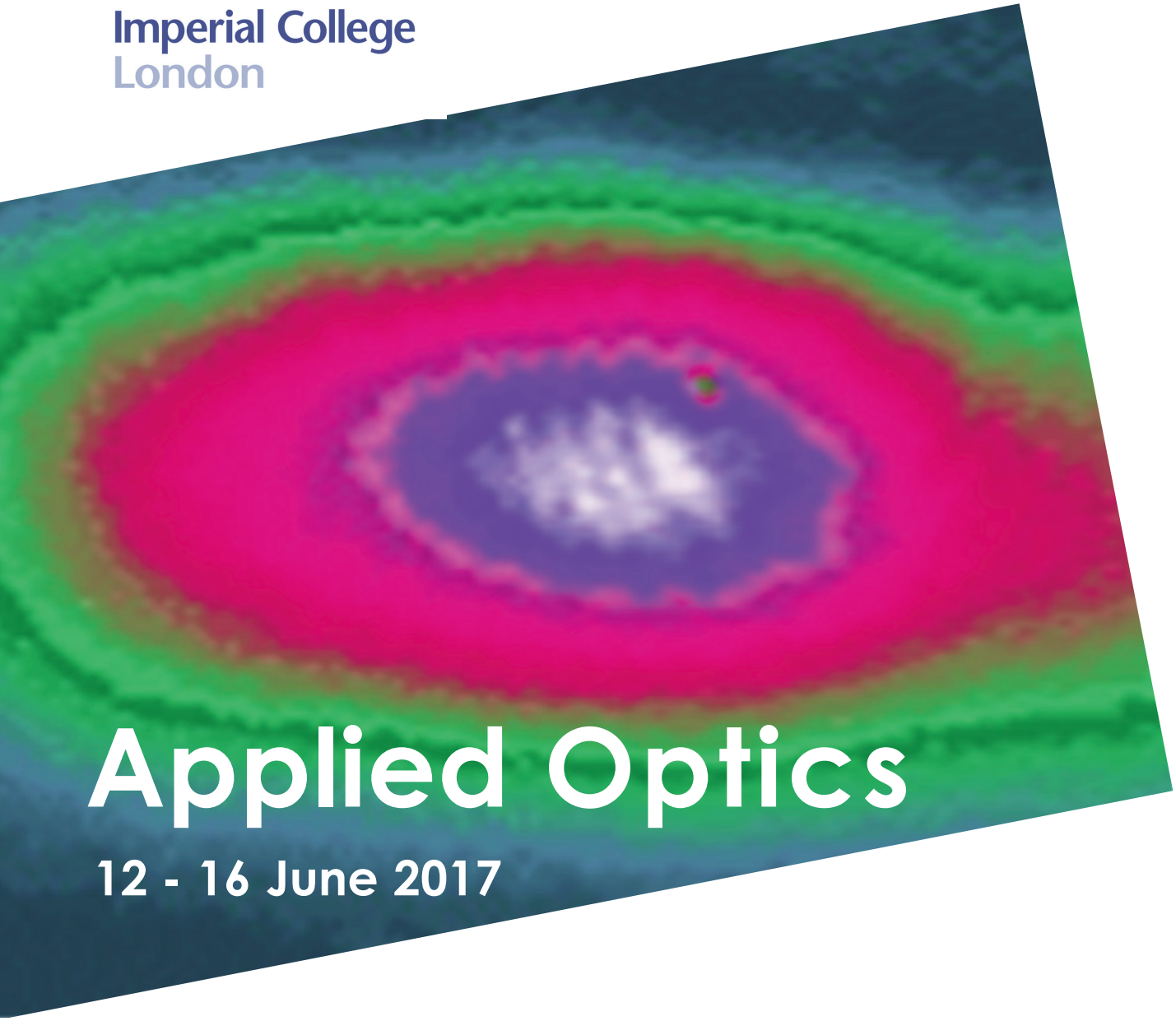
Imperial College London



Applied Optics

12 - 16 June 2017

A five-day course with the Photonics Group, Department of Physics

IOP Institute of Physics
Endorsed Training Provider

The continuing programme of Short Courses in Optics at Imperial College London is supported by SPIE - The International Society for Optical Engineering

The Centre for Continuing Professional Development Programme

Course Structure

This one week course, consisting of approximately 30 hours of lectures with supporting laboratory demonstrations, aims to provide the required basis of knowledge for the application of optics in science, engineering and technology.

The course provides a basic introduction to the theoretical foundations of applied optics, and then develops this theme to illustrate the many diverse applications of optical technology. A comprehensive set of lecture notes is provided.

The course is designed to:

- Explain the basic underlying physical principles of optics, optical phenomena and optical equipment.
- Introduce and demonstrate a range of optical instruments and techniques including geometrical and physical optics, thin film devices, optical fibres, detectors, interferometry and holography.
- Provide an introduction to the techniques involved in designing optical systems.

