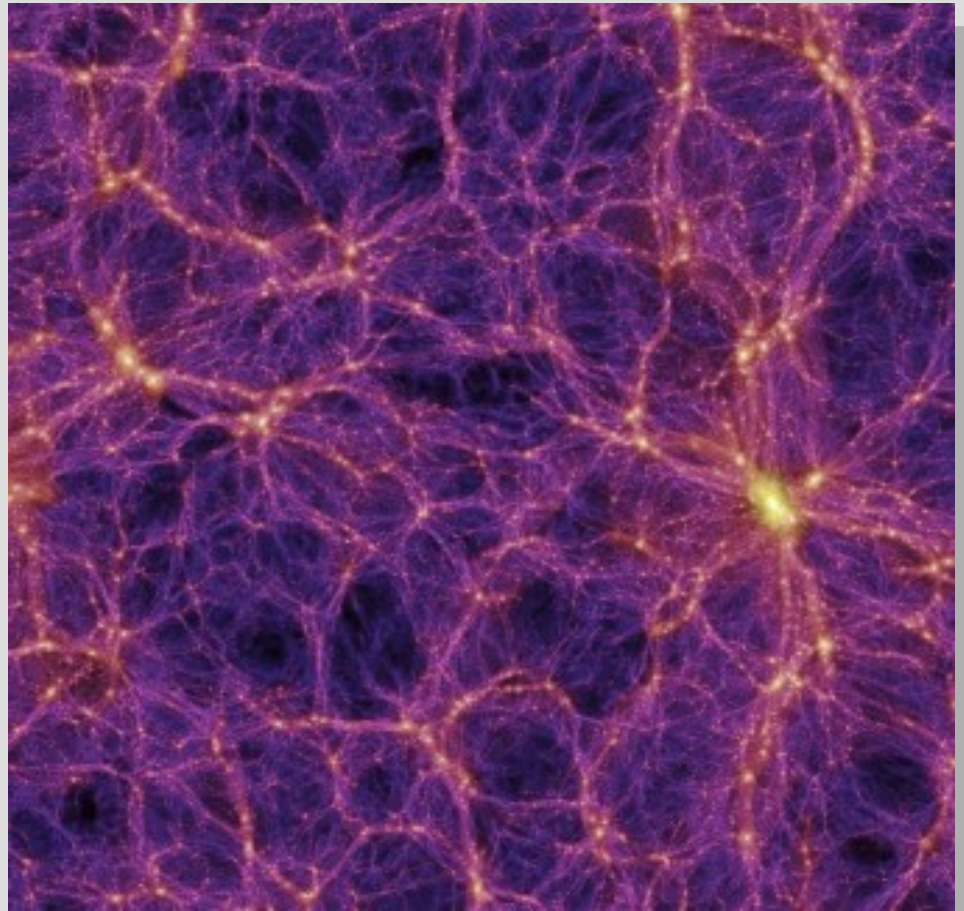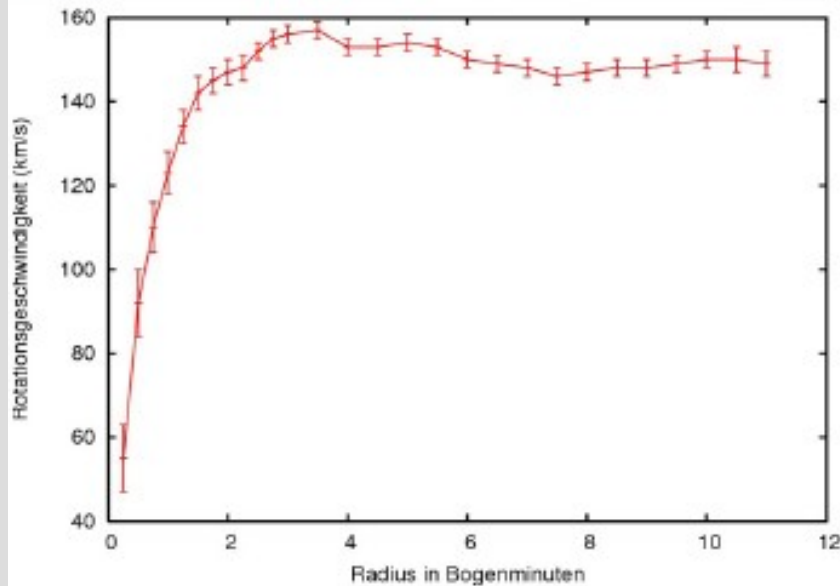# Halo mass dependence of galaxy properties

