

Star-Forming Compact Groups (SFCGs): An ultraviolet search for a local sample

(2015, MNRAS, 453, 1965)

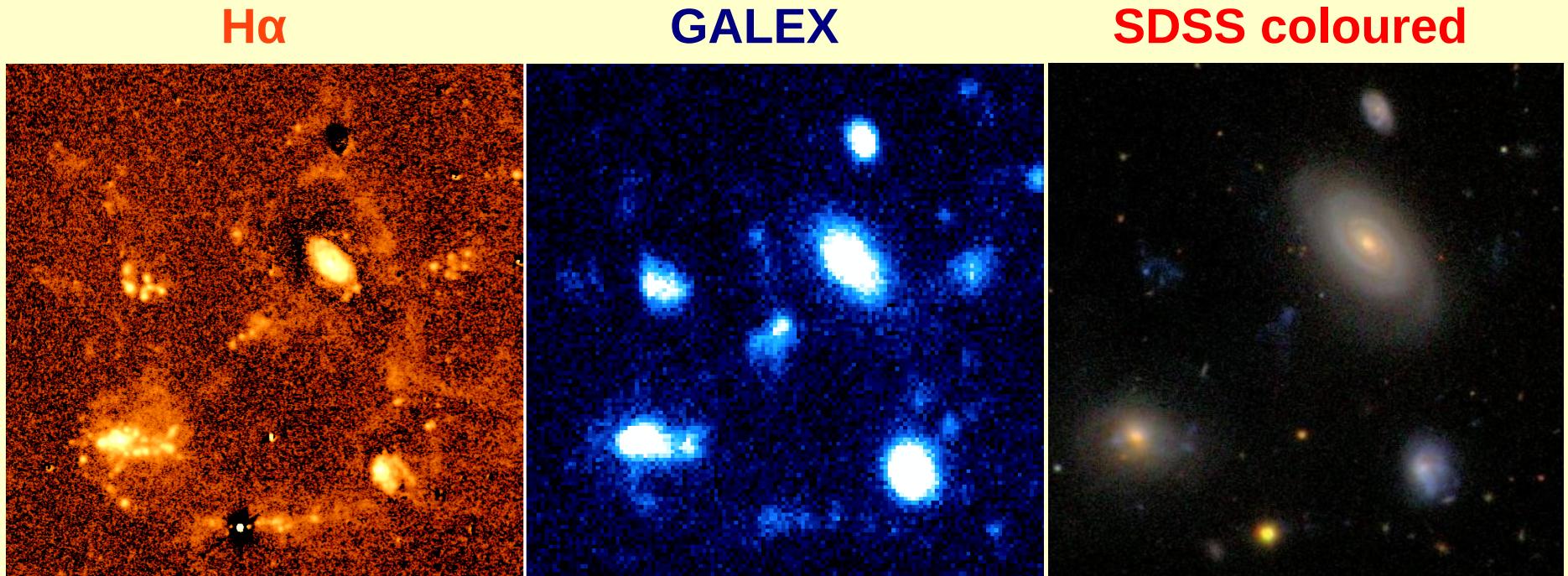
Jonathan D. Hernández Fernández

Colloquium at the AURA Lecture Hall

April 21th 2016 La Serena, Chile

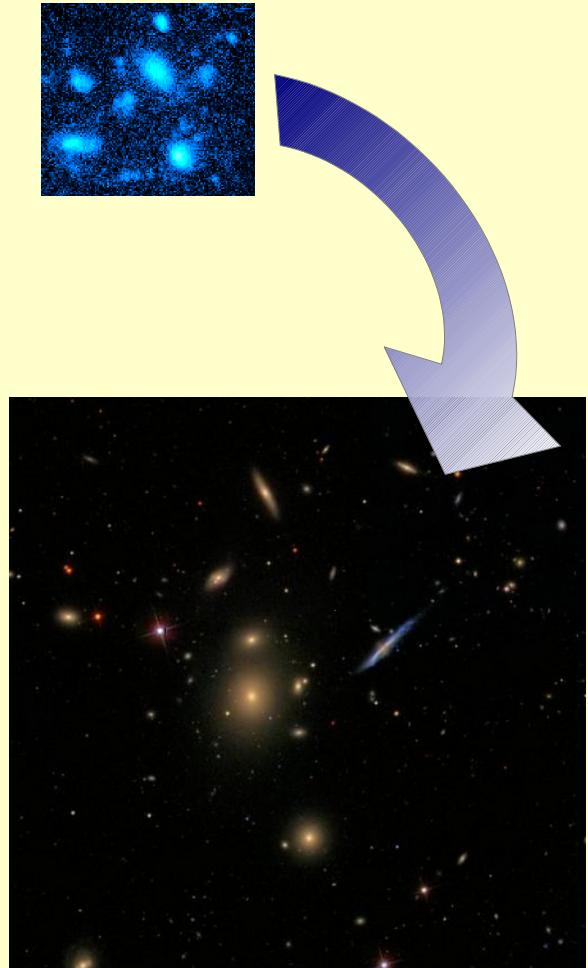
The BLUE INFALLING GROUP is a compact group of galaxies infalling into the dynamically young cluster Abell 1367

BIG is "the region with the highest density of star forming systems ever observed in the Local Universe" (Cortese et al 2006).



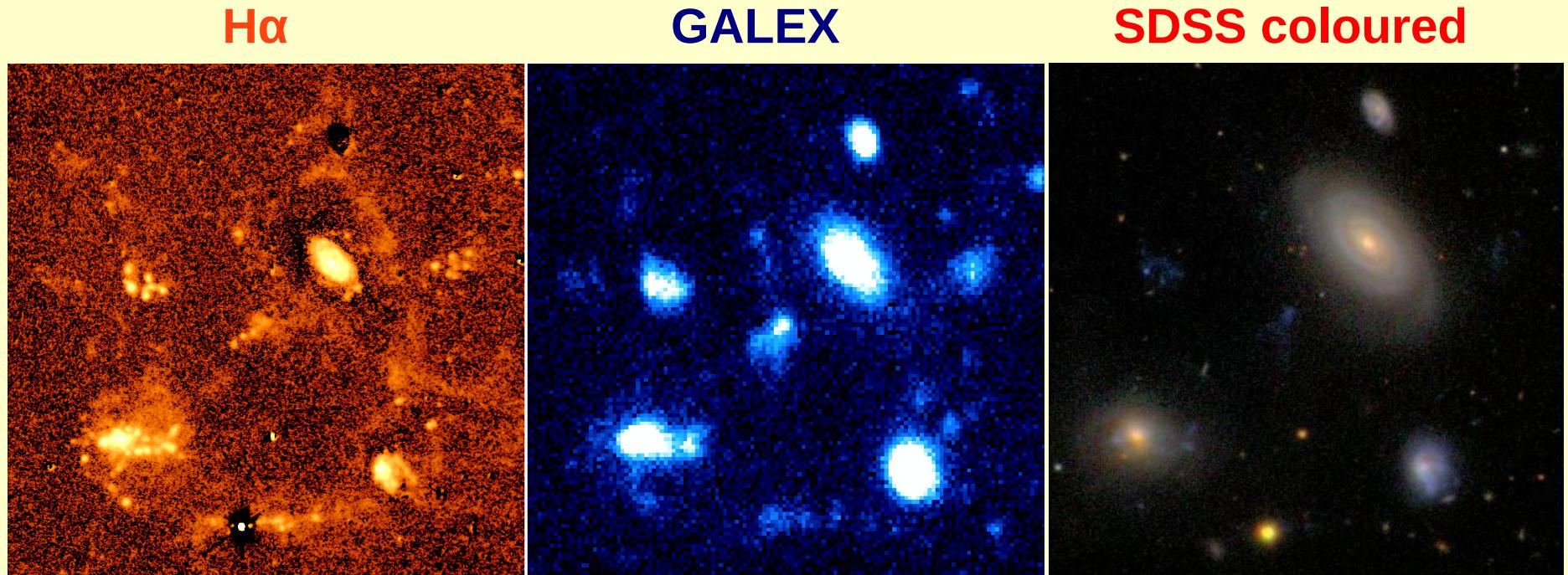
The preprocessing scenario and the Blue Infalling Group (BIG).

- *The unique case in the local Universe attributes to the preprocessing scenario is the BIG.*
- *A significant mechanism of star-formation quenching in clusters.*
- *Infalling groups seem to be a possible place where spiral galaxies are becoming lenticulars (Haines+2013)*



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*GALEX catalogues are
the place to search for this kind of groups...*

SEARCH STRATEGY

- (1) Compilation of an all-sky sample
of UV-bright sources*

- (2) Search for groups in the UV sample*

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- UV sources from **All-sky Imaging Survey (AIS)**
the largest sky area covered by GALEX in a homogeneous way

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- FUV (1530 Å) selection: **17 < FUV < 20.5**
FUV is even more biased toward star-formation than the NUV.
The brightest UV galaxies in BIG are approx. in this range
 - lower limit: Avoiding bright galaxies which photometry shredded in parts.
 - upper limit: Reliable sources, avoiding oversize the sample of UV sources.

