What is interesting?

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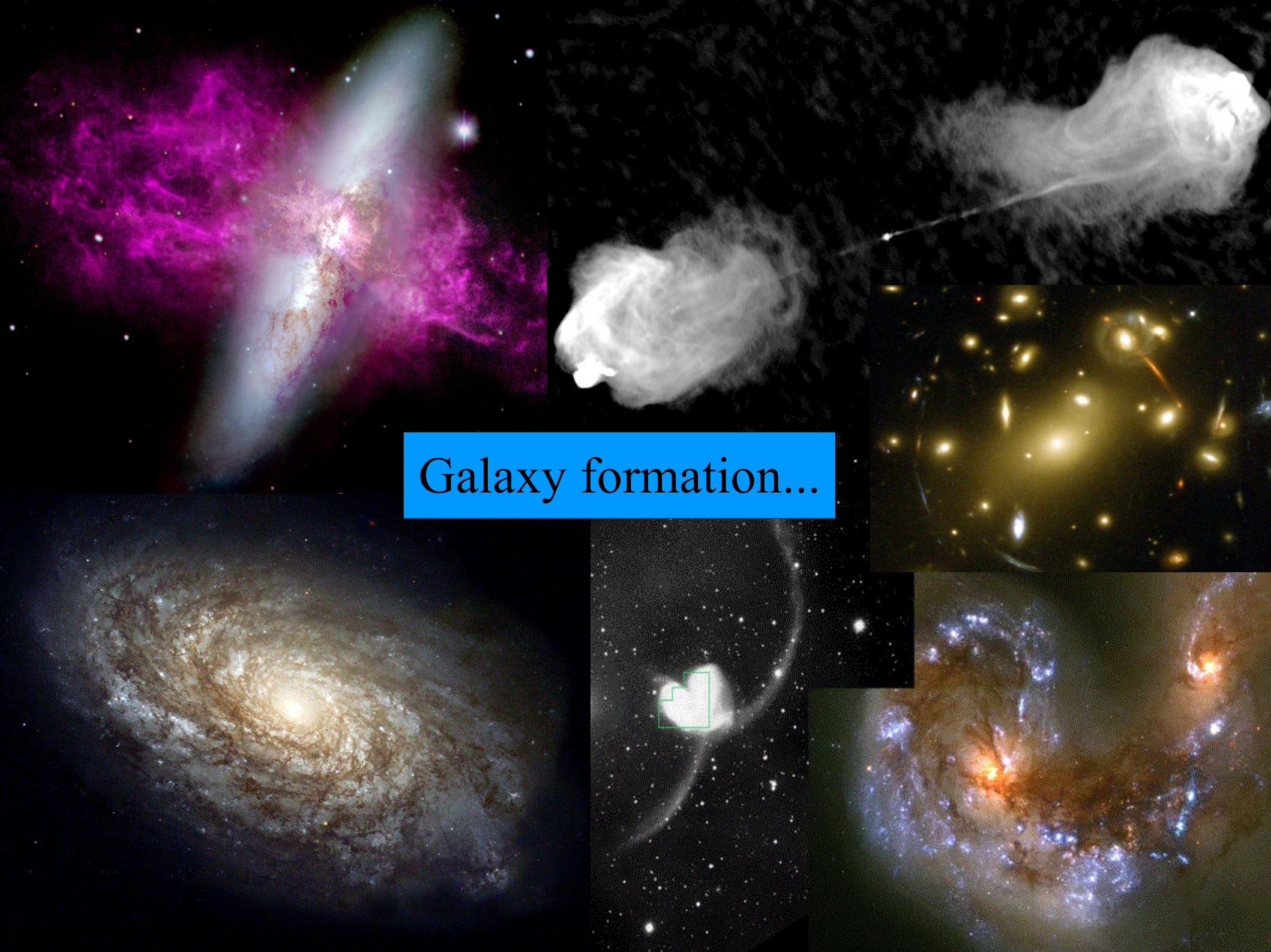
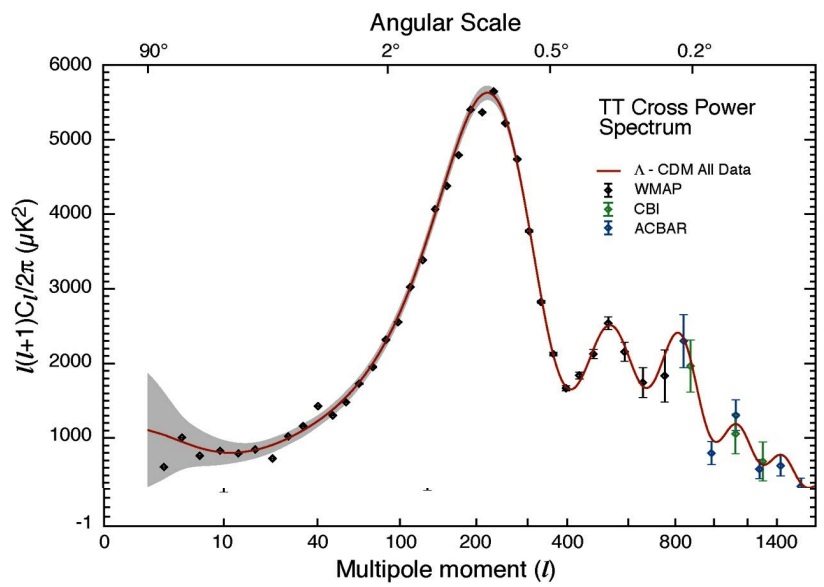
