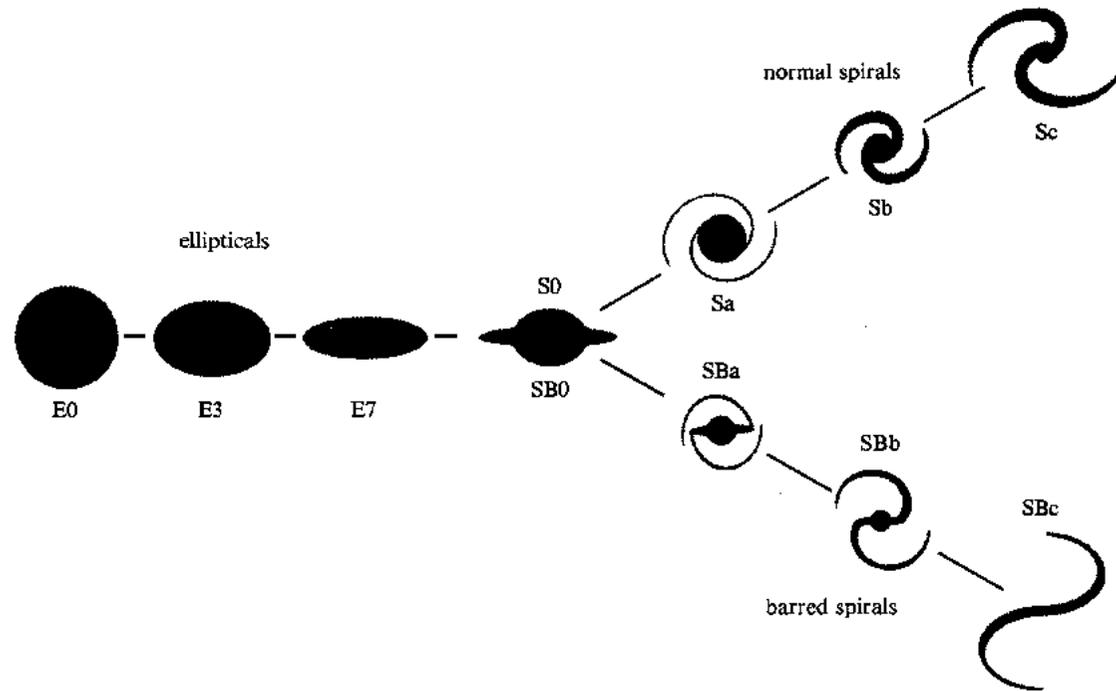


Galaxy Morphologies



Céline Hadziioannou

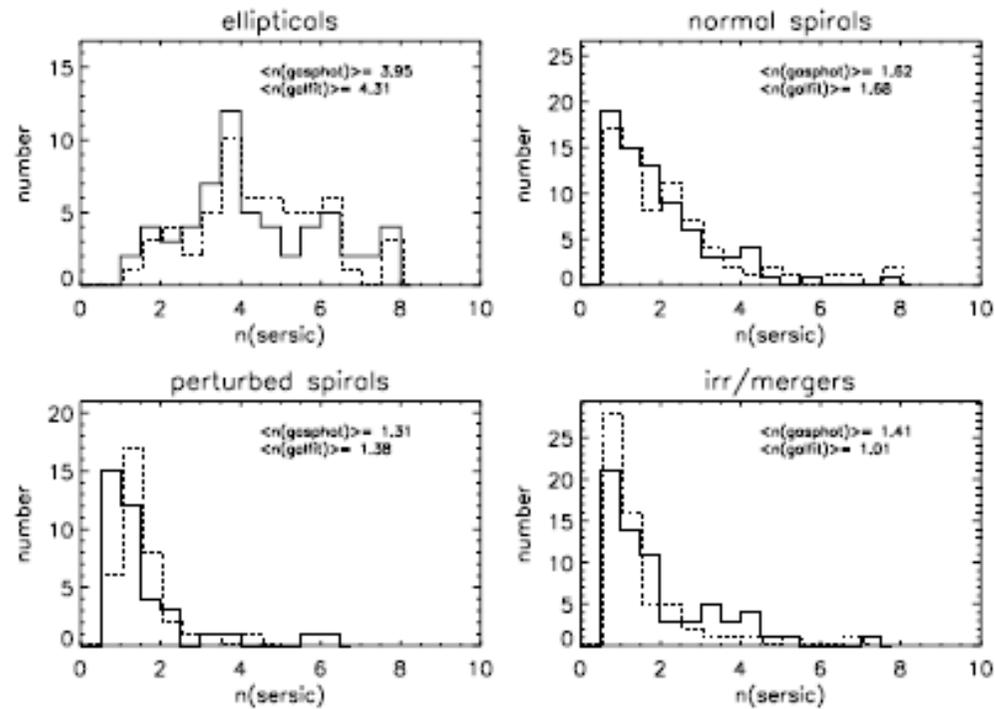
What can morphologies tell us?