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- nuv_artifact <=1 ~ good quality detections
- We avoid the Milky Way disk: galactic latitude modulus $|b| > 15^\circ$

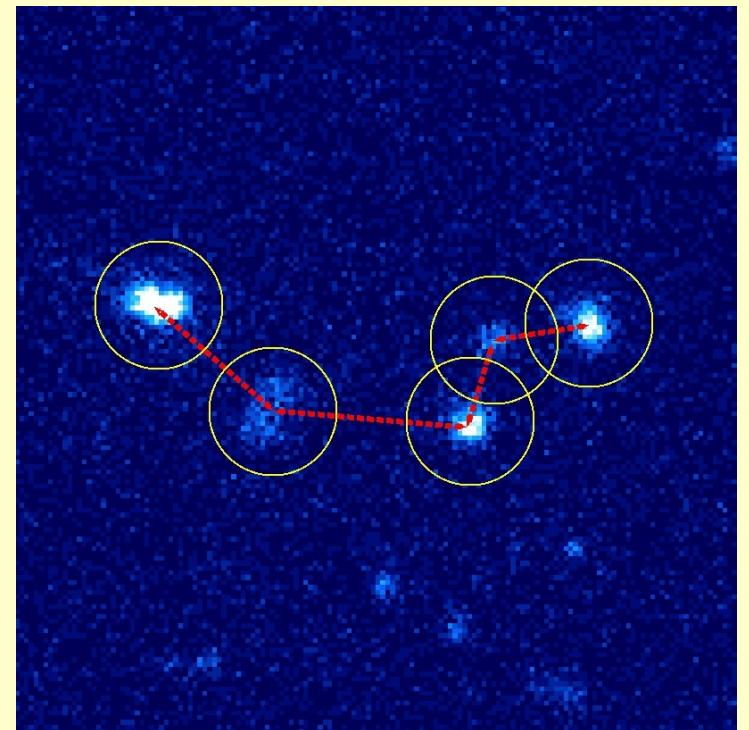
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925,428 UV-emitting sources

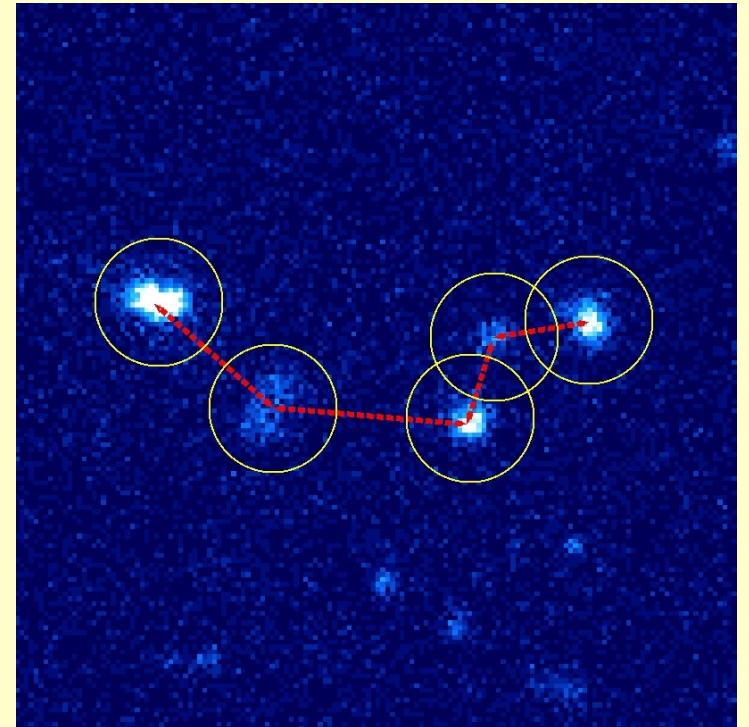
(2) Search for groups in the UV sample

- Friends-of-Friends Algorithm applied to sky positions grouping elements with a sky separation equal or less than a **linklength = 1.5 arcmin**
This corresponds to a physical distance of **88 kpc at z=0.05**



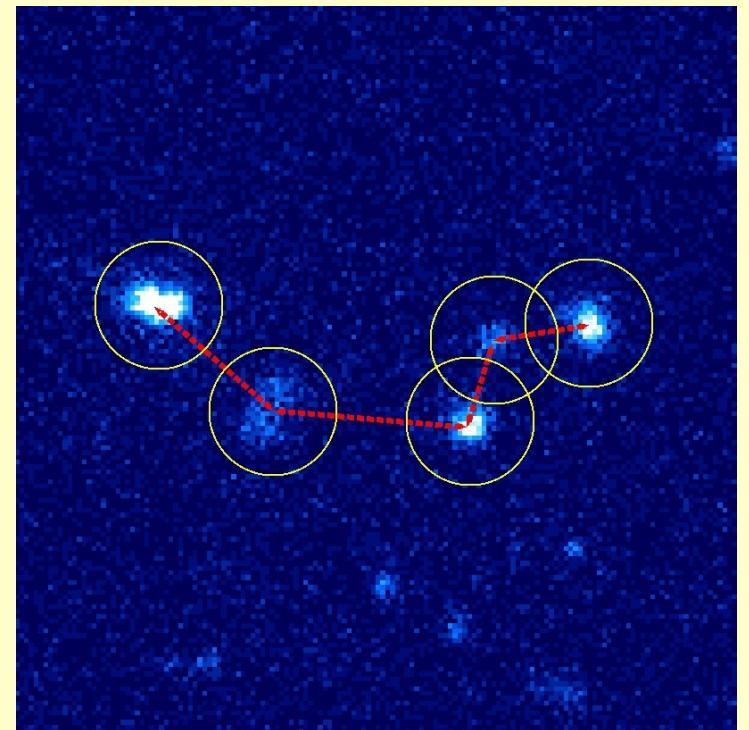
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- Constraints over UV group members:
 - At least **three** UV bright sources classified as '**galaxy**' by NED
 - At least **two** galaxies with a **redshift** separation **Δz<0.004**



This final output of the search is a sample of ...

280 groups of UV-emitting galaxies!!

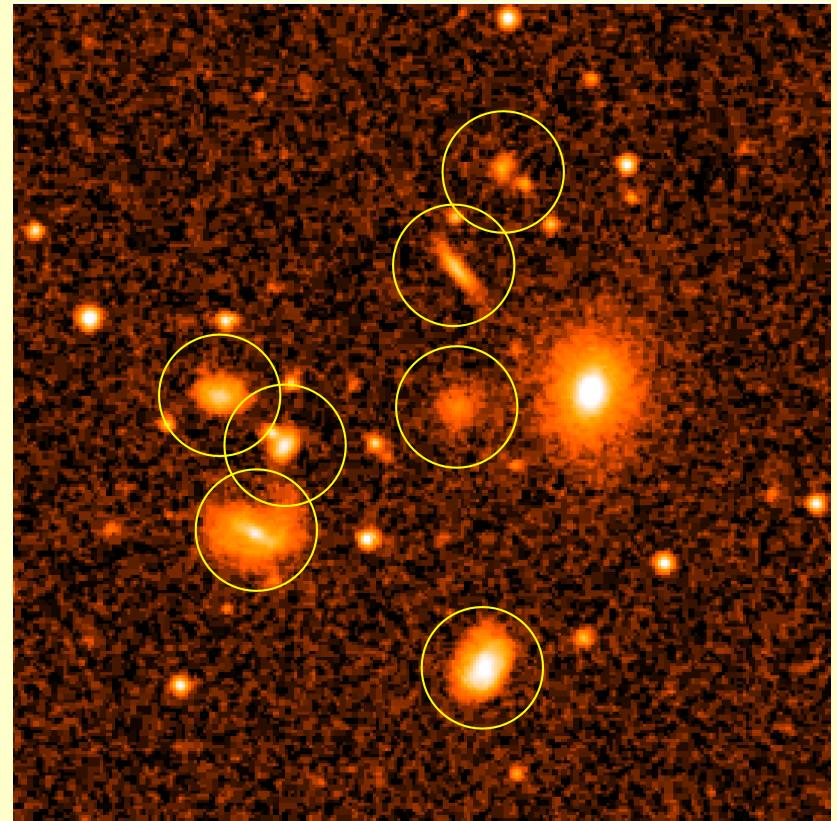
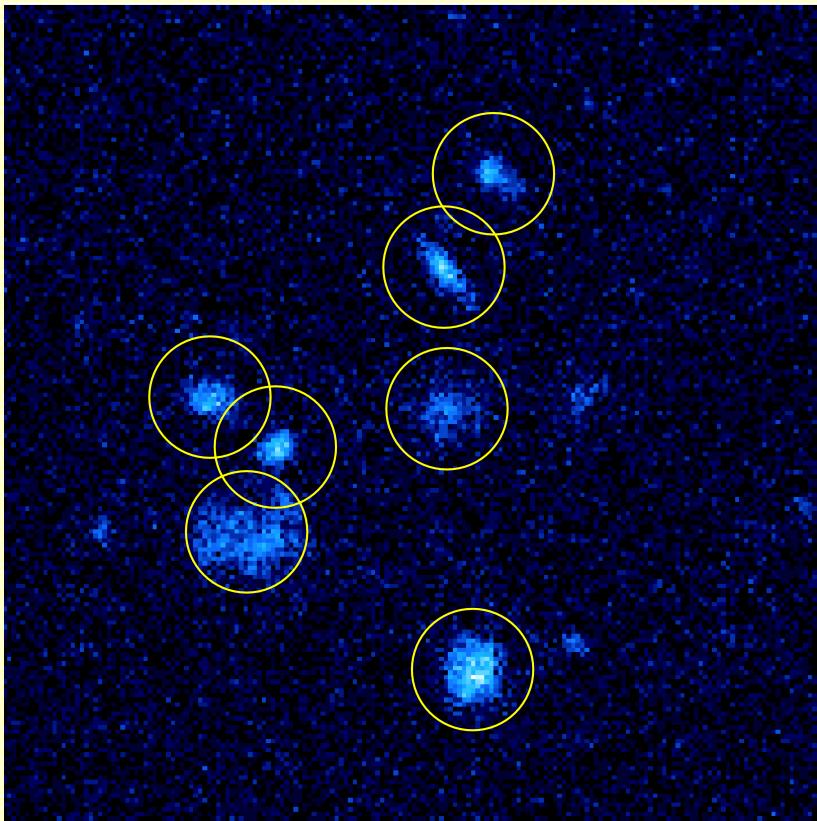
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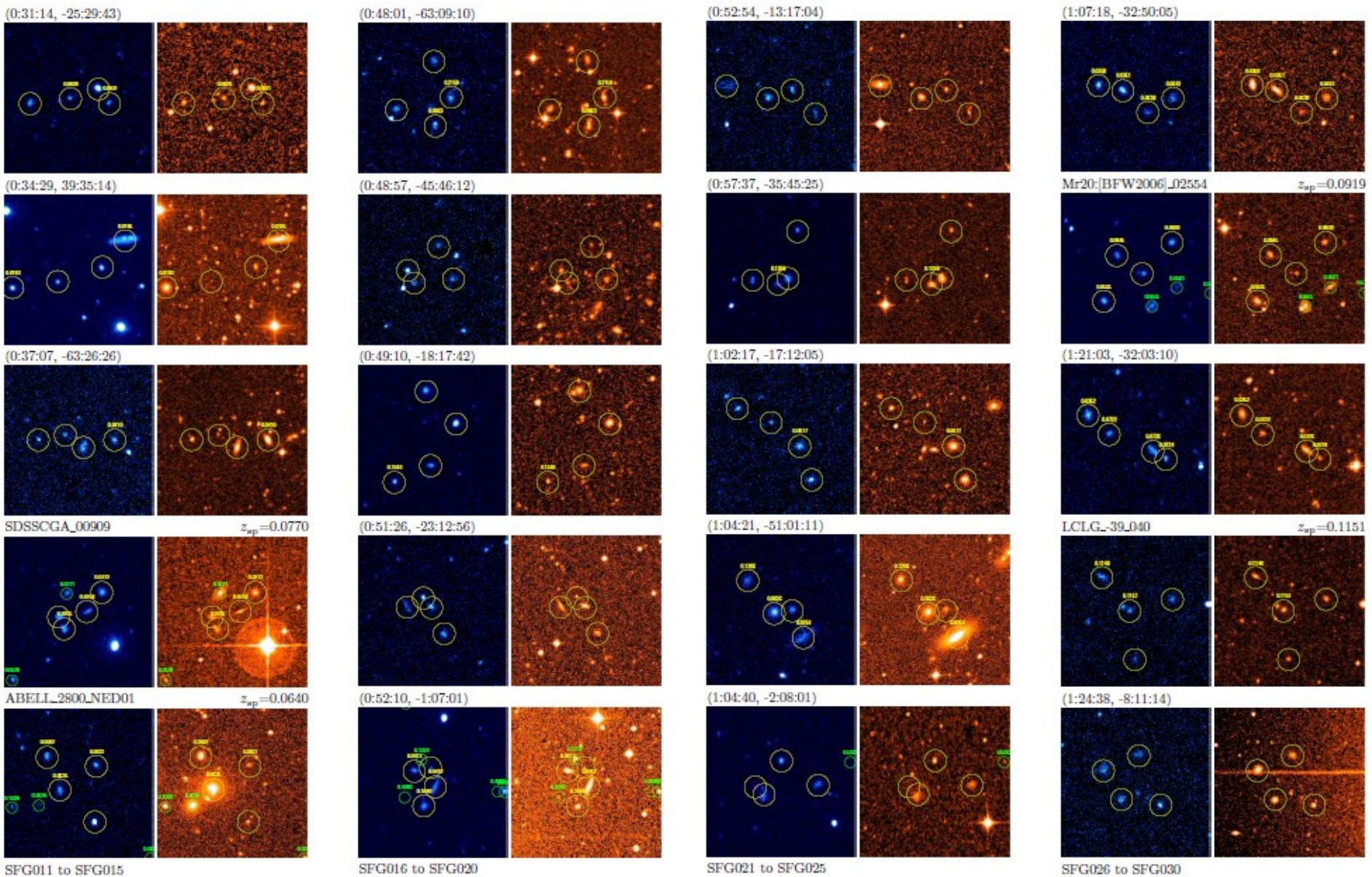
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- n_{UV} “UV richness” distribution:
 - 226** groups with 4 members,
 - 39** groups with 5 members,
 - 11** groups with 6 members and
 - 4** groups with 7 members

