# Topics for Term Papers (PHY 654)

1. Slipher and first measurements of galaxy redshifts, current status of galaxy redshift measurements: 2df and SDSS surveys.

2. Hubble, Humason and the earliest measurements of distances to other galaxies. HST key project and measurement of distances to galaxies. Determination of Hubble's constant.

3. The Galaxy and its rotation. Oort's constants and estimation of angular velocity as well as variation of circular velocity with distance from the galactic center. Determination of the mass surface density of the disk. Determination of these quantities using Hipparcos data.
Implications for dark matter in the Galaxy.

4. MOND (MOdified Newtonian Dynamics) as an alternative for dark matter. Implications of MOND for other observations. Relativistic formulations of MOND. Status of observational support.

5. Galaxy rotation curve data and determination of individual components. Implications for dark matter.

6. Inventory of the Coma cluster and determination of gas fraction and density parameter. Data on more clusters from recent surveys.

7. Inverse Compton scattering and the Sunyaev-Zel'dovich effect. Information content of X-ray and SZ observations. Discovery of clusters using the SZ effect (Planck, SPT, etc.).

8. Lyman-alpha forest and the inter-galactic medium. The equation of state. Chemical enrichment.

9. SNIa data, accelerated expansion and the evidence for dark energy.

10. Dyer-Roeder distances and the impact on distance measurement.

11. Random walks with absorbing boundary, excursion set approach to mass functions, Press-Schechter mass function. Survival rates and merger probabilities. Merger trees.

12. Spherical collapse and the relation of virial temperature with the halo mass and the collapse redshift. Impact of dark energy.

13. Damped Lyman alpha Absorption Systems (DLAS) and their relation with galaxies. Estimating neutral gas content of DLAS from observations and the evolution of total neutral gas content with time.

14. Density-velocity relation in the linear perturbation theory, redshift space distortions, clustering in the redshift space.

15. Super Massive Black Holes (SMBH). The SMBH at the center of the Galaxy, observational evidence. SMBH as the engine for active galactic nuclie (AGNs). Relation between SMBH and galaxy properties.

16. Dark matter. Evidence for dark matter in galaxies and clusters of galaxies. Constraints on interaction cross-section for dark matter: Triaxial elliptical galaxies, merging clusters, etc. Constraints on hot/neutrino component in dark matter: early galaxies, Lyman alpha forest.

17. Epoch of reionization. Observational evidence from spectra of high redshift objects: Quasars, GRBs, galaxies. Observational evidence from luminosity function evolution of Lyman alpha emitters. Observational evidence from observations of CMBR.

18. Luminosity function (LF) of galaxies. Methods of estimating the LF. Low redshift luminosity function for galaxies, LF by galaxy type. Evolution of LF with redshift.

19. Clustering of galaxies. Redshift surveys of galaxy distribution. Estimation of correlation function and power spectrum in surveys. The role of selection function and survey geometry. Scale of homogeneity.