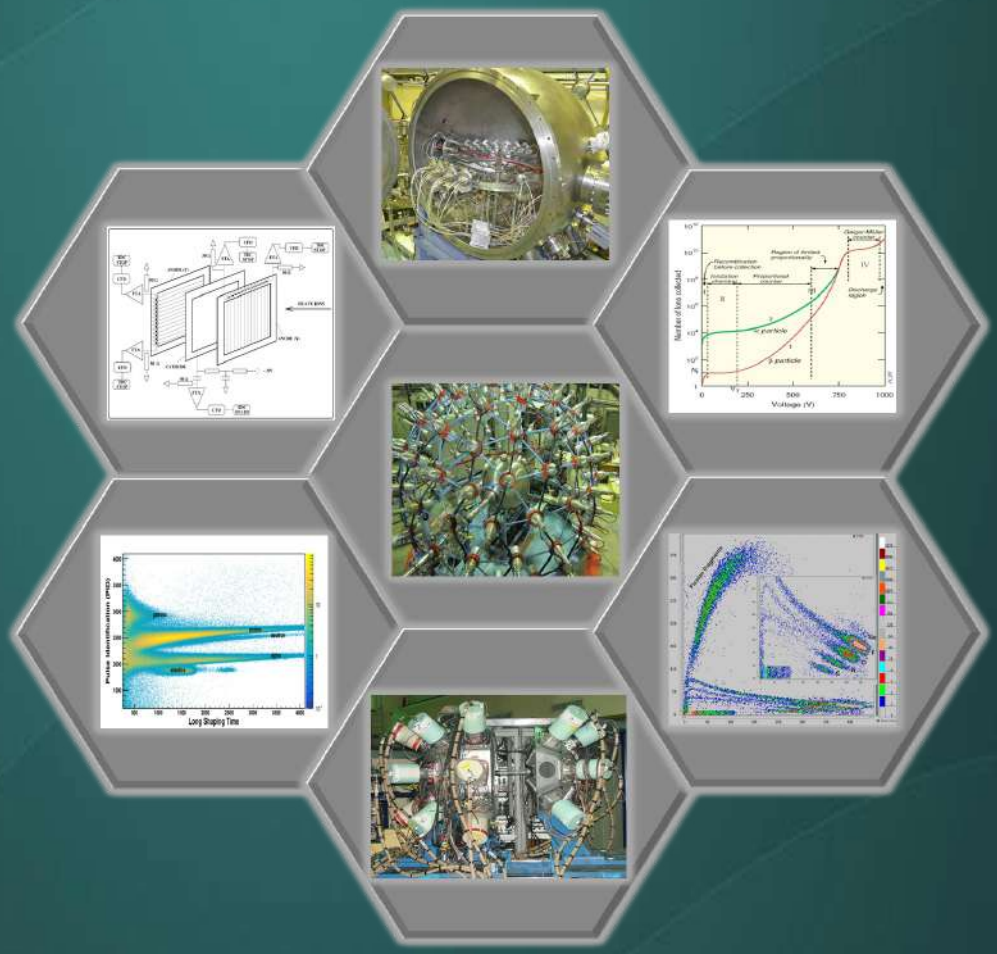
Book of Abstracts

ON-LINE Workshop on Detectors & Allied Instrumentation

(संसूचक तथा सम्बंधित उपकरण पर कार्यशाला)

November 22 - 25, 2022

Inter University Accelerator Centre (IUAC), New Delhi
(अंतर विश्वविद्यालय त्वरक केंद्र, नई दिल्ली)



Editors
M. Kumar, A. Jhingan

Organized & Sponsored by
Inter University Accelerator Centre (IUAC), New Delhi

Organizing committee

Dr. A. Jhingan
Dr. R. P. Singh
Dr. J. Gehlot
Mr. N. Saneesh
Mr. M. Kumar
Mr. A. Kumar
Dr. P. Sugathan

ON-LINE Workshop on Detectors and Allied Instrumentation

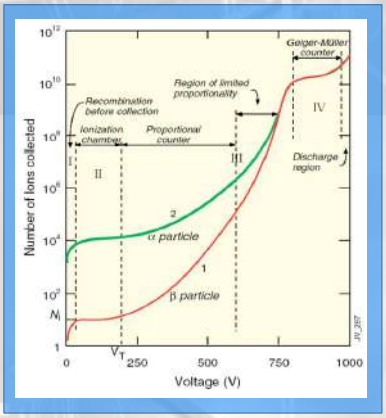
(संसूचक तथा सम्बंधित उपकरण पर कार्यशाला)

22nd Nov. - 25th Nov., 2022

Inter University Accelerator Centre (IUAC), New Delhi

(अंतर विश्वविद्यालय त्वरक केंद्र, नई दिल्ली)

We are pleased to announce ***Workshop on Detectors and Allied Instrumentation*** at IUAC. The objective of the workshop is to provide young researchers exposure on experimental and theoretical aspects of Radiation Detectors and their application in experiments around Coulomb barrier and related nuclear structure studies. Workshop will cover lectures and talks on fundamentals of detector operating principles, design aspects, simulations and its front-end electronics. The talks will also focus on industrial applications of detectors, and will give a perspective of future experiments with the existing and upcoming nuclear physics facilities in India and the world. Short presentations by the young researchers will be encouraged. The workshop will be conducted in on-line mode.



Particle Detectors and allied nuclear instrumentation play a very important role in nuclear physics experiments. Wide range of detectors are used to perform these experiments. These include gas detectors such as proportional counters and ionization chambers, solid state detectors based on semiconductors and scintillators, liquid detectors based on hydrocarbons etc. Detector systems are designed to provide information about the identity of reaction products. Apart from their use in basic research, detectors are widely used in medical imaging, security and many other industrial applications. The main objective of this workshop is to provide exposure to young researchers on the principles of radiation detection and allied signal processing techniques.

Topics to be covered

- Interaction of Radiation with matter
- Ionization chambers & proportional counters
- Silicon, Germanium & Micro-channel Plates
- Organic and Inorganic scintillators
- Particle Identification Techniques
- Signal processing techniques
- Simulation techniques

Organizing committee

A. Jhingan (Contact person)
R. P. Singh
J. Gehlot
N. Saneesh
M. Kumar
A. Kumar
P. Sugathan

Interested students from universities and research institutes pursuing Ph.D in nuclear physics, and young faculty members are encouraged to attend this workshop. Those interested may apply with their bio-data, and a recommendation letter from their Ph.D guide/supervisor by 15th November 2022 at the following link:

https://gate.iuac.res.in/iuac_forms/index.php/web_panel/home/website/5

Contact Email : iuacdetector.workshop@gmail.com

ON-LINE Workshop on Detectors and Allied Instrumentation

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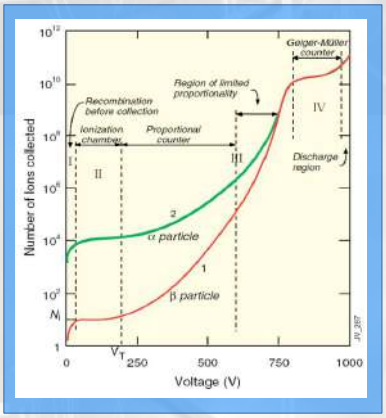
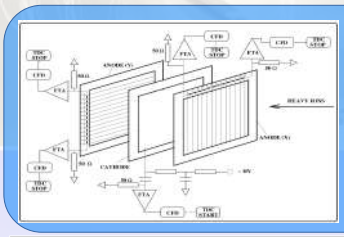
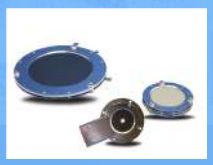
हम हर्ष के साथ आई.यू.ए.सी. में संसूचक तथा सम्बंधित उपकरण पर कार्यशाला की घोषणा करते है। कार्यशाला का उद्देश्य युवा शोधकर्ताओं को विकिरण संसूचक का प्रयोगात्मक और सैद्धांतिक अनुभव प्रदान करना, तथा कूलम्ब बैरियर के आसपास के प्रयोगों से संबंधित परमाणु संरचना अध्ययन में उनके अनुप्रयोग की जानकारी देना है। कार्यशाला में संसूचक परिचालन सिद्धांतों के मूलतत्त्व,रचनात्मक पहलू, सतत अनुकरण और इसके सम्बंधित यंत्र पर व्याख्यान तथा चर्चा की जाएगी। व्याख्यान में संसूचक के औद्योगिक अनुप्रयोगों पर भी ध्यान केंद्रित किया जाएगा, तथा भारत और दुनिया में मौजूदा और आगामी परमाणु भौतिकी सुविधाओं के साथ भविष्य के प्रयोगों के परिप्रेक्ष्य पर चर्चा की जाएगी। युवा शोधकर्ताओं द्वारा लघु प्रस्तुतियों को प्रोत्साहित किया जाएगा। कार्यशाला ऑनलाइन मोड में आयोजित की जाएगी।



विकिरण संसूचक और संबंधित उपकरण परमाणु भौतिकी प्रयोगों में एक बहुत ही महत्वपूर्ण भूमिका निभाते हैं। संसूचकों की विस्तृत श्रृंखला इन प्रयोगों को करने के लिए उपयोग में लायी जाति है। इनमें गैस संसूचक शामिल हैं जैसे आनुपातिक गिनती यंत्र और आयनीकरण कक्ष, ठोस सेमीकंडक्टर्स और सिंटिलेटर, और तरल पदार्थ पर आधारित हाइड्रोकार्बन आदि शामिल हैं। संसूचकों की रचना परमाणु प्रयोगों के उत्पादों की पहचान के लिये की जाति है। बुनियादी अनुसंधान के अलावा उनका उपयोग चिकित्सीय इमेजिंग, सुरक्षा और कई अन्य औद्योगिक अनुप्रयोग में व्यापक रूप से किया जाता है। इस कार्यशाला का मुख्य उद्देश्य युवा शोधकर्ताओं को विकिरण का पता लगाने और संबद्ध संकेत प्रसंस्करण के सिद्धांतों की तकनीक का ज्ञान प्रदान करना है।







