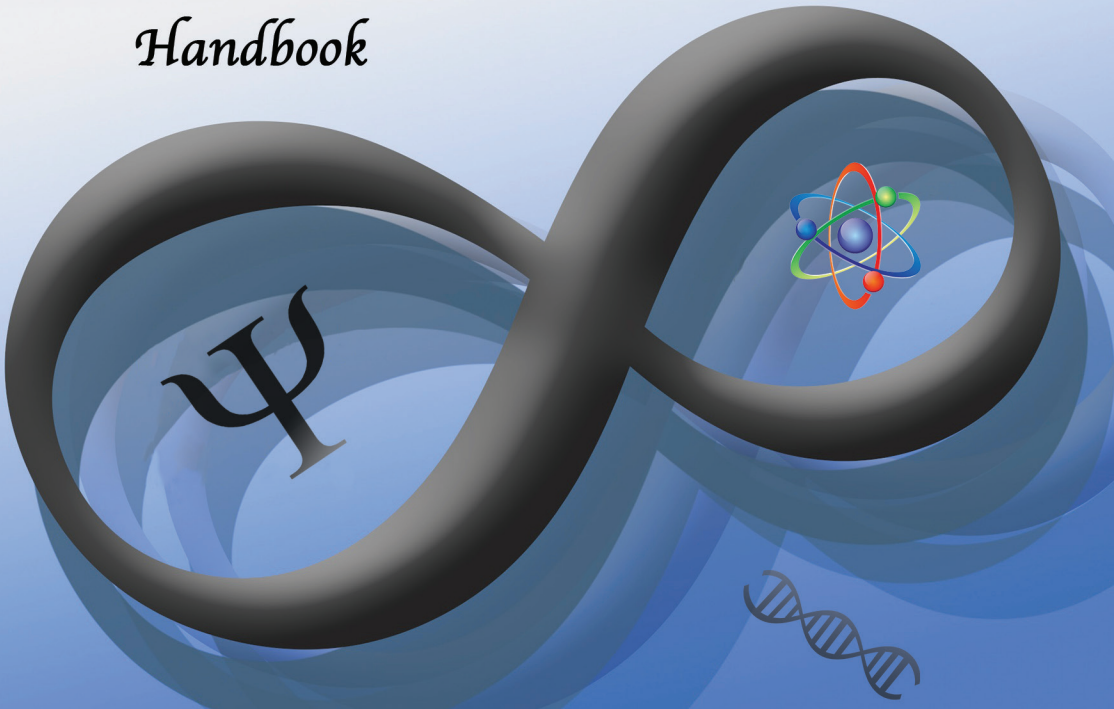
Summer School - 2022

Exploring the Foundations of Science & Beyond

Handbook



15 - 17 July 2022

Gopabandhu Ayurveda Mahavidyalaya,
VIP Road, Puri, Odisha (Hybrid Mode)

Organized by:

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Visionary:

Dr. T. D. Singh
Founder Director,
Bhaktivedanta Institute

vedanta

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Vedanta Limited
1st Floor, Module C/2, Fortune Tower,
Bhubaneshwar, Odisha - 751023, India
E-mail: infoaluminium@vedanta.co.in

Jharsuguda, Odisha
Vedanta Limited
Village Bhurkamunda, Jharsuguda,
Odisha - 768201, India
E-mail: infoaluminium@vedanta.co.in

Lanjigarh, Odisha
Vedanta Limited
Lanjigarh, Kalahandi,
Odisha - 766027, India
E-mail: infoaluminium@vedanta.co.in

Corporate Office

New Delhi
Vedanta Limited
Core-6, 3rd Floor, SCOPE Complex, 7 Lodhi
Road, New Delhi - 110003, India
E-mail: infoaluminium@vedanta.co.in

Mumbai
Vedanta Limited
75, Nehru Road Vile Parle (East) Mumbai,
Maharashtra - 400099, India
E-mail: infoaluminium@vedanta.co.in

Reason's last step is to acknowledge that there are infinitely many things beyond it.

– Blaise Pascal

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VIP Road, Kolkata 700 059, India
www.binstitute.org
Email: bi@binstitute.org
Tel: +91-33-2500-9018

Dedicated to

Dr. T. D. Singh

(His Holiness Bhaktisvarupa Damodara Swami)

(1937-2006)

Scientist & Saint

Founder Director, Bhaktivedanta Institute

&

Founder President, Vedanta and Science Educational Research Foundation

Acknowledgements

We are thankful that by the mercy of the Supreme Lord and blessings of the school visionary Dr. T. D. Singh and all the dedicated team members, the 6th Summer School, "Exploring the Foundations of Science and Beyond", is finally being organized in hybrid mode. We express our deep gratitude to the Honourable Chief Guest - Prof. Ashok Kumar Mahapatra, Former Director, AIIMS Bhubaneswar, Vice Chancellor, SOA University; esteemed special guest - Prof. Vijay Bhatkar, Chancellor of Nalanda University; and distinguished guests of honour - Dr. B. D. Mundhra, Emeritus Chairman, Simplex Infrastructure Limited; Smt. Sasmita Samanta, Vice Chancellor, KIIT University; Dr. Ramji Singh, Director, AIIMS Kalyani; Prof. Jasobanta Jena, Director, Institute of Mathematics and Applications, Bhubaneswar; Prof. Hari Hara Hota, Vice Chancellor, Sanskrit University, Puri and Prof. Dr. Sudharsan Behera, Principal, Ayurvedic College, Puri for kindly accepting our invitation to grace the event and share their profound words of wisdom. We would also deeply acknowledge all the esteemed speakers and session chairs for kindly accepting our invitation to share their profound wisdom.

We would like to specially thank the - Prof. Virendra Kumar Tewari, Director of IIT Bhubaneswar; Prof. Sujit Roy, Dean of Continuing Education; Dr. Rajesh Roshan Das; Dr. Tarakanta Naik for organizing a special and memorable curtain raiser ceremony of the school at IIT Bhubaneswar on 4th July, 2022 and encouraging students to take part in this school. We as well express gratitude to the Directors of AIIMS Bhubaneswar, IMA Bhubaneswar and Vice-Chancellor of Soa University - Dr. Mukesh Tripathi, Prof. Jasobanta Jena and Prof. (Dr.) Ashok Kumar Mahapatra, for encouraging us to organize preschool seminars in their institutes respectively. We would like to thank Dr. Debasish Hota, Dean of AIIMS Bhubaneswar; Prof. (Dr) Nachieketa K. Sharma; Dr. Kamal Lochan Mohanta, Dr. Trailokya Panigrahi, Mr. Hari Prakash and Students Association of AIIMS Bhubaneswar for selflessly supporting to organize the preschool seminars.

We also humbly acknowledge and thank our institute members and volunteers of various

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The assistance rendered by the members coming from different parts of the country and all the members of the Bhaktivedanta Institute are beyond imagination. Without their dedication, and full support, this school would not have been possible. Our sincere thanks to all of you for your wonderful dedication. We gratefully acknowledge the good wishes and prayers from friends, well-wishers, community of Dr. T. D. Singh's family without whose blessings, we could not have thought about this school.

