Colours & Star Formation Rates in Isolated Galaxies

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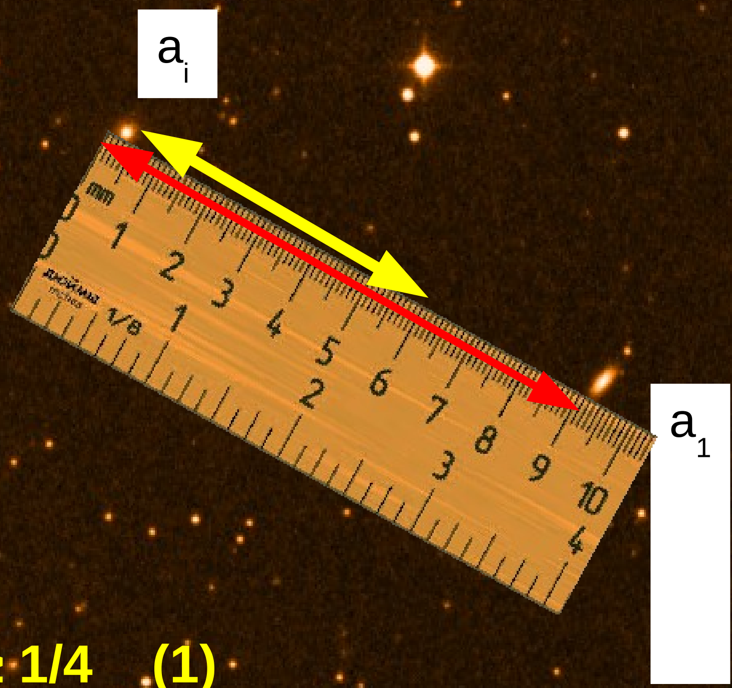
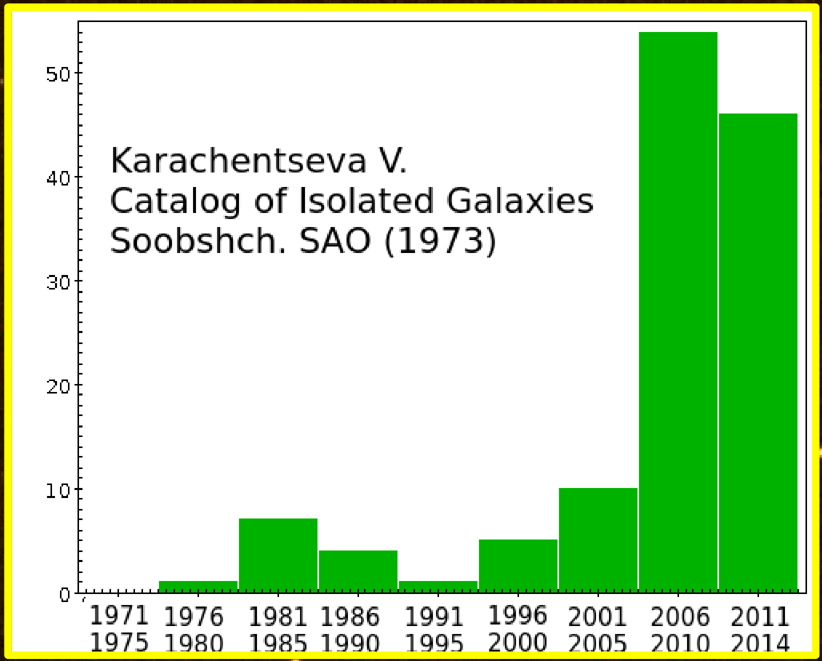


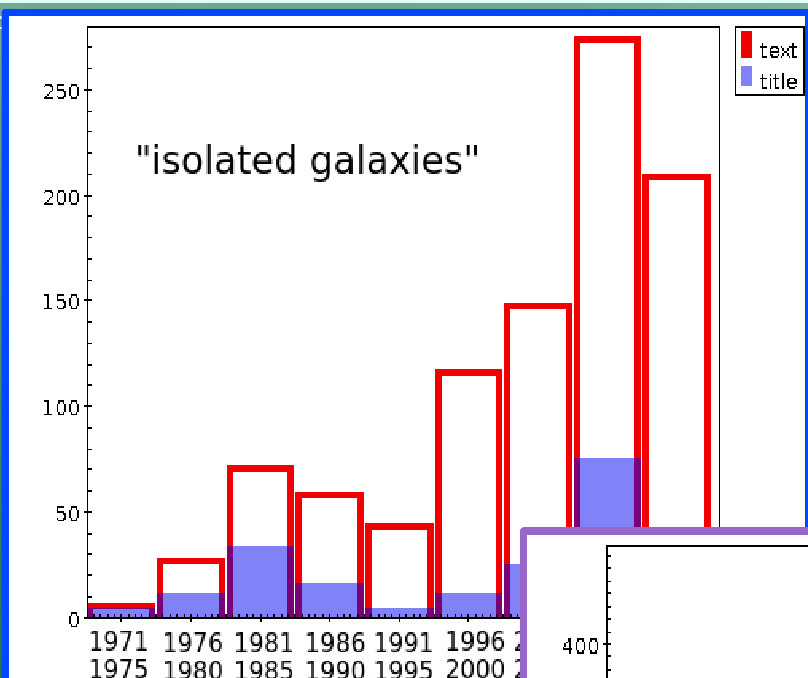


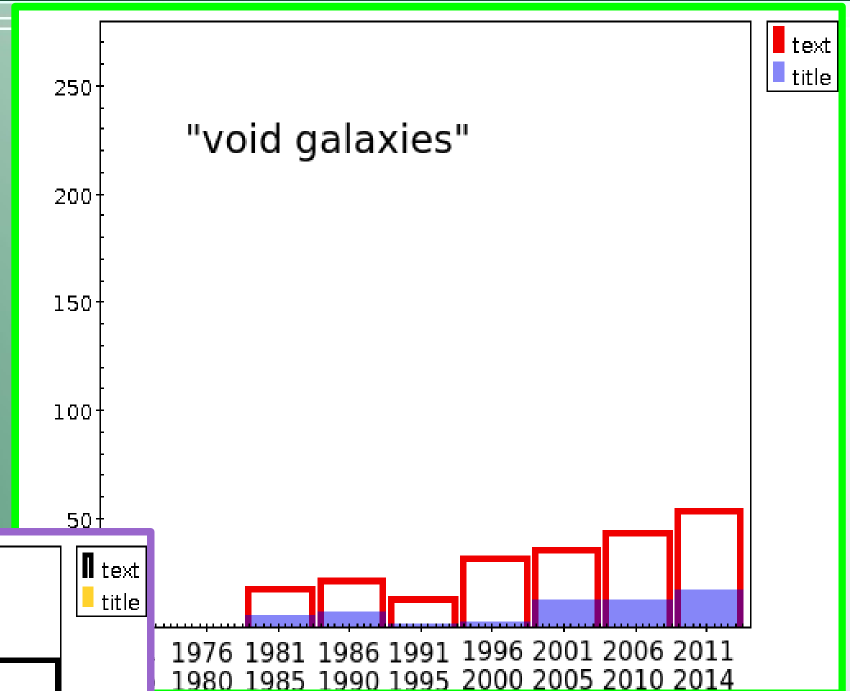
$4 \geq a_i / a_1 \geq 1/4$ (1)

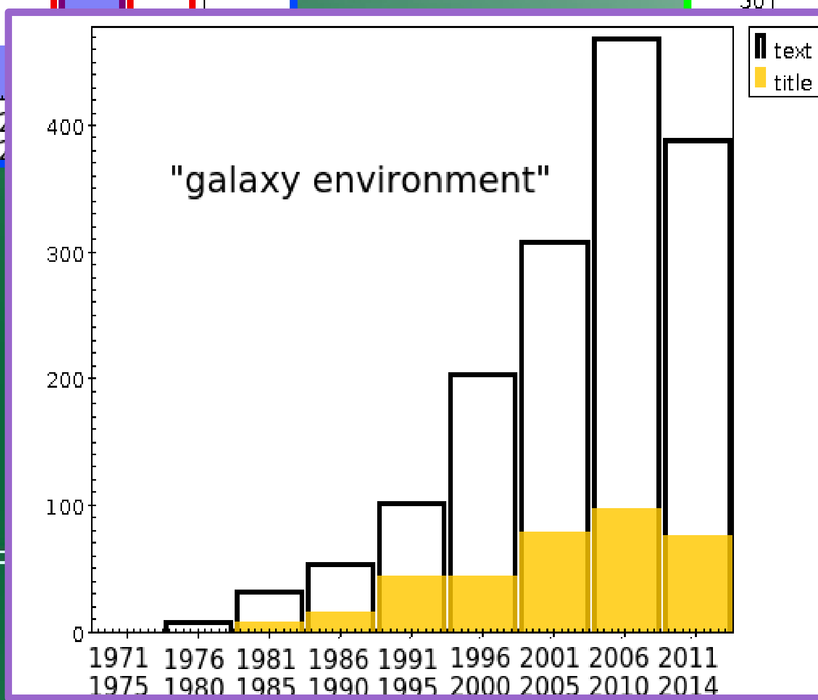
$X_{1i} \geq 20 a_i$ (2)

