

## **Warsaw University of Technology | Doctoral School No. 3**

**Course offered in the Doctoral School No. 3  
– Spring semester of the 2021/2022 academic year**

<b>TITLE</b>
Big Science
<b>CONDUCTING UNIT</b>
Doctoral School No. 3
<b>SCIENTIFIC DISCIPLINE</b>
Physical sciences
<b>IMPLEMENTING UNIT</b>
105000 - Faculty of Physics
<b>SUMMARY DESCRIPTION</b>
Overview of the present and future Big Science projects. The main characteristics of Big Science projects are their big budgets, big collaborations, big machines, and big laboratories. The success of the strategy and the impact of technologies developed within big science projects have changed society and technology with deep economic and political impacts. The course will review the history of the Big Science projects, the current facilities, and the ones planned, or which are being discussed in the scientific community. Several accelerators and fusion facilities, devices for the study of gravitational waves, searches of dark matter, astrophysics and space laboratories are going to be discussed in the course.
<b>FULL DESCRIPTION</b>
Overview of the present and future Big Science projects. The main characteristics of Big Science projects are their big budgets, big collaborations, big machines, and big laboratories. The success of the strategy and the impact of technologies developed within big science projects have changed society and technology with deep economic and political impacts. The course will review briefly the history of the Big Science projects starting from the Manhattan Project until recent days. After the introduction, the following topics are going to be studied:
1. Then the present and future accelerator-based facilities are going to be introduced as the LHC (and the upgraded HL-LHC) at CERN, NICA, FAIR, RHIC and

- e-RHIC, FCC, and ESS. Additionally, the main experiments and international collaborations and their missions are going to be discussed during the course.
2. The study of gravitational waves and the LIGO and VIRGO laboratories.
  3. Neutrino laboratories: the Long-Baseline Neutrino Facility, Hyper Kamiokande, IceCube
  4. Fusion reactors: ITER, Stellarator, and other facilities.
  5. Searches of dark matter: XENON
  6. Astrophysics: the Square Kilometre Array; Next Generation Very Large Array, European Extremely Large Telescope
  7. Space laboratories: International Space Station, James Webb Space Telescope

The seminars given by the lecturer will be complemented with presentations prepared by students where one specific experimental facility will be introduced.

#### LITERATURE

There is no bibliographic overview book and/or summary. The course content is based on Technical Design Reports, official publications, scientific publications, and Reports of several Scientific Commissions and roadmap documents.

#### LEARNING OUTCOMES

Students will be aware of current and future Big Science projects in different fields of physics and engineering. The introduction of the projects provides students a broader overview and state-of-the-art of scientific project which involve large teams and accumulate resources. Additionally, students will train their presentation and communication skills.

#### ASSESSMENT METHODS AND CRITERIA; COURSE COMPLETION FORM

Evaluation: the presentation (50% of the course), the attendance (20%), and participation (30%) during the classes are going to be evaluated. The preparation of the presentation is mandatory and participation in the classes will be strongly encouraged. In case the number of students will not permit a presentation of a topic during the class it will be substituted by the preparation of a scientific poster with a 5-minute presentation explaining the main aspects of the assigned facility.

LANGUAGE OF THE COURSE		ECTS CREDITS
English		3
TYPE OF CLASSES	NUMBER OF HOURS	COURSE INSTRUCTOR
Lecture	30	Georgy Kornakov, dr

#### ADDITIONAL INFORMATION

The course is realized within the SEED Project – NAWA STER Programme. Therefore, in order to take part in it, each participant is obliged to deliver to the PhD Students' Office the Declaration of the Project Participant concerning personal data. The document must be submitted until **March 1, 2022**.

The document can be found here:

[https://www.sd.pw.edu.pl/sd\\_en/SEED-NAWA-STER](https://www.sd.pw.edu.pl/sd_en/SEED-NAWA-STER)