व्याख्यान में सम्मिलित विषय

- विकिरण तथा पदार्थ की परस्पर क्रिया
- आयनीकरण कक्ष और आनुपातिक गिनती यंत्र
- सिलिकॉन, जर्मेनियम और माइक्रो-चैनल प्लेट्स
- कार्बनिक और अकार्बनिक सिंटिलेटर
- कण पहचान तकनीक
- संकेत प्रसंस्करण तकनीक
- सतत अनुकरण तकनीक

आयोजन समिति

अखिल झिंगन (संपर्क व्यक्ति)
आर. पी. सिंह
जे. गहलोत
एन. सनीश
एम. कुमार
ए. कुमार
पी. सुगथन

परमाणु भौतिकी में पीएचडी करने वाले विश्वविद्यालयों और शोध संस्थानों के इच्छुक छात्र, तथा शोधकर्ताओं को इस कार्यशाला में भाग लेने के लिए प्रोत्साहित किया जाता है। इच्छुक छात्र अपने जीवनी विवरण तथा पीएचडी गाइड/पर्यवेक्षक से एक सिफारिश पत्र के साथ आवेदन कर सकते हैं। आवेदन करने की अंतिम तिथी 15 नवंबर 2022 है।
नवीनतम जानकारी और आवेदन के लिए, निम्न लिंक का उपयोग करें।

https://gate.iuac.res.in/iuac_forms/index.php/web_panel/home/website/5

संपर्क करे Email : iuacdetector.workshop@gmail.com

On-line Workshop on Detectors and Allied Instrumentation

(TIME TABLE)

Workshop link - meet.google.com/ajh-akon-sae

Tuesday 22.11.2022, Day 1

Opening Session ***09.30 - 10.30 AM***	*Welcome Address*
	Opening Remarks *Prof. A. C. Pandey (Director IUAC)*
	Keynote Address *Dr. Amit Roy (Former Director IUAC)*
	Vote of Thanks
10.30 – 11.00	***Tea Break***

	Prof. Sukalyan Chattopadhyay (SINP, Kolkata) ***(Session Chairman)***
11.00 – 12.00	**Introduction to Radiation Detection & Measurement** *Dr. P. Sugathan, IUAC New Delhi*
12.00 – 13.00	**Introduction to Gas Detectors** *Dr. Akhil Jhingan, IUAC New Delhi*

13.00 – 14.30	***Lunch Break***

	A. Jhingan, IUAC New Delhi **(Session Chairman)**
14.30 – 15.30	**Introduction to Semiconductor Detectors** *Dr. K. Mahata* *Nuclear Physics Division, BARC, Mumbai*

15.30 – 16.00	***Tea Break***

	Dr. R. P. Singh, IUAC New Delhi **(Session Chairman)**
16.00 – 17.00	**Introduction to Scintillator Detectors** *Dr. Tumpa Bhattacharjee* *Physics Group, VECC, Kolkata*

17.00 – 18.00	***Tea Break***

18.00 – 19.00	**Particle and Radiation Detectors – Heavy Ion Research at GSI Helmholtz Centre** *Evening Seminar* ***Prof. H. J. Wollersheim*** *GSI – FAIR, Darmstadt, Germany*

Workshop on Detectors and Allied Instrumentation

Wednesday 23.11.2022, Day 2

	Prof. Devinder Mehta (Panjab University, Chandigarh) **(Session Chairman)**
09.30 – 10.30	**Signal Processing Techniques** *Dr. R. K. Bhowmik, IUAC*
10.30 – 11.30	**Data Acquisition Systems** *Subramaniam E T, IUAC*

11.30 – 12.00	***Tea Break***

	Prof. B. R. Behera (Panjab University, Chandigarh) **(Session Chairman)**
12.00 – 12.30	**Focal Plane Detector Systems for Recoil Mass Spectrometers** *Dr. Jagdish Gehlot, IUAC New Delhi*
12.30 – 13.00	**Detector systems for NAND and GPSC facilities** *Dr. N. Saneesh, IUAC New Delhi*

13.00 – 14.30	***Lunch Break***

	Prof. A. M. Vinodkumar (University of Calicut, Kerala) **(Session Chairman)**
14.30 – 15.00	**Tools for gamma ray spectroscopy at IUAC** *Dr. R. P. Singh, IUAC New Delhi*
15.00 – 15.30	**Recoil Mass Spectrometer facilities at IUAC** *Dr. Subir Nath, IUAC New Delhi*
15.30 – 16.00	***Tea Break***
	Prof. B. P. Singh (Aligarh Muslim University) **(Session Chairman)**
16.00 – 16.30	**NAND and GPSC facilities at IUAC** *Dr. K. S. Golda, IUAC New Delhi*
16.30 – 17.00	**Atomic and Molecular facilities at IUAC** *Dr. C. P. Safvan, IUAC New Delhi*
17.00 – 18.00	***Tea Break***

18.00 – 19.00	**A glimpse of physics opportunities and detection assets of GANIL-SPIRAL2** Evening Seminar ***Dr. Antoine LEMASSON*** *GANIL CEA/DRF, CNRS/IN2P3, Caen, France*

Workshop on Detectors and Allied Instrumentation

Thursday 24.11.2022, Day 3

	Dr. S. Muralithar (IUAC, New Delhi) **(Session Chairman)**
09.30 – 10.30	**Detector development activities at IUAC** *M. Kumar, IUAC New Delhi*
10.30 – 11.00	**Advances in Gamma-ray Detection for Nuclear Structure Studies and Applied Sciences** *Prof. R. Palit (TIFR, Mumbai)*
11.00 – 11.30	**Microchannel plate detectors in Nuclear Reaction studies** *Prof. Sunil Kalkal (TIET, Patiala, Punjab)*
11.30 -12.00	***Tea Break***
	Prof. B. K. Nayak (HBNI-BARC, Mumbai) **(Session Chairman)**
12.00 – 12.30	**Neutron detection techniques and their applications in nuclear reaction studies** *Dr. Kaushik Banerjee, VECC Kolkata*
12.30 – 13.00	**Detector development activities at BARC** *Dr. P. C. Rout, BARC Mumbai*
13.00 – 14.30	***Lunch Break***
	Dr. N. Madhavan (IUAC, New Delhi) **(Session Chairman)**
14.30 – 15.00	**Techniques in High Energy Gamma Ray Spectroscopy** *Prof. I. Mazumdar, TIFR Mumbai*
15.00 – 15.30	**Compact scintillator-based position-sensitive detector system for detection of photons and electrons** *Prof. Samit Mandal (Delhi University)*
15.30 – 16.00	***Tea Break***
	Dr. S. S. Ghugre (UGC-DAE CSR, Kolkata Centre) **(Session Chairman)**
16.00 – 16.30	**Digital Route to Gamma Spectroscopy:the Kolkata Context** *Dr. Rajarshi Raut, UGC-DAE CSR, Kolkata Centre*
16.30 – 17.00	**Scintillation Detectors : Eyes of Radiation Oncologist** *Dr. D. Siwal, Baba Farid University of Health Sciences, Faridkot, Punjab*
17.00 – 18.00	***Tea Break***

18.00 – 19.00	**Radiation detectors in nuclear and particle physics and some applications** Evening Seminar ***Dr. Archana Sharma*** *Experimental Physics Department, CERN Geneva, Switzerland*

Workshop on Detectors and Allied Instrumentation

Friday 25.11.2022, Day 4

	Prof. J. J. Das (Cotton University, Guwahati) **(Session Chairman)**
09.30 – 10.15	**GEANT4 The physics simulation Toolkit** *Dr. Sonali Bhatnagar (Dayalbagh Educational Institute, Agra)*
10.15 – 11.00	**Detectors for Nuclear Physics Experiments at VECC** *Dr. Gopal Mukherjee, VECC Kolkata*

11.00 – 11.30	***Tea Break***

	Dr. D. C. Biswas (NPD-BARC, Mumbai) **(Session Chairman)**
11.30 – 12.00	**Single crystal scintillators for nuclear radiation detection; basics to novel devices** *Dr. Mohit Tyagi, TPD-BARC Mumbai*
12.00 – 12.30	**Possibility of using diamond detectors in high current low energy experiments** *Dr. Chinmay Basu, SINP Kolkata*

12.30 – 14.30	***Lunch Break***

	(Session Chairman)
14.30 – 15.30	**Summary Talk** *Dr. B. K. Nayak (Raja Rammana Fellow HBNI-BARC)*

15.30-16.00	***Tea Break***

16.00 – 17.00	**Discussion Session** *Dr. A. K. Sinha (UGC DAE CSR, Indore)* **(Session Chairman)**
17.00	***Closing***

Opening Remarks by Director IUAC

Prof. A. C. Pandey

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067

Prof. Avinash Chandra Pandey is Director IUAC since August 2018. Prior to this, he has held several important positions such as Director, Institute of Interdisciplinary Studies, University of Allahabad (2016-2018),Vice Chancellor of Bundelkhand University from 2012 to 2015. Prior to that he was a Professor at University of Allahabad. He obtained his masters in Physics & Mathermatics followed PhD from University of Allahabad. As a Principal Investigator he led to development of three new centres in Allahabad University. He is accredited with the development of the Nanotechnology Application Centre (NAC) besides setting up of High Fluence Ion Beam Facility: a state of art Ion Implanter facility in the premises of University of Allahabad and Innovation Center, Weather Station, Animal Research Facility at Bundelkhand University. He has earlier been Professor & Founder Head, Department of Atmospheric & Ocean Sciences and Co-ordinator of K Banerjee Centre of Atmospheric & Ocean Studies, M N Saha Center of Space Studies at University of Allahabad. He is also an Adjunct Professor at Michigan Tech, USA. His researches have focused in developing novel nonmaterial for various real life applications from LED, PDP, biomedical and diagnostics and a new fluorescent carbon material besides non-linear dynamics and surface modification using ion beams. Prof. Avinash Chandra Pandey has been an Associate of ICTP, Trieste, Italy (2004- 2009). He has been member of governing boards and academic councils/courts of many institutes such as INST, Mohali ARIES, Nanital, Dr H S Gour University, Saugor and University of Allahabad. He is a member of many academic societies such as American Physical Society, Ion Beam Society of India, Indian Meteorological Society, Computer Society of India, IETE, Biotechnology Research Society of India etc.

