

# Indo-Japan Accelerator Accelerator, IIT Hyderabad

From 17<sup>th</sup> Feb till 22<sup>th</sup> Feb 2018

## Over View:

The aim of the school is to attract the physics and engineering researchers towards the multi-disciplinary field of accelerator physics and technology at the early stage of their career with the access to national and international experts and the advance laboratory facilities and to provide a platform for the scientist to work collectively on the key issues on the leading accelerator program of the country. This school will cover the full spectrum of subjects related to accelerators, beam diagnostics, RF systems and application of accelerators in scientific research and technology development. School will offer seminar style description of topics by both international and national subject experts. This school will address basics for the beginners to the start-of-art technology for the advanced researchers.

### Modules:

This workshop had two sections;

First section covers three days (17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup>), which included lecture series related to basics of radiation physics, laser, particle physics and laboratory demonstration and its medical applications.

Second section (20<sup>th</sup>, 21<sup>st</sup>, 22<sup>nd</sup>) contains a series of seminars from invited speakers, which dealt with various prospective of research across the world.

### You Should Attend If....

This course is designed for Engineers, Faculty and Students. For the Engineers, and Faculty from Civil, Mechanical, Aerospace, and Biomechanical, it is a refresher course. For PG students it will in their research projects. For BTech it will be an advanced course to encourage them check out research avenues.

### Fees:

For TEQIP Participants its free of cost.

## About Speakers:



**Prof. Junji Urakawa** is presently in research administrator of KEK and professor at Waseda University. He was a Professor of Tsukuba University since 2010.11-2014.3 and served as a special professor in Accelerator Laboratory in KEK and Sokendai since 2014.4-2014.10.



**Prof. Juzer Ali Chakera** was born in 1967 in Mhow (M.P.), India. He received his B.Sc. and M.Sc. degrees in Physics from DAVV, Indore in 1986 and 1988 respectively. He joined RRCAT after completing 34<sup>th</sup> batch of training school at BARC. He did his Ph. D in Physics from DAVV in 2005. Later he received Post-doctoral fellowship during 2006 - 2008 at the University of Alberta, Canada. Presently, he is heading the Laser Plasma Division at RRCAT. He is also a faculty member of Homi Bhabha National Institute, Mumbai (a Deemed University). His current research interests focus on ultrahigh intensity laser matter interaction viz. acceleration of particles, high energy radiation generation and its applications, and fast electron transport. Dr. Chakera has also worked on indigenous development of many plasma diagnostics for ultrahigh intensity laser matter interaction studies. During his Ph D research, he has carried out work related to plasma opacity enhancement of Au-Cu mix-Z alloy leading to higher soft x-ray conversion of laser light. Under his leadership the group has produced various new results which are demonstrated for the first time viz. quasi-mono-energetic gold ion acceleration in nano-structured target, negative ion acceleration in transparent CH targets, and reducing the divergence of MeV fast electron beam, which are important aspects for fast ignition ICF related to strategic importance.



**Prof. Anand Moorti** is now, Head of Advanced Plasma Acceleration Section Raja Ramanna Centre for Advanced Technology, Indore 452013, India. His research interest is broadly on Laser plasma based advanced particle acceleration techniques: Laser wakefield and Direct Laser Acceleration of Electrons, high intensity laser plasma interaction and laser synchrotron source (x-ray/ $\gamma$ -ray) using laser accelerators.



**Prof. Jinfeng Yang**, is an Associate Professor in Institute of Scientific and Industrial Research (ISIR), Osaka University, Osaka, Japan. His research interests are RF gun & low-emittance ultrashort-pulsed electron source, ultrafast pulse radiolysis & radiation chemistry, ultrafast electron diffraction/microscopy and study of ultrafast structural dynamics. He is member of Committee on Particle Accelerator and Beam Science, Atomic Energy Society of Japan (2017 - present) and member of committee of Japanese Society of Radiation Chemistry (2018 - present).



**Prof. Shigeru Kashiwagi** is an Associate Professor, Research Center for Electron Photon Science, Tohoku University since april 2010. He is expert in the field of high energy Physics: development of tracking detector using CR-39 and X-ray film for dark matter search, accelerator Science and Beam physics: Development of energy compensation system for linear colliders, Research for wake-field in accelerating structure, accelerator Science and Quantum Radiation: Development of Photocathode RF-gun system, Generation and Application of High Intensity X-ray via inverse Compton Scattering, Accelerator Science and Quantum Radiation: Development of Insertion device (Strong focusing undulator), Development of far-Infrared Free Electron Lasers and SASE and accelerator Science and Beam Physics: Generation and Application of Extremely Short Electron Bunch, Development of High Intense Coherent Radiation Source. ILC Accelerator & D: Positron source, Emittance control etc.

