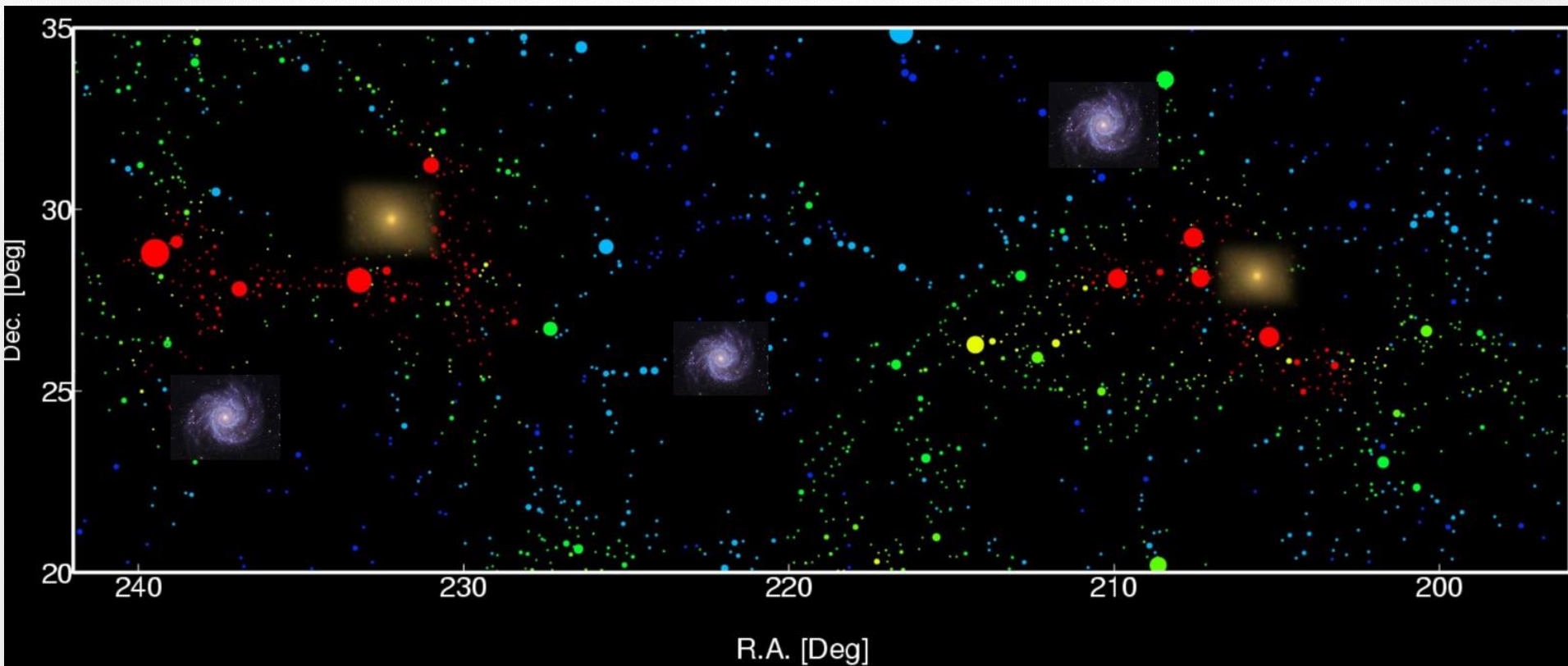


Galaxy quenching in various environments



Maret Einasto

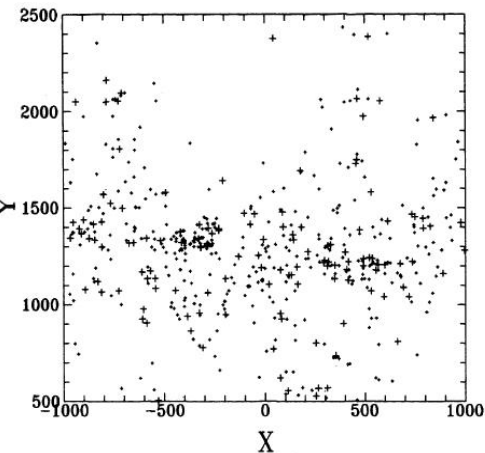
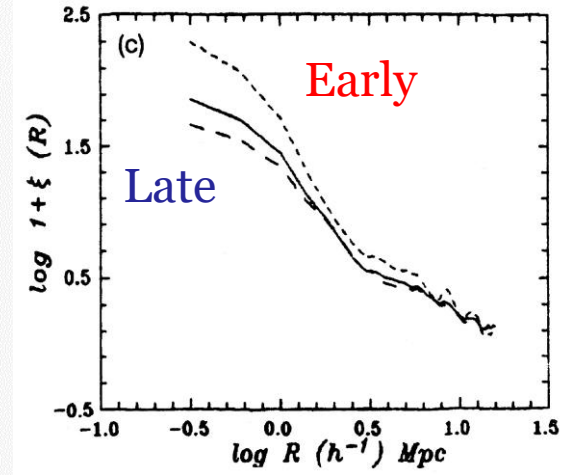
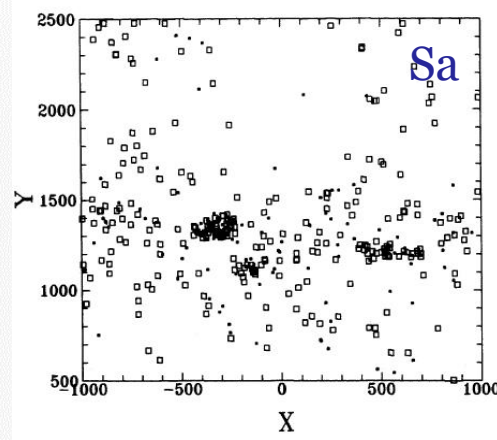
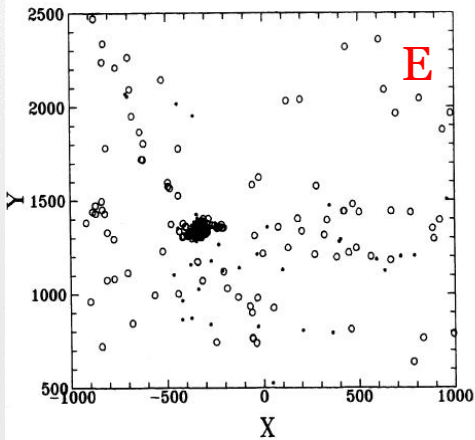
Tartu Observatory, Tartu University, Estonia
Porto Ercole 2023

✦ www.to.ee