Getting to know nature through detectors

Amit Roy

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067

Email: amitroy1948@gmail.com

Nature equipped us with five sensors to learn about the world around us. Over the years human ingenuity has extended our knowledge about the universe in macro and micro scale through the invention of detectors of different kinds. I shall give a brief sketch of the evolution of this journey and in particular the radiation detectors of interest

Amit Roy completed his Masters in Physics from Delhi University in 1968 and his Ph.D. from Tata Institute of Fundamental Research, Mumbai in 1975 where he continued till 1990 as Associate Professor. He spent two years at Florida State University, USA as a Post-Doctoral Fellow and has worked at KVI, Netherlands and Argonne National Laboratory, USA as visiting scientist. He joined Inter-University Accelerator Centre (formerly Nuclear Science Centre) as a senior scientist in 1991 and was its director from 2001 till July 2013. He led the team for building the Superconducting Linac at IUAC and pioneered the development of Niobium superconducting cavity for accelerators in India. He was DAE Raja Ramanna Fellow at Variable Energy Cyclotron Centre, Kolkata, till May 2017. He is Guest Lecturer at Indian Association for the Cultivation of Science, Kolkata and Adjunct Professor at Manipal Centre for Natural Sciences. His research interests are in Nuclear Physics, Accelerator Physics and Atomic Physics. He is a Fellow of the National Academy of Sciences, India and received the Eminent Scientist award of the Indian Nuclear Society. He has served as member of Governing Boards and Councils of several institutes and as member of many National and International Scientific and Technical Committees. He was President of Indian Cryogenics Council for two terms and Chairman of Asian Committee of Future Accelerators for one term. He enjoys communicating science and has written the Great experiments in Physics series in the journal of Science Education, Resonance and a book by the same name.

Introduction to radiation detection & measurement

P. Sugathan

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi – 110067

email: sugathan@iuac.res.in

Radiation detectors are important for Nuclear and Particle physics research experiments. Physics and instrumentation of radiation detectors find applications in fields such as research, security, medicine etc. In this talk, I will try to present basic introduction to type of radiation detectors typically used in nuclear/particle experiments. The lecture will introduce to historical developments, emergence of detectors from early discoveries, working principle of different detectors, detection and measurement techniques and electronics instrumentation.

Dr. P. Sugathan works at Inter University Accelerator Centre (IUAC), New Delhi as a Scientist. He has more than 33 years of academic experience in experimental nuclear physics. He worked on different types of radiation detectors, nuclear electronics, computation and data analysis and was instrumental in implementing various experimental facilities to augment the research programs at IUAC and. His current research interest is physics and instrumentation for study of fusion-fission reaction using heavy ion induced reactions. He has co-authored more than 100 publications and mentored PhD students at IUAC

Introduction to Gas Detectors

Akhil Jhingan

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi - 110067, India

Email: jhinganakhil@gmail.com

Gas detectors are being used at every nuclear physics facility in the world due to several important advantages they offer for charged particle detection. They are also in use for the detection of minimum ionizing particles such as X-rays, cosmic radiations etc. They work on the principle of ionization and excitation of the gas molecules caused by the passage of radiation. They offer good stability, robustness, radiation hardness, flexibility to design in large areas with different geometries, possibility to tune the effective thickness by varying the gas pressure, provides moderate energy resolutions and good timing resolutions, can handle high count rates without any radiation damage etc. In other words, they offer a very efficient, inexpensive and flexible solution as compared other detectors for the radiation detection. Operating parameters such as applied electric field, gas pressures etc. can be adjusted to operate them in different regions such as ionization, proportional/avalanche, limited proportional, Geiger mode etc. In this lecture, the operation principle and the different kinds of gas detector systems for charged particles employed will be presented, with particular focus on the requirements of nuclear physics experiments.

Dr. Akhil Jhingan is currently working at Detector Development Laboratory of IUAC (formerly known as Nuclear Science Centre), New Delhi. He is mainly involved in the development of charged particle detectors such as position sensitive multi-wire proportional counters, gas ionization chambers, silicon strip detector systems, hybrid gas-silicon detector systems, CsI – photo-diode detector system etc., and their hybrid amplifier units for signal processing used routinely in nuclear physics experiments. He obtained his M.Sc. Physics degree from Jamia Millia Islamia, New Delhi. He has joined IUAC in 1997 and since then has been actively involved in the research and development on charged particle detector systems for Nuclear Physics experiments. He obtained his PhD degree from Panjab University, Chandigarh in 2016.

Introduction to semiconductor detectors

K. Mahata

Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai 400085, INDIA

Email: kmahata@barc.gov.in

Semiconductor detectors are extensively used for detection of ionizing radiation in basic research as well as in applied areas. Advantages of using semiconductor detectors include extremely high energy resolution, compact size, good stability and simplicity of operation. Large area semiconductor detectors with pixel/ strips allows high resolution position and track measurement. Semiconductor detectors also give good time resolution. Generally silicon detectors are used for charged particle measurement and high purity germanium (HPGe) is used for gamma ray detection. While ΔE-E technique is widely used to identify charge particles, time-of-flight and pulse shape discrimination techniques are being explored to increase the dynamic range. Basic properties of semiconductors and working principles of semiconductor detectors will be discussed in this talk.

Dr. K. Mahata, presently working as Scientific Officer - H at NPD, BARC, Mumbai and a faculty at Homi Bhabha National Institute (HBNI), Mumbai, received his Ph.D. degree from Mumbai University based on experimental research work carried out using the BARC-TIFR Pelletron LINAC facility at Mumbai. He was a post-doctoral fellow at GSI, Germany. His current studies focus on experimental nuclear physics. He has expertise in heavy-ion induced fusion fission and reactions involving weakly bound projectiles around the Coulomb barrier. He has been also involved in development of nuclear instrumentation and techniques. He is the recipient of young scientist (2007), scientific and technical excellence award (2016) and a Group Achievement award (2010) of DAE. He has co-authored about 140 peer-reviewed journal articles.

Introduction to Scintillator Detectors

Tumpa Bhattacharjee

Variable Energy Cyclotron Centre, 1/AF Bidhannagar, Kolkata – 700064

Email: btumpa@vecc.gov.in

The scintillator detectors are one of the most widely used particle and photon detectiondevices in nuclear physics. 'Scintillators' are the absorbing materials with a property of luminescence and they convert the energy deposited by the incident radiation into flashes of visible or ultra-violate lights. The light signal is amplified with the use of photo sensing devices by converting it into proportionate electrical signals and thereby, used in studying thecharacteristics of the ionizing radiations. The use of scintillators has been indispensible in nuclear physics experiments today. In the present talk, the details on scintillator detectors will be discussed in the light of their use in different domains of nuclear physics research.

Dr. Tumpa Bhattacharjee is a senior scientist at Variable Energy Cyclotron Center, Kolkata and Associate Professor in Homi Bhabha National Institute, Mumbai. She has graduated from 42 nd batch of BARC training school and joined nuclear physics research at VECC, Kolkata in 1999. She received her PhD degree in Physics from Jadavpur University and her current studies are focused on exploring the exotic structures in nuclei using Indian accelerators. Her group has studied the lifetimes and transition moments in several neutron rich nuclei around 132 Sn populated with fission followed by radiochemical separation and with development of a gamma-gamma fast timing array, VENTURE, using CeBr 3 scintillator detectors. She has about 170 publications in peer reviewed journals and conferences. She is the recipient of DAE Scientific Excellence Award 2018.

Signal Processing Techniques

R. K. Bhowmik

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Signal Processing Instrumentation categorized as Nuclear Electronics is an integral part of every nuclear physics experiment. They are required to process signals from the radiation detectors while generating important information about experimental parameters such as energy and timing of each event in a nuclear reaction. Energy and timing spectroscopy requires sophisticated instrumentation and in many cases state of the art electronics in the modern nuclear physics experiments. This includes charge sensitive preamplifier, fast timing amplifiers, spectroscopy amplifiers etc. For generating timing information, variety of techniques are used that includes leading/trailing edge timing, constant fraction timing , zero-cross timing etc. Variety of other logic modules such as gate and delay generators, coincidence units etc. are used to process the desired data and reject the unwanted events. Operating parameters are varied depending upon the type of detector used and nature of experiment being performed. In this lecture, the operating principle of different type of electronics used for nuclear physics experiments will be presented with particular focus on detector systems used for experiments around coulomb barrier.

Dr. R. K. Bhowmik obtained his M.Sc in Nuclear Physics from Presidency College Kolkata in the year 1968. He did his Ph.D. from the University of Maryland, USA in the year 1974. He had post-doc position at Michigan State University from 1974-76. He held Research Fellow positions at the University of Birmingham, Kernfysisch Versneller Instituut (KVI), University of Oxford and Tata Institute of Fundamental Research from year 1976 to 1987. He joined IUAC (formerly NSC) as a senior Scientist in the year 1987. He headed the Gamma Detector Array and Electronics group at IUAC. He was the head of the Nuclear Physics group at IUAC from 2001 to 2011. He was the Principal Investigator of INGA and NAND project funded by DST. He retired from IUAC in the beginning of 2011 and joined Guru Ghasidas University, Bilaspur as a Professor from where he retired in the end of 2012. He was involved in setting up of accelerator at Bilaspur. His research areas include Nuclear Structure Physics, Heavy Ion Reactions, Nuclear Instrumentation, computer programming, development of computer codes and algorithm for data analysis. He has guided several PhD students and authored/co-authored more than 200 publications.

Data Acquisition Systems

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In this talk we would discuss the concepts of data acquisition strategies that are best suited for medium sized DAQ systems (~ 1000 parameters). A walk through the basic concepts of data acquisition systems, analysis engines that are required for the present day complex experimental setups, the digital signal processing techniques along with their pros and cons, keeping in mind the current requirements and experimental setups available. A visit to the detector simulation techniques using Geant4 package.

