

Spenta R. Wadia 16 December 2023 Alladi Ramakrishnan Centenary Conference, IMSc Chennai

FUEL PERCENT

A CONTRACTOR AND A

Prehistory - String Theory at TIFR

String Theory at TIFR - 1

String theory, a theory in making, has its origins in the high energy physics of strongly interacting particles (1960s). It is an attempt to answer questions about the origin and future of our universe, about the conundrums of black hole physics and about the unification of gravity with the weak, strong and electromagnetic forces.

In the summer of 1984 it became clear that String theory may be able to describe elementary particle physics including the weak interactions. Around the time some of us at TIFR had started working on String theory as a continuation of our work in the theory of strong interactions...hence we hit the ground running!

The first thing we did was to grow the local community: train students and postdocs, our first batch of students were postdocs at Stanford, IAS Princeton, Brown, Harvard, and we inducted our earliest students as faculty to build a nucleus - Avinash Dhar and Gautam Mandal. By then Sunil Mukhi had also joined TIFR.

String Theory at TIFR - 2

The second thing we did was to go abroad every summer and inform the world what we were doing at the Tata Institute (I learned this from Ludvig Faddeev, on a train ride in 1982 from Saclay to Paris - "Every summer I go out and tell the world what we are doing in Leningrad".

ICTP and Abdus Salam played a very important role in the early years of string theory in India. I was myself a Staff Associate and a regular annual visitor at ICTP for about 10 years 1985 onwards. Over the years most members of the string theory group became associated with ICTP. We lectured there and helped organise activities. ICTP supported our visits to other institutions in the world when we did not have travel funds from the home institution.

During these visits, I went looking for faculty, visited Sumit Das and Ashoke Sen in Fermilab, asking them to join the Tata Institute and they did.

When I was at IAS, Princeton during 1990-91, I encouraged Sandip Trivedi and Atish Dabholkar to join the Tata Institute and they did so a few years later!

So we had assembled a strong group by the end of the 1990s: Atish Dabholkar, Sumit Das, Avinash Dhar, Gautam Mandal, Sunil Mukhi, Ashoke Sen, Sandip Trivedi and myself.

String Theory at TIFR - 3

We started organising international conferences and summer schools at the Tata Institute...Mahableshwar and TIFR-Mumbai.

A lot of important and impactful work came out of the Tata Institute in String Theory that encouraged us to organise **Strings 2001** at TIFR, Mumbai which hosted Stephen Hawking, Edward Witten and David Gross and other eminent people in String Theory (David Gross made sure that we invited Stephen!). We had 3 public lectures in a single day! This meeting was organised by Atish Dabholkar, Sunil Mukhi and myself. The visit of Stephen Hawking was supported by Mr Shibulal of Infosys Technologies, and Mr Murthy and Mr Gopalakrishnan had also came over.

Strings 2001 was a watershed moment for String theory in India! We had arrived on the national and international stage. In the years that followed Sumit Das, Ashoke Sen and Atish Dabholkar relocated to other institutions for personal reasons, however in 2004 we could attract Shiraz Minwalla to join TIFR.

String theory at TIFR grew mainly due to the support and encouragement of Prof Virendra Singh who recognized the importance of the questions string theory attempts to answer. In the early 1990s, Prof S.S. Jha, Chair of the Department of Theoretical Physics created a new unit in the Department of Theoretical Physics: **String theory and Mathematical physics**.

ICTS

2001: The idea of the ICTS

- University of Chicago (1978-1982)
- Strings 2001 in TIFR, Mumbai
- Visit to Infosys Campus, Bangalore on 12 Jan 2001 with Edward Witten, and the memory of my visit to TIFR in 1967

The idea to create a Centre such as the ICTS, where 'Science is one story', took shape in 2001, after the success of the Strings 2001 conference at TIFR Mumbai and a visit to the Infosys Campus in Bangalore.

The former boosted our confidence based on our achievement in fundamental physics and the latter assured us that Institutional infrastructure and management of the highest international quality was possible in India.

The visit to the Infosys campus happened at the insistence of Edward Witten who was keen to visit the 'temples of modern India.'