N=1051 CIGs (KIGs)

Statistics on references





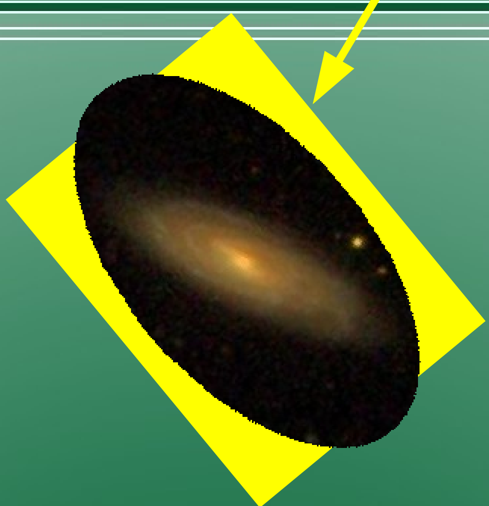


Gott J. R. III, Turner E. L.
The mean luminosity and mass densities in the Universe
1976, AJ
“galaxy environs”

Selection criteria

- Isolated galaxies:
  - criteria of isolation (in projection or by both Rh and dV/dz);
- Non-clustered (field) galaxies:
  - Apply clustering algorithm;
  - Take galaxies outside groups and clusters.
- Void galaxies – galaxies are located in underdense regions:
  - Choose a magnitude threshold;
  - Apply the void finder;
  - Look for the population void galaxies.

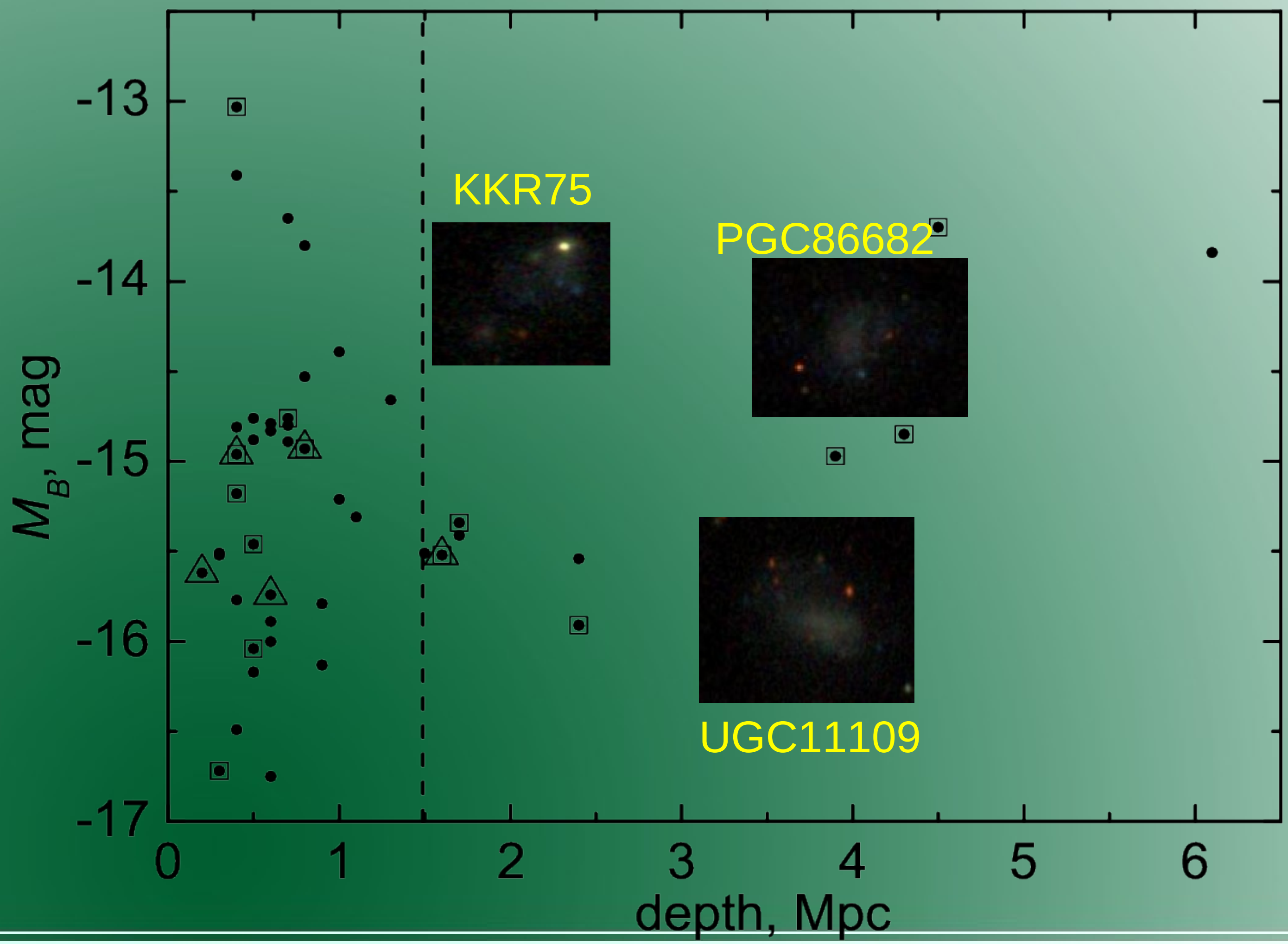
Isolated vs void galaxies



- Locally isolated, however may have small “non-significant” neighbours;
- “Normal” mass galaxies;

- Globally isolated i.e. located in undersense regions, however may have close neighbours of the same mass and interact;
- Low mass “dwarf” galaxies;

Local Void Galaxies
Elyiv et al. 2013



- majority of void galaxies located under void surface <1.5 Mpc;

- only **40**% are also isolated;

- 85% are Ir, Im, BCG, Sm;

-gas reserves per luminosity unit in 2-3 times larger
$M_{HI}/L_B = 2.1\ M_\odot/L_\odot$
for the same types from other environments

The galaxies in voids are bluer and fainter than those in denser environments
Rojas et al. 2004, Hoyle et al. 2005, 2012, Sorrentino et al. 2006). Contrary to Patiri et al. (2006).

Isolated galaxies

2MASS selected Isolated Galaxies
(2MIG; Karachentseva et al. 2010)

- selected from 1.6 million objects of the 2MASS XSC (Jarrett et al. 2000) Ks < 12 mag and a_{Ks}>30''

- Karachentseva (1973) $X_{1i}/a_i>30$ and $1/4<a_i/a_1>4$

- visual inspection ~ 750 kpc, dV=+/-500 km/s

<6% of isolated N=3227, z<0.06

Local Orphan Galaxies
(LOG; Karachentsev et al. 2011)

- 11000 galaxies from HYPERLEDA and NED with V_{LG}<3500 km/c (z~0.01)