- Short introduction
  - Dark Matter
  - Halos
  - Halo galaxy connection
- Galaxy properties
- Galaxy types
- Halo mass dependence
- Models

Some obvious hints on Dark Matter

- Rotational velocity
  - Flat end at high velocities
- Gravitational lensing
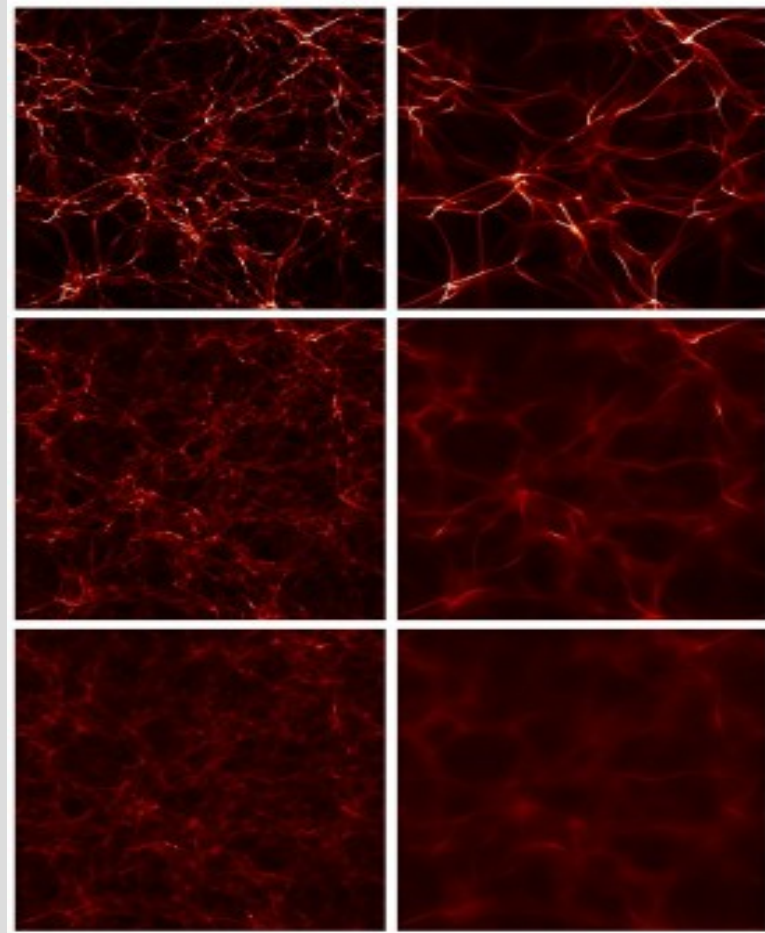 - Distortion
  - Multiple images
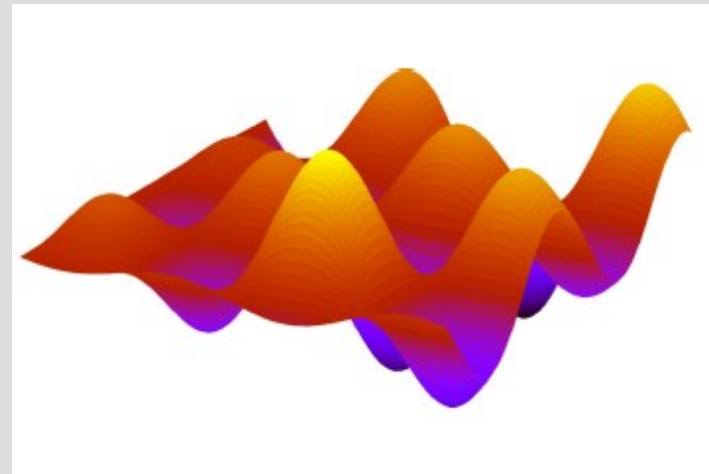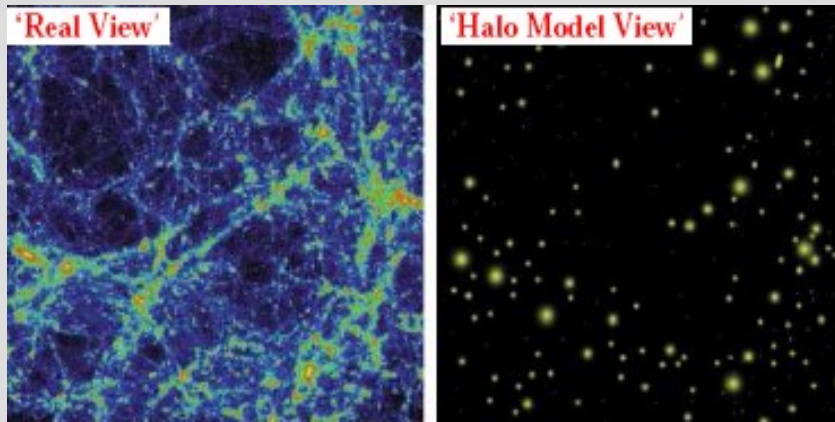
Initial conditions

