


The Centenary of S. N. Bose's Colossal Work

$$E = \sum_s \frac{8\pi h\nu^s}{c^3} V \frac{1}{e^{\frac{h\nu^s}{kT}} - 1} d\nu^s$$

Public Outreach
Celebrating BoseStat@100
Date: February 3, 2024, Time: 2:00-5:00 PM
Venue: Science City Auditorium, Kolkata

Program details:
1 Inaugural address by B. N. Jagatap, IIT Bombay
2 Planck's Formula, Bose's Derivation, and Einstein's Generalization by Palash Baran Pal, University of Calcutta
3 Screening of "Dear Master", A documentary by Sukha Das Majumdar
4 Personal recollections on S. N. Bose by Partha Ghose, student of S. N. Bose, Kolkata



Charles Henry Bennett is a distinguished physicist and astrophysicist who has made significant contributions to the understanding of the universe. He is the author of several books and articles, and has been a member of the National Academy of Sciences. He is also a member of the Indian Academy of Sciences and the Indian National Science Academy.


BOSE Stat@100
PUBLIC LECTURE in Bengali
S. N. Bose National Centre for Basic Sciences
Jointly Organized by S. N. Bose National Centre for Basic Sciences & Bangiya Bijnan Parishad

Date: **NOV 17**
Time: **3 PM**
Venue: **EZCC Kolkata**

A new frontier in quantum science and engineering
by Prof. M. Zahid Hasan, Princeton University, US

Prof. M. Zahid Hasan is the James H. McGraw Professor of Physics at Princeton University. He received his PhD from Stanford University in 2002 and has since been a faculty member in the Department of Physics at Princeton University. He is also a member of the National Academy of Sciences and the Indian Academy of Sciences. He is the author of several books and articles, and has been a member of the National Academy of Sciences and the Indian Academy of Sciences.

Artist: Subrata Gangopadhyay



BOSEStat@100
Centenary of Bose Statistics

BOSE Stat@100
International Conference on Quantum Science and Technologies
July 17 - July 19, 2024, SNBNCBS, Kolkata

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বোস সংখ্যায়ন
আয়োজক
রামকৃষ্ণ মিশন বিবেকানন্দ সেন্টেনারি কলেজ
বঙ্গীয় বিজ্ঞান পরিষদ
সত্যেন্দ্রনাথ বসু জাতীয় মৌল বিজ্ঞান কেন্দ্র

বক্তা
অধ্যাপক গৌতম গঙ্গোপাধ্যায়

সময় : দুপুর ২.৩০ মিঃ
তারিখ : ৩০শে সেপ্টেম্বর, ২০২৪
স্থান : স্বামী বিবেকানন্দ সভাগৃহ

বোস সংখ্যায়ন
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Celebrating a Landmark
Indian Contribution
in Quantum Science

PHYSICS DEPARTMENT,
Dacca University.

Dacca, the 4th June 1924.

Respected Sir. I have ventured to send you the accompanying article for your perusal and opinion. I am anxious to know what you think of it. You will be that (I have tried to deduce the coefficient $\frac{8\pi v^2}{c^3}$ in Planck's Law independent of the classical electro-dynamics) only assuming that $\frac{1}{2}mv^2$ that the ultimate elementary regions in the Phase-space has the limit h^3 . I do not know sufficient German to translate the paper. If you think the paper worth publication, I shall be grateful if you arrange for its publication in Zeitschrift für Physik. Though a complete stranger to you, I do not feel any hesitation in making such a request. Because we are all your pupils through profiting only by your teachings through the far workings. I don't know whether you still remember that some time from Calcutta asked your permission to translate your papers on Relativity in English. You assented to the request, the book has since been published. I was the one who translated your paper on Generalised Relativity.

Yours faithfully
S. N. Bose

2. VII, 24

Lieber Herr Kollege!

Ich habe ihre Arbeit übersetzt und der Zeitschrift für Physik zum Druck übergeben. Sie bedeutet einen wichtigen Fortschritt und hat mir sehr gut gefallen. Ihre Einwände gegen meine Arbeit finde ich zwar nicht richtig. Denn das Wiensche Verschiebungsgesetz setzt die Undulationstheorie nicht voraus und das Bohrsche Korrespondenzprinzip ist überhaupt nicht verwendet. Doch dies thut nichts. Sie haben aber zuerst den Faktor quantentheoretisch abgeleitet wenn auch wegen des Polarisations-Faktors 2 nicht ganz streng. Es ist ein schöner Fortschritt.

Mit freundlichen Grüssen
(Ld) Ihr A. Einstein.

The Centenary of **S. N. BOSE'S COLOSSAL WORK**

Celebrating a Landmark
**Indian Contribution in
Quantum Science**



S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

An Autonomous Institute under Department of Science & Technology, Government of India
JD Block, Sector III, Salt Lake, Kolkata-700 106

The Centenary of
S. N. BOSE'S COLOSSAL WORK

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**Indian Contribution in
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Published on
1st January, 2025

Designed & Printing at
Saileepress Pvt. Ltd.
saileepress@yahoo.com
saileepress.gfx@gmail.com

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Preamble

Sometime in the middle of 2023, S. N. Bose National Centre for Basic Sciences took the decision to have a year long celebration to commemorate one hundred years of the publication of Bose's seminal paper “Planck's Radiation Law and Light Quantum Hypothesis”.

Bose's original paper had been translated into German by Einstein and published in Zeitschrift für Physik, with a note of appreciation by Einstein. In this paper, Bose had shown a new way of counting light quanta. Implicit in his statistics was the idea of indistinguishability. Einstein applied this statistics to an ideal gas and predicted the existence of Bose Einstein condensates. More importantly, Bose statistics applied to matter revealed dual nature of matter – something that Louis de Broglie had proposed as an analogy to light quanta. From this followed the works of Heisenberg, Schrodinger and Dirac. The discipline of 'quantum mechanics' was established. This new discipline stands on the foundation laid by 'old quantum theory.' Bose's statistics forms the fourth pillar of this foundation, the other three pillars being Planck's Radiation Law, Einstein's Photoelectric Effect and Bohr's model of the Hydrogen atom.

One hundred years later, as we are witnessing the second quantum revolution, Bose's statistics is being reinvoked in different domains of quantum technology.

In our celebration BoseStat@100, through the tireless efforts of our team at the S.N. Bose Centre, we have been able to facilitate a meeting of minds at three international conferences, half a dozen public lectures and a series of outreach programmes. Renowned scientists from research laboratories and universities all over the world have come and spoken about their work, shared their views on the future of the second quantum revolution, and interacted with students and young researchers to ignite their minds about the expanding horizons in quantum science and technology. If Charles Bennett from IBM was the star speaker of the first conference



Prof. Tanusri Saha Dasgupta
(Director, S. N. Bose National Centre
for Basic Sciences)

dedicated to Photonics, Quantum Information and Quantum Communication, the Nobel Laureate William D Phillips and his talk on laser cooling of atoms was the prime attraction of the third conference dedicated to Bose-Einstein Condensation, Superconductivity, Superfluidity, and Quantum Magnetism. At the second conference dedicated to Women in Quantum Science and Technology, Shohini Ghosh and Rupamanjari Ghosh mesmerized the audience with their frank talks on biases and prevalent perceptions in the world of science that push women scientists towards invisibility. At this conference, Prof. Rohini Godbole made an online presentation, which was perhaps her last public appearance before she succumbed to age and ill health.

At each of the three conferences there have been over a hundred poster presentations. Students and young research scholars from all over India and even from universities abroad, participated with posters on a range of topics.

2024 has been an eventful year for the S.N. Bose National Centre. At the three high-level scientific events organized this year, we had talks by a Wolf prize winner, Buckley prize winners, a Dirac medallist, a Bardeen prize winner, Onsager prize winners, Europhysics prize winners and a Nobel Laureate. Among them were several prominent Indian diaspora scientists from Princeton, Penn State, UIUC, Toronto, OSU, Harvard, UC Davis, Oxford and other institutions.

The public lectures had packed halls, attended by school and college students, their teachers, science popularisers, science writers and science enthusiasts in general. At the third conference, both the public lectures were delivered in Bengali, to honour Bose's lifelong crusade to teach and learn science in one's mother tongue.

In our outreach programmes, we organized seminars and talks at different colleges and universities in West Bengal and Odisha. More than a thousand students have been reached through these programmes, which were organized in collaboration with Bangiya Bijnan Parishad, an organization established by Prof. Bose in 1948 and with the Indian Physics Association, a national level organization, dedicated to popularizing Physics.

The S.N. Bose Centre has also facilitated publication of special articles on Bose's work, to read between the lines of his paper and to trace its lasting impact on the development of science. The paper “Boson Bloom” published in the Journal of Physics B: Atomic, Molecular and Optical Physics, is a case in point.

A special issue of Gyan O Bigyan, a publication of Bangiya Bijnan Parishad, contains highly engaging articles in Bengali, on Bose's life and work and repercussions of his work.

At the end of 2024, S.N. Bose National Centre for Basic Sciences looks back with great satisfaction – through this booklet of highlights of the events of the year – at the way Bose's seminal paper was celebrated by bringing the spotlight on new ideas and re-examining old ideas.



Dr. Jitendra Singh

Union Minister of State
(Independent Charge) for Science and
Technology, Minister of State
(Independent Charge) for Earth Sciences,
MoS PMO, Department of Atomic Energy,
Department of Space, Personnel,
Public Grievances and Pensions

Message *from the* Hon'ble Minister

“Satyendra Nath Bose was one of the founding fathers of quantum mechanics. His pioneering work in quantum statistics is fundamental in explaining the macroscopic quantum phenomena. Bose was a modest man from India who helped solve some of the puzzles that eluded big scientists of Europe. Although Bose never got a Nobel Prize, some of the Nobel Prizes in the last 100 years are based on Bose statistics. This includes the 2005 Nobel Prize for creating a Bose Einstein condensate and the 2013 Nobel Prize for Higgs Boson. I am happy that S.N. Bose National Centre is celebrating Bose's momentous contribution 100 years ago with three international conferences and several outreach programmes.

