

# The distribution of galaxies in spectral space

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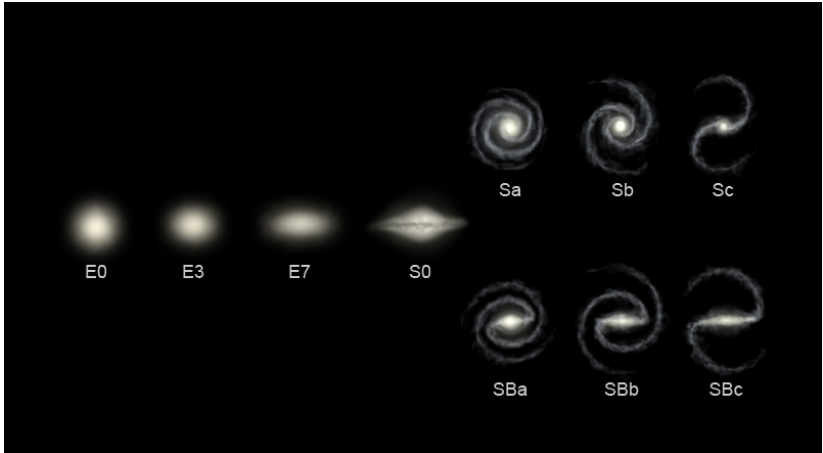
Astrostatistics and Data Mining in Astronomical Databases  
La Palma (Spain), 16/02/2011

# Outline

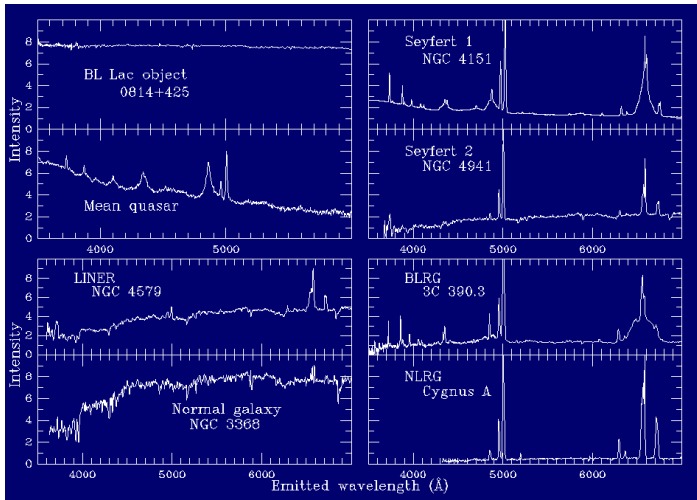
- 1 Motivation
- 2 A "spectroscopic sequence"?
  - Automatic Spectroscopic K-means (ASK)
  - Minimal spanning tree (MST)
  - Physical interpretation
- 3 Conclusions

# The Hubble tuning fork

Hubble (1926)



# Spectroscopic classes

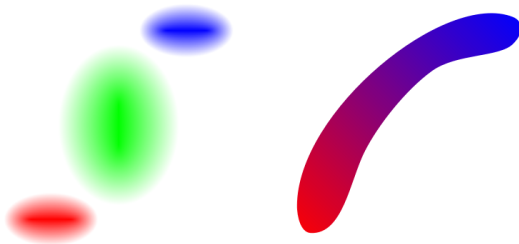


# Distribution in spectral space

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What do you think?

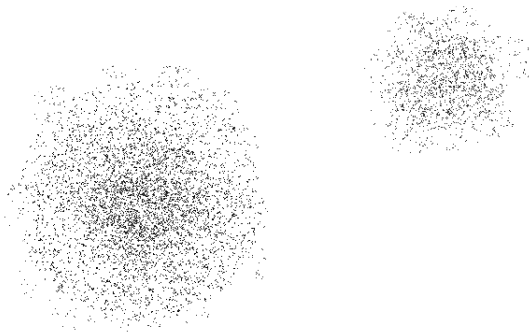
# Distribution in spectral space



# Is there a “spectroscopic sequence”?

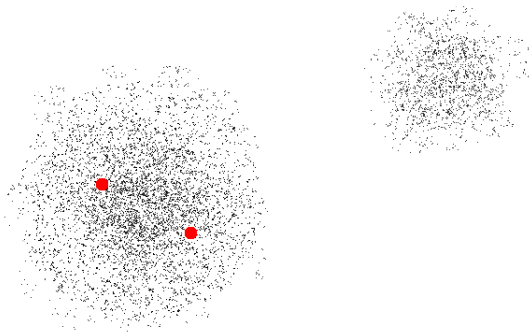
# Automatic Spectroscopic K-means (ASK)