Who Should Attend?

This course is relevant to physicists, engineers and other technical workers whose professional training is likely to be in fields other than optics. It is suitable for those wishing to receive an in depth introduction to the subject through to a relatively advanced level. It is also suitable as a refresher course for optics specialists. Some knowledge of basic physics and mathematics is assumed.

A brief summary of the course

Geometrical Optics and Aberration Theory
Prof R W Smith

Laws of reflection and refraction, Gaussian optics, stops and pupils, aberrations in terms of rays and wavefronts. Aberration types, Seidel aberrations, chromatic aberration, Seidel aberrations of thin lenses.

Physical optics
Prof Peter Török

Scalar waves, two-beam interference. Diffraction theory of image formation. Aberrations. Coherence. Extended objects, transfer functions.

Design of Imaging Systems
Mr J Maxwell

Fundamental anatomy of specifications for corrected optical systems. The Characteristics and importance of aberrations and their balancing. Aberration correction techniques. Use of aspherics. Influence of computers. Photographic objectives, microscope optics, reflecting and catadioptric optical systems.

Interferometry and Testing
Prof R W Smith

Wavefront testing using Fizeau, Twyman-Green, common path and shearing interferometers. Knife edge and star image tests. Resolution and modulation tests. Interference microscopy.

Thin Film Optics
Prof R C Thompson

Propagation of electromagnetic waves in layered media. Antireflection coatings, high reflectance mirrors, bandpass filters, polarising beam splitters. Narrow band interference filters.

Lasers
Prof G H C New

Principle of laser action, stimulated emission and population inversion, pumping mechanisms, CW and pulsed operation, laser cavities and laser modes, review of different types of laser, Q-switching, mode-locking and ultrashort pulses.

Holography
Prof M A A Neil

Principles of holography. Recording materials. Diffraction efficiency, thick and thin reflection and transmission holograms. Hologram aberrations. Applications, including holographic interferometry, diffractive optical elements and display holography.

Light Detectors
Dr K Weir

Wavelength dependence of sensitivity. Signal conversion. Photoconductors, photovoltaics and photomultipliers. Attainable signal to noise ratios. Practical considerations.

Biophotonics
Prof P M W French

Advanced microscopy including confocal and nonlinear modalities; multi-parameter fluorescence imaging resolved with respect to wavelength, lifetime and polarisation; imaging through biological tissue.

N.B. It may be necessary to make minor changes to the syllabus depending on the availability of Staff.

Presenters

Professor P M W French is Head of the Photonics Group. He received his PhD degree for work on femtosecond dye lasers from Imperial College and has concentrated most of his career on ultrafast laser technology and its applications, particularly in the field of biomedical optics. His current research portfolio includes ultrafast laser technology, high speed 3-D imaging using photorefractive holography and fluorescence lifetime imaging for biomedicine and microscopy.

Mr J Maxwell has more than 20 years of industrial experience in optical design and engineering and has spent the last twelve years as a lecturer in Applied Optics at Imperial College London. He is currently working for Cooke Optics in Leicester designing fixed focal length and zoom lenses for cinematographic applications and working part time as a lecturer in Imperial College London. His publications include papers on optical design, optical testing and the engineering of optical systems; he has also authored and co-authored two books, one on the design of Catadioptric Imaging Systems and one on Precision Optical Glassworking.

Professor M A A Neil studied Natural Sciences at Cambridge before moving to the Engineering Department where he completed a PhD in Optical Information Processing. He then spent a number of years at the department of Engineering Science at Oxford working on a range of subjects including integrated, diffractive and adaptive optics, imaging and microscopy. He joined the Photonics group at Imperial in 2002 as a Lecturer, becoming Professor in 2009, and his current research interests include programmable optics and advanced imaging and microscopy for biomedical applications.

Professor G H C New is a member of the Quantum Optics & Laser Science Group. His research interests are in the theory (esp. the computer modelling) of lasers and nonlinear optical processes, with particular emphasis on the ultrafast processes and novel optical beams. He is involved in numerous national and international collaborations. He is a Fellow of the Institute of Physics and of the Optical Society of America.

Professor R W Smith joined Imperial College London as a lecturer in 1968 and was the Head of the Applied Optics Group from 1987 until September 1992. He has taught most of the courses in the Applied Optics MSc programme. His research interests cover many aspects of applied optics including lens and optical system design, diffractive optics, interferometry, image formation, holography and thin films.

Professor R C Thompson took his first degree in Physics at the University of Oxford in 1976. Following a DPhil in Atomic Spectroscopy in Oxford, he worked at the Kernforschungszentrum Karlsruhe and moved to the National Physical Laboratory in Teddington in 1983. He came to Imperial College London as a lecturer in 1986 and was promoted to Reader in 1993 and Professor in 2003. His current research is in the area of laser cooling and spectroscopy of trapped ions.

