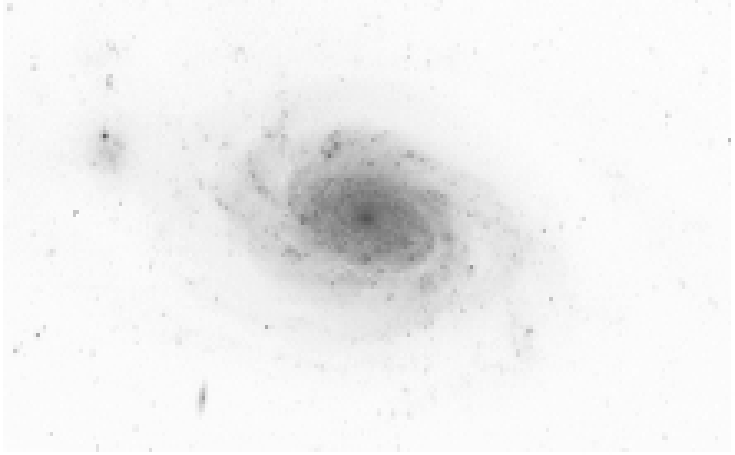
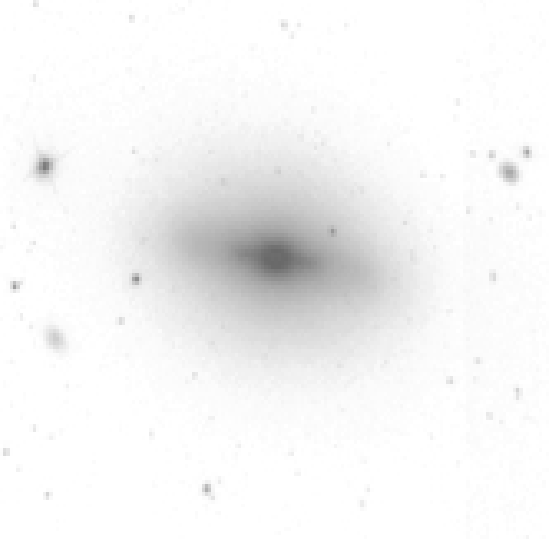
Caught in the act: Cluster k+a galaxies as a link between Spiral galaxies and S0s

Bruno Rodríguez Del Pino

Steven Bamford, Alfonso Aragón-Salamanca



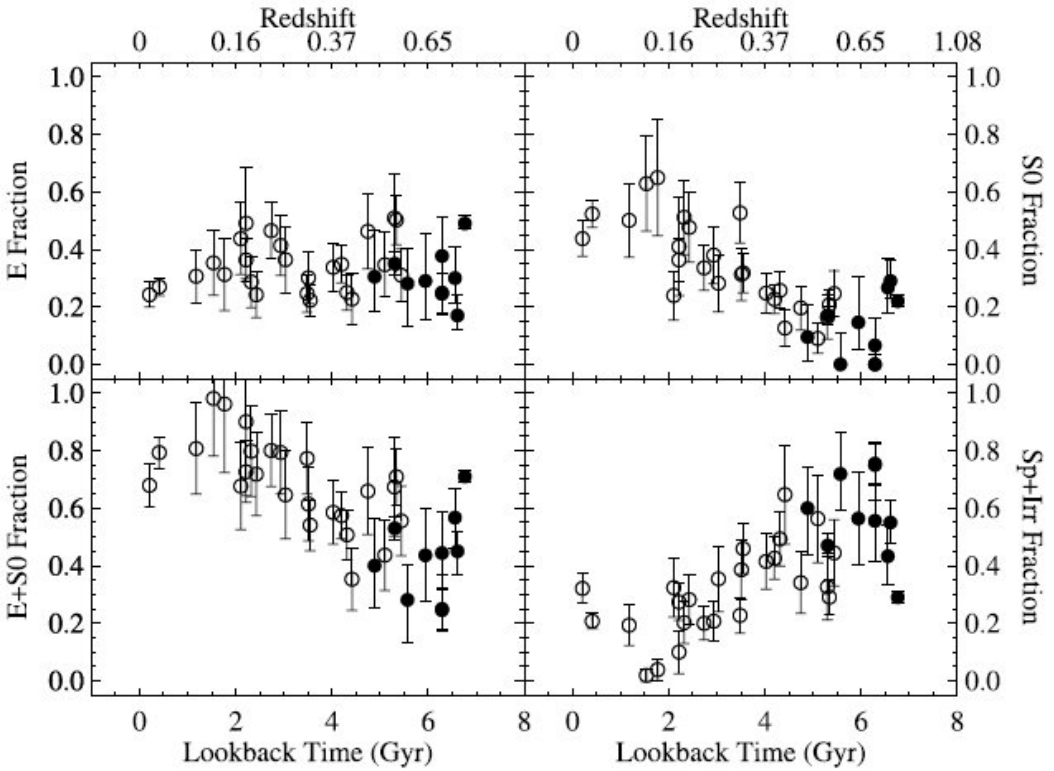
Outline



- From spirals to S0s
- Why K+A?
- IFS sample and Analysis
- Results
- Conclusions

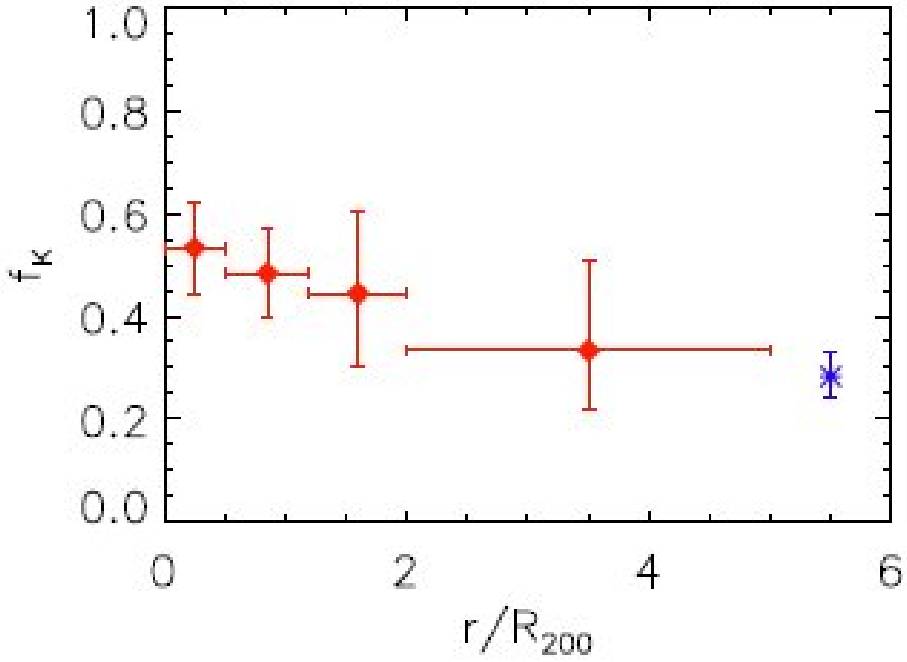
Motivation

- Morphology-redshift relation:



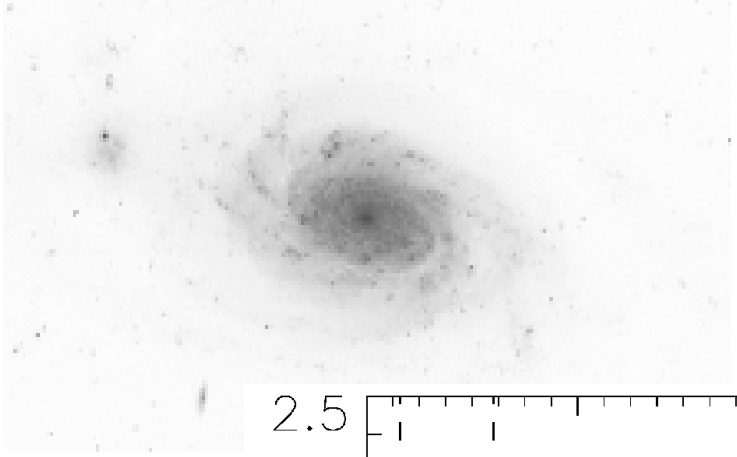
Desai et al. 2007

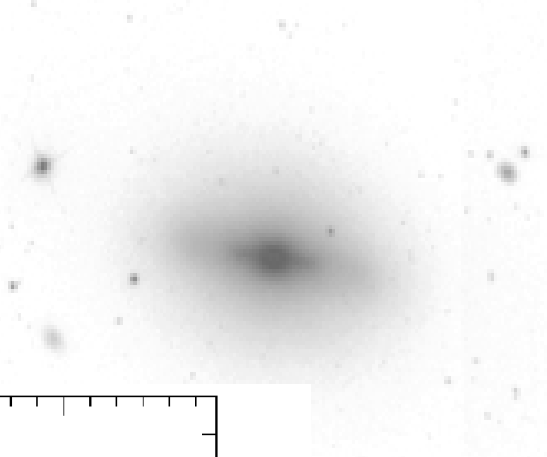
- Loss of gas when joining clusters:

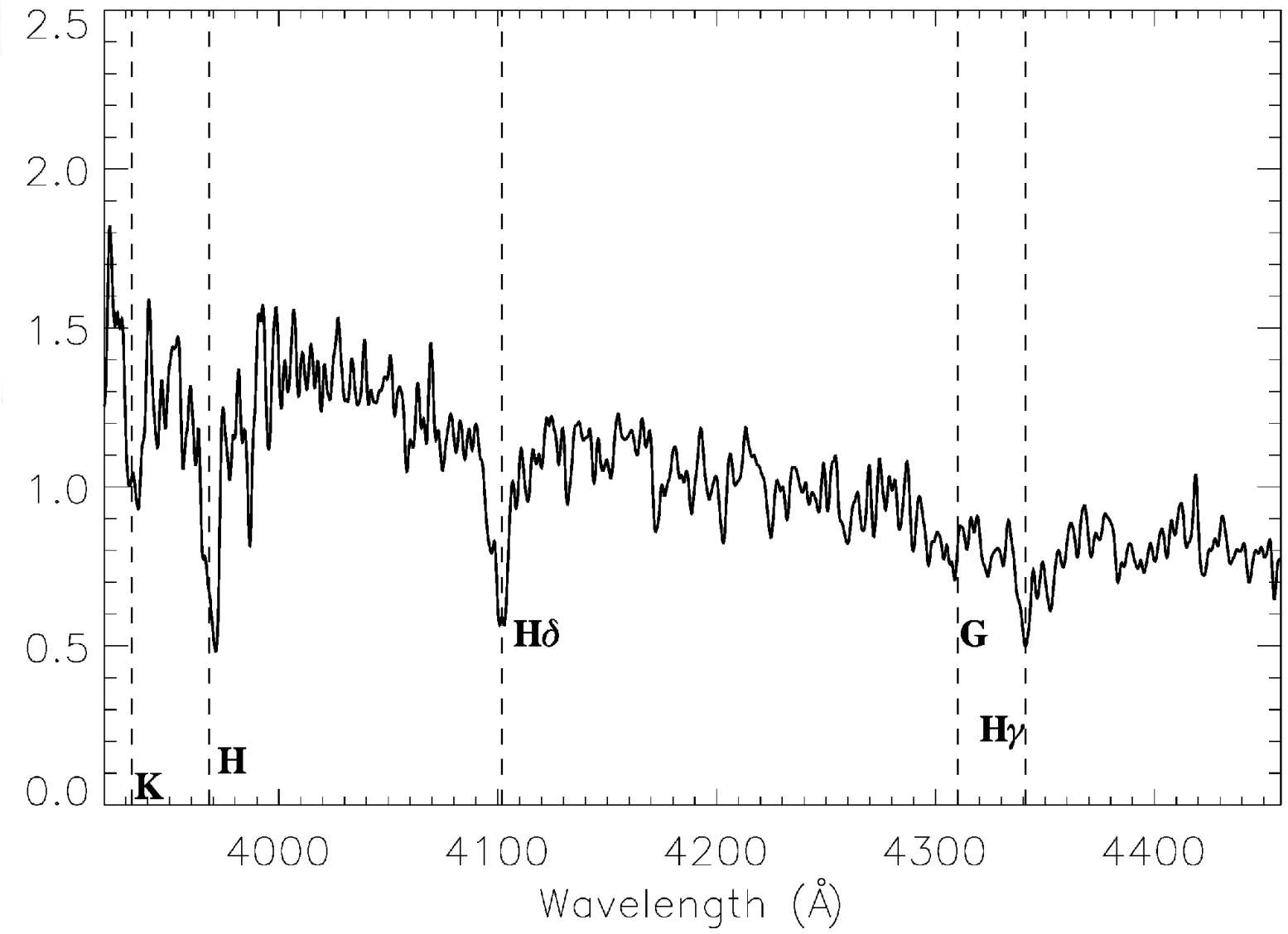


Jaffé et al. 2011

Why K+A?






2.5
2.0
1.5
1.0
0.5
0.0
K
H
Hδ
G
Hγ
4000
4100
4200
4300
4400
Wavelength (Å)

Why K+A?

- Mix of an old 'K' and a young 'A' populations implying a recent (<1Gyr) truncation of the star formation (with our without previous starburst).

- Dressler et al. 1999, Poggianti et al.1999:
  - Increasing with z. Up to a 20% in clusters at z=0.4-0.5.
  - Disk morphology

- Mechanisms triggering and quenching SF:
  - Major mergers (no disk as a result) .
  - Minor mergers and tidal interactions (young population in the center rotating faster).
  - Truncation of star formation in the disk: ram-pressure stripping, harassment, interactions with the strong tidal field (young stellar population spread throughout the galaxy).