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Khan, Amit Mondal, Vaman Bali, Balaji, Sourabh, Subramanyam, Bhakt Vatsal Das, Srikanth Chandragiri, Nithish Yenugu, Lalbabu Singh, Barun Singh, Anil Singh, Ajit Singh, Blogen Singh, Romen Sarma, Manoj, Bhakti Devi, Niva Devi,- Tikendra Singh, Suresh Singh, Biswajit Singh, Sanahanbi Devi, Amarjit Singh, Chetan Singh, Brajalika Devi, Suchitra Sikdar and many other generous supporters for this school. Thank you!

Sincere thanks to our special sponsors Dr. Tapan Kumar Chand, President of Vedanta Limited, Odisha & Chhattisgarh; Dr. B. D. Mundhra, Emeritus Chairman, Simplex Infrastructures Limited; Shri Brahmananda Mangaraj, Shree Krishna Contech Private Limited and school partners for their generous support and encouragement.

We are indebted to Dr. T. D. Singh (H. H. Bhaktisvarupa Damodara Swami), a pioneer of science and spirituality dialogue, Founder Director of the Bhaktivedanta Institute, who has guided us immensely for organizing the school for the benefit of humanity. Our deep gratitude to Srila A. C. Bhaktivedanta Swami Prabhupada, a visionary saint for the modern age and the Founder Acarya of the Bhaktivedanta Institute - for giving us this wonderful platform and vision.

Words are limited but feelings of heart are beyond what our minds and hands can grasp. We sincerely thank each and every individual, whether your name is mentioned or not, from the unlimited depths of our hearts. May good thoughts come from all directions. May everyone be happy.

Sarve jana sukhino bhavantu!

In the service of the Supreme Lord and your good self,

Organizing Committee
Summer School – 2022
Bhaktivedanta Institute, Kolkata

Contents

— ❋ —

Welcome

Quest to understand the roots or foundations of reality is a natural curiosity of humans. It is this quest that enabled us to discover and organize knowledge into various fields of study. The scientific method has been very successful in unravelling the mysteries of reality including that is not obvious to common eye. It is this happiness that drives the passionate scientific research. Albert Einstein was happy to express, *"The important thing is not to stop questioning. Curiosity has its own reason for existing. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvellous structure of reality. It is enough if one tries merely to comprehend a little of this mystery every day."*[1] We ponder why and how something is existing or happening and that leads to understanding the roots of reality. It is the same curiosity which enables us to understand the foundations of reality, and leads us to understand the foundations of science itself. We are fascinated by the beautiful theories and models we use in science that predicts to unbelievable precision. With such success and precision our faith in science has grown leaps and bounds.

We want to understand how science is so successful in unravelling reality. What are the foundations of science that bring such beauty and symmetry in our understanding of reality? The founding fathers of science like Heisenberg and Schrödinger and founding fathers of mathematics like Hilbert and Gödel have gone further and explored questions like, "Are the foundations of science complete, consistent and secure?" Mathematics is considered as the queen of sciences due to its extensive use in science in a foundational way. "Are the foundations of mathematics complete, consistent and secure?" They have found some profound conclusions which have

1 From the memoirs of William Miller, an editor, quoted in Life magazine, May 2, 1955; Expanded, p. 281

permanent implications for science and mathematics. Therefore, our curiosity should not only be limited to celebrate our privilege to know and do science, but also question the science itself for its own good. This may allow us to discover some fundamental realities which we have not yet found through science by expanding the scope of science.

Scientific method involves, experimentation, observation, hypothesis, prediction and verification. We learn from cosmology that the universe is at least 250 times larger than the observable universe. It is intriguing as well as fascinating to think that even the majority of objective reality appears to be beyond the reach of science. Then there is the subjective reality of our very self which we cannot deal through science. Our sense of morality, responsibility and beauty cannot be understood through present scientific framework. This prompted some deep thinkers to contemplate on the need for a new science or a new way of doing science. Dr. T. D. Singh, the Founder-Director of the Bhaktivedanta Institute, felt that the traditional wisdom can be a partner in this noble endeavour.

I would like to welcome you all to immerse in the exciting deliberations in this three day summer school on 'Exploring the foundations of science and beyond' being held from July 15-17, 2022 in Puri, Odisha, India.

We wish you pleasant stay.

With gratitude,

K Vasudeva Rao (Bhaktisvarupa Vrajapati Swami)
(Alumnus, IIT Kanpur)
President, Bhaktivedanta Institute

Introduction

The quest to understand nature and its underlying principles through various scientific methods has taken deep roots since the past few centuries. With the development of new scientific tools and technologies, our exploration has ventured across a wide scale, from subatomic particles to galaxies. However, when we focus on the foundations of science, we encounter various unknowns in every discipline - ranging from mysteries of space and time in cosmology to intricacies in quantum mechanics; in foundations of mathematics and computer science ranging from enigma of imaginary numbers to the limits of logic; in foundations of biology from the unfathomable riddles inside the cell to the most evident but mysterious 'consciousness'; in foundations of psychology from unknowns in perception and cognition to personal traits and much more.

What is even more surprising besides various unknowns in science, is the 'unknowables' - which cannot be known at all. Even though it sounds strange, but it's true. These are not merely some external blockages in our workings we encounter in our laboratories, but rather intrinsic limits found in the very discipline itself. Gödel's theorem in mathematics, the uncertainty principle in physics and Turing's halting problem in computer science are some of the famous examples of these impossibility results.

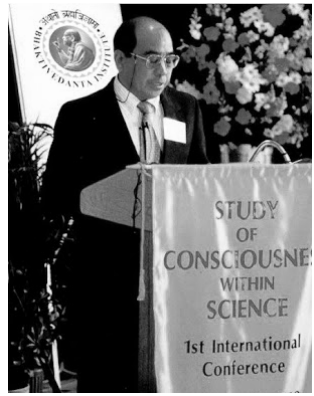
The main objectives of the Summer School - 2022 on "Foundations of Science and Beyond" are many-fold. It will bring together a multidisciplinary group of researchers and scholars around the world i) to inspire and expose the audience to the amazing foundational concepts and their limits prevailing in various disciplines of science in exploring the nature and its underlying principles, ii) to educate them on what further can be known and what will remain unknown forever and iii) to explore the foundational principles (if any) which the present-day science might be missing in its

search for the Ultimate Reality or Absolute Truth. The school will also aim to provide alternative proposals and novel ideas to handle the issues by taking guidance from ancient - spiritual traditions. The school is as well intended to present future visions with an opportunity to learn from and interact with the leaders of both science and spirituality in a stimulating setting. Thus, the lectures to be delivered will cover a broad range of perspectives and will enthuse the participants with thought provoking questions, ideas and an undoubting hankering for the answers to the questions on foundational issues in science.