Professor Peter Török obtained his first degree at the Technical University of Budapest, Hungary and subsequently his DPhil degree at the University of Oxford. After completing post graduate studies, he did his post-doctoral studies at the Universities of Cambridge and Oxford. Peter was appointed Lecturer in Photonics in 2003 at Imperial College London and was promoted to Reader in Optics in 2006 and subsequently Professor of Optical Physics in 2009. His research interests include the theory of electromagnetic problems, diffraction, focusing and microscopy with especial emphasis on confocal microscopy and optical data storage.

Dr K Weir joined Imperial College London as a lecturer in 1994. He has experience in optical fibre sensors and instrumentation. His current research interests are in the areas of optical and optical fibre sensor systems for the measurement of physical parameters and other novel applications of optical fibre in sensor systems.

General Information

● Registration

To book a place on the course, please go to ***www.imperial.ac.uk/cpd/appliedoptics*** and click on the the online booking icon.
If you have any queries regarding your booking, please contact us on telephone +44 (0)20 7594 6884 or by email cpd@imperial.ac.uk
Detailed joining instructions, including a map, will be sent to all participants 10-14 days prior to the commencement of the course. Places on the course are limited. EARLY BOOKING IS ADVISED.

● Fees

The fee for the course is **£1450** with a **discount if you book before 12 May 2017**.
The fee covers attendance at the course, course materials, lunches and light refreshments.
Please note all fees must be received before the course start date.

● Accommodation

Single bedroom accommodation is available in local hotels within easy access to the College. Minimum cost of a room with shower/bath will be in the region of £85 per night. This is additional to the conference fee, and participants are responsible for payment of their hotel bills.

For further details and reservations, please contact:
Hotel Booking Service
Accommodation Bookings
London SW7 2AZ
Tel: +44 (0)207 594 9507/11
Email: accommodationlink@imperial.ac.uk
Information available at:
www.imperial.ac.uk/conferences

● Duration

Lectures are scheduled between 9:00 and 15:45 each day with breaks for light refreshments and lunch. Additional laboratory demonstrations will be presented after the lectures on Monday to Thursday with the day ending at 16:45. Registration will take place between 8:30 and 9:00 on the first day and there will be a Welcome Reception held after the laboratory demonstrations on the first day.

● Cancellations

A 20% administration fee will be levied for cancellations made up to two weeks prior to the start of the course. Cancellations thereafter will be liable to the loss of the full fee. Notice of cancellation must be given in writing by letter or fax and action will be taken to recover, from the delegates or their employers, that proportion of the fee owing at the time of cancellation.

Imperial College London reserves the right to cancel an advertised course at short notice. It will endeavour to provide participants with as much notice as possible, but will not accept liability for costs incurred by participants or their organisations for the cancellation of travel arrangements and/or accommodation reservations as a result of the course being cancelled or postponed. If the course is cancelled, fees will be refunded in full. Imperial College London also reserves the right to postpone or make such alterations to the content of the course as may be necessary.

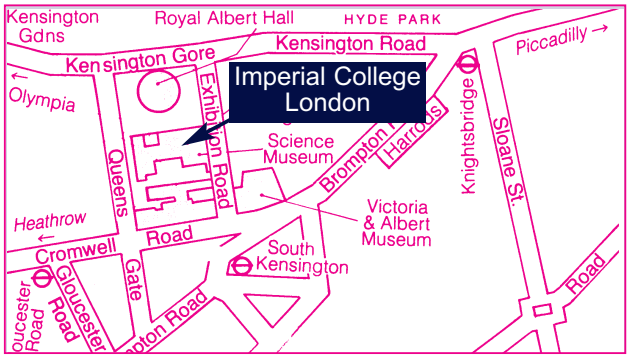
● Queries

Queries regarding the **content of the course** may be obtained from:

Judith Baylis
Blackett Laboratory,Imperial College London
Tel: +44 (0)20 7594 7713
Email: j.baylis@imperial.ac.uk

Queries regarding **registration** matters contact:

Stephen Godfrey
Centre for Continuing Professional Development
Imperial College London, South Kensington Campus
London SW7 2AZ, UK
Tel: +44 (0)20 7594 6884
Email: cpd@imperial.ac.uk



For updated information about the course visit
www.imperial.ac.uk/cpd/appliedoptics

Also of Interest

A Short Course in Adaptive Optics

A two-and-a-half day course which covers the basic principles of adaptive optics. Topics covered will include causes of aberrations, wavefront sensing and reconstruction, adaptive systems and the practical implementation of adaptive optics for astronomical applications.

Course fee to be confirmed

To register interest in this course, please go to: **www.imperial.ac.uk/cpd/adaptiveoptics**