

PH2814 Science-Fiction and Physics

Professor: Pascal Bernaud

Language of instruction: English* – **Number of hours:** 36 – **ECTS:** 3

Prerequisites: It is recommended to have completed the following courses or equivalent PH1100 PH2300 EN1100

Period: S8 Elective 09 February to March IN28IE2, SEP8IE2

Course Objectives

The main objective of this course is not to “learn” physics but to “do” physics, using the knowledge students have of physics to understand and model specific problems. The work is done in teams. However, the instructors will provide training on subjects not usually taught at Ecole Centrale: relativity, introduction to astrophysics, allometry etc.

On completion of the course, students should be able to

- ✧ acquire a critical sense vis a vis readings or other type of information
- ✧ learn how to use order-of-magnitude analysis, out-of-the-box thinking, common sense.

Course Contents

Most of the course is based on science fiction readings. The goal is to determine if what is described in the texts is compatible with the laws of physics. To this end, the problem must be modeled and then solved as realistically as possible. Additional material (for instance elements on star evolution, neutron stars, black holes, similitude, allometry, etc) may be introduced by the professor as needed.

A typical lecture is organized as follows:

- ✧ after reading short texts, students identify the parts that may be the object of scientific questions
- ✧ the related scientific themes are identified
- ✧ the students attempt to solve these scientific questions
- ✧ the professor may provide additional knowledge to solve the problems
- ✧ an « official » report is given by the professor and registered on *Claroline* after the lecture.

This course is typically a good opportunity to delve into the following topics:

- ✧ statistical physics
- ✧ quantum physics
- ✧ heat transfer: steady and unsteady conduction, convection, radiation
- ✧ fluid mechanics
- ✧ strength of materials
- ✧ celestial mechanics
- ✧ astrophysics, stellar evolution

Course Organization

Combined lectures and tutorials: 30 hr, Exam: oral defense of a teamwork during the final 3 hours (+ a 1.5-hr written exam)

Teaching Material and Textbooks

All necessary documents are provided by the instructors for topics including relativity, stellar evolution, neutron stars, black holes, ...

Resources

Lecturers: Pascal Bernaud (Centrale Paris), Ann-Lenaig Hamon (Centrale Paris), Peter Schattschneider (TU Wien)

Evaluation

- ✧ 1.5an-hr written exam without reference text or computer (1/3 of the final mark) during the final session or during next-to-last session
- ✧ oral presentation in teams, usually during next-to-last session or during final session (2/3 of the final mark)