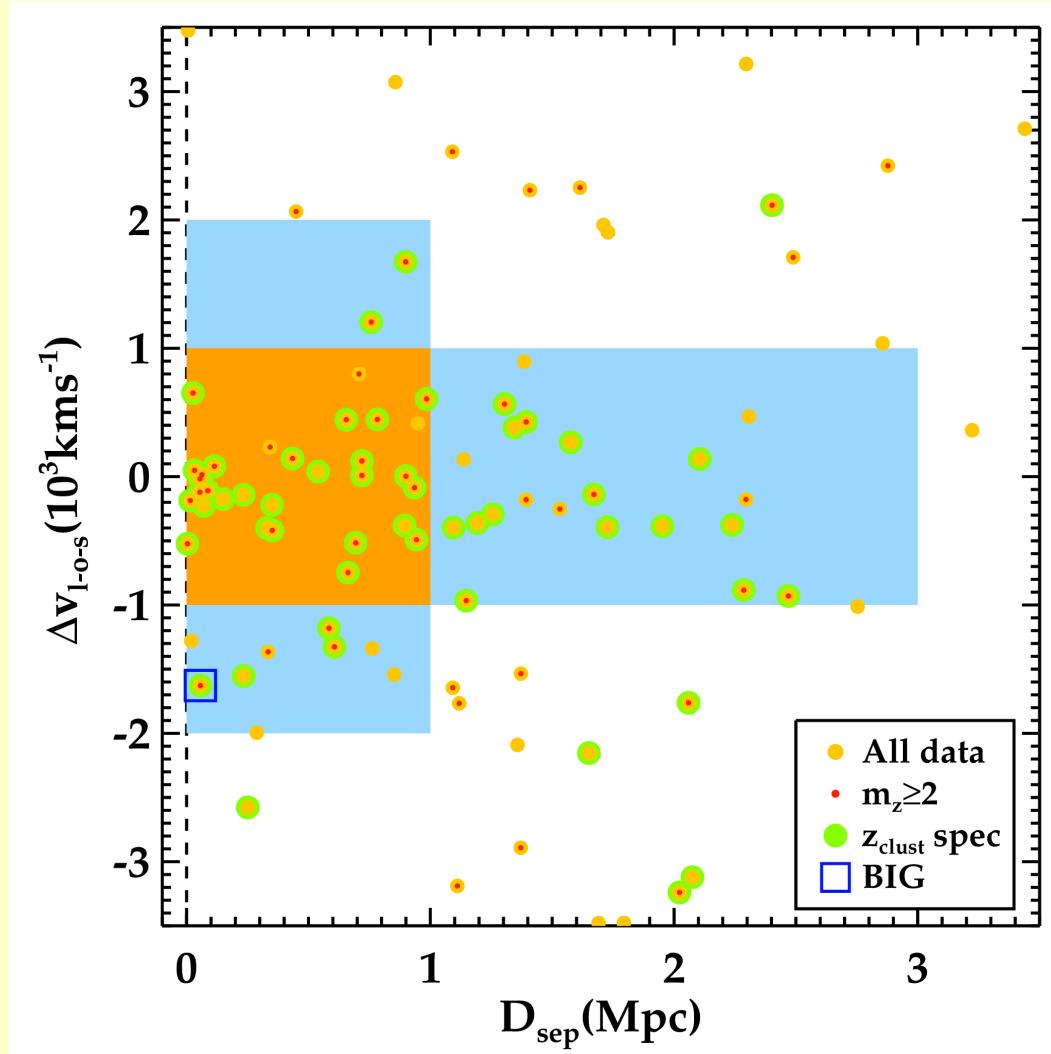
$$N_{\text{groups}}(n_{UV}) \sim (n_{UV})^\alpha \text{ with } \alpha \approx -7.53$$

One example of the groups that we found...





SFCGs close to clusters



*There are around
26 SFCGs embedded
in the infalling regions
of clusters
with known redshifts.*