- Evolution
 - Bar evolution
 - $T - \Sigma$ relation
- Mergers
 - Observation of mergers
 - Merger rate

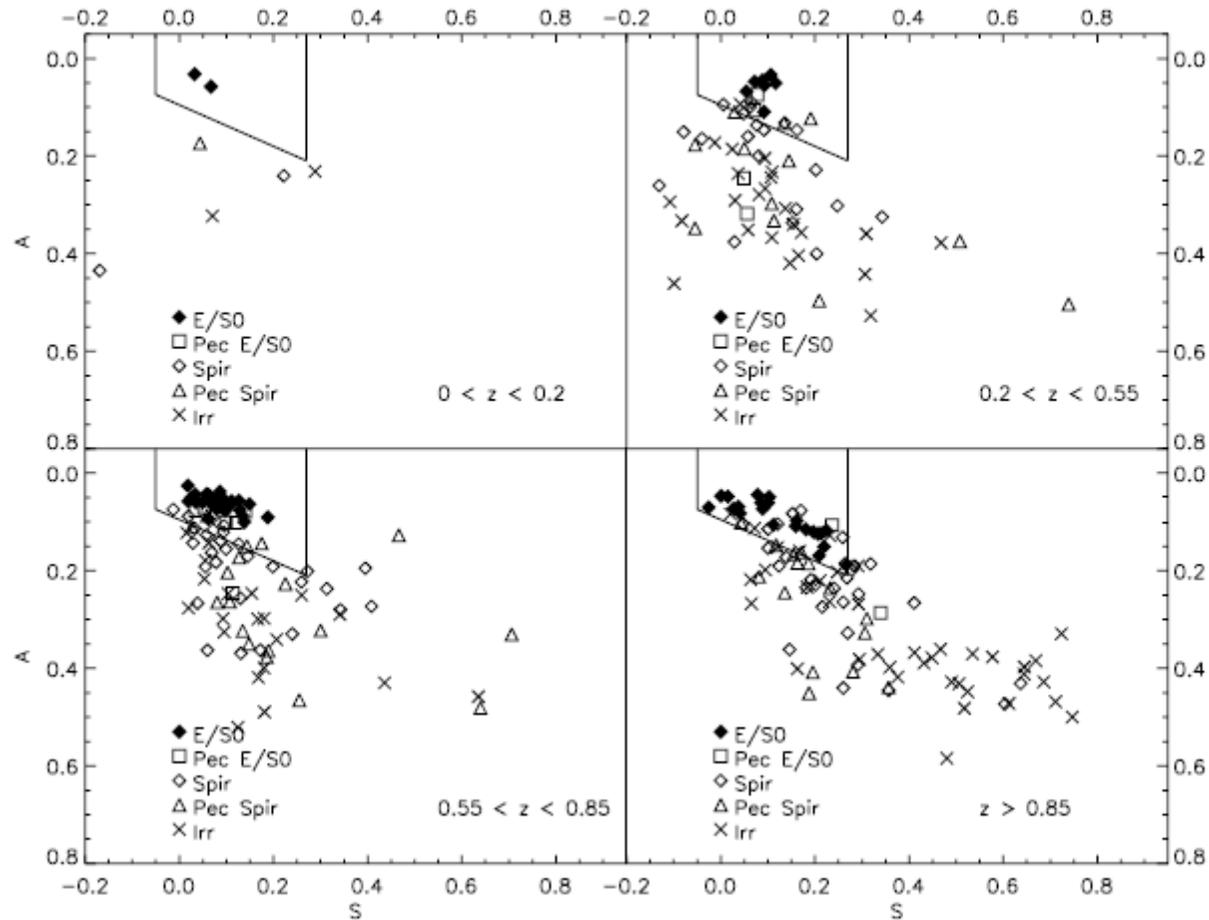
But first.. We need a good way to classify galaxies

