

Course plan for Cosmology and Astroparticle Physics FK7050
Edvard Mörtzell

The format of the course is Flipped Classroom (FC). This means that the lectures will be in the form of movies available through the platform ScalableLearning. Access to the material will be granted by invitation to the registered participants of the course. The scheduled events will be FC sessions (see below) and problem solving sessions.

Note that (with the exception of the first lecture), you need to watch the corresponding online lectures beforehand. You can view them when you want as long as you do it at least 24 hours before the FC session. Also you need to answer the quiz questions in the online lectures. And don't worry; your answers are not used for grading. Active participation gives three bonus points on the written exam.

Active participation amounts to watching the online lectures, answering quizzes and participating in FC-lectures for at least 10 (out of 12) occasions.

This will get you one grade higher automatically, apart from the fact that the increased activity will probably also push you up a step or two.

BG refers to material in Bergström, L. & Goobar, A., "Cosmology and Particle Astrophysics". The *Readersguide* gives more detail on the relevance and importance of different sections in the book.

Schedule

We meet in FB41 at 13:15-15:00. The exam is in FR4/FA31/FA32 (TBD) at 8:00-13:00 on Wed 30/5.

Week	Date	Activity	Comment
12	Tue 20/3	FC1	BG 1
	Thu 22/3	FC2	BG 6
13	Tue 27/3	FC3	BG 2
14	Tue 3/4	PS1	See Problem Solving section below
	Thu 5/4	FC4	BG 3
15	Tue 10/4	FC5	BG 4.1-4.3.2, 4.7
	Thu 12/4	PS2	See below
16	Tue 17/4	FC6	BG 4.3.3-4.7
	Thu 19/4	FC7	BG 8
17	Tue 24/4	PS3	See below
	Thu 26/4	FC8	BG 9
18	Thu 3/5	FC9	BG 11.1-11.3, 11.7
19	Tue 8/5	FC10	BG 11.4-11.6, 11.8, 10.1-10.3
20	Tue 15/5	PS4	See below
	Thu 17/5	FC11	BG 5
21	Tue 22/5	FC12	BG 15 and 10.4
	Thu 24/5	PS5	See below

Flipped Classroom (FC) sessions: Edvard Mörtsell

Make sure that you come prepared to work for the FC sessions. Useful things to bring are a computer, a device with internet connection, pen, paper, calculator etc. We will discuss possible uncertainties in the filmed lectures, but mainly work in groups on problems associated with the material.

FC 1: 1-Introduction

BG Chapter 1.

This first session, we will meet and discuss the practicalities of the course. We will also discuss the Introduction lecture and the ScalableLearning tool.

FC 2: 2-Particles and fields

BG Chapter 6.

FC 3: 3-Special relativity

BG Chapter 2.

FC 4: 4-General relativity

BG Chapter 3.

FC 5: 5-Cosmological models

BG Chapter 4.1-4.3.2, 4.7.

Additional material: Mörtzell, E., "Cosmological histories from the Friedmann equation", available at <https://arxiv.org/abs/1606.09556>

FC 6: 6-Cosmological distances

BG Chapter 4.3.3-4.7.

FC 7: 7-Thermodynamics in the early Universe

BG Chapter 8.

FC 8: 8-Nucleosynthesis

BG Chapter 9.

FC 9: 9-CMB

BG Chapter 11.1-11.3, 11.7

FC 10: 10-Structure formation

BG Chapter 11.4-11.6, 11.8, 10.1-10.3.

FC 11: 11-Gravitational lensing

BG Chapter 5.

FC 12: 12-Gravitational waves and Status of Cosmology

BG Chapter 15 and 10.4.

Problem Solving (PS) sessions: Sunny Vagnozzi

Again, the key to learning is active participation. Thus, do not expect Sunny to simply provide black board solutions, but rather giving small hints on possible ways to attack problems. Be prepared to work in small groups with problems and discuss solutions and strategies in class.

PS 1:

1: 1.2-4; 6.3; 2.2, 4, 11 and 12

PS 2:

3.1, 3 and 5; 4.1, 3 and 4

PS 3:

4.7, 11 and 13; 8.3, 4, 6 and 7

PS 4:

9.2-4; 11.1, 3, 4 and 6; 10.2-3

PS 5:

5.1-3 and 5; 15.3

Literature

1. "Cosmology and Particle Astrophysics",
Bergström, L. & Goobar, A., 2:nd edition,
Springer-Verlag Berlin Heidelberg (2004)
2. "Cosmological histories from the Friedmann equation: The universe as a particle",
Mörtsell, E.,
Eur. J. Phys. 37 (2016), <https://arxiv.org/abs/1606.09556>