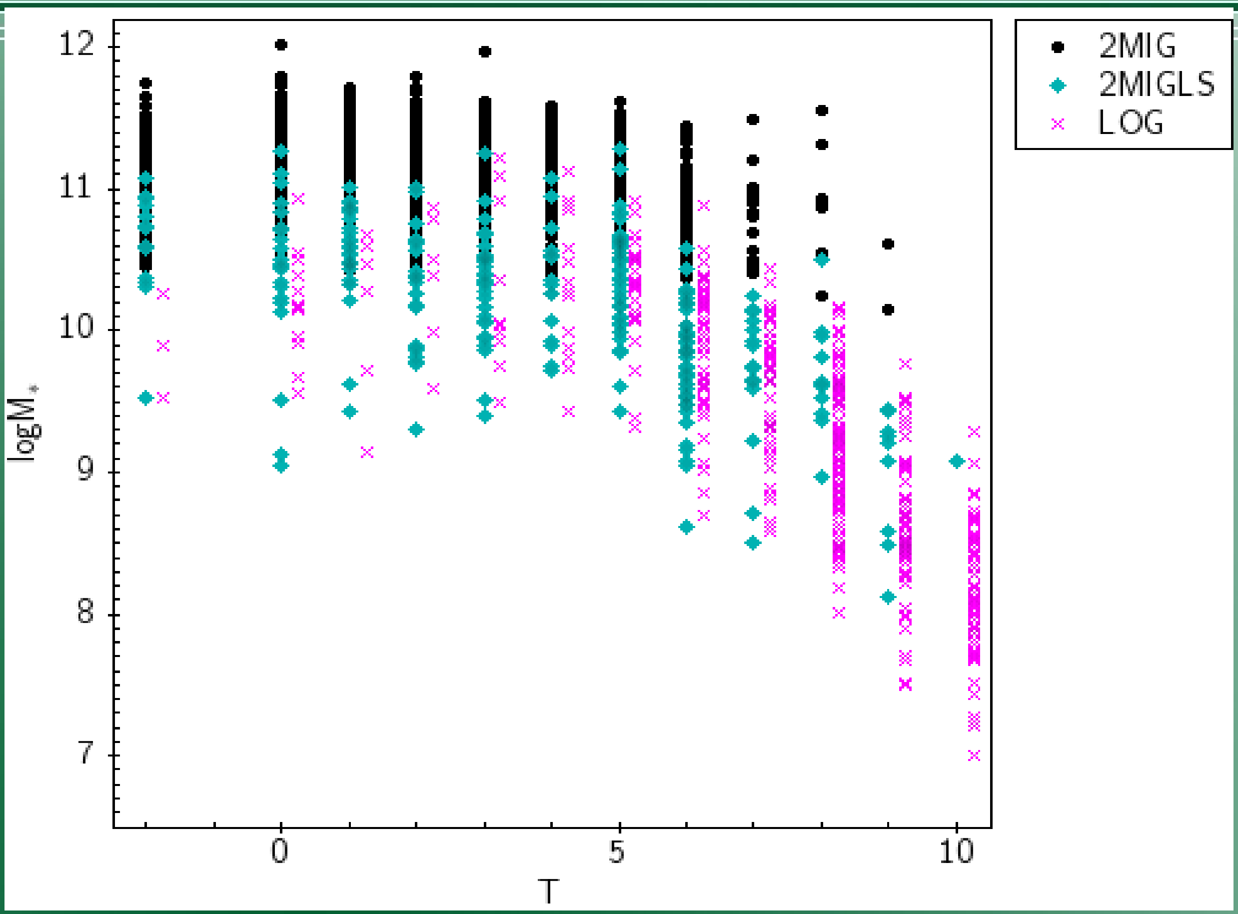
-non-clusterized galaxies defined

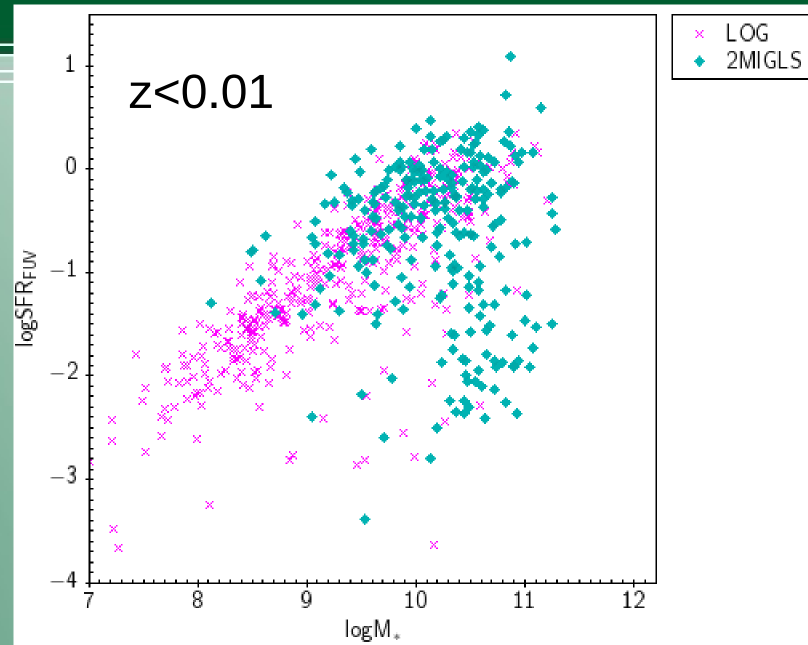
-visual application of isolation criteria by Karachentseva (1973)+ ~ 750 kpc, dV=+/-500 km/s

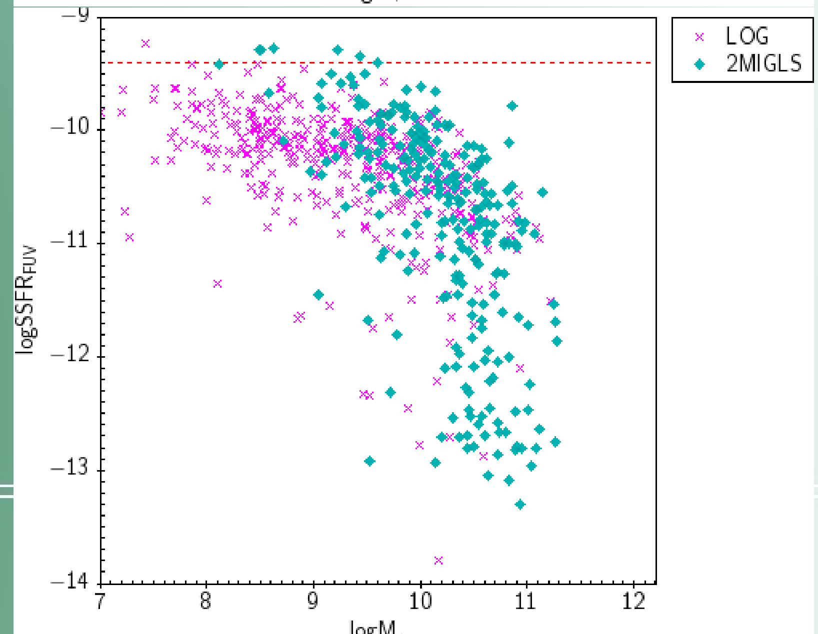
5% of isolated N=520, z<0.01

Only 16 common galaxies

2MIG and LOG isolated galaxies







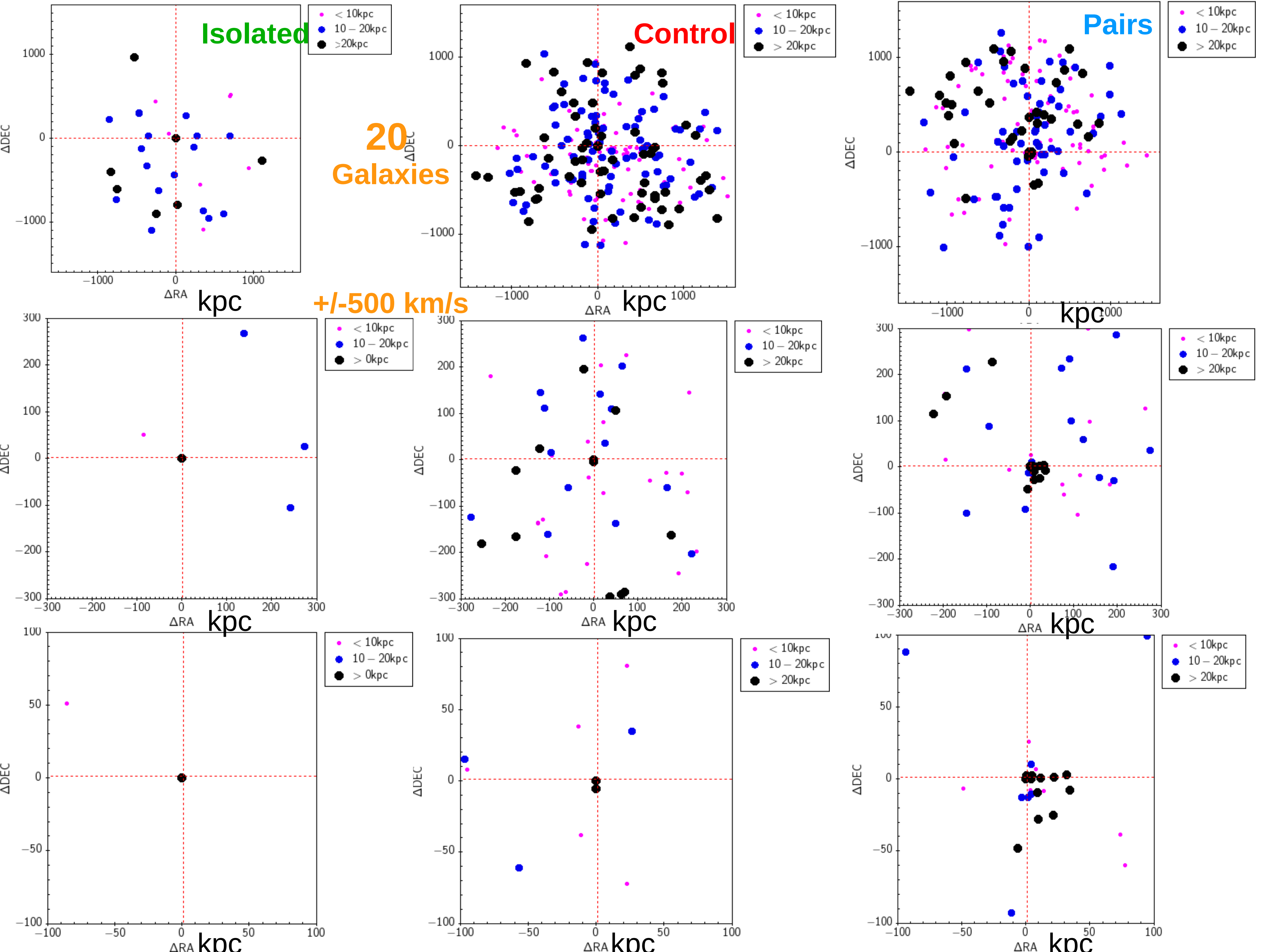
Kennicutt et al. (1998) calibration for SFR_{FUV}