We hope the school will enable the participants to appreciate multidisciplinary approaches highlighting the foundational issues in science and will lay the ground for the holistic approach in the quest for understanding Ultimate Reality. Best wishes for your life's journey to uncover the hidden truth.

— Convener
Summer School - 2022

Visionary



Dr. T. D. Singh (His Holiness Bhaktisvarupa Damodara Swami) received his Ph.D. in Physical Organic Chemistry from the University of California at Irvine in 1974. Then, he was a Postdoctoral Research Fellow in the Chemistry Department of Emory University, Atlanta, Georgia, U.S.A., from 1974-76. He has contributed papers in the prestigious journals, such as, Journal of American Chemical Society and the Journal of Organic Chemistry in the field of fast proton transfer kinetics in model biological systems using stopped-flow technique and NMR spectroscopy. He also worked on gas phase reaction mechanisms using Ion Cyclotron Resonance (ICR) spectroscopy. He was a scientist and spiritualist known for his pioneering efforts in the synthesis of science and religion for a deeper understanding of life and the universe. He was trained in Vaishnava Vedanta studies from 1970 to 1977 under His Divine Grace A. C. Bhaktivedanta Swami Prabhupada and was appointed Director of the Bhaktivedanta Institute in 1974. He organized four major International Conferences on Science and Religion - First and Second World Congress for the Synthesis of Science and Religion (Mumbai, 1986 & Kolkata, 1997), First International Conference on the Study of Consciousness within Science (San Francisco, 1990), and Second International Congress on Life and Its Origin (Rome, 2004). Collectively, thousands of prominent scientists and religious leaders including several Nobel Laureates participated. He has authored and edited more than dozen books including What is Matter and What is Life? (1977), Theobiology (1979), Synthesis of Science and Religion: Critical Essays and Dialogues (1987) and Thoughts on Synthesis of Science and Religion (2001). He was also the founder Editor-in-Chief for both the prestigious journal, "Savijnanam - Scientific Exploration for a Spiritual Paradigm," as well as students magazine, "Tattvajinasa - Scientific and Spiritual Quest for Ultimate Reality," of the Bhaktivedanta Institute.

Dr. Singh was very concerned for the student community with regard to their holistic development. He felt our younger generations were exposed to the latest scientific and technological developments in various disciplines at numerous colleges and universities around the world, but lacked a spiritual foundation to make proper use of them. He therefore laid down the mandate of Bhaktivedanta Institute to educate each and every student on essential foundations of science and spirituality through numerous educational programs. He emphasized educating the young generations to spiritual foundations of life in addition to scientific and technological development to construct a society of balanced growth of scientific temper and spiritual wisdom. Hence, he felt the need to organize student conferences on the interface of Science and Spirituality for their holistic growth and development. With this vision, Dr. Singh conceptualized the series of conferences, summer schools and workshops for the benefit of students. Since 2015, Bhaktivedanta Institute has organized over five summer schools on various foundationally simulating themes like "Mathematics & Spirituality", "Computation & Mind", "Space & Time - in science & spiritual traditions", "Mathematics, Logic & Spirituality" and "Origin of Life Research - History, State-of-art, New Ideas, Future Visions." Today, inspired by his vision, his students, friends and well-wishers throughout the world are making a humble attempt to carry out his grand vision of harmonizing modern civilization through the synthesis of science and spirituality.

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Schedule

Day 1: July 15, 2022 (Friday)

8:00 am – 9:00 am	Breakfast
9:00 am – 9:25 am	Registration
9:30 am – 10:45 am	**Opening Ceremony & Welcome Address**
10:45 am – 11:00 am	Break
Session 1: Foundation of Quantum Mechanics	
11:00 am – 11:45 am	**Causality in Classical and Quantum Physics** Prof. N. D. Hari Dass, *Retd. Senior Professor, Institute of Mathematical Sciences, Chennai, INDIA*
11:45 am – 12:00 pm	Q & A
12:00 pm – 12:45 pm	**How to be a Quantum Realist: Topos Theory in the Foundations of Quantum Theory** Prof. Andreas Döring, *Ex-Professor of University of Oxford, UK*
12:45 pm – 1:00 pm	Q & A
1:00 pm – 2:15 pm	Lunch and Break
2:15 pm – 2:30 pm	**Young Minds Speak** **Can Quantum Physics Explain Consciousness?** Mr. Deepankar Sarmah, *PhD Researcher Scholar, University of Basel, SWITZERLAND*
2:30 pm – 2:35 pm	Q & A
2:35 pm – 3:20 pm	**Poster Presentation**
Session 2: Brain, Mind and Consciousness: Limits in Mathematical Modelling	
3:30 pm – 4:15 pm	**Noise, Coherence and States of Meditation: Challenges to Modern Science** Prof. Sisir Roy, *National Institute of Advanced Studies, IISC Campus, Bangalore, INDIA*
4:15 pm – 4:30 pm	Q & A

4:30 pm – 5:15 pm	**A Comparison of Axiom based Spaces and Hypothesis based Mathematical Modelling** Prof. Sandeep Kumar, *IIT (BHU) Varanasi, INDIA*
5:15 pm – 5:30 pm	Q & A
5:30 pm – 5.45 pm	**Young Minds Speak** **The Limits of Mathematical Logic** Mr. Rajesh Pandit, *Alumnus of IISER Kolkata, INDIA*
5:45 pm – 5:50 pm	Q & A
5:50 pm – 8:00 pm	Tour and Sight Seeing
8:00 pm – 9:00 pm	Dinner

Day 2: July 16, 2022 (Saturday)

8:00 am – 9:00 am	Breakfast
Session 1: Foundation of Cosmology - Issues, Limits and Lessons Learnt	
9:30 am – 10:15 am	**The Flowing Self: Why Time Seems to Pass** Prof. Craig Callender, *University of California, San Diego, USA*
10:15 am – 10:30 am	Q & A
10:30 am – 11:15 am	**Foundation of Science: How We Discover?** Prof. Pankaj S Joshi, *Tata Institute of Fundamental Research, Mumbai, INDIA*
11:15 am – 11:30 am	Q & A
11:30 am – 11:45 am	Break
11:45 am – 12:30 pm	**Time Dimension Exploration from Science-Spirituality Synthesis** Prof. Ramgopal Uppaluri, *IIT Guwahati, INDIA*
12:30 pm – 12:45 pm	Q & A
12:45 pm – 2:00 pm	Lunch and Break
Session 2: Young Minds Speak	

