

ASTRONOMY 113: INTRODUCTION TO COSMOLOGY

I. INTRODUCTION (*Chapt. 1-2 Liddle, Chapt. 1-2 Ryden*)

- 1.1 Prologue
- 1.1 The Cosmological Principle
- 1.2 Particles in the Universe
- 1.3 Elementary Properties of Radiation
- 1.4 Olbers Paradox
- 1.5 Doppler effect

II. STANDARD COSMOLOGICAL MODELS (*Chapt. 1-2 Liddle, Chapt. 1-2 Ryden*)

- 2.1 Homogeneity and Isotropy
- 2.2 Expanding Universe
- 2.3 Redshift

III. NEWTONIAN COSMOLOGY (*Chapt. 3-5 Liddle, Chapt. 4 Ryden*)

- 3.1 Friedmann equation
- 3.2 Density Parameter
- 3.3 Fluid Equation
- 3.4 Solving Friedmann equations
- 3.5 Fate of the Universe
- 3.6 Acceleration equation and Initial Singularity
- 3.7 Deceleration Parameter
- 3.8 Problems with the Big Bang
- 3.9 Cosmological Constant
- 3.10 The Preposterous Universe

IV. RELATIVISTIC COSMOLOGY (*Chapt. 4 Liddle, AdvTop. 1 Liddle, Chapt. 3 Ryden*)

- 4.1 A Quick Primer to Non-Euclidean Geometries
- 4.2 Einstein's Field Equations
- 4.3 Metric
- 4.4 Equations of Motion
- 4.5 Redshift
- 4.6 Peculiar Velocities

V. ALTERNATIVE COSMOLOGIES (*Notes*)

- 5.1 Tired Light
- 5.2 Steady State Model
- 5.3 Large Number Hypothesis
- 5.4 The Anthropic Principle

VI. MEASURING COSMOLOGICAL PARAMETERS (*AdvTop. 2 Liddle, Chapt. 7 Ryden*)

- 6.1 Age of the Universe
- 6.2 Distances
- 6.3 Time-Varying Redshift

VII. COSMIC MICROWAVE BACKGROUND (*Chapt. 9 Ryden, Chapt. 10 Liddle*)

- 7.1 Photon to Baryon Ratio
- 7.2 Origin of the CMB
- 7.3 Physics of Recombination
- 7.4 Radiation Drag
- 7.5 Horizon Problem

VIII. THE EARLY UNIVERSE (*Chapt. 12, AdvTop. 3,4 Liddle, Chapt. 10 Ryden*)

- 8.1 Relic Neutrinos
- 8.2 Nucleosynthesis
- 8.3 Dark Matter

IX. INFLATION (*Chapt. 13 Liddle, Chapt. 11 Ryden*)

- 9.1 The Inflation Solution
- 9.2 The Physics of Inflation

X. THE FORMATION OF COSMIC STRUCTURE (*Chapt. 12 Ryden*)

- 10.1 Gravitational Instability
- 10.2 The Jeans Length
- 10.3 Instability in an Expanding Universe
- 10.4 Simulations of Galaxy Formation in Λ CDM