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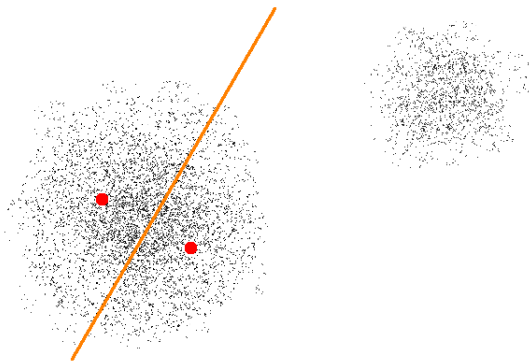
k-means algorithm

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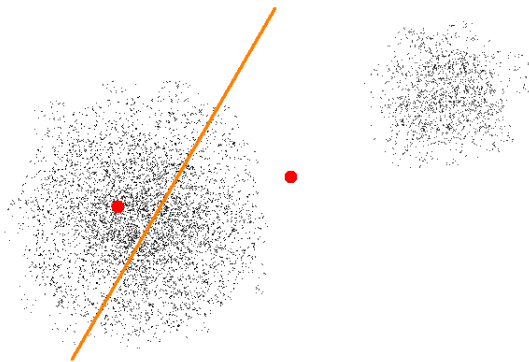
k-means algorithm

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k-means algorithm

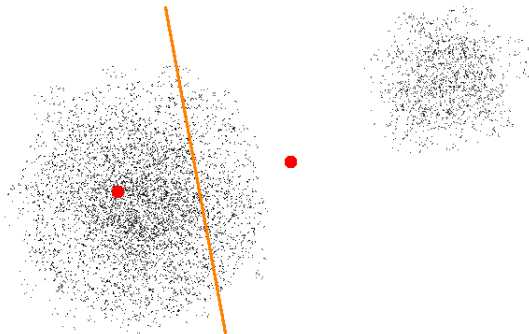
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k-means algorithm

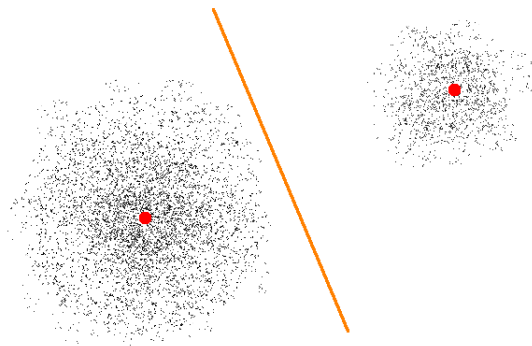


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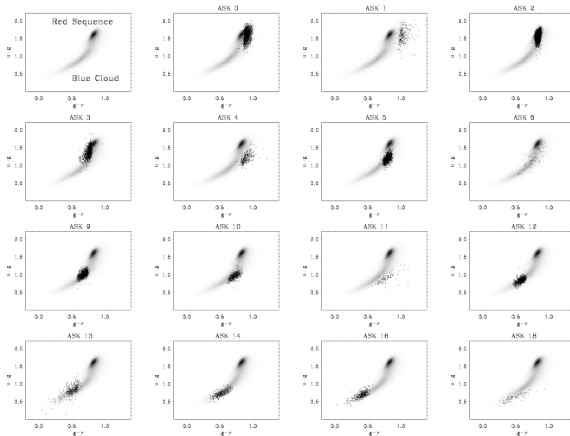
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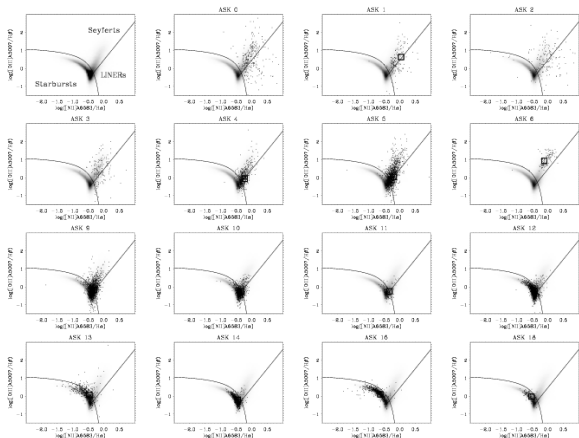
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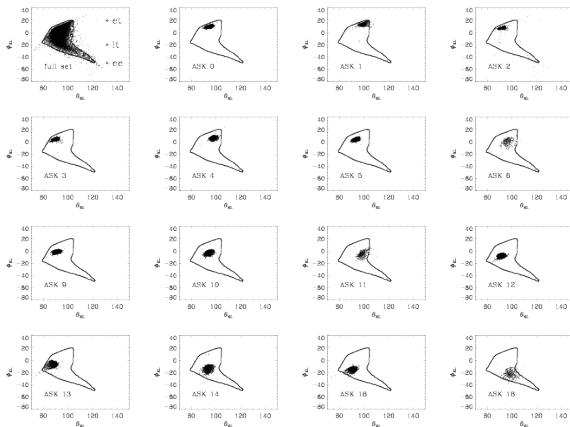
Sánchez-Almeida et al. (2010)