Course Co-ordinator

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**Prof. Dipak Kumar Palit** is distinguished for Emeritus Professor & Associate Dean, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Kalina Campus, Mumbai 400098. His indigenous development of the most sophisticated ultrafast pump – probe spectrometers in the visible, IR and THz regions based on lasers and accelerators could reveal the dynamics of molecules and materials with sub-angstrom resolution of atomic motions and helped in elucidation of the nature of the elementary processes, such as electron, proton and energy transfer, hydrogen bond and conformational relaxation in molecules as well as exciton migration in nanomaterials relating the dynamics and structures to functions in real systems at the most fundamental level. He is particularly specialized to Photo and Radiation Chemistry, Ultrafast Spectroscopy and Chemical Reaction Dynamics using lasers and accelerators.



**Prof. S. S. Prabhu**, PhD in Physics from TIFR. Currently Associate Professor of Physics. He has more than 52 papers in international journals, and several articles (popular and technical) in many magazines and more than 70 papers in conferences and has given several invited talks. His research interests ultrafast Time resolved Phenomena in Materials THz spectroscopy of materials Metamaterials, high field THz and Near Field THz Microscopy.



**Dr. Tanuja Dixit** is a Scientist at SAMEER since 2008. Her Ph.D is on All Ion-Accelerator (AIA) based on novel Induction synchrotron concept. She has designed an acceleration scheme for the KEK All-Ion-Accelerator (KEK-AIA). She has worked on S-band standing wave 6 MeV Medical Linear Accelerator and has contributed in the design and development, assembly, integration and testing of linac tubes. She played crucial role in developing the 6 MeV medical linac technology. She has contributed in dual photon energy and multiple electron energy medical linear accelerator development at SAMEER. She has designed key components for the dual energy linac like retractable target and triode gun. And also developed energy variation mechanism using detuning plunger to get 6 and 15 MV photons. She is also involved in the 30 MeV high beam power accelerator development for radio-isotope production. She has worked on the convertor target design and Moly target design and optimization using GEANT4 software. Both direct and indirect target method is studied for higher yield of <sup>99</sup>Mo production. Her recent research interest is to design and develop a Compact Hadron Therapy machine based on All Ion -Induction Synchrotron based accelerator scheme. The synchrotron under design is injector free and many ions like protons, helium, carbon etc. can be provided for therapy purpose. The fast cycling operation of the synchrotron will make the beam delivery faster and active beam scanning option will become feasible. Energy sweep extraction is a very novel beam delivery options which is under study. Finally, a hadron therapy machine without gantry is her recent research interest. She has published more than 45 papers in journals and proceedings. She is a life member of Indian Society for Particle Accelerators, ISPA.



**Prof. Masao Kuriki**, is a professor of Graduate school for advanced sciences of Matters, Hiroshima University, Japan. His research interest is on Study for spin dependent nuclear structure functions, study for rare decay of Charged Kaon, linear collider Accelerator development and X-ray generation with a laser-Compton scattering.



**Dr. Aravind Kumar Rengan** Dr. Aravind kumar Rengan is currently an Assistant Professor at IIT Hyderabad. He had a successful start in academics, obtaining merit seat for his M.B.B.S at Govt. Medical College- Thanjavur (Tamilnadu Dr. M.G.R Medical University). During his medical internship, he was captivated by research in the emerging field of nanoscience and technology. This made him to take up Master in Nano-medical sciences at Amrita Centre for Nanosciences and Molecular medicine-DST Centre of Excellence. Owing to his competitive academic performance he was able to secure University rank and Department of Science and Technology (DST) fellowship. Immediately after his masters in nano-medical sciences, he was selected for his PhD at IIT Bombay.

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**Dr. Vaishali Naik** is presently serving as Head, RIB Facilities Group and Project Manager, ANURIB project and is also as Project Leader for Superconducting Electron Linac Collaboration with TRIUMF Canada. She is also serving as Member, Project Appraisal Subcommittee for DAE Mega Science Vision Scheme since May 2018. A post-graduate in physics from Dept. of Physics, University of Pune, Dr. Vaishali Naik graduated from the 33rd batch of BARC Training School. Dr. Naik joined VECC in the year 1991 and started her career as an experimental nuclear physicist. She later started working on particle accelerator development for the RIB programme at VECC where she played a leading role in design and development of ECR ion sources and RFQ linac and developed a gas-jet ECR technique that led to first successful production of RIB using the facility.