- (*Cassata et al.*) try to quantify morphological properties.
- Sérsic index: $\mu \sim \exp[(r/r_c)^{1/n}-1]$
- CAS:
 - Concentration (Sérsic & B/D)
 - Asymmetry (irregulars vs. E/S0/Sa)
 - Clumpiness (small scale structure, SF rate?)

Sérsic index and morphology

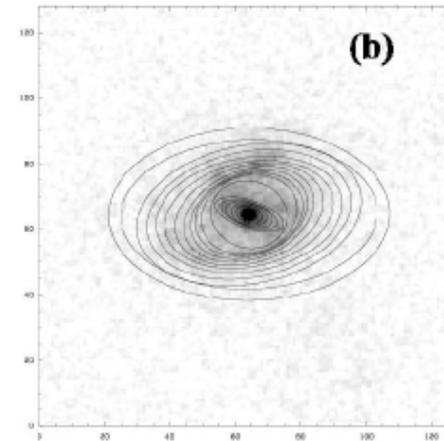


CAS results

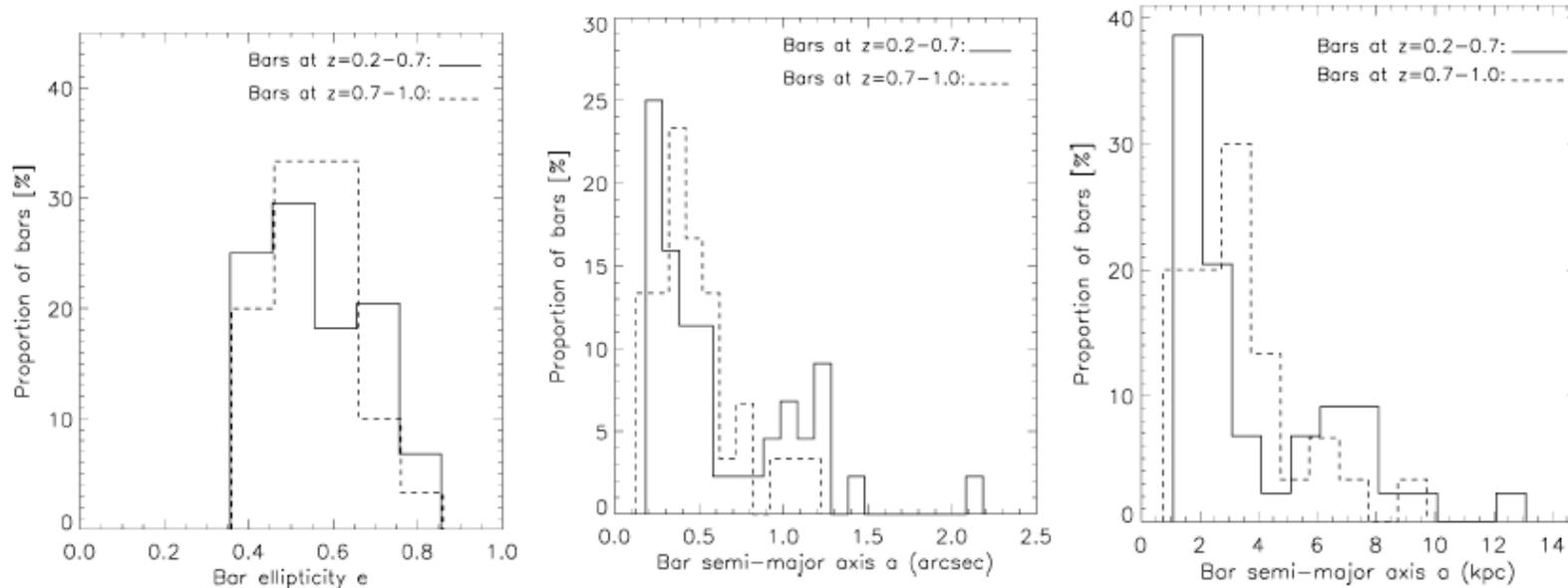


Bar evolution

- How do they form? Did they form recently?
- Are they long-lived or do they form and dissolve in $< t_H$?
- Ellipse fit:



Bar evolution: results



- Bars can form early
- Similar fraction at different look-back times: bars are long-lived.
- Other aspects of bars may evolve.

