

Galaxy Evolution

Dr Michelle Cluver: 6 x 1.5hr lectures

Description: The galaxies we observe at the present time exhibit remarkably diverse properties given the homogeneous beginnings of the universe. What do we know (or think we know) about how galaxies have formed and evolved and how have these changes been reflected in the aggregate properties of the universe over time? How do “static” observations across cosmic time inform us of the dynamic and evolving processes that govern galaxy evolution?

Lecture 1: The Rise of the Galaxies

- the formation of structure in the universe
 - the formation of galaxies
 - fundamental quantities: star formation, stellar masses, metallicity
 - the role of AGN and supernovae
 - galaxies across cosmic time (star formation and stellar mass)
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Lecture 2: Observing the Changing Universe

- galaxies at different wavelengths
- photometry and spectral energy distributions
- energy production and the “fading universe”
- spectroscopy and redshifts
- emission line diagnostics
- galaxies in HI
- galaxies in radio continuum

Lecture 3: Galaxies in the Local Universe

- our place in the universe (the Local Group, the Virgo Supercluster)
- our local Cosmic Web
- the constituents of galaxies: baryons and dark matter
- the baryon cycle
- scaling relations
- bimodality in galaxy evolution

Lecture 4: The Role of Environment in Galaxy Evolution I: Density

- Groups of galaxies
- Clusters of galaxies
- Superclusters
- The morphology-density relation
- Starbursts
- Case Study: M82
- AGN
- Case Study: Centaurus A

Lecture 5: The Role of Environment in Galaxy Evolution II: Interactions

- observing interacting galaxies
- the physics and chemistry of interacting galaxies
- the distribution of gas
- Mergers as an engine of galaxy evolution:
 - minor mergers
 - major mergers

Lecture 6: Feeding, Feedback, and Fireworks

- the fuelling of star formation as an engine of galaxy evolution
- feedback mechanisms
- a non-exhaustive list of quenching mechanisms
- the most energetic phenomenon:
 - supernovae, FRBs, GRBs, quasars
 - LIRGS, ULIRGS and HyperLIRGS