Limit ~dex(-9.4) [yr^{-1}] for Local Volume 11 Mpc (~600 km/s)
Karachentsev, Makarov & Kaisina, AJ 2013

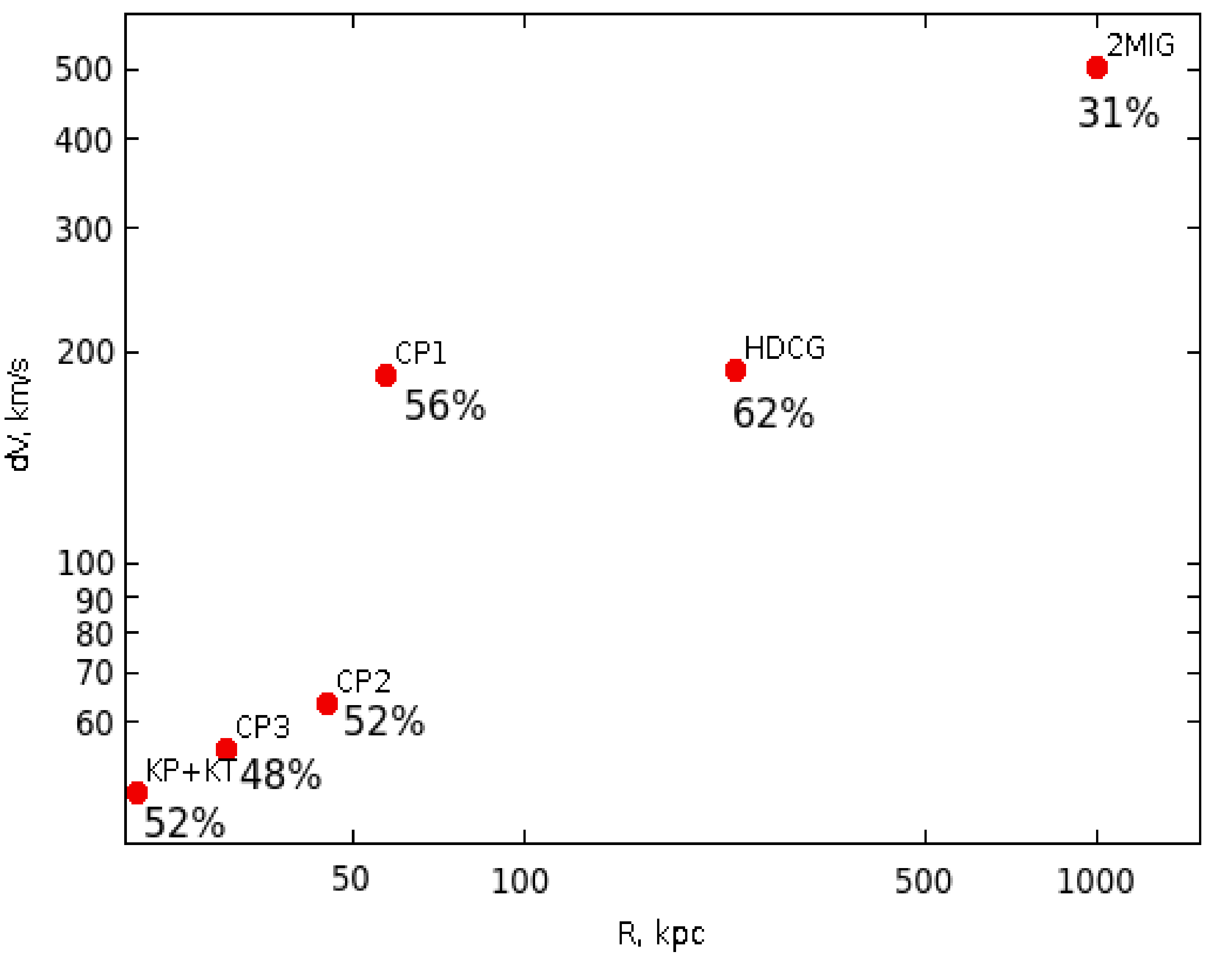
Samples for comparison

All galaxies with
Ks <12 mag
a_K < 30''

- **Isolated 2MIG galaxies** (Karachentseva, 2010);
- Control sample – randomly selected galaxies;
- High Density Contrast Groups (selected from 2MASS XSC by Crook et al. 2007);
- galaxies from pairs and triplets (KP+KT; Karachentsev 1987, Karachentseva et al. 1979, Karachentseva & Karachentsev 2000)
- galaxies from the compact pairs selected from 2MASS XSC:
  - CP1 (dV<1000 km/s, Rh<240 kpc)
  - CP2 (dV<300 km/s, Rh<100 kpc)
  - CP3 (dV<150 km/s, Rh<50 kpc)


Isolated
Control
Pairs
20
Galaxies
+/-500 km/s
< 10kpc
10 – 20kpc
>20kpc
> 0kpc
> 20kpc
ΔRA
ΔDEC
kpc

Fraction of early type galaxies

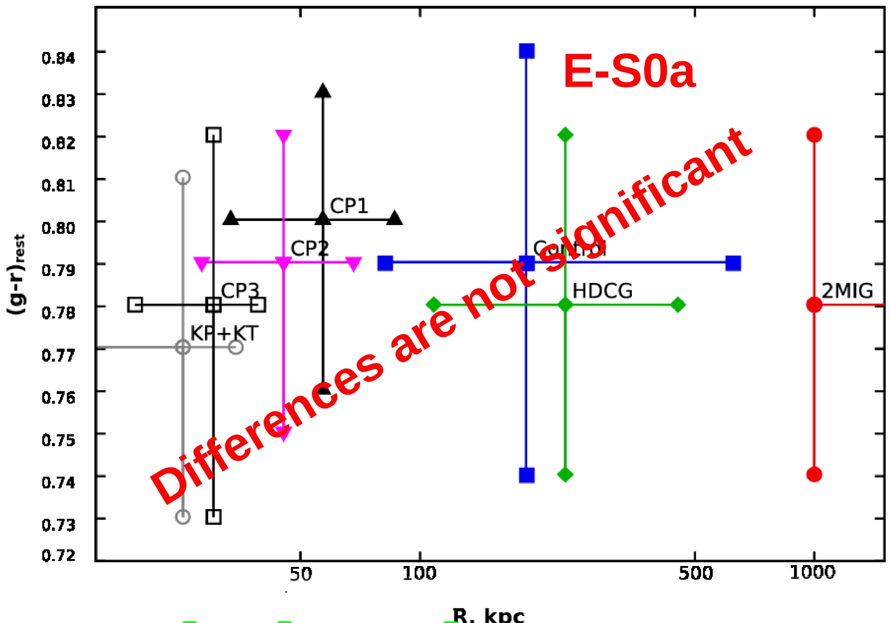


Conclusion:

Morphology-density Relation (Dressler 1980)