This combination of highest quality science within a modern state of the art campus, managed along modern lines inspired the basic idea of the ICTS.

What would make ICTS unique in India was that it was to be an international science hub that would transform the ways of doing scientific research and advanced science education in India.



2001 : 1st Proposal for setting up ICTS was sent to Infosys on 12 Feb 2001

2004 : Discussion with David Gross at KITP, Santa Barbara

Draft Proposal to Infosys Technologies for the creation of a Center of Excellence in Theoretical Sciences

Spenta R. Wadia

Background and critique of current science management in India:

I have been working at the TIFR for the past 18 years during which period I seeded and contributed to the building of a world class String theory group. Based on my experience it seems to me that the present model of a scientific research institute that grew out of the vision of people like Dr. Homi Bhabha, is in need of radical revision. Dr. Bhabha's was one great leap forward for Indian science at a time when India became an independent nation. This birth of "big" Indian science took place in the Nehruvian era and there is no doubt that it has contributed to the building of a scientific infrastructure in India which surpasses that of almost all developing countries and matches that of several developed countries. However it seems to me that the problem lies in accepting the science management model as almost static for over 50 years. One needs to assess and revise these models from time to time, in keeping with the changing times, so that one ensures productivity commensurate with the investment of intellectual and financial capital. Such changes seem difficult to bring about, given the bureaucratic attitude of government funding agencies and the science managers. This is true not only of the TIFR but also of other centers in India that I am familiar with.

Indian science management gives little by way of incentive and a conducive research atmosphere to the researcher. These are usually generated by the scientists' own ideals for science and for many the decision to live and work in India derives from a sense of being Indian and a strong desire to live in India. Both these bastions seem to be fast eroding in today's world. A career in the basic sciences in India is less attractive today than ever before, given the attractive financial benefits and job satisfaction afforded by the 'knowledge based enterprises'. Even if one's ideals can withstand the onslaught of economics there is a lot lacking in the work atmosphere within which most scientists function. The sense of being Indian also needs to be redefined in the face of the extraordinary global networking of people that has occurred in recent times.

There is a clear need to address this issue and there are two possible approaches. The first is the obvious one where one begins re-engineering the administrative set up of the existing institutions and also clearly defines their relationship with their funding agencies which are government departments like the DAE, DST, UGC, ISRO and others. A second complementary approach would be to set up a model institution run along modern management lines. This document is devoted to briefly spelling out the second approach.

The Vision:

It would be desirable to set up a small institute devoted to research in theoretical aspects of basic sciences viz. physics, mathematics, theoretical computer science and theoretical biology (Such an endeavor, begun on a small scale, would provide an important input on the dynamics of research institutes in India and its success would serve as an example to revamp the several existing institutions.)

Areas of Research:

To begin with the subjects could be fundamental aspects of elementary particle physics and cosmology, mathematics theoretical computer science, theoretical biology and complexity. The institute should emphasize an interdisciplinary character which strives to put up bridges between traditionally distinct areas of research. The areas that can be seeded will also depend on the available faculty.

and financial facilities for research should be (almost) worldwide competitive.

Faculty:

The institute should have a small permanent faculty: perhaps three to four members in each of the areas it wants to grow. This faculty is carefully selected. They should be excellent in their field, their selection should be after a thorough per review and they should have leadership qualities including the ability to function within a team. There should be no <u>nationality bar</u> on the faculty. To be able to attract the best, the salaries

TPS

option (not just academically) as opposed to going abroad or taking up non-academic jobs. Doctoral degrees can be awarded by an arrangement with an educational institution either in India or abroad. It is important for the institute to interact with undergraduates in the form of summer science programs and even semester-long visits from undergraduates

Location:

of institutions like the IITe

Visitors' Program:

Santa Barbara. 7

Students:

570

The location of the Institute is a factor of prime importance. It is important from the point of attracting the best faculty who would not only be satisfied by their own workplace but also expect to have opportunities for their families: good schooling for their children and also in many cases a satisfying job for their spouse. Since the proposed institution is small in size its scientists need to interact with others who are pursuing related areas. For example those working in areas of theoretical biology need to interact from time to time with experimental biologists; those involved in high energy physics need to interact with their more phenomenological colleagues; theoretical computer scientists need to interact with those in information technology. Since students are an important resource it is important to be situated near existing institutions which have a reasonably good student body. It seems to me that Bangalore is a place that satisfies most of these requirements, but this matter needs more thinking and discussion.