Bose's work has not only improved our theoretical understanding, but has also opened the new vistas of technology. Along with developing the new statistics of quantum, Bose's work has also laid the foundation for the second quantum revolution. This revolution is strongly backed by the Govt. of India, spearheaded by Prime Minister Narendra Modi. The Union Cabinet of India, in its meeting chaired by Honourable Prime Minister, has initiated the National Quantum Mission. This Mission aims to seed, nurture and scale up scientific and industrial R & D, while creating a vibrant and innovative ecosystem in quantum technology. NQM is a key pillar in realizing Prime Minister Modi's vision of Atma Nirbhar Bharat, that is self reliant India, as well as Viksit Bharat 2047, underscoring India's determination to be in the forefront of quantum technology. The NQM also represents a strategic investment in India's future, laying the ground work for economic growth, job creation and leadership role in a quantum driven world.

A central element of NQM is the establishment of four thematic hubs, focused on quantum computing, quantum communications, quantum sensing and quantum technology, and quantum materials and devices. These hubs consist of 14 technical groups with 17 project teams from 43 institutions. S.N. Bose National Centre for Basic Sciences plays a key role in several of these themes.

The three international conferences on quantum science and technology, organized by S.N. Bose Centre in this centenary year of Bose Einstein Statistics, have brought together scientists in the forefront of quantum research in different research institutions and laboratories in India and the world. The new synergies created will have fruitful manifestations in the near future.”

(Excerpt from the Hon'ble Minister's speech given on November 12, 2024, at the inauguration of the conference 'Bose-Einstein Condensation, Superconductivity, Superfluidity, and Quantum Magnetism')



Prof. Abhay Karandikar

Secretary, Dept. of Science and
Technology, Govt. of India

Message *from the* Secretary

“I am delighted to be a part of the centenary celebration of the publication of landmark paper of Prof. Satyendra Nath Bose. And I congratulate S.N. Bose National Centre for Basic Sciences for taking this initiative. Written in 1924, this paper gave rise to Bose-Einstein statistics, which has a profound impact on modern science. The pioneering work of Prof. Bose on quantum statistics is fundamental to explaining macroscopic quantum phenomena. Bose's work has not only significantly improved our theoretical understanding of physical phenomena, but has also opened new vistas of technology. We are pleased that National Quantum Mission has been launched during the centenary year of the publication of the foundational paper. The mission will carry forward the legacy of Prof. Bose by developing technologies having national and global impact. These hundred years have witnessed fundamental science turning into commercially viable and deployable technology, because of which there is a significant ecosystem of startups. There have been more than 100,000 startups across the country, out of which 12,000 'deep technology' startups are being supported directly by DST.

I once again congratulate S.N. Bose National Centre for organizing this year long celebration that has brought under focus different modern day spin-offs of Bose Einstein statistics.

We have great expectations from the young generation of scientists in making the second quantum revolution a reality. I do hope that the three conferences organized by S.N. Bose National Centre have created the necessary enthusiasm among the youth.”

(Excerpt from the Secretary's message sent to S.N. Bose National Centre on 1st November, 2024)



Prof. Ajay K. Sood

Principal Scientific Adviser to the
Government of India

Message *from the* Principal Scientific Adviser

“Friends, it is a wonderfully exciting time for all of us. We are witnessing – no, we are a part of - the second quantum revolution. Quantum science and technology is poised to take over our lives through quantum computing, quantum communication, quantum material and devices, and quantum cryptography. Across the globe, 23 countries have established National Missions in Quantum Information Science. Global investment in these missions is 39 billion USD. India is one of the 23 countries. Our National Quantum Mission has plans to invest 750 million USD to support research in laser and photonics, semiconductors, superconductors, cold atoms, and many more exciting emerging areas of research. All cutting edge research is not intensely dependent on technology. Even as we wait for the hardware to be put in place, the Indian mind can come up with quantum algorithms to drive the machines.

Quantum supremacy will come sooner than later. However, I would like to warn the audience about the hype that is being created around the word “Quantum”. We have to propagate a conscious and calibrated view by choosing the right problems. Quantum sensing is a great area and it is easy to contribute on an international scale. Quantum communications is also a good area to start with. The Govt of India is supporting a lot of startups in the quantum communication domain. Post quantum cryptography and “Quantum safe” are other big areas open for research. Set yourselves short time goals of 1 to 5 years. The National Quantum Mission's focus is on the outcome.

Let us rejoice in the exciting time we are living in and let us remember that what we are witnessing today started with S.N. Bose's paper submitted to Einstein a hundred years ago.”

(Excerpt from the speech given on January 29, 2024 at the inauguration of the conference 'Photonics, Quantum Information & Quantum Communication'.)



Dr. Ajai Chowdhry

Chairman, National Quantum Mission and Founder, HCL

Message *from* Dr. Ajai Chowdhry

“The story of quantum computing is intricately linked to India and it literally can be traced back to the legacy of Satyendra Nath Bose. He wrote the last of the four publications that led to the foundation of quantum mechanics. A century later, the world's greatest tech companies are vying for a share of the quantum computing pie and nations are evolving strategies for quantum technologies.

In India, the Quantum Mission Strategy was created very early by the Department of Science and Technology. The National Quantum Mission, initiated earlier this year, has set a target of eight years to achieve specific goals in different areas of quantum technology. The Coordination Centre of the National Quantum Mission will monitor the implementation in areas of fundamental quantum research as well as quantum applications in various domains. The Mission is also deeply involved with Ministry of Defence, Department of Atomic Energy and Department of Space and they are working together with us in many areas. Department of Space will launch a satellite, that will be used for secure quantum communication, spanning distances of 2000 km between ground stations within India, as well as with other countries.

We plan to build a quantum computer with 50 to 1000 physical qubits across various platforms such as superconductors, photonics, etc. Some startups are also taking a leap into this area. We are setting up four Section 8 companies, which are not-for-profit companies that will run with a clear objective of delivering products.

The National Quantum Mission is now working on a policy of creating a quantum secure India. The policy paper is being prepared. We also want to collaborate with the Indian diaspora all over the world. International conferences like the ones organized by S.N. Bose National Centre for Basic Sciences will go a long way in establishing networks and explore collaborations.”

(Excerpt from the speech given on November 12, 2024, at the inauguration of the conference 'Bose-Einstein Condensation, Superconductivity, Superfluidity, and Quantum Magnetism'.)

1st

International
Conference on

Photonics, Quantum Information, and Quantum Communication

January 29 – February 2, 2024

Biswa Bangla Convention Centre, Kolkata

International Conference on Photonics, Quantum Information, and Quantum Communication

January 29 – February 2, 2024

Biswa Bangla Convention Centre, Kolkata

4 plenary talks

18 invited talks

8 contributory talks

93 posters

Lighting
of the
Inaugural Lamp

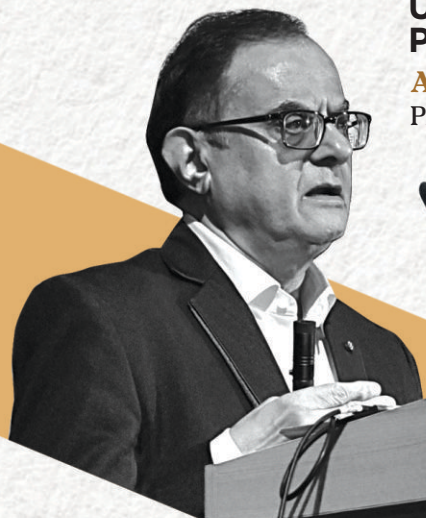


L to R: Prof. Charles H. Bennett, Prof. Abhay Karandikar, Prof. Ajay K. Sood, Prof. Tanusri Saha Dasgupta, Dr. Manik Banik, Prof. Sunandan Gangopadhyay

**Ultrafast photonics as a
Probe of Quantum Topology**

Ajay K. Sood

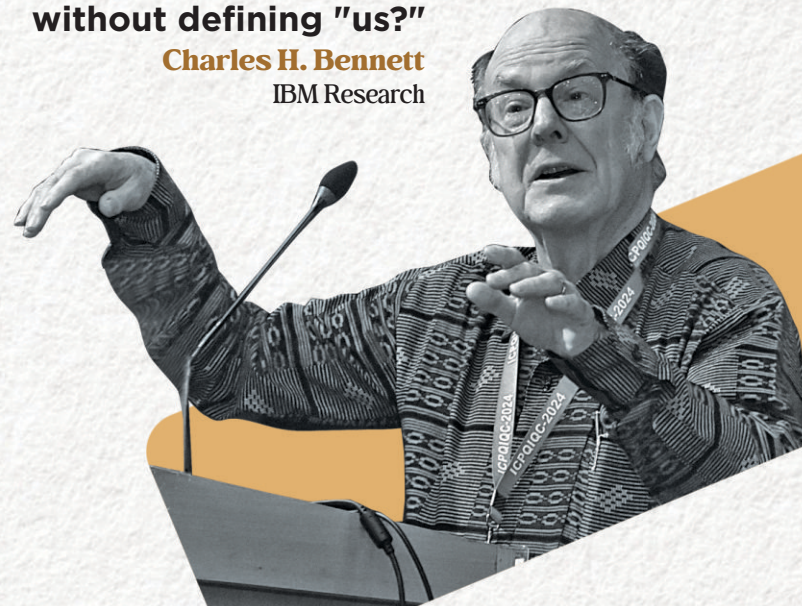
Principal Scientific Advisor to the GoI



**Occam's Razor, Boltzmann's Brain
And Wigner's Friend Can we reason
about our place in the universe
without defining "us?"**