Evidently quenching is more efficient in denser environments

However 2MIG sample contains also a significant fraction of E-Sa galaxies



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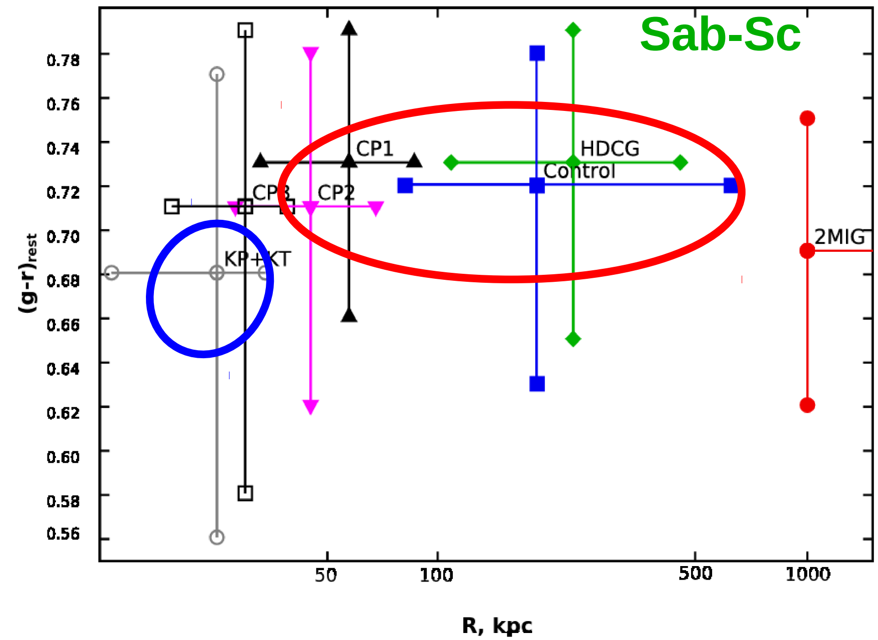
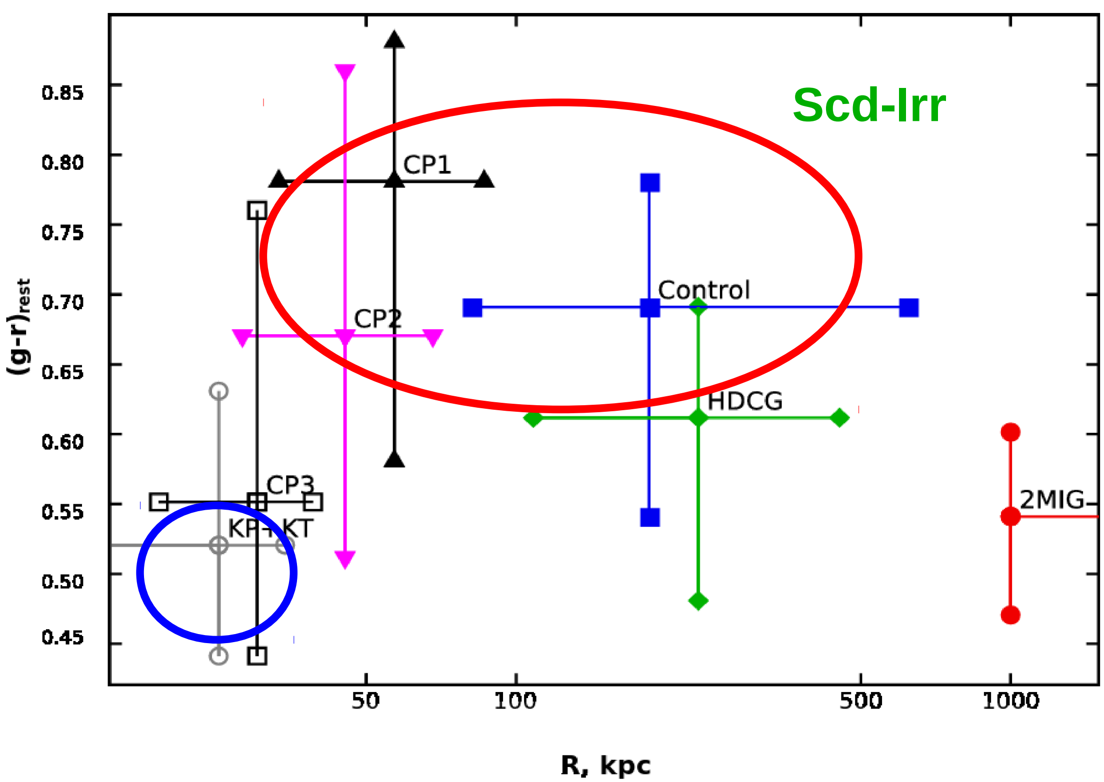


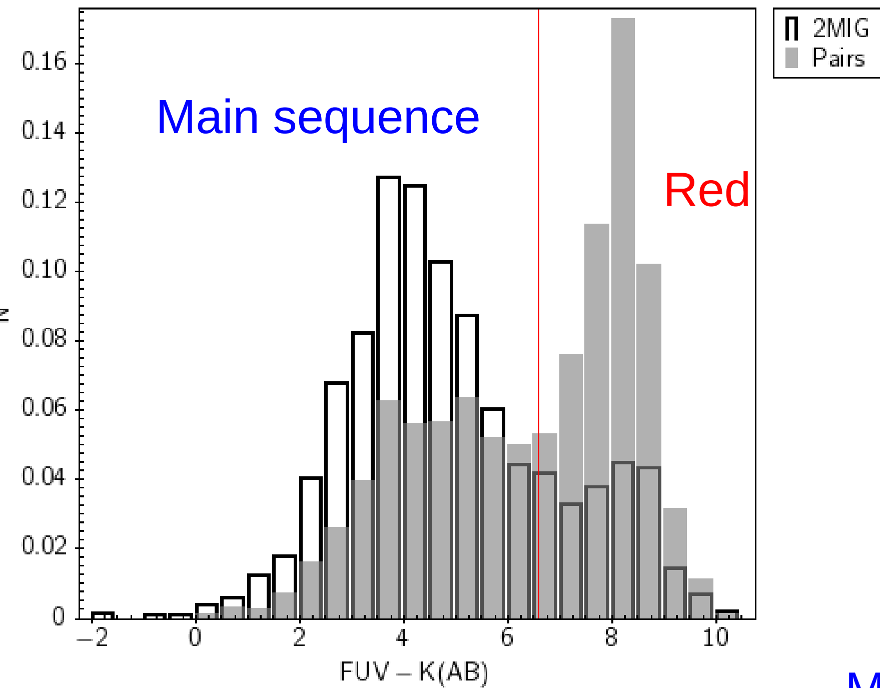
Melnyk et al. 2014



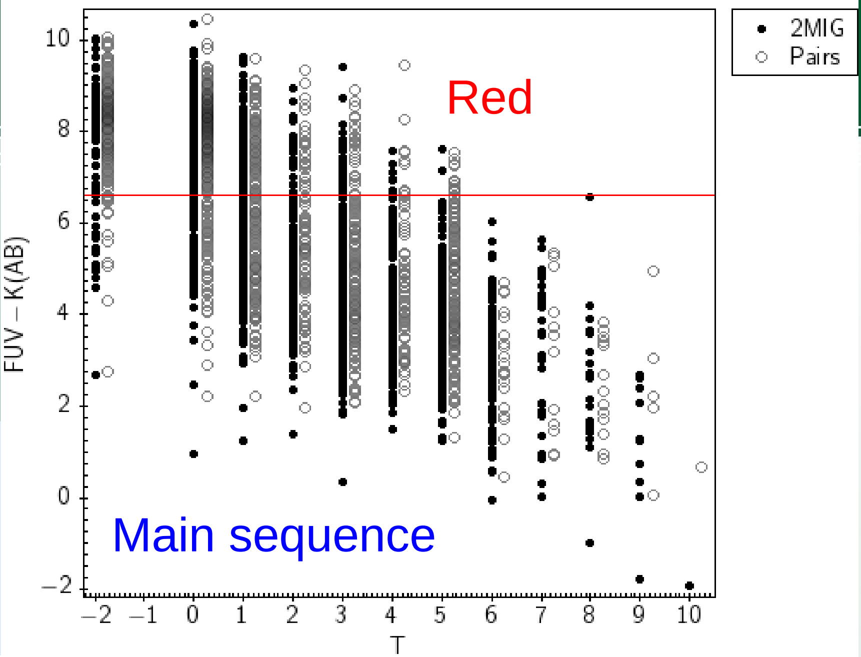
Conclusion:

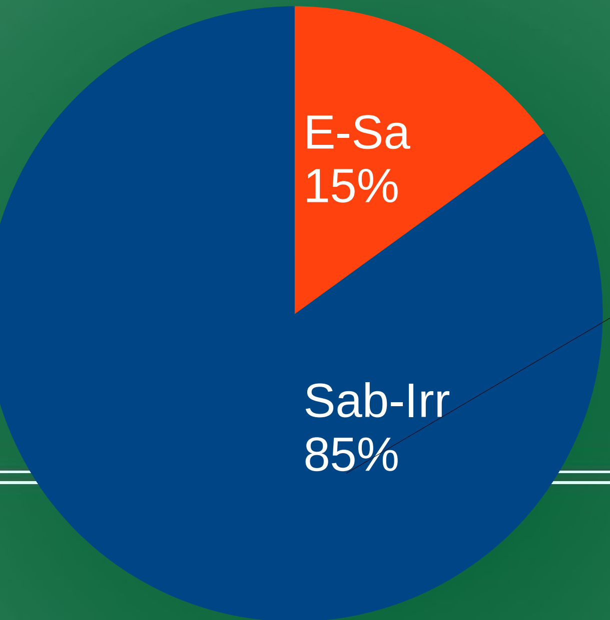
1. In different environments early type galaxies do not show any differences in optical colours (**Patton et al. 2011), Fernandez Lorenzo et al. 2012).**
2. Galaxies in group/cluster environments are redder than IG (**Rojas et al. 2004, Hoyle et al. 2005, 2012, Sorrentino et al. 2006**)
3. Galaxies in close pairs are bluer than IG (**Fernandez Lorenzo et al. 2012). Trinh et al. (2013)** found that the galaxies in pairs have a red excess for ”red” galaxies and a weak blue excess for “blue” galaxies.