2:00 pm – 2:15 pm	**Treading on the Path to Beyond with Light and Eyes** Mr. Roshan Tiwari, *PhD Research Scholar, IISER Kolkata, INDIA*
2:15 pm – 2:30 pm	**Barriers in Synthesis of DNA in Laboratory – Insights to Ponder on How Far We are in Synthesis of Life in Lab?** Mr. Nikhil Yenugu, *PhD Research Scholar, IISER Kolkata, INDIA*
2.30 pm – 2.40 pm	Q & A
2:40 pm – 3:00 pm	Break
Session 3: Foundation of Computer Science	
3:00 pm – 3:45 pm	**Computation: Formal vs. Inimitable** Sri Shushant Sharma, *Bhaktivedanta Institute, Kolkata, INDIA*
3:45 pm – 4:00 pm	Q & A
4:00 pm – 4:45 pm	**Special Guest Lecture** Prof. Vijay P. Bhatkar, *Renowned Computer Scientist, IT Leader and Educationalist; Chancellor, Nalanda University, INDIA*
4:45 pm – 5:00 pm	Q & A
5:00 pm – 6:00 pm	Cultural Program
6.00 pm – 8:00 pm	Tour and Sight Seeing
8:00 pm – 9:00 pm	Dinner

Day 3: July 17, 2022 (Sunday)

8:00 am – 9:00 am	Breakfast
Session 1: Revisiting the Foundation of Life Science: Insights from Ancient Traditions	
9:00 am – 9:45 am	**From Cell to Universe: Beauty and the Mysterious Fine Tuning** Dr. Viknish Krishanan Kutty, *Founder and CEO of Cellivate Technologies, SINGAPORE*

9:45 am – 10:00 am	Q & A
10.00 am – 10.45 am	**Revisiting the Non-Reductionistic Ayurvedic approach in the Light of Modern Biophysics** Dr. Dheeraj Dube Prakashchand, *University of California, San Diego, USA*
10:45 am – 11:00 am	Q & A
11.00 am – 11.15 am	Break
Session 2: Overview of Foundation of Science	
11.15 am – 12.00 pm	**Overview of Foundation of Science - Issues, Developments, and Lessons Learnt** Sri Varun Agarwal, *Director, Bhaktivedanta Institute, Kolkata, INDIA*
12.00 pm – 12.15 pm	Q & A
12:15 pm – 2:00 pm	Lunch and Break
2:00 pm – 2:15 pm	**Young Minds Speak** **Mystery of Consciousness** Mr. Ruthvik Galem, *2nd Year M.Tech. (Environmental Engineering.), IIT Bhubaneswar, INDIA*
2: 15 pm – 2:20 pm	Q & A
Session 3: Science and Vedanta	
2:30 pm – 3:15 pm	**Vedic Cosmology** Prof. Harekrishna Mohanta, *BITS, Pilani, INDIA*
3:15 pm – 3.30 pm	Q & A
3:30 pm – 4:15 pm	**Foundations of a New Science** Sri K Vasudeva Rao, *President, Bhaktivedanta Institute Kolkata, INDIA*
4:15 pm – 4:30 pm	Q & A
4:30 pm – 5:30 pm	**Panel Discussion**
5:30 pm – 6:30 pm	**Valedictory Session**
8:00 pm – 9:00 pm	Dinner

Abstracts & Bio-datas

Day 1

Session 1: Foundation of Quantum Mechanics

"The laws of quantum mechanics itself cannot be formulated... without recourse to the concept of consciousness."

– Eugene Paul Wigner
Nobel Laureate in Physics

1.1. Causality in Classical and Quantum Physics

Prof. N. D. Hari Dass, *Retd. Senior Professor, Institute of Mathematical Sciences, Chennai, INDIA*

I will give a pedagogical overview of causality in classical and quantum physics, both in mechanics and field theory. Among the topics I plan on covering are: concept of arrow of time, causality in Newtonian Mechanics, in Special Relativity, notions of 'Causal Structure', faster than speed of light propagation by Tachyons, causality in Non-relativistic Quantum Mechanics, in Relativistic Quantum Mechanics, Positrons and anti-particles, Acausal theories, causality in General Relativity Theory, closed time-like curves, causality and analyticity etc. I shall end with brief remarks on time- reversal violation in elementary particle physics, as well as the recent notions of 'Indefinite Causal Order' in Quantum Theories. The emphasis will be mostly on clarifying the concepts rather than on technical details.

Prof. N.D. Hari Dass is Retired Senior Professor Institute of Mathematical Sciences, Chennai and was a visiting Professor at TIFR, Hyderabad. He obtained his Ph.D. from the University of California at Santa Barbara. After that he worked at UCLA, Max Planck Institute for Physics at Munich, Niels Bohr Institute at Copenhagen, Raman Research Institute at Bangalore, and National Institute for High Energy Physics in Amsterdam before joining IMSc in Chennai. He retired from there as a Senior Professor and became

the DAE Raja Ramanna Professor at IISc, Bangalore, and Adjunct Professor at Chennai Mathematical Institute. He is a fellow of the National Academy of Sciences, Allahabad. His current research interests are in high energy physics (working on strings in Quantum Chromodynamics), astrophysics (working on magnetars), and foundations of quantum mechanics (working on weak measurements). In 2004 he built India's fastest supercomputer KABRU which was among the top 500 supercomputers in the world. He has authored the well received book "The Principles of Thermodynamics". He is also very passionate about raising science awareness among young students.

1.2. How to be a Quantum Realist: Topos Theory in the Foundations of Quantum Theory

Prof. Andreas Döring, *Ex-Professor of University of Oxford, UK*

"Those who are not shocked when they first come across quantum theory cannot possibly have understood it."

– Niels Bohr
Nobel Laureate in Physics

Quantum theory is an enormously successful physical theory with a huge range of applications. At the same time, there have been debates about what quantum theory actually means and what it tells us about the world ever since its inception more than a hundred years ago.

As a starting point for my talk, I will present one key result from 1967, the Kochen-Specker theorem (or KS theorem, for short). This theorem shows that under very mild and natural conditions, observables in quantum theory cannot all have values at the same time. This demonstrates the difference between classical and quantum physics particularly clearly, and it shows that it is hard to find a realist interpretation of the quantum formalism.

The Kochen-Specker theorem suggests to take the concept of contextuality seriously, and from 1997 on, Chris Isham developed a set of ideas based on a novel mathematical formalisation of contextuality. In the early years, this was joint work with Jeremy Butterfield (1998-2002), and from 2006 to 2011, Chris

and I developed these ideas much further. Later, other researchers joined. Apart from contextuality, the main mathematical novelty of our approach is the use of topos theory in physics.

Topos theory is a branch of category theory, which is a bit like the grammar of mathematics. Although a proper introduction to category and topos theory is well beyond the scope of this talk, I will give some ideas what a category and a topos are, and how they can become useful for physics. Intriguingly, every topos comes with a built-in logic, which typically is multi-valued and intuitionistic. Multi-valued means that there are more than two truth-values, so there are shades of grey between true and false. Intuitionistic means that the law of excluded middle need not hold.

I will demonstrate how this kind of logic can be applied to quantum theory, and why this can be useful for a realist interpretation. In fact, I will also show that the topos approach to quantum theory allows us to reformulate large parts of quantum theory in a completely new mathematical setting, not based on Hilbert spaces, operators etc. This is the first such reformulation of quantum theory since 1928, when von Neumann introduced the Hilbert space formalism. I will finish by sketching some open problems and prospects for further research.