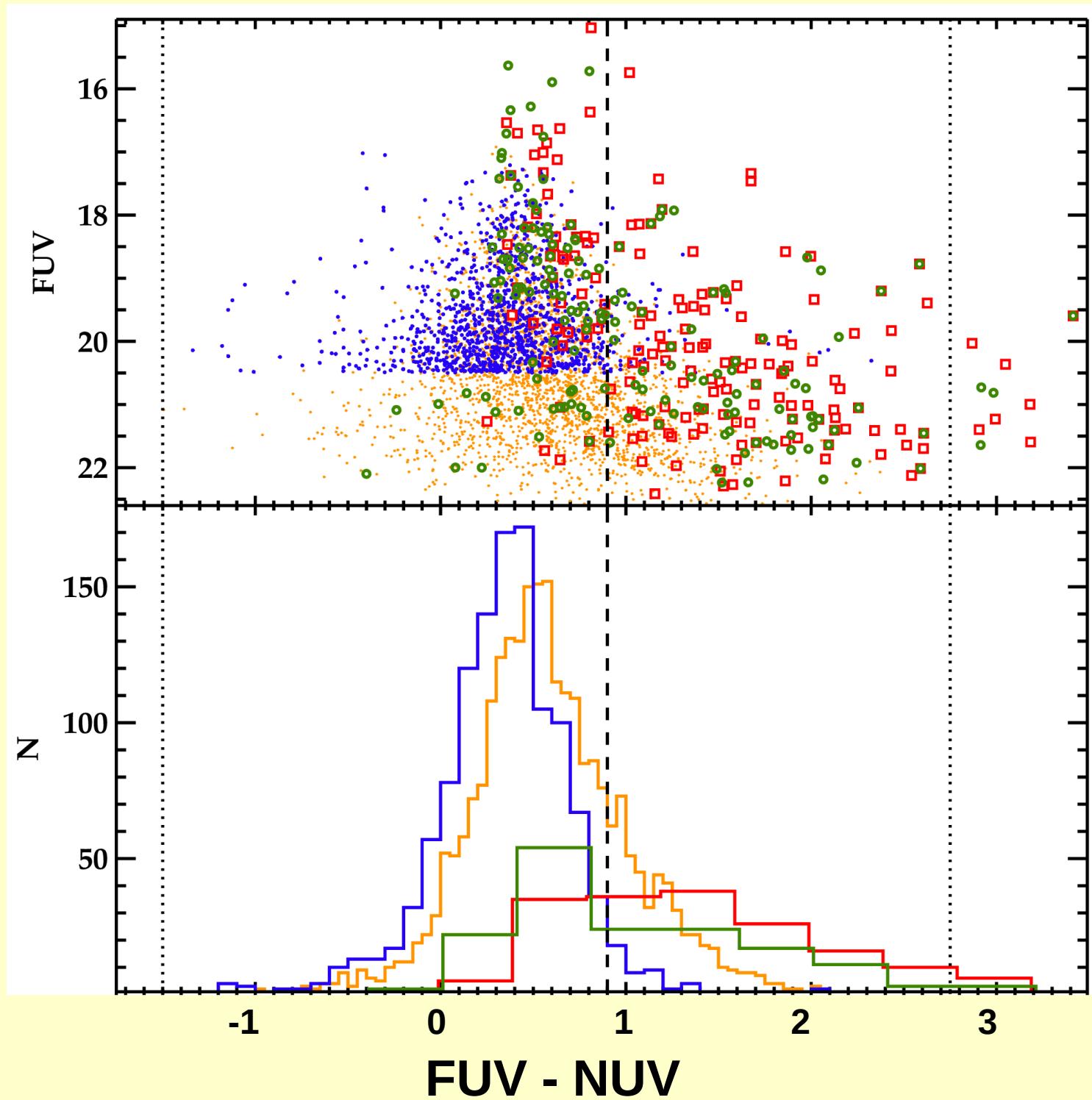
*infalling regions:
light blue areas*

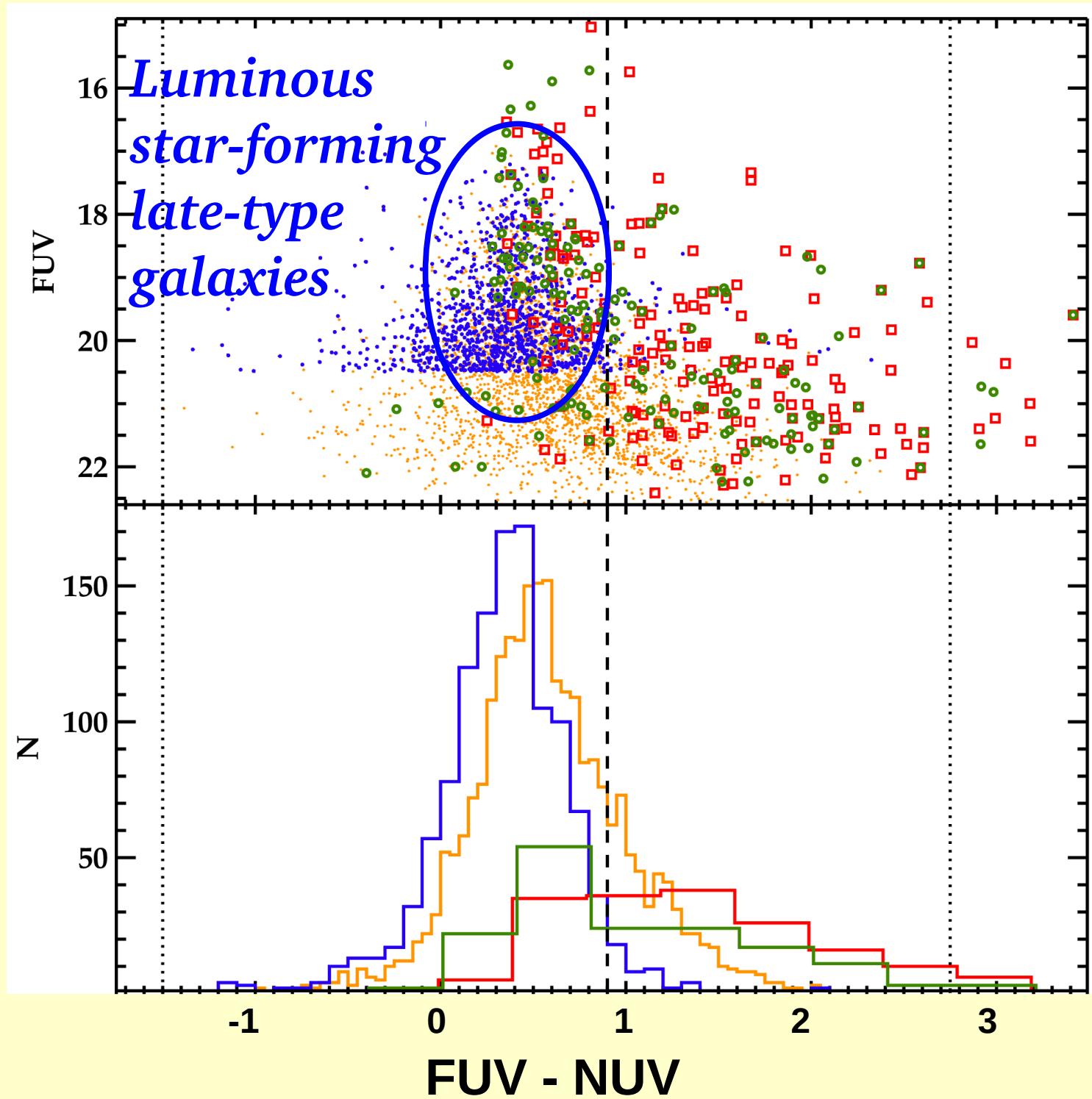
- *Our initial motivation was the search for similar examples to the BIG*
- *We have also a sample of compact groups*

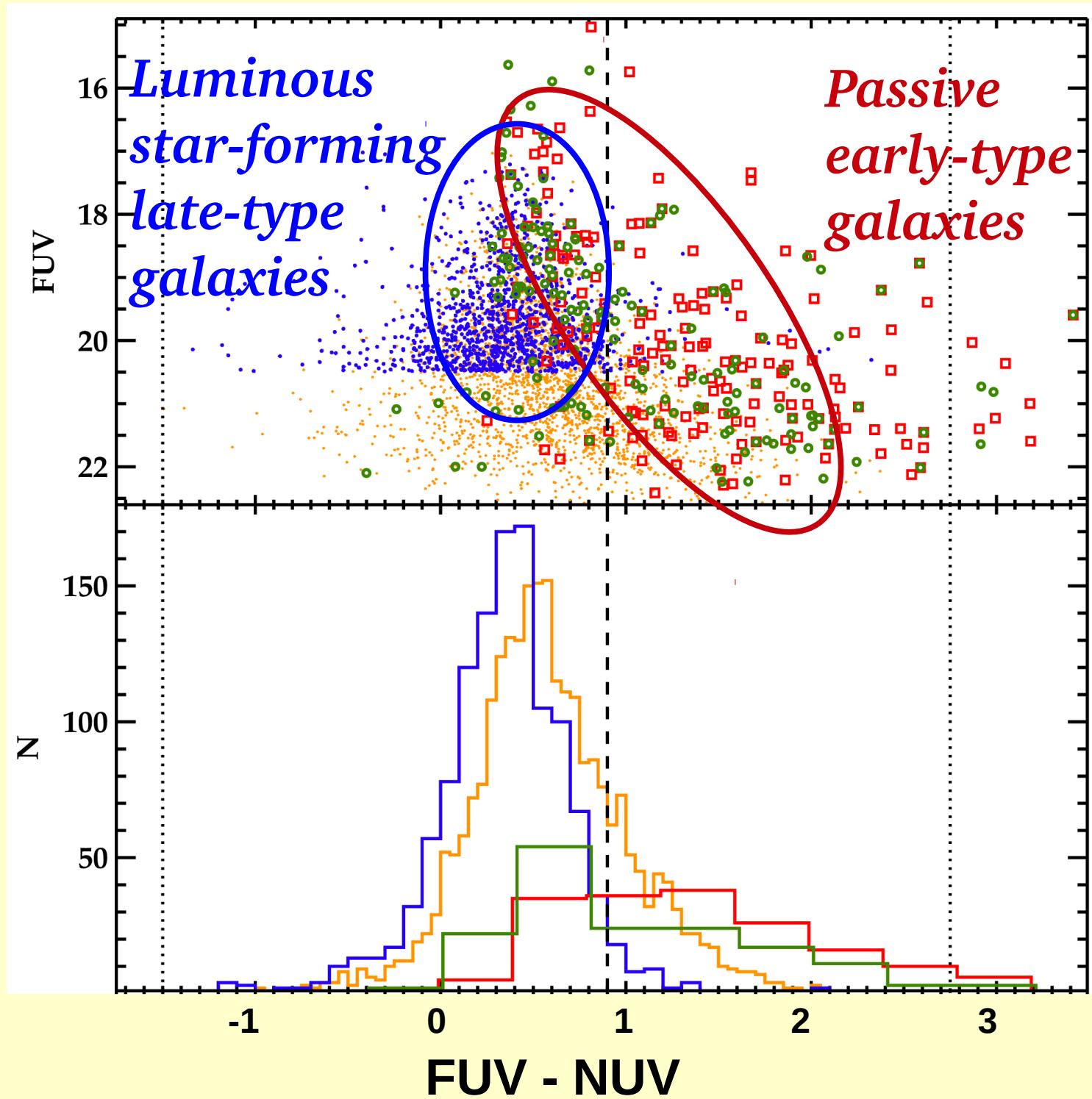
What are the average group properties in comparison with other compact group samples?

Comparison with other samples of compact groups

- **Hickson compact group sample**
(Hickson 1982, Hickson et al. 1992)
- **SDSS compact group sample**
(McConnachie et al. 2005)
- **2MASS compact group sample**
(Diaz-Gimenez et al. 2002)





