

Examples of Report Topics

These are just meant as suggestions to get you started thinking about a topic for your seminar. Projects will all start with reading one or several relevant papers, but might include – or lead to – some original research. Please do some further thinking about your project, and plan to meet soon with Avishai Dekel and/or Joel Primack to discuss it further. We'll try to help you choose a topic and find suitable articles to get you started.

Examples of topics to summarize from the literature:

- Angular momentum problems in galaxy formation
- Feedback effects in galaxy formation
- Outflows from galaxies
- Black holes in galactic centers – origins, correlations, and effects
- Dwarf galaxies, the galaxy luminosity function, and “missing satellites”
- Tidal streams

Massive Black Holes (MBH)

- Origins of first MBH and their masses
- Formation of supermassive black holes that power the earliest quasars
- Role of MBH feedback in galaxies and clusters
- Expected numbers of satellite black holes and black hole mergers
- Expectations for observations by LISA

Redshift Surveys and Implications

- Broad Redshift Surveys: 2dF and SDSS
- Deep Redshift Surveys, especially GOODS, DEEP/AEGIS, and COSMOS

Structure of Λ CDM Dark Matter Halos

- Smallest scale of CDM structures
- Centers of dark halos, and comparison with observations of dwarf spiral galaxies
- Phase-space properties of substructure
- Halo Occupation Distribution (HOD) and implications
- Halo shapes – triaxiality, velocity anisotropy, radial dependence, implications
- Angular momentum distribution and implications for galaxy formation
- Effect of clump dynamical friction on dark matter distribution near cluster centers
- Formation of the Local Group in the standard Λ CDM cosmology

Hydrodynamic simulations of galaxy formation and evolution

- The first stars, including possible effects of dark matter annihilation
- The first quasars, and their effects
- Effects of cold streams on galaxy formation
- Galaxy merger simulations and implications
- Evolution of galaxy populations
- Correlations of galaxies and of galaxy properties

Applying galaxy morphology statistics

- Traditional statistics – e.g., bulge/disk ratio, radii, asymmetry
- Nonparametric galaxy morphology statistics – e.g., G/M20, shapelets
- Applied to galaxy merger simulations, determination of merger rates
- Applied to various observational data sets
- Correlations with other galaxy properties

Semi-Analytic Modeling of galaxy formation – e.g.

- Formation and evolution of low-mass galaxies, origin of scaling relations
- Understanding the growing data on damped Lyman alpha systems
- How spiral galaxies satisfy Tully-Fisher relation and Luminosity Function
- Formation and evolution of Sub-millimeter Galaxies

Clusters of Galaxies

- Using cluster X-rays and/or galaxy counts to probe cosmology
- Sunyaev-Zel'dovich effect
- Cooling flows issues