

Student's Name:

Course Name: Experimental Cosmology

Teacher's Name: J.F. Macias-Perez

NOTE: Lectures notes can be used.

Q1: BASIC CONCEPTS AND FACTS

1. What are the main ingredients of the cosmological standard model? Discuss their relationship.
2. Describe the main cosmological probes to date (CMB, SNIa, LST surveys, others). Discuss the notion of concordance model.
3. Discuss how matter perturbations form and evolve in the universe
4. Indicate why the temperature CMB anisotropies power spectrum can be used to constraint cosmological parameters

Q2: A BIT OF INSTRUMENTATION

Consider a CMB dedicated experiment that consists of a telescope of 0.7-meters in diameter and a microwave and millimetre camera with four frequency bands centred at 70, 100, 143, 217 and 353 GHz, with a total of 10000 high quality detectors equally shared between frequencies and a circular field of view of 4 degrees diameter.

1. What is the resolution of the instrument? What kind of detectors could be used? To which temperature do we need to cool down those detectors?
 2. Which scientific objectives could be considered with such an instrument? Describe the main observable quantity and how it relates to cosmology. Why do we need multi-frequency observations?
 3. Where would you place such an instrument (ground, balloon or satellite? Which scanning strategy will you choose to fulfil your objectives? Discuss what would be the maximum percentage of sky that could be observed.
 4. Assuming the detectors are a factor of two more sensitive than those of Planck compute how long you should observe to increase Planck results by a factor 100 (do not forget to account for sky coverage and choose those detectors which are in the right frequency range for your scientific goal).
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