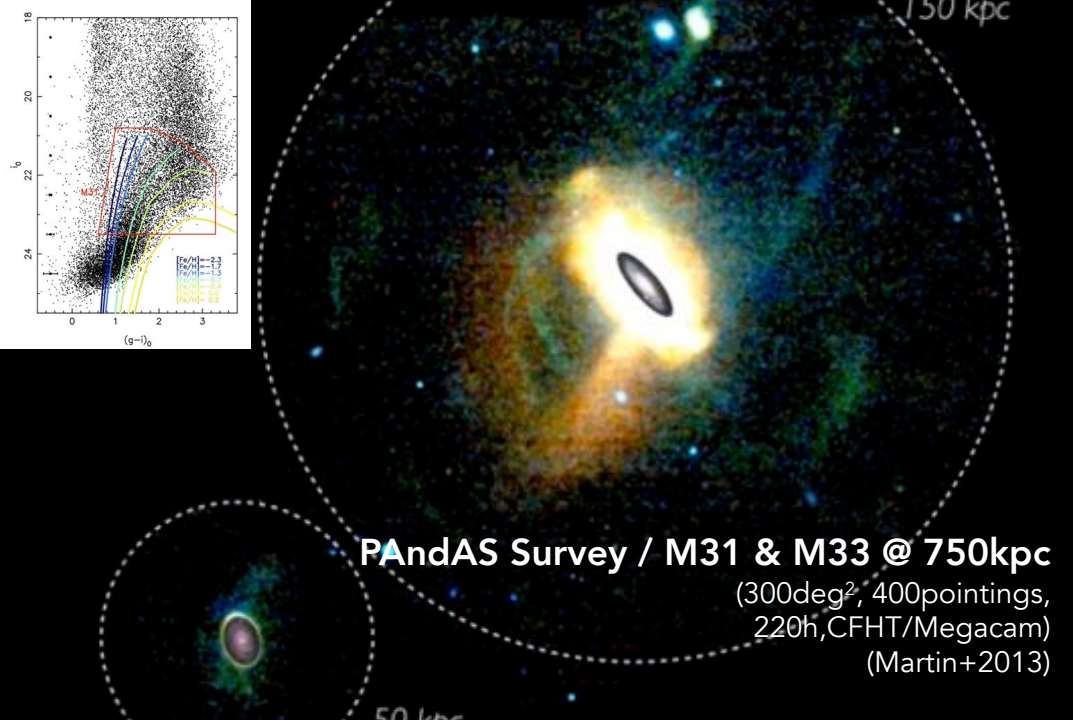
DM densities of MW-like galaxy halos



Stars born in satellites but now belonging to MW-like galaxies



In Λ CDM framework, galaxies having similar total mass may have different stellar halo fraction, radial density, the radial metallicity profiles, and the richness of substructures.