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protoms - NOT VISITIRS

The institute should have a vigorous and focused visitors' (programs.) There should

be long and short-term visitors both from India and abroad. For people from India

it would provide an opportunity to lift research quality via intensive interactions and

encouragement (both psychological and monetary). Their visits and association with the institute would exert the sort of lateral pressure needed to reform the system prevalent

in their institutions. Here there is similarity with the Institute for Theoretical Physics at

Graduate students are an important resource in research. They are also a source of

future leaders. The graduate stipend should be attractive enough for it to be a viable

Re S

3

LINOT TATA Management:

The model institute may be run along progressive management lines

1. that recognizes that people working in the institute are assets and does its best to provide a supportive administration for researchers to function. Also researchers should get a feeling that they can bring about positive changes when needed,

2. that is non-hierarchical and democratic and at the same time recognizes merit, 3. that does not necessarily discourage collective and team performance, 4. that has enough flexibility to allow the institute to innovate and evolve with time: Incorporating positive ideas and suggestions and responding to new situations,

5. that pays adequate attention to performance rewards (the definition of 'performance' in basic research is not simple but can be adequately formulated in terms of peer reviews)

6. that recognizes the fact that science is global. The institute can have a council \leftarrow which has a global representation and a regular mandatory review of its performance by an international committee every few years. IS=?

Funding:

NOT

It is desirable to have sustained financial support and hence long term financial planning is necessary. Given the concerns I have expressed about government funding in India I would think that the proposed institute should be largely funded by the private sector. Here again I believe that you and your colleagues are best equipped to help evolve a working model. In fact I would leave this matter for further discussion and your careful 258 MATCHANG 4 consideration and advice. seeping.

Epilogue:

When I was being taken around Infosys the other day I was in a state of a pleasant shock. What was encouraging to me was that an institution like Infosys exists in India and it was built by people with humble beginnings, who exercised great and timely vision, perseverance and team work to succeed at the international level. It also occurred to me that just as the Tatas had laid the foundation of IISc Bangalore way back in 1912 and later TIFR in 1945. Infosys may well be able to seed a new culture of scientific

institution-building in the new millennium. These initial thoughts, on which our conversation of January 14 was based, have now grown into this preliminary proposal. I am aware that there is a great challenge in adapting to scientific research, management principles (typically guided by definitive criteria like market and customer satisfaction) that ideally suit the business world. However, I believe that with the right vision the challenge can be met and we can succeed in building a working model that other institutes can emulate.





2006-7: ICTS approved by the TIFR Governing Council

On 13 October 2006, I made a presentation to the Council of Management of TIFR, outlining the concept of a 'National Centre for Theoretical Sciences'.

On 2 August 2007, the Council of Management of TIFR recommended the setting up of a Centre with the name (suggested by CNR Rao), "International Centre for Theoretical Sciences of TIFR", at a suitable location in India with 3 main missions:

- PROGRAMS that bring together physicists, astronomers, cosmologists, mathematicians, biologists, students and researchers from all over the world, under one roof, to work together to solve the most challenging questions posed by nature;
- **RESEARCH** by highest quality faculty in the theoretical sciences;
- SCIENCE OUTREACH that stimulate and harness young minds of India and connects with members of the public who are interested in the latest scientific developments.

ICTS would have three tier management structure with Advisory Council, Management Board and Program Committee. TATA INSTITUTE OF FUNDAMENTAL RESEARCH National Centre of the Covernment of India for Nuclear Science and Mathematics (Deemed University) Homi Bhabha Road, Colaba, Mumbai 400 005

December 06, 2007

OFFICE ORDER OD-68-2007

 It has been decided to set up an International Centre for Theoretical Sciences (ICTS), TIFR. Prof. Spenta Wadia will be the first Centre Director of ICTS.