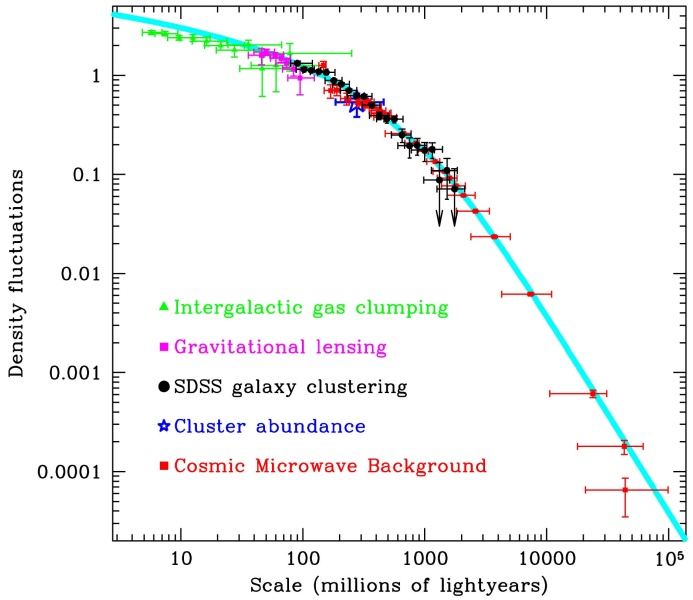
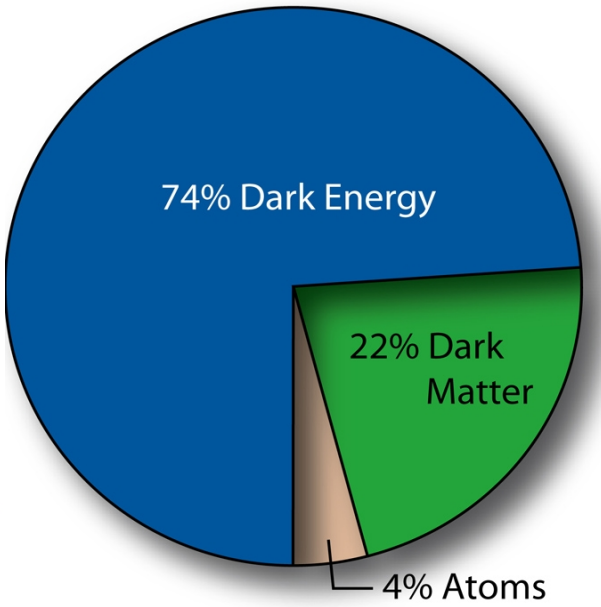
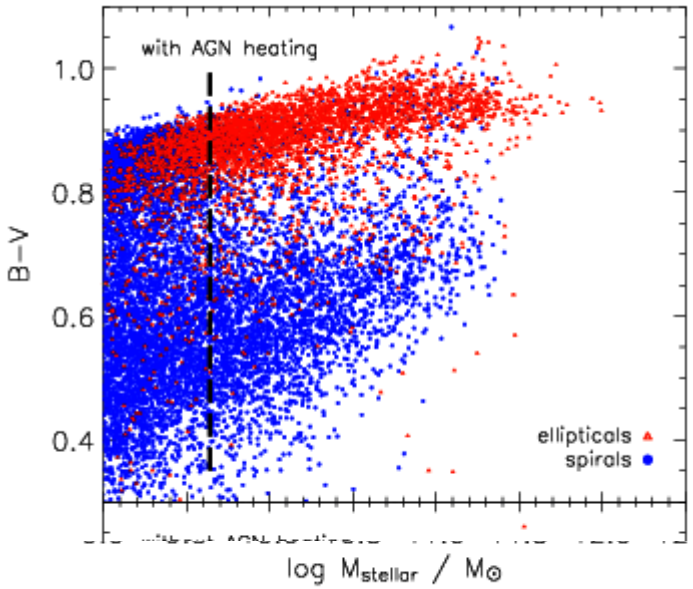

