

REPORT OF C.K.MAJUMDAR MEMORIAL WORKSHOP IN PHYSICS 2020

28TH DECEMBER, 2020 TO 4TH JANUARY, 2021

Introduction and the Background

C.K. Majumdar Memorial Summer Workshop in Physics is the flagship programme of the IAPT RC 15. For last several years the IAPT RC15 organizes this programme jointly with S.N. Bose National Centre for Basic Sciences (SNBNCBS) and this year was no exception. It is a national workshop which is being held every year during summer. But in 2020 there had to be an exception due to the pandemic. It could not be organized as per schedule in June. RC 15 is privileged to have many institutions of repute which are either undergraduate colleges or research establishments as collaborators for hosting the programme, and conspicuous among their range of support happens to be the boarding and lodging of the outstation students. But this time holding the Workshop face-to-face with the students was out of question for obvious reasons. Shrouded with uncertainties the RC15 opted for the only viable alternative of holding it online.

The Workshop got postponed, fixing a suitable set of dates was a big challenge and after repeated deliberations the stretch, 28th December, 2020 to 4th January, 2021 was agreed upon by the members. The word 'Summer' was dropped from the name of the Workshop. RC 15 will remain indebted to the SNBNCBS for agreeing to host the Workshop by providing all sorts of technical support. The duration of the Workshop had to be curtailed and participation also turned out to be smaller in comparison to the previous years.

The year 1999 saw the beginning of this workshop under the stewardship of none other than Prof Chanchal Kumar Majumdar, who passed away in 2000. IAPT RC 15 is continuing the legacy. This was the 22nd edition of the workshop and for the first time it was held in the online mode. It is a matter of great pride, satisfaction and honour that the prestigious institution, S.N. Bose National Centre for Basic Sciences had been instrumental in providing enormous support in co-organizing this important event. The target group of this Workshop is the students of Physics Honours who are on transit from Bachelor's to Master's course. The objectives of this workshop had always been to motivate the students in advancing their knowledge through inspiring lectures and to provide them firsthand experience of some novel experiments under the guidance of highly experienced teachers. Like previous years, we had a galaxy of eminent scientists covering a wide range of topics from fundamentals of classical and quantum properties of matter (mechanical, acoustic, optical etc.), to condensed matter physics, relativity and cosmology. They exposed the students to some of the exciting developments of the 21st Century such as Spintronics, topological materials, ferromagnetic shape memory alloys and so on.

Inaugural Session and the Programme on the Birthday of Prof S.N.Bose

The Proceedings got initiated by Prof G.P.Das, Professor, IIT, Kharagpur. and the President of IAPT, RC 15. At the onset he lauded the efforts made by the members of RC 15 for making this event, a first of its kind through the virtual platform, a reality. He was highly appreciative of the phenomenal support provided by the SNBNCBS but for which the Workshop would not have been possible. He specifically reminded the students that they were fortunate enough to get exposure to invaluable lectures by eminent physicists and insisted that they should make best possible utilization of this opportunity and the facilities provided by the SNBNCBS.

This year's workshop coincided with the birth centenary year of Prof D.P.Khandelwal, the Founder Secretary of IAPT. Some programmes, as mentioned in the inaugural session, have been planned throughout the year.

The Welcome Address was delivered by Hon'ble Prof. Samit Kumar Ray, the Director of S.N. Bose National Centre for Basic Sciences. Prof Ray is a leading experimental condensed matter physicist of our country, and a pioneer in the field of semiconductor nanostructures and nanodevices. His speech was a commentary of his passion to promote physics teaching and outreach activities that IAPT is committed to. Dr. Bhupati Chakrabarti, who is a former General Secretary of IAPT and a very important guiding force behind the multifarious activities being pursued by IAPT, briefed the participants about the activities of IAPT in general and RC 15 in particular. He spelt out the importance of the Workshop and how successfully RC 15 has been conducting the same over the years.

The key note speaker at the occasion was Prof. Partha Pratim Majumder. He holds a National Science Chair of the Government of India and has founded the National Institute of Biomedical Genomics Institute in India. He is a Distinguished Professor in the Institute, and also an Emeritus Professor of the Indian Statistical Institute. He spoke on "Selective Sweep of a SARS-CoV-2 Mutant, with Some Hiccups", a topic which is relevant for all of us today. Dr. Achintya Pal, the Secretary of IAPT, RC 15 proposed the vote of thanks. He gave special compliments to some of our young tech savvy members who contributed significantly towards our shift to the virtual mode.

As mentioned, the Workshop got spread over eight days (28th December, 2020 to 4th January, 2021), out of which 1st January, 2021 was devoted to the celebration of the 128th birthday of Prof Satyendra Nath Bose by SNBNCBS. It *inter alia* gave the participants a unique opportunity to listen to an absolutely mind boggling lecture on "Quantum Teleportation" by Anton Zeilinger, the Wolfe Prize winner from Austrian Academy.