 ICTS would have a three-tier management structure: A Management Board which will take all academic and administrative decisions pertaining to the Centre, an Advisory Council composed of distinguished scientists and a Programme Committee. The constitution of the Management Board will be:

Prof. M. Barma, Director, TIFR (Chairperson)
Prof. S.R. Wadia, Centre Director, ICTS
Prof. V. S. Borkar
Prof. S. O. Dani
Prof. Avinash Dhar
Prof. H.R. Krishnamurthy, IISc., Bangalore
Prof. S. Ramakrishnan
Prof. K. VijayRaghavan, NCBS, TIFR
Dr. Ananda Bose, It. Sec., R&D, DAE
Dr. J.N. Kayarkar, Registrar, TIFR
Ms. Uma Mahadevan, Member Secretary

(M. Barma) DIRECTOR

All members of the Committee

Registrar - for circulation

Setting up of the Advisory Board and various committees: for guidance and accountability

International Advisory Board - 2007

Michael Atiyah (University of Edinburgh) Manjul Bhargava (Princeton University) Roger Blandford (KIPAC, SLAC) Edouard Brezin (ENS, Paris) Michael Green (Cambridge University) **David Gross (KITP, Santa Barbara), Chair** M. S. Narasimhan (CAM-TIFR, Bangalore) T.V. Ramakrishnan (IISC Bangalore) Subir Sachdev (Harvard University) Ashoke Sen (HRI, Allahabad) K. R. Sreenivasan (Abdus Salam ICTP, Trieste) Raman Sundrum (Johns Hopkins) S. R. S. Varadhan (CIMS, New York University) Spenta R.Wadia (ICTS-TIFR) Centre Director Management Board - 2007

Mustansir Barma, Director TIFR (Chair) Vivek S. Borkar, TIFR S.G. Dani, TIFR Avinash Dhar, TIFR J.N. Kayarkar, Registrar, TIFR H.R. Krishnamurthy, IISc Uma Mahadevan, TIFR, Member Secretary P. Mukherjee, Joint Secretary (R&D), DAE S. Ramakrishnan, TIFR V.R. Sadasivam, Joint Secretary (Finance) K. VijayRaghavan, TIFR, Director NCBS Spenta R. Wadia, TIFR, Director ICTS

In addition, a Program committee and an Appointments committee were also formed.



2007 - Program activities began

Now that the Centre was approved, the woods cleared and the true mountains appeared: Centre started operating from TIFR Mumbai.

Began programs within institutions (TIFR Mumbai, IUCAA, IISc, IITs...) and other locations in India.



Lyman Page in IUCAA, Pune



Peter Sarnak in TIFR, Mumbai



The inauguration of the programs of ICTS on Dec. 2, 2007 during its first program, 'Correlated Electrons and Frustrated Magnetism' and Unfurling of the ICTS logo by T.V. Ramakrishnan at the International Centre in Dona Paola, Goa.



Next steps...

The next tasks were to find the government resources and land to build the campus, work with the architect for a design suitable for the ICTS mission, see through the execution of the architectural design, create a modern administrative support system, choose the research areas and attract outstanding faculty within each!

This complex task involved a huge collective effort by members of TIFR (most notably Avinash Dhar), the Indian science community, and the Govt of India.



CAMPUS



2008: Site for Campus in North Bangalore





24 October 2008, the Government of Karnataka approved the ICTS request and allocated land for setting up the campus on a long lease for a nominal lease amount.

The new ICTS campus is located in north Bangalore and spread over 78,000 square metres.

2009: Centre approved by Atomic Energy Commission (took 2 meetings!!)

2 November 2009, the Atomic Energy Commission gave a final approval with a budget for construction of the campus in Bangalore.



L to R: M.R. Sreenivasan, Secretary (GOI), Anil Kakodkar, C.N.R. Rao, P. Rama Rao (Lunch after AEC meeting).



2009: Foundation Stone unveiled during "Science without Boundaries" inaugural event



Spenta Wadia, Mustansir Barma, CNR Rao, David Gross, Sreekumar Banerjee

The ICTS Inaugural event was organized during 27-31 December, 2009 in the campus of IISc, Bangalore.

