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# THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

## A MONTHLY JOURNAL OF EDUCATION IN PHYSICS & RELATED AREAS

VOLUME 13 NUMBER 2 FEBRUARY 2021

**Dr. D.P. KHANDELWAL -** Founder of IAPT
(1.10.1921 - 12.2.1996)

**Birth Centenary Year**
**(01.10.2020 - 01.10.2021)**

# PHYSICS NEWS

**CERN Physicists Find First Evidence for Production of Top Quarks in Nucleus-Nucleus Collisions**

New results from the CMS Collaboration at CERN's Large Hadron Collider demonstrate for the first time that top quarks are produced in nucleus-nucleus collisions. The results open the path to study in a new and unique way the extreme state of matter that is thought to have existed shortly after the Big Bang.

Top quarks can provide insights into the highest energy collisions. They also enable physicists to study how the quarks produced from top quark decay experience a 'quench' in their energies through interactions with quark-gluon plasma. The CMS collaboration saw evidence of top quarks in a large data sample from lead-lead collisions at an energy of 5.02 TeV. After isolating and counting the top-antitop collision events, they estimated the probability for lead-lead collisions to produce top-antitop pairs via charged leptons and bottom quarks.

The result has a statistical significance of about four standard deviations, so it does not yet cross the threshold of five standard deviations that is required to claim observation of top-quark production. The result is consistent with theoretical predictions, as well as with extrapolations from previous measurements of the probability in proton-proton collisions at the same collision energy.

***Read more at :*** http://www.sci-news.com/physics/production-top-quarks-nucleus-nucleus-collisions-09055.html

***Original paper*** : Physical Review Letters(2020). DOI: 10.1103/PhysRevLett.125.222001

**Trapping Light Without Back Reflections**

Microresonators are small glass structures in which light can circulate and build up in intensity. Due to material imperfections, some amount of light is reflected backwards, which is disturbing their function. Researchers have now demonstrated a method for suppressing these unwanted back reflections.

One limitation of optical microresonators is that they have some amount of back reflection of light due to material and surface imperfections. To reduce the unwanted backscattering, the British and German scientists were inspired by noise cancelling headphones, but rather using optical than acoustic interference. "In these headphones, out-of-phase sound is played to cancel out undesirable background noise," says lead author Andreas Svela. "In our case, we are introducing out-of-phase light to cancel out the back reflected light".

The method can be used to improve gyroscopes, or to improve portable optical spectroscopy systems, opening for scenarios like built-in sensors in smartphones for detection of dangerous gasses.

***Read more at :*** https://www.sciencedaily.com/releases/2021/01/210112125227.htm

***Original paper*** : Light: Science & Applications (2020). DOI: 10.1038/s41377-020-00440-2

**Scientists Make Pivotal Discovery in Quantum and Classical Information Processing: Scientists tame photon-magnon interaction.**

Working with theorists in the University of Chicago's Pritzker School of Molecular Engineering, researchers in the U.S. Department of Energy's (DOE) Argonne National Laboratory have achieved a scientific control that is a first of its kind. They demonstrated a novel approach that allows real-time control of the interactions between microwave photons and magnons, potentially leading to advances in electronic devices and quantum signal processing.

Microwave photon-magnon interaction has emerged in recent years as a promising platform for both classical and quantum information processing. Yet, this interaction had proved impossible to manipulate in real time, until now. By smart engineering, the team employs an electrical signal to periodically alter the magnon vibrational frequency and thereby induce effective magnon-photon interaction. The result is a first-ever microwave-magnonic device with on-demand tunability.

The team's discovery opens a new direction for magnon-based signal processing and should lead to electronic devices with new capabilities. It may also enable important applications for quantum signal processing, where microwave-magnonic interactions are being explored as a promising candidate for transferring information between different quantum systems.

***Read more at :*** https://scitechdaily.com/scientists-make-pivotal-discovery-in-quantum-and-classical-information-processing/

***Original paper*** : Physical Review Letters (2020). DOI: 10.1103/PhysRevLett.125.237201

**Pankaj Bhardwaj,** Friedrich Alexander University, Erlangen & Nuremberg, Germany

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**Observance of National Science Day:**
**A Part of D P Khandelwal Birth Centenary Celebrations**
**(February 28 and March 01, 2021)**
**See Page 69**

## Note for readers

The Bulletin is printed at Kanpur where the post office have fixed the date of dispatch as 8th of current month. Prior to that the printed copies are ready on 6th/7th of the month. The day the printing is over the Bulletin of the month is displayed on the IAPT website. The hard copy of the bulletin reaches the members much later – nearly a week or so, even much later at far away places.

Many members do not wish to wait that much and have asked for the soft copy which is being sent to them, their hard copy has been discontinued.

We understand there are many more members who would like to receive the soft copy. They may please send their request to the Managing Editor :

Dr. Sanjay Kr. Sharma , email –sksharma777@gmail.com, Mob. 9415404969

Please note that in all such cases the hard copy will be discontinued.

**Editor**

## Corrigendum

December 2020 issue : Back cover page showing the contents, the authors of the article " On the visibilityof mountains ....." be read as " Vijay A Singh and Arnav Singh "

**Editor**

# Prof. D.P. Khandelwal – a visionary teacher

**B.K. Srivastava**

Former Professor of Physics, University of Rajasthan, Jaipur

It is now quarter of a century since Prof. Khandelwal left for his heavenly abode. His trend setting contributions to upgradation of Physics syllabi and laboratories continue to be relevant and inspiring. For those who had the privilege of working/interacting with him, his passionate zeal for the cause of physics education continues to be infectious. Indian Association of Physics Teachers (IAPT), founded by him in 1984, is providing platform to Physics Teachers to share ideas and is abuzz with activities aimed at popularizing physics and science.

## 1. The person

A down to earth simple man sensitive to the calls of the society and uncompromising on principles, a true 'karmayogi', he touched and influenced innumerable lives. Participation in freedom movement, association with Khandelwal Mahasabha with focus on helping the needy children avail education, his clear headed and incessant working for upgrading science/physics education, launching and nurturing of IAPT and tireless working till his very last, all emanate from one eternal desire, viz., to affect change for better.

What were the inspirations? Surely parents would have imparted the basic values and the character. A brilliant student, after his B.Sc., he got selected for Indian Civil Service but his conscience did not permit to join it under the foreign rule. The importance that Prof. Khandelwal attached to experiments should owe in part to the impact created by his school teacher who primarily invoked demonstration experiments for conveying science concepts. Prof. Khandelwal would fondly recollect this. In the context of his work on development of experiments, he reminisced that Prof. D.D. Pant had been a source of inspiration and dynamic support for him. These apart, two factors seem to stand out which played role in shaping his persona, viz., (i) the call of freedom struggle and (ii) the benevolence of the owner of the school in which Prof. Khandelwal had his first teaching appointment.

The call of freedom struggle invigorated him to participate. Pricking his fingers to inscribe in blood on paper slips and sliding them in hostel rooms in Agra, he would exhort other students to join the movement. This was 1943 during his second year of M.Sc. A warrant was issued for his arrest which forced him to leave studies mid-way. For concealing identity, he had to change his surname from Rawat to Khandelwal. He took up teaching in a private Marwari Vidyalaya in Karachi. When the upheaval subsided, he returned to Agra seeking re-admission in M.Sc. (second year). He lost time but earned determination to firmly stand against injustice, something that was to reflect again in his future actions. Years down the line in 1969 when he was Head of the Department of Physics at the prestigious Agra College, an unfortunate incident of a teacher behaving inappropriately with a girl student and the College Administration, inspite of his recommendation, not coming forth with appropriate action, made his inner rebel resign the job. He remained without job for some days before appointment as Professor and Head of Physics Department at Harcourt Butler Technological Institute (HBTI), Kanpur. The spirit of standing up for a cause comes through again when he vehemently resisted certain administrative policies at HBTI. It would have its obvious share of tense times but Prof. Khandelwal with his calm persona would carry on the normal routine of teaching and Head-ship. Prof. A.N. Nigam, his colleague in the Department, recollects this in his memoirs of Prof. Khandelwal [1].

The second factor that would leave a mark on him relates to the Marwari Vidyalaya, Karachi, D.P.

Khandelwal had joined in as teacher after dropping out of M.Sc. in midway of second year. The owner of the school was impressed with his interest and dedication in teaching and gave him (financial) freedom for setting up a good laboratory for the students. Further, he sponsored his discontinued M.Sc. education at Agra College. The kind gestures, from a person who himself was perhaps not highly 'educated', added to his innate desire of devoting to education of youth in general and to science education in particular.

Prof. Khandelwal was a strict disciplinarian in sticking to a planned schedule and to this end he was very tough on himself. During the course of one summer Institute under his Director-ship at Nainital, he received the tragic news of passing away of his mother. That day he left for his native place but only to return the next day. ….Personal comfort was the last thing he would care if he had to meet some commitment. Two instances come to mind. Prof. S. Lokanathan (who had joined University of Rajasthan as Professor in 1969) recalls the following from around 1975. Prof. Khandelwal, at that time with HBTI, Kanpur, was on a visit to Jaipur in connection with ULP programme in the University Physics Department. After couple of days, after finishing day's work, he asked Prof. Lokanathan to drop him at the bus station for a night bus as he had to get back to Kanpur. Prof. Lokanathan's suggestion that he should get some rest overnight and next morning he would put him on a fast train to go in some comfort in I class, was not heeded to. … Some 15 years later, in early 1990s he was in Jaipur on a short visit. Next day he was to leave for Pune, where he had convened an IAPT meeting. I accompanied him to the railway station. His train reservation did not get confirmed till the last. I suggested that he could postpone the Pune meeting for a couple of days but it would not fit in with his self discipline of sticking to a schedule. He just boarded the train. I thought that at the age of 70+ this should have been avoided. ….. Prof. Lokanathan reminisces “Although he was years older (than him), his stamina seemed of a higher level.”.

Prof. Khandelwal loved work and hard work at that but he was not workaholic. He enjoyed games, played cricket and bridge, and enjoyed humour too. While at Agra College he was a regular wicket keeper player in the faculty team. Even on a busy day he would love to keep updated of scores in an ongoing India cricket match. At home he could be seen enjoying solitaire. Prof. Lokanathan has following interesting recollection from his visit to a workshop which Prof. Khandelwal organised at Agra College. Prof. Khandelwal would be sitting through all the Lectures and still in the evening would find out an hour to play bridge and then plan for next day's proceedings before retiring for the night. Come to humour, in a lighter mood, he would talk about three classmates in High School passing out in I, II and III Divisions respectively; in the long run the first one became a teacher, the second a bureaucrat and the third one eventually became a Chief Minister. The first one was he himself; two others shall like to remain nameless.

