AST1430-2019 Class Schedule

October 10
(3) Define and describe the following terms: Comoving Distance, Proper Distance, Angular Diameter Distance, Luminosity Distance, Proper Time, Coodinate Time.

(2) The universe is said to be "flat", or, close to flat. What are the properties of a flat universe and what evidence do we have for it?

(13) Consider a cosmological model including a positive cosmological constant. Show that, in such a model, the expansion factor eventually expands at an exponential rate. Sketch the time dependence of the expansion factor in the currently favoured cosmological model.

October 24

(11) Describe cosmological inflation. List at least three important observations it is intended to explain.

October 31
(17) What are the similarities and differences between the cosmic neutrino background and the cosmic microwave background?

(5) Describe Big Bang nucleosynthesis. Why are only very light elements (H, D, He, and traces of Li) produced?

November 7
(1) What is recombination? At what temperature did it occur? Explain why this does not match the ionization potential of hydrogen.

(14) Define and describe the epoch of reionization. What are the observational constraints on it?

(4) State and explain three key pieces of evidence for a Big Bang origin for the observable Universe.

November 14
(12) Define the two-point correlation function of a gaussian random field. How is it related to the power spectrum of that field? How is it calculated using galaxies as tracers? Describe how this concept is used in cosmology?

(16) Define and describe four cosmological parameters that can be constrained by the angular power spectrum of the Cosmic Microwave Background. Explain their imprint on the CMB.

(7) Describe as many steps of the distance ladder and the involved techniques as you can.

November 21
(9) Why is the cosmic microwave background expected to be weakly polarized, and what is practically required to observe this signal?

(10) Our view of the cosmic microwave background is affected by what is along the line of sight. Give two examples of CMB secondary anisotropies that also provide information about the cosmic parameters.

(19) What are galaxy clusters? List and explain three methods for detecting them or determining their basic properties.

November 28
(6) Explain how and why Type Ia Supernovae are used in the measurements of cosmological parameters.

(18) Give three examples of possible dark matter candidates (current or historical). What is their status observationally?

(8) Describe a method, other than Type Ia supernovae and CMB foregrounds, by which the cosmological parameters can be determined by astronomical observations, and describe the current status of constraints from this method.

December 5
(15) The 21 cm line of hydrogen is expected to show up in absorption against the cosmic microwave background at some redshifts, and in emission at other redshifts. What physical processes lead to this behaviour?

(20) What is star formation quenching in galaxies? What is the evidence for it, and why is it thought to happen?