Charles H. Bennett

IBM Research

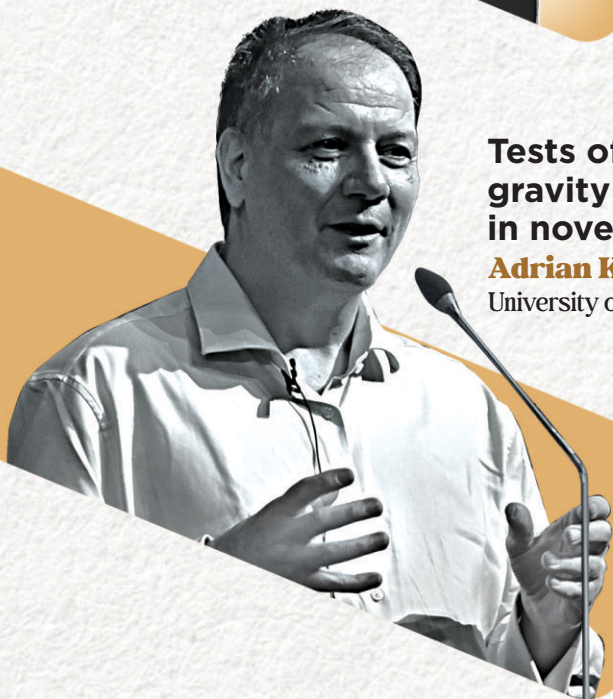


**1st Conference
Plenary
Talks**

**Tests of semi-classical
gravity and related models
in novel regimes**

Adrian Kent

University of Cambridge



**The value reproducibility and
intersubjectivity of quantum
measurements based on the theory of
quantum perfect correlations**

Masanao Ozawa

Nagoya University





Speaker

Title

Alok Kumar Pan , IIT Hyderabad	Negative quasiprobability and its implications in quantum foundations
Anand Jha , IIT Kanpur	Orbital Angular Momentum Entanglement
Anirban Pathak , IIIT Noida	In search of efficient ways of entanglement routing and solving bottleneck issues
Antonio Acin , ICFO Barcelona, Spain	Network quantum information processing
Arul Lakshminarayan , IIT Madras	From combinatorics to maximally entangled multipartite states
C.M. Chandrashekar , IISc Bengaluru	Photonic quantum computing using quantum walks
Dipankar Home , Bose Institute	Towards testing macrorealism and quantumness of an arbitrarily massive object
Francesco Buscemi , Nagoya University, Japan	Incompatible incompatibilities, and how to make them compatible again
Gerardo Adesso , Univ. of Nottingham, UK	Fundamental limitations on Gaussian quantum key distribution

1st Conference Speakers from different parts of the Globe



Otfried Gühne



Antonio Acin



Joyee Ghosh



Howard Wiseman



Giulio Chiribella



Anand Jha



Gerardo Adesso



Alok K. Pan



Speaker

Title

Giulio Chiribella , Univ. of Hong Kong	From indefinite causal order to indefinite input-output direction
Howard Wiseman , Griffith University, Australia	The Heisenberg limit for laser coherence, with preliminary experimental proposals
Joyee Ghosh , IIT Delhi	Telecom-band Entangled Photons for Fiber-based & Integrated Quantum Communication & QI Applications
Otfried Gühne , University of Siegen, Germany	Characterizing Quantum Networks
R.P. Singh , PRL, Ahmedabad	Free-space quantum communication: Road to satellite quantum communication – A Review
Sai Vinjanampathy , IIT Bombay	Shallow-Depth Variational Quantum Hypothesis Testing
Sougato Bose , University College London, UK	Laboratory tests of the quantum behaviour of gravity
Subhash Chaturvedi , IISER Bhopal	Bose's notion of indistinguishability — its extension in the symmetric group sense - quantum statistics of indistinguishable particles
Urbasi Sinha , RRI Bangalore	Interference at the heart of quantum

The audience was
alert and
curious.



1st Conference Audience Interactions



1st Conference Contributory Talks

Speaker	Title
Amit Mukherjee , IIT Jodhpur	Nonlocal Advantage in Vehicle Routing Problem
Ashutosh Rai , KAIST South Korea	Non-Local and Quantum Advantages in Network Coding for Multiple Access Channels
Chandan Datta , IIT Jodhpur	Is There a Finite Complete Set of Monotones in any Quantum Resource Theory?
Damián Pitalúa-García , Univ. of Cambridge, UK	Unconditionally secure relativistic multi-party biased coin flipping and die rolling
Manabendra Nath Bera , IISER Mohali	Squashed quantum non-Markovianity: a measure of genuine quantum non-Markovianity in states
Saptarshi Roy , Univ. of Hong Kong	Activation of the communication utility of entanglement breaking channels
Tamal Guha , Univ. of Hong Kong	Quantum networks boosted by entanglement with a control system
Varun Narasimhachar , IHPC, A*STAR, Singapore	Quantum pattern engines: work from temporal correlations

1st Conference Poster Sessions

“Entanglement is fundamental to our existence.”
Charles H. Bennett ignites the minds of the
next generation



Almost 100 posters by research scholars and students from all across India and abroad



Active and quality participation by young scholars was a highlight of the Conference

“We are at the start of the
exponential curve.
So it still looks linear. But it will shoot up.”

- Gerardo Adesso



The BOSON family poised for the second quantum revolution



2nd International
Conference on

Women in Quantum Science and Technologies

July 17 – 19, 2024

Silver Jubilee Hall, SNBNCBS, Kolkata



International Conference on Women in Quantum Science and Technologies

July 17 – 19, 2024

Silver Jubilee Hall, SNBNCBS, Kolkata



L to R: Ms. A. Dhanalakshmi, Prof. Umesh Waghmare, Prof. Indranil Manna, Prof. Tanusri Saha-Dasgupta

“ Gender did not matter to S. N. Bose at all, as far as science is concerned. Dr. Purnima Sinha, the first female Ph.D. in Physics in India, worked under Prof. Bose's guidance. Prof. Ashima Chatterjee started her initial research on medicinal plant extracts with Prof. Bose. In Europe and Japan, forums have been set up to support Women in Quantum Science. We should follow their example. ”

Prof. Tanusri Saha Dasgupta
(Director, SNBNCBS)

2nd Conference Inaugural Addresses

“ Despite significant progress, the journey for women in science, has been fraught with several challenges. In this conference, we recognize their contribution and honour their resilience in their respective fields. The Govt. of India has taken several initiatives to increase the participation of women in science and technology. The National Quantum Mission has got an overwhelming response to the call for proposals. Very soon we will roll out approvals and funds. ”

Prof. Abhay Karandikar
(Secretary, DST)

“ The path to gender parity in quantum science is still fraught with challenges. According to a recent study, women make only 20% of the work force in quantum technology. This disparity calls for positive action to inspire, support and nurture women in their career. Educational initiatives, encouraging girls to pursue science and mathematics in their higher studies, plays a major role in this direction. ”

Ms. A. Dhanalakshmi
(Joint Secretary, DST)

“ A recent survey has revealed that only 2% job applications in quantum science and technology come from women. In more than 80% of companies engaged in quantum science & technology, there is no woman in the senior position. A start up company She Quantum has identified 52 women engineers in the quantum field. 4 out of the 52 women are Indian and they do not come from premier institution in India. So India has a huge potential that needs to be tapped. ”

Prof. Umesh Waghmare
(JNCASR, Bangalore & President, IASc, Bangalore)

“ When we talk about science and technology, we must remember that there is a bridge between science and technology – and that is engineering. Engineering is the translation of fundamentals from 'know why' to 'know how'. As we take this leap, we cannot leave our women behind. If one-half of the nation is not given the right importance, then we cannot reach our goal of 'Viksit Bharat'. As Gurudev Tagore had said, men and women complement each other. They should be equal partners in all endeavours. ”

Prof. Indranil Manna
(BIT Mesra and Vice President, INSA and President, INAE)

“At the centenary celebration of S. N. Bose, I have spoken about the 'structure of light'”

■ That happens to be my first love. Today, at the centenary celebration of Bose's seminal paper, I shall speak about my second love – which is, women in STEM. In India, the fraction of women studying science is not small. About 50% of science students in higher education are women. But the number drops drastically when it comes to practicing women scientists. Number of women doing science in India is rather small. This is because of a clash between two clocks ticking at their own pace. According to the science clock, it is at the post-doctoral stage that a scientist develops his/her own identity. But this is precisely the time when the body clock is also ticking away, which results in the invisibility of women in the scientific community.

There is another invisibility gnawing at the roots of our society. It is the invisible bias. Unless we overcome this bias, unless we accept women as agents of change, and give them the space, we will have to struggle to be visible. We have miles to go before we can rest.”

- Rohini Godbole

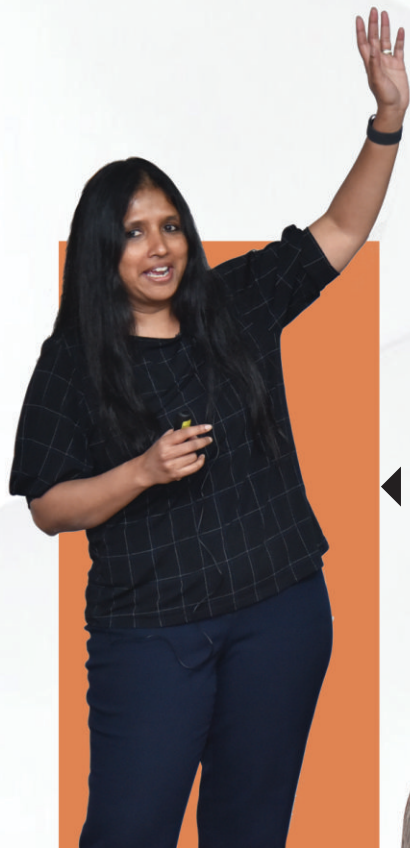


Prof. Rohini Godbole

(Nov 12, 1954 – Oct 25, 2024)

IISc Bangalore & Vice President, IASc, Bangalore
Padma Shri, 2019

2nd Conference Role Model Speakers



Seeing the invisible:
A quantum perspective

◀ **Shohini Ghose**
Wilfrid Laurier
University, Canada



Journey in
Quantum
Technologies –
An Academic
Perspective

◀ **Aditi Sen-De**
HRI



Quantum Spins:
An Untold Story

◀ **Indrani Bose**
Bose Institute

The Issue of Gender
Imbalance in
Physics
Education,
Careers and
Leadership:
My personal
reflections

Rupamanjari Ghosh ▶
Shiv Nadar
University, Noida



The road to
establish oneself
as a female
researcher:
Opportunities,
challenges and
barriers during
career paths

Anjana Devi ▶
IFW Dresden



My journey through
a wonderland of
quantum fluids

Efrat Shimshoni ▶
Bar-Ilan University, Israel



2nd Conference Special Lectures

Life and Work of Purnima Sinha

Sukanya Sinha
ISI Bangalore

Purnima Sinha broke the gender stereotype by doing masonry work, carpentry work and even playing the tabla. She had fabricated her own X-Ray crystallography instruments for her Ph.D. work.



