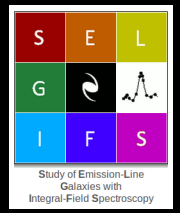
Ageing, quenching and rejuvenation in SDSS galaxies

Javier Casado
(Universidad Autónoma de Madrid)

Carmen de la Victoria, Albayzin, Granada



What do we mean by...

Ageing, quenching and rejuvenation...

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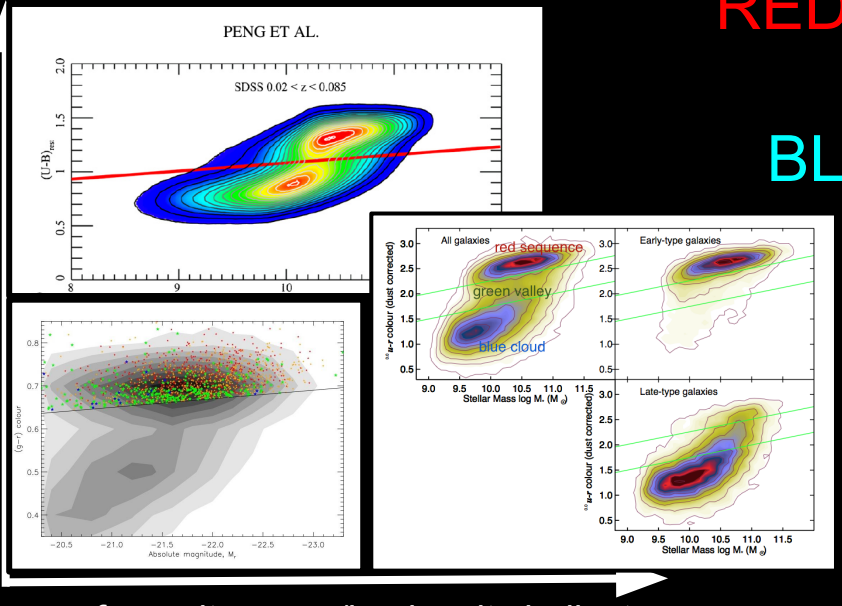
Ageing, quenching and rejuvenation...

EVOLUTION

RED SEQUENCE

green valley

BLUE CLOUD



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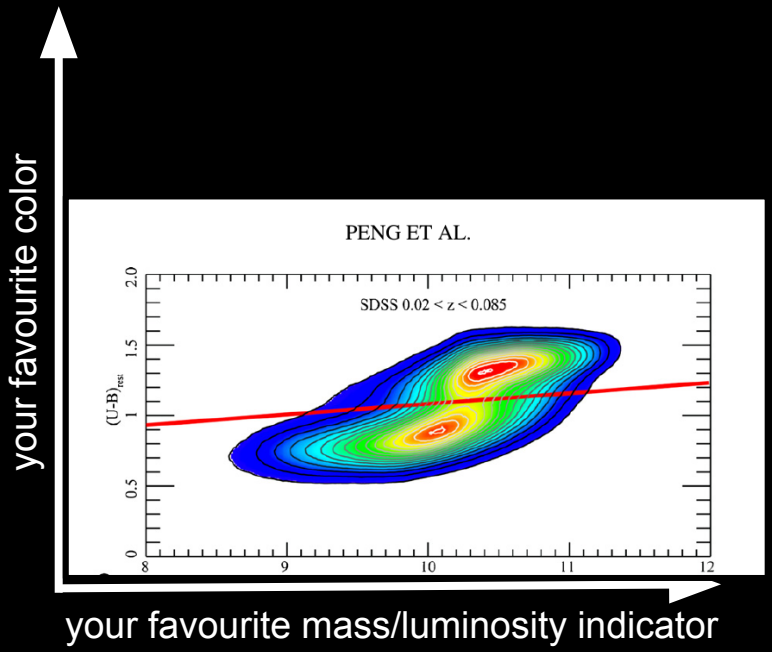

Peng et al. 2010

- QUENCHING
  - NATURE? NURTURE?

FAST

BLUE CLOUD → green valley → RED SEQUENCE

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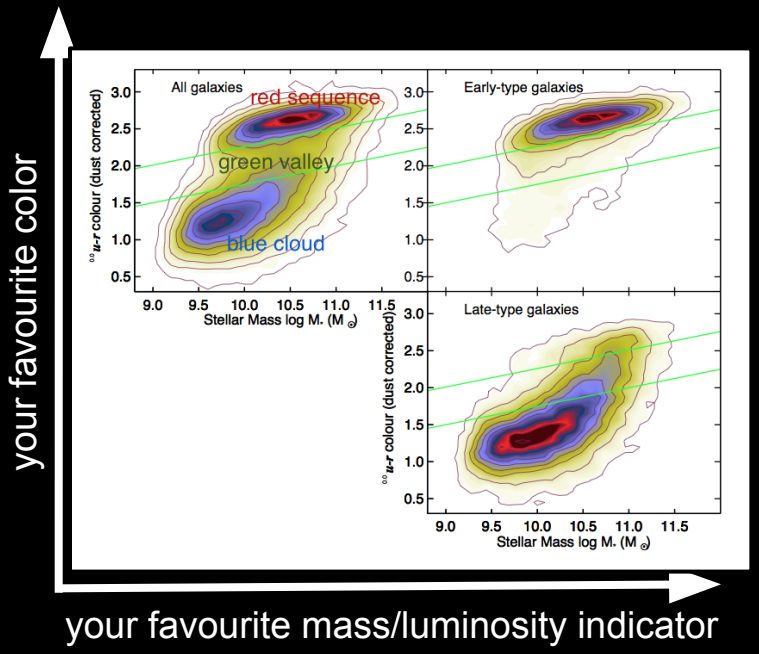

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Peng et al. 2010

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FAST

BLUE CLOUD → green valley → RED SEQUENCE

Schawinski et al. 2014

- Morphology is a **KEY** aspect
  - ET galaxies evolve fast → merger → nurture
  - LT galaxies evolve slowly → ? → nature

NO BIMODALITY

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How did we approach EVOLUTION...