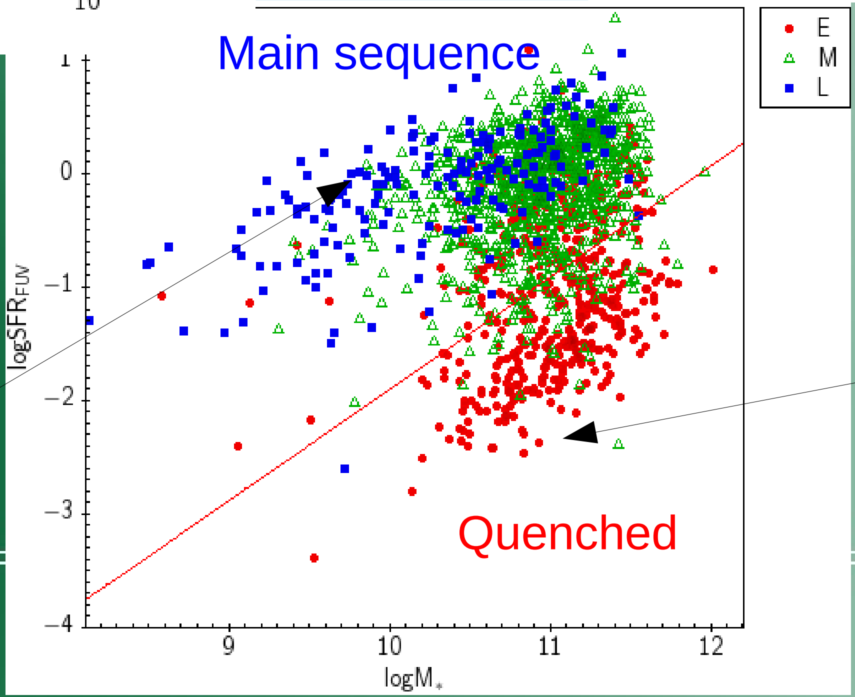
Main & red sequences

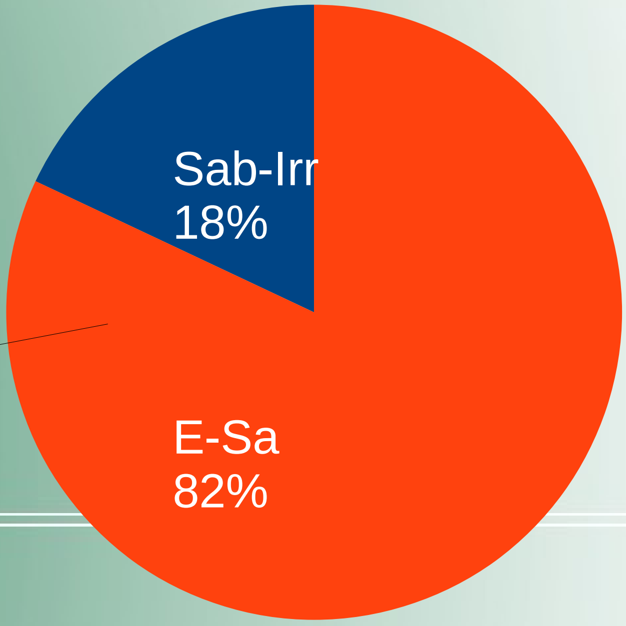


33% of E gals from MS detected in HI

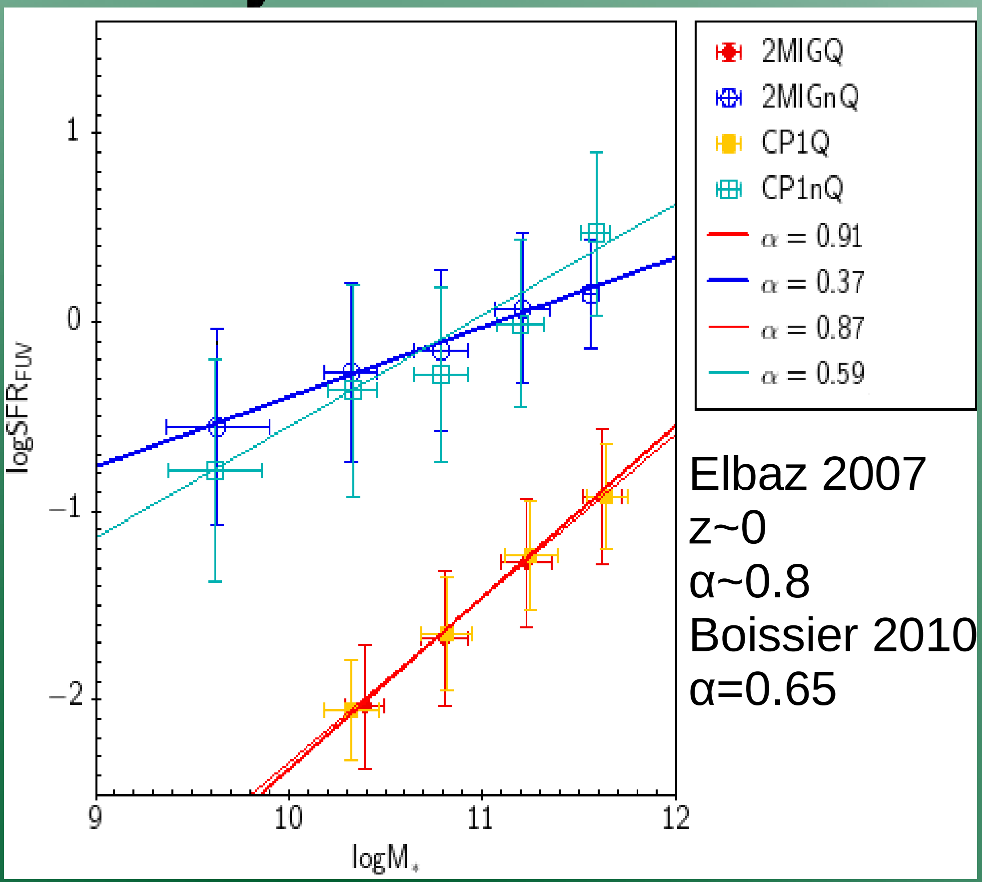


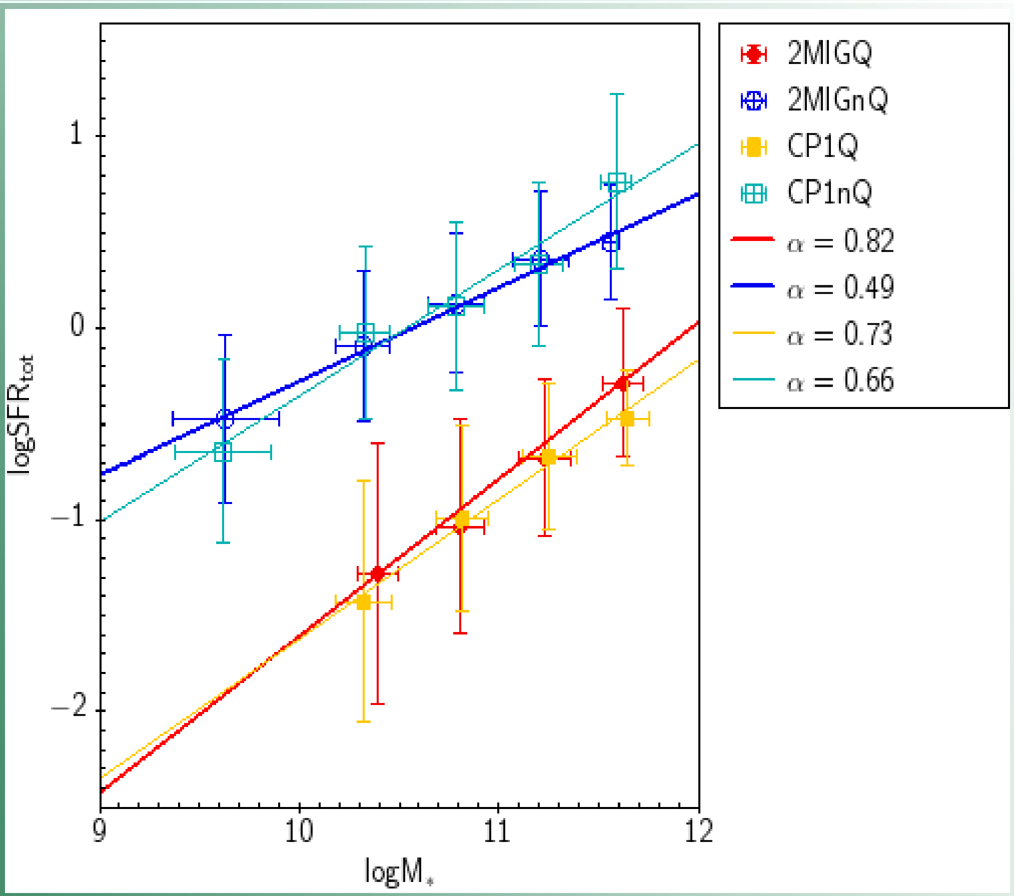






Star formation rates
Melnyk et al. in prep.

