POLISH NATIONAL AGENCY FOR ACADEMIC EXCHANGE

STER PROGRAMME

KISD

Krakow School of Interdisciplinary PhD Studies <KISD>
invites PhD students and members of the research staff
to attend the series of guest lectures given by:

Dr. Marco Calvi

Paul Scherrer Institute PSI, Switzerland

Introduction to the physics of accelerator based modern light sources

The course provides a comprehensive understanding of the fundamental principles and modern technologies involved in the production of radiation by relativistic particles. The course begins with a review of relativistic classical mechanics and progresses through detailed analyses of accelerator-based light sources, with a focus on storage rings, free electron lasers, and undulator technologies. Each lecture builds upon the previous one, incorporating practical examples and real-world data to enhance learning. The final lecture will explore cutting-edge advancements in undulator technologies and their future potential.

1. Introduction to Relativistic Classical Mechanics. A review of relativistic classical mechanics, focusing on the key principles governing the motion of particles at relativistic speeds. Core topics: Lorentz transformations, Relativistic dynamics, Energy and momentum of relativistic particles.

2. Radiation Properties of Relativistic Particles. Core topics: Synchrotron radiation, The influence of particle energy and acceleration on radiation emission, Radiation spectrum and definition of brightness.

3. Overview of Accelerator-Based Light Sources. Core topics: Introduction to storage rings and their role in synchrotron radiation, Fundamentals of free electron lasers (FELs).

4. Technology of Contemporary Light Sources: Undulators. Core topics: Design and function of undulators in storage rings and FELs, Magnetic field generation and control, Analysis of real magnetic data from undulators.

5. Advanced Undulator Technologies and Future Directions. Core topics: Polarisation control via Apple undulators, Knot undulators to reduce the heat load on the optics, High-temperature superconducting undulators for higher brightness and higher photon energies.

6. A High Temperature Superconducting Undulator at the new Swiss Light Source, SLS2.0.

Schedule:

1. ***Tuesday 19.11.2024***, *10.00-11.30 am.*
   IFJ PAN, MSD room, 1st floor
2. ***Wednesday 20.11.2024***, *9.45-11.15 am.*
   IFJ PAN, MSD room, 1st floor
3. ***Thursday 21.11.2024***, *9.30-11.00 am.*
   IFJ PAN, MSD room, 1st floor
4. ***Tuesday 26.11.2024***, *10.00-11.30 am.*
   IFJ PAN, MSD room, 1st floor
5. ***Wednesday 27.11.2024***, *9.45-11.15 am.*
   IFJ PAN, MSD room, 1st floor
6. ***Thursday 28.11.2024***, *11.00-12.30 am.*
   IFJ PAN, Auditorium, 1st floor

Dr. Marco Calvi *is a senior scientist at the Photon Science Division of the Paul Scherrer Institute (PSI), where he has worked since 2009. He earned his PhD in 2004 from the University of Geneva, focusing on the stability of the LHC superconducting dipoles. After completing his PhD, he joined CERN as a postdoc in the magnetic measurement section. He worked on the series tests of the LHC superconducting magnets and further developed expertise in thermo-hydraulic calculations and the stability of superconducting cables. He then moved to EPFL (École Polytechnique Fédérale de Lausanne) as a scientific collaborator for the ITER project, participating in the cold cable tests for its superconducting Tokamak. In connection with the Swiss Free Electron Laser (FEL) project, Dr. Calvi joined PSI to help develop the undulator system for the Aramis X-ray beamline. He later became the sub-project leader for the Athos soft X-ray beamline, overseeing the magnetic assessment and operation of its 16 Apple X undulators.*
Dr. Calvi is an expert in accelerator-based light sources, including synchrotrons and FELs, with a particular focus on high-temperature superconducting undulators. He has served as the spokesperson for the LEAPS working groups on photon sources and is a member of several international boards.

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