## 2. Professional career

As mentioned earlier, in 1943 leaving his M.Sc. (second year) studies mid-way, Prof. Khandelwal joined as teacher in Marwari Vidyalaya, Karachi. In the turmoil of partition in 1947, he moved to Birla College, Pilani, to take up teaching Physics to Intermediate students. In 1948 he was appointed as Lecturer in the prestigious Agra College, Agra, where he would engage UG and PG classes. In 1954 he got selected for Lecturer-ship in Government PG College, Nainital, where he also pursued his Ph.D. work under the supervision of Prof. D.D. Pant. Served there till 1961 when he moved to Rajasthan University, Jaipur, as Reader in Physics. In the year 1963 he went back to Agra College, this time to Head the Department of Physics, a position which provided him space to pro-actively pursue his passion of working for upgradation of Physics syllabi and laboratories. In 1965 he went on short visits to USA and UK, under the USAID Programme of the Government of India, for studying development of teaching programmes and organisation of teacher orientation courses. In 1969, from Agra College, he went to Kanpur as Professor and Head of the Department of Physics at HBTI. In 1977 for one year he went on deputation as Visiting Professor to work in the University Leadership Programme (ULP)

at University of Rajathan, Jaipur. Prof. Khandelwal retired from HBTI in 1981.

Post retirement, during 1981 - 84, Prof. Khandelwal associated as Research Scientist with Prof. H.D. Bist's group at IIT/K. He launched IAPT in 1984 and its functioning became his singular devotion. In 1993 he joined Poona University as Emeritus Fellow in a UNESCO Project "University Foundation Course in Modern Physics" with Prof. A.S. Nigavekar. Sharing his time between IAPT activities and the UNESCO Project, Prof. Khandelwal kept working for long hours till his very last.

### 3. Works on upgradation of Physics education and on research

Prof. Khandelwal was passionate working for upgradation of syllabi and designing/renovation of experiments. In relation to these, he also devoted his time on preparation of course content/teaching material and training/orientation of teachers. The first ever seminar held at Jaipur for the teachers of Rajasthan for discussing syllabi and laboratory development was convened by him in 1963. He was also the Convener of the first ever Seminar, with similar objectives, held in Agra College for Agra University teachers in 1964. He worked for lower classes, VI onwards to Intermediate, with as much vigor and enthusiasm as for UG classes. Some twenty summer Institutes/Seminars/experimental workshops/teacher orientation courses were organized over the years.

Two of his trend setting works of far reaching consequence are introduction of Berkeley Physics based B.Sc. syllabi in Agra University in 1967 and renovation of Laboratory experiments with open ended approach. In due course, the syllabi were adopted by Universities across the country. Prior to this, UG Physics syllabi were so to say compartmentalised into "General Properties of Matter, Sound, Heat, Light, Electricity & Magnetism and Electronics". The carried out upgradation brought in the much needed and thitherto missing perspective in Physics teaching in the country.

His love for experiments and student like zeal for performing experiments was striking. He put emphasis on an open ended approach for experiments with an objective of studying a system or a phenomenon instead of determining a constant. Large number of experiments was designed by Prof. Khandelwal and his colleagues/fellow teacher participants in number of Summer Institutes/workshops organized in his Director-ship, and in his places of work, viz., Agra College, DSB College at Nainital and HBTI, Kanpur. The 1971 Summer Institute at Nainital needs special mention. 15 new B.Sc. level experiments were designed in this workshop. The report of the Summer Institute got wide acclaim and several of the experiments became part of the laboratories of different colleges. The experiments developed over the years are rich in their depth as also in coverage of the range of phenomena. His book "A Laboratory Manual of Physics" [2] gives a vivid description of these experiments. It also includes experiments developed under University Leadership Project at University of Rajasthan, Jaipur, with which Prof. Khandelwal was closely associated right from its inception. The experiments include adaptations of old and established experiments to open ended approach, new low cost experiments effectively conveying concept with freedom to play and new experiments with relatively costly equipment but adding to student's excitement and precision of the data.

In his last few years' association with Poona University, Prof. Khandelwal was involved with the UNESCO Project right from the stage of drafting of the proposal. Professors A.W. Joshi and A.D. Tillu [3] thus recount his contribution 'Although a large team was involved in this Project, almost the entire development of the course "A World-View of Physics" (which includes a textbook, a teacher's guide and quite a few experiments) was due to him'.

His research interests were in fluorescence spectroscopy, molecular and solid state spectroscopy using infrared and Raman techniques, and in theoretical lattice dynamics. Six students obtained Ph.D. degree under his supervision. His own Ph.D. work carried on a home built fluorimeter was extensively quoted in a monograph by Rabinwitch and Belford (Academic Press, 1964). Results of experimental work on molecular and solid state

spectroscopy were published in reputed Journals like Chemical Physics Letters and Journal of Molecular Structure. An invited Review article came out in Applied Spectroscopy Review. Results of the work carried out in theoretical lattice dynamics brought out publications in Journals like Physical Review and Journal of Chemical Physics.

**4. Long time associations**

In his over three decades of teaching career spread over at Agra, Nainital, Jaipur and Kanpur, Prof. Khandelwal enjoyed close cooperation of many fellow teachers/colleagues. Also he had been closely associated with ULP Programmes at University of Rajasthan, Jaipur and at Punjab University, Chandigarh and with Physics Education Programmes at Poona University. Long time associations with three Professors, namely, Prof. D.D. Pant, Prof. B.L. Saraf and Prof. H.D. Bist, stand out.

Prof. Pant has narrated [4] that when D.P. Khandelwal was selected as Lecturer in Physics for the Government College, Nainital, he went to meet him (Prof. Pant) who was then Head of the Physics Department there. D.P. Khandelwal also had an offer of appointment as Income Tax Officer. He, however, expressed his desire, to Prof. Pant, of joining as Lecturer but he would also like to have the possibility of doing Ph.D. there. That was in 1954. Prof. Pant made him join the Department. The College did not have facilities for research. It was decided to ab-initio set up a fluorimeter for undertaking a research programme on fluorescence spectroscopy. Basic units like photomultiplier tube and transformers were collected and a non-recording fluorimeter was assembled around a student's spectrometer. D. P. Khandelwal carried out his Ph.D. work on this laboratory assembled fluorimeter. In 1961, Dr. Khandelwal moved to Rajasthan University, Jaipur. Association with Prof. Pant continued over the years. In 1970s Dr. Khandelwal conducted Summer Institutes at Nainital and when Prof. Pant was Director of Education in UP, did extensive work on training of teachers for organizing Summer Institutes of teachers of Intermediate classes.

Prof. Khandelwal had the longest association with Prof. B.L. Saraf. Their first acquaintance was in 1948 - 49 in Agra College where Dr. Khandelwal had recently joined the Department as Lecturer and B.L. Saraf was a M.Sc. student. Their long time association commenced when in 1965 Dr. Saraf, after his stint in BARC, joined teaching faculty at University of Rajasthan. Dr. Khandelwal, having earlier served as Lecturer in University of Rajasthan (1961 - 63), had moved to Agra College in 1963 and was actively involved with programmes relating to upgradation of Science/Physics education at various levels. First collaborative venture of Prof. Khandelwal and Prof. Saraf was during 1966 - 69 on a NCERT Project for producing teaching material/experiments for classes VI – VIII. A novel "Question Book" approach was developed under the Project for teaching of science at the lowest level. In 1971, University Leadership Project (ULP), aiming at design/development of experiments, was taken up under the Coordinator-ship of Prof. Saraf with a strong team including Prof. S. Lokanathan and others, at University of Rajasthan. Prof. Khandelwal was actively associated with this Project right from the stage of its inception and was a regular visitor to the Department interacting with the team. This association resulted in development of very novel experiments. As mentioned earlier, in 1977 Prof. Khandelwal went to Jaipur for a year as visiting Professor for working for development under the ULP. One would vividly recollect the images of Prof. Khandelwal performing, like a student, the experiments in great details in the University Science Instrumentation Centre Building in the extreme summer time of May - June, 1978. The sustained efforts resulted in rich observations on the newly developed concept-wise rich experiments. The experimental development work carried out under ULP was presented in two books, "Physics through Experiments, Vol. I and Vol. II". Prof. Khandelwal was associated in various stages of the work compiled in both the volumes. His spending one year at Jaipur particularly enriched Vol. II; it also brought out a more detailed second edition of Vol. I.

Association between the two Professors continued. Prof. Khandelwal launched IAPT in March 1984; in October 1984 Prof. Saraf took over as President and

continued till Dec. 1986. He returned back to undertake this responsibility for the period Jan. 1998 - Dec. 1999.

Since Prof. Khandelwal moved to HBTI, Kanpur in 1969, he initiated research collaboration with Dr. H.D. Bist at IIT/K in the field of Molecular and Solid State Spectroscopy using Infrared and Raman techniques. They had acquaintance during their overlapping times at DSB College, Nainital. Dr. Khandelwal had joined the faculty in 1954. Both, Dr. Khandelwal and Dr. Bist did their Ph.D.s under Prof. D.D. Pant, Dr. Khandelwal during 1954 - 58 and Dr. Bist during 1958 - 62. They collaborated on some research problems in Nainital. When Prof. Khandelwal moved to Kanpur, for some months he stayed on IIT Campus. This enabled commencement of an extensive collaboration between them. Several research students (one being myself) benefited. After his retirement from HBTI, the collaboration continued and Prof. Khandelwal associated as Research Scientist with Prof. Bist's group during the period 1981 - 84. Over all they co-authored more than 30 research papers and co-edited a book "Lasers and their applications in Indian context" (Tata McGraw Hill, 1985).

**5. Prolific write**

Prof. Khandelwal loved to write. As reminisced by his son Sri Anil Khandelwal, no letter addressed to him went unanswered. Come to writing articles/ research papers, one remark which captures his style is worth recalling. I was doing my Ph.D. under the supervision of Prof. Khandelwal. Infrared spectroscopy experiments for the Ph.D. work were carried out in the research Laboratory of Dr. Bist at IIT/K. In the course of writing a research paper, first draft would be written by the Ph.D. student, it would be critically examined/corrected/re-written by Prof. Khandelwal and then taken to Dr. Bist for opinion/corrections. Once, first draft of a research paper, prepared by me, was with Prof. Khandelwal for some time. And one fine day when I took the corrected draft to Dr. Bist in IIT/K, a pleased Dr. Bist's spontaneous remark was 'Doctor Sahib nay aaj ek hee sitting may likh diya hoga'. That was the style. It would take a while for ideas to get concretised and then he would write them down generally in one go.