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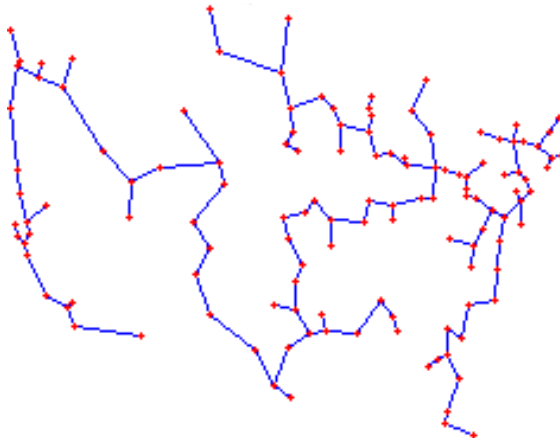


Sánchez-Almeida et al. (2010)

# Minimal Spanning Tree (MST)



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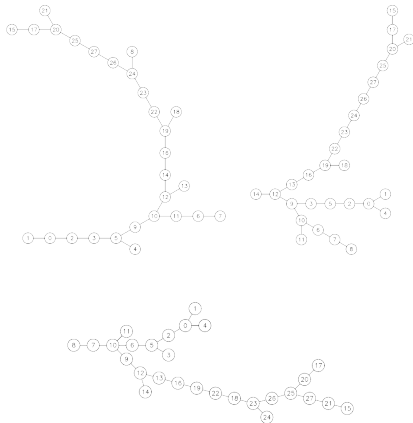
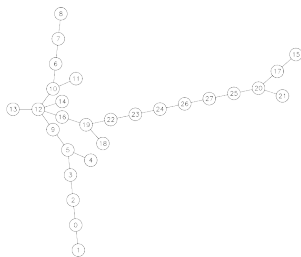




# The MST of ASK classes

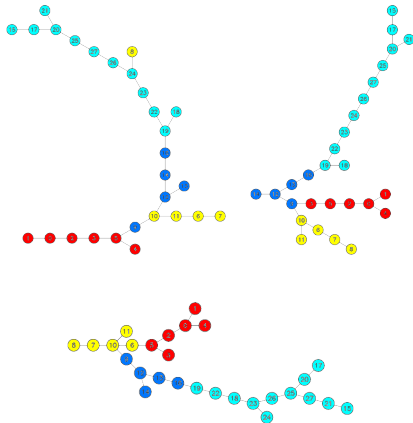
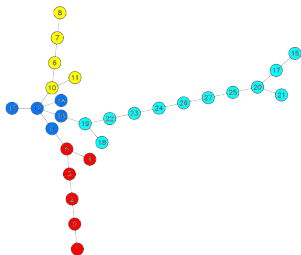


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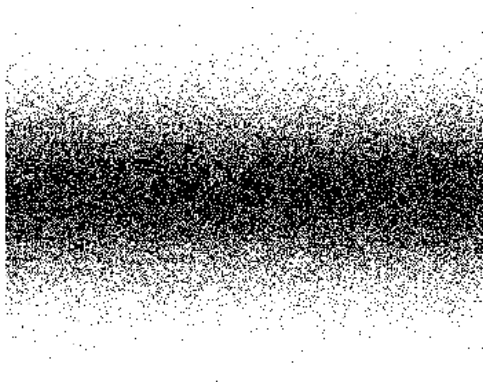




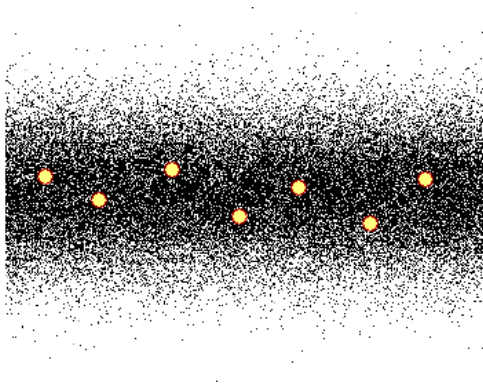
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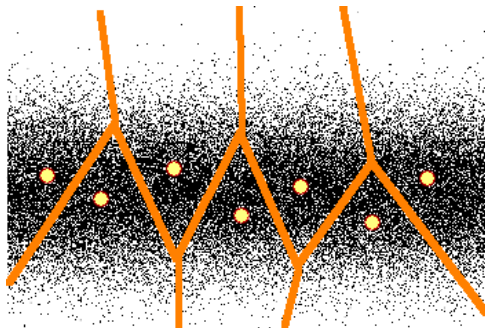
# More on k-means