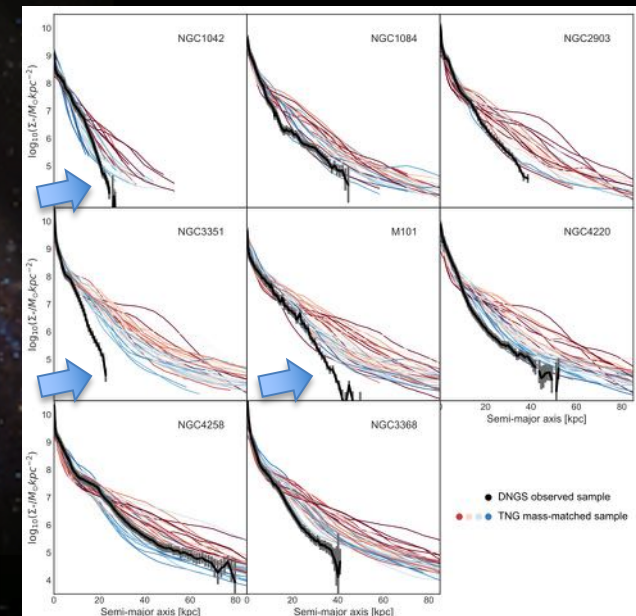
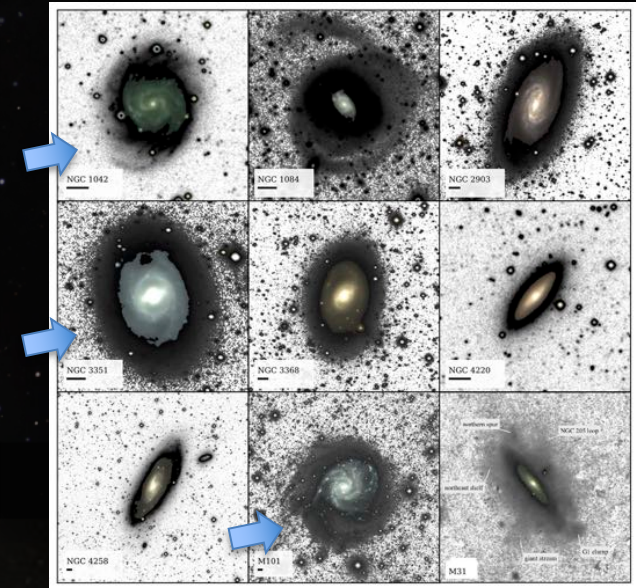
Integrated Surface Photometry:

a significant number of galaxies
lack of stellar halos?

Resolved Stellar Photometry:

- ✧ Reach well below the sky level ($>34\text{mag/arcsec}^2$)
- ✧ Direct proof of faint (sub-)structures
- ✧ Better constraint on Age/Metallicity of individual stars
- ✧ Less foreground/background contaminations
- ✧ Less influence of foreground cirrus and sky-subtraction
- ✧ Limited number of target galaxies ($< \text{a few Mpc}$)
- ✧ Require both **image depth** and **wide FoV**

Dragonfly telephoto array (Merritt+2016)



SNFC: target selection

Selection:

- Nearby galaxies $D < 5$ Mpc
- Not "dwarf" $M_B < -18.0$
- Visible from MK more than 3hours/night
- Galactic latitude $|b| > 30$ degree
- Variety of Morphological type, Mass, etc.

Target magnitude:

- 1.5mag below TRGB_i, $(g-i) < 2.0$

Target area

- $> \frac{1}{2} R_{\text{vir}}$

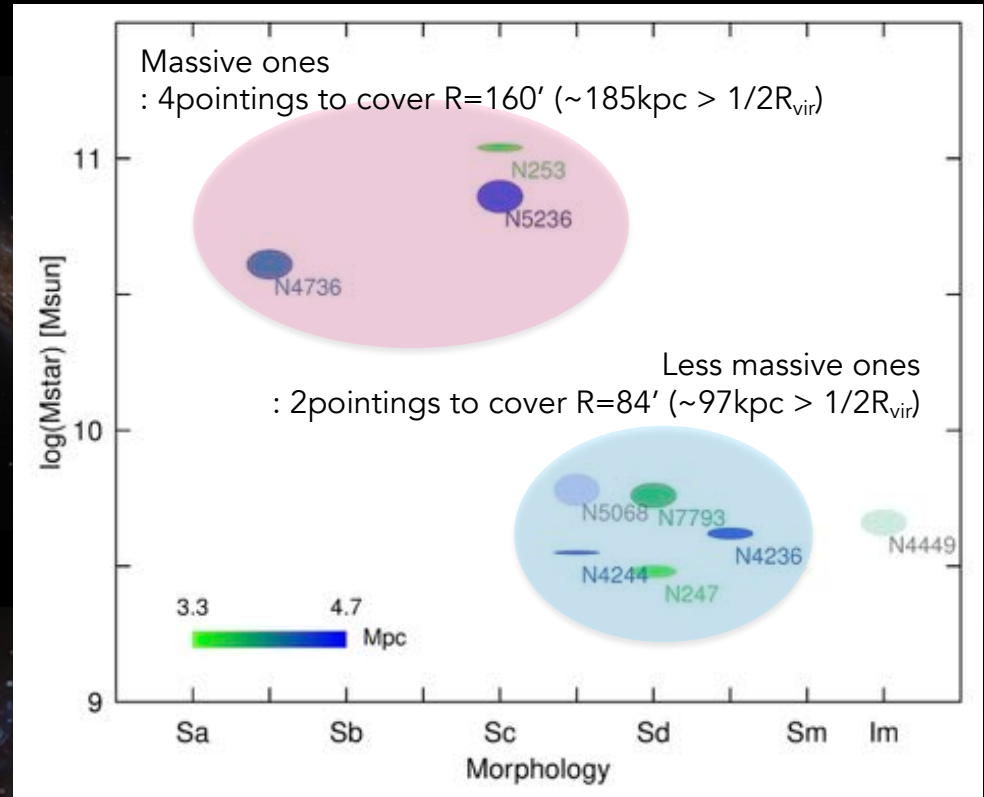
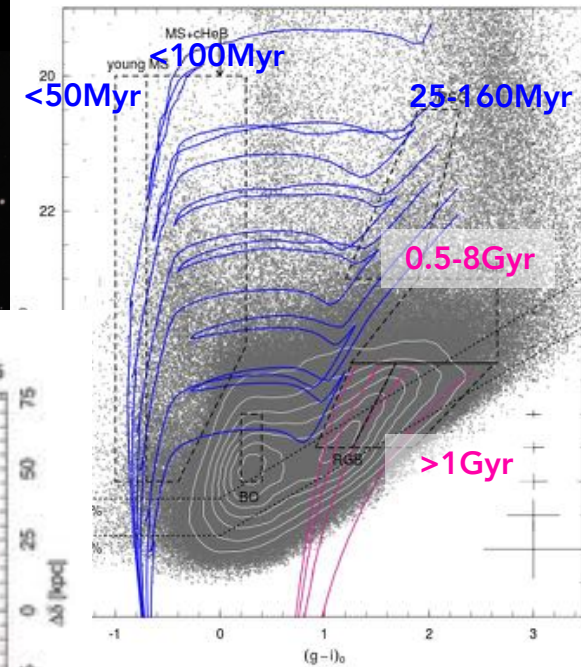
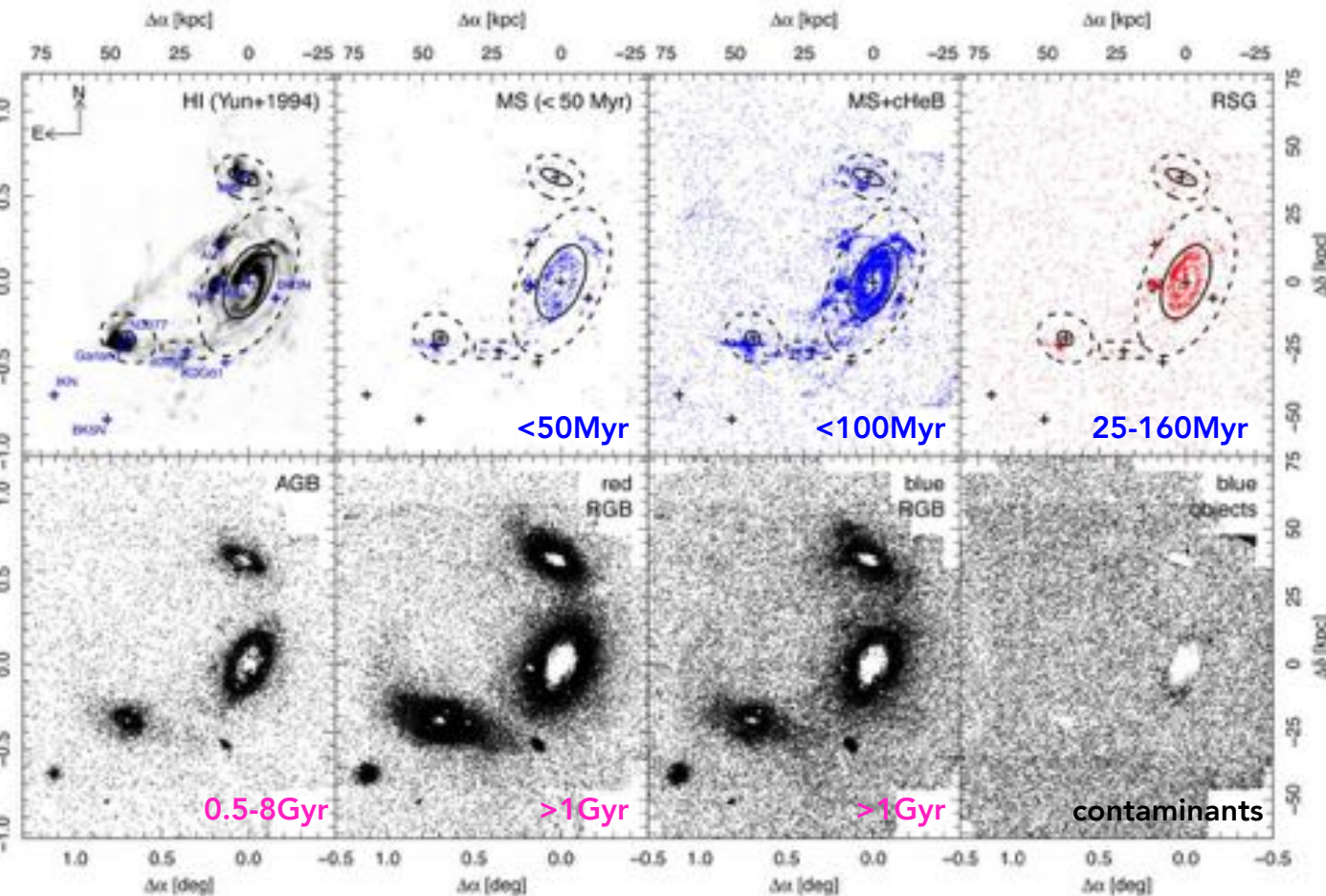