Sample and Analysis

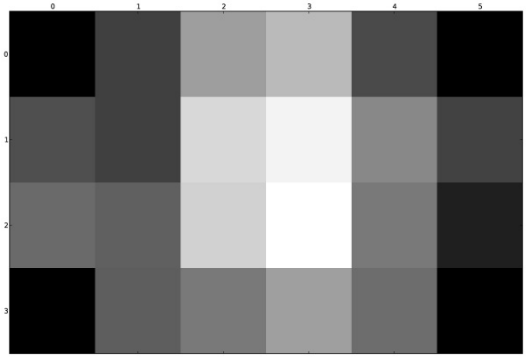
CATCHING THEM IN THE ACT:

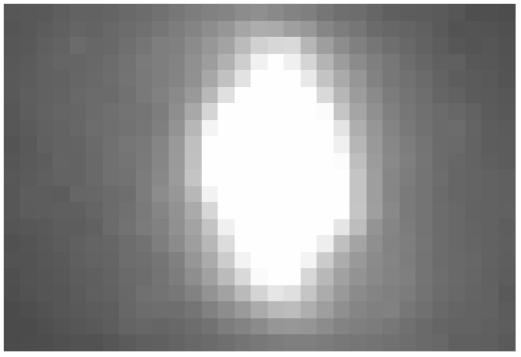
13+7 K+A galaxies of a cluster at z~0.3 selected to have:

- EW (Hδ) > 3Å (from previous study Couch & Sharples 1987).
- Disk morphology (from HST imaging).
- 4 having detected emission in [OII]λ3727.

(Completed with previous observations (Pracy et al. 2005))

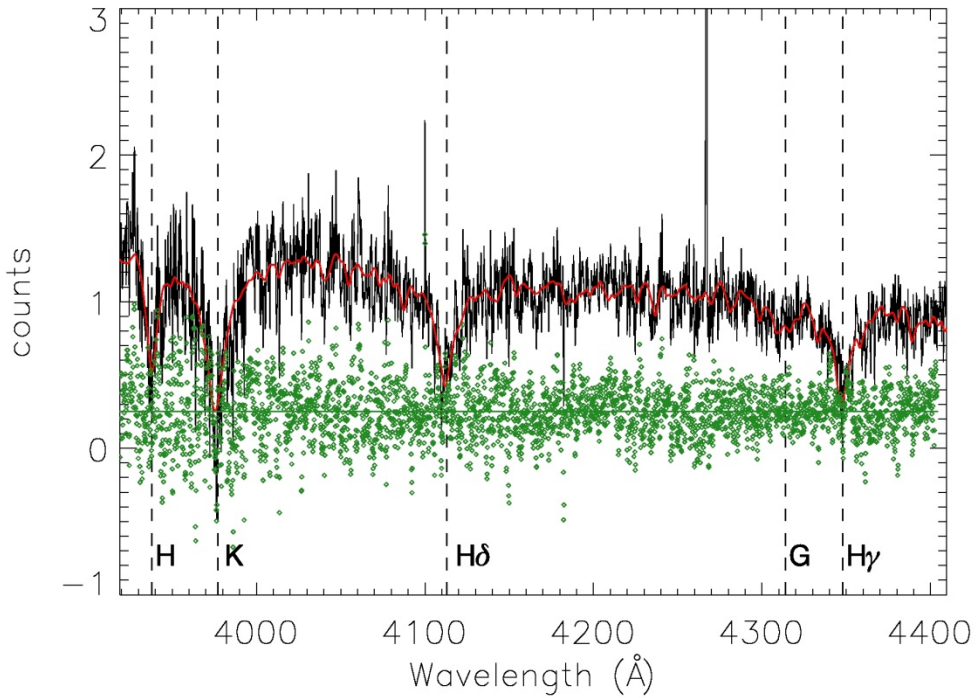
IFS from GIRAFFE/FLAMES at the VLT to obtain spatial and spectral information.