Mr. Subramaniam joined Inter University Accelerator Centre in the year 1989. The field of expertise are high speed digital design, mixed signal systems, communication links as well as developing analysis engines, graphical user interfaces, low level drivers to a complete full stack development. He was actively involved in the installation of Pelletron, HIRA, and all the beam lines in Phase-I along with installation of uVAX systems based DAQ systems. Developed PC based control system package (HIRACTL), and many DAQ packages (NSCSPEC, Freedom, CANDLE, MARS). Worked on the Simulation of Elastic Recoil Detection and Analysis (SERDA) and developed a package for the same in collaboration with Technical University, Munich. Worked in GANIL-IUAC-INFN collaboration for porting of Global Trigger and Synchronization module (GTS). Invloved in indigenous design and development of DAQ modules : High precision analogue to digital converter, AD814 (in collaboration with GANIL, France), CAMAC Crate controller LPCC and Event identifier modules GEM and VME Crate Controller ROSE and VME Event idenitification module VGEM.

Focal Plane Detector Systems for Recoil Mass Spectrometers

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Recoil mass Spectrometers are devices to study Nuclear Reactions. They can be used in conjunction with other detectors/arrays around target chamber or focal planee chamber for specific studies. I will talk about the existing detector setup at the focal planes of spectrometers HIRA (Heavy Ion Reaction Analyzer) and HYRA (HYbrid Recoil mass Analyzer) at IUAC New Delhi. Also will discuss different arrangements for different measurements, which can be set up during the measurements or proposed as future up-gradation of the detection system.

Dr. Jagdish Gehlot is a Scientist at Inter University Accelerator Centre, New Delhi. He joined the Nuclear Physics Group in 2005. He acquired his PhD in Nuclear Physics from Calicut University. He has been involved in the installation of gas filled separator HYRA from beginning and actively participated in initial source/beam tests of HYRA and the experiments thereafter. Also involved in maintenance and experiments with vacuum mode spectrometer HIRA. He gained the skill of Gas detector fabrication and fabricated Multi-wire proportional counters (MWPCs) for the mass separators. Currently engaged in the research work, along with the University users, involving ER (evaporation residue) and Transfer measurements. He has contributed to many publications.

Detector systems for NAND and GPSC facilities

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Nuclear fission has been the topic of extensive theoretical and experimental studies since its discovery in the year 1939. The influence of various parameters in this complex phenomenon is not yet fully known and hence nuclear fission and related phenomena continues as one of the main themes of experimental studies. Fission process is investigated experimentally from its observables such as fission fragments and particles evaporated during the evolution of fission. Properties of fission fragments like their mass distribution, angular distribution and kinetic energy distribution and the correlation of fragment mass with particle multiplicities can give important information about the nature of fission. Two major Nuclear Physics facilities, namely General Purpose Scattering Chamber (GPSC) and National Array of Neutron Detectors (NAND) have been extensively used for studying properties of fission fragment mass, and their correlation with light particle multiplicities. In this talk, I will present the detector systems used in NAND and GPSC for fission studies. The development of fission detectors in various configurations, features of liquid scintillators used for fast neutron detection, important features of the 100 detector facility, NAND, etc. will be briefly discussed.

N. Saneesh is a scientist at Inter-University Accelerator Centre (IUAC), New Delhi. He received his Master's degree in Physics from University of Calicut, Kerala. He joined IUAC in the year 2012 and contributed significantly to a number of fission studies performed using NAND and GPSC facilities. His interests are in heavy ion induced fission research, Monte Carlo calculations and detector instrumentations.

Tools for gamma ray spectroscopy at IUAC

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Gamma Detector Array (GDA) and Indian National Gamma Array (INGA) are the prime tools for gamma ray spectroscopy at Inter University Accelerator Centre (IUAC). These arrays consist of hyper-pure germanium detectors, while GDA comprises of single crystal detectors the INGA array is made up of composite detectors known as clovers. Building the level structure of nuclei using various correlations between de-excitation gamma rays and lifetime measurements have been the holy grail of studies using the above arrays. From time to time different ancillary detectors or devices are employed in conjunction with INGA and GDA arrays to enhance their capabilities. In the past ancillary devices such as multiplicity filter, charge particle detector arrays, plunger and mass spectrometers have been used. In this talk I would try to summarize the basic characteristics of the above arrays and give some examples of the studies that have been carried out using the above experimental setups.

Dr. R. P. Singh is Scientist 'H' at Inter University Accelerator Centre (IUAC) . He holds a Ph.D in Physics from Jawaharlal Nehru University (JNU), Delhi. He did his M.Sc. from University of Bombay and post-M.Sc. from Institute of Plasma research, Gandhinagar. He is one of the core members of INGA/GDA group and has played key role in setting up these experimental setups. He has also developed a plunger device for lifetime measurement of excited nuclear states in the sub-nanosecond range. His current interests are various dynamical symmetries in nuclei.

Recoil Mass Spectrometer facilities at IUAC

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Recoil separators have been useful in the study of nuclear reaction and nuclear structure for decades. Trajectories of ions, produced in nuclear reactions, are manipulated by application of electric and magnetic fields. These devices are capable of separating reaction products of interest from dominant background events, which are then detected at the focal plane. There are two recoil separators at IUAC, the Heavy Ion Reaction Analyzer (HIRA) and the HYbrid Recoil mass Analyzer (HYRA). This talk will cover the design features and operating principles of these devices along with their applications in the study of fusion, fusion-fission and multi-nucleon transfer reactions.

Dr. S. Nath obtained his M.Sc. (Physics) from Calcutta University in 1997. He joined IUAC (formerly NSC) in January 1998. He obtained his PhD from Andhra University, Visakhapatnam in 2013. He has been working in the field of heavy ion-induced nuclear reaction dynamics for over two decades. He has special interest in the design, commissioning and operation of recoil separators, sub-barrier fusion dynamics, multi-nucleon transfer reactions, fusion-fission dynamics in heavy mass region and nuclear reaction models. He has developed computer codes based on Monte-Carlo techniques which simulate study of fusion and quasi-elastic reactions using recoil separators. He has guided three PhD students (one ongoing) and mentored four research associates (one ongoing) at IUAC. He is currently working on multi-nucleon transfer reactions and coupled reaction channel analysis of measured differential transfer cross sections.

NAND and GPSC facilities at IUAC

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Inter University Accelerator Centre (IUAC) have dedicated experimental facilities to cater the basic research in experimental Nuclear Physics in the low energy region using particle accelerators. General Purpose Scattering Chamber (GPSC) and National Array of Neutron Detectors (NAND) are two major facilities used for Nuclear reaction studies at IUAC. GPSC has been extensively used for nuclear reaction studies near the coulomb barrier to study the direct reactions like elastic and in-elastic scattering, transfer reactions, quasi elastic reactions, etc and compound nuclear reactions ever since its inception in 1991. NAND is a dedicated system specially designed for the study of nuclear reaction dynamics in heavy induced fusion-fission reactions using neutron spectroscopy. The special features of these facilities, the importance experiments carried out using these facilities and the research highlights will be discussed in the lecture.

Golda K.S. has been working as a Scientist in the Nuclear Physics group of IUAC since 2001 and she has been associated with GPSC and NAND facilities. She is working in the field of Nuclear fission. She is one of the Co-PIs of the NAND project. She has authored/co-authored more than 70 peer reviewed journals in journals of international repute and more than 150 conference proceedings.

Atomic and Molecular facilities at IUAC

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In this talk an overview of the available facilities for conducting Atomic and Molecular Physics facilities will be provided. At present experimental areas are available for high energy (Pelletron or LINAC) and low energy (positive) ion beams. At the high energy beam line, situated in Beam Hall 2, experiments mainly use the beam foil technique to study the lifetimes and excited state dynamics. The available equipment includes beam two-foil excitation and X-ray detectors. A new electrostatic charge state separator is in the process of being built. Further a Doppler tuned spectrometer is available for use in the general-purpose scattering chamber for high precision X-ray measurements. At the low energy ion beam facility, the beam foil technique is used to measure L and M shell citation cross sections. The recoil ion momentum spectrometer at the low energy ion beam facility is used to study the kinematics and dynamics of molecular dissociation. Studies include the measurements of lifetimes, angular distributions, kinetic energy releases, intra molecular bond rearrangementsand dissociation pathways. A decelerator system is available and has been used to study the interaction of slow ions with biological molecules, as well as measure ECR plasma potentials. An upcoming penning trap will be used for measurements of metastable lifetimes and ion electron interactions.

Dr. C. P. Safvan did his B.Sc and M.Sc from Bangalore University. He did his Ph.D from TIFR in the field of Molecular Dissociation dynamics. This was followed by Post-doc from the University of Aarhus, Denmark (1997-99). Thereafter he has been working as a Scientist at IUAC since 1999. His area of work includes Atomic and Molecular Physics, and Accelerator Development. He has been the recipient of INSA Young Scientist Award and IUAC Excellence Award. He has been involved in several International Collaborations namely CIMAP-Ganil (France), GSI (Germany), Tokyo Metropolitan University (Japan) etc.

Detector development activities at IUAC

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Inter University Accelerator Centre (IUAC), New Delhi provides facilities for nuclear physics experiments, focused at energies around Coulomb barrier, using the Pelletron-LINAC accelerator system. The heavy-ion induced fusion and fusion-fission reactions are characterized by performing measurements such as fission mass and angular distributions, fusion cross-section and barrier distributions, multi-nucleon transfer, neutron and charged particle multiplicity, Coulex etc. To execute these experiments, detector systems based on position sensitive and fast timing proportional counters, particle identification telescopes based on gas ionization chambers and gas-silicon detectors, and scintillators for light charged particle and neutron detection have been developed. The detectors are routinely used in experiments involving facilities of mass spectrometers, scattering chamber, gamma and neutron array at IUAC. New detector systems are being planned and developed for these facilities as well as for the future facilities such as FAIR and SPIRAL2. An overview of techniques involved in detector fabrication and developments in detector instrumentation at IUAC will be presented.

Mohit Kumar did his B.Sc and M.Sc from Delhi University. He did M. Tech in Opto-electronics and optical communication from IIT Delhi in 2013. He worked as assistant professor in Shyam Lal college, Delhi University for one year. Thereafter he joined IUAC as a Scientist. He has been working in the development of charged particle detectors system for nuclear physics experiments at IUAC. He has been contributing to fusion-fission, fission experiments in NAND and GPSC since joining, currently involved in CPDA project of IUAC.