Prof. Andreas Doering is a mathematician and mathematical physicist at Imperial College London formerly. He obtained his Ph.D. in theoretical physics in 2005 from Frankfurt University, Germany, and he worked as a postdoc at Imperial College London, from 2005 to 2009 and then at the University of Oxford from 2009 to 2013. He served as professor at Universität Erlangen-Nürnberg, Germany and then joined Imperial College London. His research interests lie mainly in working on the foundations of mathematics and quantum theory using topology. In recent years, he developed the topos approach to formulate physical ideas.

1.3. Can Quantum Physics Explain Consciousness?

Mr. Deepankar Sarmah, *PhD Researcher Scholar, University of Basel, SWITZERLAND*

The early 20th century witnessed a revolution in science following the development of quantum physics, which was used to explain many unknown phenomena. With further advancements in the field, the area of quantum biology was developed. We see some attempts in explaining consciousness using quantum physics by scientists like Penrose, Hameroff etc. But the question remains: Is it really possible to explain consciousness using quantum physics? Can one use the quantum phenomena in explaining the complex processes in the brain?

In this talk we explore this idea using the fundamental concepts of quantum mechanics and the known research in the field of "consciousness". We discuss how the phenomena like wave-particle duality, superposition etc., introduces the idea of consciousness into the picture. We also try to understand the measurement problem in quantum physics. Finally we draw some conclusions based on empirical and logical observation on whether quantum physics can alone describe the very fundamental basis of our existence, the consciousness.

Deepankar Sarmah is a second-year PhD student at the University of Basel, Switzerland. He obtained his Integrated BS-MS degree in Physics from IISER-Kolkata in 2020.His research interests include quantum computing, semiconductor-superconductor hybrid quantum devices, semiconducting nanowires, quantum transport and microwave engineering.He is working on the development of quantum computer architecture for spin-qubits in nanowires quantum-dots and coupling quantum-dots in Silicon nanowire to superconducting resonators.

Session 2: Brain, Mind and Consciousness: Limits in Mathematical Modelling

"Purely mathematical inquiry in itself, according to the conviction of many great thinkers by its special character, its certainty and stringency, lifts the human mind into the closer approximately with the divine…"

– Hermann Weyl
FRS, Eminent German Mathematician

2.1. Noise, Coherence and States of Meditation: Challenges to Modern Science

Prof. Sisir Roy, *National Institute of Advanced Studies, IISC Campus, Bangalore, INDIA*

Meditation practices have drawn large attention to the scientific community as they are able to enhance cognitive functioning and thereby promoting one's well being by studying the neuronal correlates in the brain. However, we have a wide variety of meditation practices across different spiritual cultures, which are mainly devised and recruited to cultivate positive qualities of mind, to enhance one's understanding, and in the process, to gain control over different aspects of the mind, and finally for the purpose of self-realization. Thus, set of practices generally characterized as meditation would have a wide range of short-term and long-term anatomical and functional brain changes, but as indicated, these effects are specific and unique to each particular type of meditation. Since each of these practices use different somatic and cognitive modalities based on their traditional and cultural sources, they lead to different psycho-somatic effects promoting different brain activities. In various meditation practices, different types of oscillatory waves like Gamma, Alpha, Delta become predominant in different cortical areas. The recent progress of scientific researches on the neuronal correlates of various types of meditation practices raise debates and challenges to modern neuroscience.

For recording of these neuronal activities, the term 'deep meditator' is used i.e. who practised more than some number of hours say '1000' hour or so. It raises an important issue, is it meaningful to categorize the depth of meditation

considering simply by counting the number of hours of practice? We emphasize the meditation is not only a state but also a process. Our traditional texts like Patanjali Yoga Sutra and Bhavanakrama by eminent Buddhist scholar Kamalashila as well as by Jaina scholar Subhachandra in Jananrava discussed various stages of meditation. We need to understand the various stages from neuroscientific point of view to resolve the above issue. The states of meditation can be broadly classified as conceptual, dual and non-conceptual and non dual states. The first one is associated to cognitive functioning whereas the later one is not. This is crucial in understanding the dominance of different synchronized oscillations based on different meditative techniques. However, one should understand the proper scientific methodology by which the above analysis can be done. One such procedure is to study the degree of coherence associated to the synchronized oscillations in the brain during meditation. There exist two types of degree of coherence- spatial degree of coherence as well as temporal degree of coherence. Again coherence is intimately connected to the concept of noise. One of the major issues in meditation research is to understand the role of noise in brain function.

A unique feature of meditation which has not been well studied in recent years includes its characteristic definition given in the Patanjali Yoga Sutras - a well-known repository of yoga and meditation in the Hindu yogic tradition. This text defines yogic meditation as 'Yogah Chitta Vritti Nirodhah'.This translates in simplistic terms to the view that meditation involves the process that subdues various fluctuations (or noise) of the mind. It is not an easy task to quite the mind; as the essential nature of mind is conceived to be fluctuating. Here, the fluctuation is nothing but the 'wandering and uncontrollable activity of the mind' or more precisely 'scattered thoughts',which can be seen as the 'unwanted variation of thoughts. It is nothing but noise in the sense of 'unwanted variation', although it is very much depends on the context. If one considers the meditation as a process, then it is a kind of noise regulatory process in the brain. This regulation of noise is closely related to the coherence of the synchronized oscillations in the brain. It is important to understand the role of noise in the brain and its relevance to the process of meditation. Here, brain may be considered as a noise regulatory system in this process of meditation. But what is the source of noise in the brain? Deciphering noise in the brain is a major challenge in modern brain research. How various practices of meditation reduce the noise in the brain? Can we estimate the various noises in the brain and its reduction based on the current understanding of modern science?

Prof. Sisir Roy is visiting Professor and Senior Homi Bhabha Fellow at the National Institute of Advanced Studies, IISc, Bangalore. He obtained his PhD in theoretical physics from Indian Statistical Institute Kolkata in 1979. He has been a professor at the Indian Statistical Institute, Kolkata for 21 years and also a visiting professor at the University of Arkansa, USA and George Mason University, USA, and visiting scientist at Henri Poincare Institute, Paris. His areas of research include Foundations of Quantum Mechanics, Brain Function modeling and Cognitive Science, Data Analysis, and Quasar Astronomy. To his repute he has more than 170 peer reviewed papers in internationally renowned journals, and 13 Research Monographs/Edited Volumes.