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Uffff…

mass
metallicity
luminosity
age
star-formation
stellar-to-gas fraction

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We focus on the **SSFR** → Casado et al. 2015
accepted - arXiv:1504.07010

We use proxies

Mr, 03N2

R_1/R_2, $R_5/\hat{r}$

Morphology

Hα(EW), (u-r) color

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Chemically primitive
Gas rich, metal poor, low mass

Chemically evolved
Gas poor, metal rich, higher masses

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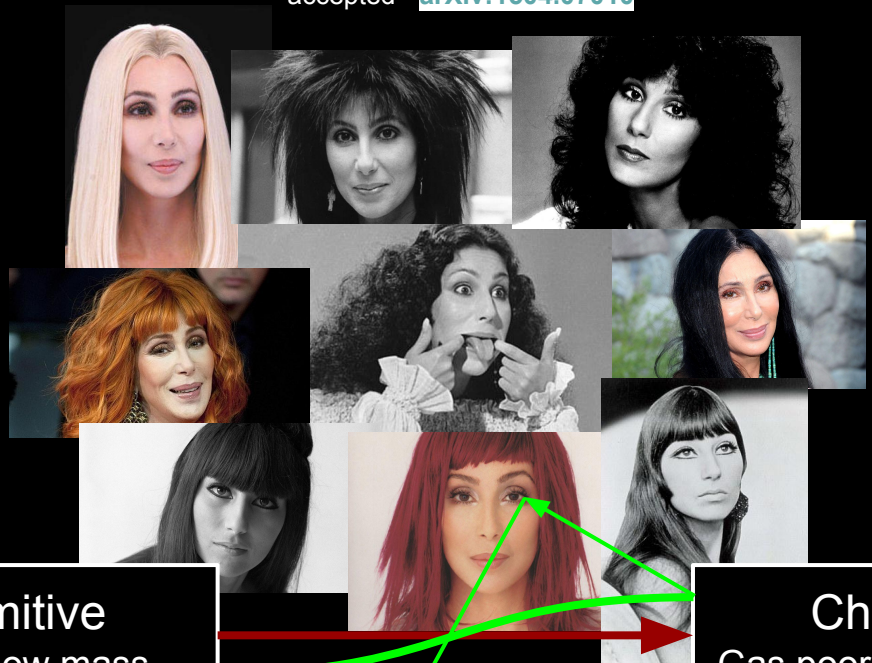

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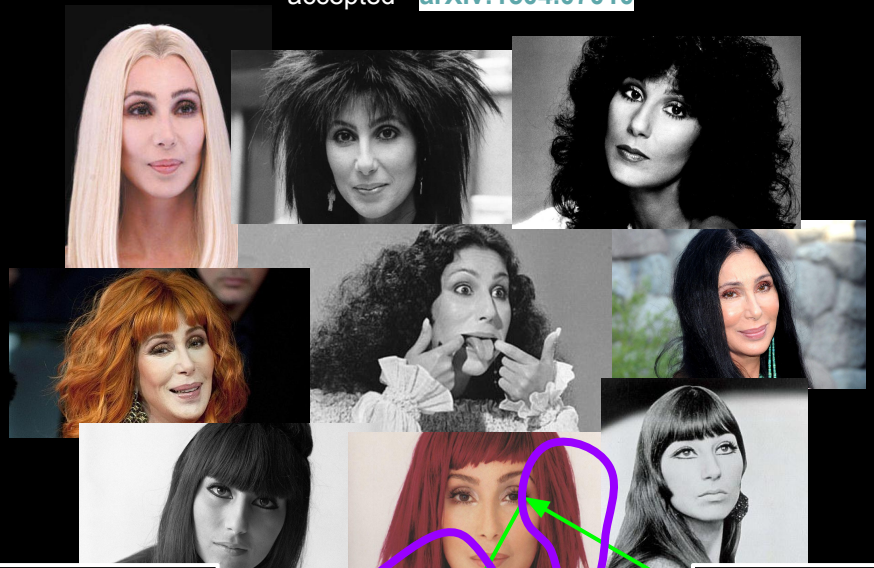

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NATURE

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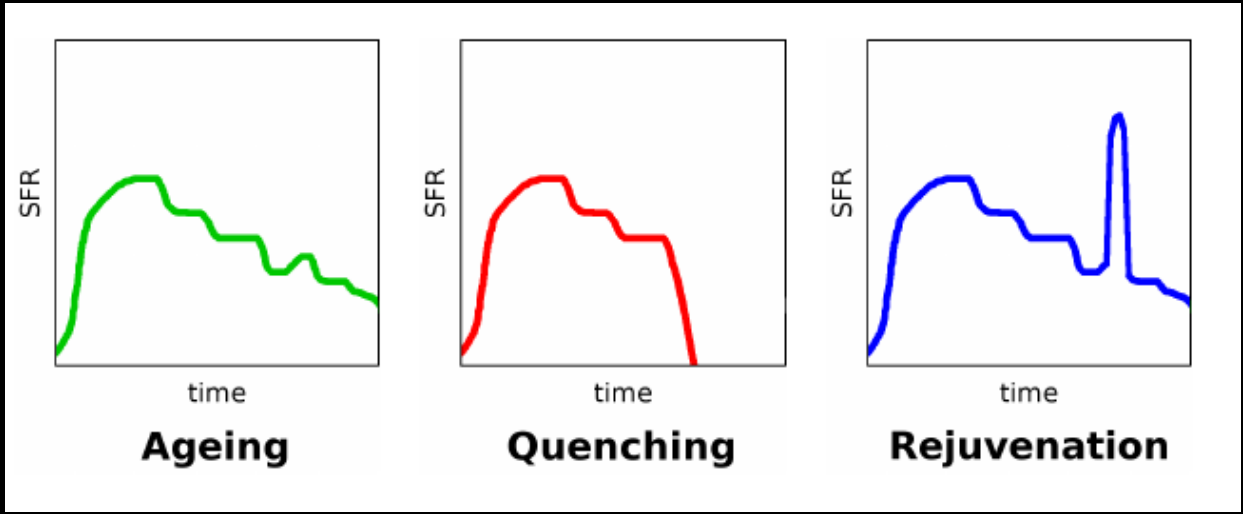
What do we mean by… NATURE