Table 1: The target galaxies

Name	# ^a	term ^b	D (Mpc) ^c	group ^d	M_B	class ^e	b/a	$M_*(M_\odot)$ ^f	image	comments
NGC0247	2	B	$3.4 \pm 0.06^{(1)}$	ScI	-18.5	Sd	0.32	3×10^9	HSC ^g	
NGC0253	5	B	$3.5 \pm 0.1^{(2)}$	ScI	-21.3	Sc	0.22	1×10^{11}	CFHT	two satellites ^h
NGC7793	2	B	$3.7 \pm 0.1^{(2)}$	ScI	-18.5	Sd	0.68	5.8×10^9	Gemini	
NGC4736	5	A	$4.2 \pm 0.3^{(2)}$	M94	-19.9	Sab	0.81	4.1×10^{10}	n/a	
NGC4244	2	A	$4.4 \pm 0.2^{(2)}$	M94	-18.2	Scd	0.11	3.6×10^9	HSC ^g	no stellar halo?
NGC4236	5	A	$4.5 \pm 0.3^{(4)}$	M81	-18.6	Sdm	0.32	4.2×10^9	n/a	extended UV disk
NGC5236	5	A	$4.5 \pm 0.3^{(5)}$	M83	-20.6	Sc	0.89	7.2×10^{10}	HSC ^g	HI, satellite ^h

