Smart Photons from Synchrotron for Probing Condensed Matter to Bio-Nanomaterials

Overview

Charged particles do not radiate while in uniform motion, but during acceleration a rearrangement of its electric fields is required and this field perturbation, travelling away from the charge at the velocity of light, is what we observe as electromagnetic radiation. Relativistic charged particles forced to move along curved trajectories by applied magnetic fields emit electromagnetic radiation called Synchrotron Radiation (SR). In today's world SR provide users a wide spectral range from infrared to hard X-rays. Thanks to its peculiar characteristics, synchrotron radiation is one of the more powerful tools for investigating the properties of matter in many different fields like molecular and atomic physics, cell biology, medical applications, Nanomaterials, interfaces, catalysis and cultural heritage. Up to now three generations of synchrotron radiation sources emitting radiation with increasing brightness and high quality resolution have been developed. The fourth generation, based on free-electron lasers, already produces high power and ultrafast pulses of highly coherent radiation. In this course, the main characteristics and properties of the synchrotron radiation sources and of the produced radiation and why this is important in understanding various material properties and its application. The module delivery will be in the form of formal lectures combined with tutorials

Brief overview of X-rays and Synchrotron radiation- characteristics and properties of Synchrotron Radiation, types of synchrotrons, first, second, third and fourth generation sources. Problem solving session with examples: X-rays and penetration capabilites and analysis

Quantum description of interaction of matter with radiation, Synchrotron instrumentation and beamlines. Problem solving session and outreach: Beamline construction and pre requirements, magnetic moments and calculations.

X-ray Diffraction by Lab based X-ray source vs. Synchrotron source, Problem solving session with data interpretation and analysis

X-ray absorption and emission spectroscopies- XAS, XES, NEXAFS, EXAFS. Data interpretation and analysis with fitting programs to determine electronic structures

Chemical and magnetic imaging with X-ray photoelectron microscopy (XPEEM)

Synchrotron Radiation in Nanostructured systems

Synchrotron Radiation studies of materials for Renewable Energy and bio medical applications

NB: Participants may request 1 Credit against successful completion of this course

Dates	**December 5 to December 11, 2016**
You Should Attend If…	You have an interest in synchrotron techniques or in energy/biomedical materials and you are : • a scientist, engineer or researcher in industry/academia and R&D laboratories • You are a student at B.Tech./M.Sc./M.Tech./Ph.D. level • You are a faculty member in educational/ academic institute
Fees	• Participants from abroad : US $100 • Industry/ Research Organizations: INR 5000/- • **UG/PG students: INR 1500/-** • **Ph.D. students or above: INR 2000/-** NB: The above fee includes all instructional materials. The participants may be provided with budget accommodation on payment basis upon advance request.

The Faculty

Dr. Satheesh Krishnamurthy a Senior Lecturer in Energy, Nanoscale energy and Surface engineering in Department of Engineering and Innovation at The Open University. He has over 15 years of experience in Synchrotron radiation and material science, process analytical technologies, surface and engineering Nanomaterial's. He has been a synchrotron beam time user at various world-class synchrotrons such as Max-lab, Sweden, Elettra Italy, Bessy Germany, Advanced Light Source, National Synchrotron Light Source, Stanford Synchrotron Light Source, USA etc.

His current research focuses on the functionalization and surface engineering of Nanomaterials for industrial applications in particular to energy storage and harvesting. He has authored more than 60 archival journal papers, 3 international patents and the co-author of 4 books. He has publications in Nature, Advanced Materials and high impact factor journals He graduated 6 PhD students and currently supervises or co-supervises 6 in the UK. He has more than 50 invited talks in conferences, industries and guest lectures. He was invited by former president Abdul Kalam to discuss about Nanotechnology initiatives. He also chairs NRI entrepreneurship network in UK. He believes in socially oriented research that has direct impact on society

Dr. Amit K. Chakraborty is an Associate Professor of National Institute of Technology, Durgapur. He received his PhD from University of Nottingham (U.K.) in 2005. He then worked as Research Associate at Durham University during 2005-2008, and at Empa, Swiss Federal laboratories for Materials Science & Technology, Duebendorf, Switzerland during 2008-2010 before joining NIT Durgapur as Associate Professor in 2010. His research interest is carbon based nanostructures (graphene, carbon Nanotubes) and their composites with metal oxides, polymers, etc. for applications in solar photovoltaics, supercapacitors, and others. Dr. Chakraborty has the experience of working in some of the well known synchrotrons of Europe viz. Daresbury Lab (UK), Diamnd Light Source (UK), ELETTRA (Italy) and MAX-Lab (Sweden).

Course Co-ordinator

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