Prof. Khandelwal had equally good command in Hindi and English. He was a poet at heart. A few of his Hindi poems printed in Feb. 97 issue of IAPT Bulletin reflect his sensitive side. In his early teaching career, he wrote books in Hindi for High School and Intermediate classes. He also translated two well known Physics books into Hindi – Beaching's 'Electron Diffraction' and Saha and Srivastava's 'Heat'. His two books – 'Optics and Atomic Physics' and 'Elements of Thermodynamics and Statistical Physics' (this one with Prof. S. Lokanathan) – have been reference material for generation of teachers and B.Sc. students. His book 'Laboratory Manual of Physics', as mentioned earlier, is an authentic resource of selected new experiments. ULP's two books 'Physics through Experiments, Vol. I (second edition) and Vol. II' have distinctive imprints of his efforts. Each of the umpteen number of summer Institutes/workshops/orientation courses coordinated by him was followed with a detailed report/write-up.

**6. Man with a purpose and team builder**

Prof. Lokanathan recalls [5], from his first meeting with Prof. Khandelwal when in1965 he and Prof. Saraf visited IIT/D where Prof. Lokanathan was on the faculty, "He immediately struck me as a person with a purpose. He wanted information about some laboratory equipment he needed and came straight to the point". Everyone meeting Prof. Khandelwal carried that impression. The focused approach was a characteristic all through…. S.A. Agte and Nitin Bhamare [6], who worked with Prof. Khandelwal for the Pune UNESCO Project, in his last few years (1993 - 96), recall in the following words "He used to start working just right after entering the room and will leave the room just after he has finished……He used to preplan what should be completed today".

Prof. Khandelwal had a belief that everyone has got his own strength and the job of a team head/leader is to spot it and get out the best. With this belief, with his unassuming nature and with his so apparent sincerity of purpose, he was able to win support. This stood strong in his long time academic associations/collaborations and ultimately in the building up of strong team of

IAPT flag bearers.

**7. The teacher - always there to help**

The spark in Prof. Khandelwal's eyes while emphasizing on a point would keep the students spellbound. During my B.Sc. days in Kanpur in 1970, he visited the College to deliver a lecture under the auspices of Kanpur Physical Society. We students were thoroughly charmed. After my M.Sc. from DAV College, Kanpur, I was fortunate to get selected for Junior Research Fellowship under his guidance. Students had an important place for him and he was always there to help. Even when busy in discussions with colleagues or attending to some administrative work, if a student approaches with either a study related or an office related problem, he would be attended to without having to wait. Teachers and the teaching Institutes exist for and because of the students, was always put into practice. One worth mentioning instance relates to the then M.Sc. student Babu Lal Saraf at Agra College. Prof. Khandelwal was on the teaching faculty and B.L. Saraf had taken admission in M.Sc. One day as the student Saraf was looking for some book, teacher Khandelwal accompanied him to the Central Library to help him find the appropriate book. That bond of sincerity of a teacher would have played role in their nearly four decade long friendship which resulted in illustrious collaborative efforts in the cause of Physics education.

Prof. Khandelwal encouraged students to engage in research/Ph.D. work which essentially provides some five years of hands on experience of rigorous analytic thinking/work. In his characteristic style he would sum it up in the words 'dhai aakhar prem ka padhey so pandit hoye'. Y.S. Jain who in second half of 1960s was working as Lecturer in a Private College at Agra fondly remembers Prof. Khandelwal encouraging him to join as research student in a Project with Dr. H.D. Bist at IIT/K. That changed his course. He did his Ph.D. from IIT/K and went on to make substantial contributions in the fields of Molecular/Solid State Spectroscopy and Condensed Matter Physics and served as Professor at North Eastern Hill University, Shillong. At HBTI, Prof. Khandelwal encouraged and helped the Faculty and research students, for undertaking quality research work in collaboration with research groups at IIT/K and Universities. This created a lively atmosphere for research in the Department.

Alok Kumar who was a Ph.D. student (of Prof. A.N. Nigam) at HBTI, and presently Distinguished Teaching Professor at State University of New York, Oswego, cherishes memories of seeking Prof. Khandelwal's advice on different occasions starting from his HBTI days. One specific instance he mentions is from 1989 when Alok Kumar was teaching in California State University, Long Beach. He was working on writing a book titled “Science of the Ancient Hindus”. He requested Prof. Khandelwal for his comments on the manuscript. Alok Kumar says that Prof. Khandelwal critically read the book and gave his comments. He wanted Alok to publish the book as it should encourage others to work in the field. Based on Prof. Khandelwal's comments/suggestions, he worked on improving the text and finally published it in 2005.

I myself owe my professional career to Prof. Khandelwal. I had the privilege of being his research student during 1972 - 77 at HBTI, Kanpur. In 1977, he was to go to Jaipur as Visiting Professor under the ULP Programme with Prof. B.L. Saraf. My Ph.D. had just got completed. Prof. Khandelwal advised that it should be explored if I could have an opportunity of being part of the research programmes at Physics Department of University of Rajasthan which was abuzz with research activities with Prof. B.L. Saraf and Prof. S. Lokanathan at the helm. Prof. Khandelwal asked me to accompany him to Jaipur. For couple of initial days I stayed with him in the University Guest House. Subsequently when he moved to regular Professor's residential quarter, he offered and allowed me to stay with him. This was not with slightest hint of obliging but it was part of his moral/human value system as a teacher. When L.C. Joshi, who had been his student in Nainital, went to Jaipur to be part of ULP team, he also stayed with Prof. Khandelwal along with me.

On Prof. Khandelwal's recommendation, Prof. Lokanathan accepted me in his research group on Mossbauer Spectroscopy. I was fortunate to get an

opportunity of working as Research Associate in a major Research Project under Prof. Lokanathan and in due course got opportunity to join the teaching Faculty in the Department.

**8. His concerns/ views**

Not many youngsters opting for physics/science (he termed it internal brain drain) - particularly for fun of it and not just for jobs, quality of M.Sc.'s and Ph.D.'s, disconnect of Universities and more so of big Institutes with problems at lower level, college/school level teachers not having a platform to share their teaching related problems, the gap between Universities and colleges in terms of research environment and the big science facilities largely not being in reach/under control of Universities, all worried him [7].

He suggests [7] a common test for M.Sc. pass outs not only for teaching and research but for any job openings for M.Sc.'s. For popularising physics/science he prescribed multi-pronged approach including (i) science stage shows, (ii) setting up of Centres for Science Culture where common public could visit, just as to a public library, and do experiments of their choice, (iii) setting up of model school and UG level Laboratories with continuous renovation where teachers would visit, interact, work on and choose experiments for their own school/college and (iv) making experimental evaluation, along with theory evaluation, mandatory be it for admissions in higher classes or for jobs. He attached great importance to student Laboratories and advocated for teachers to devote, and being duly recognized for it, more serious attention to Laboratory work. Alike the more heard dictum of the class teacher to be accorded flexibility in choosing say 20% of the course content, Prof. Khandelwal advocated for teacher to be given freedom to choose a laboratory programme as per his taste and available facilities.

With the view of establishing primacy of Universities as the seats of education and research, he suggests that any big science facility should be set up only with a proper University link/control. Establishing of Inter University Consortium for DAE Facilities and Nuclear Science Centre are welcome. Still this is a work in progress.

**9. Launching and nurturing of IAPT**

There was no forum in the country to which physics/science teachers of all levels could truly relate to. Through his experience of extensive interactions with teachers in Summer Institutes/orientation courses/experimental workshops and of academic collaborations in Universities/Institutes, Prof. Khandelwal had a clear realization of importance of teachers – and teachers of all levels – coming together for the cause of popularization of science and for upgradation of Physics/science teaching/education. This lead him conceptualise an Association of Physics Teachers. His discussions with Prof. D.D. Pant, Prof. B.L. Saraf and Prof. S. Lokanathan at Jaipur during "International Conference on the Role of Laboratory in Physics Education" (Dec. 29, 1983 – Jan. 2, 1984), firmed up the idea.

Prof. Khandelwal's work place Kanpur became the head quarter. He had a belief in collective wisdom. On a couple of occasions when he needed to have opinion on effectiveness of some experiments, he resorted to survey among large number of teachers. On the issue of launching of physics teachers association too, he decided to go for a survey. Two circulars, first on Feb. 1, 1984 and second on Feb. 20, 1984, were posted to outstation teachers asking if they would like to be founding member of a proposed Indian Association of Physics Teachers. First one fetched a positive response from about 600 teachers and the second one from 1056 teachers. Convinced of the sufficiency of the number for sustainability of the association, Prof. Khandelwal took the plunge. A local steering committee of 10 eminent Physics teachers, from IIT/K, HBTI and different colleges of Kanpur, did drafting of the statutes and took decision on qualification and membership etc. It was decided to bring out a monthly Bulletin of the Association. IAPT got formed. Story of the formation of IAPT has been described in some details by Prof. R.N. Kapur [8].

Its first bulletin of March 19, 1984, was partly written in hand and partly typed and 1400 cyclostyled copies were posted. Receiving the hand written Bulletin, one was reminded of Prof. Khandelwal's participation in

another revolution little over four decades ago when he would inscribe in blood on paper slips exhorting students to join the freedom movement. His unabated conviction in a well thought out cause and his inner strength for taking a plunge for such a cause, belief in the power of collective thought pooling of teachers, his organisational capacity, ability of identifying talent and winning support, all blended together in launching and sustaining of IAPT. Prof. Lokanathan's words [5] "Many of us have aspirations, dreams of serving causes dear to us but few have the sustained strength and ability to achieve their goals. Prof. Khandelwal was that rare breed who could create an Institution" catch this the best.

In its first convention held in October 1984 at Kanpur, an executive committee was formed. Prof. B.L. Saraf was chosen as the President. Prof. Khandelwal took up the responsibility of General Secretary continuing till Dec. 1990. From Jan. 1991 onwards he was elected President for three successive terms and continued in this role till his last. During those first twelve years of IAPT, one by one several activities were taken up. The monthly Bulletin which has been getting published without a break and the annual conventions provide platforms for exchange of ideas among the teachers. Articles appearing in the Bulletin deal in aspects/problems of teaching, relate to innovation in experiments and latest developments in different areas. Palpable enthusiasm of teachers of all levels including school level is heartening. The examination programmes – National Standard Examination in Physics (NSEP) and National Graduate Physics Examination (NGPE) – have caught the imagination of students. Evaluation of experimental skills, aside the (objective type) theory papers, is a loud statement on the need of attaching, otherwise missing, greater seriousness to experiments. Schemes of IAPT scholarships based on these exams aided to these goals. Later developments of their linking up with International/Asian Physics Olympiad and admission in PG course of SN Bose Centre for Basic Sciences symbolize their accredited authenticity. That IAPT is also conducting National Standard Examinations in Biology, Chemistry and Mathematics which become the base for selecting participants for Olympiads in the respective subjects, is gratifying. Centre for Science Culture Programme (Midnapore) came up as catalyst for popularsing science among public at large. Other important activities which were taken up are National Competition for Innovative Experiments in Physics, and Orientation Programmes, Seminars and Workshops conducted by the Regional Centres of IAPT.