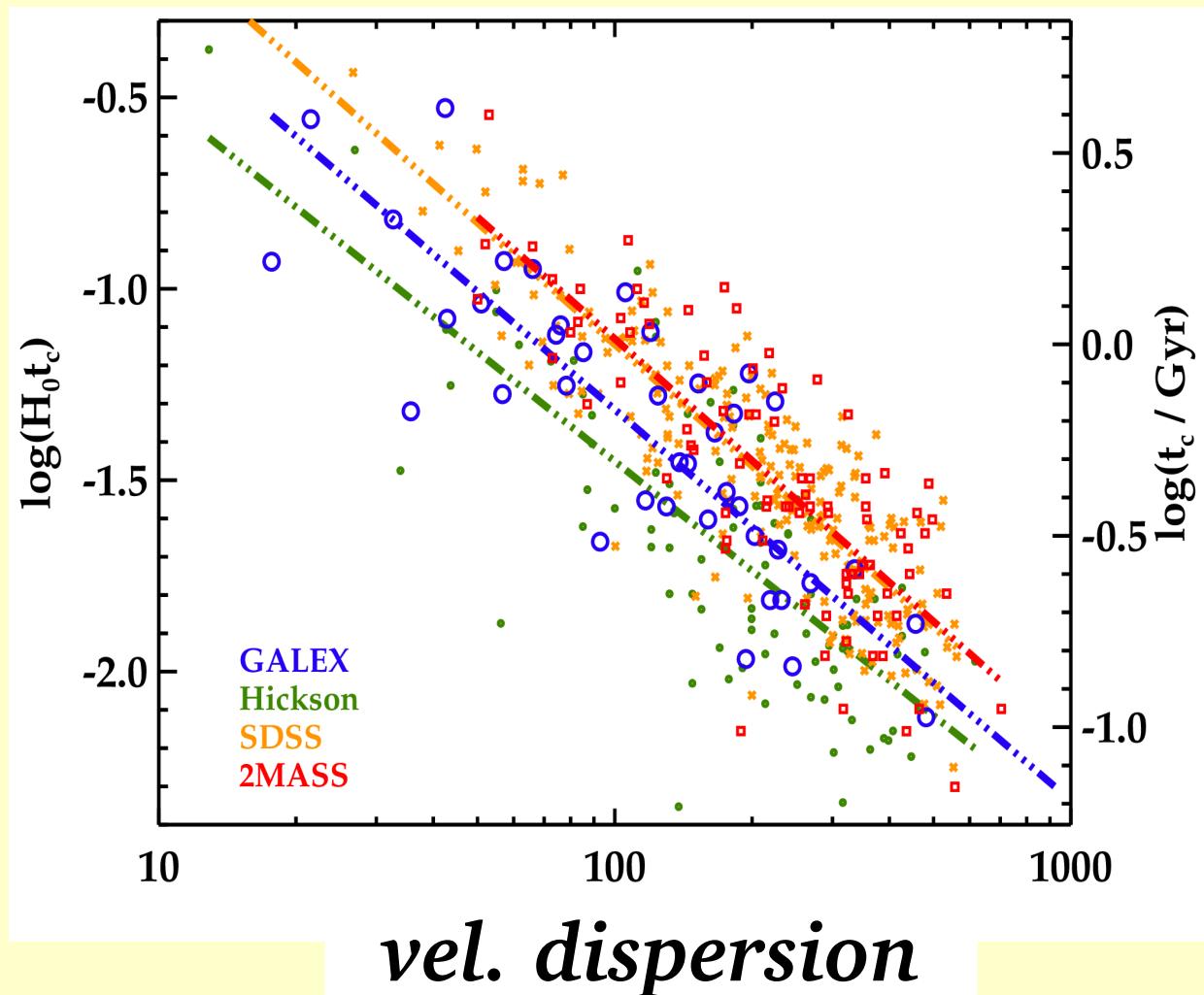


Star-Forming fraction

Sample	SFing fraction
SFCG	96
HCG	19
2MCG	13
SCG	20

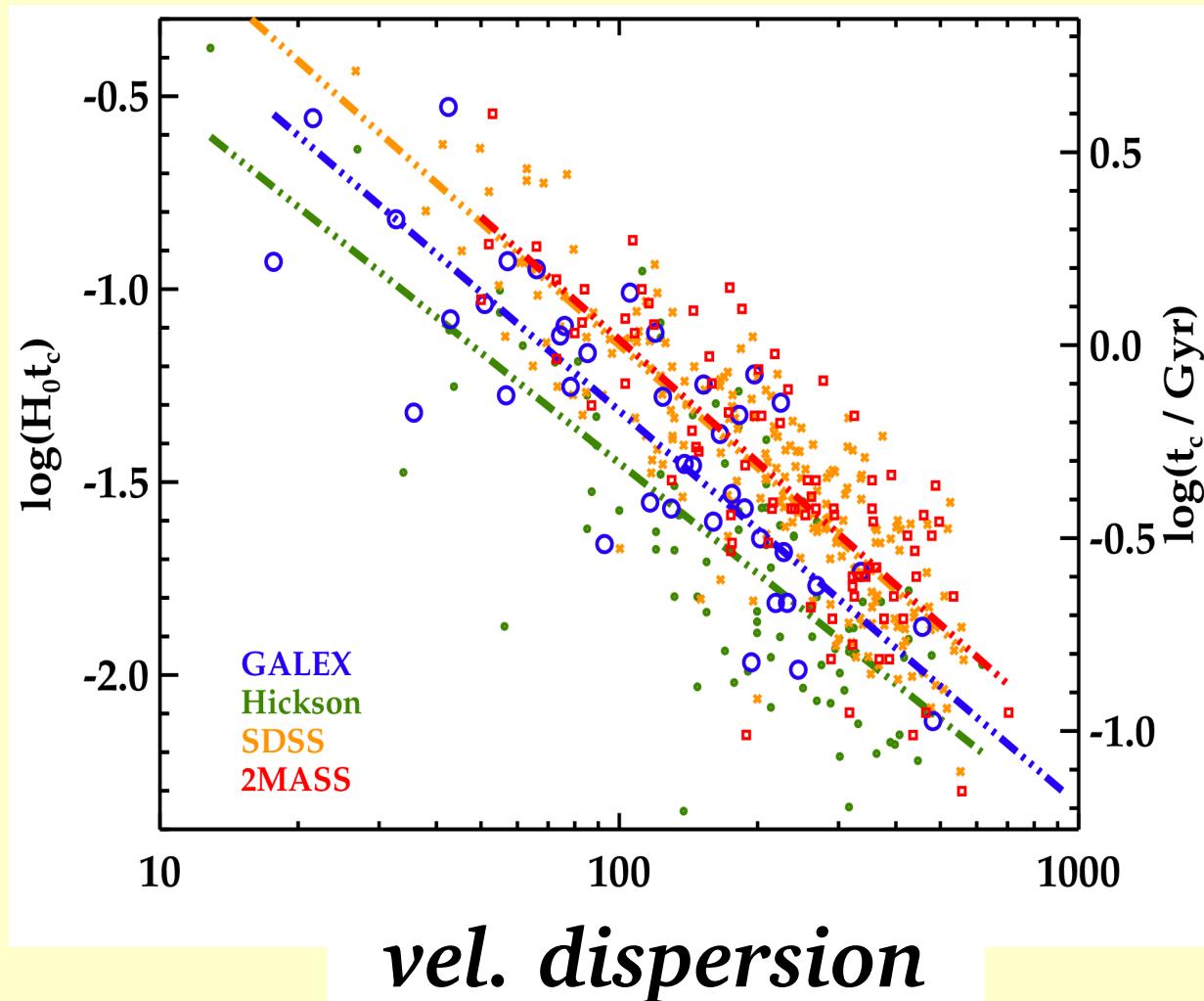
Dynamical (evolutionary) stage

dyn. time-scale



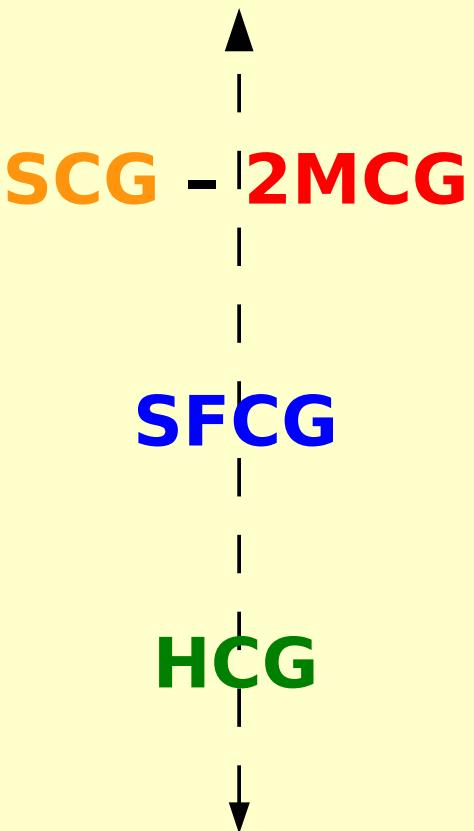
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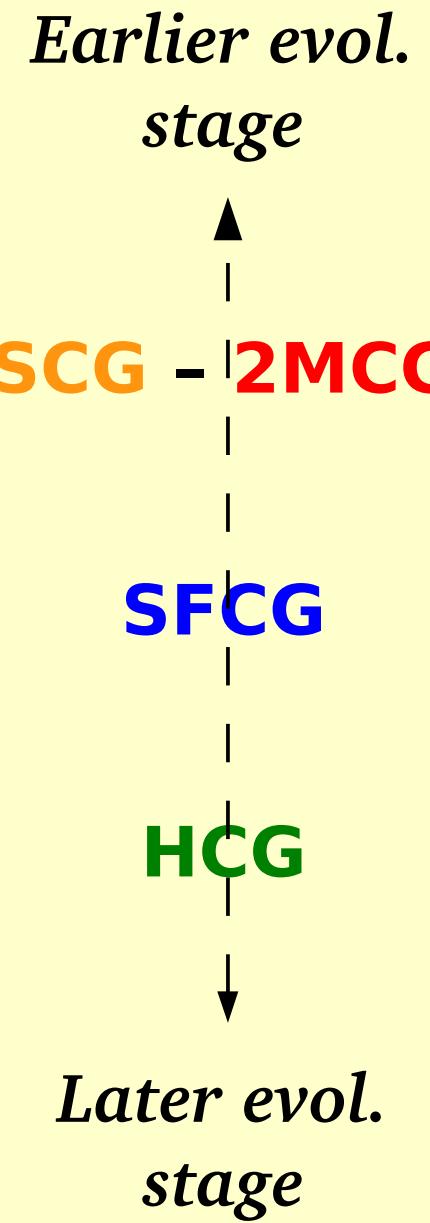
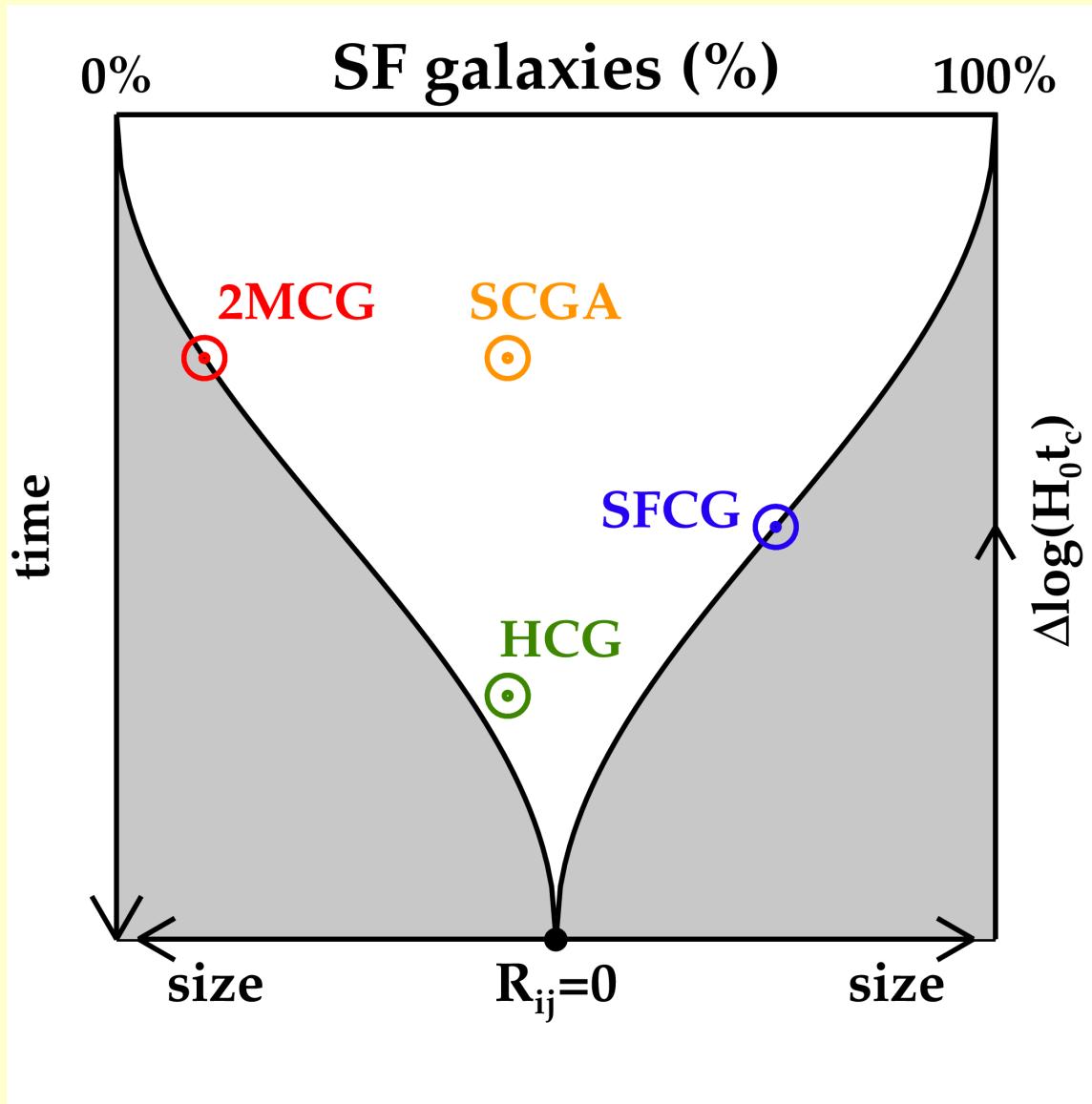