Galaxy formation...

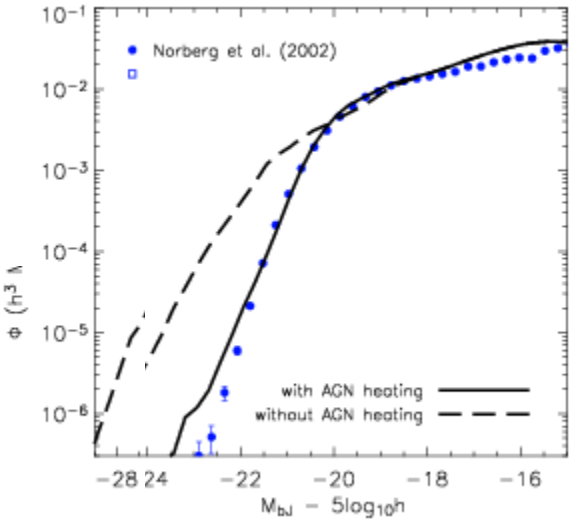


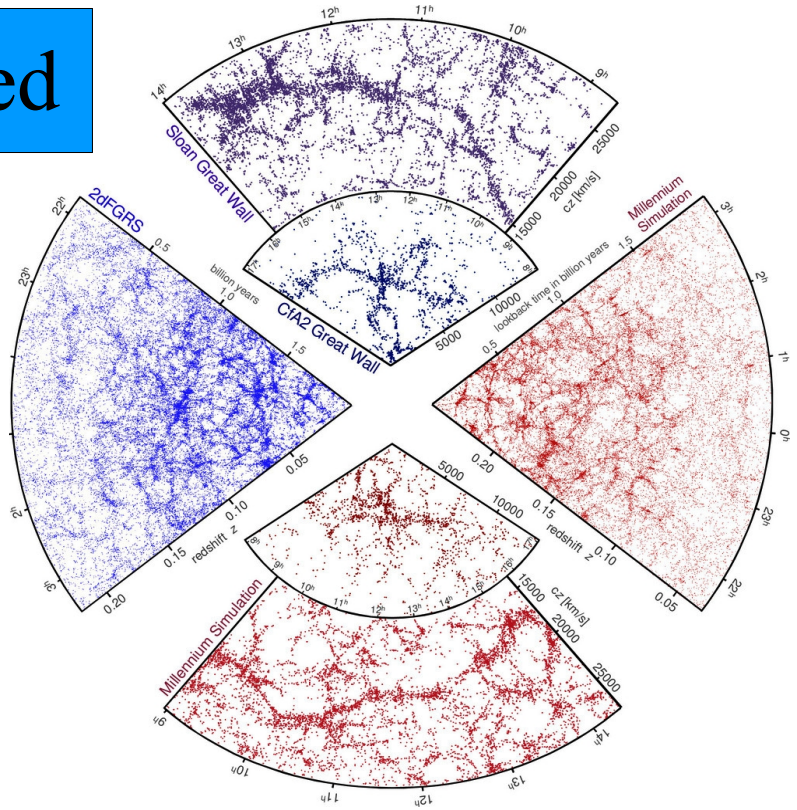






...has been solved





Galaxy Formation.....

- ...starts from small-amplitude, gaussian, near-scale-invariant fluctuations generated in the very early universe...
- ...and imposed in an almost flat FRW cosmology which is today a mixture of ~4% baryons, ~20% DM and ~76% DE.
- Structure grew under the influence of *gravity* to nonlinear amplitudes...
- ...then dissipative processes caused gas to collect at the centres of dark halos and turn into galaxies.
- Star formation and feedback processes regulated the masses, morphologies and structure of the final star/gas/BH objects

Fundamental Questions

- Is there really dark matter? / What is it?
- Is the cosmic expansion really accelerating? / Why?
- Why does the Universe appear flat today?
- Did inflation produce cosmic isotropy? cosmic structure?
- Why is there matter rather than antimatter?
- Are we affected by additional dimensions? other universes?
- Why is the real world described by mathematical laws?

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...but are these of current scientific interest?

Interesting Questions: galaxies

- What shapes the galaxy mass function at high/low masses?
- What sets the sizes of galaxies?
- What causes the disk/spheroid dichotomy?
- Do disks evolve into spheroids? How? A role for bars?
- How do galaxies grow? What triggers star formation?
- What role do black holes play? What triggers activity?
- Where do globular clusters fit in? halo populations?
- How do galaxies interact with their environment?
- Does radiation from early galaxies affect later structure?

Interesting Questions: IGM/Z

- Structuring through winds + ionizing radiation:
  --effects on "simple" Ly α forest models: ν masses, cosm.par.
  --enrichment pattern, ionization structure, intergal. dust
  --injection and acceleration of CR, injection of B field
  --relation to UV absorption OVI, OVII, etc.

- Linking chemistry and structure growth in Milky Way/LG
  --timescales for SNIa/CNO enrichment, component assembly
  --searching for tidal extensions/streams from LG dwarfs

- Insights into galaxy group/cluster structure and growth
  --dynamics/stripping from PN studies
  --evolution of IGM abundances (X-ray) vs galaxy pops
  --galaxy pop.'s as functions of cluster mass, structure, radius

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and don't forget COS, ALMA, lensing surveys, SKA, JWST...