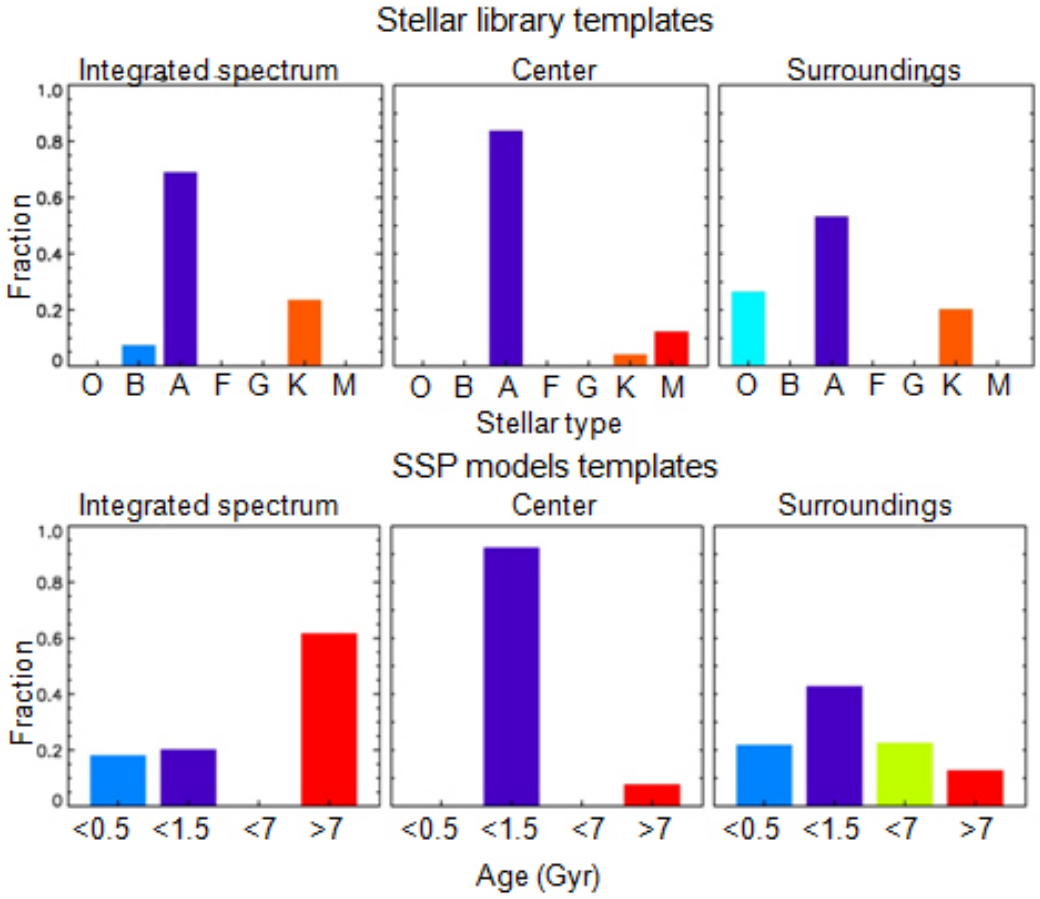
Analysis

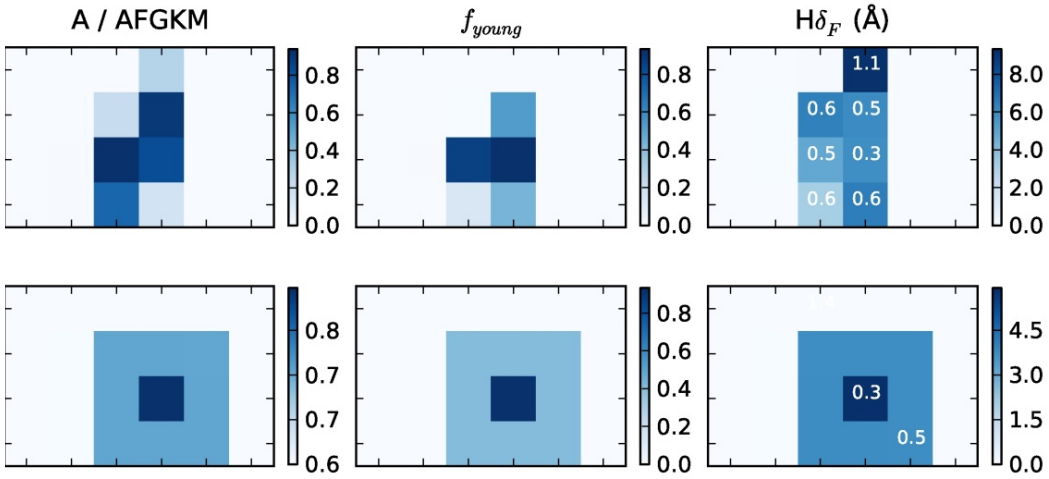
- Spectral information extracted with pPXF (Capellari & Emsellem 2004)
  - ELODIE stellar library (3900-6800Å, (0.5Å FWHM))
  - SSP models computed with PÉGASE-HR



Young population indicators

- 3 indicators: EW (Hδ), A/AFGKM and f_{young} pPXF.
- Individual fibers and integrated regions.

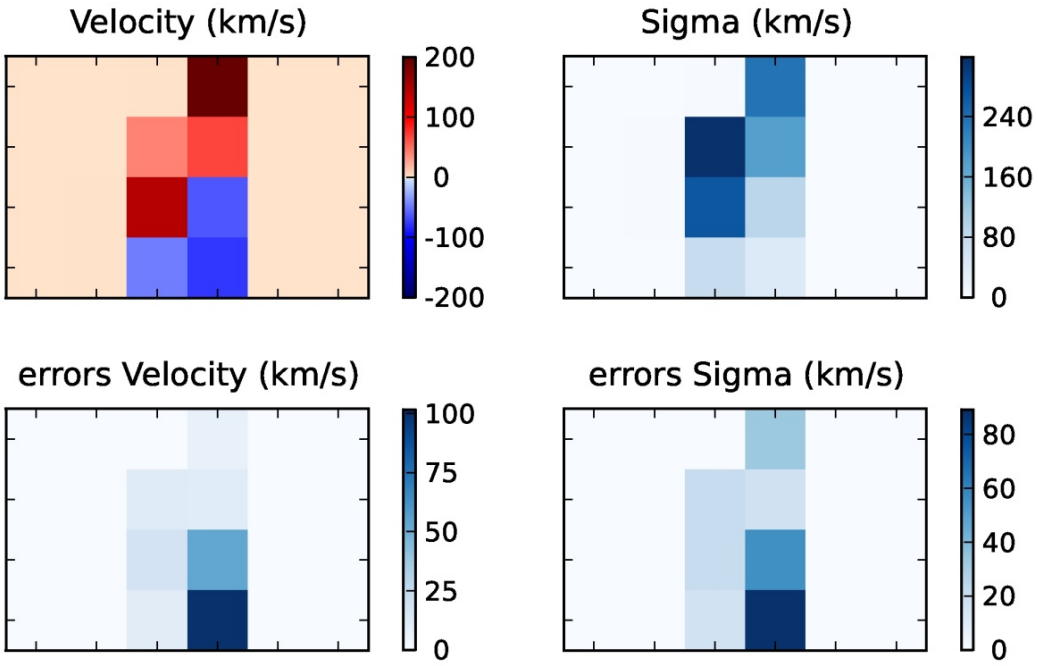




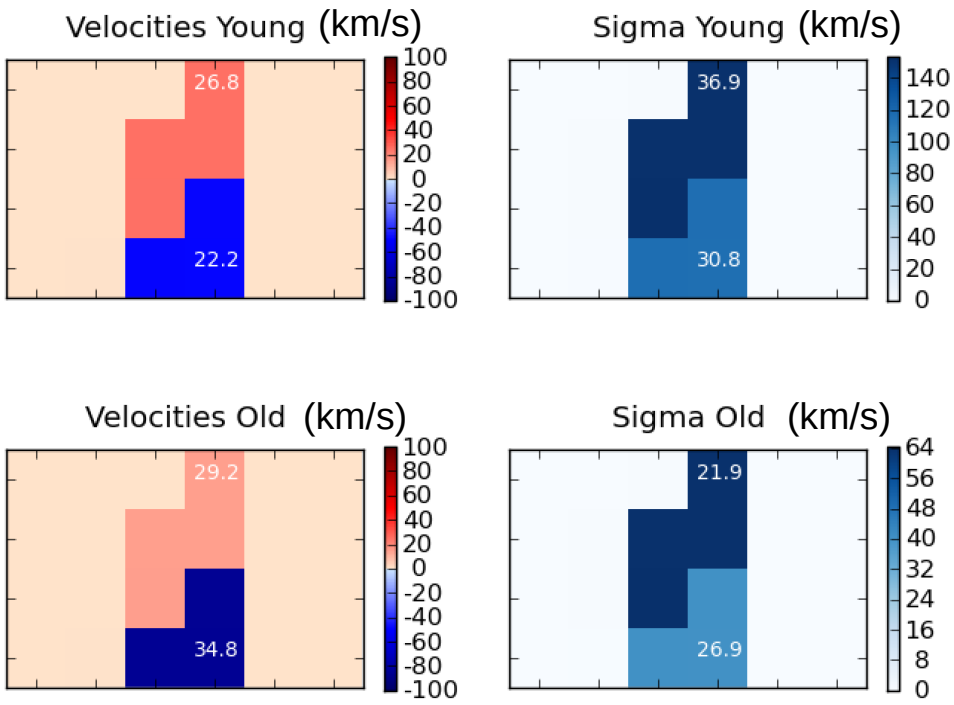
Rodriguez Del Pino et al. 2013

Kinematics

Global kinematics:



Kinematic decomposition:

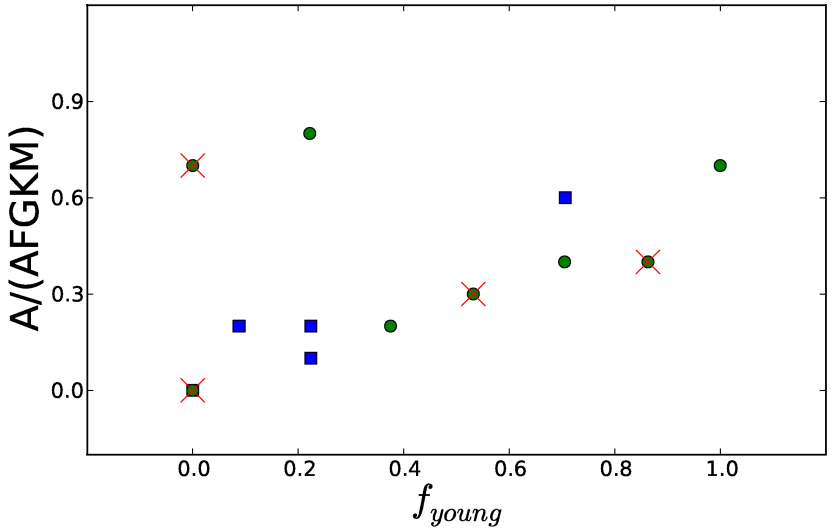


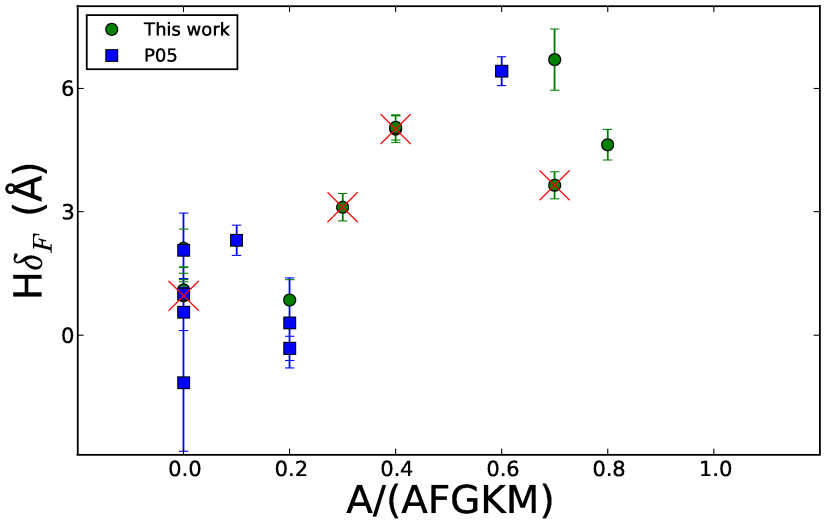
Rodriguez Del Pino et al. 2013

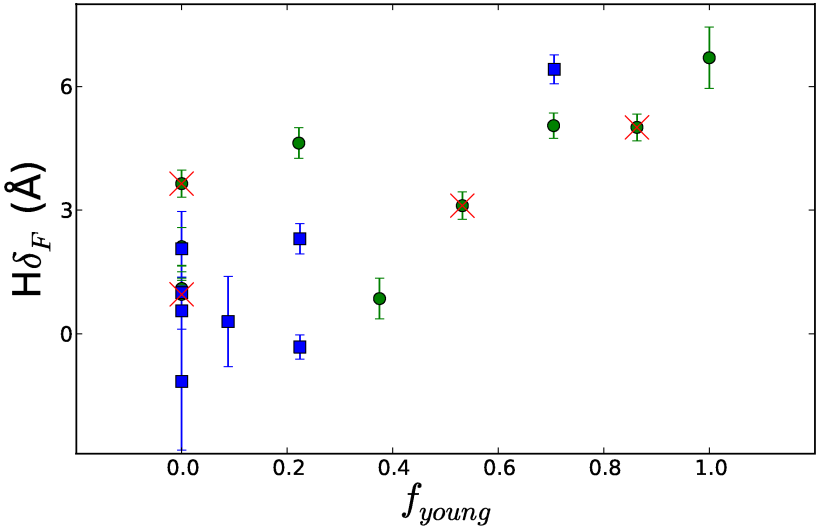
Results

Good correlation between different indicators: chances of correlations being spurious < 1 per cent.

Approximately half of the sample is not real 'k+a'.







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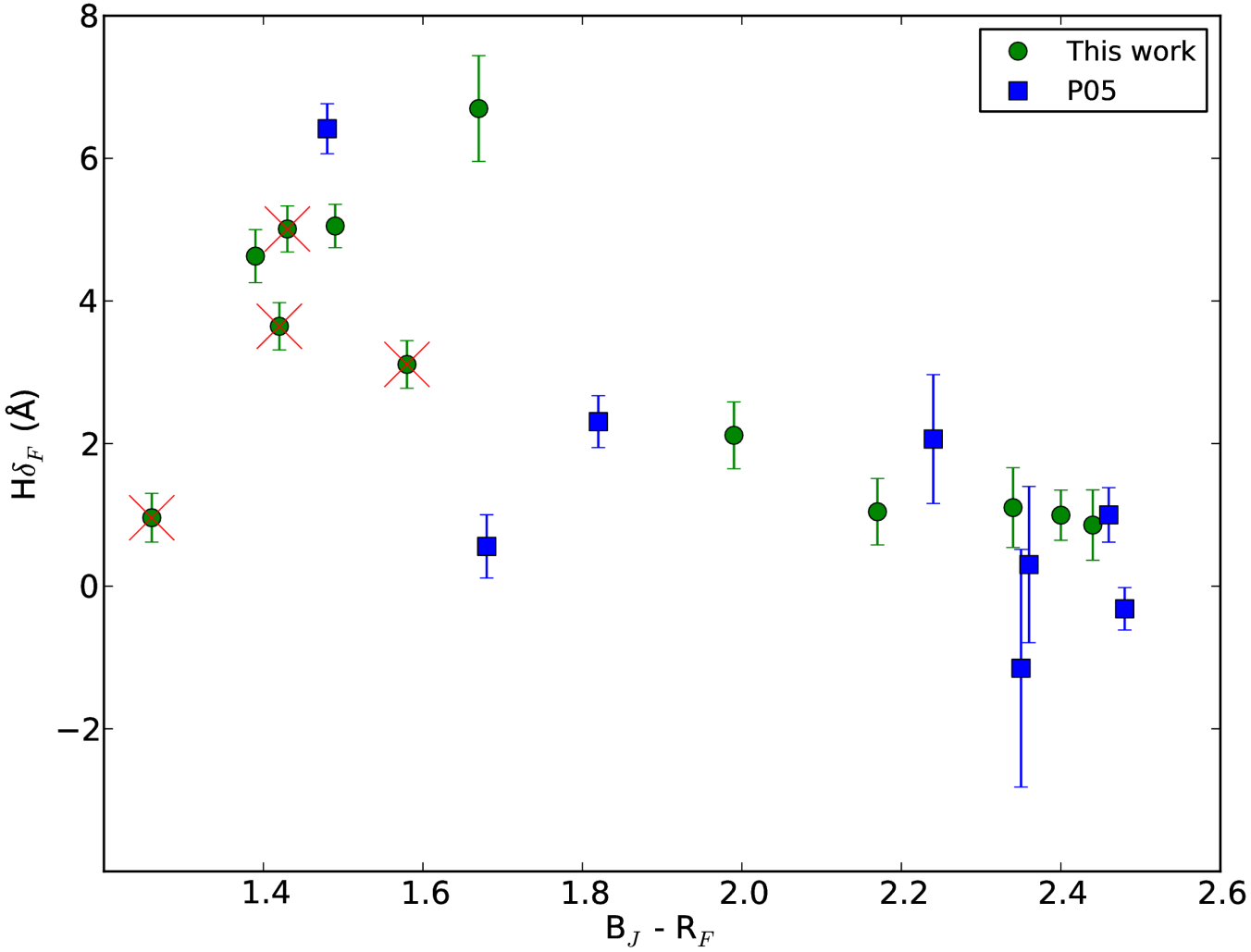
Results