2.2. A Comparison of Axiom based Spaces and Hypothesis based Mathematical Modelling

Prof. Sandeep Kumar, *IIT (BHU) Varanasi, INDIA*

We believe, axioms based space can lead to better logic than the assumption/ hypothesis based model particularly in the situations where it is not possible to verify results with the help of any experiment. The mathematical modellings often contain number of fundamental flaws which can be traced out by only experts of the field. For example, in case of deflection of the plates and shell, which we studied during Ph.D. program, basic equations are derived with the assumptions that the deflection is very small but the computer program are used to get the results of very large deflection. It simply means that we are extrapolating results beyond the initial assumptions/ constraints of mathematical model. The whole process may be a good mental exercise but it is fundamentally wrong. Further, while solving these nonlinear problems, we also encountered 2-3 states where solution did not converge. This phenomenon is never discussed in our papers. The plates and shell results cannot be verified experimentally for large deformation because geometry of the plate and shell changes after small deflection and so the initially assumed boundary conditions do not remain valid. A popular mathematical model about the creation of the Universe is Big Bang model. We believe Big Bang theory has similar flaws. It is also based on simplified assumptions, a lot of extrapolation of computational results and manipulation in nonlinear solution. It cannot be verified experimentally. There are some scientist who reject the Big-Bang model. Various mathematical models on the creation of the Universe are

proposed by those who do not believe in spirituality. Spirituality is based on the concept of existence of higher intelligence. We believe that this intelligence is very logical which can be expressed in the language of mathematics.

Dr. Sandeep Kumar is a Professor, Department of Mechanical Engineering, IIT (BHU), Varanasi. He graduated from MNREC Allahabad and completed post-graduation from BHU, Varanasi. His field of interest is Computational Mechanics. After completing Ph.D. from IIT Delhi in the field of composite plates and shells, he has worked in various fields of research such as meshless methods, chaos theory, and wavelets etc. Before joining IIT (BHU), he worked in REC Kurukshetra, BITS Pilani and AIMST, Malaysia. He has completed several research projects for DST and BARC. He has numerous publications in international journals of repute. He has authored a popular book, "Mathematical Theory of Subdivisions - Finite Elements and Wavelet Methods", which is published by CRC press.

2.3. The Limits of Mathematical Logic

Mr. Rajesh Pandit, *Alumnus of IISER Kolkata, INDIA*

The mathematical logic helps us to unfold the universal truth through mathematical deduction. The logic is the most basic language of the mathematics and the underlining principle of proof. But, this logic itself has limitations, there are situations where logic fails to unfold the mysteries. The law of excluded middle and the law of bivalence contradicts sometimes. In this presentation we shall go through such interesting things.

Rajesh Pandit received his integrated masters in mathematics from IISER Kolkata in 2019. He is being trained in data science by IIT Madras through distance education from 2021. He has been working as an associate subject matter expert of Mathematics in Hurix Digital. His research interests include in the field of data science and artificial intelligence.

Day 2

Session 1: Foundation of Cosmology - Issues, Limits and Lessons Learnt

"... if we see the structure of the universe as having really remarkable characteristics, it seems to suggest that there is a purpose.... if we understand the structure and how it works very well, then that may give us some hints as to the purpose of the universe. If we understand the purpose, then that should probably say how it is structured."

– Charles H. Townes
Nobel Laureate in Physics

1.1. The Flowing Self: Why Time Seems to Pass

Prof. Craig Callender, *University of California, San Diego, USA*

As we navigate through life, we employ a model of time as flowing. Despite its importance to us, physics suggests that this conception of time is fundamentally flawed. Many dismiss it as an illusion. Before we can dismiss the flow, however, we need to explain the "self-consistent set of rules that would give a beast this kind of phoney picture of time" (Thomas Gold). Here I take up this interdisciplinary project, drawing on psychology, biology and physics to develop a theory of why "beasts" like us feel that time flows. I'll argue that our conception of a self is a crucial part of the explanation of why time seems to flow.

Prof. Craig Callender is a Professor of philosophy at the University of California, San Diago, USA. He is also the Founding Faculty and Co-Director of the Institute for Practical Ethics. He obtained his Ph.D. in 1997 from Rutgers University with a thesis entitled "Time's Arrow" under Prof. Robert Weingard. From 1996 to 2000, he worked in the Department of Philosophy, Logic & Scientific Method at the London School of Economics. His main area of research is the philosophy of science, with special emphasis on physics, time, and the environment. For his outstanding book in philosophy of science, "What Makes Time Special?" honoured with the 2018 Lakatos Award by Latsis Foundation and the 2022 Suppes Prize by

American Philosophical Society. He has won the Chancellor's Associates Excellence Award twice. He is also the author of popular books like "Time, Reality and Experience" and "Physics meets philosophy at the Planck scale: contemporary theories in quantum gravity".

1.2. Foundation of Science: How We Discover?

Prof. Pankaj S Joshi, *Tata Institute of Fundamental Research, Mumbai, INDIA*

One of the most fundamental questions in our growth of knowledge on the Universe is to really find and understand how we make the scientific discoveries, and for that matter any other discoveries. The Newtonian picture of the Cosmos assumed the two distinct components when investigating Nature, namely the Observer, that is ourselves, and the Universe. The Universe was thought to be an entirely independent and separate entity whereas we were supposed to investigate and find the basic laws that governed the same. The modern science and Quantum Theory tells us however that this is not in fact the case. The Observer is inseparably intertwined and connected with the Universe that s/he observes. Whereas logic and mathematics are basis of any theoretical investigation, and the experiment and instruments are needed for any applied or experimental research, it needs to be emphasized that at the basis of any such endeavor lies the human mind. We need to remember it is we the Humans who are inquiring on the Cosmic Laws. When does the human mind observe correctly, and when is it capable of observing and deciphering the underlying symmetries and basic patterns and fundamental laws of Nature? On the other hand, when the Mind fails to comprehend Nature correctly? Why is scientific investigation such an arduous task and long drawn out process? We discuss and analyze some of these intriguing issues and fundamental questions in this talk.

Professor Pankaj Joshi is presently the founding director of the International Centre for Cosmology at Charotar University of Science and Technology. He obtained his PhD in theoretical physics from Saurashtra university in 1979. After his doctoral work, he joined the Tata Institute of Fundamental Research in Mumbai as a visiting fellow. He held several positions at TIFR,

Mumbai from 1980 to 2018. He was a senior professor at the department of astronomy and astrophysics in TIFR Mumbai. He served as president at Indian Association of General Relativity and Gravitation from 2010 to 2012. He also currently holds the position of president at Gujarat Science Academy. His research interest lies in general relativity and cosmology. He has published more than 200 research papers in reputed international journals. He is a fellow of The World Academy of Sciences, Indian National Science Academy (INSA) and National Academy of Sciences India (NASI) and received INSA Vainu Bappu award in 2020.