History of the working group of women in physics in India

Sumathi Rao
ICTS Bangalore

The International Union of Pure and Applied Physics conducted a study on problems of under representation of women in science and technology. At the conference held in Paris in 2002, nobody suggested discrimination. India faces the problem of retaining girls in a career in science.



S. N. Bose at University of Dhaka

Shamima Choudhury
Bose Centre, Dhaka University,
Bangladesh

Bose resigned from Dhaka University on October 1, 1945. He never went back to Dhaka. After the foundation of Bangladesh, Bose was given a D.Litt degree posthumously.

The Bose Centre founded in
July 1, 1974



Women in Science and Engineering: Challenges & Opportunities

Vandana Singh
DST

DST has initiated a scheme called WISE-KIRAN to bring gender parity in science and technology. DST also runs the Vigyan Jyoti Scheme for school girls, under which year long activities are conducted in Maths, Physics and Engineering





Chandrima Banerjee
IIT Kanpur

"Opto-Spintronics:
Ultrafast Optical Control and
Probing of Dynamic
Magnetization"



Dhaval Suri
IISc Bangalore

"Exchange Coupling Based
Proximity Effects in Topological
Insulators & Superconductor
Based Heterostructures"



Raka Dasgupta
Calcutta University

"Engineering Various
Phases in an Ultracold
Rydberg System"



Sanjukta Roy
RRI Bangalore

"Quantum Science and
Technology
with ultra-cold
Rydberg atoms"



Kasturi Saha
IIT Bombay

"Widefield magnetic field
microscopy with Nitrogen
Vacancy centers in diamond"



Sayantika Bhowal
IIT Bombay

"Orbitronics: A New Frontier
for Exploring Quantum
Science and
Technology"



Kusum Dhochak
IIT Palakkad

"Symmetry protected
topological (SPT) phases in
exactly solvable 1dimensional
quantum Gamma matrix models."



Swastika Chatterjee
IISER Kolkata

"The influence of water on the
post-spinel transition at the
660 km phase boundary of the
earth: A first-principles study"



Parijat Dey
SNBNCBS Kolkata

"Probing conformal field
theory with defect"



Vidya Kochat
IIT Kharagpur

"Van der Waals epitaxial
growth of 2D/quasi-2D
materials and their prospects
for optoelectronic and
spintronic devices"

2nd Conference
Invited
Talks

Invited talks by **Young Speakers**

Panel Discussion

Challenges faces by women in higher education and ways to overcome them



L to R: Vandana Nanal, Subhra Chakraborty, Chandrima Shaha, Suchetana Chatterjee, Tanusri Saha-Dasgupta

Panel Discussion

Opportunities for women with a focus on quantum science and technologies



L to R: Aditi Sen-De, Shikha Varma, Rupamanjari Ghosh, Amitabha Lahiri, Ekta Kapoor, Prasanta K. Panigrahi

“Today, we are here to acknowledge these challenges and, more importantly, to take collective action to overcome them.”

– Madhu Dikshit



- Make parental leave and childcare leave gender neutral as opposed to the current policy of 6 months maternity leave and 15 days of paternity leave
- Mobility scheme
- Mandatory gender auditing in faculty positions and leadership positions as well as in conferences
- All government-supported conferences should ensure that a certain percentage (~ 30%) of the organizing committee, plenary speakers, and chairs are women. This data should be submitted along with the conference report.
- Discipline wise gender data for each university/institute at all levels should be part of the annual report and publicly available. (This is important to highlight gender inequity, especially at elite institutes).

- Gender statistics for entrance exams and recruitment should also be part of the annual report.
- Each institute/university should mandatorily have outreach activity focused on showcasing women achievers, increasing awareness of career opportunities, etc. This could be focused around February II.
- Gender issue awareness, sensitivity, and best practices training should be a part of orientation for senior administrative posts and faculty.
- Age limits at various levels are detrimental largely to women, and at least in academic jobs, this needs to be removed.
- More scholarships from school to college and appropriate fellowships to women in STEM till entry into faculty positions, along the lines of INSPIRE scheme.
- Appropriate efforts to help remove 'two-body' problems.
- Special efforts by all parties, to ensure desired girl/women participation in projects, workshops, etc. facilitating travel and accommodation.



“A gender rich society is
both desirable and beneficial.
Diverse teams are smarter.”
– Rupamanjari Ghosh

2nd Conference
Group
Photograph



Visibility for women in quantum science and technology





3rd International
Conference on

Bose-Einstein Condensation, Superconductivity, Superfluidity, and Quantum Magnetism

November 12 – 16, 2024

Biswa Bangla Convention Centre, Kolkata



Inaugural Session of the International Conference on Bose-Einstein Condensation, Superconductivity, Superfluidity, and Quantum Magnetism

Organized by

S. N. Bose National Centre for Basic Sciences, Kolkata

November 12 – 16, 2024 at Biswa Bangla Convention Centre, Kolkata



Lighting
of the
Inaugural Lamp

L to R: Prof. Tanusri Saha Dasgupta, Prof. Subir Sachdev,
Prof. Bertrand Halperin, Dr. Ajai Chowdhry, Prof. Ganapathy Baskaran



“We hope that the seminal contribution of Bose will keep on inspiring the young minds of India and they will take India to the stage of a global leader by connecting and networking with all the experts, many of whom are present in the audience today.”

– Prof. Tanusri Saha Dasgupta, Director, SNBNCBS



“I am happy to note that this high level International conference is being participated by Nobel laureate, Wolf prize winner, Buckley prize winner, Dirac medalist, Bardeen prize winner, Onsager prize winner and Europhysics prize winner. And most importantly, there is significant contribution from Indian diaspora community”

– Dr. Jitendra Singh, Hon'ble Minister of State for Science and Technology, MoS for Earth Sciences

3rd Conference Message from the
Director, Hon'ble Minister and
Ajai Chowdhry

Inaugural addresses at the 3rd and final conference of the year-long celebration of BoseStat@100

“What a charming coincidence that a century after Bose's seminal paper was published, the world's biggest tech companies are vying for a share of the quantum computing pie and nations are evolving strategies for quantum technologies.”

– Dr. Ajai Chowdhry,
Chairman, NQM & Founder, HCL



Inaugural addresses at the 3rd and final conference of the year-long celebration of BoseStat@100



“To me, the major insight from Bose's paper is the idea of indistinguishability of quantum particles, which is very different from indistinguishable classical particles. A system of identical particles is very different from a mixture of almost identical particles. The papers were restricted to an ideal gas of non interacting particles, photons in case of Bose, massive particles in case of Einstein. The key point is that this property of indistinguishability survives into new quantum mechanics of interacting particles.”

– **Prof. Bertrand Halperin,**
Harvard University, USA

“If you look back on Bose's work, it really teaches you a lot on how scientific progress is made. There is a train of thoughts that is going on. And an outsider comes up with a new interpretation, like Bose came up with a new interpretation on how Planck's law may be derived. A brilliant idea, but not fully formed when it was proposed. Eventually this brilliant idea changed the course of the development in the field.”

– **Prof. Subir Sachdev,**
Harvard University, USA

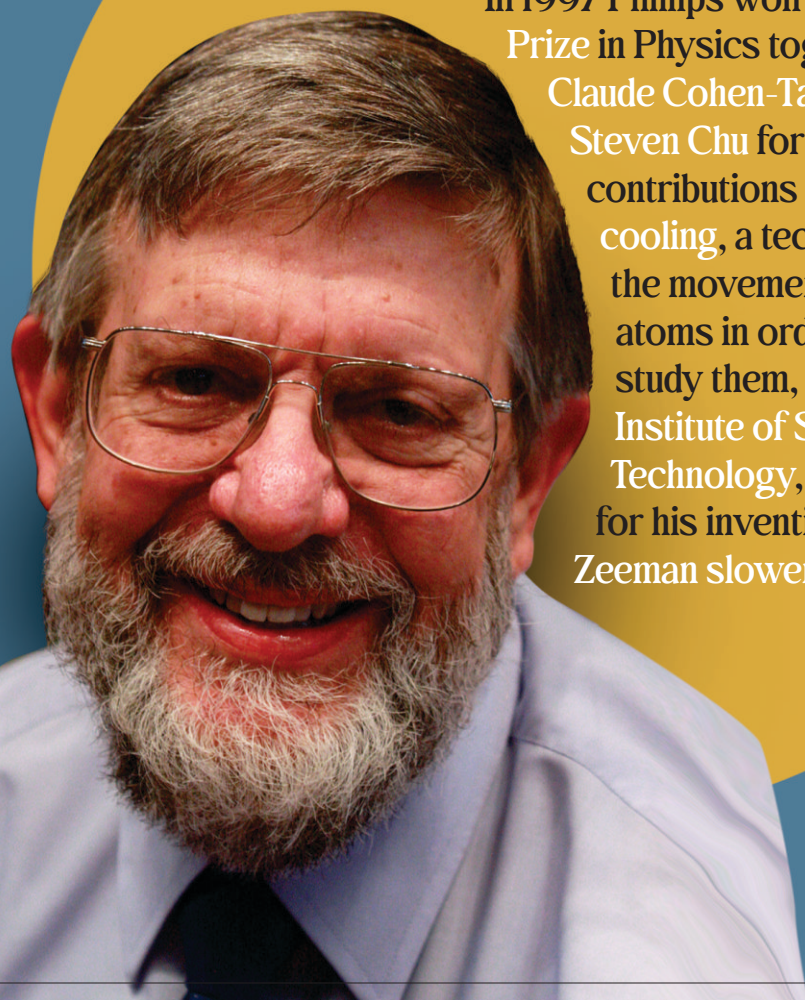
“I just make a few observations and requests. The retirement age in India is 60. Fifty outstanding quantum mechanics guys will be kicked out this year! The NQM should take advantage of this situation. Quantum Mechanics keeps you young.”