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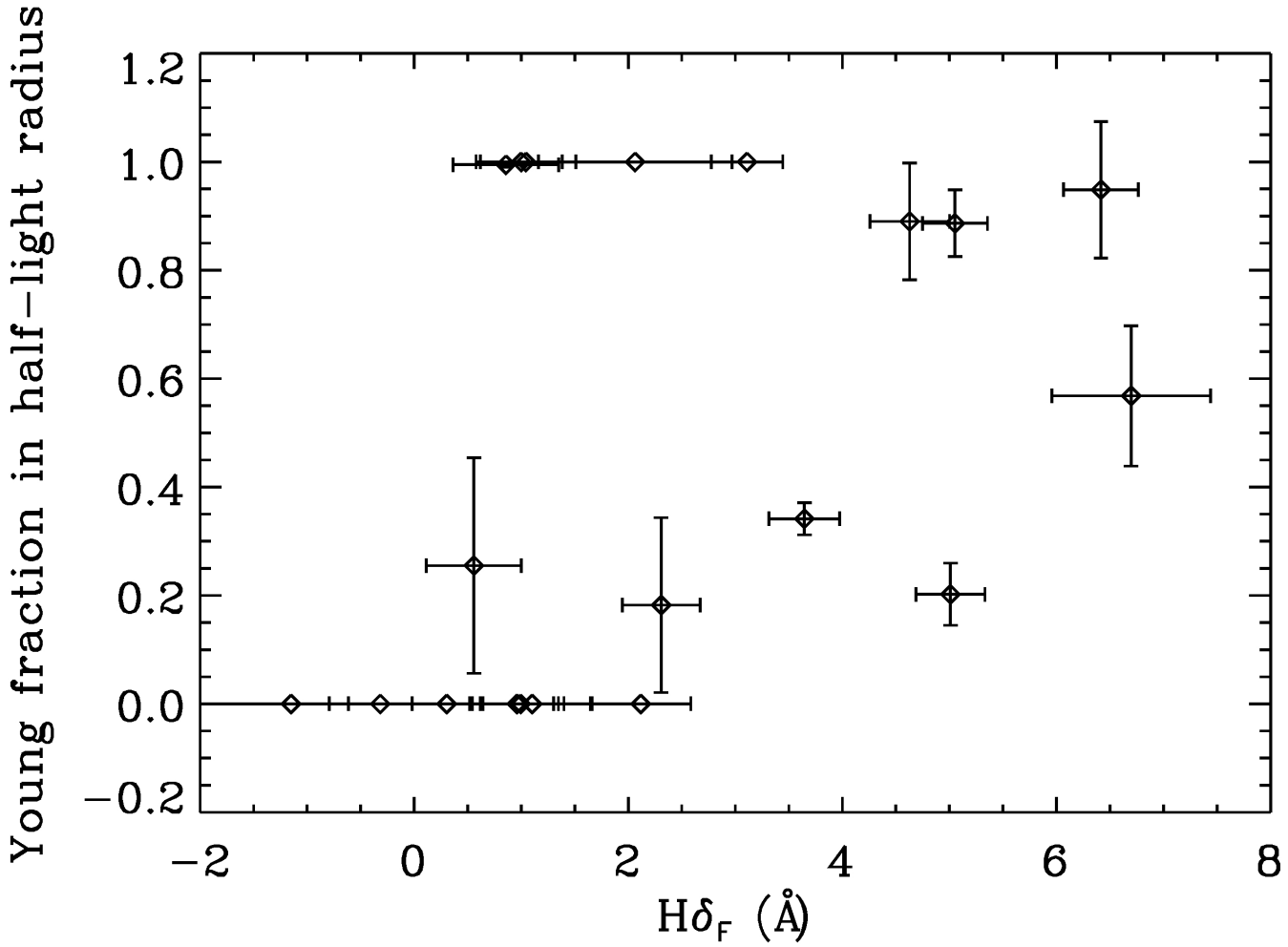
Results



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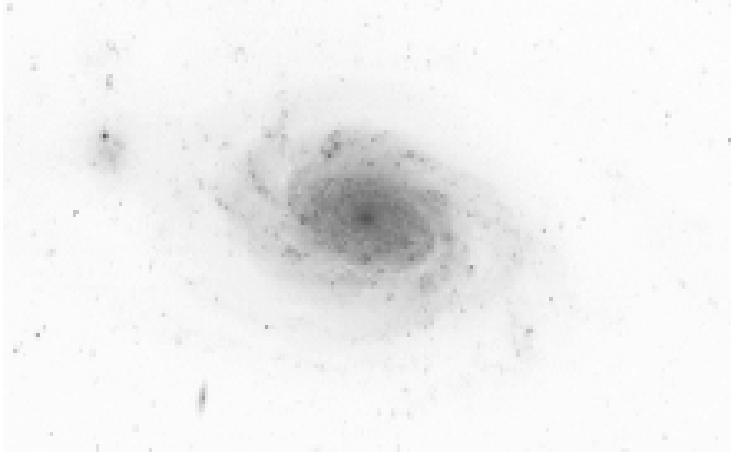
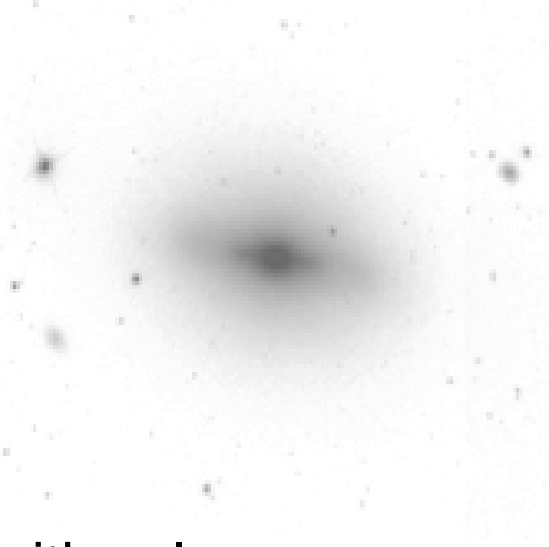