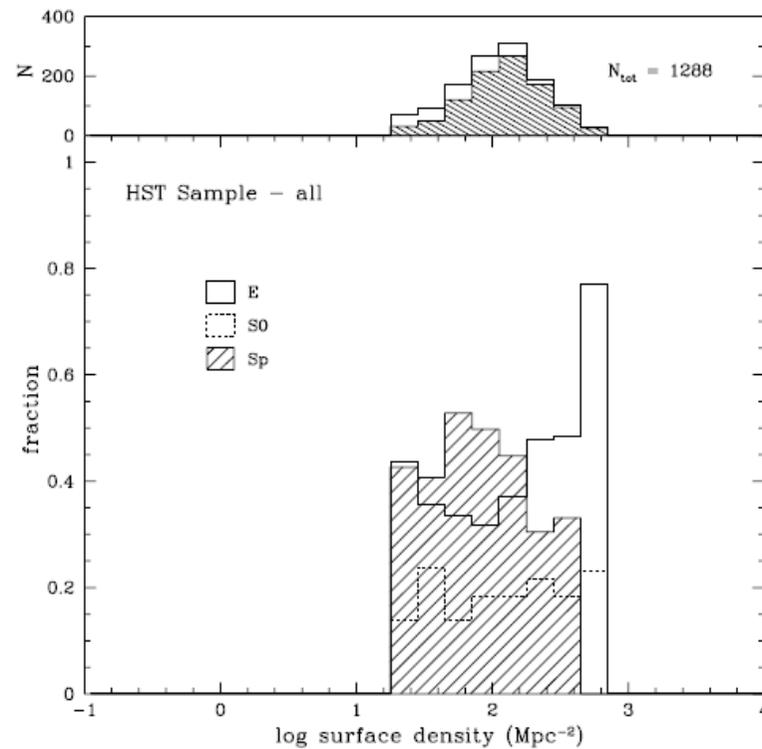
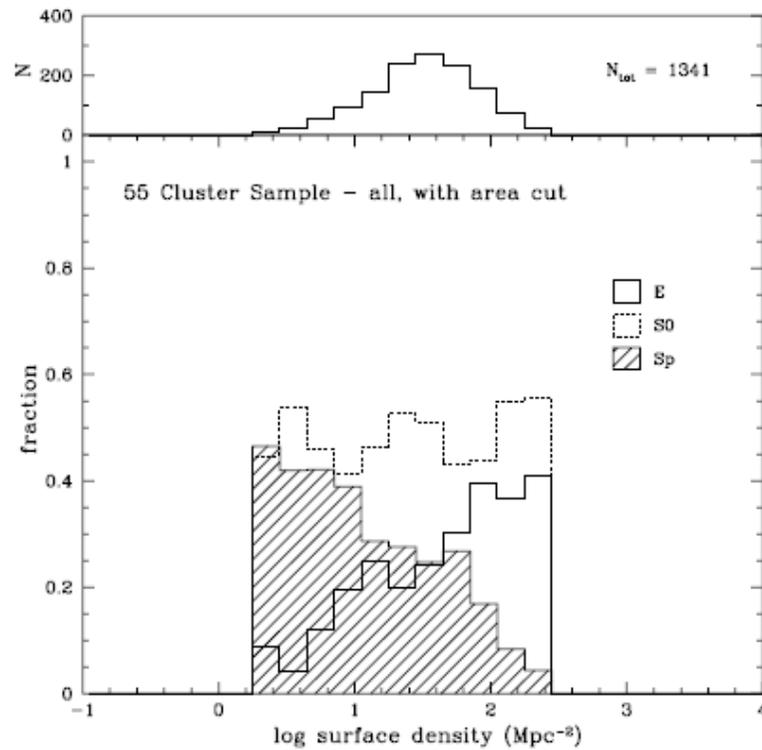
Morphology – density relation

- Denser: more E/S0. Less dense: more Spirals.
- Does environmental density influence the evolution of morphological types?