It is a tribute to Prof. Khandelwal that the support he received and the larger team that got built up has strengthened the movement and it is adding more and more innovative programmes. Prayas - the bi-monthly Students' Journal, the series 'Horizons of Physics', setting up of as of now more than 20 Anveshikas beginning with the first one in 2001 at Kanpur, setting up of more than 20 innovative hubs starting with the first one in 2013 at Vivekananda Global University, Jaipur, National Anveshika experimental skill test, competitions in essay writing and computer based innovative experiments, Deenbandhu Saha award for UG teaching, the list is only adding up. Prof. Khandelwal should be proud.

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# The First Nobel Prize in Physics

**B C Pandey**

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## Introduction

On 10 December 1901, Wilhelm Konrad Rontgen of Germany, was awarded the first ever Nobel Prize in Physics, for his discovery of X-rays. The function was held in Stockholm, and it was presided by His Majesty Oscar II, King of the United Kingdoms of Norway & Sweden. The Citation of the Award was read by Hon'ble the President of the Academy of Sciences of the United Kingdoms of Norway & Sweden.

Since then this function has been held on the 10th of December every year,except in 1916, 1931, 1934, 1941, 1942, and 1943, when the physics prize was not awarded, due to the non-availability of a suitable candidate for this subject. Also, in 1905, the United Kingdom split intotwo countries: Norway and Sweden, but this function has continued to be held in Stockholm, and presided by His majesty the King of Sweden. The Citation of the Award has been read by the President of the Swedish Academy of Sciences.

## A Brief Account of the Discovery

The 19th century witnessed the invention of the induction coil. In this instrument, we feed a low D.C. voltage, from a cell, and in the output, we get high voltages pulses. William Sturgeon was the first to invent it in 1837, then it was improved by Charles page in 1938, Heinrich Ruhmkorff in 1850, and Alfred Apps in 1877.

The second half of the 19 Century saw the application of the high voltage from it,by joining the output to the ends of a sealed glass tube, with low pressure air in it, resulting in passage of the

current in the tube, followed by a discharge in it. In addition to the visible light from the discharge, many scientists observed different phenomenon, in this light emitting discharge tube.

The names of physicists, who worked with the discharge tubes, energised by induction coil are: J. Plucker, J. W. Hittorf, C. F. Varley, E. Goldstein, Sir William crooks, H. Hertz, Ph. Von Lenard, and Wilhelm Conrad Rontgen. Goldstein gave the name to the electron beam going from cathode to anode as cathode rays.

Rontgen's work in cathode rays lead him to the discovery of X-rays, where the letter X stands for the word “Unknown”. On the evening of 8 November 1895, he found that if the discharge tube was enclosed in a thick black carton, in a dark room, a paper plate covered by barium platinocyanide, and placed near the black box, became fluorescent, even when it was placed about 2 metres away, from it. In a subsequent experiment that objects of variable thickness were recorded by a covered photographic plate.

Now he took the X-ray photograph of his wife's palm with her wedding ring around her finger, and later he took an X-ray photo of her whole body. These two were the first two Roentgenograms or X-ray

pictures, shown below. When Lady Rontgen saw her full Roentgenogram, she was frightened, screamed, and then she said that she had seen her own ghost!

One can see the umbra of the bones, the penumbra of the flesh, and her ring, and she saw similar things in her whole-body X- ray picture. His discovery gave to mankind an unparalleled gift, by its application in medical science. He never patented his discovery, in view of its immense service to humans and animals too.

### About Wilhelm Rontgen

He was born at Lennep, Remscheid, Germany, on 27 March 1845. When he was 17 years old, he attended the Technical School, Utrecht. He was expelled from the school, under false suspicion, for making a caricature of his class teacher. Actually, some other student had made the caricature, who never came forward to own it,since Wilhelm was a trouble maker of the class, he was wronglysuspected for doing it. In his class he was good in all subjects, but physics. He then changed his school.

When he was 23 years old, he qualified as a mechanical engineer, from Polytecnikum in Zurich. Kundt noted his experimental qualities, and took him in his laboratory. Rontgen did his Ph.D. under Kundt in 1869.

He was at the University of Strasbourg, France, during1874; he was a professor at the Academy of Agriculture, at the University of Hohenheim, during 1875; Prof. of Physics, University of Strasbourg, during, 1876; Chair of Physics, University of Glessen, Germany, during 1879; Chair of Physics, University of Wurzburg, Germany, during 1888-1900. During 1900 - 1923, he was Chair, University of Munich, till his death on 10 February 1923.

From 1907 and onwards, he was a member of the Royal Netherland Academy of Sciences. He was awarded the Matteucci Medal in 1896; Rumford Medal in 1898; and Nobel Prize in Physics in 1901. After 1902, he did not work on X-rays, but devoted in teaching in various branches of physics. Since then physics was at its infancy, his teaching theory and practical classes was actually at a research level.

In post 1901 period, so many schools, hostels, colleges, and roads etc. were named after him, that if I write it here, it would need many pages to record it.

### Acknowledgement

I have used in this article the photos and information about X-rays, and Wilhelm Rontgen etc. found via the Google Search Engine. I am grateful to Google for it, and also thank them.

# Laboratory-assembled time-resolved laser spectrofluorometer

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Laboratory-assembled time-resolved laser spectrofluorometer (TRLS) is capable of recording the short-lived luminescence decays, ranging from millisecond to nanosecond time domain, for all the transitions emanating from shallow and deep trapping states over the whole visible spectrum. Laser induced photo-physical properties of solid and liquid samples can be measured with high precision in the temperature range 77K (liquid $N_2$ temperature) to ~300 K (room temperature). Figs. 1 and 2 show the photograph and schematic block diagram of TRLS set up, respectively, It is composed of following the components:

(i) Pulsed laser excitation source
(ii) Sample stage
(iii) UV filter
(iv) Monochromator
(v) Phosphorescence detector element
(vi) Data analyzer

**Fig. 1 Photograph of Time-Resolved Laser Spectrofluorometer (TRLS)**

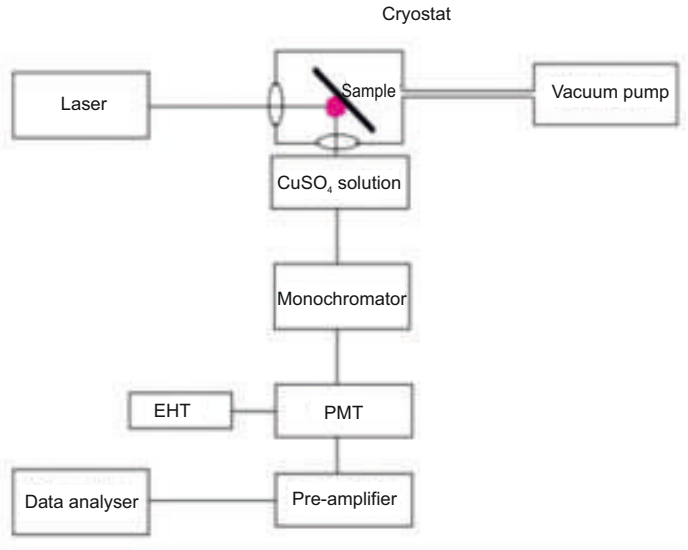


Fig. 2 Schematic block diagram for Time-Resolved Luminescence Spectrofluorometer (TRLS)

The detailed description about the functioning of various components of TRLS is given below:

**1.1 Pulsed laser excitation source**

High peak power (10kW), pulsed (pulse-width ~7-10ns) $N_2$-laser ($\lambda$=337.1 nm) has been employed as the excitation source for efficient photo-physical analysis in transient phosphorescence experiment. When a high current transverse electrical discharge passes through the nitrogen gas, which is flowing at a relatively low pressure (30-50 torr), it can generate a pulse of coherent radiation at a wavelength of 337.1 nm. The laser action begins when a molecule of nitrogen absorbs energy by colliding with an electron moving in the plasma column. This collision causes excitation of the molecule, which further de-excites to a state of lower energy by emitting a photon of wavelength 337.1nm. The emitted photon may encounter another nitrogen molecule in the excited state and stimulates it to emit an identical photon. In this way, the two emitted photons proceed in the same direction with their waves in lockstep. The resulting pulsed radiation contains twice the energy of each photon and the emitted photons are in phase with each other. This process is called the laser action. The laser action will continue as long as the growing pulse encounters more excited nitrogen molecules along its path than absorbing molecules. But the laser action stops after a short while due to the short lifetime of the upper excited laser level.

The energy level diagram of $N_2$ molecule relevant to important laser transitions is shown in Fig. 3. Important laser transitions are $C^3\Pi_u \rightarrow B^3\Pi_u$ , which is the second positive system ( ultraviolet region), and $B^3\Pi_g \rightarrow A^3\Sigma^+_u$ , known as first positive system (IR region) .

In the second positive system, following vibrational transitions are observed:

$0-0$ : 337.1nm $\quad$ $0-1$ : 357.7nm

$0-2$ : 380.5nm $\quad$ $1-0$ : 315.9nm

Out of these, (0 - 0) transition is the most prominent and easily obtainable in electrical discharge of nitrogen gas. In the first positive system various bands from 735 to 1235nm have been observed. The radiative lifetime values of different states at low pressure are as follows:

C ~ 40 ns ; B ~ 5.8 μs ; A ~ 1.2 s

These lifetimes are actually pressure dependent. On increasing the pressure, rate of collisions increases and lifetime of the level 'C' decreases. At atmospheric pressure the pulses of the order of picoseconds can be obtained in the second positive system.

The lifetime values of C (~40ns) and B (~5.8μs) levels make continuous wave (CW) laser action impossible between these levels; since for a continuous laser one requires a metastable upper level and fast decaying lower level. In nitrogen laser both positive systems have lifetimes of upper level much shorter than the lower level. Therefore, both are inherently transient laser systems and can be operated by pumping upper level faster than the lower level. Under certain approximations population inversion exists only for a time:

$$t < \frac{1}{Y_{21}+\tau_{21}^{-1}} \qquad (1.1)$$

where $Y_{21}$ is collisional de-excitation rate from level C to B and $\tau_{21}$ is the radiative lifetime of $C \rightarrow B$ transition.