vel. dispersion

*Earlier evol.
stage*

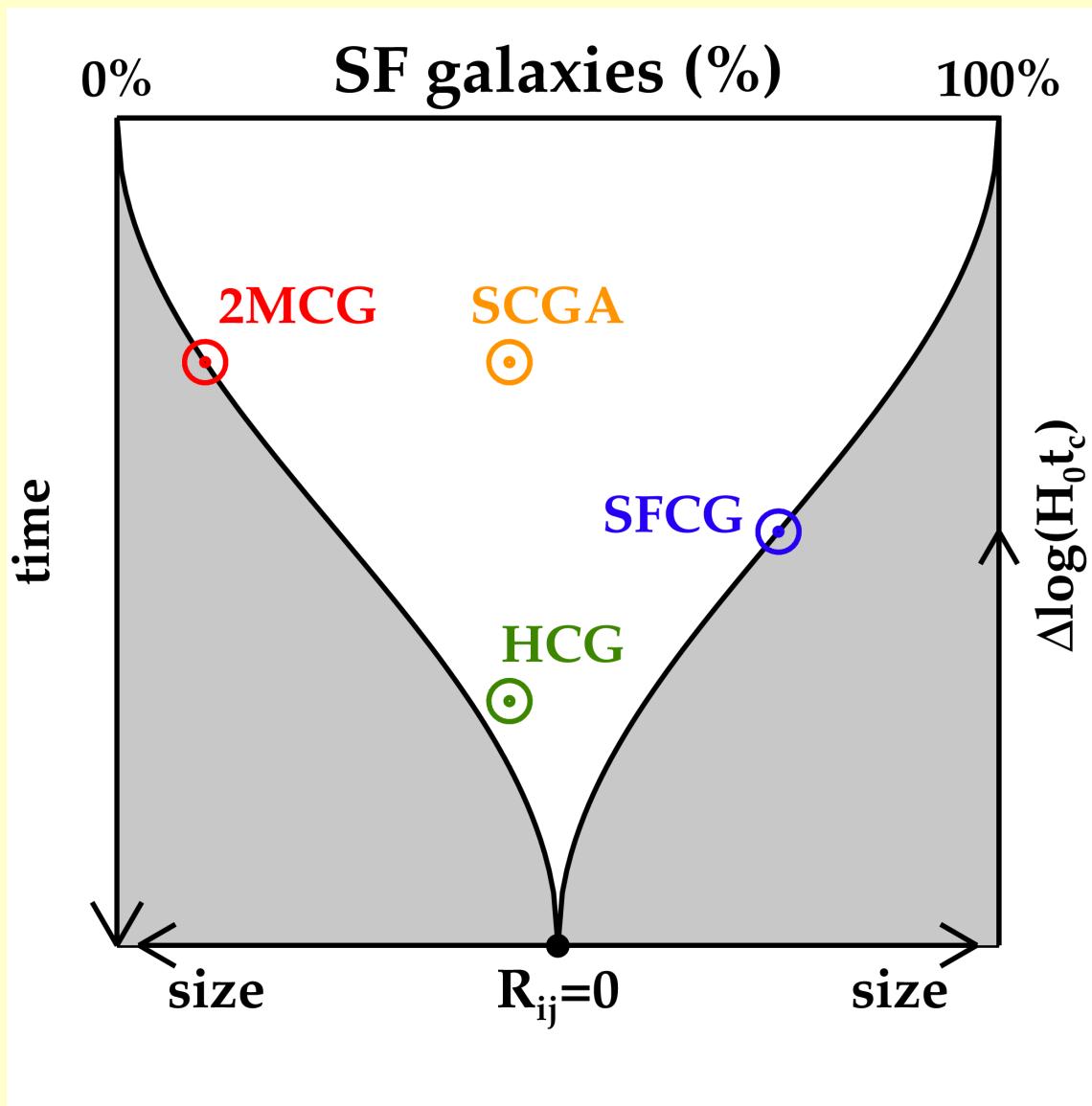


*Later evol.
stage*



SFCG properties

- Low velocity disp.
 $\sigma_{\text{los}} \sim 120 \text{ km s}^{-1}$
- \sim small time-scales
 $t_c \sim 0.7 \text{ Gyr}$
- High SFing fraction
 $f_{\text{sf}} \sim 95 \%$
- Dyn. masses
 $\sim 3.4 \times 10^{12} M_\odot$



~ RESULTS ~

- Compilation of a sample of 280 candidates to SFCGs
- Distinct properties from the group samples studied up now (optically and NIR selected)
 $\sigma_{\text{los}} \sim 120 \text{ kms}^{-1}$, $t_c \sim 0.7 \text{ Gyr}$
 $f_{\text{sf}} \sim 95 \text{ \%}$, $M_{\text{dyn}} \sim 3.4 \times 10^{12} M_\odot$
- 26 SFCG candidates infalling to clusters

\sim *Lines of future work* \sim

- Only a 57 % of galaxy candidates to being group members have a redshift counterpart
 - It is required a **REDSHIFT SURVEY**:
What of them are real groups?
- SFCG show a very high fraction of SFing galaxies
 - Level of star-formation activity: **H-ALPHA SURVEY**
origin of this star-formation activity?
a different evolutionary stage?

\sim *Spectroscopic survey* \sim

- 34 groups asked to be observed
in the Poor Weather mode in GMOS
- A long-term project (6 semesters) in the SOAR
Goodman spectrograph

~ Spectroscopic survey ~

We have derived z's
from 6 groups
from observations
w/ SOAR Goodman
(only 3 nights)