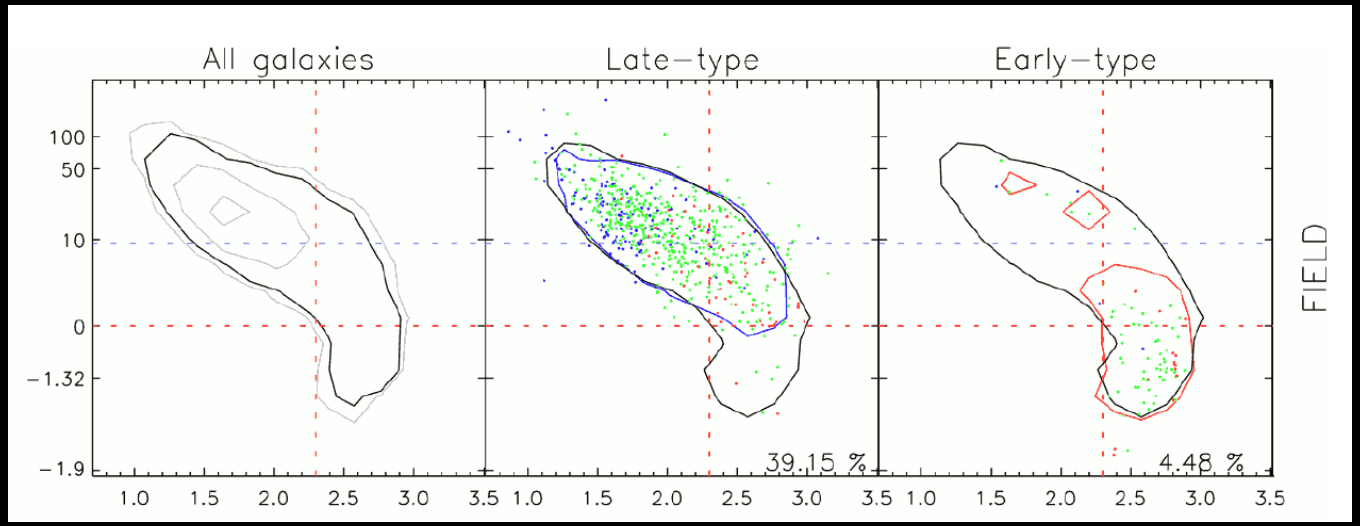


The definition of age is something a bit odd...

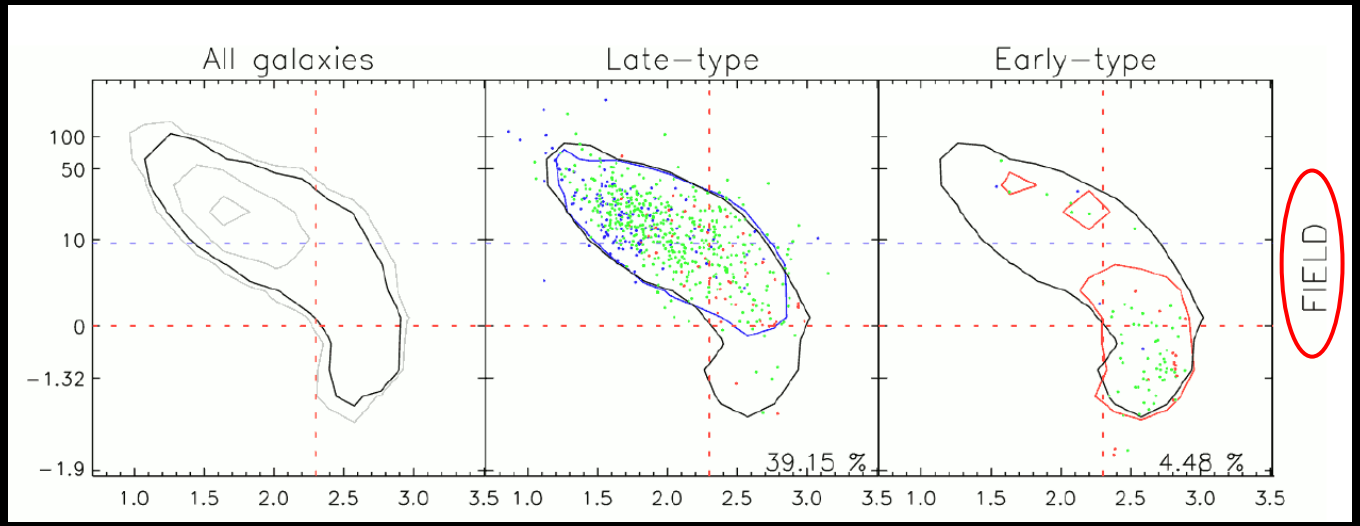
$$\tau_* = t - \frac{\int_0^t t'\psi(t')dt'}{\int_0^t \psi(t')dt'}$$

mass-weighted average age

Ageing...


All galaxies
Late−type
Early−type
Ha(EW)
100
50
10
0
−1.32
−1.9
1.0
1.5
2.0
2.5
3.0
3.5
39.15 %
4.48 %
FIELD
(u-r) color

Ageing...