Apart from the 24 registered student participants the workshop was also attended by 33 invitees who were mostly teachers. There were 18 speakers altogether and 12 senior members of IAPT took up the responsibility of chairpersons for smooth conduction of the sessions in the online mode. Broadly speaking there were a set

of talks covering various areas of physics viz. General Relativity and Cosmology, Quantum Cryptography, Condensed Matter Physics and Material Science.

Invited Talks

Excellent talks suited to the level of the outgoing UG or first year M.Sc students were delivered by all the speakers. The titles of these talks along with the respective speaker's affiliations are given below.

- Prof G.P.Das, (IIT, Kgp) spoke on 'Happenings in Condensed Matter Physics: Emergence of Topological Materials',
- Prof Sayan Kar (IIT, Kgp) talked on 'Introducing the Raychaudhuri Equation to Undergraduates'.
- Dr Kaushik Dutta (IISER, Kolkata) spoke on 'Cosmic History of the Universe
- Prof Kalyan Mondal, a Coordinator of the programme from SNBNCBS delivered a talk on Magnetic Properties and Their Measurements: Bulk to Nano.
- Dr Surajit Chakrabarti (Formerly at Department of Physics, Maharaja Manindra Chandra College, Kolkata), shared his experience about an experiment that he did in Homi Bhabha Centre for Science Education (HBCSE) in collaboration with Prof. Rajesh Khaparde. The title of his talk was 'A Study of the Loss of Energy of a Wheel with its Axle Rolling on a Soft Horizontal Surface'.
- Dr. Achintya Pal a Retired Exploration Geophysicist and the Secretary, IAPT RC 15 discussed a set of problems on Exploring the Conic Sections, Equation of **Electric** Lines of Force, Yukawa Potential with the participating students and gave them an assignment on those. It was found after the stipulated time that a good section of the students, took keen interest in this exercise of problem solving.
- Dr S. Thirupathaiah of SNBNCBS spoke on 'X-Ray Diffraction: A Unique Tool to Unravel the Structural Properties of a Material'.
- A talk entitled 'Molding 3D Curved Structures by Selective Heating' was the title of the talk delivered by Prof Shankar Ghosh of TIFR, Mumbai.
- The talk by Dr Ananda Dasgupta of IISER, Kolkata was 'Sherlock Holmes meets Schrodinger's Cat'.
- Prof Subham Majumdar of IACS spoke on 'Ferromagnetic Shape Memory Alloys: Fundamentals to Applications'.
- Dr. Sumanta Chakrabarti of IACS spoke on 'From Black Hole to Quantum Gravity'.
- The talk on 'Decoding Quantum world was delivered by Dr Saumyadev Bhattacharyya of IIIT, Hyderabad.
- Prof Anjan Barman of SNBNCBS spoke on 'Spin-Orbit Effect :A New Wing of Spintronics'.

Experimental Component in Online Workshop

In all the previous years the experimental component has remained a very special feature of the Workshop. Organizers have always tried to provide the participants with some exposure to the experimental physics with

whatever opportunity available, and the students have always enriched themselves in the process. However, the year 2020 being a year with a difference owing to the pandemic situation and the fact that the Workshop has been conducted in online mode the experimental component was planned in an entirely different way.

A section of very active IAPT members who are the faculty members at different reputed institutes and colleges, that included Dr Rangeet Bhattacharyya (IISER, Kol), Dr S.Minhaz Hossain (IEST, Howrah), Dr Pardipta Panchadhyayee (P.K.College, Kanthi), Dr Rajib Pradhan (MidnaporeCollege, Midnapore), Dr Ananda Dasgupta (IISER, Kolkata) and Dr. Surajit Chakrabarti made special planning keeping the pandemic scenario in mind and acted as Resource Persons for this unique initiative. After long interactions among themselves and with some senior IAPT members, that included among others Dr. S.C.Samata (Former GS, IAPT), the group planned some 'home experiments' with materials available in every household. A smart phone and a laptop were necessary for the experiments. The students were instructed to download and install certain Apps. All the Resource Persons took at least two online sessions first one for the introduction of the experiment and the second one for discussions with the students about their problems and results. Broadly speaking the experiments were on SHM, Pulse Propagation on water surface, Fourier Optics, Doppler Shift, Coefficient of restitution from Bouncing Balls. The students were first shown the use of the software like Video Tracker, Image J, Phyphox, Audacity and were then asked to make use of them in the analysis of the experiments.

The assignments were given to the students after the first talk. Students interacted with the teachers after a couple of days when they shared their experience with their questions and observations. The students had taken videos of their experiments by smart phones and analyzed them either by the software or directly making measurements on laptop. They submitted their data, analysis, graph etc. in Google Classroom reflecting that most of them had taken keen interest in the tasks given and some of them actually excelled in their work. The Google Classroom was kept open to enable them to submit their work for comments and for some sort of an evaluation till 10th January, 2021 though the Workshop formally over on 4th January, 2021.