- Gaussian density distribution from initial quantum fluctuations grow and lead to gravitational collapse

$$\delta(\vec{x}, a) = \frac{\rho(\vec{x}, a) - \bar{\rho}(a)}{\bar{\rho}(a)}$$

$$\delta(a) = \delta_i \, D_+(a)$$

Dark Matter Halos

- spherical, homogeneous Dark Matter collapses when linear density contrast
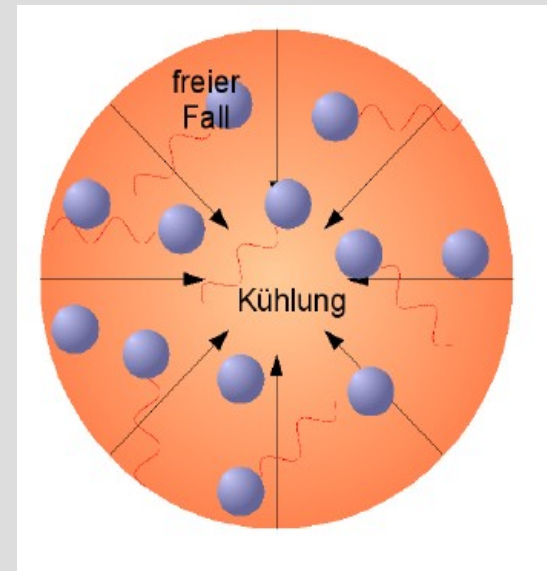
$$\delta_c \approx 1.86$$

- => Halos

Galaxy formation

- Collapse of gas sphere when

$$\tau_{cool} < \tau_{free\ fall}$$

- Cooling through
  - excitation
  - ionisation
  - bremsstrahlung
  - etc.

- Halos are continuous potential minima
- For $M < 10^{12}\ M_{sun}$ gas can cool and form stars
- Structure forms from small to big, i.e. galaxy clusters form late from galaxies