10^7 yr

Ha(EW)

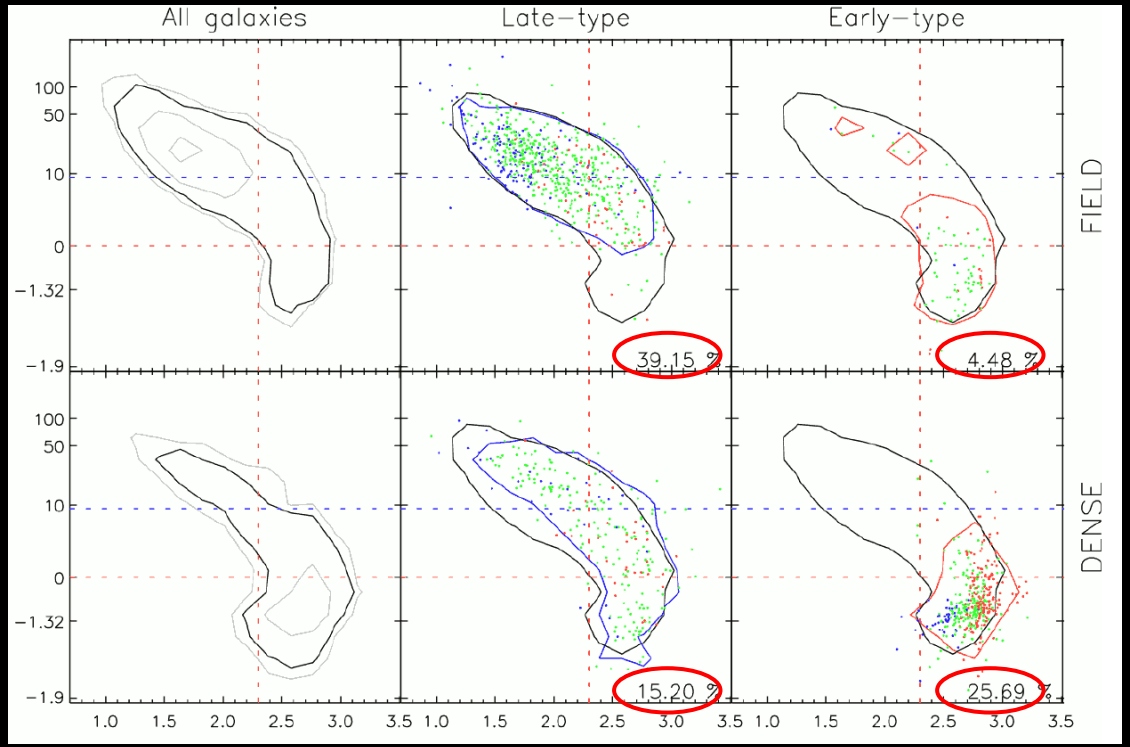
(u-r) color

$10^{8.5}$ yr

$\psi/\dot{\psi}$

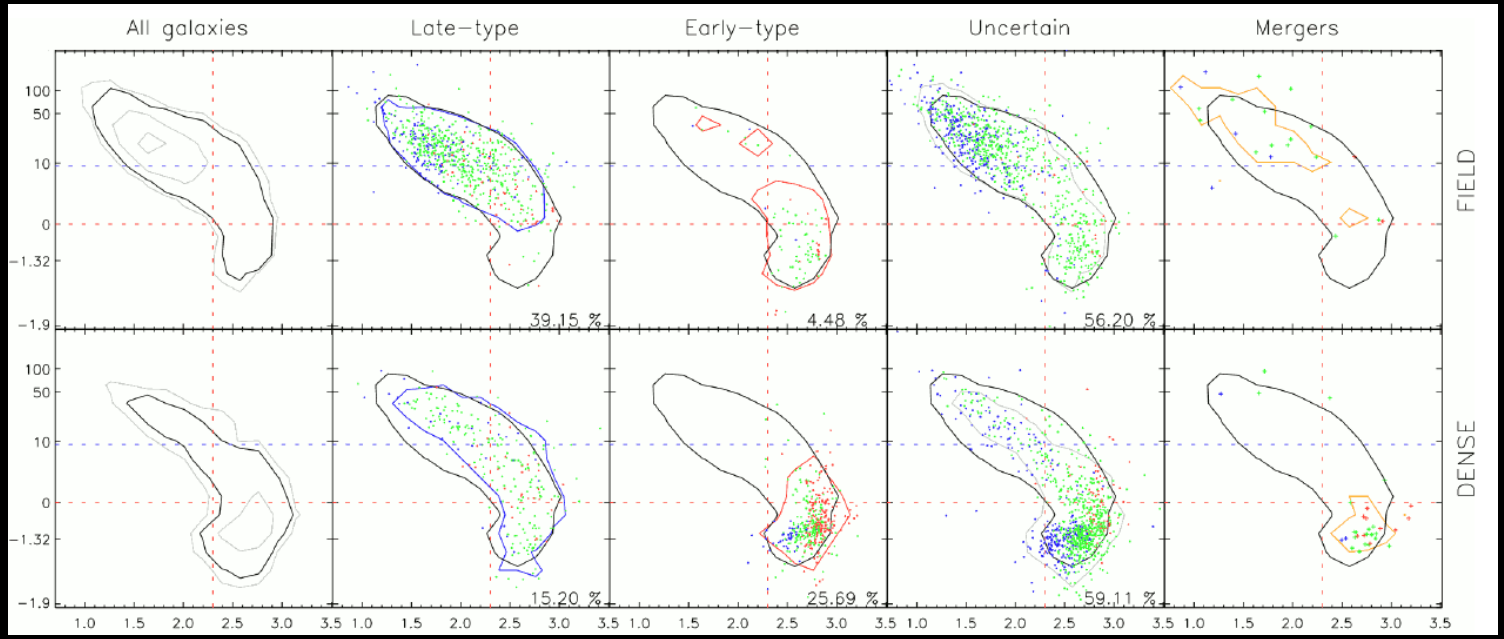
TWO PROXIES FOR THE SSFR
BUT WITH DIFFERENT TIME SCALES

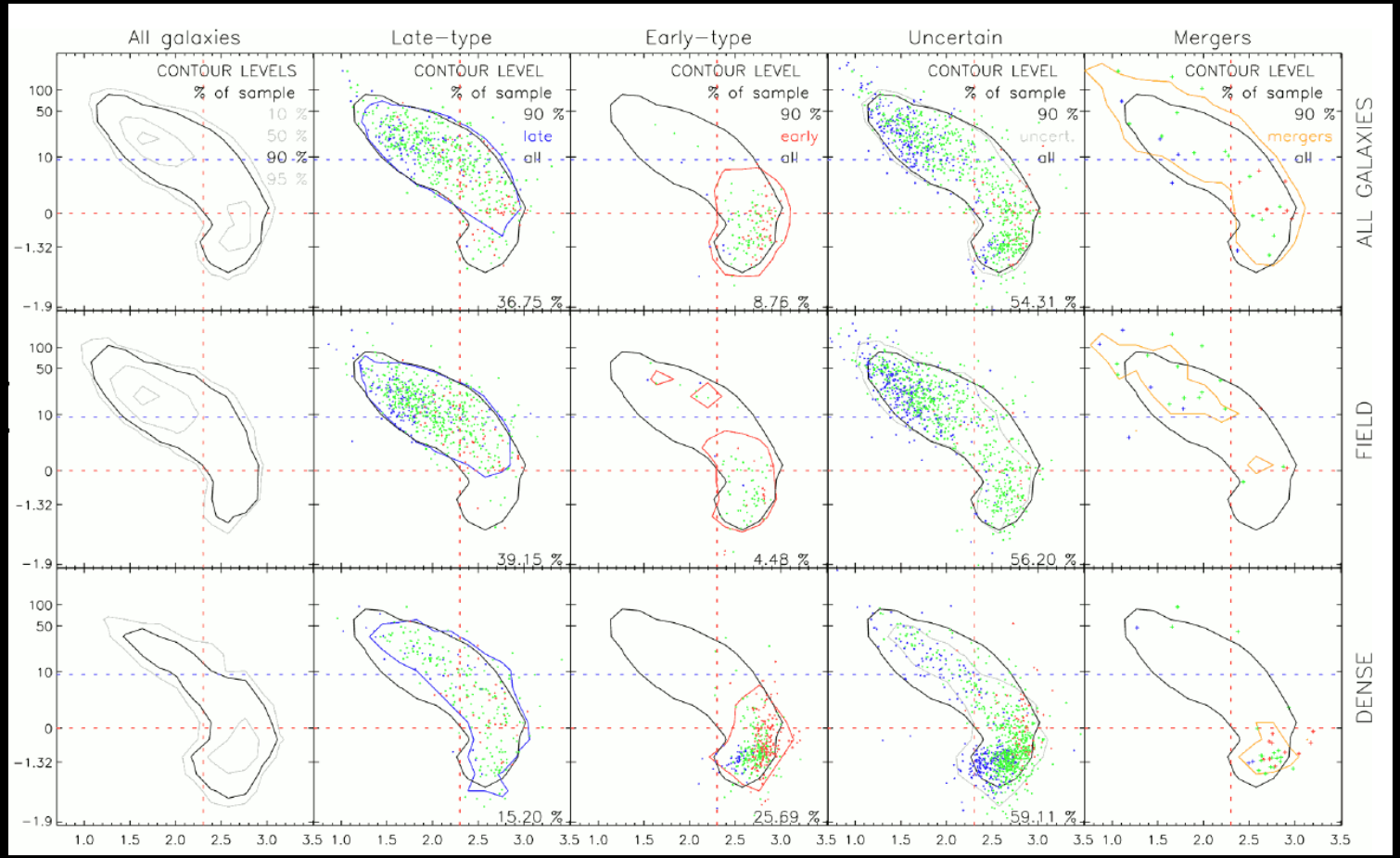
Quenching (+ageing)