A lot of positives emerged out of the Workshop, a crucial feature of which was the maintenance of punctuality by all concerned. This aspect can be considered as an exemplar for all sorts of online educational programmes now in vogue throughout the country. It was probably for the first time that general degree students and of first semester M.Sc. found an opportunity to perform software based Home Experiments. The Workshop was a testimony to the commitment towards participation and keenness among the students about interactivity which was evident from the lively discussions that followed every lecture. The most satisfying feature was the phenomenal interest shown by the students in performing the experiments from home and to see a student applying Tracker software, learnt for the first time in the context of one experiment, in a different experiment

successfully. Credit goes to the teachers who worked tirelessly towards designing the experiments and customizing them following the tenets of online education, and of course the students who justified the faith bestowed on them by their teachers. Some students burnt the midnight oil to meet the timelines of submission of assignments. The approach taken by the students had been an exercise in establishing the importance of experiments in Physics, which has of late been found wanting at every level, from school to post graduation. The experience of the Workshop can be utilized for planning conduction and evaluation of experiments performed from home which is a big challenge for the academicians during the pandemic.

A pale of gloom had struck the Workshop when at the beginning of the second day, that is 29th December, 2020 it was informed that one of our very senior members, Prof Nandini Raha(Retired faculty, Bethune College, Kolkata) had passed away on the same morning. She had been very intimately involved with the activities of IAPT and a highly committed teacher. A good number of members of IAPT had been her direct students. So, before the start of the Proceedings of the day, one of our members, Prof Manimala Das, who was also a student of Prof. Raha reminisced about her and in the process paid tributes to her on behalf of all members of the IAPT.

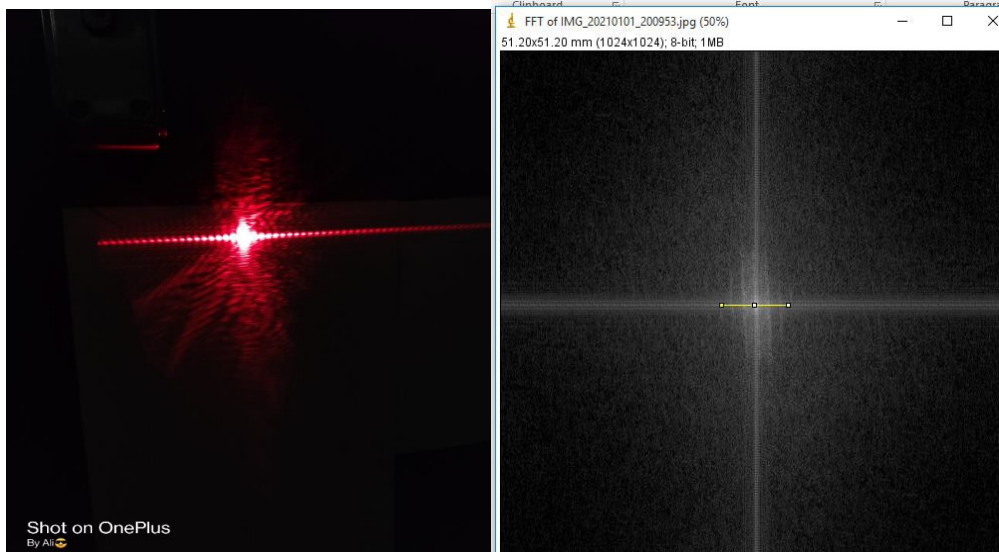
Valedictory Session and Concluding Remarks

At the Valedictory Session, chaired by Prof G.P. Das, the participants had expressed overall satisfaction about the organization of the Workshop. One student observed that sitting in front of the computer for the entire duration of the Workshop followed by the additional hours at home for writing the assignment responses had been a matter of discomfort. Everyone expressed the desire of visiting the labs of SNBNCBS which could not be made possible for obvious reasons. The organizers promised that they would take up the cause of the participants once the pandemic comes under control. The most important outcome of the Workshop was its role in generating confidence among the organizers about the virtual platform in respect of teaching-learning transaction of a laboratory based discipline.

From the feedback of the students it is clear that they enjoyed the workshop and requested for this sort of sessions in future even if that is conducted in face-to-face mode. They said they would recommend their junior friends to attend this workshop in future. They liked the experiments and though some had difficulties in collecting the materials needed for the experiments, they were generally of the opinion that some of the concepts of physics became clear by performing the experiments. One student said he did not have a laptop and so faced difficulty. Not all students enjoyed all the presentations equally. This is not unexpected from a workshop. However, the organizers felt encouraged to hold similar workshops in future.



Doppler shift experiment by Debdatta Banerjee (Left). Formation of ripple on water surface (top right) and experiment on diffraction (below, left) and its FFT have been taken by Imamah Ali, Both were the student participants in the Workshop



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