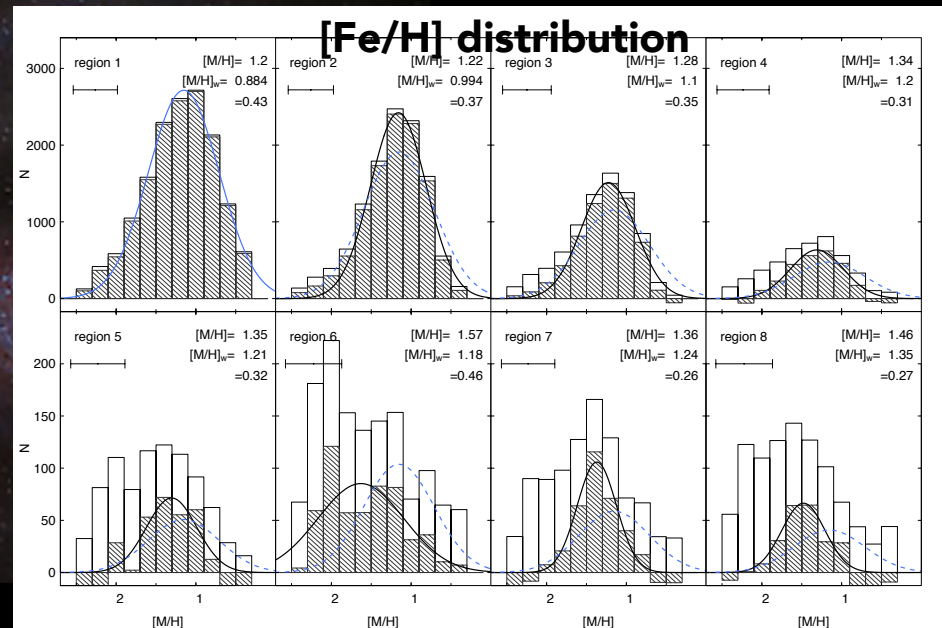
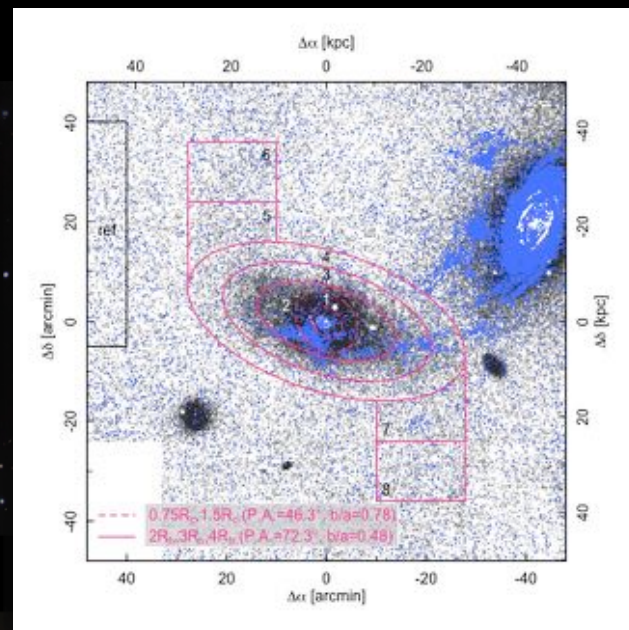
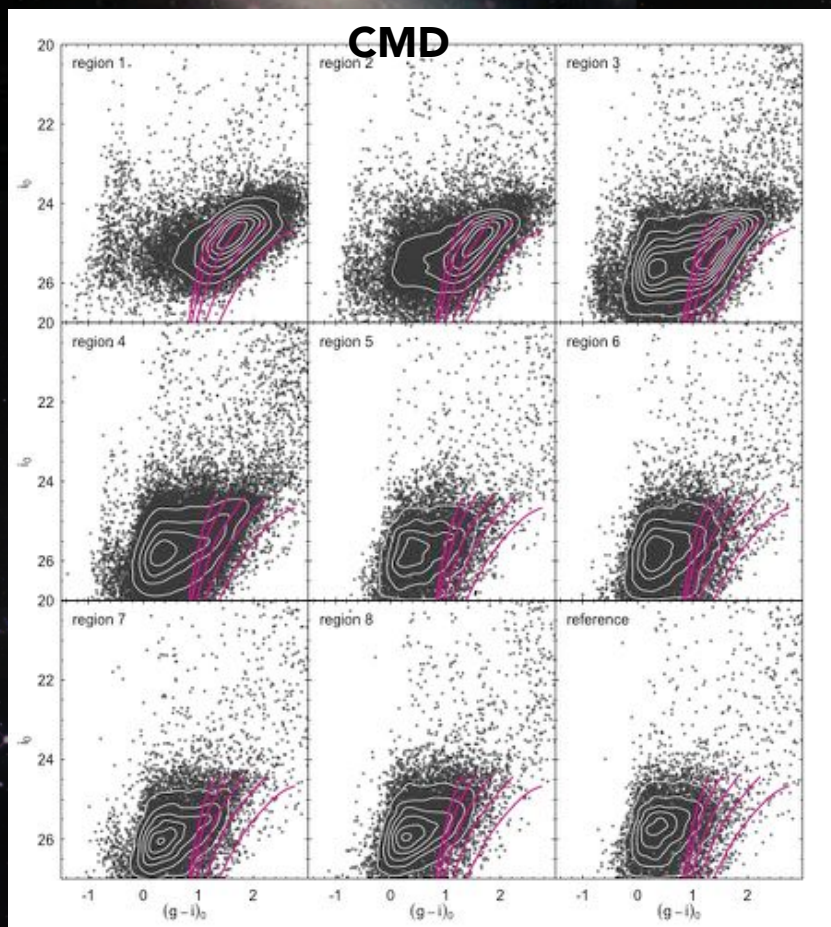
SNFC: age constraint