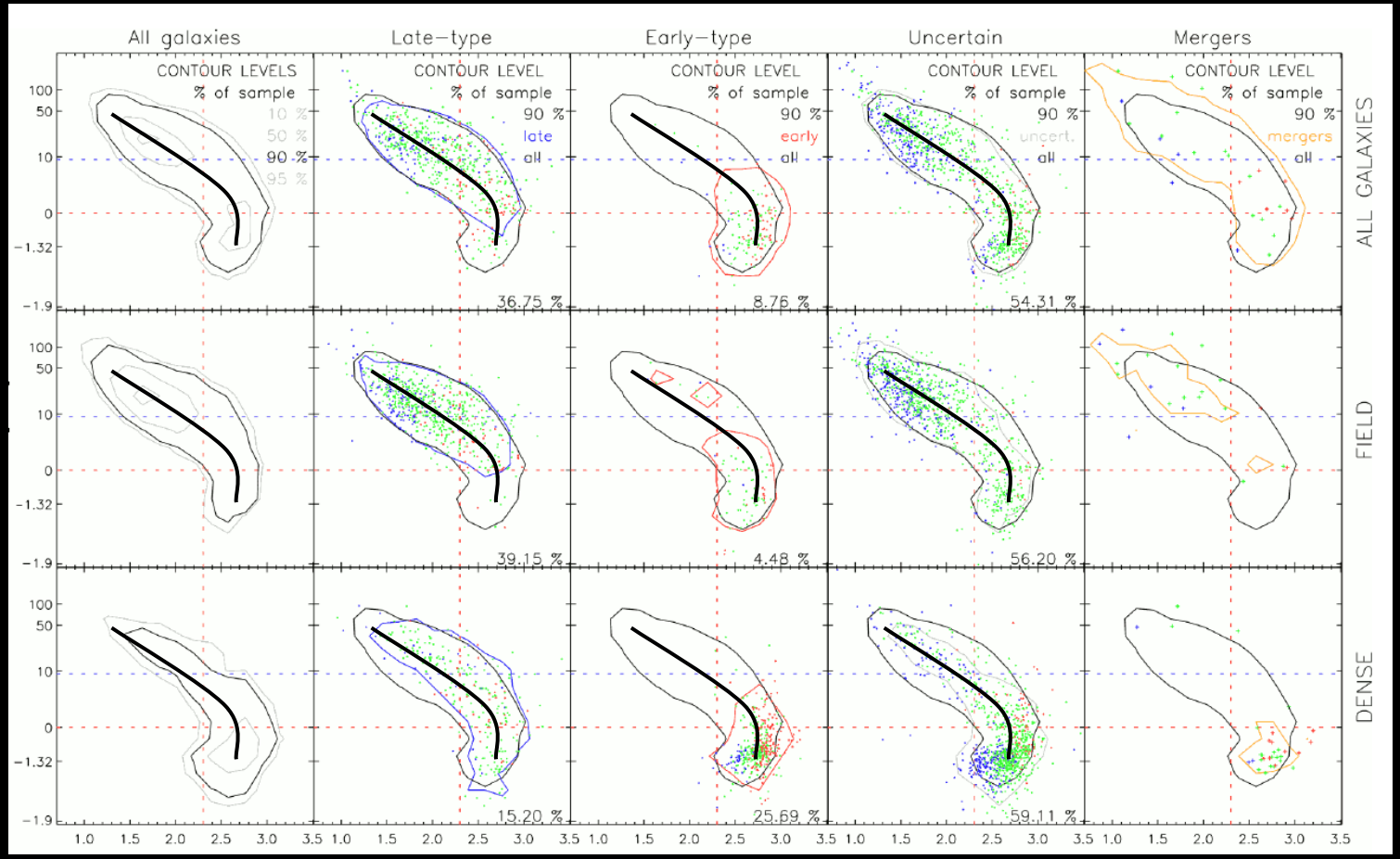


Rejuvenation

(+quenching + ageing)