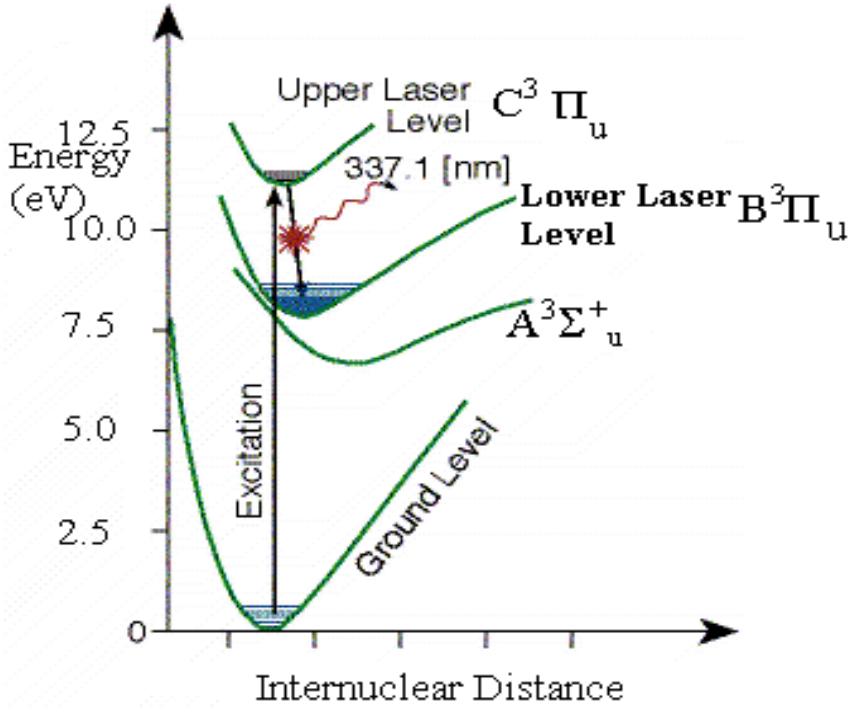


**Fig. 3 Energy level diagram of nitrogen molecule**

Thus, if one neglects $Y_{21}$, population inversion can exist only for ~ 40ns. For an electron density $N_e \sim 10^{14}$ $cm^{-3}$, $Y_{21} \sim \tau^{-1}{}_{21}$ and inversion duration is further reduced. Also, the above calculation neglects loss due to stimulated emission. Hence in actual case, population inversion lasts only for a time 10-20 ns [1-3]. Due to the short-lived upper state, gain for the transition is quite high. In fact, the nitrogen laser generally operates in a super-radiant mode. Spontaneous emission gets amplified along the laser axis. High power pulse can be built-up even in a single pass. A convenient way of producing population inversion is via an intense electrical discharge of $N_2$ gas. The discharge must be rapid enough so that maximum energy in the gas is deposited in a time of 10-20ns, and energy spent afterwards is a waste because inversion ceases to exist. Electrons produced in the discharge undergo inelastic scattering with $N_2$ molecules causing excitation and

ionization. It can be clearly observed from the energy level diagram shown in Fig. 3 that the minimum of the energy for C state lies directly above the ground state minima, and B state minima lies at greater inter-nuclear separation. Hence the excitation cross section for v = 0 level of C state is greater than v = 0 level of B state. In case of $N_2$ gas, since ground state is singlet while B and C are triplet states, a transition is possible only through electron exchange. Electrons with energy in the range 12-18 eV will predominantly excite C state. At energy of 16 eV the ratio of excitation cross sections of C to B level is maximum [3].

**1.2 Sample Stage**

Samples for time-resolved laser spectroscopic studies are placed at 45° to the incident laser beam. Two types of sample holders are used for room temperature and low temperature studies. Grooved perspex sample holder is used for the open air room temperature studies, whereas for low temperature studies cold copper finger of cryostat is used as the sample holder. This cryostat is equipped with temperature sensor and connected through the vacuum pump to the sample holder.

**1.3 UV Filter**

To overcome the scattered UV radiations of the excitation source, which can interfere the luminescent radiations in the detection system; two types of UV filters are commonly used as named below:

(i) Aqueous $CuSO_4$ solution (ii) Thick glass slab

**1.4 Monochromator**

Monochromator has been used as the wavelength selective element to choose single wavelength from the beam of incoming luminescent radiations. Constant deviation spectrometer equipped with a constant deviation prism has been used as monochromator. In the constant deviation prism emergent ray is always perpendicular to the incident ray. The prism is placed on a prism table, which can be rotated about the vertical axis by means of a calibrated rotating drum. Always before use the monochromator was calibrated with mercury vapor lamp.

**1.5 Phosphorescence Detector Element**

The photomultiplier tube (RCA8053 PMT, response time~5ns) has been used as the phosphorescence detector element. It receives the monochromatic optical signal from the monochromator and converts it to an electrical signal, which is further fed to data analyzer. When a photon incident on the photocathode of Photomultiplier tube, it emits secondary electrons due to photo-electric effect. These electrons are accelerated in vacuum across a series of dynodes, which are held at increasingly more positive potentials. Secondary electrons are produced for every electron encounter on a dynode. There is generally four times multiplication for each incident electron (one electron hitting the dynode causes emission of four electrons). This effect generates $4^N$ (N is the number of dynodes) electrons for each emitted photoelectron. These electrons are collected at the anode and produce a current output in the form of a negative pulse.

**1.6 Data Analyzer**

Amplified electrical signal from the Photomultiplier tube is fed to the data analyzer through pre-amplifier. Data analyzer is composed of a 100MHz digital storage oscilloscope (Tektronix TDS 1012, DSO) coupled with PC. The luminescence decay curves recorded on digital storage oscilloscope are procured in PC with the help of interfacing software wave star for further analysis.

In the present work [4-6], powder phosphor sample was pasted in the groove of a perspex sample holder with the help of xylene and used for recording the room temperature luminescence spectra. $N_2$ laser is a suitable excitation source as the laser energy matches the band gap of samples under investigation and excites effectively the luminescent centers introduced by the dopants in the host lattice. High photon flux density ($10^{19}$ photons per pulse) of the laser is very useful to excite the short-lived shallow trapping states, which were otherwise impossible to excite with conventional light sources like mercury vapour lamp or xenon flash lamp. Short pulse-width of $N_2$ laser (~7-10ns) is very useful to determine the decay time values with high precision in the millisecond to few tens of nanoseconds time domain without introducing its own effect. Moreover, its high repetition rate (10-100Hz, which can be changed by adjusting the power supply components) is very beneficial for fast data collection of decay measurements. The short-lived phosphorescence from the sample at an angle of $90^o$ to the excitation beam was collected by a fast photo-multiplier tube through an assembly of monochromator (which act as a wavelength selective element) and UV filter. Photomultiplier tube acts as a transducer as well as amplifier to convert optical signal into the electrical signal. Then the amplified electrical signal was recorded in the digital storage oscilloscope through pre-amplifier. Recorded decay curves were analyzed with the computer simulations to calculate optical parameters. For low temperature (liquid $N_2$ temperature) studies same procedure was followed, but the sample was pasted on the cold copper finger of cryostat. Liquid $N_2$ was poured into the cryostat container after creating the required vacuum and corresponding temperature was noted down from the temperature sensor coupled with the cryostat.

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**To our readers**

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# Ammani Anveshika

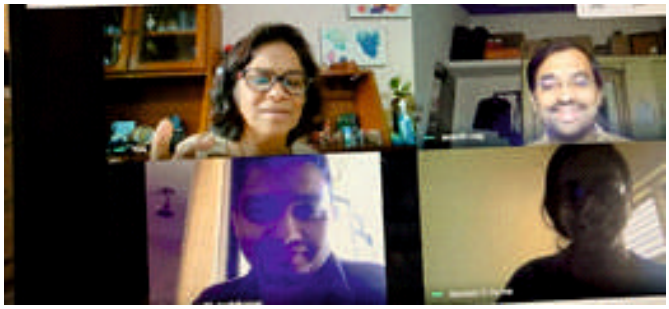
## Bangalore

**Webinar - 1**

**Organized by: A**gastya **I**nternational **F**oundation,
**Anchored** by: Ananth N **Platform:** Zoom Meetings
**Date:** 15 Dec 2020 **Time:**10.30am to 1pm
**No. of teachers**: 10 **No. of trainee**: 10
**Topic:** Multiple reflection and Angles-activity based
**Resource Person:** Sarmistha Sahu

Online teacher's workshops are catching up at Agastya International Foundation. Interested teachers from various states are opting to participate in it voluntarily. Academic Director's efforts to arouse curiosity among students, is clear in the Workshops. A manicured plan of action, short and lively activities, is pathway to 'process skills' in science learning. How Feynman learnt science to how we can learn science, and finally pass it on to our students was progressively applied. The response of the ten teachers and participants was noteworthy.

The 'Multiple Reflection and Angles-Activity based' was a dynamic session experiencing the science-process-skill.



**Webinar - 2**

**Organized:Dev Samaj College for Women, Firozepur City**
**Moderated** by Ms Asma, Asst. Prof
**Platform:** Google Meets, Facebook and Youtube
**Date:**16 Dec 2020 **Time:**11am to 1pm
**No. of teachers**: 10 **No of Students**: 200 +
**Class**: Undergraduate **Topic:** Wonders of Physics
**Resource Person:** Sarmistha Sahu

A three-day workshop on "Wonders of Physics Experiments" was organised by DSCW, a DBT star program.

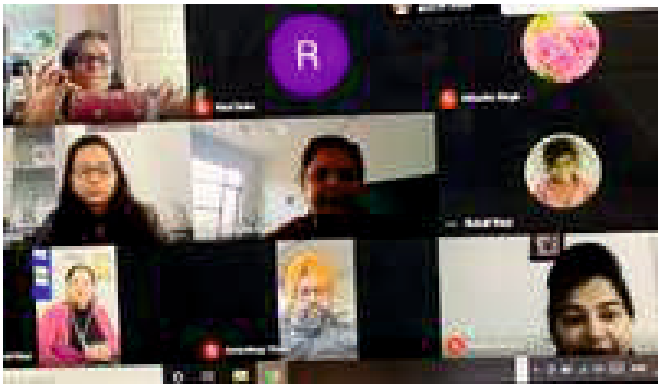
The session on 16th Dec. 'Wonders of Physics' startled the onlookers. Only after the event of a monkey somersaulting and obeying the owner's command did the students wake up to have a hot discussion, to find out the cause of this miraculous feature! They are still communicating with us to arrive at the solution. The next event on the curious film on the wire-cube was still more fascinating. Smart children got the answer from an associated demo and spelt out very comfortably.

The rest of the time was fully engaged in fitting in the puzzle bits, one by one, to arrive at the formula for the planar as well as the solid angle by noticing the number of images formed in multiple plain mirrors. Students unravelled the mystery smartly and proved to be young scientists!

The interaction and discussion were in the high tempo! A true scientific temper was aroused!

Dr Ramnita S Sharda, Principal's message to the students and the guests was thumping and bold.

Dr Asha gave a pleasant vote of thanks.



**Webinar -3**

**Organized by: Majlis** **Platform:** Zoom Meetings
**Anchored** by Ms SutapaLaha De
**Date:** 25 Dec 2020 **Time:**3.30 pm to 5 pm
**No. of teachers**: 19 school teachers of Delhi and others

**Topic:** Dynamics of Heat (Part I)
**Resource Person:** Sarmistha Sahu

Physics Majlis follows its calendar of events seriously. The program was dedicated to Santa Claus of 2020 Christmas celebration. Brainstorming was the cake of the event!