Advances in Gamma-ray Detection for Nuclear Structure Studies and Applied Sciences

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Recent developments in radiation detectors provide new opportunities to study nuclear structure and reaction dynamics. Improvement in detection efficiency, along with better energy, time, and position resolutions, are crucial for these studies. I will present an overview of our current activities related to detector developments for nuclear structure studies. The performance of various ancillary detectors coupled with the Digital INGA will be highlighted. Our involvement in the DEcay SPECtroscopy (DESPEC) Germanium Array Spectrometer (DEGAS) project at FAIR for the development of the detectors in the different phases will be discussed. In addition to the nuclear physics experiments, some of these detectors have the potential to serve the medical imaging industry because of their better spatial sensitivity.

Rudrajyoti Palit is a Professor at Tata Institute of Fundamental Research, Mumbai (TIFR) in the Department of Nuclear and Atomic Physics. He got his Ph D in nuclear physics from TIFR in 2001. After post-doctoral work at the Institute of Kernphysik, Frankfurt University and Gesellschaft für Schwerionenforschung (GSI), Darmstadt, Germany, he joined TIFR as a faculty in 2004. He is interested in the investigation of the structure of exotic nuclei and nuclear isomers using large gamma detector arrays. He is involved with some of the R&D efforts related to the Indian National Gamma Array (INGA) within India and DEspec Gamma Spectrometer (DEGAS) at the future FAIR facility for nuclear structure studies.

Microchannel plate detectors in Nuclear Reaction studies

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To characterize the reaction outcome in nuclear physics experiments, the energy, angle, mass and charge number etc. have to be determined. For identification of the particles produced in a nuclear reaction, a detector system with good energy, timing and position resolutions is required. The atomic (charge) number of the reaction products is routinely determined by using a ΔE-E detector whereas; the mass identification is performed using time-of-flight (ToF) measurements. Therefore, the timing resolution of a detector determines the mass resolution of the set-up. To obtain the ToF information of the reaction products, microchannel plate (MCP) detectors are the best suited due to their fast timing response. Timing resolution as good as ~ 100 ps can be obtained. ToF set-ups based on MCPs are being used routinely in various labs worldwide for different types of nuclear physics experiments. A ToF spectrometer, CORSET, consisting of two ToF arms based on MCP detectors, was developed at JINR, Dubna, to identify the nuclear reaction products. A transmission-type MCP detector system is being developed based on the principle of secondary electron emission for the transfer reaction measurements in the General Purpose Scattering Chamber (GPSC), Inter University Accelerator Centre (IUAC), New Delhi. This requires designing and fabrication of an electrostatic mirror for focusing the secondary electrons on the MCP. In this talk, the results of simulations of electron trajectories under different scenarios along with working principle of the microchannel plate detectors will be discussed.

Dr. Sunil Devi is working in the School of Physics and Materials Sciences, Thapar Institute of Engineering and technology, Patiala, Punjab. She received her Ph.D. degree from the University of Delhi on heavy ion fusion and transfer reactions. She worked as a post-doctoral fellow in Indiana University on developing TOF setup using MCP. She also worked as research fellow in the Department of Nuclear Physics at the Australian National University, Canberra on reactions with weakly bound nuclei. Her current research studies focus on fusion and transfer reactions.

Neutron detection techniques and their applications in nuclear reaction studies

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Neutron carries important information about the reaction dynamics for an in-beam nuclear collision. Detection and identification of neutrons and measuring their energy and multiplicity on an event by event basis is the basic requirement. Detection of neutrons strongly depends on their energy. Fast neutrons (Energy > 500 KeV) are generally detected by liquid scintillator based detectors whereas thermal/epithermal neutrons are detected using 3He/BF3 based gas proportional counters. In this talk I will present the detection principles of different types of neutron detectors and their applications in nuclear reaction studies.

Dr. Kaushik Banerjee joined the Variable Energy Cyclotron Centre in 2003 after graduating from the 46th batch of the BARC Training School. He is responsible for the development of the neutron detectors array at VECC. He completed his PhD in 2013. Dr. Banerjee worked as a post-doctoral fellow in Australian National University during the period 2017 – 2019. His research interests include fusion fission dynamics, neutron spectroscopy and instrumentation for fast neutron detection. Some of his notable research works are as follows; study of reaction mechanisms in cold fusion reactions (reaction with Pb and Bi) used for the super heavy elements synthesis and fade out of collective enhancement in nuclear level density at higher excitation energy. He received IPA S N Seshadri Instrumentation award 2014 and DAE scientific and technical excellence award 2017.

Development of Scintillation Detectors for Nuclear and High Energy Physics Experiments

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The scintillators convert the fraction of energy deposited by the ionising radiation into light which can be detected using a photo device such as a photomultiplier tube(PMT), photo-diode, or silicon photo-multiplier. Inorganic scintillators , NaI, CsI, BGO, BaF2, LaBr3 etc are mostly used for high energy gamma spectroscopy and multiplicity measurement due to its high quantum efficiency while the organic scintillators such as plastic and liquid scintillators are used for fast neutron and neutrino measurements. In this talk, we will discuss the experimental setups at the BARC-TIFR Pelletron LINAC Facilty (PLF) to carry out high-energy gamma and fast neutron spectroscopy. The LaBr3 array is used for high energy gamma-ray measurements and BGO multiplicity array is used for gamma ray multiplicity measurement to obtain the angular momentum populated in the compound nucleus. The array of plastic scintillators(1mx1m) and liquid scintillator array will be discussed for fast neutron spectroscopy at the PLF and anti-neutrino measurement using research reactor. Finally, we will discuss the recent indigenous R&D efforts to develop linearly alkyl benzene based liquid scintillators and deuterated water based liquid scintillators for neutrino and neutron measurements.

Dr. Prakash Chandra Rout is working as a scientific officer (SO/G) at Bhabha Atomic Research Center Mumbai, Associate Professor at HBNI Mumbai and an alumnus of Indian National Young Academy of Science (INYAS). He joined Nuclear Physics Division after graduating BARC training school and obtained Ph.D degree in Nuclear Physics from HBNI Mumbai. His research interests are experimental nuclear physics using heavy-ion accelerators in the country and development of scintillation detectors for fast neutron spectroscopy and neutrino experiments. He has received Best graduate student and University Gold medal in both B.Sc and M.Sc for ranking first, prestigious INSA Medal for Young Scientists-2014 by Indian National Science Academy, New Delhi, Best Young Physicist Colloquium Award-2014 by Indian Physical Society Kolkata, DAE-Young Scientist Award-2014 by Department of Atomic Energy, DAE Science and technology excellence Award-2019 by Department of Atomic Energy. He has completed five-year tenure of Membership of Indian National Young Academy of Sciences New Delhi, Member of Indian Physical Society Kolkata, Member of many scientific committees of DAE. He has also contributed to science outreach and soft skill development programs for promotion of science education in school colleges and among research scholars.

Techniques in High Energy Gamma Ray Spectroscopy

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Measurements of high energy gamma rays (~ 5 to 50 MeV) from the decay of the Giant Dipole Resonance (GDR) states in excited atomic nuclei continues to be one of the leading topics of research in nuclear structure studies involving low and medium energy projectiles. The analysis of continuum high energy gamma rays spectrum provides valuable information about the structure and structural evolution of the atomic nucleus at high excitation energy and angular momentum. However, the GDR decay is a rare process compared to the emission of neutrons and charged particles from an excited nucleus. The detection of high energy GDR gamma rays demand large volume detectors of high efficiency. In addition, several associated techniques are involved to mitigate the issues concerning pileup events, rejection of neutrons, rejection of cosmic ray induced backgrounds etc. Exclusive measurements of GDR gamma rays also demand ancillary detection systems, like, sum-spin spectrometers for detection of discrete, low energy gamma rays in conjunction with the high energy GDR gamma rays. In this talk we will discuss all the necessary techniques for exclusive measurements of high energy GDR gamma rays. We will also review some of the major facilities from the past and existing facilities for high energy gamma rays spectroscopy.

Indranil Mazumdar is currently Professor of Nuclear Physics and Dean, Infrastructure at the Tata Institute of Fundamental Research, Mumbai. Indranil read physics at Delhi University and received his PhD in nuclear physics jointly from Nuclear Science Centre (currently, Inter University Accelerator Centre) and University of Delhi. He did post-doctoral work from State University of New York at Stony Brook. Later, Indranil spent extended period on sabbatical leave at the Triangle Universities Nuclear Laboratory (TUNL) at Duke University, North Carolina, USA. His research interests span both theoretical and experimental investigation of problems of nuclear structure and reaction and associated instrumentation. Indranil is an elected member of the National Academy of Sciences in India (NASI) and winner of the Swarnajayanti award and fellowship of the Govt. of India. In more recent times he has co-authored a monograph titled " Few Body Dynamics, Efimov Effect and Halo Nuclei " and published by Springer.

Compact scintillator-based position-sensitive detector system For detection of Photons and electrons

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A brief overview of the scintillator coupled with a position-sensitive Photomultiplier Tube (PMT) and Silicon Photo-multiplier (SiPM) for the detection of gamma rays and electrons will be presented. A Cerium-doped Lutetium Yttrium Orthosilicate (LYSO) crystal-based precision gamma detection system has been developed using a position-sensitive photo-multiplier tube, with minimal pulse processing requirements. The assembly's detailed characterization will be discussed. This kind of setup with a precise spatial resolution can be very useful for scanning high-purity germanium detectors that use pulse shape analysis algorithms for signal processing in gamma-ray spectroscopy experiments. This kind of detector can be used in various fields, vis-à-vis, medical imaging, radioactive waste management, nuclear proliferation control, and various applications that precisely identify and locate radioactivity.

