

Education and Training

John Adams Institute for Accelerator Science

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CERN & JAI University of Oxford

Universities meet Laboratories
Laboratoire de L'Accélérateur Linéaire
Université Paris-Sud 11
3 November 2016

Introduction

- **JAI** – Imperial College London, Royal Holloway University London, University of Oxford
- The JAI programme is organized around three pillars:
 - Research in accelerator science.
 - **Training the next generation of accelerator scientists.**
 - Outreach to industry and the public.

Review Recommendations

- STFC Programmatic Review of 2013
 - *The stated JAI aims are...to **train a new generation** of accelerator scientists and engineers...*
 - JAI received **positive assessment** in this review, in particular in relation to its training programme.
 - Recommendations (Para. 86) - JAI should maintain its **important role** in training.

Review Recommendations

- STFC Accelerator Programme Review of 2014
 - 117. Accelerator R&D at DLS relies on, and helps maintain and develop, in-house expertise. Highly skilled and motivated staff are essential to maintain the position of Diamond as a world-class facility. **The training and support provided by the JAI has been significant.**

JAI Advisory Board

■ General Comments

- ❑ JAI continues to deliver a **world-class** accelerator science education and training programme.
- ❑ The AB commends JAI for the remarkable **success** of the programme as testified by the numbers and careers of the former students.

Graduate Accelerator Physics Course (I)

- **Term I October-December 2016**
 - **Lectures** – Types of Accelerators, **Live Link-up with LHC Control Centre**, Transverse Optics (2), Longitudinal Dynamics, Momentum Effects, Concepts in Accelerator Plasma Physics, Lattice Design, Beams & Imperfections, Introduction to Laser-Plasma Ion Accelerators, Synchrotron Radiation (2), Introduction to Plasma Wakefield Accelerators, RF Cavities (3), Beam Instrumentation, Electron Dynamics (2), Parameters for Compact X-ray Source Student Project Design
 - **Exercise Classes** – Transverse Optics, Longitudinal Dynamics, RF Cavities (2), Synchrotron Radiation

Graduate Accelerator Physics Course (II)

- **Term II January-March 2016**
 - **Lectures** – Magnet Design (2), Non-linear Dynamics (2), Beam-Beam Effects, Space Charge Tune Shift, Beam Transport, Linear Colliders (4), Instabilities (2), Applications of Accelerators (2)
Exercise Classes – Magnet Design
 - **Tutorials** – FCC-ee Design Project (8)

Consolidated Accelerator Course

- Graduate lecture course includes plasma lectures provided by ICL, as part of development of **integrated accelerator-laser-plasma training**.
- Lecturers & Instructors
 - A. Alekou (Oxford), R. Bartolini (Oxford), S. Boogert (RHUL), S. Mangles (ICL), N. Marks (CI), A. Milanese (CERN), C. Plostinar (RAL), A. Sahai (ICL), S. Sheehy (Oxford/RAL), F. Tecker (CERN), E. Tsesmelis (CERN/Oxford), E. J . N. Wilson (CERN/Oxford)
 - **Healthy mix** of lectures and instructors from JAI universities (and beyond – CERN, CI, RAL)

Issues and Solutions

- Design project is very important component of graduate training
 - Carried out in parallel with intense coursework programme and research thesis
- Consolidation of design project
 - Select design project to combine conventional and plasma accelerator aspects.
 - Design of Compact ring-based X-ray source with on-orbit and on-energy laser-plasma injection.

Remote Access

- Creation of dedicated site on INDICO for JAI accelerator courses
 - <https://indico.cern.ch/category/5869/>
- Incorporates
 - Timetable
 - Slides and Documents
 - Vidyo connection

Denys Wilkinson Bldg., Oxford (Videoconference Room) Manage


Description
John Adams Institute - Accelerator Courses Accelerator Physics

Videoconference Rooms JAI_Accelerator_Courses Join ▼

Go to day




Wednesday, 13 January 2016

14:15 - 16:15 Week 0 - FCC-ee Project 🔗

14:15 **Tutorial 1 - Project FCC e+/e- 2h0'** 🔗
Speaker: Prof. Emmanuel Tsesmelis (CERN)


Wednesday, 20 January 2016








10:00 - 11:00 Week 1 - Magnet Design 🔗

10:00 **Lecture 1 - Magnet Design I 1h0'** 🔗
Speaker: Attilio Milanese (CERN)
  

Thursday, 21 January 2016



10:00 - 16:15 Week 1 - Magnet Design 🔗
Location:

10:00 **Lecture 2 - Magnet Design II 1h0'** 🔗
Speaker: Attilio Milanese (CERN)

14:15 **Tutorial 2 - Demonstration Magnet Design Program 2h0'** 🔗
Speaker: Attilio Milanese (CERN)
   
  



Wednesday, 27 January 2016

10:00 - 11:00 Week 2 - Non-linear Effects 🔗

10:00 **Lecture 3 - Non-linear Dynamics I 1h0'** 🔗
Speaker: Prof. Riccardo Bartolini (Diamond Light Source and John Adams Institute)
 

Thursday, 28 January 2016

10:00 - 16:15 Week 2 - Non-linear Effects 🔗
Location:

10:00 **Lecture 4 - Non-linear Dynamics II 1h0'** 🔗
Speaker: Prof. Riccardo Bartolini (Diamond Light Source and John Adams Institute)
 

Get-togethers

- Full day annual **JAlfest** (2 Dec. 2016)
 - Academic staff & student presentations
- **JAI Lecture Series**
 - Distinguished lecturers from JAI and other laboratories/ universities.
 - Scheduled for students to attend.