Are galaxies (in groups) pre-processed

before eventually entering the extreme environment of galaxy clusters?

Yes, indeed!



Sd, Irr

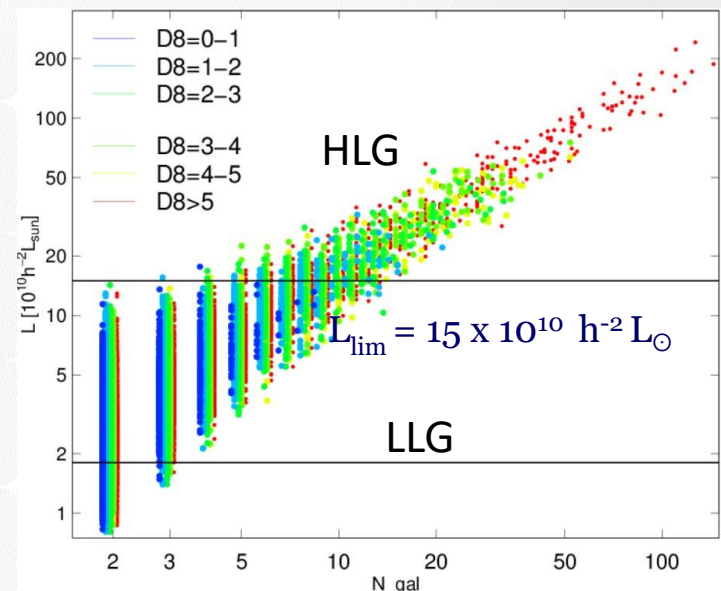
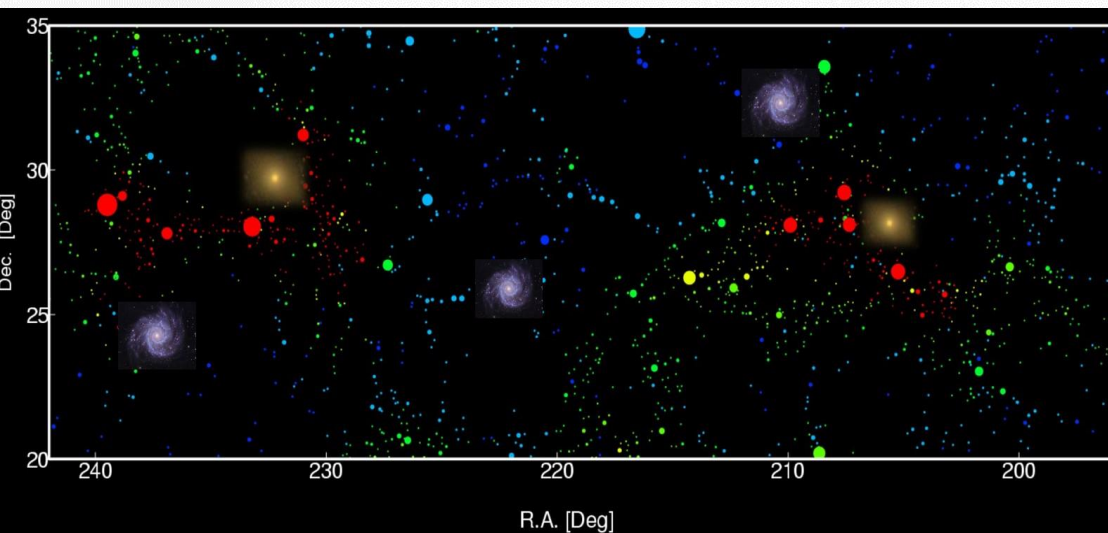
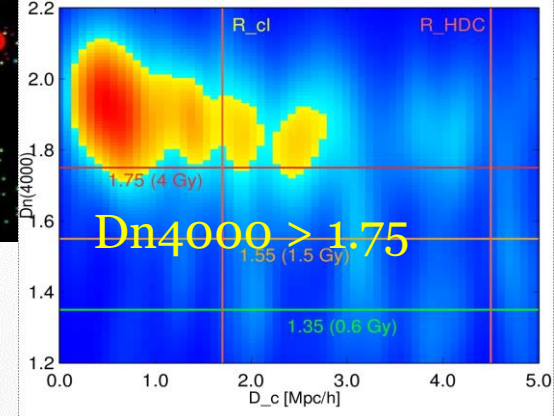
Early-type galaxies in clusters and in small groups in filaments between clusters.