All galaxies
Late−type
Early−type
Uncertain
Mergers
ALL GALAXIES
FIELD
DENSE
CONTOUR LEVELS
% of sample
10 %
50 %
90 %
95 %
late
early
uncert.
mergers
all
36.75 %
8.76 %
54.31 %
39.15 %
4.48 %
56.20 %
15.20 %
25.69 %
59.11 %
Ha(EW)
(u-r) color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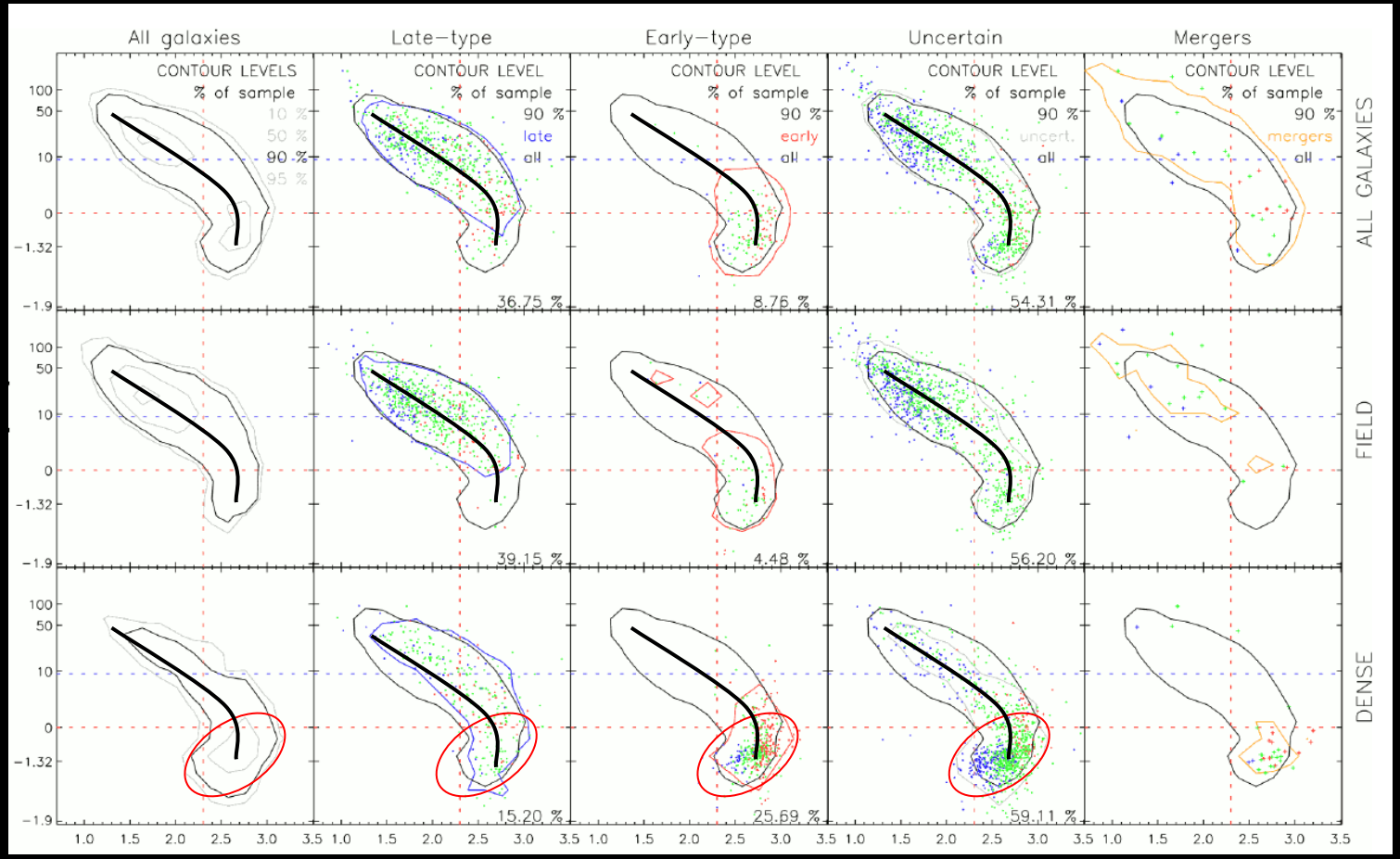