Dr. Samit Kr Mandal is a Senior Professor of Physics at the Department of Physics & Astrophysics, University of Delhi. He received his Ph.D. degree from the University of Kalyani based on the research work carried out at the Nuclear Science Centre, New Delhi, and was a post-doctoral fellow at the Saha Institute of Nuclear Physics, Kolkata, and GSI Helmholtzzentrum für Schwerionenforschung, Germany. His current studies focus on the multi-nucleon transfer and its effect on fusion reactions, the fission time scale, the development of a gamma tracking array based on the Pulse Shape Analysis technique, and the setup for neutron capture cross-section for nuclear astrophysics using neuron activation technique. He is a member of several national and international committees and at the present joint secretary of the Indian Physics Association. He has published more than 160 peer-reviewed journal articles and supervised more than eight doctoral (Ph.D.) students, dissertations for several master's students, and mentored the work of four post-doctoral fellows.

Digital Route to Gamma Spectroscopy: the Kolkata Context

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Advent of digitizer based pulsed processing and data acquisition (DAQ) systems has revolutionized experimental practices including those in nuclear physics. Digital DAQ is now being used at facilities for nuclear spectroscopy across the globe wherein exotic excitation phenomena of the atomic nucleus are being pursued with the state-of-the-art experimental setups of large detector arrays along with fast and efficient instrumentation for pulse processing and data acquisition. The application of digitizers therein has made it possible to accommodate higher event rates, as is necessary in the pursuit of rare (excitation) phenomena, as well as to combine different genres of detectors in a compact framework. The merit of fast processing and the time stamped data that characterize the digital DAQ provide for validation of events beyond the real time acquisition, thus facilitating wider choice of (event) trigger conditions for stringent checks on the experimental observations. Digital DAQ systems are being used with the Indian National Gamma Array (INGA) for over a decade now. The understanding of the evolved setup and its expanded usage for diverse (nuclear structure) studies have substantially progressed through these years. The proposed presentation at the present Workshop aspires to summarize the application of the digital methodology in gamma spectroscopy and the associated endeavours in the country, particularly in Kolkata that has recently hosted an experimental campaign of the Digital INGA at the Variable Energy Cyclotron Centre (VECC). More than thirty experiments were carried out during the campaign and a number of publications have already resulted therefrom. Different aspects of the digital DAQ, that was used to sustain the campaign, will be elaborated during the presentation.

Rajarshi Raut is a Scientist at UGC-DAE Consortium for Scientific Research, Kolkata Centre. His current research interests are nuclear structure studies through gamma-ray spectroscopy along with allied instrumentation and software development for data reduction and analysis. He has particular interest in nuclear level lifetime measurements using Doppler shift methods. He has around 70 publications in international peer reviewed journals. He did his Post-Doctoral research at Triangle Universities Nuclear Laboratory (TUNL), Duke University, USA. He did his Ph.D from Saha Institute of Nuclear Physics (SINP), Kolkata.

Scintillation Detectors : Eyes of Radiation Oncologist

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Detectors have widespread usage in nuclear and high energy physics, nuclear nonproliferation, homeland security, elemental analysis, X-ray imaging in satellite cameras and much more. Their medical application includes ; soft/hard X-ray imaging, X-ray computed tomography (CT), mammography, SPECT (single photon emission tomography) and PET (positron emission tomography) imaging. In this talk I would describe the application of a position sensitive scintillation detector in multi-slicing X-ray CT scanning which can produce human soft/hard tissues images leading to disease diagnosis. Owing to high detection efficiency and better timing response, scintillation detectors are extensively utilized in radio-tracer imaging of tumor to quantify its physiologic, metabolic activity, monitoring malignancies, therapy monitoring and assessment of cancer recurrence. The time-of-flight PET technique together with a fast image reconstruction algorithm leads to better image diagnosis to identify malignant region precisely to 4 mm. While examining the images, the metabolic bio-markers of tumor blood flow can be set up, helpful to study the cancer evolution and its early detection, thereby serving as eyes to the radiation oncology practitioner. Scanned profiles for a Shepp-Logan mathematical phantom, mimicking the experimental profiles, can be back-projected in the image space while pre-processing with Fourier kernels to get the image contrast, would be presented in this talk. Algebraic fast image reconstruction methods available in literature which are used in X-ray CT machines, developed on CERN ROOT platform would be highlighted.

Dr. Siwal has received his Ph.D. degree from University of Delhi, and former post-doctoral fellow at IUAC New Delhi, Indiana University, Bloomington, and Panjab University, Chandigarh. At present he is Assistant Professor (Nuclear Physics) at the department of radiation oncology, GGS Medical College and Hospital, Baba Farid University of Health Sciences, Faridkot, Punjab. Recently, he has been awarded by Indian Physics Association for Aswini Kumar Rath Memorial award-2020 for his outstanding contribution in Nuclear Physics from Indian perspective. His interest is inclined towards the development of detector instrumentation, and has contributed in HPGe, microchannel plate, resistive anode, and fast timing scintillation detectors signal processing methods. Further, interest is inclined towards the image reconstruction and pulse processing strategies used in diagnostic X-ray CT, therapy X-ray, and PET/SPECT imaging detector for cancer diagnostics and treatment purpose.

GEANT4 The physics simulation toolkit

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Geant4 is an open software that simulates the passage of particles through detectors, based on the laws of particles interacting with matter and forces across a broad range of energy. A critical component of high-energy physics this tool has found applications in nuclear experiments, accelerator, space, and medical science. Simulations enable the optimization of designs for efficient performance with lower costs, like internet saving money through sharing information. A plastic scintillation detector is simulated in Geant4 to study applications in hadron therapy, carbon ion therapy. The proton and carbon beam are simulated through the tumor region to study the stopping power and depth dose distribution for different organs. The energy range for each study is optimized and Bragg curve is then interpreted in detail with Bragg peak position and range. The second application of detectors is in designing a shielding material from the harmful effects of cosmic rays. The space scientists are exposed to a high intensity of cosmic rays in the form of galactic cosmic rays, Solar energetic particles, and trapped radiation near magnetic field of Earth. The effects of these energetic particles are studied on phantoms simulated with different shield material and optimum material is found out. This is a very important study for Mars mission also. Simulations are done in Hadronic Binary model with energy ranging between 40 MeV to 10 GeV with output in ROOT format.

Dr. Sonali Bhatnagar is a Senior Assistant Professor of physics at Dayalbagh Educational Institute, Agra. She received her Ph.D. degree from Punjab University, Chandigarh. Her current area of expertise is in high energy physics and has set up a muon telescope in the nuclear laboratory. Apart from this recently a small array for studying secondary cosmic rays with temperature and pressure at Agra has been set up. This is called Dayalbagh Educational Air Shower Array (DEASA) in collaboration with T.I.F.R., Mumbai. She was awarded Young Scientist Award FOR WOMEN IN SCIENCE at FMT 2020 Conference, by Department of Physics, School of Applied Sciences, Kalinga Institute of Industrial Technology (KIIT). She has published around 45 peer-reviewed articles.

Detectors for Nuclear Physics Experiments at VECC

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The gamma-ray and charged particle detectors play very important roles in the field of experimental nuclear physics research. Gamma ray detectors are used for high-resolution g-ray spectroscopy studies, for the measurements of total (sum) energy and for the detection of high-energy gammas, e.g from GDR (Giant Dipole Resonance) decay. Similarly, charged particle detectors are used for different studies. All these experimental measurements have different requirements of detector properties, like detectors having very good energy resolution, timing resolution and high efficiency. It is not possible to get best of all these parameters in any one type of detector. So, different types of these detectors are used for different applications. At VECC, we have variety of detectors for the detection of gamma rays and charged particles which fulfil a vast range of experimental requirements. I will discuss all these detectors, their use in the measurement of different physical quantities and how one can chose a type of detector to be used for an experiment and will show some examples.

Dr. Gopal Mukherjee, presently a Scientific Officer - G at VECC, Kolkata, received his Ph.D. degree from Visva Bharati Univ., Santiniketan. His Ph.D work was done at IUAC (formely, Nuclear Science Centre), New Delhi and was awarded best thesis presentation. He was a post-doctoral fellow at the University of Massachusetts, Lowell and Argonne National Lab., USA and GANIL, France. He was also a Research Associate at TIFR, Mumbai and SINP, Kolkata. His current studies focus on experimental nuclear physics. He has expertise in nuclear structure studies and also in nuclear reactions. He is the recipient of scientific and technical excellence award of DAE in 2013 and Group Achievement of DAE for the years 2012, 2013, 2014 and 2017. He has co-authored more than 190 peer-reviewed journal articles.

Single crystal scintillators for nuclear radiation detection; basics to novel devices

Mohit Tyagi

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The single crystal scintillators have been the vital component for current and advanced technologies based on nuclear radiations. The applications of scintillators are continuously increasing after the key discovery of NaI:Tl, about seven decades before, and therefore open an expanding scope of research and development. This ongoing increment in demands has need of the finding of novel scintillating crystals having required and improved performance characteristics. However, the discovery of alternative crystals and the improvement of existing scintillators' performances require a systematic and integrated multi-disciplinary approach. It can be achieved only when the researchers, experts in diverse fields, work altogether along with the end-users of the devices. Further, the advancement in material synthesis and purity refinement techniques along with the state of art sensors and data acquisition systems have also provided another dimension in this field. In this talk, some recent systematic approaches for adequately addressing various issues in the development of advanced scintillators will be presented along with the general view of selecting an appropriate scintillator for a particular application. The current interest in finding promising scintillators for neutron detection and pulse shape discrimination will be also discussed.

Dr. Mohit Tyagi received his Master degree in Physics from C. C. S. University, Meerut, U.P in 2004 and awarded gold medal for securing the first rank. After completing one year orientation course from the BARC training school, He joined Crystal Technology Section, Technical Physics Division in 2005 and working on single crystal scintillators for novel nuclear radiation detection devices since then. He completed his Ph.D. from HBNI, Mumbai and Post-Doc from University of Tennessee, USA and also worked as Brain pool visiting fellow at KNU, South Korea. He has published six patents and about 70 publications in referred journals with about 950 citations. He is a recipient of 'DAE Group Achievement-2013', 'DAE Young Applied Scientist -2014', 'IACG Young Crystal Grower-2015', 'Nucleonix best researcher -2015', 'Indian Physical Society Young Physicist-2016' , 'NASI Young Scientist -2017' , DAE SSPS Young Acheiver – 2018, and DAE scientific and technical excellence award -2020.

