



High Energy Particle Accelerators for Physics Research

PLAN 472.3 (3-credit units)
2020 Summer Term

APPLY BY
January 15, 2020

For more information:
AandS.abroad@usask.ca

 UNIVERSITY OF SASKATCHEWAN

Course Description

CERN is the world's premier particle accelerator laboratory with research achievements such as the discovery of the Higgs Boson particle and the invention of the World Wide Web. The mission of CERN is Science for Peace and their goal is to build and operate the best possible particle accelerators to conduct fundamental and applied research. This course taught at CERN during a few weeks in the summer term is designed to help students understand how accelerators can be used for their research in a very broad field from high energy particle physics to medical applications. Dr. Boland will combine with experts from CERN to lecture on the physics of particle accelerators with emphasis on how these impact the research that can be conducted with them in the fields of high energy particle and nuclear physics.

Learning Outcomes

On completion of this course students will be familiar with the particle accelerators used at CERN and be able to calculate the fundamental design parameters of these machines. Students will learn how to design basic accelerators and model their performance for use in research in high energy physics and synchrotron light source research. Tours of the particle accelerators and high energy particle physics detectors located at the CERN campus in Geneva will be conducted to give students an understanding of how these machines are built and used for fundamental physics research. Through the taught abroad approach, students will get access to the experts who build and operate the world's most powerful particle accelerators and get an overview of the designs that are being made for the next generation particle accelerators they will have access to in their future research careers.

Program Overview

The lectures will give an overview of the particle accelerators at CERN and how they are used in high energy physics. Some of the topics covered include:

1. Introduction to CERN and high energy particle accelerators and detectors in research physics.
2. The world of particle physics and accelerator based research.
3. Research and computing at CERN for the design and operation of accelerators and in experimental particle physics experimental analysis, including the World Wide LHC Computing Grid network.
4. Accelerator technology and future challenges.
5. Particle detectors for accelerator based research experiments.
6. Theoretical concepts in particle physics at accelerator facilities.
7. Luminosity and Brightness: A key accelerator design parameters which determines the rate of particle production in a collider and the rate of photon production in a lightsource.
8. Nuclear physics at CERN.
9. Medical and industrial applications of particle accelerators and detectors at CERN.
10. Beyond the Standard Model of Particle Physics and the next generation of particle accelerators to understand Dark Matter and Dark Energy.

Prerequisites:

EP 253 and PHYS 356

Note:

This course is a physically demanding class and students must be able to walk long distances over long periods of time. If you have a disability, **please contact AES as early as possible** to discuss your accommodation needs while abroad.

Faculty Coordinator:

Dr. Mark Boland

Office: PHYS 69, 306-966-6436

mark.boland@usask.ca

Cost to Student:

The College of Arts and Science has generously provided \$200 per student taking the course for credit and \$100 for those auditing (if applicable) to help reduce the program fee for each student. The program fee below reflects the reduced amount.

- a) **UofS tuition:** approx. \$696 (individual registration and payment)
- b) **Program fee:** approx. \$1010 (less \$200 grant from A&S) equals **\$810**, which includes:
 - a. includes accommodation; entrance fees to sites, on-site transportation
- c) **Airfare:** approx. \$1200 (participants will make their own individual flight arrangements)
- d) **Other costs:** individual meals, personal expenses (gifts, souvenirs), textbooks or other course materials, personal on-site transportation, possible medical insurance; etc.

Payment Schedule:

A \$500 non-refundable deposit is due upon acceptance into the program likely within a week after the deadline but no later than January 31st.

The remainder of the program fee is due at the end of **February 2020** (details will be specified in the acceptance letter). Program fee payments may be made by money order or cheque only, payable to the University of Saskatchewan.

Financial Assistance:

All students accepted to participate in the program, and are taking the course for credit, will receive the [\\$1000 Global Engagement Scholarship](#) to help offset costs related to studying abroad. The study abroad coordinator will submit the group application. Students do not need to apply themselves.

NOTE: Students must be taking the course for credit towards a degree to be eligible.

Eligible UofS students may apply for additional funding. For further information please

visit: <http://artsandscience.usask.ca/undergraduate/scholarships.php>

<https://students.usask.ca/academics/study-abroad/awards.php>

Applications:

Application forms are available online from the Study Abroad Website:

<https://students.usask.ca/academics/study-abroad/term-taughtabroad.php#Process>

For more information and to submit applications, contact:

LaVina Watts, Program Coordinator, ARTS 921, [306-966-4194](tel:306-966-4194). AandS.Abroad@usask.ca