– **Prof. Ganapathy Baskaran,**
IIT Madras

3rd Conference
Talk by Nobel Laureate
William D. Phillips

Talk by Nobel Laureate William D. Phillips

In 1997 Phillips won the Nobel Prize in Physics together with Claude Cohen-Tannoudji and Steven Chu for his contributions to laser cooling, a technique to slow the movement of gaseous atoms in order to better study them, at the National Institute of Standards and Technology, and especially for his invention of the Zeeman slower.



From the birth of quantum indistinguishability and quantum statistics to the achievement of Bose-Einstein condensation in atomic gases

International Conference on Bose-Einstein Condensation, Superconductivity, Superfluidity and Quantum Magnetism



16 November 2024, Kolkata

William D. Phillips (remotely)
Joint Quantum Institute



National Institute of Standards and Technology, Gaithersburg, MD
University of Maryland, College Park, MD, USA

NIST Laser Cooling and Trapping Group:

John Campbell, Paul Lett, Trey Porto, Ian Spielman,
Eite Tiesinga, Charles Clark, Paul Julienne,
Nicole Yunger Halpern, Alaina Green



S N BOSE

S N BOSE

“ So what Einstein discovered was that when he used Bose's ideas about the statistical mechanics of such a system, using the idea that the number of atoms is conserved as you lower the temperature, or if we keep the temperature constant, and simply change the number of atoms by adding them. What he found was that at a certain temperature and density of the atoms, as you would add more atoms at a constant temperature, the states available for those atoms had already filled up and all the atoms had to go in at zero velocity. So we go from a state in which there is a wide distribution of velocities, with just a few atoms having zero velocity, to a system in which a large number of atoms have zero velocity. And this change from a microscopic fraction of atoms having zero velocity to a significant fraction having zero velocity, that is the phase transition that we now call Bose-Einstein condensation. What is remarkable is that the phase transition happens in an ideal gas. ”



Subir Sachdev
Harvard University, USA

From the Sachdev-Ye-Kitaev model to theories of strange metals and charged/rotating black holes
- *S. Sachdev*



Jainendra Jain
Penn. State Univ., USA

Complex Emergent Bosons and Even-Denominator Fractional Quantum Hall Effect
- *J. Jain*



Nitin Samarth
Penn. State Univ., USA

Emergent superconductivity in epitaxial quantum materials
- *N. Samarth*



Steven Kivelson
Stanford University, USA

Absence of BEC to BCS Crossover in the cuprate superconductors
- *S. Kivelson*



Bertrand Halperin
Harvard University, USA

Bosons, fermions and anyons: Fractional statistics and the quantized Hall effects
- *B. Halperin*



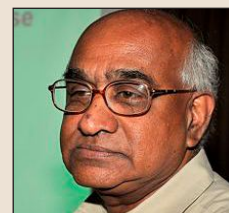
Shivaji Sondhi
Oxford University, UK

Are superconductors Bose condensates?
- *S. Sondhi*



Stuart S.P. Parkin
Max Planck Institute, Germany

Racetrack Memory 5.0
- *S. S. P. Parkin*



T. V. Ramakrishnan
IISc, Bangalore

High temperature Superconductivity in Cuprates: Mainly Phenomena from a Theorist's Perspective
- *T.V. Ramakrishnan*



Burkard Hillebrands
University of Kaiserslautern-
Landau, Germany

Transport phenomena in Bose-Einstein magnon condensates
- *B. Hillebrands*



G. Baskaran
IIT Madras

There is Plenty of Room in Room Temperature Superconductivity in Quantum Spin Liquids
- *G. Baskaran*

3rd Conference Moments



S. Sondhi, S. S. P. Parkin, S. A. Kivelson, S. Bhattacharjee



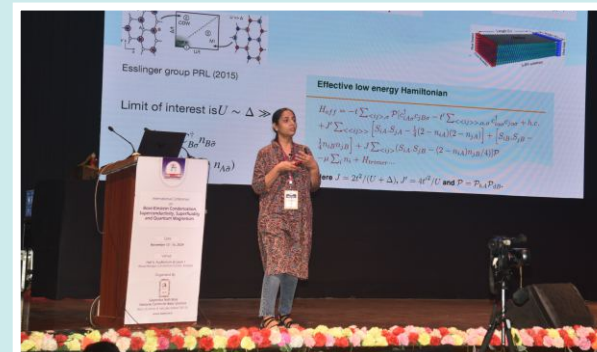
T. Giamarchi



B. Hillebrands



A. Lahiri, G. Baskaran, M. Z. Hassan, B. Hillebrands, T. Giamarchi, T.Saha-Dasgupta



A. Garg



Speaker

Title

Amit Ghosal , IISER Kolkata	Superconducting Vortices with Non metallic Cores
Arun Paramakanti , University of Toronto, Canada	Phonon driven dynamics in multipolar Mott insulators
Avinash Mahajan , IIT Bombay	(H,Li)₆Ru₂O₆ : A zero field Ru₃⁺ based Kitayev Quantum Spin Liquid
Goutam Sheet , IISER Mohali	Superconductivity under uniaxial pressure in elemental metals
Md. Kamrul Hassan , University of Dhaka, Bangladesh	Historical perspective on the birth of Bose-Einstein statistics and percolation transition
Pratap Raychaudhuri , TIFR, Mumbai	Visualizing Pinned vortex liquids and inverse melting in superconducting thin films
Robert Seiringer , Institute of Science & Technology, Austria	Validity of the Gross-Pitaevskii equation for the description of dilute trapped bose gases
S. M. Yusuf , BARC, Mumbai	Quantum Magnetism in Low Dimensional Spin Systems
Sunil Nair , IISER Pune	Interfacial magnon drag in a ferromagnet/metal bilayer device
Thierry Giamarchi , University of Geneva, Switzerland	Dimensional crossover and Bose-Einstein condensation



Speaker	Title
Amit Agarwal , IIT Kanpur	Light-induced Nonlinear Spin Magnetization
Arindam Ghosh , IISc Bangalore	Engineering interfaces in metals for strong electron-lattice coupling
Arnab Sen , IACS, Kolkata	Aspects of confinement and weak universality in a (2+1)-d lattice gauge theory with annealed $Q=\pm 2$ charges
Arti Garg , SINP Kolkata	Exact relations between coherence and measure of localization: Application to superconducting qubit arrays
Atsushi Fujimori , University of Tokyo, Japan	Nodal metal versus antiferromagnetic metal in an extremely underdoped clean inner CuO_2 planes
M Zahid Hasan , Princeton University, USA	New frontiers in Topological Quantum Matter
Satyajit Banerjee , IIT Kanpur	Exploration of emergent rich strongly correlated state in SmB_6 and a comparison of this system with a conventional topological insulator Bi_2Se_3
Shantanu Mukherjee , IIT Madras	Role of Unconventional Superconductivity in Monolayer Di-Chalcogenide Superconductors
Subhro Bhattacharjee , ICTS Bangalore	Interacting SPT, duality and phase transition in dimerized XXZ spin-1/2 chain
Sumilan Banerjee , IISc Bangalore	Measurement -induced Superconductor-Insulator Transition in Weakly Monitored Josephson Junction Arrays
Tanmoy Das , IISc Bangalore	Fractional orbitals and Tight-Binding Gauge Fields in Flat Bands and Superconductors

