



Syllabus (Fall, 2021)

ver. June 22

Course Title	The Universe, Life and Light	Course No.	37061
Department/ Major	Scranton Honors Program	Credit/Hours	3
Class Time/ Classroom	Tuesday 4 th (12:30) Friday 5 th (14:00) Online course. Please refer to CyberCampus for Webinar address, etc.		
Instructor	Name: Choi, Kang Sin 최강신	Department Scranton Honors Program	
	E-mail: kangsin@ewha.ac.kr	Telephone 3277-6706	
Office Hours/ Office Location	Tue 17:00 / Int'l Edu Building 국제교육관 603-2		

I. Course Overview

1. Course Description

Education is what remains after one has forgotten what one has learned in school.
 - Albert Einstein

The aim of the course is twofold: The first is methodology, which is applicable to wherever reasoning is involved. History of science have shown that good questions turned out to be more important than the 'facts' that we have found. The accumulated wisdom of clever questions and finding evidences will also help to understand things in our daily life and study. To this end, we try to create good atmosphere rather than learning individual facts. Secondly, we learn odd but interesting ideas revealing how the world behaves. Nature is sometimes strange but this tells us a lot. This is related to understanding ourselves and our world. We ask the following questions: What are the basic building blocks of Nature? What governs their interactions? What is the origin and meaning of life? Are we different from other animals or matter? The answer people so far found are sometimes quite counter-intuitive, but very exciting at the same time. Visiting some selective topics, we will have a flavor on what is going on the basic level of our world.

2. Prerequisites

1. Assumes no knowledge in science.
2. This is major course in Scranton Honors Program. Attendants are limited in this program.



3. English lecture.

3. Course Format

Lecture	Discussion	Experiment/Practicum	Field Study	Other
70 %	30 %	%		%

Also a portion of lecture (time) is allocated to discussion and question. Every question is possible.

4. Course Objectives

Motto: We learn more from discussion than lecture.

This is intended mostly for non-science major students. Lectures try to be as less technical as possible, and basic ideas and concepts will be dealt with. This does not mean the basic ideas themselves are easy to understand; because they are sometimes contrary to common sense and counter-intuitive to our prior understandings. Such cases emerge under special circumstances, so we have to deal with some concrete scientific facts.

Preview readings and assignments are intended to help students get used to this topic.

5. Evaluation System

Midterm Exam	Final Exam	Quizzes	Presentation	Projects	Assignments	Participation	Attendance
35 %	35 %	%	%	%	20 %	%	10 %

* Evaluation of group projects may include peer evaluations.

Explanation of evaluation system:

II. Course Materials and Additional Readings



1. Required Materials

Lecture notes, available on Cyber Campus.

Note that lecture notes and slides may not be identical.

2. Supplementary Materials

3. Optional Additional Readings

최강신. (2016). 빛보다 느린 세상. MID. - Relativity.

최강신. (2018). 우연에 가려진 세상. MID. - Wave, Quantum mechanics.

Hermann Weyl. (1956). Symmetry. Princeton University Press. [번역] 헤르만 바일. 권희재 번역. (2015). 대칭. 은명. - symmetry

Martin Gardner, The Ambidextrous Universe, [번역] 양손잡이 자연세계, 과학세대 옮김, 까치. - electricity, left and right.

Kristin Madefessel-Herrmann외, Chemie rund um die Uhr, [번역] 화학으로 이루어진 세상, 에코리 브르. - Atoms

이강영, 보이지 않는 세계, 휴먼사이언스. - small world

Jacque Monod, Le hasard et la nécessité [번역] 자끄 모노 (2010). 우연과 필연, 조현수 옮김, 동녘 - definition of life

You can find everything covered during the lecture (and additional advanced explanation as well) in Wikipedia. [Http://en.wikipedia.org](http://en.wikipedia.org) [Http://ko.wikipedia.org](http://ko.wikipedia.org)

III. Course Policies

* For laboratory courses, all students are required to complete lab safety training.