Galaxy properties

- Properties
  - Colour: g-r
  - Star formation rate
- Type definition:
  - early: red,low SFR
  - late: blue,high SFR
  - intermediate: red,high SFR
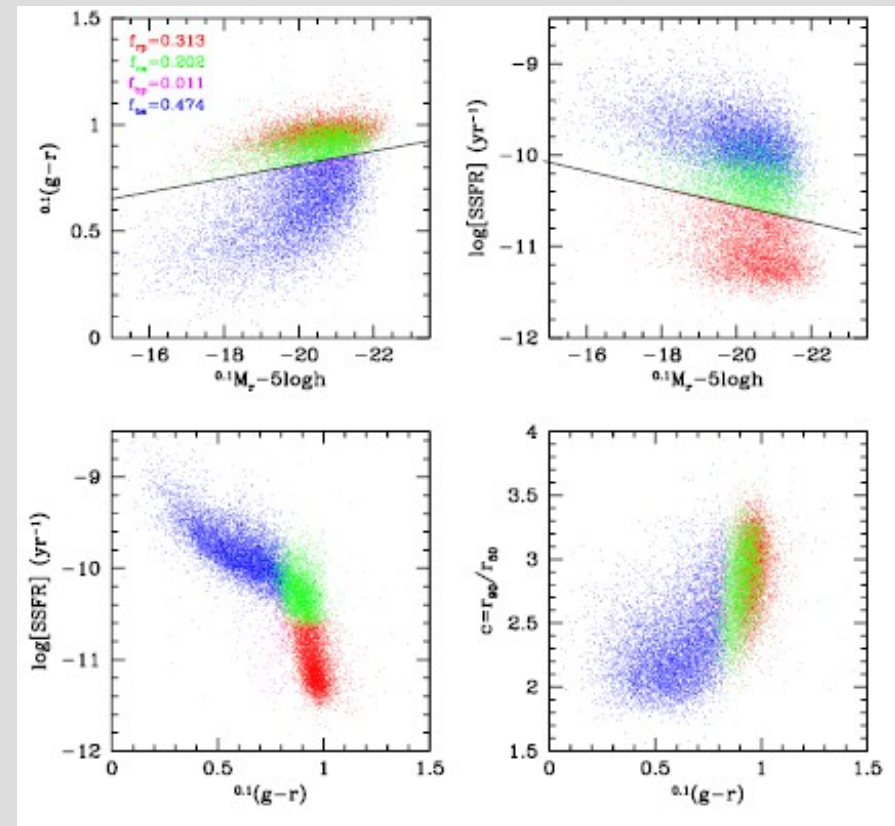
Halo mass dependence

- Late type decrease with halo mass
  - different processes (e.g.:ram-pressure stripping, strangulation, galaxy harassment) stop Star Formation when halos merge
- Early type increase with halo mass
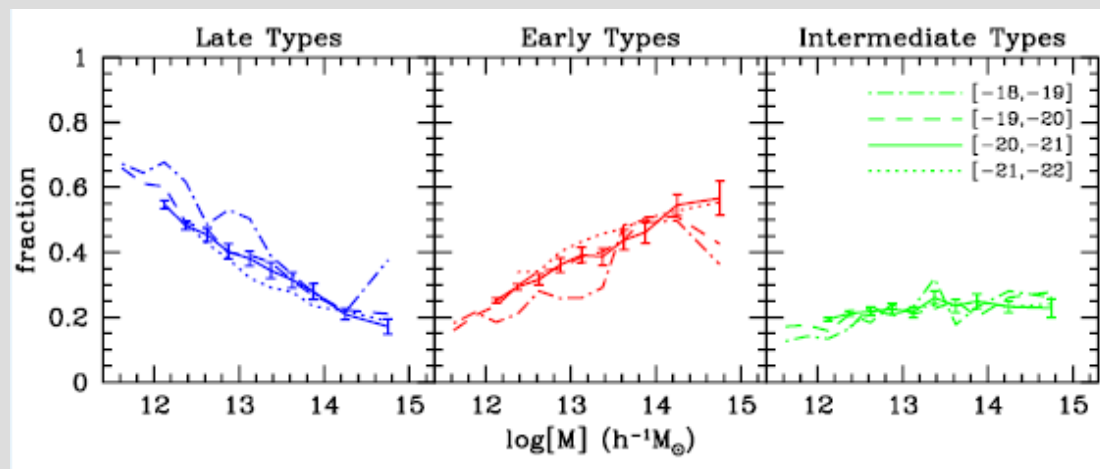
Mechanisms

- strangulation:
  - depriving of hot gas through pressure
- ram-pressure stripping
  - also depriving of cold gas through pressure
- galaxy harassment
  - changing shape through tidal forces

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SDSS vs SAM

- Data of Semi-analytical matches well SDSS Data
- Be careful: this does not mean that they also match for Halo mass dependence