Possibility of using diamond detectors in high current low energy experiments

Chinmay Basu

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Diamond detector is a high band gap semiconductor radiation detector usually used in high energy physics experiments. These detectors are known for their radiation hardness and temperature tolerance. Single crystals have excellent energy resolution for charged particles and poly-crystalline detectors offer excellent timing properties. A review and possibility to use such detectors in high current low energy experiments will be explored.

Chinmay Basu born in the year 1967 in Kolkata is presently a Professor in the Nuclear Physics Division at the Saha Institute of Nuclear Physics, Kolkata. He did his Masters in Physics from the University of Calcutta with a specialization in Nuclear Physics and PhD in Physics from the Saha Institute of Nuclear Physics on Non-equilibrium nuclear reactions. After his PhD, he continued as a research associate in the same institute and later joined as a faculty member in 2002. His interests in research are Nuclear Reactions, Nuclear Astrophysics and development of nuclear gas detectors. He has about 40 publications in reputed international Journals and has delivered lectures at various institutes in India and abroad. He is also a guest teacher in the University of Calcutta and also regularly teaches in the Post MSc course at the Saha Institute of Nuclear Physics. The author's present interests are in the field of Nuclear Astrophysics and its study through experiments with very low energy high current ion beams.

Evening Lectures

Particle and Radiation Detectors – Heavy Ion Research at GSI Helmholtz Centre

Hans-Jürgen Wollersheim

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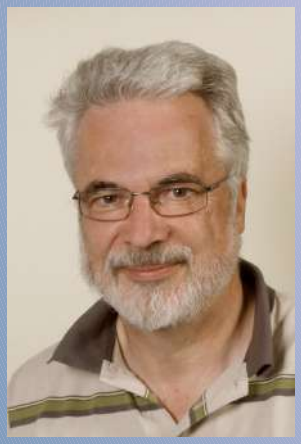
GSI Helmholtzzentrum für Schwerionenforschung GmbH operates a unique large-scale accelerator for heavy ions. Researchers from around the world use this facility for experiments that help them make fascinating discoveries in basic research. A new, unique international accelerator facility (FAIR) will be erected at GSI for the research with antiprotons and ions. The Republic of India signed the FAIR convention on 4 October 2010, and declared its contribution to the FAIR accelerator facility. Various teams of finest engineers and scientists develop new and impressive detector systems to understand the nuclear structure and the evolution of the Universe 13.8 billion years ago. In the present lecture some of the particle and radiation detectors will be presented which are used at Coulomb barrier energies as well as for ions with velocities up to 80% of the velocity of light. Most of the detectors are highly-segmented to correlate projectiles or target nuclei with their decay properties. One can perform Doppler shift corrections at these high energies to obtain spectroscopy results with the intrinsic resolution of these detectors. In this presentation gas detectors, scintillation and semi-conductors will be discussed.



Prof. H. J. Wollersheim received his doctorate in 1976 from the Johann Wolfgang Goethe university in Frankfurt. His research area is Nuclear Physics. He joined GSI as a senior Scientist in nuclear structure group in 1976. From 1979 till 1981 he worked as a senior scientist in the nuclear reaction group of Prof. Dr. J.R. Huizenga in Rochester, New York, USA. Afterwards he continued his research in the nuclear structure group at GSI. In 1993 he had completed his habilitation and has been teaching nuclear physics, detector physics, accelerator physics and nuclear astrophysics. In 1994 he was the representative of C4 professor at the Ludwig Maximilian University in Munich. From 2000 to 2009 he was manager of the RISING project at GSI and later till 2013, manager of the PreSPEC project. As in-kind coordinator FAIR@GSI, he was the FAIR liaison person for the collaboration between BMBF (Germany) and DST (India). His achievements in teaching and research were honored by the nomination for a visiting professorship at IIT Ropar (2016-2018) and an adjunct professorship at Delhi University in 2022.

Radiation detectors in nuclear and particle physics and some applications

Dr. Archana Sharma

Experimental Physics Department, CERN Geneva, Switzerland

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Physics at a subatomic scale requires innovation, invention, tools, techniques and technologies that could help exploring the intricate mysteries of space, time, matter and energy. Radiation detectors that are developed in nuclear and particle physics have transformed modern experimentation into gigantic human endeavors, for example the Compact Muon Solenoid Experiment at the Large Hadron Collider at CERN. These detector technologies have found their way into other fields of research like astrophysics, cosmology and space applications. In this talk, I will present to you advancements of detection techniques that have made major contributions to particle physics, advanced research in other fields of science and has contributed to progress in numerous societal applications.

Dr. Archana Sharma is a Principal Staff Scientist at the CERN Laboratory in Geneva, Switzerland active in the field since 1989 mainly working on instrumentation. She is the pioneer of simulations and experimentation on gaseous detectors in high energy physics over the last three decades. A Ph.D. in particle physics from Delhi University in 1989, a D.Sc. from the University of Geneva in 1996, and an Executive MBA from International University in Geneva. She has worked at CERN experiments on R&D and commissioning of large scale gaseous detectors. She is founder and Project Manager of CMS GEM Collaboration since 2008, bringing a new technology GEM (Gas Electron Multiplier) – for exploiting one of the most sensitive detectors with the highest discovery potential. The GEM project has spanned about 40 institutions in 17 countries yielding over 75 PhDs under her leadership. She has been recently appointed as Head of Engagement Office in the CMS Experiment. Archana also serves as Senior Advisor for Relations with International Organisations at CERN, in support of CERN's objective of integrating and highlighting fundamental research towards Science Diplomacy, and Sustained Development Goals. She has collaborated with events at the ILO Geneva and World Communication Forum Davos as spokesperson for diversity, excellence in scientific communication. She is also an author of 3 popular science books:

https://tinyurl.com/A-to-Z-CERN
https://tinyurl.com/IndiaScienceGeniuses
https://tinyurl.com/Nobel-Dreams-of-India

A glimpse of physics opportunites and detection assets of GANIL-SPIRAL2

Antoine LEMASSON

GANIL CEA/DRF, CNRS/IN2P3, Caen, France

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The Grand Accélérateur National d'Ions Lourds, Caen, France offers unique opportunities to contribute to advance our knowledge in the nuclear physics field. In this talk, I will first briefly introduce the GANIL accelerator facilities (Cyclotrons and SPIRAL2). I will then give an overview of the detection facilities operated at GANIL. These include the VAMOS large acceptance spectrometer, the LISE and S3 separators, the Neutron For Science Facility, gamma-ray (AGATA, EXOGAM), charged particle (INDRA/FAZIA, ACTAR, MUGAST) and neutron (NEDA) detection arrays. The performances of theses devices will be presented and recent results in nuclear structure and dynamics will be highlighted.

Antoine LEMASSON is researcher at the Grand Accélérateur National d'Ions Lourds (GANIL, France). He obtained his PhD from the University of Caen/GANIL in 2010. After a Research Associate position at MSU/NSCL, he joined GANIL as a researcher in 2012. He is scientific coordinator of the VAMOS spectrometer since 2014. His research activities ranges from nuclear structure to nuclear dynamics at energies around the Coulomb barrier using the VAMOS spectrometer, covering studies of shell evolution and nuclear shell structure using the AGATA gamma-ray tracking array as well as studies of the fission process induced in inverse kinematics.

Session Chairperson

Session Chairman

Prof. Sukalyan Chattopadhyay

Nuclear and High Energy Group, Saha Institute of Nuclear Physics, Kolkata

Dr. Sukalyan Chattopadhyay is a senior professor and head of the Nuclear and High Energy Group of Saha Institute of Nuclear Physics. He did his Ph.D from Tata Institute of Fundamental Research. His current research interests are: (a) Nuclear Structure studies at high angular momentum with particular interest in the mechanisms of angular momentum generation in nuclei of A~100 region and (b) Ultra-relativistic heavy ion collisions with particular interest in the physics of strongly interacting matter at extreme temperature and energy densities. He is a Fellow of National Academy of Sciences and has been the Apex Coordinator for the DAE funded projects of Saha Institute since 2015. He has published more than 120 peer-reviewed journal articles.

Session Chairman

Prof. Devinder Mehta

Physics Department, Panjab University, Chandigarh

Prof. D. Mehta, is presently a Professor of Physics in the Physics Department, Panjab University, Chandigarh. He did his M.Sc Physics (1983) followed by PhD in experimental Nuclear Physics in 1988 from the Panjab University, Chandigarh. He has been a Humboldt Fellow at ISKP University of Bonn, Germany from 1989 – 1991. He has held the positions of Chairman Physics department and Dean of Science Faculty, Panjab University. His research area includes Experimental Nuclear Spectroscopy and X-ray Spectroscopy. He has carried out research work using several accelerator based nuclear physics experiments using the facilities at IUAC (New Delhi), TIFR (Mumbai), Cyclotron at Panjab University, and many of the European Accelerator Labs. He has supervised more than 15 Ph.D. students and published more than one hundred research articles.

Session Chairman

Prof. Bivash R. Behera

Department of Physics, Panjab University, Chandigarh

Prof. Bivash Behera is currently working as a professor at Department of Physics, Panjab University, Chandigarh. For his Ph.D. he worked at Nuclear Science Centre (Now Inter University Aceelerator Centre, IUAC) on fusion-fission dynamics and obtained his Ph.D. degree from Utkal University in the year 2002. From 2002 to 2004 he was a post doctoral fellow at INFN, Leagnaro National Laboratory (LNL). At LNL he was involved in the installation of the large acceptance magnetic spectrometer PRISMA and fusion measurements with a electrostatic deflector. In 2004 he joined the Department of Physics, Panjab University. He is a recipient of DAE young scientist research award, felicitation for best teaching and research from Panjab University, certificate of appreciation from IUAC, New Delhi for the utilization of the accelerator and experimental facilities. His current research work is focused with the fusion-fission dynamics, Quasi-elastic barrier distribution, heavy-ion induced fusion using the IUAC Pelletron + LINAC accelerator facility.