An Innovative design of the apparatus allowed the audience to see the linear expansion of a metal, which had been a known fact to all teachers, yet never really OBSERVED! The interaction of the participants, questions and explanations, suggestions and loud thinking elevated the quality of the session. The apparatus was double purpose, good for qualitative school demonstration as well as a perfect experimental kit for quantitative measurement by undergraduates.

The second experiment was also simple with bottle-balloon-n-hot water. But the discussion was rich and fruitful.

Some feedback then and there, "Very nicely explained the mechanical magnification"; "Fantastic teacher", "*mam ne to itna simple way me linear expansion dikhadiya*";" Wonderful session" "awesome", … from the August audience.

**Sarmistha Sahu**
Coordinator

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## IAPT Member gets Award


Dr Lalit Kishore, Life Member of IAPT, has been awarded the Commonwealth Award 2020, for his innovation in Science, Technology, Engineering and Mathematics (STEM) education (Link: https://www.castme.online/awards).

He has got this award for the third time, in a row

Dr Kishore, currently a senior research fellow at Disha Foundation, Jaipur, has been selected for the award for his entry "Middle School Science to Spin, Swirl and Sway for Self-Development of Science Educator as Action Researcher and Learner-Teacher." The other recipients of the award are from Sri Lanka and Nigeria respectively. Out of three awards, one is for educational project and two are for community projects in STEM education.

# Narender Singh Kapany: The Man Who Bent Light


**Narinder Singh Kapany,** an Indian origin physicist, also known as father of fibre optics died recently on December 4, 2020 at the age of 94 years. November 1999 issue of famous American magazine Fortune cited him one of seven "Unsung Heroes", who greatly influenced life in the twentieth century.

Kapany was born on October 31, 1926, in Moga district of the state of Punjab, India. He completed his education up till graduation in Dehradun Uttarakhand. (https://youtu.be/0qnyxNX4AXg). He served in Ordnance Factory, Dehradun for some time and later went to Imperial College, London (1952) for his further studies.In the year 1955, he was awarded doctorate degree in Optics by the University of London.

Kapany developed applications of fibre optics for endoscopy during the fifties and coined the term 'Fibre Optics' in an article in *Scientific American* in 1960. This article is deemed as a reference point of the subject for the scholars even today. His work has provided the basis for the development of any and all applications in communications.He had to his credit numerous publications and patents, and was a member of the National Inventors Council, United States. He was an International Fellow of many scientific societies including the Royal Academy of Engineering, the Optical Society of America, and the American Association for the Advancement of Science.He received many awards including the Pravasi Bharatiya Samman, awarded by the Government of India in 2004, and "The Excellence 2000 Award" from the USA Pan-Asian American Chamber of Commerce in 1998. He received the UC Santa Cruz Foundation Fiat Lux Award in 2008.

In 1960, he founded Optics Technology Inc. and was chairman of the board, President, and Director of Research for twelve years. In 1967 the company went public with numerous corporate acquisitions and joint-ventures in the United States and abroad. In 1973, Kapany founded Kaptron Inc. and was president and CEO until 1990 when he sold the company to AMP Incorporated. For the next nine years, Kapany was an AMP Fellow, heading the Entrepreneur & Technical Expert Program and serving as Chief Technologist for Global Communications Business. He founded K2 Optronics. He also served on the boards of various companies. He was a member of the Young Presidents Organization and later a member of the World Presidents Organization. As an academician, Kapany taught and supervised research activity of postgraduate students. He was a Regents Professor at the University of California, Berkeley (UCB) and at the University of California, Santa Cruz (UCSC). He was also Director of the Centre for Innovation and Entrepreneurial Development (CIED) at UCSC for seven years. At Stanford University, he was a Visiting Scholar in the Physics Department and Consulting Professor in the Department of Electrical Engineering.

In a paper published in 1996 Charles K Kao put forward the revolutionary idea of manipulating fibres optics for communication using light. For the ground-breaking achievements concerning the transmission of light in fibres for optical communication, Charles K Kao has been awarded Nobel Prize for Physics for 2009 by the Royal Swedish Academy of Sciences. He tirelessly evangelised it and fully deserves the Prize, However, the fact remains that it was Kapany who first demonstrated

successfully that light can be transmitted through bent glass fibres during his doctoral work in the fifties.

In an interview published in 2009 on Rediff News(http://news.rediff.com/report/2009/oct/08/how-india-missed-another-nobel-prize.htm) Narinder Singh Kapany recounted, "When I was a high school student at Dehradun in the beautiful foothills of the Himalayas, it occurred to me that light need not travel in a straight line, that it could be bent. I carried the idea to college. Actually it was not an idea but the statement of a problem. When I worked in the ordnance factory in Dehradun after my graduation, I tried using right-angled prisms to bend light.However, when I went to London to study at the Imperial College and started working on my thesis, my advisor, Dr Hopkins, suggested that I try glass cylinders instead of prisms. So, I thought of a bundle of thin glass fibres, which could be bent easily. Initially my primary interest was to use them in medical instruments for looking inside the human body. The broad potential of optic fibres did not dawn on me till 1955. It was then that I coined the term fibre optics."

Dr.Kapany would be an inspiration for the forthcoming generations who strive to bring revolution to the field of science through innovative ideas and out of the box thinking.

**Amit Kumar Sharma**
DAV (PG) College, Dehradun

**Disclaimer:** Information compiled and photograph used in this article is based on Wikipedia, youtube, Rediff news and some other random web links dedicated to Narinder Singh Kapany.

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## 'Jnan O Bijnan Puraskar' Award


Dr Bhupati Chakrabarti, formerly of Department of Physics, City College, Kolkata and a former General Secretary of IAPT had been bestowed upon the

prestigious 'Jnan O Bijnan Puraskar' award by Bangiya Bijnan Parishad, Kolkata. This organization was established by Prof S.N. Bose in 1948 for science communication and particularly for promoting the science writing in Bengali. The organization publishes a Bengali monthly science magazine 'Jnan O Bijnan' for last 73 years without a break.

Dr Chakrabarti has received this award for his overall contribution in science writing and science communication in Bengali on January 25, 2021 the 74$^{th}$ foundation day of Bangiya Bijnan Parishad in Kolkata.

# C K Majumdar Memorial Workshop in Physics 2020

December 28, 2020 to January 4, 2021

C K Majumdar Memorial Summer Workshop in Physics is the flagship programme of the RC 15. For the last several years the 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. This year, due to the pandemic, it could not be organized as per schedule in June. This time holding the Workshop face-to-face with the students was out of question, so we opted for holding it online.

The Workshop got postponed,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. 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, SNBNCBS 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 has 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, of IIT, Kharagpur and the President of 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 told the students that they were fortunate enough to get exposure to invaluable lectures by eminent physicists and 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 Welcome Address was delivered by Prof Samit Kumar Ray, Director, SNBNCBS. Prof Ray is a leading experimental condensed matter physicist of our country, and a pioneer in the field of semiconductor nanostructures and nanodevices. Dr Bhupati Chakrabarti, a former General Secretary of IAPT and a 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.

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, secretary, 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.

1st January, 2021 was devoted to the celebration of the 128$^{th}$ 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 conduct 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 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 Schroedinger'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 expérimental physics and the students have always enriched themselves in the process. Since the workshop has been conducted in online mode the expérimental component was planned in an entirely different way.

A section of very active IAPT members who are the faculty members at différent reputed institutes and colleges, that included Dr Rangeet Bhattacharyya (IISER, Kol), Dr S.Minhaz Hossain (IIEST, Howrah), Dr Pardipta Panchadhyayee (P KCollege, 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, 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 Class room, 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 was 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 exemple 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.

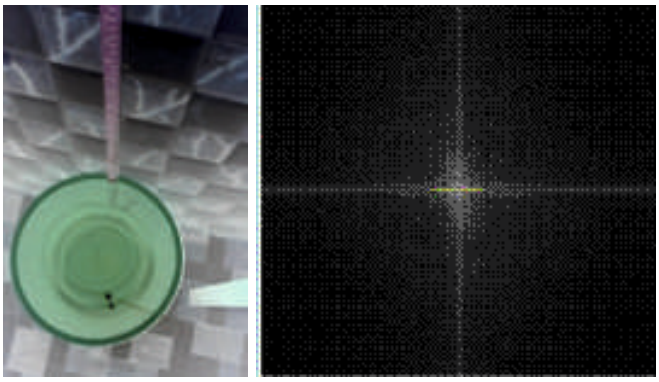
*A pale of gloom struck the Workshop when at the beginning of the second day, that is 29th December, 2020 it was informed that one of our very senior members, Prof Nandini Raha(Retired faculty, Bethune College, Kolkata) passed away the same morning. She had been very intimately involved with the activities 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 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 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.

Doppler shift experiment by Debdatta Banerjee



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

**C K Ghosh**

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**Report(RC-02)**

## Innovation Hub- Physics behind experiments

**Venue:** DAV College, Bathinda (Punjab)
**Date:** 23 Dec. 2020
Time: 9:00AM-2:00PM
**No. of participants:** 23 (Physically) and 90 (Online)

**Coordinator:** Dr. Kulwinder Singh Mann
**Resource Person:** Prof. Y. K. Vijay

Prof Y K Vijay and his team demonstrated many physics

principles and their Innovation-Hub applications. All designed experiments,focused on inculcating students' interest in physics experiments and making it easier for students to understand various essential physics concepts. Dr. Gurpreet Singh, HoD, introduced Prof. Vijay, who said that the motivation to develop such low-cost experimental demonstrations for various complex physics concept came from Late Prof. Babu Lal Saraf who first initiated them. Similar innovation hubs have been installed at 22 educational institutes, many under the DBT Scheme. College Principal, Shri Parveen Kumar Garg conveyed that such experiments are in line with the Department of Science and Technology goal. Dr. Mann emphasized that the hub will help to make science teaching and learning more effective. Students can be engaged in performing several activities on each of the interactive experiments. Such an approach to teaching and learning beyond books is even more relevant in this development era. The physics department's efforts in setting up the Innovation-Hub, were lauded by the college administration and staff.

**K S Mann**

**Report (SRC-08)**

## NGPE Preparation Lecture Series

December 16-20, 2020


IAPT, SRC08C, Pune organized invited talk by Prof B P Tyagi, Chief Examination Coordinator, IAPT on 16th December 2020.The program started with deep condolence to Prof. Dharkar for his full devotion to the different activities of IAPT. Prof B P Tyagi discussed the pattern, required qualifications and different benefits of National Graduate Physics Examination, (NGPE). Principal and Executive Council member, Dr S B Mane discussed the different activities organized by IAPT, throughout the year for the student's benefit. President Prof Bharat Kangude, SRC08C, explained the need and motivation behind the proposed lecture series. The series of lectures were further continued with the different topics in Physics. Prof. Bharat Kangude, Dr S F Dhakane, Dr Ashok Datir, and Dr P S Tambade delivered their talk. Dr Sandip Kakade, Secretary, SRC08C proposed the vote of thanks. All committee members of SRC08C helped a lot in organizing the invited talk. More than 100 students took the benefits from the invited talk.