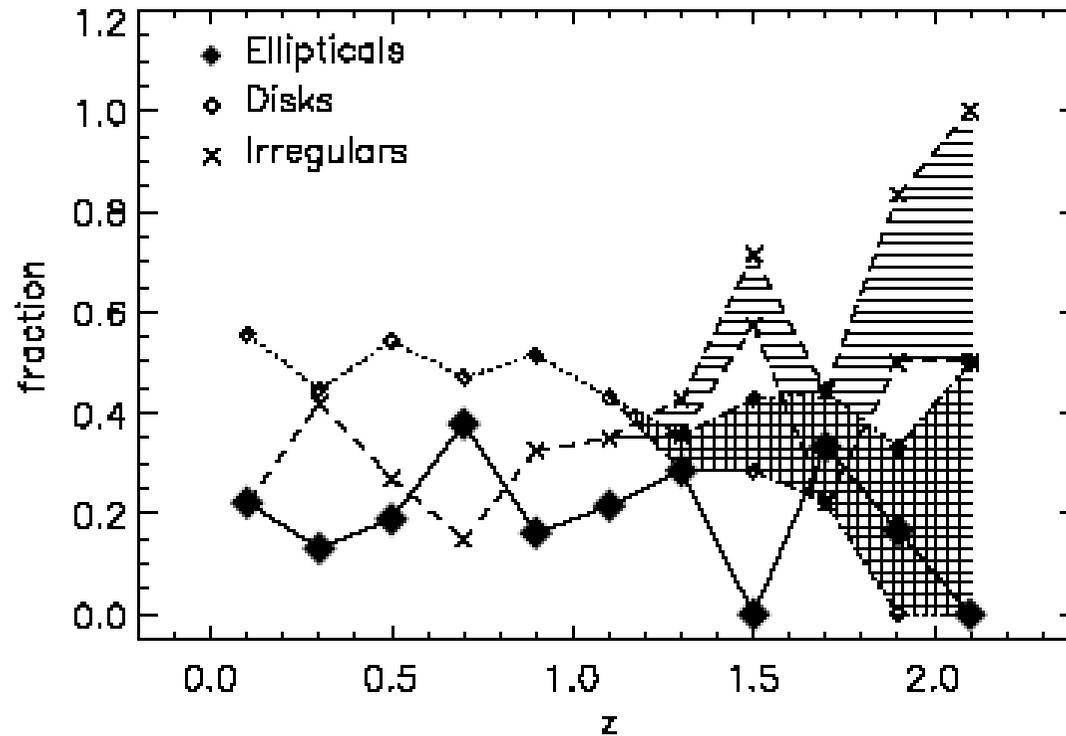
Results (*Dressler et al.*):

- Fraction of ellipticals stays same for different z .
- Fraction S0 is lower at $z \sim 0.5$: more have been added since.

T – Σ relation for local galaxies and $z \sim 0.5$



(Cassata et al.) morphological fraction as a function of z



Can we observe mergers?

- (*Mihos et al.*) investigate the detectability of merger signatures at intermediate redshifts.
- < 1 Gyr window to see tidal tails & features, rapid relaxation.
- Best bet: starbursts and companions.