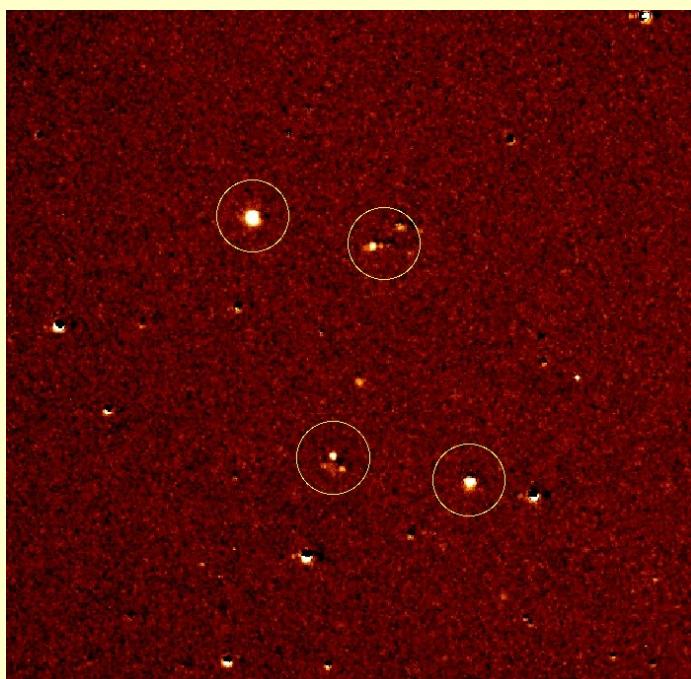
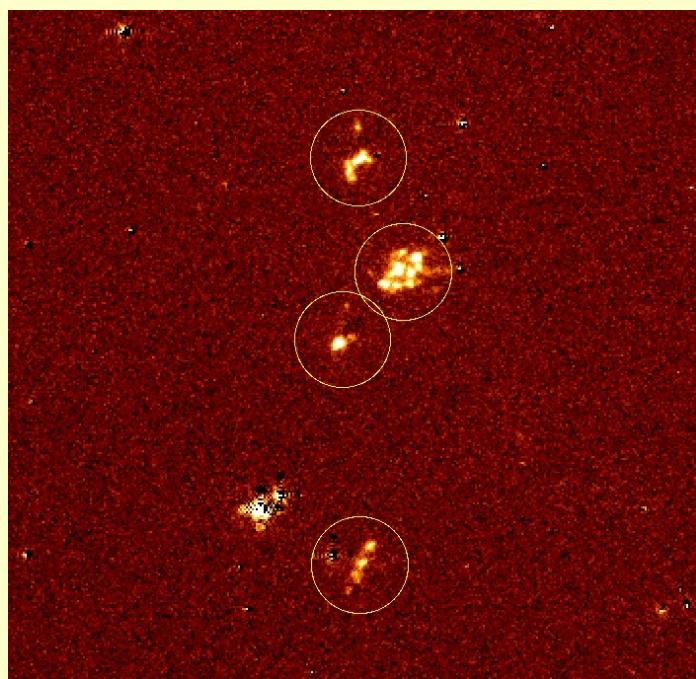
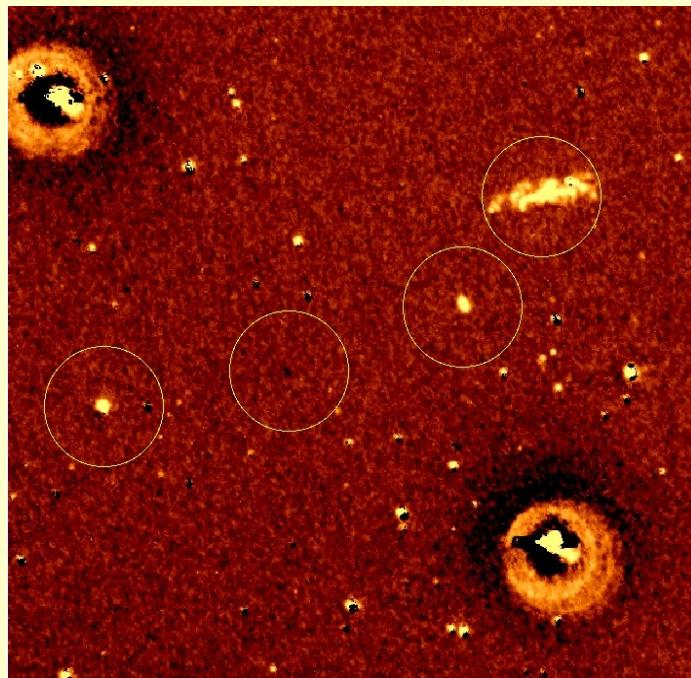
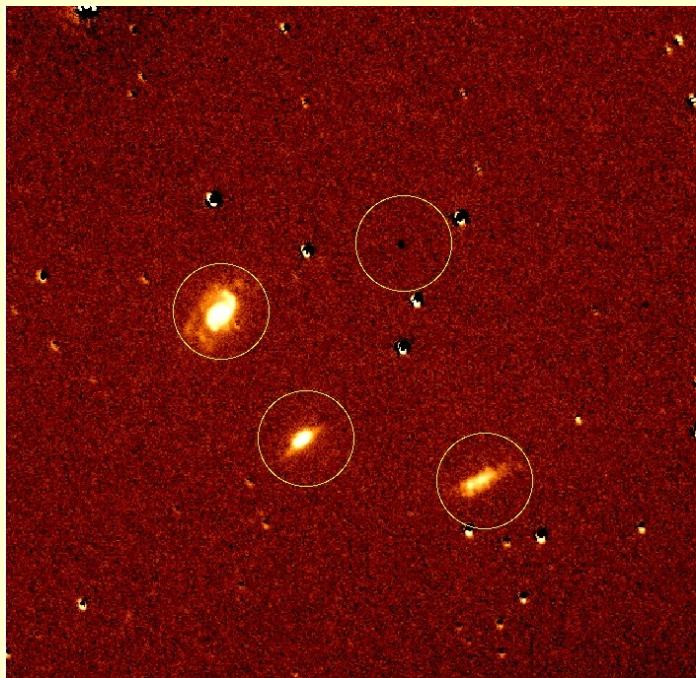
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SDSS ID	Phase	RA [hhmm]	Dec [ddmm]	z	δz	PA _{al.}	RA _{al.}	Dec _{al.}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2014/04/01								
273	2	121427.482	-005150.12	0.0589	1.04e-4	118.0	121427.282	-005150.04
273	4	121424.306	-005151.48	0.0590	4.85e-4	118.0	121424.282	-005150.04
273	5	121425.300	-005150.00	0.0587	4.89e-4	118.0	121425.282	-005150.04
273	5	121423.943	-005149.93	0.0587	7.36e-4	145.0	121423.284	-005127.14
273	6	121425.300	-005150.00	0.0589	1.85e-4	145.0	121425.284	-005127.14
273	6	121424.797	-005150.05	0.0584	1.36e-4	12.0	121424.059	-005150.07
273	6	121425.305	-005150.52	0.0587	3.04e-4	12.0	121425.059	-005150.07
273	6	121425.300	-005150.00	0.0578	0	12.0	121425.059	-005150.07
273	0	121427.767	-005149.52	0.0599	5.73e-4	12.0	121427.069	-005149.07
273	0	121424.797	-005150.05	0.0573	4.00e-4	35.0	121424.874	-005151.54
273	0	121425.375	-005150.52	0.0588	2.77e-4	35.0	121425.874	-005151.54
273	0	121425.375	-005150.52	0.0588	2.77e-4	35.0	121425.874	-005151.54
273	5	121423.995	-005149.97	0.0594	2.05e-4	35.0	121423.874	-005151.54
0	1	120202.749	-162355.553	0.0580	3.49e-4	145.0	120202.670	-162355.007
0	4	120201.500	-162358.334	0.0573	1.59e-4	145.0	120201.670	-162358.007
2014/10/25								
194	3	220047.751	-024656.79	0.0579	2.42e-4	283.3	220047.895	-024651.335
194	0	220044.382	-024655.37	0.0570	1.89e-4	283.3	220044.895	-024650.335
194	1	220040.320	-024649.95	0.0576	2.39e-4	283.3	220040.895	-024649.335
194	1	220040.320	-024649.95	0.0575	1.70e-4	307.3	220040.895	-024649.744
194	2	220043.440	-024647.40	0.0578	2.07e-4	307.3	220044.895	-024649.744
194	4	220050.840	-024642.97	0.0547	1.46e-4	307.3	220044.895	-024649.744
257	1	044454.855	-522654.040	0.0172	3.33e-4	57.1	044450.150	-522442.775
257	1	044454.855	-522654.059	0.0175	2.43e-4	57.1	044450.150	-522442.775
257	4	044451.335	-522653.74	0.0168	7.39e-4	57.1	044450.150	-522442.775
257	3	044450.074	-522650.35	0.0159	1.55e-4	95.5	044450.054	-522443.322
257	5	044451.730	-522651.406	0.0169	3.53e-4	95.5	044450.154	-522443.322
2014/10/27								
007	2	001826.635	-420816.07	0.0452	3.35e-4	62.5	001826.711	-420795.475
007	0	001822.082	-420742.79	0.0397	1.85e-4	70.5	001822.082	-420798.545
007	1	001824.358	-420743.55	0.0445	3.33e-4	70.5	001824.358	-420798.545
007	3	001829.395	-420745.58	0.0399	1.47e-4	70.5	001829.395	-420798.545
205	1	045705.575	-452242.02	0.0472	7.75e-4	42.5	045705.181	-454129.174
205	2	045705.575	-452242.78	0.0474	2.15e-4	42.5	045705.181	-454129.174
205	5	045721.535	-452242.28	0.0478	4.33e-4	42.5	045721.535	-454129.174
196	2	220226.391	-220555.555	0.0540	9.23e-4	55.5	220226.395	-220554.735
196	3	220223.005	-220554.445	0.0731	3.03e-4	55.5	220223.005	-220554.735
196	1	220226.579	-220551.75	0.0715	2.45e-4	52.1	220226.094	-220553.094
196	0	220223.334	-220546.77	0.0595	1.63e-4	52.1	220223.094	-220553.094
196	4	220224.797	-220543.553	0.0544	5.04e-4	52.1	220224.094	-220553.094