Location of point-sources in CMD:
Young / intermediate / Old age



SNFC: metallicity constraint

(g-i) color of individual RGBs:
Metallicity Distribution Function
in different spatial area in a galaxy

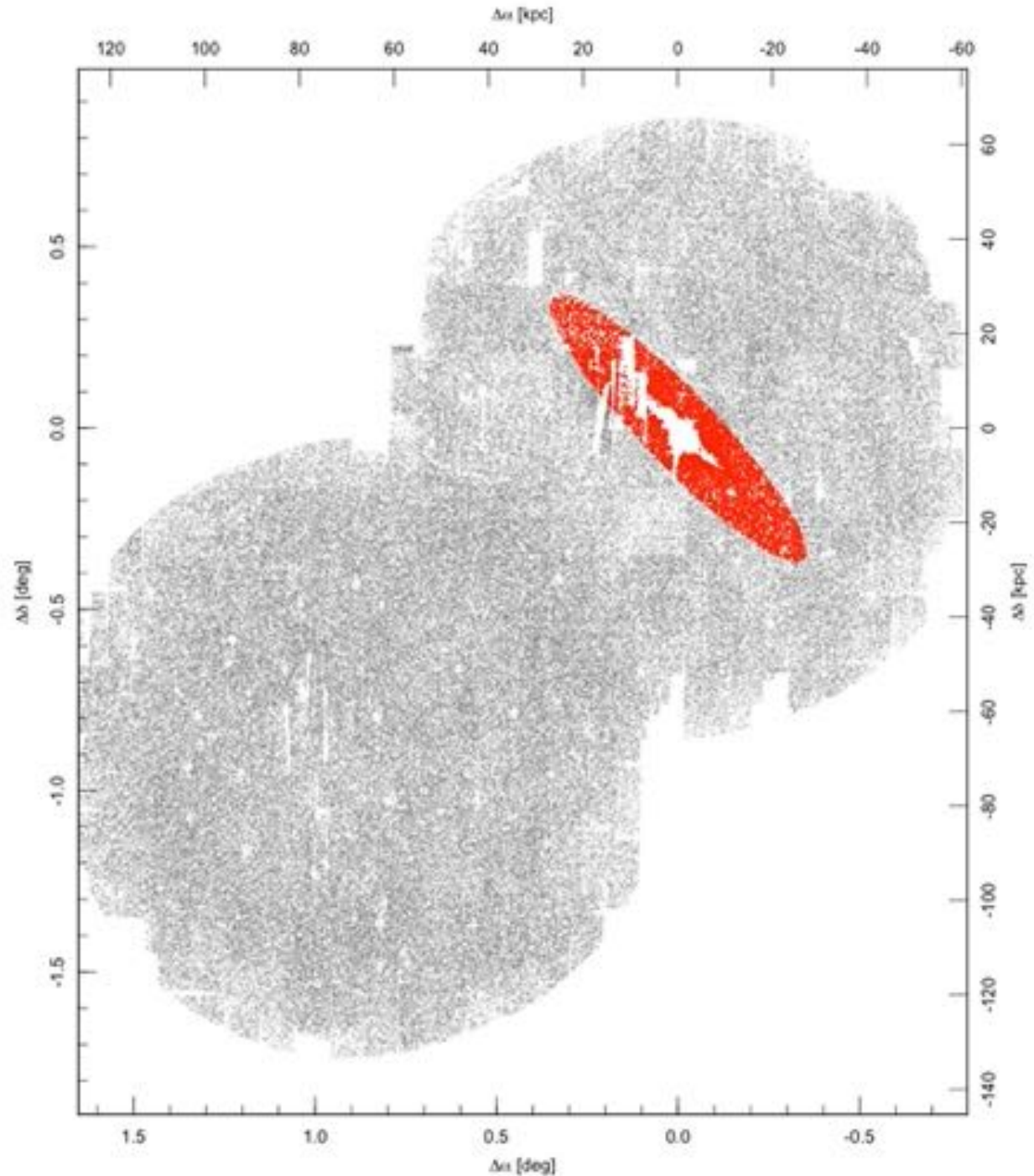


SNFC: N4244

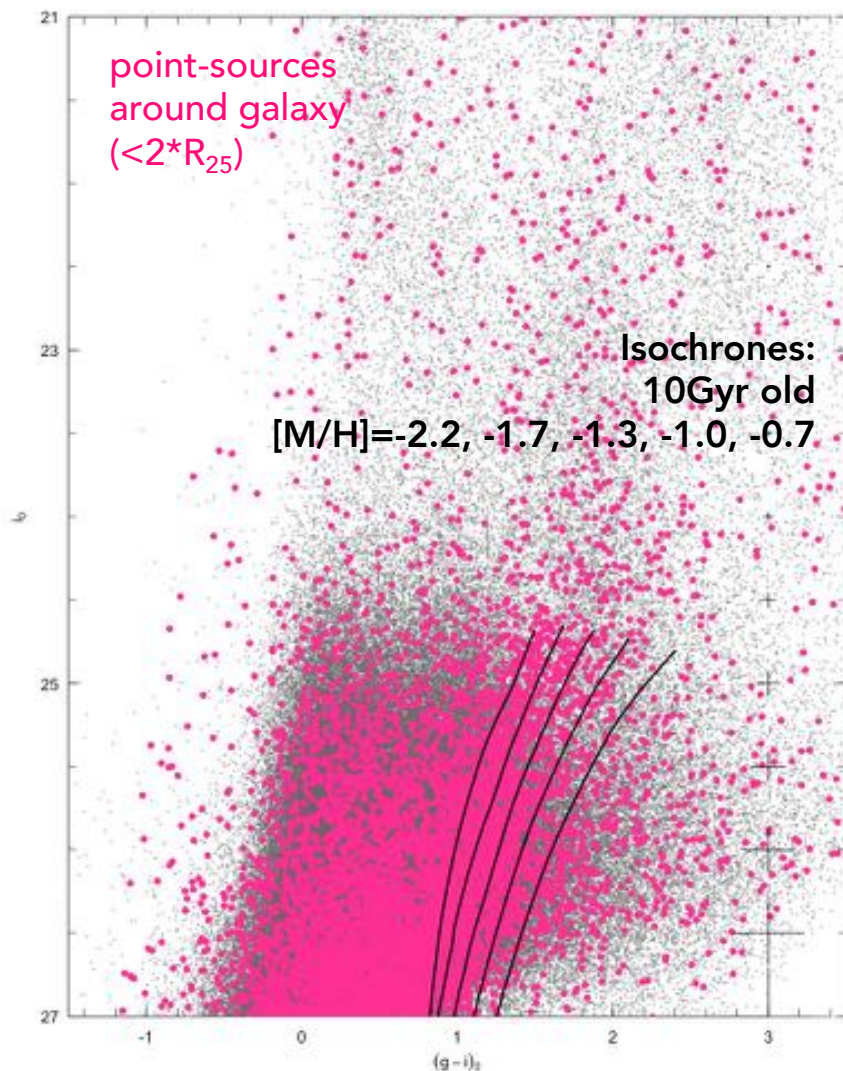
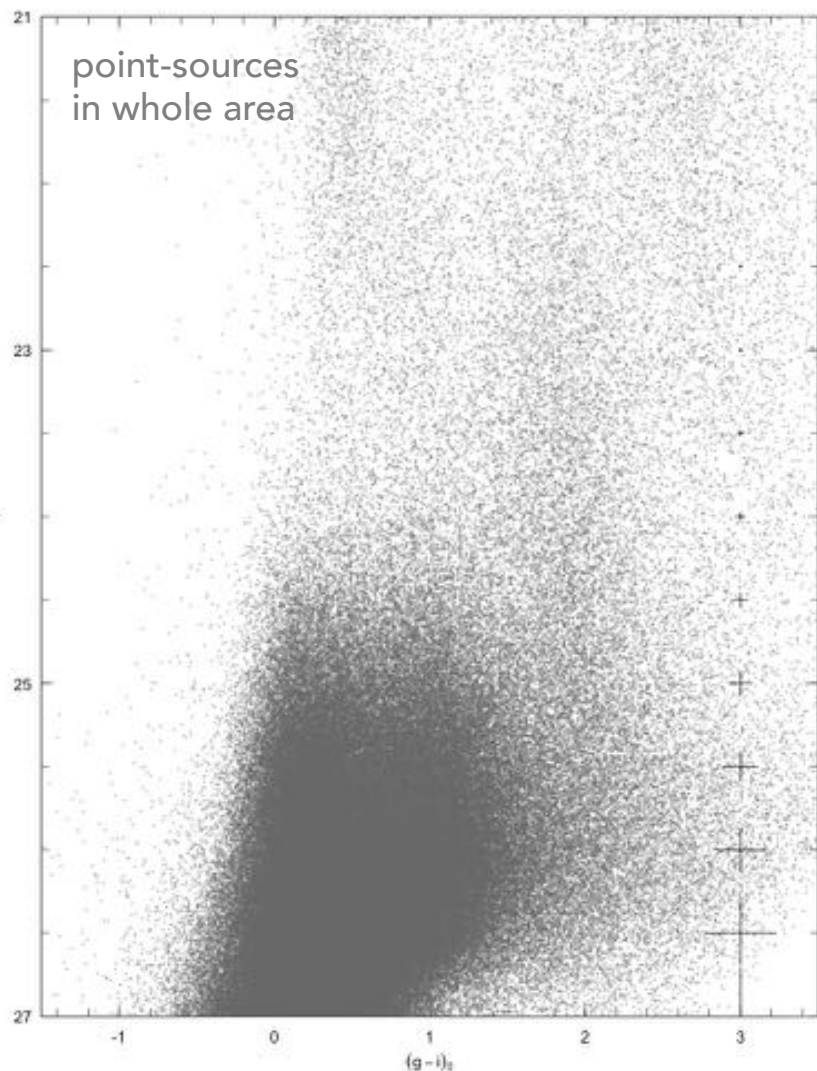
Scd galaxy @ 4.4 Mpc

2 pointings

All point-sources



SNFC: N4244



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- 1 galaxy with 3 pointings with g, i2-band,
- 2 galaxies with 2 pointings with g, i2-band,
- 2 galaxies with 1 pointing with g, i2-band,
- no data at all for 2 galaxies
- 5 pointings of only i2-band images for 3 galaxies

Finish all observations (completion rate = 60%),

Data analyses on-going

NGC4244: old, metal-poor population does exist in the outskirts.
halo fraction seems to be relatively small.

apply for g-band images of N4236, N4736, and N253 in future semesters