1.3. Time Dimension Exploration from Science-Spirituality Synthesis

Prof. Ramgopal Uppaluri, *IIT Guwahati, INDIA*

Prof. Ramagopal Uppaluri obtained B.Tech. (Chemical Engineering) from Andhra University, Visakhapatnam, M.Tech. (Chemical Engineering) from IIT Kanpur and Ph.D. (Process Integration) from University of Manchester, England. After a brief post-doctoral research at Robert Gordon University, Scotland, he joined IIT Guwahati and became the youngest Professor of IIT Guwahati in a very short span of time. He has diversified research profile in areas of chemical engineering, petroleum science and technology, computational mathematics and food science and technology. He has published 115 international journal publications and has filed three Indian patents in the fields of surfactant enhanced oil recovery and palladium composite membranes. For about two decades, Prof. Uppaluri served in various capacities to assist and promote the activities of the Bhaktivedanta Institute, Kolkata. He received training and guidance from Dr. T. D. Singh to imbibe holistic aptitude towards the synthesis of science, philosophy and spirituality. He served the organization of the AISSQ conference series in several capacities as well as contributed several articles ranging from wider topics such as time dimension, origin of life, death, embryology and consciousness, consciousness studies etc. He has been instrumental in evolving Diploma and Certificate Courses in Science-Spirituality. Presently, he is serving as the Honorary Director of the Department of Education of the Bhaktivedanta Institute, Kolkata.

2.1. Treading on the Path to Beyond with Light and Eyes

Mr. Roshan Tiwari, *PhD Research Scholar, IISER Kolkata, INDIA*

More than 90 percent of stars in the universe including our Sun emits 70 percent of its energy in the visible and infrared band. Light in the visible band of the EM spectrum is quite important for biochemical reactions in photosynthesis, eye receptors etc. This visible band is confined to a very small region of EM spectrum where it's wavelength range in comparison to that of the entire spectrum is compared to the width of single card in the stock of cards stretching beyond Andromeda galaxy. Within this Goldilocks region light is not so energetic to disrupt the chemical bonds and not too low to activate the reaction. Apart from these biochemical reactions, it turns out that the narrow range of visible light is also suitable for high visual acuity in organisms of our approximate size.

So, is the precise matching of energy difference required to activate the biochemical reactions through this very narrow wavelength range and the high acuity of our eye is mere a product of deep time and chance or involves some purpose?

Roshan Tiwari is a Research Scholar in the Department of Physical Sciences at the Indian Institute of Science Education and Research (IISER) Kolkata.He completed his B.Sc. in Physics from Banaras Hindu University (BHU), Varanasi, in 2014 and is currently pursuing his Integrated Ph.D. at IISER Kolkata.His research interests include spectroscopy, bioinspired-waveguides, microscopy, sensing, optical trapping and statistical analysis. He is also interested in the connections of unexplored aspects of reality with age-old wisdom.

2.2. Barriers in Synthesis of DNA in Laboratory – Insights to Ponder on How Far We are in Synthesis of Life in Lab?

Mr. Nikhil Yenugu, *PhD Research Scholar, IISER Kolkata, INDIA*

Building blocks of life such as carbohydrates, proteins, nucleic acids and lipids have several stereogenic centres making the synthesis of suitable polymers highly unlikely. Even the synthesis process itself requires enough monitoring to get a right product with good yield. Then how did nature promote abiogenesis? How did protein become homochiral when there is no prebiotically relevant route to make homochiral amino acids? Have we made life in the laboratory? How probable is the formation of a long polymer with the correct nucleated sequence by random chemical reactions? These are some of the thought provoking questions that have been a challenge for us and baffling us for decades. Inspite of recent good developments in various fields such as chemistry,biology, geology and astronomy the origin of life still remains such a great mystery.

In my presentation I would focus on two aspects: 1) How it is less probable to obtain DNA with precise stereochemistry in a beaker through laboratory synthetic procedures from building blocks. 2) The mysterious aspects of formation of certain sequences and origin of information in DNA.

Yenugu Nikhil is a First year Research Scholar in the Department of Chemical Sciences at the Indian Institute of Science Education and Research (IISER) Kolkata. He obtained his Integrated BS-MS degree in Chemistry with Physics minor from IISER-Kolkata in 2020. His research interests include Quantum Chemistry, Electronic Structure Theory and Molecular Reaction Dynamics. Apart from his academic studies, he is also interested in studies at the interface of foundations of science and consciousness.

"I say that computers will never be conscious. Now the question that remains is whether they could behave in a way that looks like consciousness."

– Sir Roger Penrose
Nobel Laureate in Physics

3.1. Computation: Formal vs. Inimitable

Sri Shushant Sharma, *Bhaktivedanta Institute, Kolkata, INDIA*

We know that computers carry out the most fundamental task of computation. However this computation is having a nature different from what we humans have and that is their being 'formal' in nature. In fact it begs for the question - What exactly is a computation? Kurt Gödel and Alan Turing with their individual works have shown some hints of something which even a very sophisticated computer (of present times) won't be able to account for. However the proof of superiority of human beings over computers may require something even more tangible, subtle and foundational. These last three adjectives can be attributed to the common spirit carried by all viz. Spirituality. Spirituality's tenets such as hope, faith, religion etc. are principles which will have a hard time to be formalized, and hence be adopted by formal computers, not only computers of the present times, but also the theoretical computing machine.

Sushant Sharma is a B.Tech graduate in Computer Science and Engineering from IIT Guwahati. He has a rich experience of over 15 years as an IT Professional, working with well known organizations such as CATS-pvt Ltd, TCS, Techmahindra and Roamware. After his meeting with Dr. T. D. Singh in 2000, he developed a keen interest in the domain of synthesis of science and spirituality. Under the mentorship of Dr. Singh and his students, Sushant has been exploring the studies at the interface of foundations of computer science, mathematics and consciousness, and consequently has been delivering many talks in various conferences, seminars and workshops organized by Bhaktivedanta Institute. His study interests include foundations of set theory and computer science, Godel's incompleteness theorems and Vedanta. In

2016, he joined Bhaktivedanta Institute as full time scholar and dedicated member, and served in many crucial roles in various events and publications of Bhaktivedanta Institute. Currently, he is serving as Director of Cognitive Studies and Fine arts of Bhaktivedanta Institute and also the Director of Bhaktivedanta Institute Study center, Kalyani.

3.2. Special Guest Lecture

Prof. Vijay P. Bhatkar, *Renowned Computer Scientist, IT Leader and Educationalist; Chancellor, Nalanda University, INDIA*

Padma Bhushan Dr. Vijay Bhatkar is one of the most acclaimed and internationally acknowledged scientists of India. He is presently the Chancellor of Nalanda University. He is best known as the architect of India's national institute in supercomputing where he led the development of Param supercomputers, the first Indian supercomputer. He received his Ph. D in Computer Science and Engineering from IIT Delhi. His current research interests are in supercomputing, artificial intelligence, brain-mind-consciousness, and synthesis of science and spirituality. He has been conferred Honorary D.Sc. (Honoris Causa) by Dr. D.Y. Patil University. Ph.D. by Gujarat Technological University and D.Litt. from Nagpur University. He has been instrumental in building several national institutions and research centers notably amongst them being C-DAC, ER&DC Trivandrum, IIITM-K, TechnoPark, MKCL, IsquareIT, ETH Research Lab and Multiversity and also has served as a member of the scientific advisory committee to Prime Minister of Government of India, CSIR governing body and chairperson of the Science & Engineering Research Body (SERB). He has authored and edited more than 12 books and over 80 technical and research papers. He received several well-known recognitions including notable Padma Bhushan (2015) & Padma Shri (2000).