3rd Conference Miscellaneous Photographs

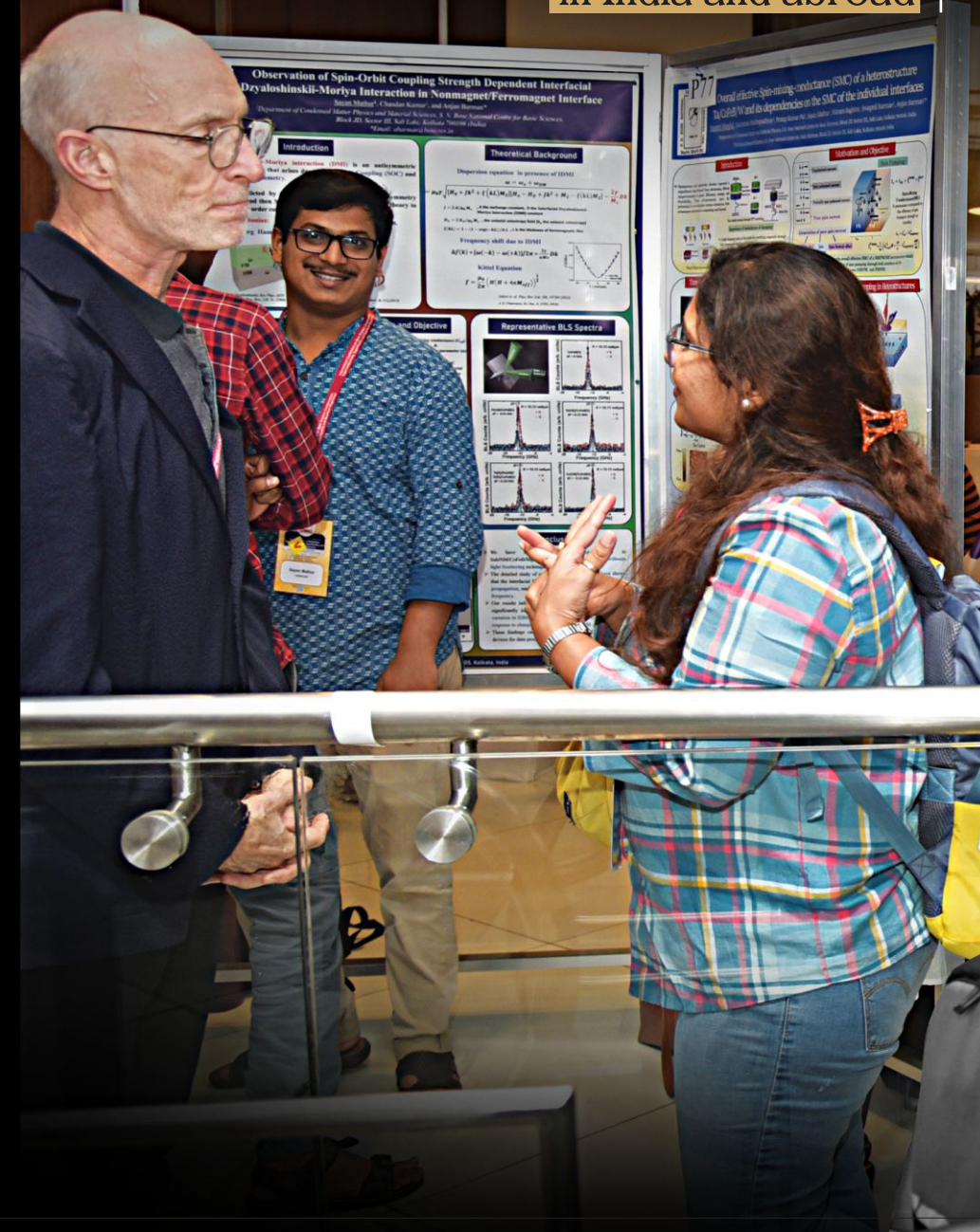


108 Posters

from more than
25 Institutions

in India and abroad

3rd Conference
Poster
Session



“Quantum mechanics
is the secret to understanding how materials function.
There are more electrons in a piece of
solid than there are stars in the universe.”

- Thierry Giamarchi



Poised to push the frontiers – the global quantum citizens at BoseStat@100

Public Lectures

February 3, 2024

Science City Mini Auditorium, Kolkata



Occam's Razor, Boltzmann's Brain and Wigner's Friend

Prof. Charles H. Bennett, IBM Research



“How does the complicated but superficially classical world we inhabit emerge cosmologically from the austere high-level laws of quantum mechanics and general relativity, or terrestrially from lower-level laws of physics and chemistry? To attack these questions in a disciplined fashion, we need to define “complexity”, that which increases when a self-organizing system organizes itself”



Planck's Formula, Bose's Derivation, Einstein's Generalization

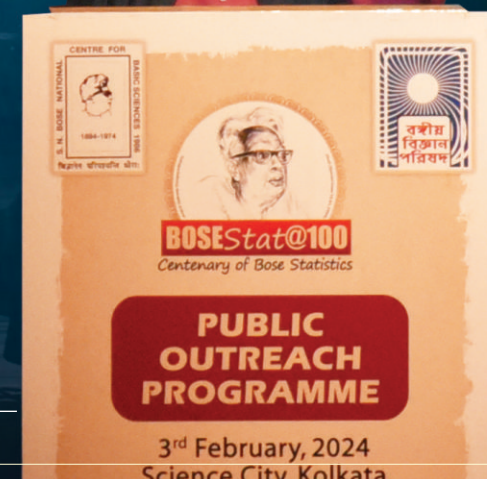
Prof. Palash Baran Pal
Univ. of Calcutta

“In 1792, Thomas Wedgwood took a peek into a potter's kiln and got a glimpse of equilibrium radiation in an enclosed space. The wall of the kiln, the coal, the pottery - everything was glowing red. In 1924 S.N. Bose derived a formula for the equilibrium state of this radiation.”

The Story of Bose, Photon Spin and Indistinguishability

Prof. Partha Ghose
TCNCP, Kolkata

“When asked why he did not come out in the open and claim that he was the first one to moot the idea of photon spin, when photon spin was eventually discovered, Bose in his characteristic style said, 'How does it matter? It is important that photon spin has been established. It is not important who first gave the idea.'”



Public Lectures

November 17, 2024

Eastern Zonal Cultural Centre, Kolkata



A Relation that Ebbd Too Soon: The Case of S. N. Bose and Meghnad Saha

Prof. Atri Mukhopadhyay
SINP, Kolkata (Retd)

"Satyen Bose was purely mathematical in nature, but Meghnad Saha was a realist. Despite being friends, they were uniquely different. Amidst India's struggle for freedom and the war, both Saha and Bose found their purposes in science"

Celebrating Centenary
BOSE STATISTICS
$$E = \sum \frac{\epsilon_i h \nu_i}{e^{h \nu_i / kT} - 1}$$

A New Frontier in Quantum Science and Engineering

Prof. M. Zahid Hasan
Eugene Higgins Prof. of Physics,
Princeton University, USA

"We are a collection of particles, trying to understand the universe which is another collection of particles."



Public Lectures

November 17, 2024

Eastern Zonal Cultural Centre, Kolkata

Prof. B.N. Jagtap
felicitates
Prof. Zahid Hasan

S.N. Bose's Granddaughter
Nandini Priyadarshini Basu
being felicitated by
Prof. Tanusri Saha Dasgupta





Ramakrishna Mission Vivekananda
Centenary College, Rahara

আলোচনা সভা সত্যেন্দ্রনাথ বোস ও বোস সংখ্যায়ন

আয়োজক

রামকৃষ্ণ মিশন বিবেকানন্দ সেন্টেনারি
বঙ্গীয় বিজ্ঞান পরিষদ
সত্যেন্দ্রনাথ বোস জাতীয় মৌল বিজ্ঞান কেন্দ্র

Outreach
Programmes



Ramananda College, Bishnupur



Presidency University, Kolkata

Acharya Prafulla Chandra
College, New Barrackpore



Serampore College

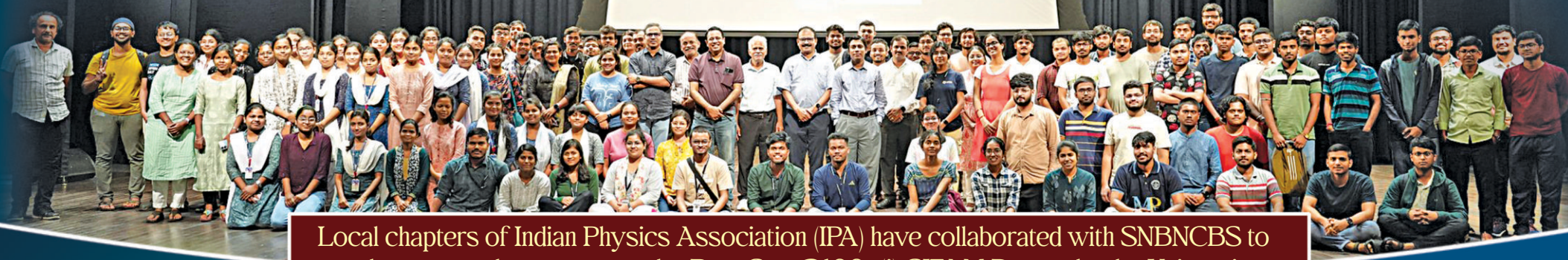


Serampore, WB, India
Nani Lala Bhattacharjee Street, Tin Bazar, Serampore,
712201, WB, India
Lat 22.751597, Long 88.352963
09/28/2024 11:47 AM GMT+05:30
Note : Captured by GPS Map Camera

Bangiya Bijan Parishad and SNBNCBS organized lectures on Bose -Einstein Statistics in several universities and colleges in West Bengal. More than a thousand students and faculty have been reached. Most of these sessions were conducted in Bengali.

Outreach

The team of students, faculty and guest speakers at NISER

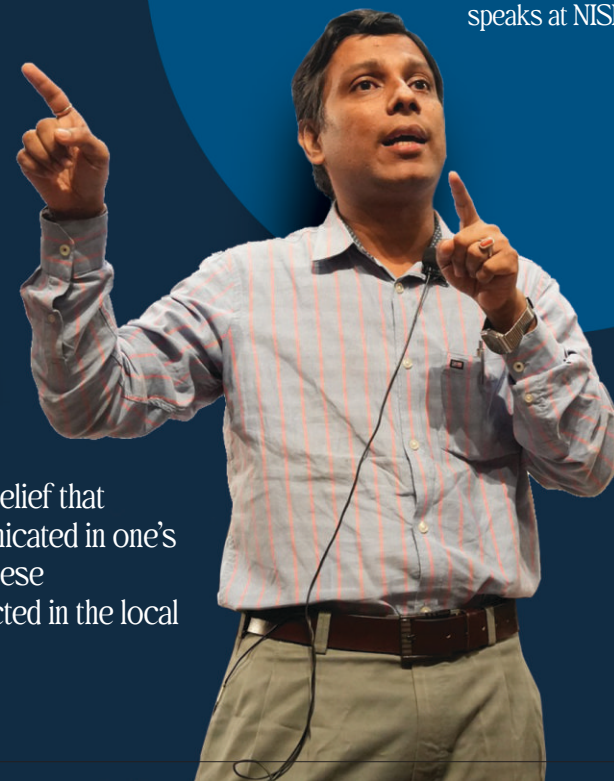


Local chapters of Indian Physics Association (IPA) have collaborated with SNBNCBS to conduct outreach programs under BoseStat@100: (i) GITAM Deemed to be University, Visakhapatnam and (ii) NISER, Bhubaneswar



Prof. Thirupathaiah Setti, SNBNCBS at Gitam University

Prof. Sunandan Gangopadhyay
speaks at NISER



In tune with Prof. Bose's belief that science should be communicated in one's mother tongue, many of these lectures have been conducted in the local vernacular.

Rapt audience at Gitam University



পাতা কলকাতা পশ্চিমবঙ্গ দেশ বিদেশ সম্পাদকের পাতা খেদা বিনোদন জীবন ধারা ভিত্তিতে আনন্দ উৎসব

আরও পড়ুন

সহ-উপাচার্য থেকে
রেজিস্ট্রার পদে নেই
আধিকারিক, যাদবপুরে
শুনা শিক্ষক-শিক্ষিকার...