Late-type galaxies: distribution is less concentrated

No randomly distributed galaxies in voids

ME 1991 (MNRAS 250,802; 252, 261)

Galaxy quenching in various environments?



Global environment:
luminosity-density field; smoothing length $8 \ h^{-1} \text{Mpc}$

SDSS MAIN sample, $210 - 270 \ h^{-1} \text{Mpc}$

Liivamägi et al.2012, Tempel et al (2014) group catalogue

$D8 < 1$: 65% of total volume (voids)

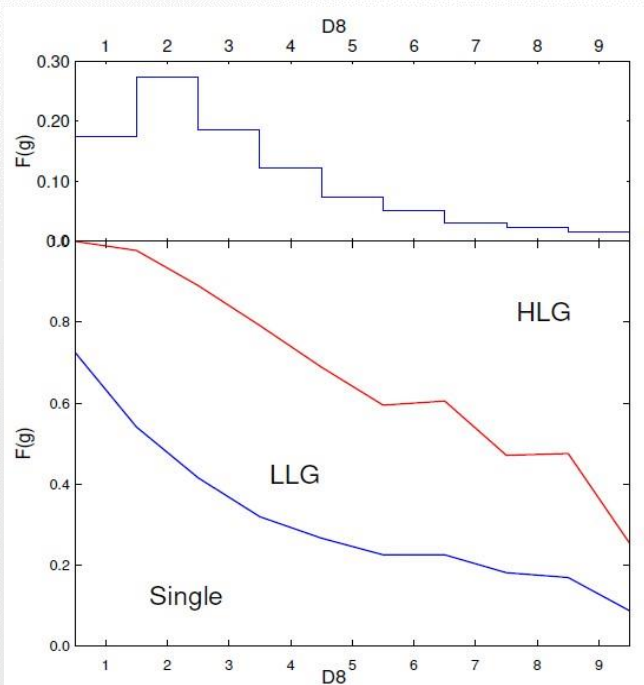
$D8 > 5$: 1% of total volume (superclusters)

Local environment: group membership
Single galaxies, satellites and the
brightest group galaxies
LLGs and HLGs