**Shri Satish Chandra Joshi**, is a distinguished Scientist and Director Proton Accelerator Group, RRCAT, is a Mechanical Engineer from Vikram University, Ujjain, joined DAE after graduating from 25 th batch of BARC Training School in 1981. He worked in Cryogenic Engineering on development of cryo-refrigerators and cryo-coolers. In 1986, he shifted to accelerator programme of RRCAT, Indore. He has worked in various R&D aspects of various sub-systems of high intensity proton accelerator. He has worked on design and development of radio frequency quadruple drift tube linac, angular coupled cavity structure and superconducting multi-cell cavities for medium and high energy acceleration of proton. He was a visiting scientist at High Energy Accelerator Research Organization, KEK, Japan, where he has participated in the design of High Energy Proton Linac Injector for a 3 GeV proton synchrotron for Spallation Neutron Source. Shri Joshi is also responsible for setting up of large infrastructure facility for development of superconducting RF cavities at RRCAT. In this connection, he has also visited Fermi National Accelerator Lab, USA.

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Day	Teaching Slot	Tea Break	Teaching Slot	Lunch	Teaching Slot	Tea	Teaching Slot
Day 1 17 <sup>th</sup> Feb, 2019 (Sunday)	EM theory J Mohanty <b>A119</b> <b>9.30-11</b>	11-11.30	Introduction to accelerators B Ramakrishna <b>A119</b> <b>11.30-1</b>	1pm to 2pm	LAB Session B Ramakrishna <b>418&amp;716</b> <b>2-3.30</b>		LAB session J Mohanty <b>418&amp;716</b> <b>4-5.30</b>
Day 2 18 <sup>th</sup> Feb, 2019	Anjan Giri Basics of Accelerators-1  <b>C- LH3</b> <b>10-11.30</b>	11.30-12	Radiation Physics J Mohanty <b>C-LH7</b> <b>12-13.30</b>	13.30 to 14.30	Aravind Rengan Radical Cancer Therapeutics <b>C -LH3</b> <b>14.30-16.00</b>		B Ramakrishna Lasers and Radiation <b>C -LH8</b> <b>16.00-17.30</b>
Day 3 19 <sup>th</sup> Feb, 2019	Anjan Giri Basics of Accelerators-2  <b>9.30-11</b> <b>C-LH10</b>	11-11.30	Beam Dynamics  B Ramakrishna <b>11.30-13.00</b> <b>C-LH5 &amp;6</b>	13.30 to 14.30	Lab session B Ramakrishna <b>418&amp;716</b> <b>2-3.30</b>		Lab session J Mohanty <b>418&amp;716</b> <b>4-5.30</b>
Day 4 20 <sup>th</sup> Feb, 2019	J Urakawa Electron Sources <b>9.30-11</b> <b>A220</b>	11-11.30	J Yang Femtosecond lasers <b>11.30-1</b> <b>A220</b>	13.30 to 14.30	Lab Session B Ramakrishna <b>418&amp;716</b> <b>2-3.30</b>		Lab session Dr Aravind Rengan <b>4-5.30</b>
Day 5 21 <sup>st</sup> Feb,2019	S Kashiwagi Coherent Radiation Sources <b>9.30-11</b> <b>A220</b>	11-11.30	M Kuriki Advanced Electron Beam Generation <b>11.30-1</b> <b>A220</b>	13.30 to 14.30	T Dixit & A Deshpande Medical Hardron Accelerators <b>2-3.30</b> <b>A220</b>		A Moorti & J A Chakera Laser based Acceleration methods <b>4-5.30</b> <b>A220</b>
Day 6 22 <sup>nd</sup> Feb,2019	V Naik & S C Joshi Review of Accelerator Activity <b>9.30-11</b> <b>A220</b>	11-11.30	D K Palit & S Kumar Accelerators in Reaction Dynamics <b>11.30-1</b> <b>A220</b>	13.30 to 14.30	S S Prabhu & S Ghosh Review of THz Sources and Delhi Light Source <b>2-3.30</b> <b>A220</b>		Janvin Ittera & Aryshev Magnets for Accelerators <b>4-5.30</b> <b>A220</b>

**Overview of Lectures:****Day 1****Session 1:**

- ⇒ The sessions started with the planetary talk by Dr. J Urakawa, Professor, Multi-national Partnership Laboratory, Research Administration Department Inter-University Research Institute Corporation High Energy Accelerator Research Organization (KEK) 1-1 Oho, Tsukuba, Ibaraki, Japan. Prof. Urkawa explained in detail the electron sources based on Photocathode RF guns.