অনুষ্ঠানের প্রচারণার পরে বিভিন্ন বিষয়ে নিয়ে আলোচনা করা হয়। নিজস্ব ছবি।

১৭ নভেম্বর কলকাতার একটি সরকারি প্রেক্ষাগৃহে 'বোসে-স্ট্যাট ১০০' শীর্ষক সেই অনুষ্ঠানে বাংলা ভাষায় কোয়ান্টাম সাত্বেল আন্তর্জাতিক সম্পর্কে আলোচনা করা হয়। অনুষ্ঠানের বিশিষ্ট অতিথি হিসাবে উপস্থিত ছিলেন ফ্রান্সের বিশ্ববিদ্যালয়ের অধ্যাপক এম জাভিঁল হুসেন, সাথে ইনস্টিটিউট অফ নিউক্লিয়ার ফিজিক্সের প্রাক্তন আধিকারিক তথা অধ্যাপক অরুণ মুখোপাধ্যায়, বঙ্গীয় বিজ্ঞান

nature > nature.india > news > article

NEWS | 22 August 2024

India's quantum scientists want industry to invest in research

Emerging quantum technologies will have bountiful applications, but funds must come first

By Sahana Ghosh

Twitter Facebook Email

PNB PRADESH

Bose Statistics continues to shape modern science and technology

Workshop on '100 Years of Bose Statistics: A Quantum Legacy' held

Renowned experts from across India converged at GITAM Deemed to be University for a workshop titled '100 Years of Bose Statistics: A Quantum Legacy'. The event, jointly organized by the Indian Physics Association and the SN Bose National Centre for Basic Sciences (SNBNCBS), commemorated the centenary of Satyendra Nath Bose's groundbreaking contributions to quantum mechanics.

Addressing the gathering, Prof KS Kishore, Dean of GITAM School of Science, emphasized the significance of Bose's foundational work in the early 1920s. 'Satyendra Nath Bose's pioneering work laid the cornerstone for a critical part of quantum mechanics, deeply influencing the development of quantum theory,' he stated. His collaboration with Albert Einstein on Bose-Einstein statistics introduced the concept of Bose-Einstein condensation (BEC), a phenomenon that has been central to advancements in quantum physics.

Prof BN Leghary, Distinguished Scientist from SNBNCBS (Kolkata) added, 'The principles discovered by Satyendra Nath Bose over a century ago remain as relevant today as they were when first announced.' He expressed optimism that further exploration of bosons and their unique properties would lead to breakthroughs that could transform not only our understanding of the universe, but also bring practical advancements to everyday life.

The workshop featured eminent speakers from IIT Bombay, SNBNCBS, and the University of Hyderabad. Over 150 attendees, including physics faculty, researchers, and students from surrounding colleges, engaged in the discussions.

আনন্দবাজার পত্রিকা অনলাইন

০২ ডিসেম্বর ২০২৪

প্রথম পাতা কলকাতা পশ্চিমবঙ্গ দেশ বিদেশ সম্পাদকের পাতা খেদা বিনোদন জীবন ধারা ভিত্তিতে আনন্দ উৎসব

Arundabazar / Education Career / An event organized by SNBNCBS & Bangiya Bijan Parishad to celebrate 100 Years of Bose-Einstein Statistics Dgtl

Bose-Einstein Statistics

কোয়ান্টাম সাত্বেল ও বাংলা ভাষা, বসু সংখ্যায়নের ১০০ বছর উপলক্ষে বিশেষ উদ্যোগ

মাতৃভাষায় বিজ্ঞানচর্চার উপর বিশেষ জোরে তেজের সনে অনুষ্ঠানে উপস্থিত অধ্যাপকরা। অনুষ্ঠানের প্রচারণার পরেও তাই বাংলা ভাষাকেই প্রাধান্য দেওয়া হয়।

BOSESTAT100 PUBLIC LECTURE
Sat, November 17, 2024, 7:00 - 8:30 PM
Virtual Auditorium, ECC, Kolkata

স্টাইনের তত্ত্ব বিজ্ঞানীদের কাছে আশীর্বাদ: চার্লস বেনেট

আনন্দ উৎসবে এদিন 'বোসে-স্ট্যাট ১০০' নামে আয়োজনসম্পন্ন হয়েছিল। উপস্থিত ছিলেন অধ্যাপক এম জাভিঁল হুসেন, সহ-উপাচার্য থেকে রেজিস্ট্রার পদে নেই আধিকারিক, যাদবপুরে শুনা শিক্ষক-শিক্ষিকার...

১৭ নভেম্বর কলকাতার একটি সরকারি প্রেক্ষাগৃহে 'বোসে-স্ট্যাট ১০০' শীর্ষক সেই অনুষ্ঠানে বাংলা ভাষায় কোয়ান্টাম সাত্বেল আন্তর্জাতিক সম্পর্কে আলোচনা করা হয়। অনুষ্ঠানের বিশিষ্ট অতিথি হিসাবে উপস্থিত ছিলেন ফ্রান্সের বিশ্ববিদ্যালয়ের অধ্যাপক এম জাভিঁল হুসেন, সাথে ইনস্টিটিউট অফ নিউক্লিয়ার ফিজিক্সের প্রাক্তন আধিকারিক তথা অধ্যাপক অরুণ মুখোপাধ্যায়, বঙ্গীয় বিজ্ঞান

আনন্দ উৎসবে এদিন 'বোসে-স্ট্যাট ১০০' নামে আয়োজনসম্পন্ন হয়েছিল। উপস্থিত ছিলেন অধ্যাপক এম জাভিঁল হুসেন, সহ-উপাচার্য থেকে রেজিস্ট্রার পদে নেই আধিকারিক, যাদবপুরে শুনা শিক্ষক-শিক্ষিকার...

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Scientists trace evolution of quantum mechanics on 100 years of SN Bose's colossal work

Satyendra Nath Bose's pioneering work in 1924 on quantum statistics has paved the way for development of modern quantum technologies including Bose-Einstein condensation, quantum superconductivity, and quantum information theory.

The Telegraph online

Monday 02 December 2024

HOME OPINION INDIA KOLKATA WORLD BUSINESS SPORTS MY KOLKATA ENTERTAINMENT EDUCATION MORE

'A true scientist appreciates being proven wrong'

Professor Charles Henry Bennett of IBM Thomas J. Watson Research Center in New York, US, is a physicist and information theorist whose pioneering efforts span various domains, including quantum teleportation and quantum cryptography. Bennett has received several prestigious awards and accolades, including the Dirac Medal (2017), Wolf Prize in Physics (2018) and the Breakthrough Prize in fundamental physics

Anindya De | Published 11.03.24, 07:44 AM

Satyendra Nath Bose: Pioneer of Quantum Statistics and Condensed Matter Physics

Satyendra Nath Bose was an Indian physicist best known for his collaboration with Albert Einstein in developing the theory of Bose-Einstein statistics and the theory of the Bose-Einstein condensate. Bose made significant contributions to theoretical physics, particularly in the fields of statistical mechanics and quantum mechanics. His work laid the foundation for the field of quantum statistics.

In addition to his collaboration with Einstein, Satyendra Nath Bose also worked on various topics in theoretical physics, including the theory of radiation and the Planck's law of blackbody radiation. His significant contributions to physics earned him numerous honours, and the term "Boson" was later coined to name a class of subatomic particles in his honour.

Nobel Prize was awarded in physics for the achievement of Bose-Einstein condensation in dilute gases of alkali atoms, and for early fundamental studies and the Planck's law of blackbody radiation. His significant contributions to physics earned him numerous honours, and the term "Boson" was later coined to name a class of subatomic particles in his honour.

Along with developing the new quantum statistics, Bose's work also constitutes the foundation of novel technologies which also finds applications in the of the properties of the condensates; and the 2013 Prize for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles; namely, the Higgs Boson.

Remarkable scientists and scientific administrators convened at the S.N. Bose National Centre for Basic Sciences (SNBNCBS) in Kolkata for an international

nature > nature.india > news > article

NEWS FEATURE | 09 February 2024

As the world looks for quantum solutions, Bose statistics turns 100

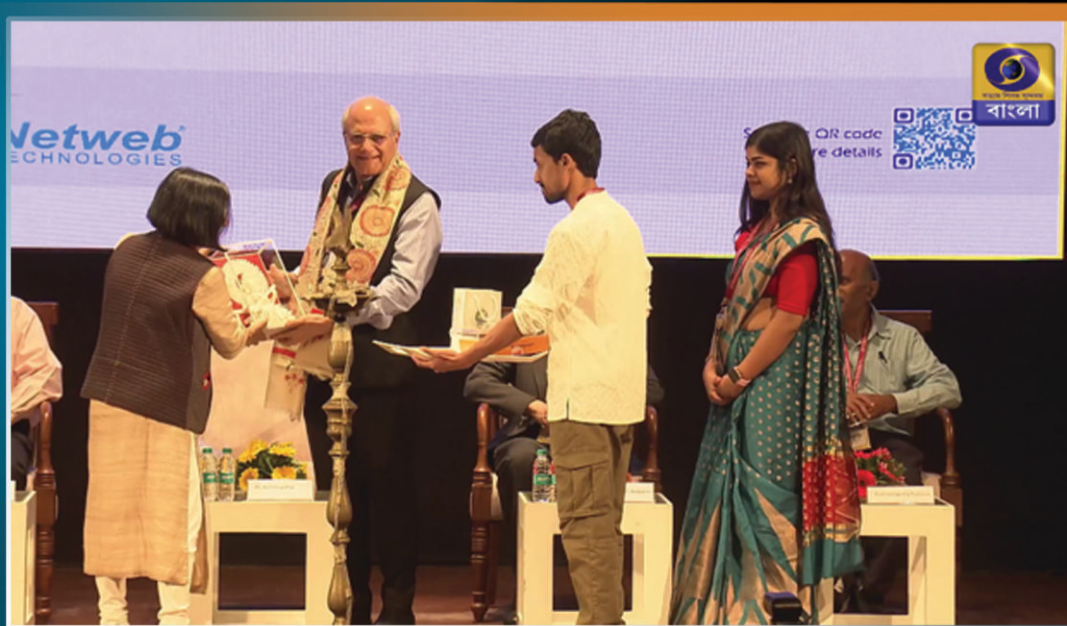
Physicist Satyendra Nath Bose's pioneering work in quantum statistics paved the way for the development of quantum mechanics, the core of India's tech revolution