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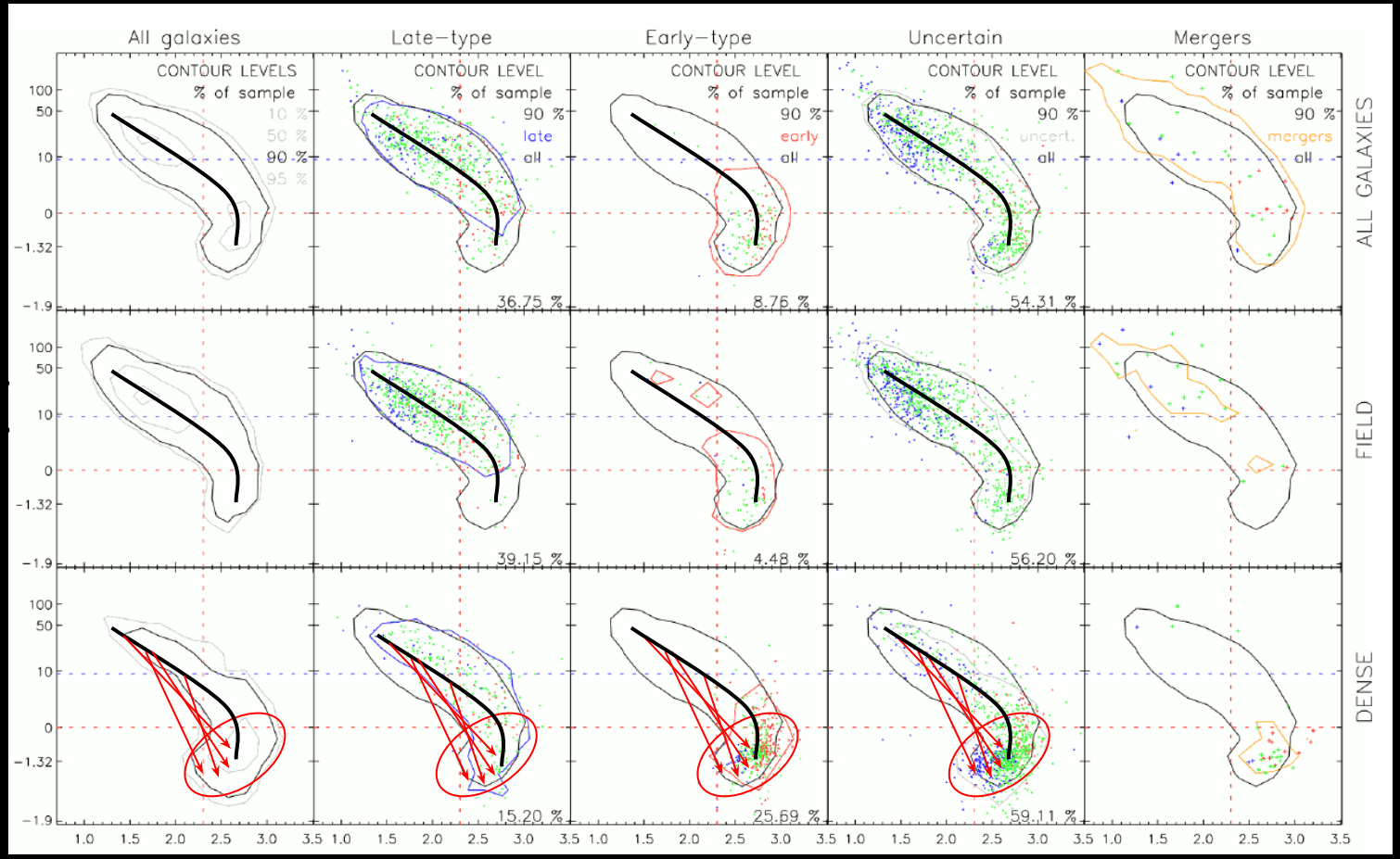

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Conclusions (on average)

- nature is the main driving mechanism
- interactions, mergers DO HAPPEN, but are not statistically significant

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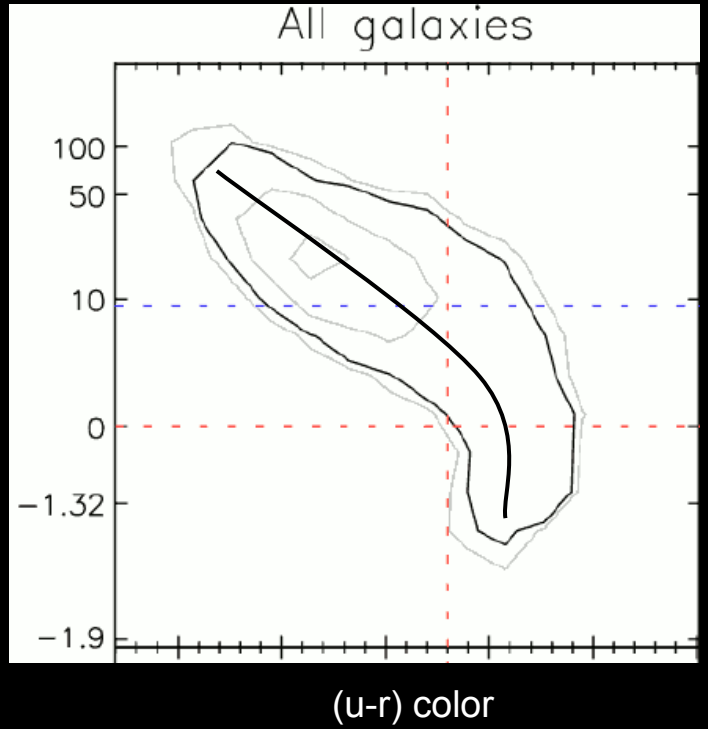

