

Seminar II

Parallel Universes

1. General instructions

This document provides preparation instructions for the second of the three seminars forming part of the examination for the 2016 version of the MSc-level course *Cosmology, 10 ECTS*. The topic of this seminar is parallel universes, a concept in cosmology that includes aspects of astronomy, theoretical physics and philosophy.

The point of this exercise is to:

- Understand the concept of parallel universes and thereby expand your knowledge about the worldview of modern cosmology
- Practice making concrete representations of abstract scientific concepts
- Practice collaborating on creative tasks
- Practice discussing cosmology with and in front of others

In preparing for the seminar, you should try to:

- Study the suggested paper on parallel Universes and try to think of ways to illustrate the four hierarchies of parallel universes presented therein

You are perfectly welcome to collaborate with your classmates when preparing for the seminar, but once there – everyone is on their own. This means that you are not supposed to rely on the notes, knowledge etc. of others.

2. Suggested reading

There are many papers on parallel universes, and you are of course free to read as many as you like to get acquainted with the topic, but the minimum reading in preparation for the seminar is:

- Tegmark, M. 2003, Parallel Universes, in *Science and Ultimate Reality: From Quantum to Cosmos*, honoring John Wheelers 90th birthday, J.D. Barrow, P.C.W. Davies, & C.L. Harper eds., Cambridge University Press (2003)
<http://arxiv.org/abs/astro-ph/0302131>

3. Instructions

Tegmark (2003) defines four hierarchies of parallel universes¹. First try to understand how these different categories differ from one another, what the reasons for considering their potential existence is and what the consequences would be if they actually existed. Then, try to think of potential ways to portray or illustrate the different types of parallel universes and their consequences to somebody unfamiliar with the topic, using some non-textual representation. This could for instance be accomplished by considering a schematic drawing or a three-dimensional model of some kind. It may help to consider the following hypothetical situation: Somebody hands you a piece of clay and asks you to mold it into something that explains what a level I parallel universe is. Please note that there is no need to attempt to create any such model representations before

¹Brian Greene have defined even more, but let's keep it simple, shall we?

the seminar – you are simply encouraged to think about different ways that this could be done. During the seminar, you will be working together in randomly assigned teams to try to construct models that embody the various classes of parallel universes, using some material/medium that will remain secret until then. While science students typically get very little practice in performing tasks of this kind, this is something that you may well encounter during your professional life. As a researcher, for instance, you may need to quickly come up with demonstration material to use in a public talk or to present your research to a funding agency – and you cannot always rely on the PR department or trained artists to do it for you. Please note, that unlike the other seminars, this one will only be graded pass/fail. If you have understood the assigned paper and makes a decent effort during the seminar session, you will pass. The emphasis will not be on artistic expression, but rather on coming up with something that could serve as a pedagogical tool.

Erik Zackrisson, October 2016