Results



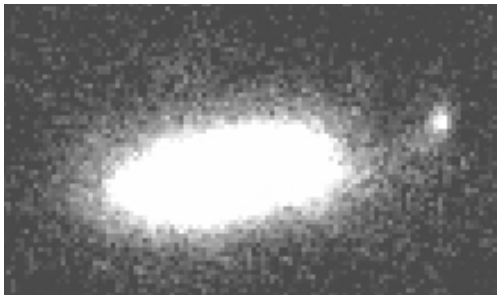
- Rotation: Detected in half of the galaxies with Hδ>3Å with values ranging from ~80 to 180 km/s.

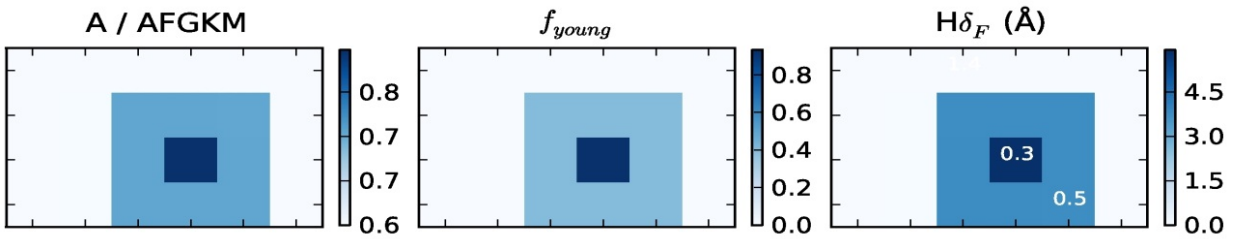
- Kinematic decomposition: A total of five galaxies with Hδ>2Å could be analysed and both populations were found to be rotating accordingly.

- Whatever process halting the SF is not disturbing the stellar disk of the galaxies.

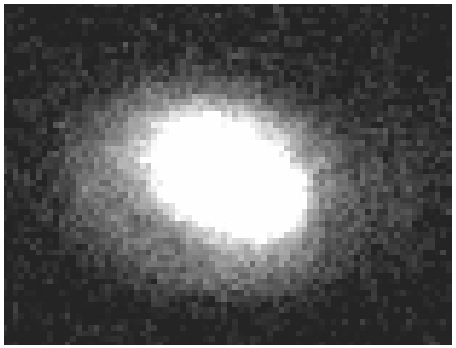
Influence of interactions

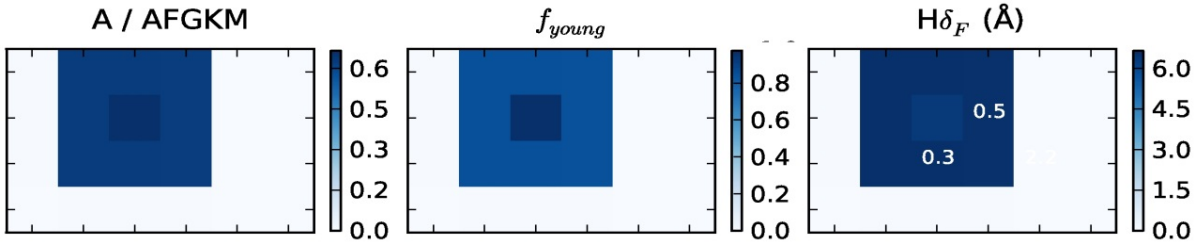
Interacting galaxies (half of Hδ>3Å galaxies):