IV. Course Schedule (15 credit hours must be completed.)

Week	Date	Topics & Class Materials, Assignments
Week 1	(mm/dd)	Course introduction - What does it mean by understanding Nature?
	(mm/dd)	Quantities - There are various kind of numbers having different meaning.
Week 2	(mm/dd)	Symmetry - The central topic throughout the class is symmetry: We can understand things by symmetry without much understanding details
	(mm/dd)	Scale: dimensional analysis - One of the application of the symmetry. Exercise on qualitative analysis.
Week 3	(mm/dd)	Motion - Classical science tries to understand our world in terms of small particles having motion and interactions.
	(mm/dd)	Conservation laws (online) - Symmetry will be connected to conserved laws.
Week 4	(mm/dd)	Sound (online) - Sound is most intuitive form of wave, whose basic concepts are to be discussed.
	(mm/dd)	Wave (online) - Generalization of wave and introduction to light.
Week 5	(mm/dd)	Vision (online) - Understanding our vision, related to what brain thinks.
	(mm/dd)	Electricity (online) - We particularly try to understand what we know and what is convention: distinguishing +/- electricity and N/S of magnetism.
Week 6	(mm/dd)	Magnetism - The most dominant force in our daily life is electric and magnetic forces which is in fact unified into 'electromagnetic' forces.
	(mm/dd)	Force and field - The nature and transmission of the force, in terms of which our world is described. After that we may understand how radio transmitter works.
Week 7	(mm/dd)	Speed of light - About the confusing nature of light
	(mm/dd)	Space and time - Relativity has changed the concepts of space and time; we try to understand its idea and meaning.
Week 8	(mm/dd)	Midterm exam period
	(mm/dd)	Midterm exam (written)
Week 9	(mm/dd)	Relativity and gravity - The meaning of force
	(mm/dd)	Particles and waves - The concept of particle in fact does not work well in describing small scale world.



Week	Date	Topics & Class Materials, Assignments
Week 10	(mm/dd)	Quantum nature - The small world behavior is summarized by quantum mechanics, which is not intelligible by human mind but well described by 'mathematics'. Still, we will ponder its meaning.
	(mm/dd)	Left and right - We try to distinguishing left and right, which looks purely conventional. It turns out that physics can answer to this question.
Week 11	(mm/dd)	Basic building blocks - The state-of-art understanding on our world in view of reductionism, which is verified up to 0.0000000000000001 cm.
	(mm/dd)	Where we are - We learn the current status observed universe and the position of human being.
Week 12	(mm/dd)	The early universe - Short history of the beginning of the Universe.
	(mm/dd)	Space - The meaning of space in more detail.
Week 13	(mm/dd)	Arrow of time - Why time flows to the future? The question is related to order in Nature.
	(mm/dd)	Life - The grand question is how do we define life. We will discuss whether we can. Can flowing water/ a mobile phone be life?
Week 14	(mm/dd)	Genes and evolutions - Genes and evolution are the key to understanding life.
	(mm/dd)	Microcosmos - We study microbes and symbiosis which cannot be easily separated from individuals in the meaning of life.
Week 15	(mm/dd)	The Game of Life - By playing John Conway's the Game of Life, we may gain insights on life and evolution of the Universe.
	(mm/dd)	Final exam (written)
Makeup Class	(mm/dd)	



V. Special Accommodations

* According to the University regulation section #57-3, students with disabilities can request for special accommodations related to attendance, lectures, assignments, or tests by contacting the course professor at the beginning of semester. Based on the nature of the students' request, students can receive support for such accommodations from the course professor or from the Support Center for Students with Disabilities (SCSD). Please refer to the below examples of the types of support available in the lectures, assignments, and evaluations.

Lecture	Assignments	Evaluation
<ul style="list-style-type: none"> Visual impairment : braille, enlarged reading materials Hearing impairment : note-taking assistant Physical impairment : access to classroom, note-taking assistant 	Extra days for submission, alternative assignments	<ul style="list-style-type: none"> Visual impairment : braille examination paper, examination with voice support, longer examination hours, note-taking assistant Hearing impairment : written examination instead of oral Physical impairment : longer examination hours, note-taking assistant

- Actual support may vary depending on the course.

* The contents of this syllabus are not final—they may be updated.