By Sahana Ghosh

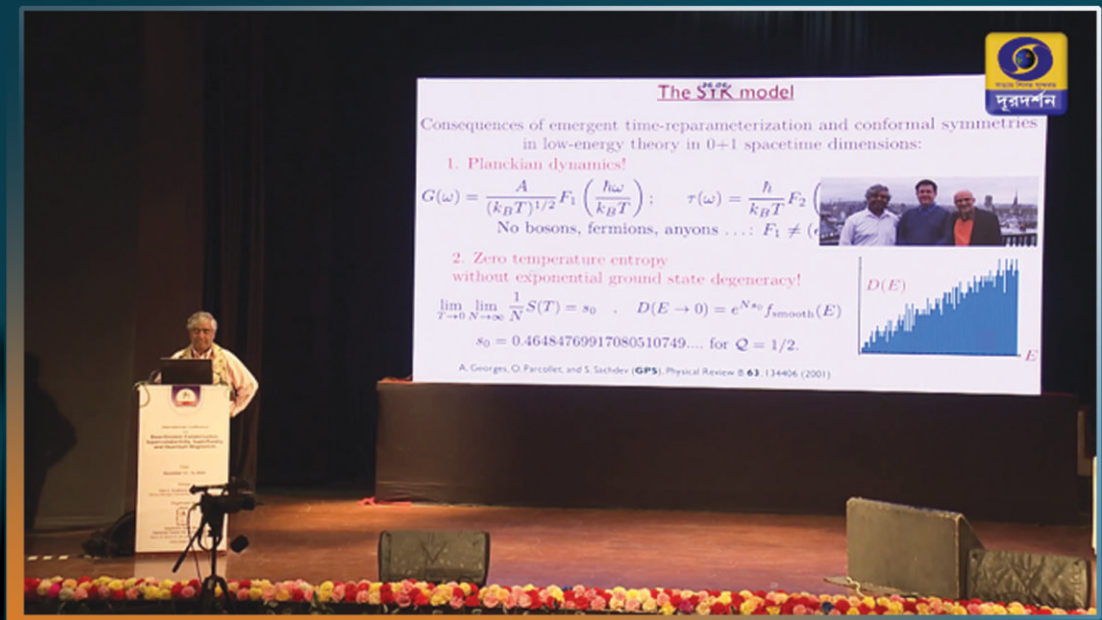
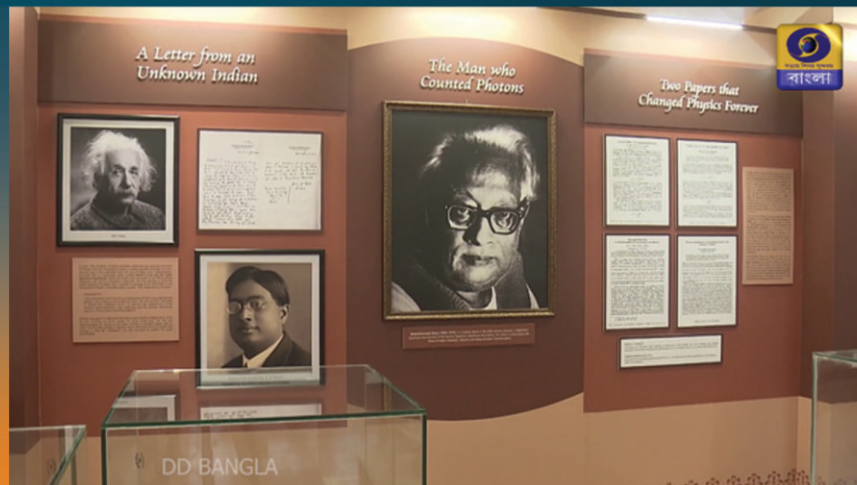
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PHYSICS DEPARTMENT, Dacca University

১৭ নভেম্বর কলকাতার একটি সরকারি প্রেক্ষাগৃহে 'বোসে-স্ট্যাট ১০০' শীর্ষক সেই অনুষ্ঠানে বাংলা ভাষায় কোয়ান্টাম সাত্বেল আন্তর্জাতিক সম্পর্কে আলোচনা করা হয়। অনুষ্ঠানের বিশিষ্ট অতিথি হিসাবে উপস্থিত ছিলেন ফ্রান্সের বিশ্ববিদ্যালয়ের অধ্যাপক এম জাভিঁল হুসেন, সাথে ইনস্টিটিউট অফ নিউক্লিয়ার ফিজিক্সের প্রাক্তন আধিকারিক তথা অধ্যাপক অরুণ মুখোপাধ্যায়, বঙ্গীয় বিজ্ঞান



শতবর্ষে বোস আইনস্টাইন পরিসংখ্যান
একটি প্রতিবেদন





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কোয়ান্টাম বিজ্ঞানে মহিলারা

এস এন বোস ন্যাশনাল সেন্টার ফর বেসিক সাইন্সেস থেকে একটি প্রতিবেদন



বোস সংখ্যায়নের শতবর্ষে সত্যেন্দ্রনাথ

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ISSN 2454-7727

৭৭ তম বর্ষ

সপ্তম সংখ্যা

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২০২৪, ১০ জুলাই ১৯২৪.



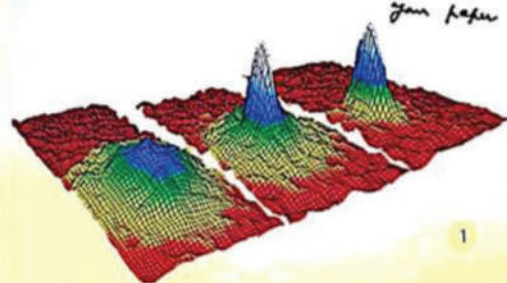
Respected Sir, I have ventured to send you the accompanying article for your perusal and opinion. I am anxious to know what you think of it. You will be the (I have tried to deduce the coefficient $\frac{1}{2\pi^2}$ in Planck's law independent of the classical electro-dynamics) only assuming the principle that the elements elementary regions in the phase space has the value h^3 . I don't know sufficient grounds to translate the paper. If you think the paper worth publication, I shall be grateful if you arrange for its publication in Zeitschrift für Physik. Though a complete stranger to you, I don't feel any hesitation in making such a request. Because we are all your pupils though pursuing only by your teachings through the four longings. I don't know whether you still remember that sometime from Calcutta asked your permission to translate your papers on Relativity in English. You attended to the request. The book has since been published. I was the one who translated your paper on Generalized Relativity.

Yours faithfully,
S.N. Bose

বঙ্গীয় বিজ্ঞান পরিষদ

প্রতিষ্ঠাতাঃ

আচার্য সত্যেন্দ্রনাথ বসু



Special issue of Gyan O Bigyan
On the occasion of 100 years of
Bose Einstein Statistics

Gyan O Bigyan is a Bengali science magazine published by Bangiya Bijan Parishad, an organization founded by S.N. Bose in 1948, to propagate science education in one's mother tongue.

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IOP Publishing

Journal of Physics B: Atomic, Molecular and Optical Physics

J. Phys. B: At. Mol. Opt. Phys. 57 (2024) 142001 (9pp)

<https://doi.org/10.1088/1361-6455/ad29f4>

Topical Review

Boson bloom

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Received 1 February 2024

Accepted for publication 17 April 2024

Published 17 June 2024



Abstract

The year 2024 marks the 100th anniversary of the first article on Bose statistics. Bose breathed life into the Planck distribution of radiation by a microscopic derivation (Bose 1924 *Z. Phys.* **26** 178), adding a new insight, namely *indistinguishability* into the then evolving quantum theory. Einstein recognized the importance of this article and got it published. Using Bose statistics Einstein wrote an article on the theory (Einstein 1924 *Sitzungsber. Preuss. Akad. Wiss. Phys.-Math. Kl.* 261) of an ideal Bose gas and Bose–Einstein condensation. The groundbreaking discovery of Bose, an unveiling of a secret of quantum mechanics, continues to reverberate after a century. Bose's paper is considered the fourth important paper in old quantum theory, following Planck's (1900) article (Planck 1900 *Verh. Dtsch. Phys. Ges.* **2** 202), Einstein's (1905) photoelectric effect (Einstein 1905 *Ann. Phys., Lpz.* **17** 132) and Bohr's model (1913) of the atom (Bohr 1913 *London, Edinburgh Dublin Phil. Mag. J. Sci.* **26** 1). Dirac (1926 *Proc. R. Soc. A* **112** 661) coined the name *boson* for one of the two families of indistinguishable particles, the other family being fermion. The edifice of modern quantum field theory, many-body quantum theory, quantum-information and quantum-computing are built on bosons, fermions and anyons. The ever-blooming quantum garden of bosons has photons, gluons, W-bosons, mesons, Higgs-bosons, gravitons, phonons, magnons, excitons, plasmons, polaritons and so on. We present a brief historical account of Bose's life and his discovery, followed by a bird's eye view of the impacts of bosons in modern science and technology: from Bose's distribution of 3-degree background radiation reaching us in the form of cosmic microwave background from the big bang era to *boson sampling*, a novel quantum computing method.

Bosogenesis before Baryogenesis?: And God said, Let there be light; and there was light (Genesis, 1:4)

Keywords: Bose statistics, history of physics, quantum mechanics

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Topical Review
“Boson bloom”

G Baskaran and A R May

Journal of Physics B: Atomic,
Molecular and Optical Physics
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The Centenary of S. N. Bose's
Colossal Work

Celebrating Indian Quantum Science



Satyendra Nath Bose National Centre for Basic Sciences

(Under Department of Science and Technology, Govt. of India)

JD Block, Sector III, Salt Lake, Kolkata, West Bengal 700106, India