



लखनऊ विश्वविद्यालय  
University of Lucknow  
(Accredited A++ by NAAC)



**Under STUTI Program, Department of Science & Technology (DST),  
Govt. of India**

**Seven Day Training Program  
in  
'Materials Science, Nanotechnology, and Quantum  
Optics'**

**(August 06-12, 2022)**

**Report: FIRST Day  
(August 06, 2022)**

*Organized by*

**Prof. Anchal Srivastava**  
*Coordinator*

**Department of Physics, University of Lucknow, Lucknow**



# *Organising Committee*

*Patron*

**Prof. Alok Kumar Rai**

Vice-Chancellor, University of Lucknow

*Program Chair*

**Prof. N. K. Pandey**

Head, Department of Physics, University of Lucknow

Coordinator

**Prof. Anchal Srivastava**

Department of Physics, University of Lucknow

Organizing Secretaries

**Prof. R. K. Shukla, Dr. Navina Wadhvani & Prof. M K Sharma**

Department of Physics, University of Lucknow

*Treasurer*

**Dr. Atul Srivastava**

Department of Physics, University of Lucknow

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Prof. Manoj Kumar Sharma	Dr. Sangita	Ms. Nidhi Singh, Ms. Shikha Rani

The first day of the Seven-Day STUTI-Workshop on Materials Science, Nanotechnology, and Quantum Optics, organized by Department of Physics, University of Lucknow (in collaboration with Aligarh Muslim University Aligarh) under the patron-ship of Honourable Vice Chancellor Prof Alok Rai, University of Lucknow, Lucknow started with inaugural session in which Prof Brijendra Singh, Dean, Faculty of Science, Prof N. K. Pandey, Head, Department of Physics and also the Program Chair, Prof. B. P. Singh, PMU Coordinator, AMU Aligarh, Coordinator of the Program Prof. Anchal Srivastava, Department of Physics, University of Lucknow and all the faculty members of the department were present. Prof N. B. Singh, Professor Emeritus, Sharda University, Greater Noida and former Dean, Faculty of Science, DDU, Gorakhpur graced this session as the Chief Guest. Research scholars coming from all over India including institutes like IIT Hyderabad, NIT Srinagar, NIT Prayagraj, IT BHU, Jaipur, CIPET Raipur, , Manipal Academy of Higher Education (MAHE), Karnataka, BHU, MNNIT Prayagraj, Allahabad University, LNMU Darbhanga, Bihar, Dr H.S. Gour University Sagar M.P., Govt. PG College Datia M.P., Nagpur, Kumaun University, Nainital, Abdul Kalam Technical University, Lucknow, BSNV PG College, Lucknow, Department of Physics, University of Lucknow and also from various districts of Uttar Pradesh like Ayodhya, Sitapur, Lakhimpur are participating in this workshop and were present in the inaugural session.

Prof Brijendra Singh, Dean, Faculty of science highlighted the importance of research and development in the area of material science and said that R & D in this area has truly changed the socio-economic structure of the country for better and it has pivotal importance for any country's growth and development. Prof N. K. Pandey, Head, Department of Physics informed the audience that the Department of Physics has a prestigious record of research in material science and this has been attested by fundings received from various agencies including DST under various schemes like FIST, PURSE. The infrastructure built using these grants has provided the necessary environment for faculty members and research scholars of the department to do research at the cutting edge and this has established the department as a prestigious centre for research in materials science. He told that these factors convinced the DST to select the department for this STUTI-Workshop via Aligarh Muslim University which is to act as the hub for this programme. He also shared that the department has a few ambitious plans for the future ahead and hoped that in near future the department will receive more funds from DST and other agencies to establish it as centre of excellence in material sciences.

Prof B. P. Singh, PMU Coordinator, Aligarh Muslim University, Aligarh explained , in his address, the motive behind STUTI program run by DST. He told that **STUTI** is the acronym

for **Synergistic Training program Utilizing the Scientific and Technological Infrastructure (STUTI)** and its main objective is to build human resources equipped with required skill-set, using already available infrastructure in the field of Science and Technology. STUTI workshops are training programs focused on enhancing the awareness of the research scholars regarding the use of state-of-the-art facility. He emphasised that this Scheme, i.e., STUTI-workshops are meant to complement the various schemes run by DST and follows a hub-and-spoke model in which an advanced institution has to act as a hub and other institutes, attached to it, act like a spoke to increase the skill base and access to resources.

University of Lucknow is acting as a spoke and Aligarh Muslim University Aligarh is playing the role of a hub. Professor Anchal Srivastava, the coordinator of this STUTI-workshop informed about the participants along with other information. Prof R.K.Shukla proposed the vote of thanks. The organizing secretaries of the workshop, Dr. Navina Wadhvani, and Prof M. K. Sharma and treasurer Dr Atul Srivastava were engaged in various activities related to successful organization of the workshop.