$D8 < 1$: only LLGs and single galaxies

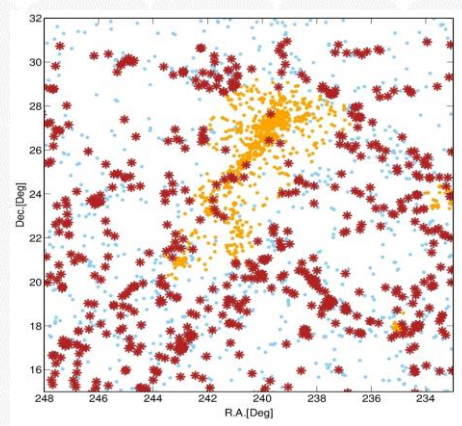


Quenched galaxies in the cosmic web

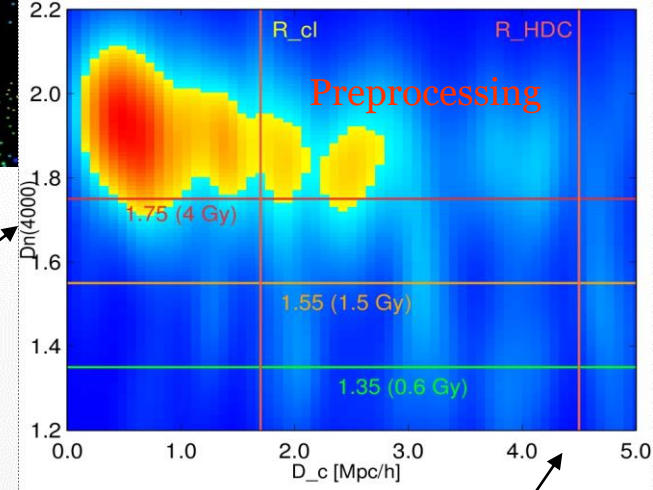


$D8 < 1$: 70% of galaxies – single
 30% in low-luminosity groups
 No high-luminosity groups

Quenched, with
 old stellar populations
 ($Dn4000 > 1.75$)