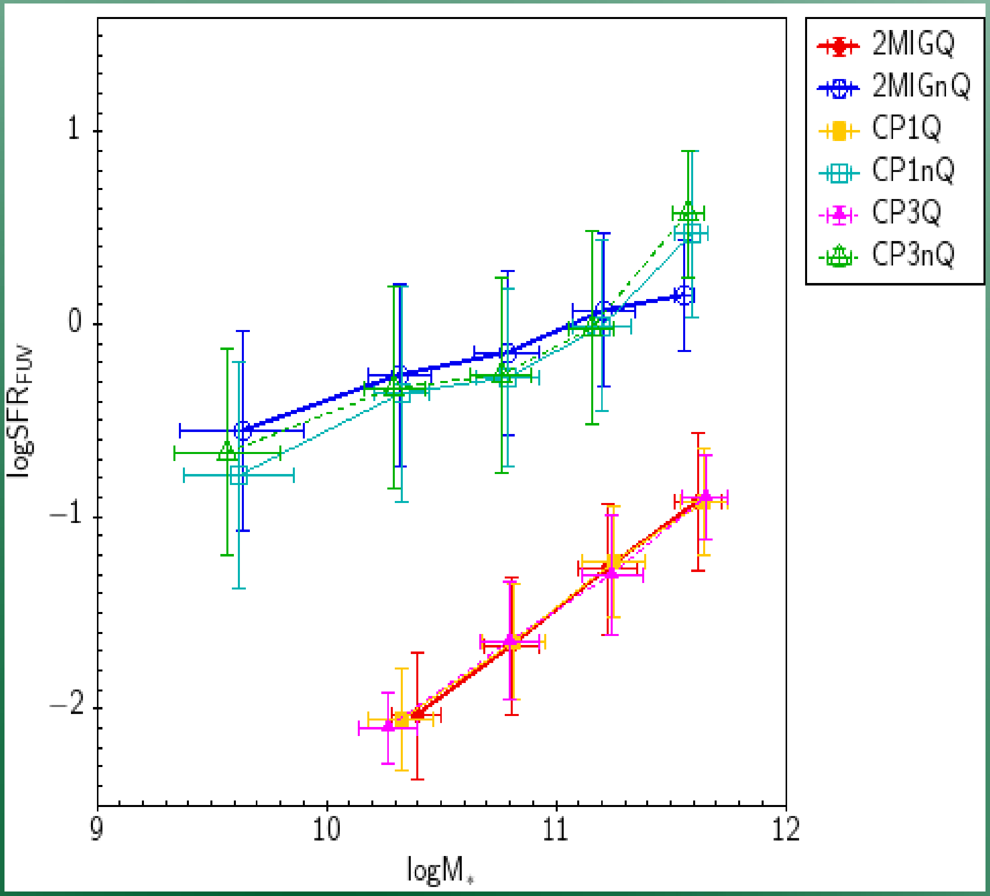


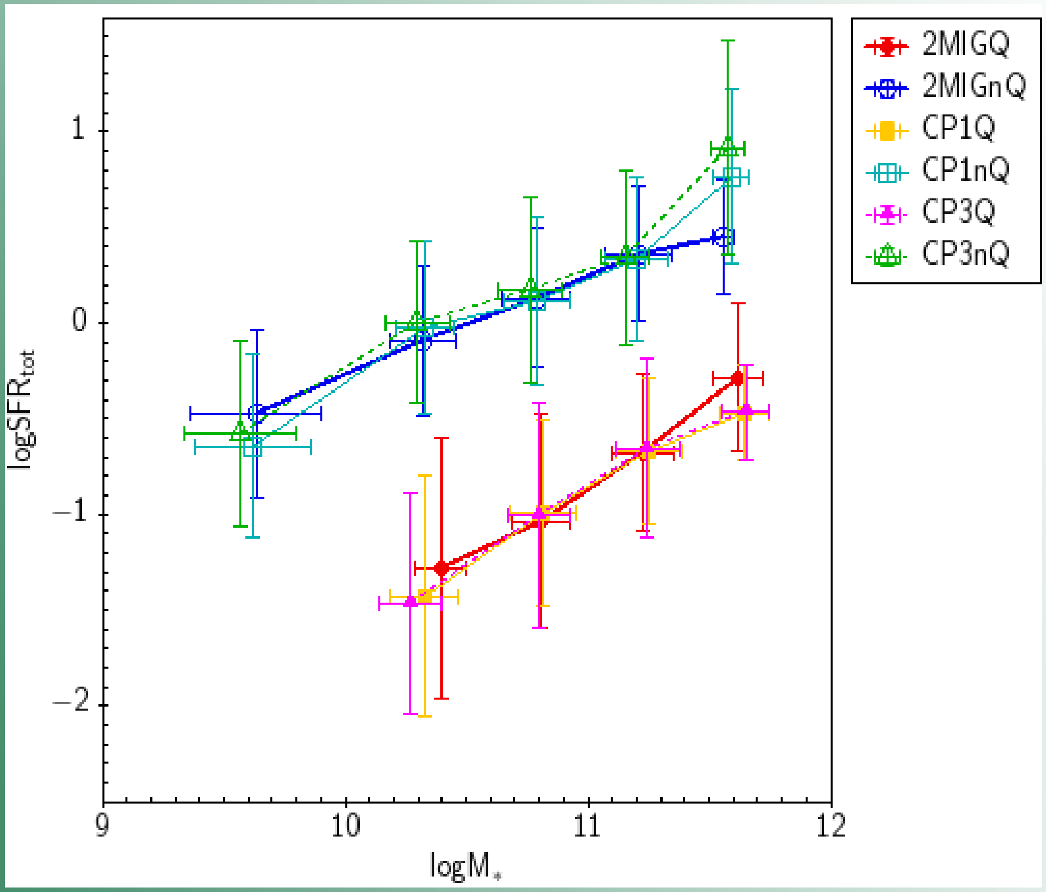


Kennicutt 1998 calibration for FUV

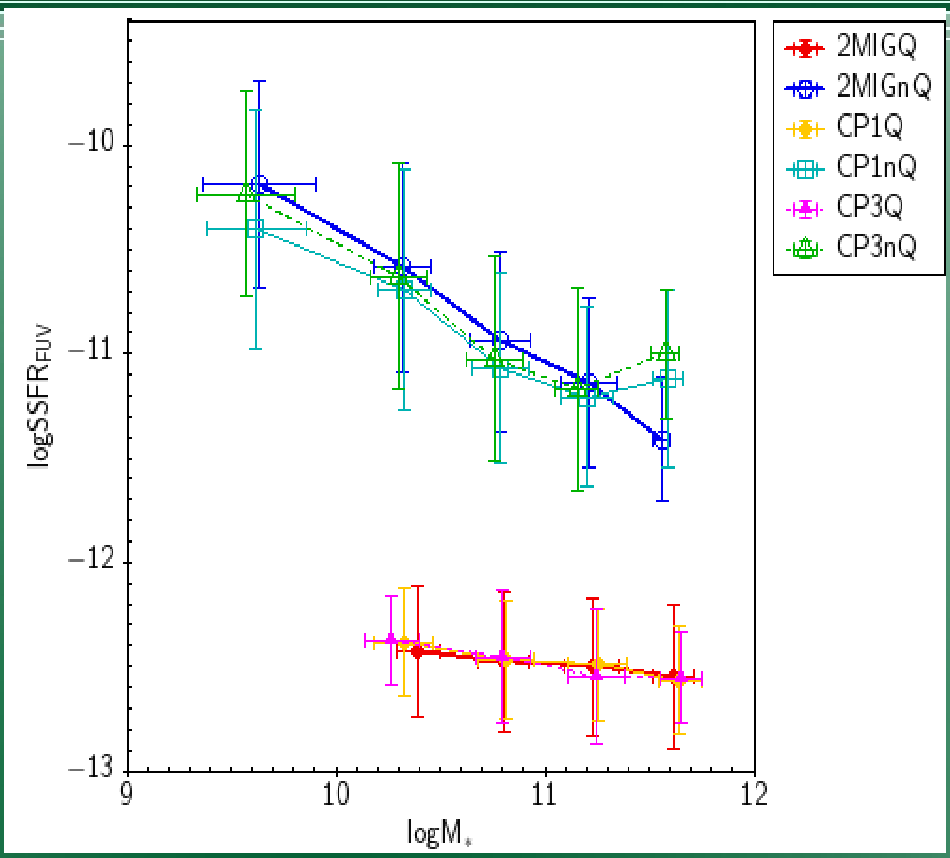
Jarrett et al. 2013 IR WISE W4 (22 um calibration