After inaugural formalities, first formal training session of this STUTI-Workshop involved the scientific talk by honourable chief guest Prof N. B. Singh, Professor Emeritus, Sharda University, Greater Noida and former Dean, Faculty of Science, DDU, Gorakhpur. Topic of his talk on “**Nanomaterials: Synthesis, Characterization, Properties and applications**”. Elaborating on the exotic properties of the materials at nanoscale, he defined nanotechnology as a discipline of study which deals with creation, understanding various properties and applications of materials whose at least one dimension is less than 100 nanometer. One nanometer is one billionth of one meter. Depending on the dimensions of the material which are at nanoscale, nanomaterials are categorised as one-dimensional (1D), two-dimensional (2D) and three-dimensional (3D) nanomaterial. The speaker stressed upon various interesting and spectacular magnetic, optical and electrical properties of such nanomaterials, and informed that the nanotechnology has caught the attention of the scientific community for its potential application in various areas like biomedical, electronic etc. It is expected to revolutionize the social, political and economic structure of the world by impacting the quality of life in a positive way. Various methods for preparation of nanomaterials like physical, chemical and biological methods were discussed. Participants of the Workshop were sensitized about various important techniques of characterization of nano-materials including Scanning Electron microscopy, Transmission Electron microscopy, Atomic Force microscopy, X-ray diffraction and Spectroscopic techniques. Various applications of nanomaterials in different sectors such as Automobiles, Medicine, Textiles and Fabrics, Sporting Equipment and Goods,

Water purification, Air Purification, Sensors, Space Sciences, Food Industry, Electronics and Devices, Cosmetics and many more were also discussed in detail.

In the next session of this STUTI-workshop, Prof A. K. Tyagi from Chemistry Division of Bhabha Atomic Research Centre, Mumbai elaborated the nuances of “**Art of Material Synthesis**”. The speaker emphasized that the 21<sup>st</sup> century belongs to materials as the bouquet of materials being used in various applications is large and it includes soft materials to super-hard materials, insulators to superconductors, extended solids to molecular solids, self assembled materials, catalysts, materials with low or negative thermal expansion, composites and hybrid materials, materials with multi-functionality, ceramics & glasses, metals, intermetallics, drugs and drugs delivery systems, polymers, bio-materials, nuclear materials, optical materials, fast ionic conductors and nano-materials etc. As these all materials are to be synthesized in a sophisticated way in a laboratory, the synthesis of the materials is of utmost important. There are two popular ways to synthesized various materials. One method is known as Ceramics method and the other is known as the solution method. Prof. Tyagi explained the intricacies of both these methods and told that various contemporary solution methods usually yield materials in their nano-form. He also told that the nano-ceramics are potential candidates for a variety of technological applications. There are a number of methods for preparing the nanocrystalline materials and a few of solution chemistry routes are also very popular for fabrication of nanocrystalline materials. Of these solution chemistry routes, the combustion technique is preferred because it helps produce nanocrystalline powders of the oxide ceramics at lower calcination temperature in a surprisingly short time, without any elaborate laboratory facilities. This process involves a combustion reaction between a fuel (e.g. glycine, citric acid, urea etc.) and an oxidizer (i.e., metal nitrates. Prof Tyagi’s lab is involved in synthesis of ionic conductors, catalysts and optical materials, employing solution route. He emphasised that it is a very cost-effective technique for synthesizing nanocrystalline powders of high purity and better sinterability. He also discussed the versatility and capability of the combustion technique as a preparatory method for a variety of nanocrystalline powders of oxide ceramics in particular for optical applications.

The last session of the first day of STUTI-Workshop was focussed on various software tools for material characterization. Dr Praveen Saxena, the founding director of Tech Next Lab at Lucknow former software engineer at Singapore sensitized the participants about research optimization of current and future semiconductor devices and its applications. Various Technology Computer Aided Design (TCAD) functionalities offered by various simulators for device characterization as well as material characterization, developed by Tech Next Lab were

also explained, comparison and associated costing. He informed that Technology Computer Aided Design (TCAD) suite offered by Tech Next Lab can reduce the technology development time and associated costing. He demonstrated the software, besides explaining some earlier results. On the request of the Coordinator, Dr Praveen Saxena kindly agreed to provide license for fifteen (15) days free of cost, to the participants for performing simulation study.



**Dignitaries present in the inaugural session**



**PMU (Aligarh Muslim University Aligarh) Coordinator Prof. B. P. Singh, while lighting the lamp in the inaugural session of the training programme**



**Participants and audience while attending the inaugural session of the training programme**