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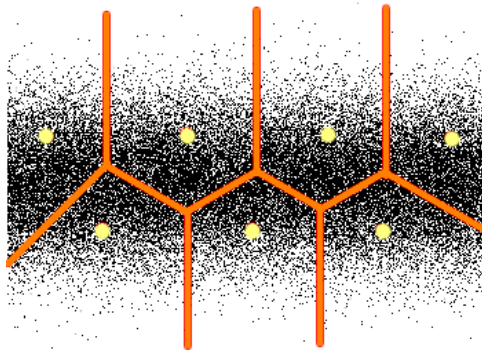


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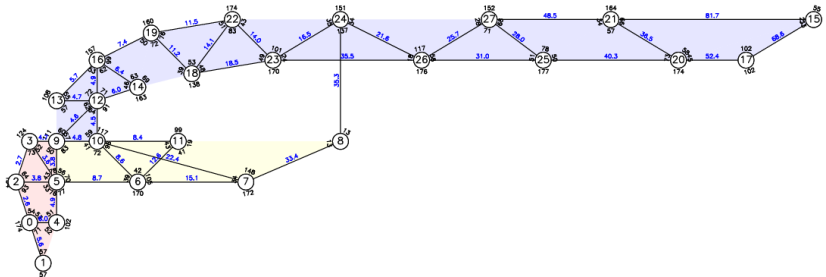




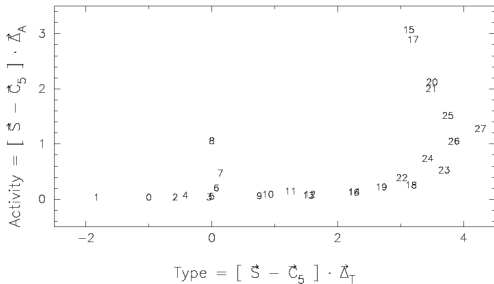
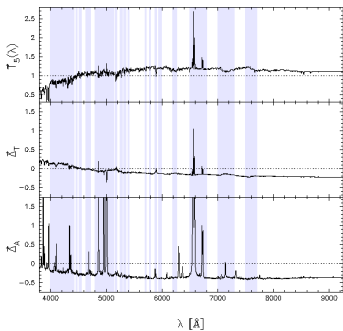
# More on k-means



# A spectroscopic sequence?



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# Galaxies are remarkably simple

## Normal galaxies

Normal galaxies form a well-defined, one-parameter sequence in spectral space

## Active galaxies

Active galaxies form a separate branch that intersects the main sequence at the green valley

## Phases of galaxy formation

- Star formation
- Optical activity
- Red and dead

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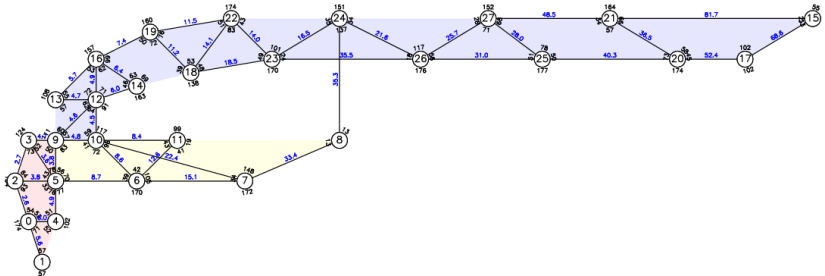
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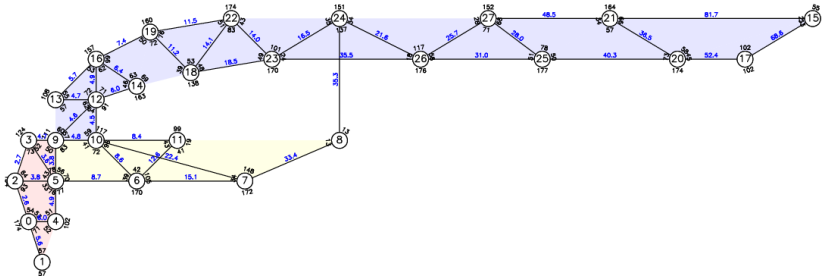
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Thank you!