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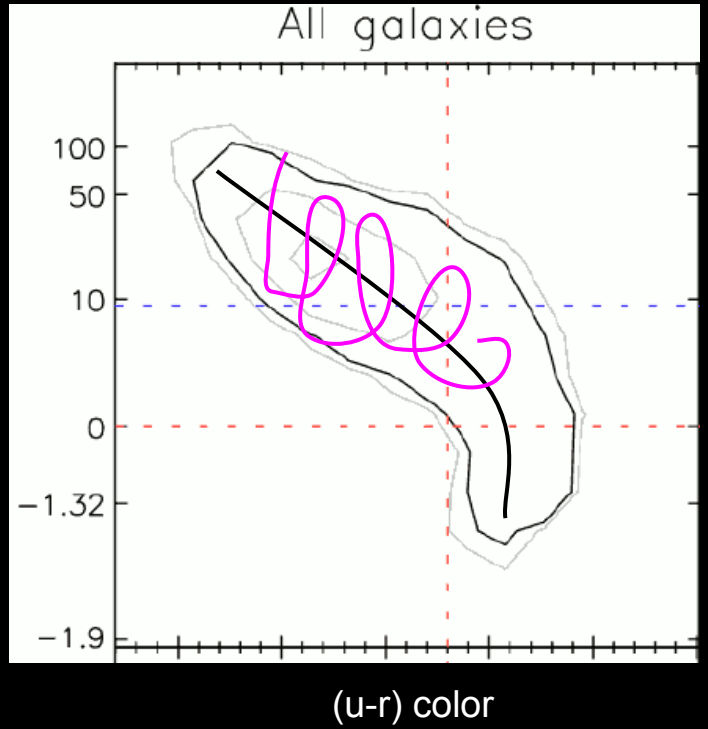
  - if gas is “conserved” (more likely in the field) → scatter



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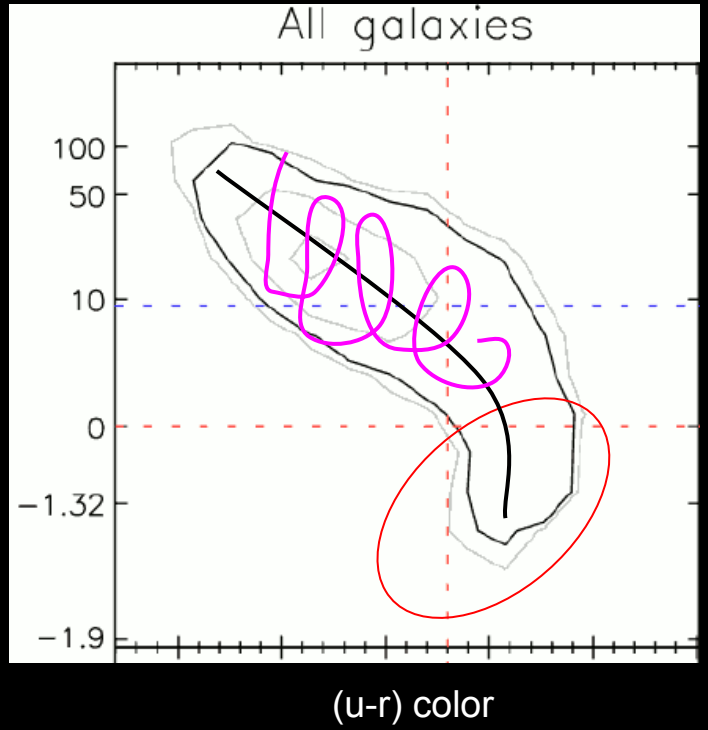

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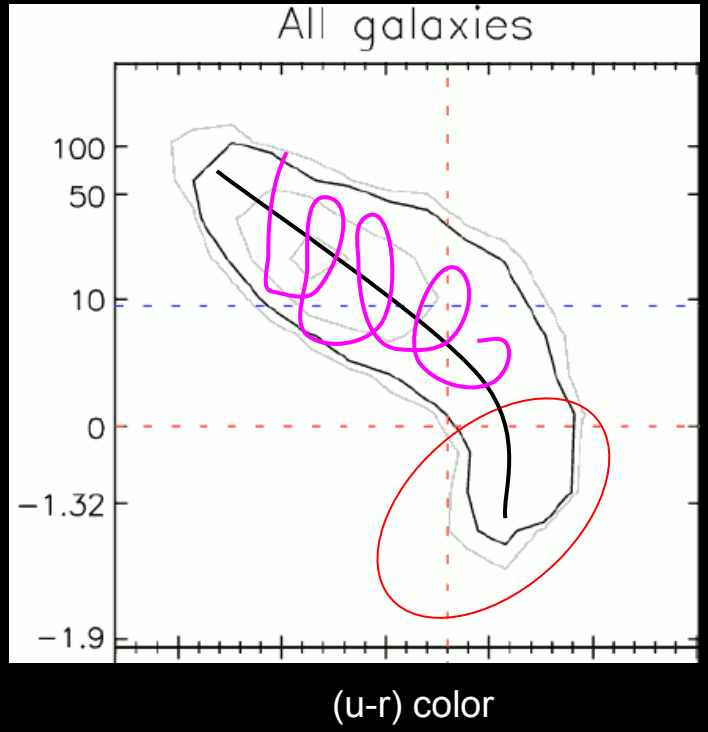
- MORPHOLOGY AS A CONSEQUENCE RATHER THAN THE CAUSE.



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thanks