**Session 2:**

- ⇒ This section started lecture on “**High intensity laser matter interaction**” by Prof. J. A. Chareka, Head of Laser Plasma Division at RRCAT Faculty member of Homi Bhabha National Institute, Mumbai ( Deemed University)
- ⇒ This session ends with the skype talk “**Beam diagnostic and THz detection radiation**” delivered by A Aryshev from KEK, Japan.

**Day 2****Session 1:**

- ⇒ This session started with talk by Prof. Jinfeng Yang , Advanced Plasma Acceleration Section, The Institute of Scientific and Industrial Research (ISIR), Osaka University 8-1, Mihogaoka, Ibaraki, Osaka, Japan. He explained “**Generation of low emittance femtosecond pulse electron beam**”.
- ⇒ The last talk of the day was delivered by Prof. Tanuja Dixit, Society for Applied Microwave Electronics Engineering & Research (SAMEER) R&D laboratory of Ministry of Electronics and Information technology (MeitY), Government of India. He explained about “**Medical Hadron Accelerator**”.

**Session 2:**

- ⇒ First talk of this session started with the lecture on “**Rare Isotope Beams-Physics and Technology**” by Dr. V. Naik, Variable Energy Cyclotron Centre (VECC), Kolkata.
- ⇒ This session ends with the skype talk by Dr. Suvendu Ghosh on “**Delhi Light Source**”

**Day 3****Session 1:**

- ⇒ The sessions started with the plenary talk by Dr. S. C. Joshi, Professor, Distinguished Scientist and Director of Proton Accelerator Group, RRCAT. Prof. Joshi explained the *overview on acclerator activity at RRCAT*, Indore.
- ⇒ This section ends with the lecture on “*Advanced Laser Acceleration Concept*” by Prof. Anand Moorti Head, Advanced Plasma Acceleration Section, Raja Ramanna Centre for Advanced Technology, Indore 452013, India.

**Session 2:**

- ⇒ This session started lecture on “*Electron microscopy with femtosecond pulses*” by Prof. Jinfeng Yang, Osaka University, Japan.
- ⇒ Next talk of this session was on “*Review on Terahertz Sources*” delivered by Dr. S. S. Prabhu, TIFR, Mumbai, India.

**Day 4****Session 1:**

- ⇒ This session started with talk by Prof. S. Kashigawa, Associate Professor, Research Center for Electron Photon Science Center, Tohoku University (Address: 1-2-1 Mikamine, Sendai, Miyagi, 9820826 Japan. He explained “*Coherrent radiation from extremely short radiation*”.
- ⇒ The last talk of the day was delivered by Prof. J. Urakawa, KEK, Japan. He explained about “*Inverse Compton scattering and application*”.

**Session 2:**

- ⇒ First talk of this session started with the lecture on “*Basics of linear accelerator*” Prof. A. Deshpande, Assistant professor, IIT Hyderabad. by
- ⇒ This session ends with the skype talk by Prof. Masao Kuriki, Graduate school for advanced sciences of Matters, Hiroshima University, Japan. He explained on “*Advanced electron beam generator*”.

**Day 5****Session 1:**

- ⇒ The sessions started with the talk by Prof. DIPAK KUMAR PALIT, Emeritus Professor & Associate Dean, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Kalina Campus, Mumbai 400098, Formerly: Outstanding Scientist, & Head, Radiation & Photochemistry Division, Bhabha Atomic Research Centre, Mumbai. Prof. Joshi explained the “*Applications of accelerator in chemical reaction dynamics*”.
- ⇒ This section ends with the lecture on “*Concepts of linear collider*” by Prof. Masao Kuriki, Hiroshima University, Japan.

**Session 2:**

- ⇒ This session started lecture on “*Applications of Accelerators in Material Science*” by Dr. Sanjeev Kumar, Scientist-H, NCCCM BARC, Hyderabad.
- ⇒ Next talk of this session was on “*Radioactive isotope production through photo nuclear reaction*” delivered by Prof. Shigeru Kashiwagi, Tohoku University, Japan.

**Day 6****Session 1:**

- ⇒ This session started with talk by Janvin Ittara, BARC. He explained “*Magnet related to accelerator*”.
- ⇒ This lecture is on “*Photothermal Therapy*” by Dr. Aravinda Rengan, Assistant Professor, IIT Hyderabad.
- ⇒ This session ends with the skype talk by Dr. A. Aryshev, KEK, Japan on “*Photocathode based electron accelerator*”.

**Dr. Bhuvanesh Ramakrishna**

Workshop Faculty Coordinator, IIT Hyderabad