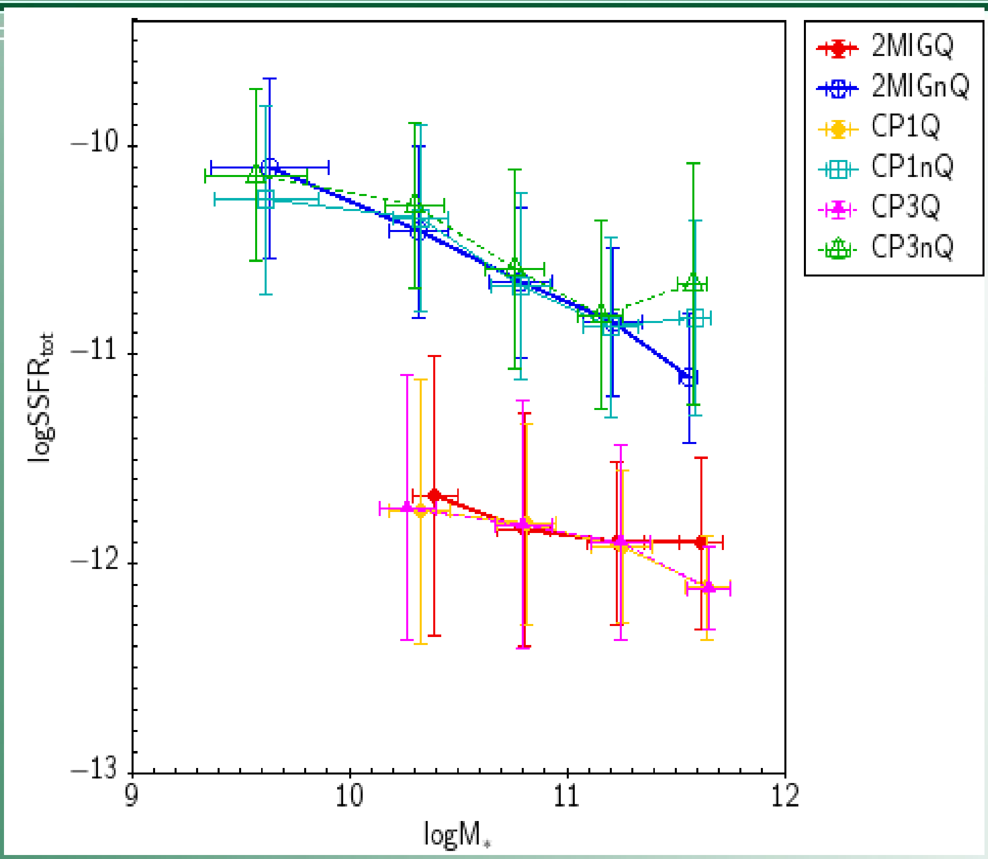
Star formation rates Melnyk et al. in prep.





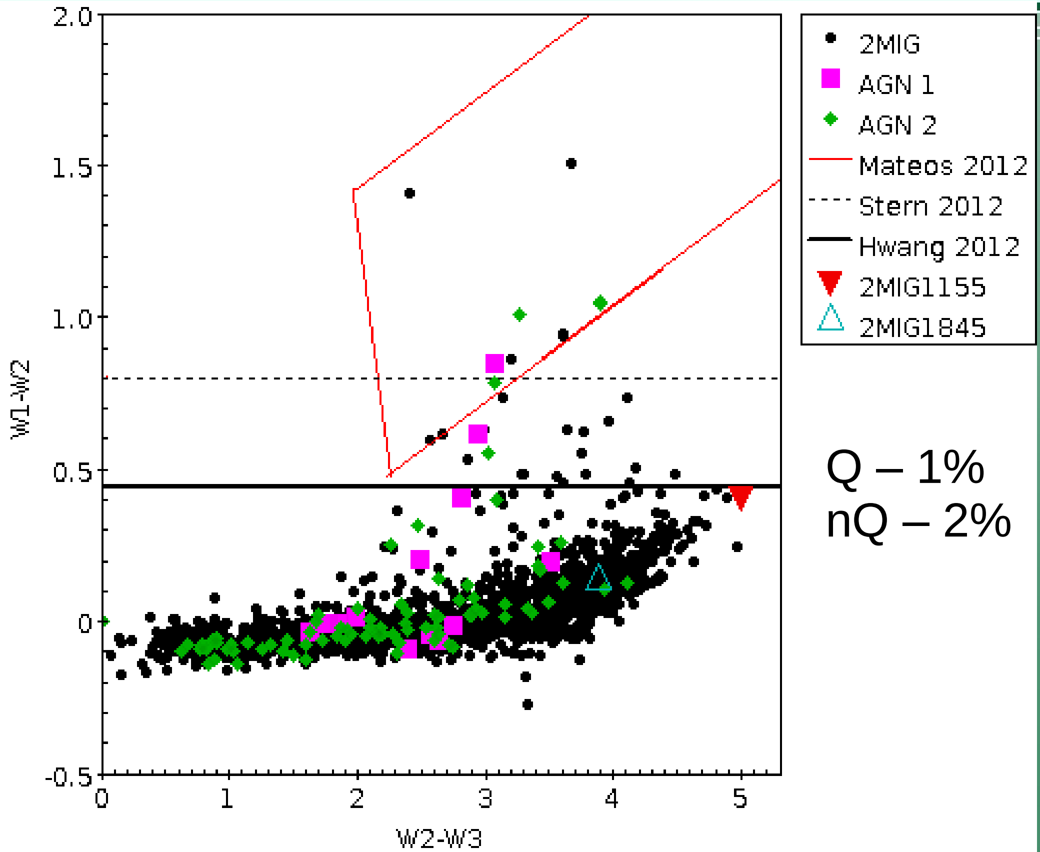
Specific star formation rates Melnyk et al. in prep.



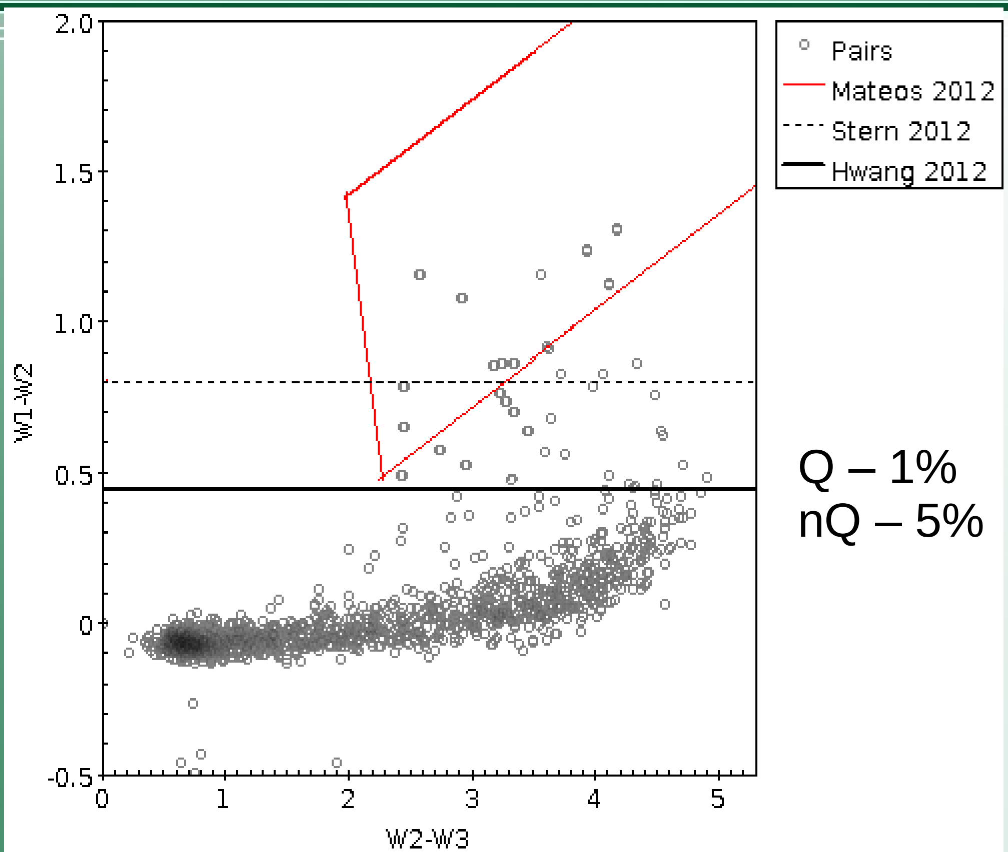


Conclusion: the main factor of evolutionary processes is defined by the galaxy mass, however we see possible triggering of the star formation in logM*>11.5 galaxies and quenching in low mass logM*<10 galaxies for paired galaxies.

AGN impact
Melnyk et al. in prep.

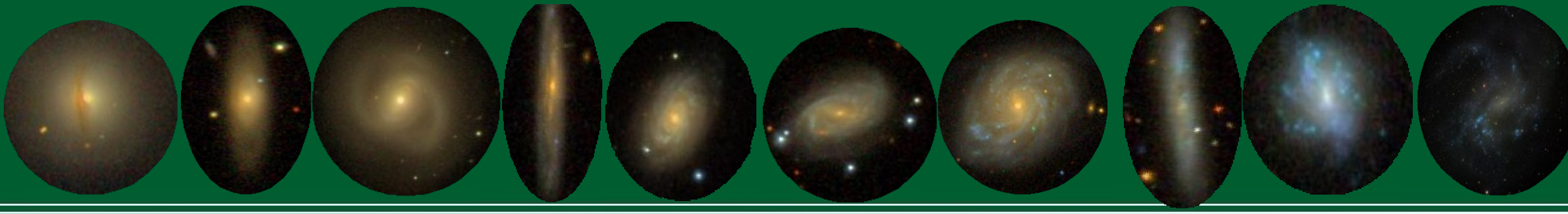


Q – 1%
nQ – 2%



Q – 1%
nQ – 5%

Conclusion: AGN phenomenon is not necessarily connected with environmental density and, the most probably, defined by secular galaxy evolution confirming the previous results by Coziol et al. (2011), Sabater et al. (2012), Hernandez-Ibarra et al. (2013), Karachentseva et al. (2014) and Pulatova et al. (2014).



Thank you!