On 28th December 2009, the foundation stone of the new Centre, the ICTS of TIFR, was unveiled by Prof. C.N.R. Rao in the presence of Prof. David Gross, Dr Sreekumar Banerjee and Prof. Mustansir Barma, in the J.N. Tata Auditorium, IISc, Bangalore.

Foundation Stone Remarks by Michael Atiyah

(Read out by Spenta Wadia during the Ceremony)

I very much regret not being with you for the laying of this Foundation Stone for the International Center for Theoretical Sciences, but I am with you in spirit and send my best wishes for the future success of this important Center. Science has the noble aim of trying to understand the natural world in human terms : to make sense of what we see. This brief phrase encapsulates both theory and experiment. What we see, in the broad sense, covers experiment and making sense is the task of theory. As the great French mathematician Henri Poincare said, science is no more a collection of facts than a house is a collection of bricks: it requires theory to hold it together.

Theory needs a framework in which to develop and, as a mathematician, I believe that mathematics provide that unifying framework. As Galileo said the book of nature is written in the language of mathematics. Galileo was thinking primarily of mechanics and astronomy but, increasingly since his time, mathematics has provided the essential underpinning of ever-widening branches of science. As soon as a science moves from the qualitative to the quantitative, mathematics becomes indispensable.

Not only does mathematics provide the technical tools that all sciences require but, by its very nature, it acts as a unifying principle, integrating the diverse aspects of nature into an organic whole. I am sure that mathematics, in all its various aspects, will play an important part in the future activities of this Center. In the complex modern world with the enormous challenges that we face, from climate change to energy, from poverty to water shortages, science provide the bedrock on which we can build our future. I am sure that this Center will play its part in guiding both India and the wider world in the years ahead.



Avi Wigderson



R Shankar, Sriram Ramaswamy, Madan Rao



S.R.S. Varadhan



Elias Kiritsis, CNR Rao



Shiraz Minwalla, Andy Strominger



Yamuna Krishnan



K. VijayRaghavan, Ajay Sood, Ajay Salve, Albert Libchaber



Édouard Brézin (Chair), Naama Barkai, Albert Libchaber, Govindan Rangarajan, Avichai Wigderson



Eitan Tadmor, Mukund Thattai, Sriram Ramaswamy, Subir Sachdev



2010: Moving to Bangalore: Activities at the "One Corridor Institute" at IISc...to build the campus, induct faculty and organize programs





This was made possible by P. Balram (IISc Director), H.R Krishnamurthy (Chair of Physics Dept, IISc) and several members of the Physics Department of the Indian Institute of Science as well as TIFR-CAM.

K. VijayRaghavan and the NCBS team provided enormous support to the fledgling institution in its initial stages.









Sydney Brenner's visit during the Turing Centenary Lecture



Sydney Brenner, Obaid Siddiqui, Mukund Thattai, Madan Rao, Sandeep Krishna, Spenta Wadia Sydney Brenner, Mukund Thattai



CAMPUS DESIGN AND ARCHITECTURE 2010-12



We visited several places to learn about the architectural design that would fit the purpose of the ICTS. This involved visits to several institutions in India and abroad.





Archaeological and Ethnological Museum Granada, Spain (1539)

New Lecture Hall, Bowdoin College, Brunswick, Maine





Floating Restaurant, Infosys Campus, Mysore



Guest House units, Infosys Campus, Mysore



2010: Competition of Architects for designing the campus

Architectural design submitted by M/s Venkataramanan Associates Pvt. Ltd., Bangalore was selected by a jury after evaluating the designs and concepts of a total of 6 competing agencies on 2nd Dec 2010 at TIFR-Mumbai.





Ravindra Kumar, Design Architect

Campus design finalized



13 Dec 2012: Ground-breaking Ceremony at Shivakote



CONSTRUCTION



2012-15: Campus construction project managed by DCSEM, DAE and constructed by JMC Pvt. Ltd.



The ICTS team was constantly monitoring the construction and its quality

ICTS started functioning from its campus since June 2015.