**Sandip G. Kakade**
Secretary, IAPT, SRC08C, Pune

# Prof. Khem Chand Thakur

March 25, 1936 – December 29, 2020

Born on March 25, 1936, Prof. K.C Thakur was a gold medalist in M.Sc. Physics from Birla College, Pilani (Rajasthan University) in 1958, which soon became BITS Pilani, Rajasthan. His first posting was at Hindu College, Sonepat.

He joined Mukand Lal National College, Yamuna Nagar, as Head of Physics Department on July 7, 1962 and served in the physics department for 35 years before retiring on March 31, 1996 and was a force to start B.Sc. at M L N College. He organized many workshops, Seminars and Invited talks from eminent teachers from various parts of country for the benefit of students and teachers. As his student from 1963 to 1966, I do not remember a single month when some academic activity was not organised under his guidance. He motivated his colleagues to start hobby clubs such as Electronics club, Radio and Television club, Chemical hobby club, etc.

He worked and travelled extensively with Prof Ved Ratna (a great experimental Physicist) in popularizing science in Haryana and Delhi region.

After retirement, he worked in Vivekanand School and Yamuna Institute of Engineering and Technology, Yamuna Nagar full-time until the age of 76. Even after the age of 76, he participated in various Science Events, Conclaves, and summits.

He had deep interest in teaching; wrote three books, and a number of research papers. He held workshops on Experimental Physics in Colleges/Schools and contributed significantly to "Optics using Laser" research. He played a pivotal role in setting up laboratories across various Senior Secondary Schools in Haryana.

Prof. Thakur was former Vice-President of the IAPT. He was also an active member of **Vigyan Prasar** and **Haryana Vigyan Manch**.

Besides his contribution to Science and Technology, he was a favorite among his grand children. No wonder his son is a Scientist in the Indian Space Research Organization (ISRO), his daughters Aruna and Sushma are happily married,

He lived a fulfilling and busy life till his last breath, which he enjoyed. His friends and family see him as a classic example of excellence not only in science but also in humanity. May his soul rest in peace and may the almighty grant strength to his family members and all those associated with him to bear the sudden loss.25

**H K Sahjwani**

Professor (retd), I E C College of

Engineering and Technology,

Greater Noida , UP

# Webinar-Lecture and Interactions

The program was organized by RC-12, Kalaburagi, on September 7-8, 2020 in collaboration with District Science Centre (National Council of Science Museums) Ministry of culture, Govt. of India. The webinar-lecture was inaugurated by Prof M I Savadatti, former Member, UGC and former Vice Chancellor Mangalore University. He talked about innovative teaching during this covid-19 pandemic period.

Sri C N Laxminarayan, District Science officer, welcomed the participants and gave an account of DSC-IAPT activities.

Guest-speakers were introduced by Dr G Venkatesh, Dr S M Khened and Dr L A Udachan.

Dr M S Jogad briefed the IAPT activities and contribution of **Dr D P Khandelwal** founder of IAPT. He said that members worked voluntarily and recalled the contributions made by many members including Prof Babulal Saraf, Prof R M Dharakar, Dr Madhuben, Prof Y R Waghmere.

DSC officials gave technical supports. 100 participants from all the regions participated and interacted during two days.

The abstracts of interactive lectures are given below.

**First day: Lecture-1, Beauty of the Complexity of Science**

**Speaker: Prof S M Shivaprasad,** Jawaharlal Centre for Adavanced Scientific Research , Bengaluru and Director, Karnataka State Higher Education Academy, Dharwad, Karnataka

The Curiosity of what are the heavenly bodies we see and what are the smallest things that make all the materials we see, has been the driving force for great advances in Science. Likening the solar system to the atomic structure posed several challenges in the early 20$^{th}$century. The understanding that emerged from this churning to differentiate between orbits and orbitals has led to the birth of non-intuitive concepts such as Quantum Mechanics and the Space-time Warping. If Science education enables the students to re-discover, and appreciate and think through these historical steps Physics could become not only palpable, but exciting and enjoyable to the young minds. Describing the need of mathematical tools to understand and explain Physical phenomena in physics education can definitely excite young minds towards the path of profundity and deep insights. The teachers should make efforts in this direction to convert curiosity of students to careful observations that can lead to the conceptual understanding of knowledge. This will enable the students to experience the beauty of Science, and get inspired to find ways to apply the knowledge that can result in innovations and discoveries.

**First day:Lecture- 2**, **Activation energy**

**Speaker: Dr M S Jogad,** Ex–Cooridinator Dept of Physics, KSWU Vijayapur/ Ex Principal S B College of Science Kalaburagi, Karnataka

Activation energy is the potential energy barrier against the formation of a product. In other words, it is the minimum energy that the reactant atom or molecules must have to be able to reach the activated state and hence form product.Activated state is the state that occurs temporarily during a transformation or reaction when the reactant atoms or molecules come together to form a particular arrangement (intermediate between reactants and products) that has a higher potential energy than the reactants. The activation energy is calculated by using Arrhenius relation. Decrease in the electrical resistivity by increasing temperature can be explained due to thermally activated drift mobility of charge carriers according to hoping conduction mechanism of electrons between multivalent cations. Explained how activation energy changes by taking examples of glass/glass-ceramics and semiconductors. There is a difference of carrier conductivity in different phases. Charge carriers get trapped at the interphases of the phase boundary. Thus they lead to the induced dipole polarization of the sample, which becomes stronger at higher electric field. At higher temperature higher activation energy is required to release them from the trapping sites. This

higher value of activation energy suggests the induction of induced dipole polarization.Conductivity data shows minimum at few composition suggesting that the conductivity mechanisms are different in these two regions. Experimental data suggest that a polaron hopping mechanism operates in the electronically conducting domain and interstitial pair mechanism operates in the ionically conducting domain. By measuring resistivity of samples of materials we can determine the activation energy. Linear relation is resulted in all cases when log resistivity/conductivity is plotted against reciprocal of absolute temperature. The slope of linear relation gives the activation energy. We designed low cost experiment to UG/PG lab that was shown and explained.

**Second Day: Lecture-3, Saga of Digital Technology and Internet**

**Speaker: Shivaprasad Khened** Nehru Science Centre, Mumbai, Maharastra

The emergence of the Digital technologies, Internet and the World Wide Web were technological triumphs of the 20th Century, which evolved from the basic understanding and underpinnings of Physics in general and solid state and quantum physics in particular. When the common architecture for digital information and communications became wedded to the broadband, fixed and mobile networks, it brought together previously distinct communication markets for data, voice and broadcast content, which is immensely helping human society in modern times. This marriage also allows society to take full advantage of a new generation of computer architectures enabled by a very large array of cheap voice and data communication and computing technologies.

The talk covered a broad spectrum of history of the development of these two technologies – Digital Technology and Internet, and highlighted how India has been immensely benefitted and how Indian are now among the best of technology solution providers. The talk ended with a message, particularly aimed at teachers, to not to ridicule or suppress failures of their students by citing a book "Brilliant Blunders: From Darwin to Einstein - Colossal Mistakes by Great Scientists That Changed Our Understanding of Life and the Universe", authored by Mario Livio. In an era where we need to try and create employment generators and not employment seekers, it is time for the teacher community to create an awareness of how failures are central to progress.

**Second day: Lecture-4**, **Story of evolution of glass and glass-ceramics**

**Speaker: Dr G P Kothiyal,** Former Head,Glass and Advanced Ceramics Division of BARC, Mumbai and Vice Chairman of National Centre of Science Communicators,

Glass is an amorphous solid, completely lacking in long range order, unlike a single crystal but showing glass-transition behavior. As a result of its structure, glass has unique combination of various physical and chemical properties such as transparency, chemical inertness, thermal stability and corrosion resistance, long durability, electrical insulation, blowing compatibility etc. but it suffers from a drawback of being brittle and mechanically weak. Therefore, glass scientists developed a new type of material, which is called glass-ceramic. It is composed of crystalline grains immersed/embedded in glassy matrix and In comparison to parent glasses, exhibits better thermal stability , superior electrical insulation , higher mechanical strength , thermal expansion co-efficient tunabilty (i.e. change in size per unit change in dimension per unit change in temperature), better bioactivity and biocompatibility, some special properties like machinability, magnetic behavior etc .

He mentioned that very little is known about first attempts to make glass. Some believed that glassmaking was discovered 4,000 years ago, or more, in Mesopotamia, there is also a reference of Sir W M Flindes Petrie, who mentioned that earliest glass was known about 12,000 BC and the earliest pure glass was available from 7000 BC (both were found in Egypt, probably brought from Asia) . However, archaeological evidence suggests that first true glass was made in coastal north of Syria, Mesopotamia or ancient Egypt**.** Naturally occurring glass, called Obsidium, formed especially during volcanic activities on earth. In this process beach sand beneath the fire melted and flowed like a liquid stream that later cooled and hardened into glass**.** Obsidium has been used by many Stone Age societies

across the globe for making sharp cutting tools.

It is interesting to note that the work on glass activities in India may have begun in 1,730 BC. It started with the use as some decorative objects but it was later molded or pressed into vessels. Invention of glass blowing ~ 1st century BC increased its uses in vessels and then for window panes etc. It is notable that earliest stained glass was made in 7$^{th}$ century. After the fall of Roman Empire, glass manufacturing was dispersed to isolated sites in the West, but was continued in Byzantium and later in the Middle East by the Arabs. Morano (a series of islands linked by bridges in the Venetian Lagoon) in Venice became the center of a resurgent glass industry in the West from about 1300 AD onwards. During nineteenth century, glass fibers were used for making fabrics. Until, the 20th century most of the advances made in the glass technology were based on empirical ideas. Scientific understanding to the improvement of manufacture and new applications of glass occurred only in the last few decades. Early in 1930's *Owens -Illinois company* made glass fiber manufacturing commercially viable. The first glass manufactured on an industrial scale was glass fiber wool (glass wool/fire resistant aprons etc). World War II onward the activity in glass science grew sharply along with technology. 1960s could be considered golden age of glass science because of useful application of basic science to understanding glass in terms of structure and composition. Though glass has been in use much before other metals, polymers, colloids, solutions, solvents and so on but its complex nature and absence of long range order have deterred, systematic studies. Use of glass-ceramics came in last 50-70years but concept had originated about 270 year ago when a French Chemist M. Reamur thought to prepare dense ceramic by crystallization of glass. Many scientist have since thought about this but S. D. Stookey, a glass scientist got the success in 1950. It is a strange story. Stookey was in fact interested in making a permanent image in glass by precipitation of Ag (silver) and chose lithium silicate glass for this work. By some unknown incidence one night the temperature of furnace increased to 850$^{o}$C and he saw the precipitation of Ag in alkali silicate glass. Glass turned somewhat white and there was metal like sound when this fell down on floor. He concluded that glass had become stronger and turned glass-ceramics. This idea was extended later and in 1959 Corning company came up with various utensils by the trade name of CORNINGWARE

He further narrated that how glass and glass-ceramics are prepared these days with controlled composition and microstructures and how they have become part of human society. Various areas where glass and glass-ceramics play important roles are : utility and decorative items, innovative architectural materials( large window panes , etc), energy production & conservation (solar panels, special coatings), safety gadgets (bullet resistant /fire proof glass windows etc),medical uses(containers/vials, diagnostics, surgery, implants etc), special applications (radiation shielding windows, laser host glass, glass-metal seals, opticalfibres / optical communication, display panel, plasma TV panel, robust mobile covers (Gorilla glass from Corning), glass laminates for foldable displays etc. It is remarkable that various laboratories and industries in India are also contributing quite a lot in the research and development and production activities.