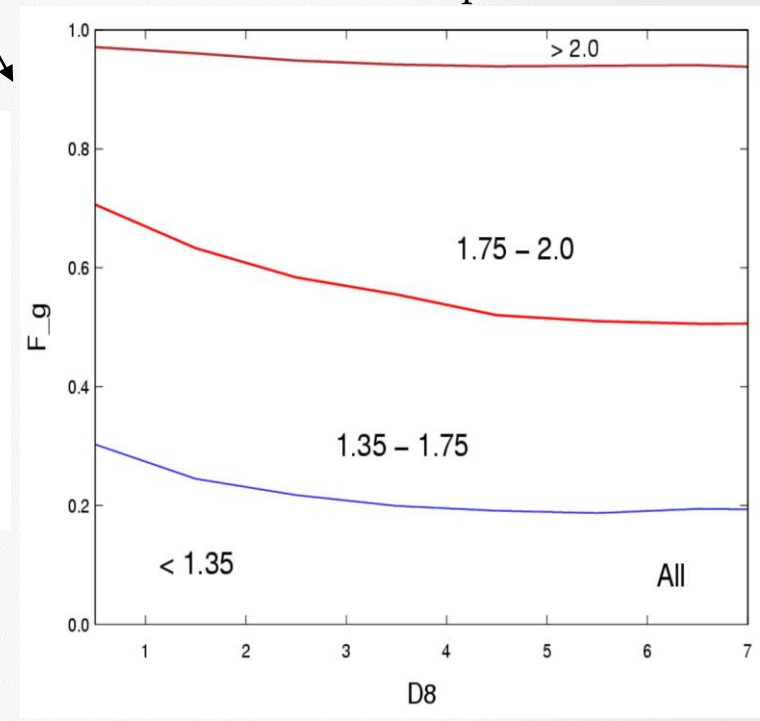


Cluster
 centre



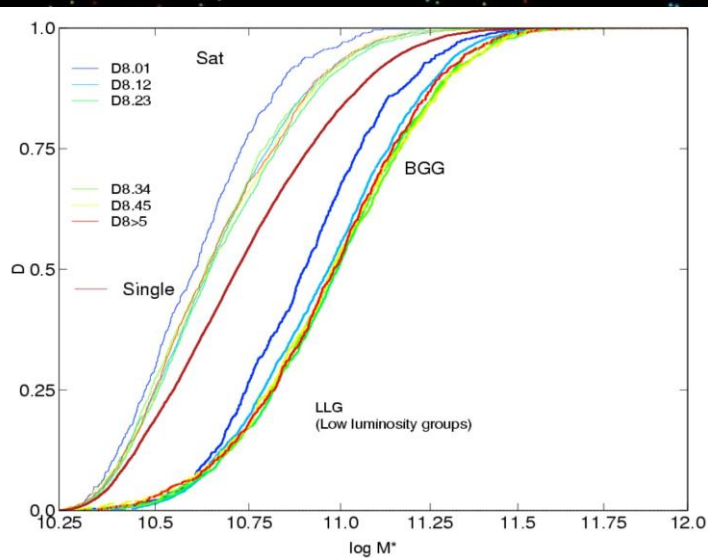
A2142

Sphere of influence

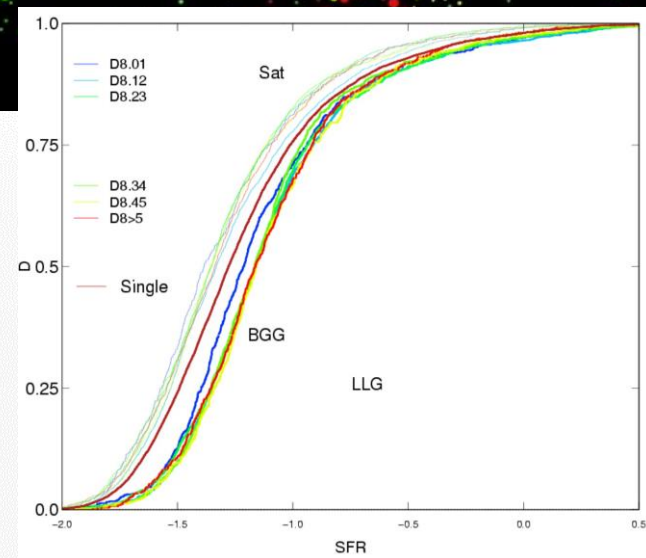


Quenched galaxies: everywhere, including single galaxies in voids

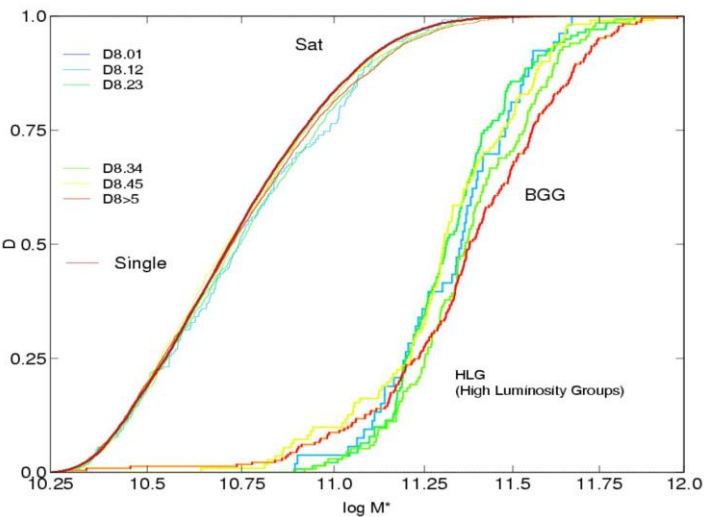
Properties of galaxies in various environments



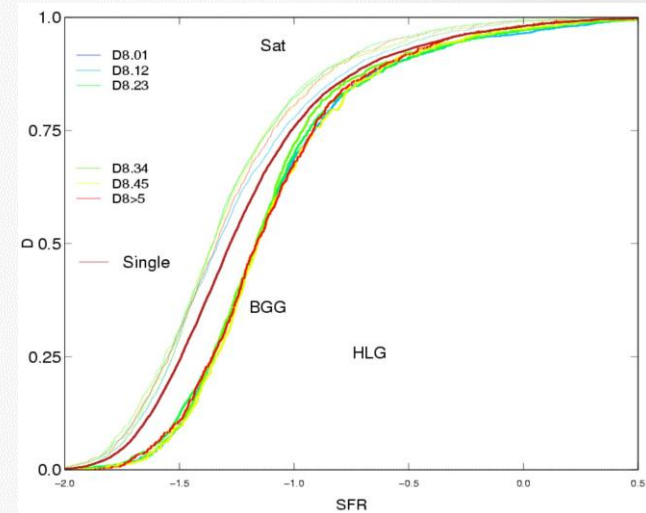
$D8 < 1$: galaxies have lower M^*
 $D8 > 8$: similar M^* , SFR, and other properties



The largest differences:
 between BGGs and satellites



Single galaxies:
 similar to HLG satellites



Single galaxies, and BGGs and satellites with $Dn4000 > 1.75$ in various global environments

E+ 2022, A&A, 668, A69

Summarizing:

Group richness and the fraction of single galaxies

change strongly with *global* environment (location in the cosmic web)

Fraction of quenched galaxies

changes less strongly with *global* environment

Properties of galaxies depend mostly on *local* (group) environment

being a single, satellite, or the brightest galaxy in a group or cluster

*Therefore, galaxies (in groups) are pre-processed even if they never fall into clusters
(not in cluster's sphere of influence at present)*

Why?

This is the topics of this workshop

References:

E+ 2022, A&A, 668, A69

E+ 2021, A&A, 649, A51

E+ 2020, A&A, 641, A172