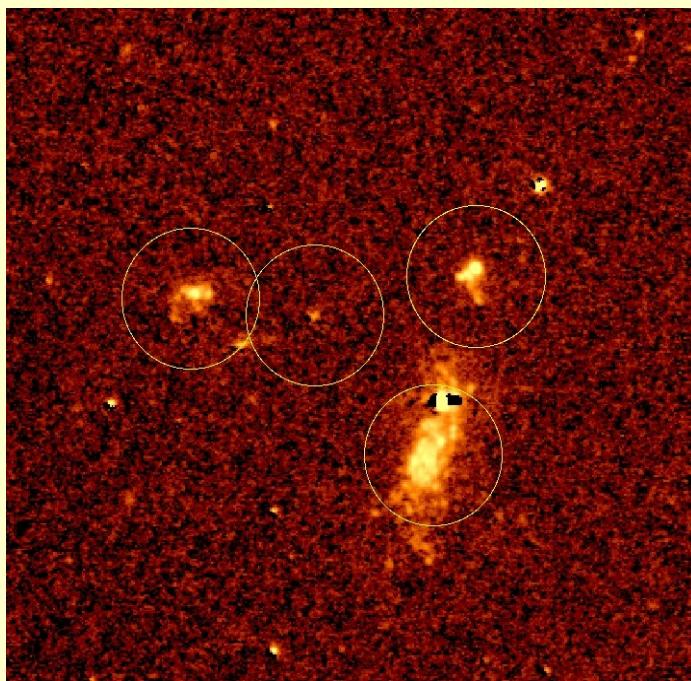
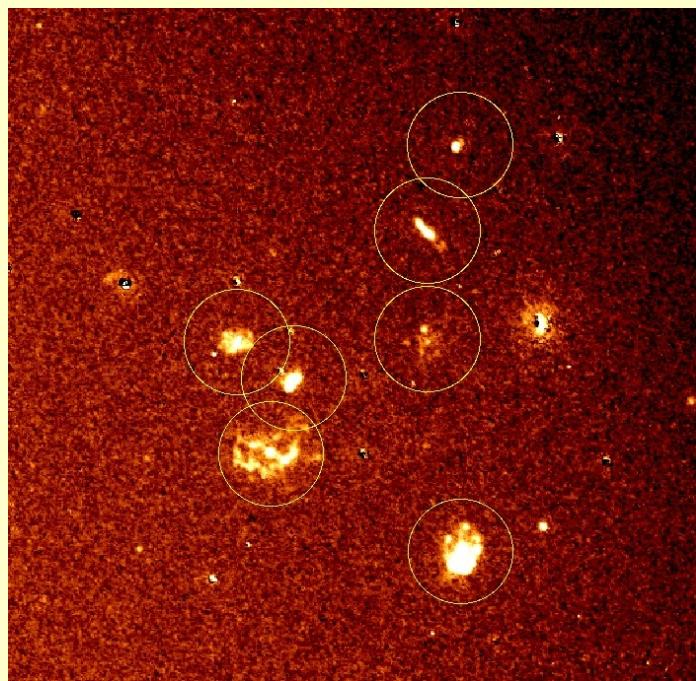
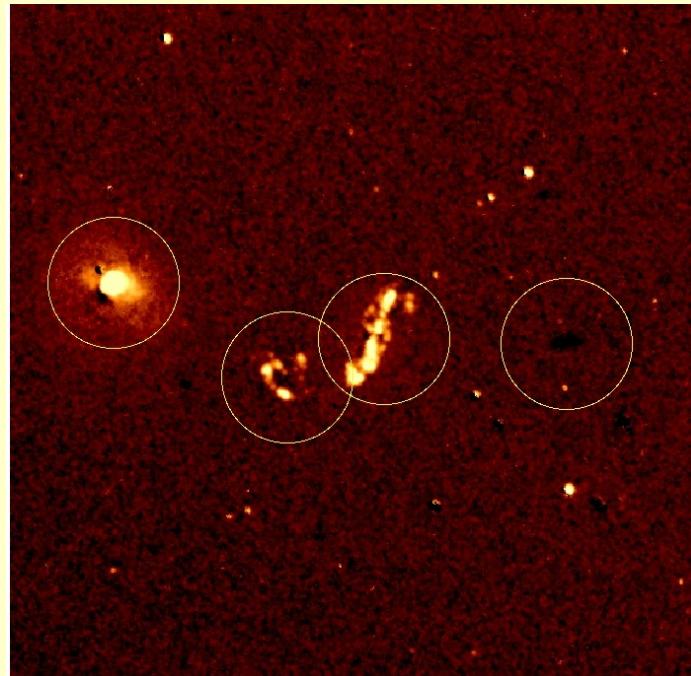
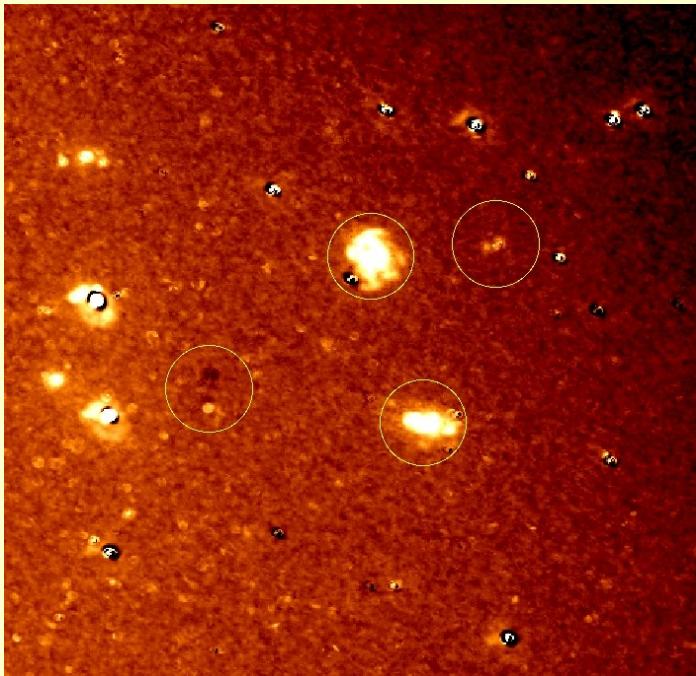
$\sim H\alpha$ survey \sim

- Long-term project (6 semesters) in the SOAR SAM imager
- 12 groups have been observed in 2.2m CAHA telescope (Spain)

CAHA 2.2m telescope (Spain)

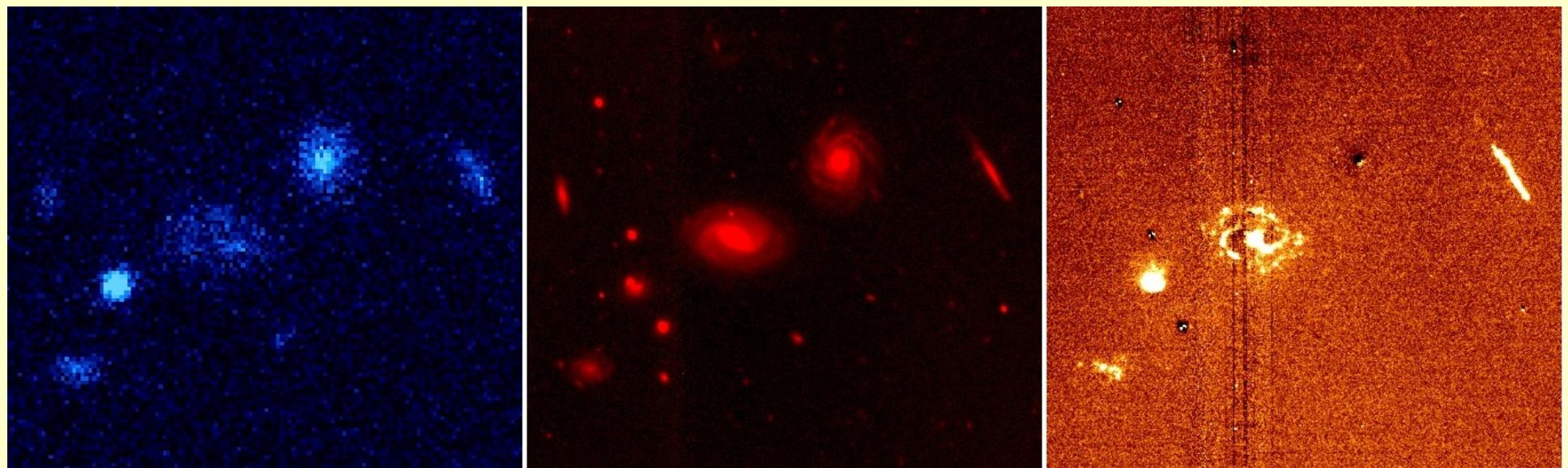


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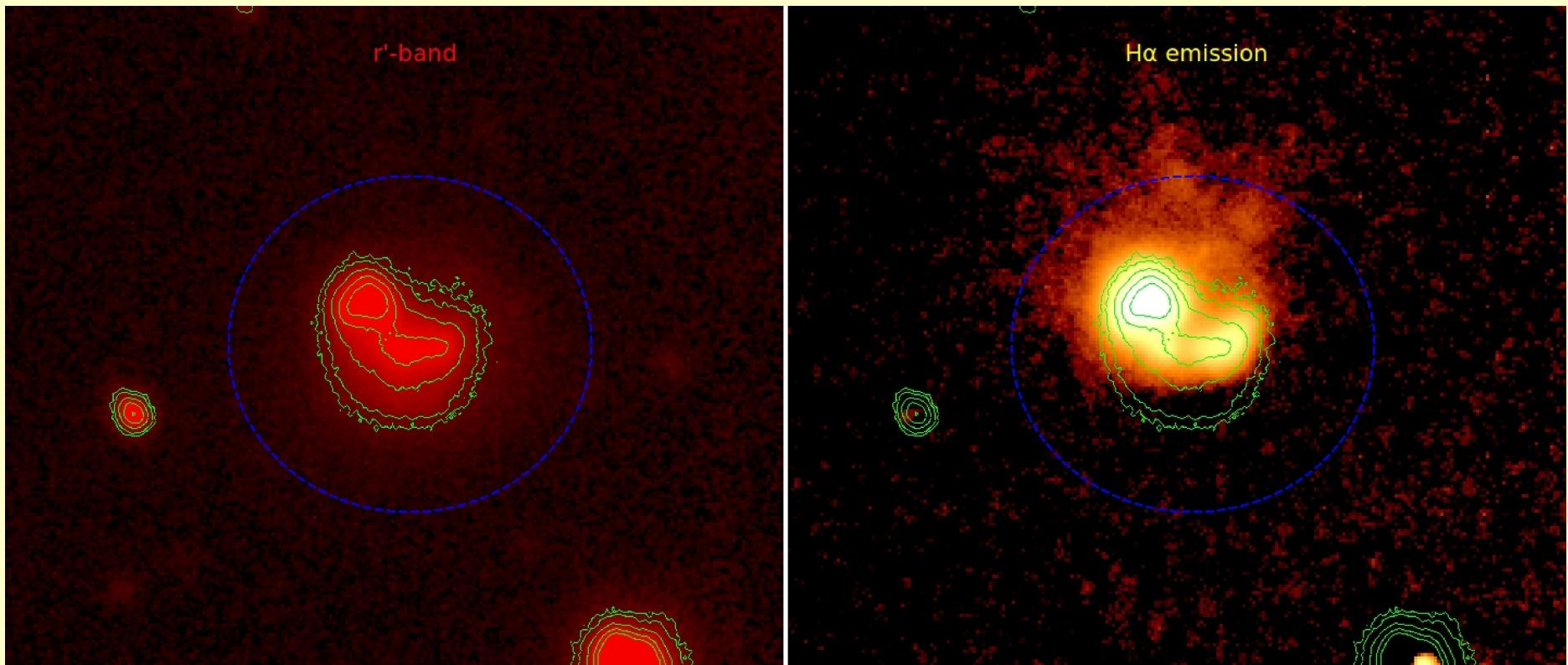


SFCG232

SOAR SAM imager (Chile)



Stripped dwarf in SFCG232



Current status of the project

Spectroscopic survey

- z's for 6 groups observed w/ SOAR Goodman
- (Asked) Long-term project at SOAR Goodman
- (Asked) 34 groups to observed w/ GMOS

H-alpha survey

- 12 SFCG observed in Halpha CAHA 2.2m
- (Asked) Long-term project at SOAR Goodman