Exoplanets & Astrobiology:

from the origin and evolution of matter, stars, and planets, to life on Earth and beyond

Uffe Gråe Jørgensen, block 3, 2023.

The subject of the course is strongly interdisciplinary, spanning aspects of astronomy, biology, geology, and several parts of physics. It is therefore the aim that the course can be followed by students without a priori knowledge from specific university level courses, but some basic university mathematics is needed and a general knowledge in natural science and, most important, a couriosity to make an effort to understand the necessary basics of the fields that are complementary to your own university background. The course consist of lectures Tuesday and Thursday mornings 9:15 to 12, and group presentations and discussions Thursday afternoons 13:15 to 4 or 5 pm

The lectures: will be on Tuesdays from 9:15 to 12 and Thursdays from 9:15 to 12. First day of teaching will be on Tuesday February 7, and last time will be Thursday March 30. All teaching will be in the auditorium at the Geological Museum, Øster Voldgade 5. If you are not familiar with the museum, the entrance to the auditorium is the same as to the museum exibitions (i.e. the door in the left corner at the end of the yard), but instead of going to the right (to the exhibitions) once you are in the hallway, you go up the stairs to the first floor, where the auditorium is right in front of you.

The student-group presentations: will be on Thursdays from 13:15 to 17 (or ∼16, depending on the length of the discussions), first time Thursday February 16 and last time Thursday Marts 23.

The exam: will be during week 15, probably on April 11 and 13.

Program:

7/2/23	Lectures:	Introduction, history and overview of the course.
9/2/23	Lectures:	Formation of the universe and the first elements.
9/2/23		no afternoon presentations or teaching on Febr.9.
14/2/23	Lectures:	Evolution of stars and the universe.
16/2/23	Lectures:	Supernovae; the formation of oxygen, iron and r-process atoms.
16/2/23	Presentation I:	Is the biosphere a kind of living organism in itself?
21/2/23	Lectures:	Red giant stars; the production of carbon and s-process atoms.
23/2/23	Lectures:	The formation of solar systems I
23/2/23	Presentation II:	Can we define life? – what is it and how did it arise?
28/2/23	Lectures:	The formation of solar systems II
2/3/23	Lectures:	Extra solar planets I
2/3/23	Presentation III:	How did we become humans? Are we anything special?
7/3/23	Lectures:	Extra solar planets II
9/3/23	Lectures:	Extra solar planets III
9/3/23	Presentation IV:	Are we (humanity) on our way to colonize the Galaxy – can and should we?
14/3/23	Lectures:	Extra solar planets IV
16/3/23	Lectures:	Basic features of the biological cell.
16/3/23	Presentation V:	Artificial intelligence and extraterrestrial life – does it exist? should we worry?
21/3/23	Lectures:	The arise and development of life on Earth I
23/3/23	Lectures:	The arise and development of life on Earth II
23/3/23	Presentation VI:	Do civilisations (always) evolve toward utopia or catastrophe?
28/3/23	Lectures:	Conditions for life in our solar system and beyond
30/3/23	Lectures:	Communication and search for extraterrestrial intelligence

The lectures: I have written **lecture notes** for the course. They are in 6 chapters of around 50 pages per chapter. I am updating as much as I can find time to every year. The first chapter will be available on the Absalon course page at the start of the course, and the following chapters will become available along the course. The program follows the six chapters of the lecture notes (universe, stars, solar systems, exoplanets, basics of life as we know it, extraterrestrial life), with the tentative dates of lecturing on each of the subjects given above.

The group presentations: You can already see the subjects of each of the group presentations in the plan above, and we will discuss the subjects in detail during the first lecture on Tuesday February 7, where we will also decide who will be in which group. If you know that you will not be there for the first lecture, you are welcome to send me an email (please always use my personal institute email: uffegj@nbi.dk) with your first and second choice of which group subject you want to participate in, then I will post on Absolon which group it has been possible to allocate you to.
The presentation by the first group will be on February 16, so this group unfortunately have only short preparation time. Choose this subject if you are interested in that subject and it at the same time fits you to spend some extra time in the beginning and/or you know you will be extra bussy with another course or something else later during the block. There are right now 26 students signed in for the course, so there will be 4 or 5 students in each of the 6 groups, which is optimal.
You are supposed to read some semi-popular books and other material on the presentation subject. Typically you will read one book each and discuss them internally in your group before the presentation. I have books available for your reading for all the subjects in the list above, but you will typically also search the web and other sources for additional material on what you want to talk about in your presentation. All group members will participate in the presentation on the listed dates. On the Tuesday before the presentation the group is expected to upload a few-pages of summary of what the group will be talking about, with some references, so that the other students can prepare themselves for the discussion of the subject. Everybody's participation in the discussions are very important, so please read careful the hand-outs from the presentation groups, so that you know the background and have time to consider your input to, and oppinion on, the subject.

The exam: There will be an oral exam in the week after Easter, most likely on April 11 and April 13. For those of you that don't know the Danish system, it works in the way that when you enter the exam room, you will draw one of the 7 questions listed below. You are expected to start giving an ultrashort abstract of the results from the group presentation you participated in (e.g. 2 minutes). Thereafter you will be expected to talk about the drawn subject. You cannot bring notes or other material for the presentation. It is expected that you in advance from home have prepared and memorized how you want to structure the presentation of each of the 7 questions you can draw, such that you can reach what you find most relevant to present in approximately 15 minutes. Consider it 7 small 15 minute talks you have prepared to give, of which one is chosen. You should aim at presenting (1) an overview of the drawn subject, (2) some indepth of the question that demonstrate a university level understanding (e.g. some mathematics, some details of the biological functionality, some understanding of the chemistry etc, depending of the question you draw and depending on your background), and fianlly (3) try to round of with some comments about how it relates to the rest of the course or other aspects of science. After this we will put you some questions about what you explained, and/or about other parts of the curriculum, for about 10 minutes. Typically, the examination will last about 30 minutes in total. The exam questions (listed below) are based on the corresponding pages in my lecture notes for the course, as outlined in the course program presented above.

(1): Origin of the universe and the first elements.
(2): Evolution of stars and formation of elements.
(3): The formation of solar systems.
(4): Extra solar planets.
(5): The biological cell.
(6): The origin and evolution of life on Earth.
(7): Extraterrestrial life: what and where can it be?, how do we find it and communicate with it?

If you have Corona or in other ways feel ill: There are no official Corona restrictions at the university anymore, and the course will be on-site. However, if you feel ill you should stay at home. I will make sure that we have a camera in the class room such that you can follow the lectures also if you need to stay at home in quarantine.