Spread over 78,000 square meters in North Bangalore, this beautiful world-class residential campus serves as an outstanding environment conducive to research and learning in India.



The campus has been planned to be self–contained and includes academic, housing and recreational facilities for more than 150 academic members, including 75 visitors. The architectural design provides space for maximum academic interactions. It contains lecture halls with enough capacity for meetings with hundred plus participants, an auditorium, recreation spaces and comfortable living quarters for staff and visitors. The academic and residential blocks, labs, seminar halls and the data centre are named after distinguished scientists.

2015: Inauguration of the Campus on 20 June 2015



The new ICTS campus was inaugurated on June 20, 2015 with an event **"Science at ICTS"**

ICTS



CNR Rao



K Kasturirangan



Anil Kakodkar



David Gross



Avinash Dhar



Mukesh Dodain



Uma Mahadevan



K VijayRaghavan



Leena Chandran-Wadia



ICTS Mission and its People



People

- Faculty, Associates, Students, Postdocs
- Administration



Research Areas 'ICTS has no departments'

Buildings can be made but prospective faculty has to be available; even if they are available they should want to join the very young institute.

Also the areas you can grow depends on the the availability of faculty.

The ICTS Appointments Committee made a determined and bold effort and succeeded! Space-Time Physics (String Theory and Quantum Field Theory, Astrophysical Relativity)

ICTS

Mathematics

Complex Systems

(Non-linear dynamics and Data Assimilation, Statistical Physics, Turbulence, Condensed matter physics, Physical Biology)

ICT:

2007: Faculty induction began A most difficult and crucial task!

Abhishek Dhar (2012) Suvrat Raju (2012) Amit Apte (2013) P. Ajith (2013) Pallab Basu (2013) Vijay Kumar Krishnamurthy (2014) Samriddhi Sankar Ray (2015) Vishal Vasan (2015) Anupam Kundu (2015) Sivaram Ambikasaran (2015) Rajesh Gopakumar (2015) Rukmini Dey (2015) Subhro Bhattacharjee (2015) R. Loganayagam (2015)



Students and Postdocs

First batch of 4 graduate students joined in Aug 2013.

First post-doc Tapan Mishra joined in Oct 2011.

Rich and vibrant post-doctoral fellowship programme included, apart from the usual institute post-doctoral fellows, special highly competitive prized positions, namely the Airbus (2013) and the Simons (2015) Postdoctoral Fellowships, and those supported through Max-Planck partner groups of individual faculty members.



Sample of early programs across disciplines

- 1. Correlated Electrons and Frustrated Magnetism (Nov-Dec 2007)
- 2. Monsoon Workshop on String Theory (June-Aug 2008)
- 3. Cosmology with the Cosmic Microwave Background (Jul-Aug 2008)
- 4. Scientific Discovery through Intensive Data Exploration (Feb 2011)
- 5. Random matrix theory and applications (Jan 2012)
- 6. The Role of Theory in Biology (Oct 2012)
- 7. Mathematical Perspectives on Clouds, Climate and Tropical Meteorology (Jan 2013)
- 8. Numerical Relativity (June-July 2013)



ICTS as a Platform for New Initiatives

Within India:

IndiaLight (India Open Research Exchange Facility for Global Scientific Cooperation in Bangalore), a large data, high speed network for Bangalore institutions at TIFR-CAM (pilot phase) with international connectivity e.g. GLORIAD (was available till October 2013) via a grant from Tata Communications and NSF (USA). 7.3 tbs of data were downloaded and mirrored in biology and the earth sciences during this period.

Nodal Centre of LIGO-India in Bangalore; LIGO tier-2 data centre

Internationally:

- ICTP-ICTS Biology Program (Dec 2013-)
- Asian Winter School on Strings, Particles and Cosmology (Jan 2010-) (KAWS since 2018)
- Mathematics of Planet Earth 2013 Programs and Math Exhibition (22 Nov-1 Dec 2013)
- UIUC-STRAND-ICTS Discussion Meeting on Computational Genomics, July 2013



Named Lecture Series with associated Discussion Meetings

Subrahmanyan Chandrasekhar Series (Physical sciences):

Ashoke Sen, Andrew Strominger, Lyman Page, Ludwig Faddeev, Subir Sachdev, Dam Than Son, Uriel Frisch, Satya Majumdar, Nima Arkani Hamed, Sankar Das Sarma, Antoine George, Robert Myers, T. Senthil, Itamar Procaccia, Herbert Spohn..