It is now possible to tailor make mechanically strong biomaterials, which mimic human bone by controlled crystallization of silico-calcium phosphate glasses with selected additives. Such a bioactive glass-ceramic forms a biologically active hydroxyapatite layer on the surface that permits bonding with bone and soft tissues

In short glass and glass-ceramics have unique combination of various physical and chemical properties such as transparency, chemical inertness, thermal stability, corrosion resistance, long durability, electrical insulation, blowing compatibility etc. Consequently are considered novel structural and functional materials. In addition, it is an environment friendly material to a larger extent (reprocess-able). Therefore they are used in almost every discipline of science, technology and engineering including our everyday life. Thinking life without glass is now unimaginable. As such International Commission on Glass (ICG) has pronounced that we are at the verge of welcoming Glass Age.

**M S Jogad**

## IAPT Essay Competition NCEWP-2020 Category A - Students' Results

Topic of the Essay was **"POLLUTION IN OUR COMMUNITY: MEASUREMENTS AND PHYSICAL INSIGHTS".**

| Student Code | Name of the Student/Institution | Total Marks(out of 300) | Rank | Prize details |
|---|---|---|---|---|
| A-10 | Hrishi A Jadhav,<br>G.N. Khalsa College, Mumbai | **221** | **I** | Rs. 7500/- plus Book and Pen Drive |
| A-5 | Deepika Sharma,<br>M.S.P. Arts, Science & K.P.T. Commerce College, Manora,Dist.Washim (MS) | **217** | **II** | Rs. 5000/- plus Book and Pen Drive |
| A-2 | Amitabha Dey,<br>NIT Agartala | **217** | **II** | Rs. 5000/- plus Book and Pen Drive |
| A-14 | Maitri Manishbhai Shah,<br>Maharaja Krishnakumarshinhji, Bhavnagar University | **212** | **III** | Rs. 3000/- plus Book and Pen Drive |
| A-13 | Kommuri Shreya Bhagavathi,<br>Birla College of Arts, Science and Commerce, Kalyan, Mumbai | **212** | **III** | Rs. 3000/- plus Book and Pen Drive |
| A-12 | Jaspreet Kaur,<br>Hansraj Mahila Mahavidyalaya, Jalandhar, Punjab | **212** | **III** | Rs. 3000/- plus Book and Pen Drive |

## IAPT Essay competition NCEWP – 2020 Category B, Teachers Result

| Name& Address | Total Marks (out of 300) from 3 evaluators | Prize Details |
|---|---|---|
| **Dr. Mahendra M. Khandpekar**<br>B.K. Birla College, Kalyan, Mumbai | 212<br>**FIRST** | Rs. 7500/- plus Book and Pen Drive |
| **Dr. Mihir Pal**<br>Ramthakur College, Agartala, Tripura | 197<br>**SECOND** | Rs. 5000/- plus Book and Pen Drive |
| **Dr. Himanshu Kapse**<br>Institute of Science & Technology for Advanced Studies & Research (ISTAR) Vallabh Vidyanagar, Gujarat | 195<br>**THIRD** | Rs. 3000/- plus Book and Pen Drive |

**S K JOSHI**
**Coordinator NCEWP 2020**
**(M) 09893084286**

# Observance of National Science Day: A Part of D P Khandelwal Birth Centenary Celebrations

**(February 28 and March 01, 2021)**

**DPK BCC Committee has decided to celebrate the birth centenary of Dr. D P Khandelwal, the founder of IAPT. In this context, IAPT is observing the National Science Day-2021 at the national level, dedicated to Dr. D P Khandelwal.**

**The programmes like Science Stage Show, (SSS) was very much dear to Dr. D P Khandelwal. He believed that these popular shows can help in reducing the 'internal brain drain' and consequently, the students would be attracted more towards the field of science education. In honouring Dr. Khandelwal, the IAPT has renamed SSS as KSSS. So on the occasion of the National Science Day, IAPT is organizing KSSS for the betterment of science education in general, and physics education in particular. In total, nine experts will present their shows. One of them will be from Singapore National University and rest from our IAPT family. Arrangements will be made so that everybody from anywhere at any time can enjoy the shows. But only registered persons, around 500 can participate in the live online programmes. While others can view the live programme on YouTube Live page of the IAPT.**

**The time schedule of this two-day programme is given below.**

**Day 1: February 28, 2021 Time: 10:00 hr. -12:30 hr.**

## SESSION I: INAGURAL FUNCTION

**Professor Vijay A. Singh (President – IAPT):**
**Welcome address and an Introduction to Dr. D P Khandelwal (10:00 to 10:05)**
**Dr. Upinder Dhar, VC, SVV Vishwavidyalaya, Indore (Chief Guest):**
**Welcome Address on behalf of the University (10:05 to 10:07)**
**Professor K N Joshipura (Gen. Secretary – IAPT):**
**On Observance of NSD, 2021 as part of DPK BC Celebrations (10:07 to 10:12)**
**Dr. S. C. Samanta, Former Gen. Secretary, IAPT:**
**About the DPK BCC programmes (10:12 to 10:15)**

## SESSION- II: KHANDELWAL STAGE SCIENCE SHOWS (KSSS)

| | | |
|---|---|---|
| **Chairman** | **:** | **Professor T. R. Ananthakrishnan:** **An introduction to KSSS as conceived by DPK (10:15 to 10:25)** |
| **KSSS I: Time (10: 25-10:55)** | **:** | **Professor B N Das** (drbndas@gmail.com; **9830607191**) |
| **KSSS II: Time (10:55-11:25)** | **:** | **Professor B. Chakradeo** (chakradeobd@gmail.com; **9146812750**) |
| **KSSS III: Time (11:25-11:55)** | **:** | **Professor M S Marwaha** (marwahams7@gmail.com; **8847211589**) |
| **KSSS IV: Time (11:55-12:25)** | **:** | **Professor R. Bhattacharjee** (ravi_bhattacharjee@yahoo.co.in; **9873376056**) |
| **Vote of thanks** | **:** | **Dr. Sanjay Kr. Sharma, Secretary – IAPT** |

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**Day 2: March 01, 2021 Time 10:00 hr. -12:30 hr.**

## SESSION- III: KHANDELWAL STAGE SCIENCE SHOWS (KSSS) Continued

| | | |
|---|---|---|
| **Chairman** | **:** | **Professor S. B. Welankar** |
| **KSSS V: Time (10: 00 -10:30)** | **:** | **Professor Sow Chorng Haur (Singapore) (physowch@nus.edu.sg)** |
| **KSSS VI: Time (10:30-11.00)** | **:** | **Professor H C Verma (hcverma@gmail.com)** |
| **KSSS VII: Time (11:00-1:30)** | **:** | **Professor T. R. Ananthakrishnan (trananthan@yahoo.com; 9447243054)** |
| **KSSS VIII: Time (11:30-12:00):** | | **Professor YK Vijay (vijayyk@gmail.com; 9461302757)** |
| **KSSS IX: Time (12:00-12:30)** | **:** | **Professor Sarmistha Sahu (sarmistha.sahu@gmail.com; 9448437747)** |
| **Vote of thanks** | **:** | **Dr. O. P. Sharma (EC Member, RC 01-Delhi & Haryana)** |

**Dr. Uttam Sharma (Secretary) and Dr. P. K. Dubey (EC Member) of RC 09 (Madhya Pradesh) of IAPT will conduct the two- day programme.**

**On both the days, the time for each presentation will be 25 minutes, followed by 5 minutes discussion.**

**The participants of the live session can ask questions or give their comments by using the QA box in the online platform. However, they can interact with the presenters freely using their given email id and WhatsApp no.**

**All the invited experts are requested to prepare and send good quality videos of their 20-min presentation each to Dr. Sanjay Kr Sharma, at Email ID < iapt2021@gmail.com > in time.**

**Registration for the Programme**

**Those who are interested to participate in the live online programme, kindly register yourself by filling the google form given at the following link:**

https://forms.gle/iAy1gxmvY3xFEUDPA

**This registration form is available on IAPT website** http://www.indapt.org

**An E-Certificate of Participation will be provided to those who participate in the live online programme.**

**The link of zoom meeting will be shared through your registered Email ID.**

**As the Zoom platform has limitation of 500 participants only, the participation will be on first come first served basis. However, as the programme will also be live on IAPT You Tube Channel, others can join the programme by using the following link:**

https://www.youtube.com/channel/UC4taKXSa_n6FxBhdG64iuLA?guided_help_flow=5

**Online Management Team:**

**Dr. Uttam Sharma, Dr. P K Dubey, Dr. O P Sharma, Dr. Sanjay Kr. Sharma.**

**Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore, will provide the Digital infrastructure.**

**Subhash Chandra Samanta**
**Convener, DPK BCC Committee**

**Report**

# National Graduate Physics Examination 2021

National Graduate Physics Examination 2021 has been conducted well on 24.01.2021 for 4132 BSc. Students at 168 registered centres in India. Most of the centre in-charges reported the proper conduct of the examination and shared photos of examination centre. Apart from the smooth conduct of the examination Covid 19 has been a big challenge for this examination. An SOP was forwarded to all the centre in-charges to be strictly observed during the examination. Centers observed all protocol pertaining to Covid-19 which are even visible through the photographs from centres. Except one or two centers things went all well. We extend our heartiest gratitude to all the centre in-charges and their Principals. Thanks are due to all those who have contributed directly or indirectly for the smooth conduct of NGPE – 2021.

**B P Tyagi**
Chief Coordinator (Exams)

**Anil Kumar Singh**
Coordinator NGPE

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## *IN THIS ISSUE*



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