

PHYSICS OF THE VERY EARLY UNIVERSE

Readings

Week 1: Review of Standard Cosmology and its Problems

- * W. H. Kinney, “TASI Lectures on Inflation,” arXiv:0902.1529 [astro-ph.CO]; Sections 1 - 3.
- * R. H. Brandenberger, “Inflationary cosmology: Progress and problems,” arXiv:hep-ph/9910410; Section 2.

Week 2: Inflationary Universe Scenario

- * W. H. Kinney, “TASI Lectures on Inflation,” arXiv:0902.1529 [astro-ph.CO]; Sections 4.
- * R. H. Brandenberger, “Inflationary cosmology: Progress and problems,” arXiv:hep-ph/9910410; Section 3.

Weeks 3 and 5: Theory of Cosmological Perturbations

- * R. H. Brandenberger, “Lectures on the theory of cosmological perturbations,” Lect. Notes Phys. **646**, 127 (2004) [arXiv:hep-th/0306071]; Sections 2 - 4.

Week 4: Cosmic Microwave Background

- * D. Baumann, “TASI Lectures on Primordial Cosmology”, arXiv:1807.03098, Sections 3 and 4.
- * W. Hu and S. Dodelson, “Cosmic Microwave Background Anisotropies”, astro-ph/0110414, up to and including subsection 4.2
- * Planck Collaboration, “Planck 2013 results: XVI. Cosmological parameters” arXiv:1303.5076. Supplementary reading for recent observational results. Focus on Fig. 1 and Table 2

Week 6: Reheating after Inflation

- * M. Amin et al, arXiv:1410.3808, Sections 1 - 3
- * R. Allahverdi et al, arXiv:1001.2600; Sections 1 - 3 (with emphasis on 3).

Week 7: Topological Defects and Structure Formation

- * R. Brandenberger, “Topological defects and structure formation,” Int. J. Mod. Phys. A **9**, 2117 (1994) [arXiv:astro-ph/9310041]. Emphasis on Sections 3.1 - 3.7, 4.1, 4.2, 4.3 (omit (4.19 - 4.30)), 4.4, 6, 8.3.

Week 8: Topological Defects (continued) & Problems of Inflation and Alternatives

- ‘* R. Brandenberger, “Searching for Cosmic Strings in New Observational Window”, arXiv:1301.2856.
- * R. H. Brandenberger, “Introduction to Early Universe Cosmology,” PoS **ICFI2010**, 001 (2010). [arXiv:1103.2271 [astro-ph.CO]]; Sections 1.4 - 1.6, 3.5, 4.1 - 4.2, 5.1 - 5.2.

Week 9: Bouncing and Emergent Cosmologies

- * R. H. Brandenberger, “Introduction to Early Universe Cosmology,” PoS **ICFI2010**, 001 (2010). [arXiv:1103.2271 [astro-ph.CO]]; Sections 4 and 5.

Week 10: Inflation in String Theory

- * D. Baumann “TASI Lectures on Inflation,” arXiv:0907.4524; Secs. 28 and 29.
- * T. D. Brennan, F. Carta and C. Vafa, “The String Landscape, the Swampland, and the Missing Corner,” PoS TASI **2017**, 015 (2017) arXiv:1711.00864 [hep-th], Section 2

Week 11: Dark Energy

- * M. Li, X-D. Li, S. Wang and Y. Wang, “Dark Energy,” arXiv:1103.5870, Sections 1 and 2.
- * C. Burgess, “The Cosmological Constant Problem: Why it’s so hard to get Dark Energy from Microphysics”, arXiv:1309.4133, Section 1.

Week 12: Quantum Field Theory Methods in Cosmology: LAST WEEK

- * R. Brandenberger, ”Quantum field theory methods and inflationary universe models”, Rev. Mod. Phys. **57**, 1 (1985); Sections II - IV (Effective potential, finite temperature field theory, bubble nucleation).