Srinivasa Ramanujan Series (Mathematics):

Peter Sarnak, Andrew Majda, Peter Scholze, Chandrashekhar Khare, Giovanni Jona-Lasinio..

Alan Turing Series (Biology, computer science, engineering and related areas): Sanjeev Arora, Robert Schapire, Ravi Kannan..

These series have been very successful especially because a discussion meeting is organized around the theme of the lectures



Special Lectures

Abdus Salam Lecture (to commemorate the memory of Salam a great physicist and a champion of science for the developing world): Fernando Quevedo, R. Ramaswamy, K. VijayRaghavan...

ICTS Distinguished Lectures:

Ashoke Sen, Valery Rubakov, Manjul Bhargava, Jennifer Chayes,, M.S.Narasimhan, Pierre Hohenberg, Philip Candelas..



Science Outreach

ICTS Public Lectures:

Juan Maldacena, Francois Bouchet, Marc Kamionkowski, Joseph Silk, Lyman Page, Avi Wigderson, David Gross, Albert Libchaber, William D. Phillips, Klaus von Klitzing, Istvan Hargittai, Kip S. Thorne, J. Richard Bond, P. James Peebles, John Ellis, Benedict Gross, Terence Tao, Etienne Ghys, Peter Sarnak, Nima Arkani-Hamed, Sydney Brenner, Sankar Das Sarma, Cumrun Vafa, Boris Shraiman, Stuart Parkin, Manjul Bhargava, Juan Maldacena, François Bouchet, David Gross, Juan Maldacena, Peter Saulson and Edward Witten, Nima Arkani-Hamed, Ashoke Sen, Nathan Seiberg, Andrew Strominger, Cumrun Vafa..

Einstein Lectures (to commemorate the Centenary of General Relativity):

Bruce Allen, Bala Iyer, Rajesh Gopakumar..

MPE 2013: An interactive exhibition on Mathematics for the Billion held at the VITM, Bengaluru from 22nd November to 1st December 2013 with over 30,000 visitors.



July 2015: Passing the baton to Rajesh Gopakumar





ICTS campus today





Present International Advisory Board

Nima Arkani-Hamed (IAS, Princeton) Manjul Bhargava (Princeton University) William Bialek (Princeton University) Roger Blandford (KIPAC, Stanford University) Jennifer Chayes (UC Berkeley)) Sankar Das Sarma (University of Maryland) Rajesh Gopakumar (ICTS-TIFR) Centre Director Senapathy Gopalakrishnan (Co-founder Infosys) Michael Green (Cambridge University) David Gross (KITP, Santa Barbara), Chair Juan Maldacena (IAS Princeton) Subir Sachdev (Harvard University) Ashoke Sen (ICTS-TIFR) Boris Shraiman (KITP, University of California, Santa Barbara) Senthil Todadri (MIT) S. R. S. Varadhan (Courant Institute, New York University) Spenta R. Wadia (ICTS-TIFR)

Present areas of research at ICTS

Natural Sciences

- 1. Astrophysics and Relativity
- 2. Biological Physics
- 3. Condensed Matter and Statistical Physics
- 4. Fluid Dynamics and Turbulence
- 5. String Theory and Quantum Gravity

Mathematical Sciences

- 1. Applied and Computational Mathematics
- 2. Computer Science
- **3. Geometry and Physical Mathematics**
- 4. Probability Theory

Science without boundaries...No Departments



Present Faculty at ICTS

Parameswaran Ajith Amit Apte Siva Athreya Anirban Basak Riddhipratim Basu Pallavi Bhat Subhro Bhattacharjee Rukmini Dey Abhishek Dhar Rajesh Gopakumar (Centre Director) Rama Govindarajan Akshit Goyal Vijay Kumar Krishnamurthy Manas Kulkarni