Simulated HST image of merger

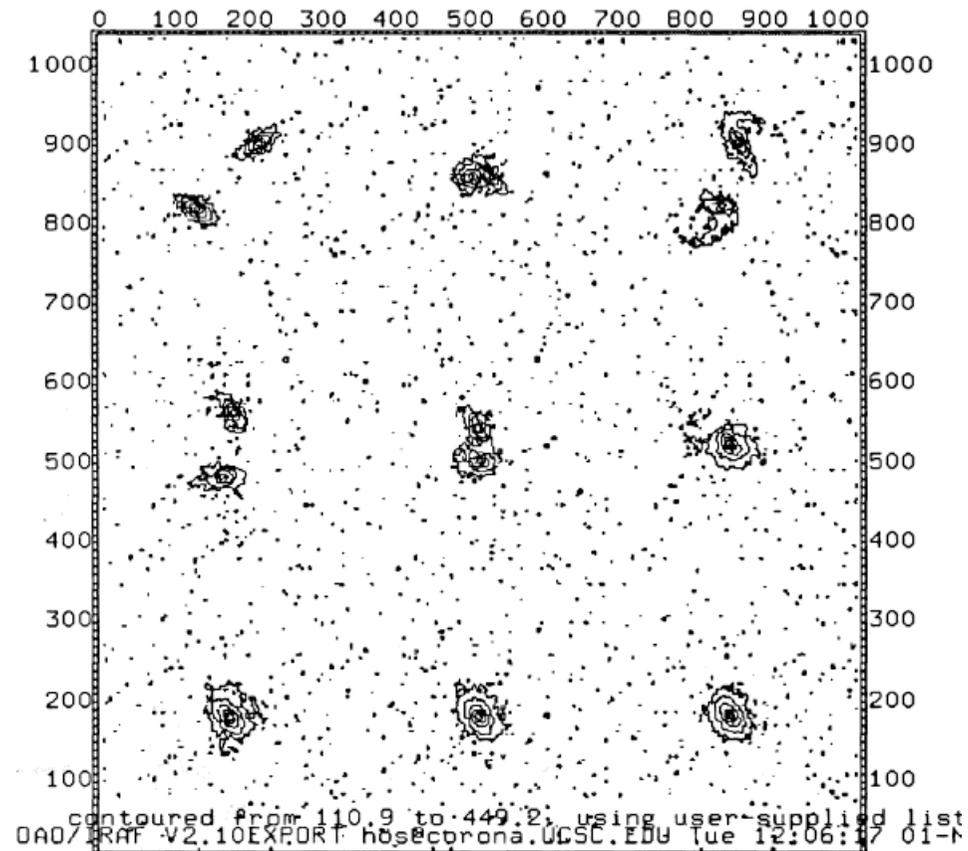
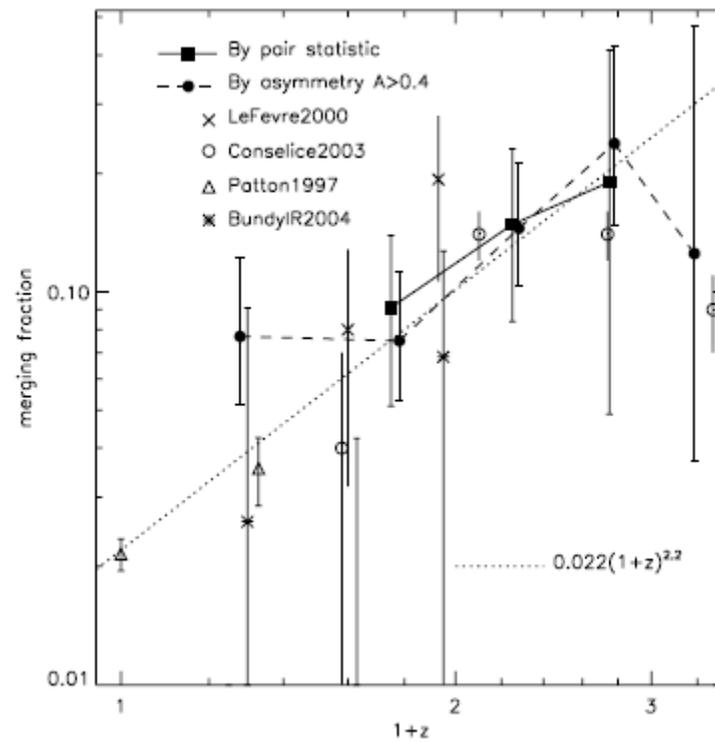


FIG. 1b

Merger rate measured

- (*Abraham 1999*): Large fraction ($\sim 30\%$) of galaxies at high z is peculiar. Are they merging?
- Measure of the ‘CAS’ suggest a merger rate increasing $\sim (1+z)^3$.
- (*Cassata et al.*): pair statistic and asymmetry obtain similar results.

(Cassata et al.) merger rate



Conclusions

- The study of morphologies give rise to some interesting results.
- Theories are nice, observations still have some problems.
- Thankfully there is definite progress..