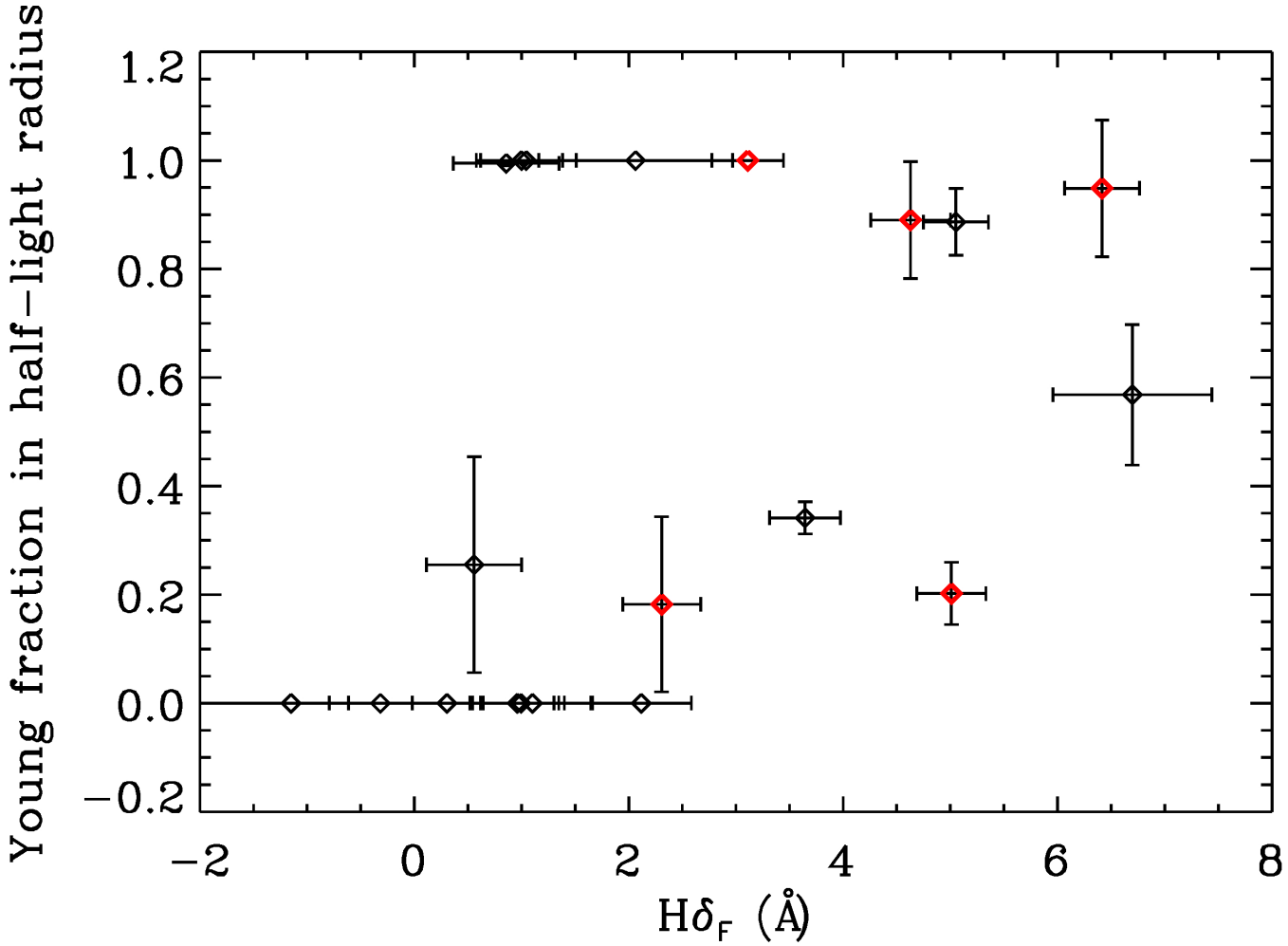


Non- Interacting galaxies:





Influence of interactions



Conclusions

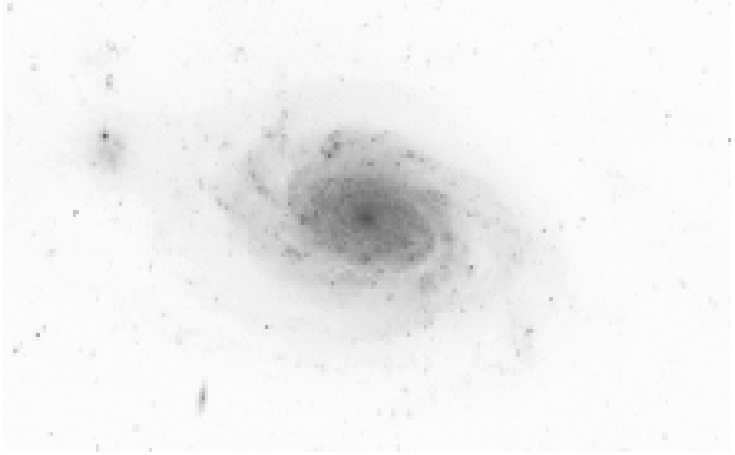
Stellar population indicators are very consistent.

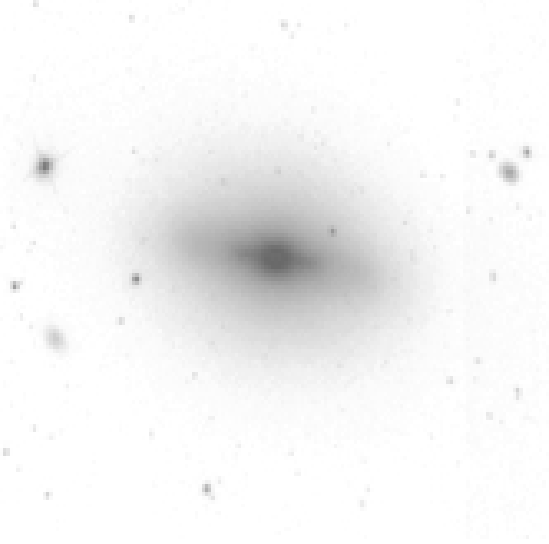
Young population more concentrated than previous generations.

No stellar disk perturbation caused by the truncation.

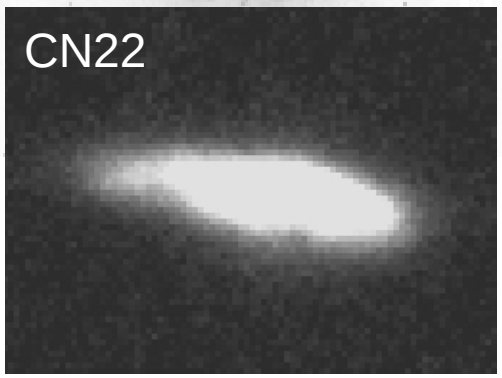
Gas-related processes are favoured although interactions seem to be playing a role as well.

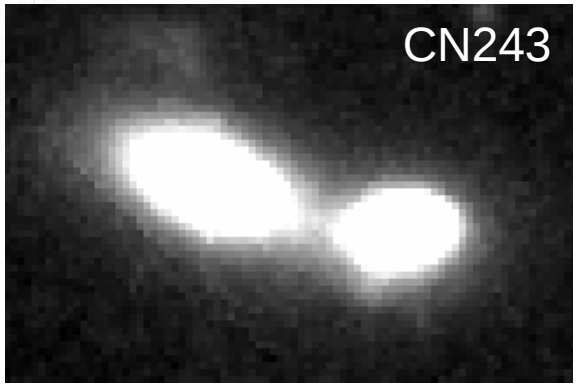
Last star formation more centrally concentrated helping to build the bulges of S0s.

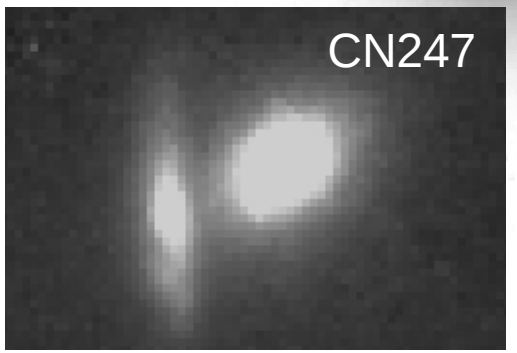




THANK YOU

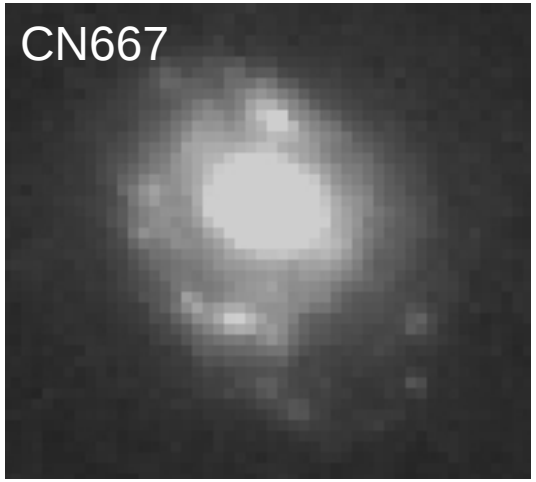

CN22


CN243


CN247


CN155


CN228


CN667


CN849