John Adams Institute for Accelerator Science Lecture Series

This page gives information on the John Adams Institute Lecture Series. Lectures will usually be held on Thursdays at either 2:30 pm or 4:15 pm, during term time, in the Fisher Room, Denys Wilkinson Building, Keble Road, Oxford. Please note that information on previous lectures is currently incomplete as the material is being transferred from the previous content management system.

Upcoming lectures

Presenter	Title	Date	Time	Venue	WebEx
Prof. William Barletta (USPAS/ MIT)	Accelerator Research in the U.S. for High Energy Physics: A biased perspective	Wednesday 6th April 2016	2:30pm	Dennis Sciama Lecture Theatre (DWB)	WebEx

Previous lectures

▶ 2016

▶ 2015

▶ 2014

Accelerator Design Projects

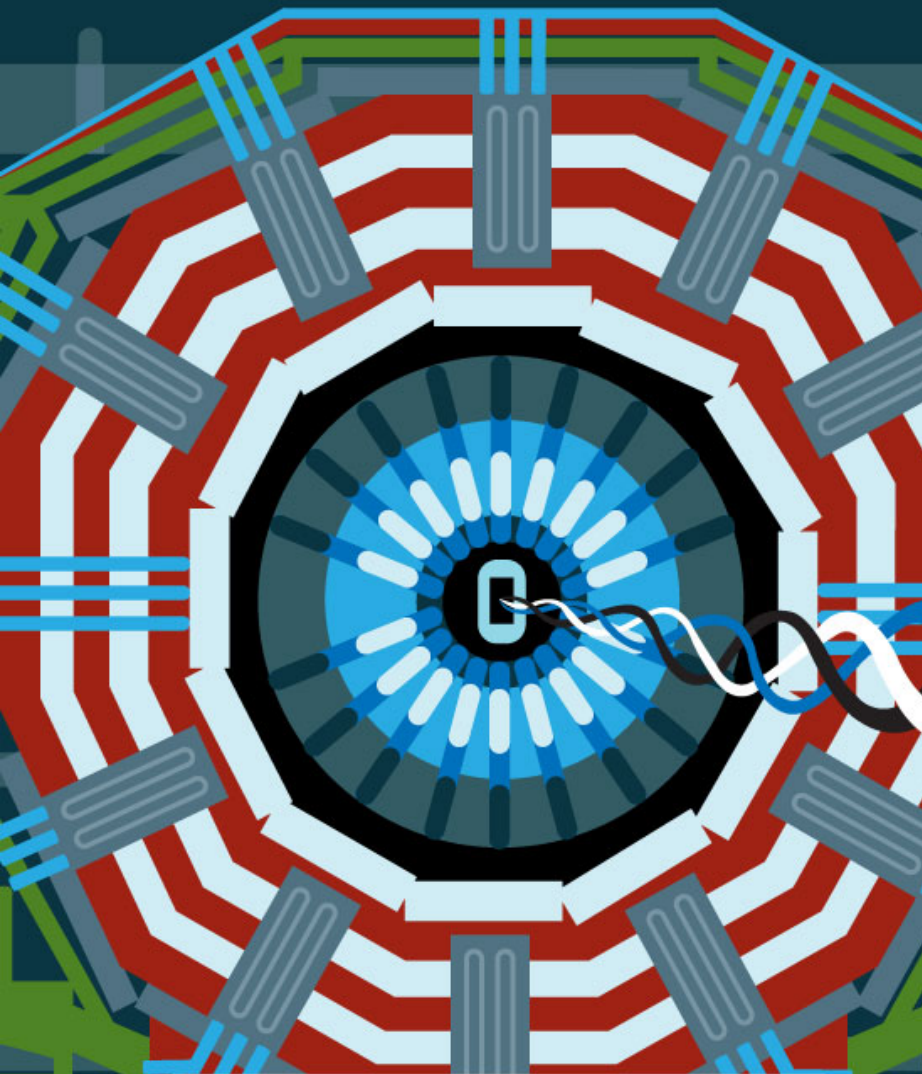
- 2016 - Accelerator Design Studies for FCC
 - The aim of this year's JAI student project work was to prepare a design for the FCC study.
 - Concentrated on the FCC-ee machine option and included a study on
 - Lattice, synchrotron radiation, magnets and RF system.
- 2017 – Accelerator Design Studies for Compact X-ray Source
 - The aim of next year's JAI student project work is to prepare a design for Compact ring-based X-ray source with on-orbit and on-energy laser-plasma injection.