Session Chairman

Prof. A. M. Vinodkumar

Department of Physics, University of Calicut, Kerala

Prof. A M Vinodkumar is currently a Professor in the Physics Department of University of Calicut. Prof. Vinodkumar completed his Ph.D from Inter University Accelerator Centre (IUAC) New Delhi and the University of Calicut in the year 1997. There after he joined Legnaro National Laboratory, Padova, Italy as a INFN Post Doctoral Fellow (1998-2000). During 2000-2001 he worked as a IN2P3 CNRS postdoctoral fellow at LPC, Caen, France. In 2002-20004, he worked as JSPS postdoctoral fellow at Tokyo Institute of Technology, Japan. In year 2004, he joined as a postdoctoral research associate at Oregon State University, USA. He joined Department of Physics, University of Calicut as a Reader in 2009. His research interests include heavy ion fusion, multinucleon transfer in near barrier energies. Also his work involves high energy theory as well as experiments.

Session Chairman

Prof. B. P. Singh

Physics Department, Aligarh Muslim University, Aligarh

Prof. B. P. Singh, is presently a Professor of Physics and has been the Chairman of the Physics Department, Aligarh Muslim University, Aligarh. After graduating from the Agra University, he completed his doctoral thesis in the field of Experimental Nuclear Physics, from A. M. U. Aligarh in the year 1991. He has been working on the accelerator based nuclear reaction studies with emphasis on study of nuclear reaction dynamics of light and heavy ion induced reactions both at low energies. He has carried out research work at major accelerator facilities of the country like Variable Energy Cyclotron Centre (VECC), Kolkata, Pelletron accelerator facility of the Inter University Accelerator Centre (IUAC), New Delhi etc. He has supervised several M.Phil and Ph.D. students. He has published nearly one hundred research articles. He has visited several scientific institutes outside India such as those in Italy, France, Japan, Russia etc. He is also a co-author of the two books entitled (i) “Fundamentals and Applications of Heavy Ion Collisions” published by Cambridge University Press and (ii) “Pre- equilibrium emission in statistical Nuclear Reactions” published recently by the Institute of Physics Publishing, England. He has successfully implemented more than 15 major/minor research projects sanctioned by various government funding agencies, as a Principal Investigator. He has been the Chairman of the Accelerator User's Committee, of the IUAC, New Delhi and also served as a Member to the National Accelerator Users Committee, of the Variable Energy Cyclotron Centre (VECC), Kolkata. He is a Life time member of Indian Association of Physics Teachers (IAPT); Indian Physics Association (IPA) and Indian Physical Society (IPS).

Session Chairman

S. Muralithar

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067

Dr S Muralithar presently leads the nuclear structure studies group at IUAC. After completing MSc (Physics) from IIT Madras and MS (Accelerator physics) from University of Manitoba, Canada, he did his PhD from Jawaharlal Nehru University, New Delhi. His research interests are nuclear structure by collective excitation vis a vis single particle excitation, phenomena such as Chirality, gamma vibration, Octupole correlation, Magnetic rotation, Anti-magnetic rotation and reaction dynamics by incomplete fusion reaction. He participated in the RISING Campaign at GSI, Germany. He visited the accelerator labs at TRIUMF, Canada, University of Notre Dame, Argonne National Lab, USA; CAEN, France; University of Kolon, Germany. He has 234 international journal publications.

Session Chairman

Prof. J. J. Das

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067

Dr. Jiban Jyoti Das is a Senior Professor at Department of Physics, Cotton University, Guwahati. He did his BSc from Cotton College, Guwahati followed by Msc from IIT Kanpur. He did his PhD from Delhi University. He worked as a Scientist at IUAC (formerly Nuclear Science Centre) from 1990 to 2008. He was a Post doctoral Fellow at Oak Ridge National Laboratory and was a Research Scientist at Michigan State University (USA) and Oak Ridge National Lab (USA). His Research interest includes Low energy accelerator and nuclear physics, radioactive ion beam, nuclear astrophysics. He has expertise in, Transport and extraction ion-optics, differentially pumped windowless jet, mass spectrometers.

Session Chairman

Dr. Sandeep S Ghugre

UGC-DAE CSR, Kolkata Centre, Kolkata

Dr. Sandeep S Ghugre is associated with the Nuclear Physics Group of the Kolkata Centre of the UGC-DAE Consortium for Scientific Research, an Inter University research Centre of the UGC. He obtained his Ph.D. degree from University of Mumbai, based on the experimental programme at the then Nuclear Science Centre, the first Inter University Accelerator Centre and was a Postdoctoral researcher at the Nuclear Structure Laboratory, University of Notre Dame, USA.
His primary area of research is experimental nuclear structure physics based on in-beam gamma-ray spectroscopy with particular interest in the instrumentation and software developments associated with the domain. He has been one of the resource personnel in the operation of the Indian National Gamma Array (INGA) and has been involved with the digitizer based pulse processing and data acquisition exercise in the recent campaign of the INGA facility at VECC, Kolkata. He has more than 110 publications in the international refereed journals to his credit. He has made invited presentations at several national and international conferences. He has been associated with the doctoral research of several scholars and has formally been the thesis supervisor to a majority of them. He is serving as a Guest Faculty at the Jadavpur University, teaching courses on nuclear instrumentation therein.

Session Chairman

Dr. D. C. Biswas

Nuclear Physics Division, Bhaba Atomic Research Centre, Mumbai

After passing out MSc. from Calcutta University, Dr. D. C. Biswas joined 27th batch of Training School in 1983 and subsequently Nuclear Physics Division, BARC. He completed his thesis work and got the PhD degree from Mumbai University. He retired from BARC in 2018 and at the time of retirement he was in OS grade and Head, Fission Physics Section also Senior Professor, Homi Bhabha National Institute (HBNI). He has made significant contribution is the field of Nuclear reaction studies, particularly in the field of nuclear fission and Development of Nuclear Radiation detectors which include, hybrid ΔEgas -Esi and ΔEgas -2E CsI telescopes, position sensitive ΔEgas-Egas ionization chamber, and MWPC. He has initiated the Fission Fragment Spectroscopy programme in India and was instrumental in the development of the facility for Dhruva Utilization in Research using Gamma Array (DURGA) at BARC. He has initiated several International collaborative experiments using EUROBALL, GASP and 8πLP facilities, during his post-doctoral work at Manchester University and sabbatical position at LNL, Italy and ILL, France. He has published about 100 research papers in refereed journals. He received S.N. Sheshadri Memorial Instrumentation award in recognition of his work for the "Design and development of Gas Detectors for Heavy Ion Experimental Research". He is Fellow of Maharashtra Academy of Sciences.

Session Chairman

Dr. N. Madhavan

Inter-University Accelerator Centre (IUAC), New Delhi

Dr. N. Madhavan is currently Scientist-H in the Nuclear Physics Group at Inter-University Accelerator Centre (IUAC), New Delhi. He is the Programme leader for HIRA and HYRA nuclear physics group and Beam transport system group at IUAC and has played a crucial role in the design, commissioning and utilization of recoil separators/spectrometers HIRA and HYRA, HIRA-GDA, HIRA-INGA and HYRA-TIFR 4p Spin spectrometer coupled systems and in the commissioning of INGA at IUAC. Dr. Madhavan obtained his M. Sc. (Physics) degree from IIT-Bombay, his M.S. (Accelerator Physics) degree from University of Manitoba, Canada and Ph. D. (in Nuclear physics) degree from Jawaharlal Nehru University, New Delhi. He has been working at IUAC (formerly NSC) since 1986 and was the Programme leader for the Nuclear physics group at IUAC since 2013 for six years. His research interests include sub-barrier fusion, multi-nucleon transfer, quasi elastic backscattering, barrier and spin distributions in heavy ion induced fusion, fusion evaporation residue tagged spectroscopy and microsecond isomer decay studies. His other interests include Recoil separators/spectrometers and beam-optics. Dr. Madhavan has worked with Prof. Jerry Nolan at MSU, USA and the Recoil mass spectrometer group at LNL, Italy and has also collaborated with/visited several international laboratories. He has delivered several course modules on nuclear reactions, heavy ion reactions, beam-optics, accelerators, signal processing, etc.

Session Chairman

Prof. B. K. Nayak

Homi Bhabha National Institute,Anushaktinagar, Mumbai-400094

Prof. B K Nayak is currently associate with HBNI as Senior Professor, Associate Dean and DAE Raja Ramanna Fellow. Previously, Prof Nayak was associated with BARC, where he was Associate Director Physics Group before his superannuation in 2020. Prof Nayak is an experimental Nuclear Physicist, who has carried out most of his research on heavy ion induced nuclear reaction studies around Coulomb barrier energies. He has co-authored more than 100 Physical Review publications to his credit. He is recipient of Homi Bhabha Science and Technology award 2009 for his contribution in nuclear physics.

Session Chairman

Dr. A. K. Sinha

UGC-DAE Consortium for Scientific Research, Indore

Dr Ajit Sinha, while finishing his PhD from IIT Kanpur in 1982, taught in Christ Church College Kanpur University from 1979 to 1984. He carried out two post doctoral assignments at IUCF Bloomington, Indiana (USA) and ISKP, UNI. of Bonn, Germany from 1984 to 1987 for which he was awarded the Humboldt Fellowship. Thereafter Dr Sinha worked as senior scientist at IUAC, New Delhi till 2000. He led the prestigious Heavy Ion Reaction group at IUAC which built a Recoil Mass Separator facility known as HIRA- Heavy Ion Reaction Analyzer. HIRA is a first ever nuclear physics facility of its kind in India and many high quality heavy ion nuclear physics expeiments have been performed by the group including the radioactive 7Be Ion beam developed using HIRA and a nuclear spin spectrometer attached to HIRA. 2001 onwards, Dr Sinha joined as Centre-Director at Kolkata Centre of UGC DAE CSR and later in 2016 as Director of UGC DAE Consortium for Scientific Research in Indore. At Kolkata Dr Sinha carried a major collaborative project INGA and helped in getting gamma ray spectroscpy of high spin nuclear states using Cyclotron beams at VECC, Kolkata. Post retirement in 2020 from UGC DAE CSR, Dr Sinha has joined Physics Department of SP Pune University, Pune in 2021 as Honorary Adjunct Professor.