Prayush Kumar Anupam Kundu Pranav Pandit Loganayagam R Jaikumar Radhakrishnan Suvrat Raju Sthitadhi Roy Samriddhi Sankar Ray Jim Thomas- - Joint Fac. Shashi Thutupalli - Joint Fac. Vishal Vasan Spenta R. Wadia (Emeritus Professor and Founding Director)

Senior faculty supported through external grants/ fellowships

Chandan Dasgupta Bala Iyer Hulikal Krishnamurthy Rajaram Nityananda Mythily Ramaswamy Sumathi Rao Joseph Samuel Ashoke Sen Debasis Sengupta T. N. Venkataramana

Adjunct/Visiting Professors

Swapan Chattopadhyay Sunil Mukhi Ravi S Nanjundiah Abhinav Kumar Tejaswi Venumadhav Nerella

Students and Postdocs



105 regular students and 13 long term visiting students.

27 postdocs

ICTS Programs





Program Statistics

- A total of **336 programs** of varying sizes
- 144 Named Lectures and several Public Lectures

(9 Nobel laureates, 4 Fields Medallists, 12 Dirac Medallists, 7 Boltzmann Medallists, 10 Lars Onsager Prize winners and many more...)

 More than 7000 talks archived on ICTStalks (Our lecture videos have over 4.5 million views and 54000 subscribers.) Number of programs held annually (2014 to 2024)



A steady increase in the number of high-level programs





Special Lecture Series

Infosys - ICTS Chandrasekhar Lecture Series

Infosys - ICTS Ramanujan Series

Infosys - ICTS Turing Series

Abdus Salam Memorial Lectures

Public Lectures

Distinguished Lectures

Einstein Lectures

Vishveshwara Lectures

D.D. Kosambi Lectures

Madhava Lectures

Infosys ICTS String Theory Lectures

Foundation Day Lectures



C.N.R. RAO

ehru Centre for Advanced

ICTS

Outreach

- Kaapi with Kuriosity
- Einstein Lectures
- Vigyan Adda
- Vishveshwara Lectures
- Public Lectures
- Maths Circles
- Science Education Program
- Science outreach in Schools
- Promise in Science and Mathematics (PRISM)
- Exhibitions: Cosmic Zoom and Climate Chaos: We're just warming up!
- GeoSphere@ICTS
- Other several events



Some present initiatives

- ICTS Science Teachers Training Camp for university, college and school teachers in modern methods in physics and mathematical pedagogy.
- Summer School for Women in Mathematics and Physics
- **Research in Teams**: brings together a small group (4 to 6) as a follow-up of a program.
- Thematic trimesters 3-month program on specialized themes to foster collaborative research and publications in highly topical and interdisciplinary areas.
- **Research directions:** computer science, data science, quantum computing and information, climate science and health, and ML/AI.

ICTS Resources

Major source of funding is from TIFR , Department of Atomic Energy, Govt of India..

ICTS for day one reached out for philanthropic foundations:

Airbus Corporate Foundation (2013-17) S.N. Bhatt memorial grant (2014-) Infosys Science Foundation (2015) Simons Foundation (2015-2020; 2020-2023) Infosys Foundation (2015-)

Other philanthropic foundations and the `Friends of ICTS' have also made contributions for various activities at ICTS.

ICTS Campus in Bangalore



The creation of the ICTS was a massive collective effort involving many many people from India and abroad. ICTS is grateful to all of them for their help, effort, guidance and commitment. It is difficult to imagine that this Centre would be what it is without them.

During the DPR approval meeting in 2009 at JNCASR, CNR Rao said, "ICTS could become the centre of new things in the theoretical sciences" ..." and expressed the hope that "ICTS would make India famous in the theoretical sciences and become the flagship of TIFR".

Today this dream and vision is indeed fulfilled! ICTS is a world class institution and among the best of its type worldwide, furthering the cause of basic research and education in India.



"Traveler, there is no road, the road is made by walking" - Antonio Machado

ICTS needs to grow to an optimal size to serve science and the nation better.

Thank you!