**Student presentations at FCC Committee at CERN in June 2016
(together with visits to accelerator facilities)**

S19 Undergraduate Accelerator Physics

- The S19 short option undergraduate accelerator physics course has been significantly updated for 2016.
 - In addition to covering key accelerator concepts & techniques, it also looks to innovative future developments and applications.
 - Bringing together contributions & synergies from electromagnetism, classical mechanics, laser and plasma science.
- Students evaluated by written examination at end of course.

Expect this course to attract undergraduate students to accelerator science.



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Graduate Student Numbers

- JAI keeps delivering first-class PhD training via research
 - Number of PhD graduates has reached 47 and all are well employed.
 - Majority (91%) of PhD theses combine all of these areas:
experiment, theory/simulations
- Number of students & mechanism of allocation
 - The 2010, 2011, 2012, 2013, 2014, 2015 and 2016 admissions were
7, 10, 11, 7, 9, 7, 11
- *“Approximately 10-12 accelerator science PhDs graduate each year in the US This is traceable to the small number of US universities that have accelerator faculty and offer instruction in accelerator science.” (US DOE, 2015)*

Graduate Student Funding

- STFC (including JAI grant co-funding)
- EPSRC (CASE & Centres for Doctoral Training)
- Helmholtz Foundation
- Marie Skłodowska Curie Actions
- Support of part-time students engaged as staff at accelerator labs (e.g. ISIS, Diamond) while simultaneously pursuing PhD at JAI
- Studentship funding from non-UK sources (CERN, ERC)

Exploring wide range of possibilities for sustainable funding

Summer Student Programme

- Oxford University Internship Programme (to CERN)

- Interns are in 3rd year of their 4-year course in Physics or Engineering.
- Participate in CERN Summer Student lecture series and in an accelerator project.
- Example project - CTF3 accelerator supervised by Oxford faculty & graduate students.

Expect programme to attract undergraduate students to accelerator science.

APPEAL

- Accelerator and Particle Physics Education at A-Level
- Annual training event started in 2010.
- 2016 Theme – Connections to Gravitational Waves

18 July 2015
University of Oxford
Europe/Zurich timezone

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Timetable

Registration

Lecturers

Resources

Venue

APPEAL 6 - The International Year of Light

The University of Oxford is organising in collaboration with CERN a one-day school to give A-level teachers an opportunity to learn about particle physics and accelerators including the LHC. This school will give an insight into particle accelerators and particle physics to Physics teachers who are not necessarily Physics specialists. Preference will be given to teachers coming from schools which usually send very few pupils to University.

The school will address questions that often fascinate students, such as "How does a particle accelerator work?" "What has been discovered at the LHC already?" "What are particle physicists looking for next?" "What will come after the LHC?" and "Will accelerators just keep on getting larger?"

Past APPEAL events ([APPEAL-1](#), [APPEAL-2](#), [APPEAL-3](#), [APPEAL-4](#) and [APPEAL-5](#)) were very successful and we are looking forward to a very interesting and thought-provoking event this year as well.

The APPEAL-6 event will take place on Saturday, 18 July 2015 at the University of Oxford.

To take part in this school please register before the 26 June 2015.

There are **no registration fees** for the teachers to participate in the event. The organisers are grateful for the support received from the following organisations:



Additional Lecture Programmes

- **Joint JAI and CI Advanced Courses**
 - Two courses per year for advanced second and third year graduate students.
 - First offered in 2016 on a) imaging and detectors for medical physics and b) LINACS.
- **Pilot two-day course on the methodology of inventiveness.**
 - Delivered jointly with the firm Oxford Creativity

External Lecture Programmes

- JAI participating in external lecture programmes
 - USPAS Course on Accelerator-Laser-Plasma
 - CERN Accelerator School (CAS)
 - Joint Universities Accelerator School (JAI is partner institute)
 - Centre for Postgraduate Training in Plasma Physics and High Energy Density Science
 - *Physics of Particle Accelerators*, an intercollegiate course for students from King's College, Queen Mary, and UCL.

USPAS 2016

- At our summer 2016 session, Prof. Andrei Seryi again taught the course "Unifying Physics of Accelerators, Lasers and Plasma – Synergy and Bridges." As a class project, Prof. Seryi's students designed a novel light source based on a laser-plasma accelerator. They then wrote a paper detailing their idea for submission to the 2016 North American Particle Accelerator Conference. **The paper was selected for an oral presentation and the talk was given by Marlene Turner, a PhD candidate from CERN. Congratulations to Andrei and to his entire class for their work. This is a first for a USPAS course."**

Conclusions

- JAI continues to deliver a world-class accelerator science education & training programme.
 - Intense undergraduate & graduate courses
 - Innovative and educational accelerator design projects
 - Recognised outreach activities
- Future Challenges
 - Sustainable funding for students over the long term
 - Exploring broad variety of funding sources