Day 3

Session 1: Revisiting the Foundation of Life Science: Insights from Ancient Traditions

"... I think that life could be beyond the assembly of biomolecules."

– Werner Arber
Nobel Laureate in Physiology and Medicine

1.1. From Cell to Universe: Beauty and the Mysterious Fine Tuning

Dr. Viknish Krishanan Kutty, *Founder and CEO of Cellivate Technologies, SINGAPORE*

In this presentation, I explore a common feature seen within this universe and within all bodies of life that is necessary for the universe to be as it is and for life to exist.

If we look around us, we notice that everything around us that is man-made, or that requires any kind of human intervention, requires some tuning, or some fine adjustments to work or to produce the appropriate results. From making the perfect cup of coffee, to writing a software code, refinements are necessary. As such, we can say that making fine refinements till we get the wanted results, seems to be a natural characteristic for human interventions.

But is this just a human trait? Definitely not! Primates and other animals have also been seen to exhibit the ability to adjust and make changes to get a desired result. Apes have been shown to use grass to pick ants from anthills. According to the depth of the ant hill, different lengths of grass are picked. Mice too have this tendency; in a maze, they are able to adjust their movements in ways that give them the best benefit. One could say that they refine their movement through the maze till they get the best results. To take it one step further, scientists have shown that this characteristic is lost when part of the brain that is responsible for memory, is damaged. As such, perhaps it will be more accurate to say that fine tuning is an attribute of animals with a brain.

Can we take this argument further, to include all life forms? From my observation, that seems to be a stretch. If we look at single cell organisms, such as bacteria or cells, they seem to act in response to appropriate stimulus. As such, this ability to fine tune and make adjustments seem to be for species that possess a brain or some level of intellect. The more acute the level of fine tuning, the higher the level of intellect.

Within this universe, we find many evidences of fine tuning. For example, if we explore the fundamental constants of the universe (speed of light, magnetic constant, etc), we see that if these constants were different, life and the universe as we know it to be will be very different. Even within Biology, there are many intricate fine-tuned details that are necessary for life to exist. Following the argument above, that a more sophisticated evidence of fine-tuning indicates a higher intellect, it is logical to infer that the intellect behind this creation has a very sophisticated intellect!

According to the Vedantic paradigm of knowledge, the explicit beauty and complexity at every level of this universe, from the smallest atom to the gigantic solar system is nothing but a small reflection of the supreme intellect, which creates and maintains everything. While scientific and philosophical investigations uncover the 'hows' and the 'whats' of this universe, the knowledge from the Vedantic paradigm teaches us the beginning and the cause of everything, from a top-down approach. Having an understanding of Science and Philosophy together with the knowledge of the Vedanta, gives a holistic understanding of the universe and our roles within the universe.

Dr. Viknish Krishnan-Kutty is a scientific entrepreneur and the Founder & CEO of Cellivate Technologies, as well as a biomedical researcher at the Nanoscience and Nanotechnology Institute, National University of Singapore (NUS). He obtained his B.Eng. (Biomedical Engineering) from the State University of New York, Stony Brook, in 2006 and then completed his Ph.D. in Bioengineering at the National University of Singapore in 2011. He is a bio-engineer with expertise in oncology, neuroscience & stem cells. His research interests include modelling methods and creating technologies to control mammalian cells and promote clean-meat revolution. He is a recipient of the NUS Graduate Research Innovation Programme (GRIP) Fellowship in

2016. He is also currently the President of the Society for Bhagavata Culture, Singapore, and has a keen interest in understanding the synthesis of science and spirituality.

1.2. Revisiting the Non-Reductionistic Ayurvedic approach in the Light of Modern Biophysics

Dr. Dheeraj Dube Prakashchand, *University of California, San Diego, USA*

There is an increasing emphasis on personalized medicines by going beyond the prevalent reductionist approach in studying diseases, pathologies and whole biological systems. The attempted over-simplification often fails to capture the complex intratissue interactions and dynamic responses towards environmental stresses. The correct understanding of processes of health and disease remains lost in the wide variety of data sets contributed by the knowledge of various molecular actors accumulated over years of toiling research work. Ayurveda, which is a traditional system of medicine originated in the ancient Vedic times of India, ever since its inception has already, incorporated and focussed on primary physiological principles: Kapha, Pitta and Vaat. The knowledge and practice of Ayurveda is based on the interaction between these governing principles. The recent interdisciplinary endeavours are witnessing a major paradigm shift pointing out epigenetics as one of the guiding principles which can help elucidate the mechanisms of these Ayurvedic principles.

Dheeraj Dube is a postdoctoral research fellow University of California, San Diego. He received his B.Tech in Mechanical Engineering from IIT(BHU) Varanasi (2010-2014). He obtained his PhD in Biophysics in 2021 from TATA Institute of Fundamental Research (TIFR), Hyderabad. His research interests include bio-macromolecules and their complex transitions in biological systems, principles of drug designing and computational biophysics. He works in deciphering the major modes of fluctuations, guided by the chemical propensities of the interacting species, behind the nucleating precursors large-scale macromolecular transition events. He is keenly interested in the interface of theoretical biology and the principles of ayurvedic sciences.

Session 2: Overview of Foundation of Science

"The recognition of certain basic impossibilities has laid the foundations of some major principles of physics and chemistry; similarly, recognition of the impossibility of understanding living things in terms of physics and chemistry, far from setting limits to our understanding of life, will guide it in the right direction.... such a demonstration would help to draw a truer image of life and man than that given us by the present concepts of biology."

– Michael Polanyi
FRS, Famous theoretical chemist

2.1. Overview of Foundation of Science - Issues, Developments, and Lessons Learnt

Sri Varun Agarwal, *Director, Bhaktivedanta Institute, Kolkata, INDIA*

Varun Agarwal is an alumnus of IIT Kanpur (Aerospace Engg - 1999) and is currently the Director of the Bhaktivedanta Institute, Kolkata.He was a recipient of IIT Kanpur Director's Gold Medal in 1999 for his excellent undergraduate academic record.His research interests include the foundations of science and its possible connections with spirituality. His search for a deeper meaning of life culminated in meeting and taking personal guidance from Dr. T. D. Singh, which completely changed his life, after which he dedicated himself to the cause of selflessly helping humanity. He is the Editor of many publications on science and spirituality, including Bhaktivedanta Institute's reputed annual science-spirituality journal, Savijnanam – Scientific Exploration for a Spiritual Paradigm. His deep interest in the foundations of mathematics and the nature of consciousness and its relation to the nature of reality as well as ancient Indian texts has led him to interact and meet with renowned scholars at Harvard, Princeton, ETH, Stanford and MIT. He has given numerous talks worldwide on the foundations of science, as well as the foundations of life, mathematics and spirituality.

2.2. Mystery of Consciousness

Mr. Ruthvik Galem, *2nd Year M.Tech. (Civil Engg.), IIT Bhubaneswar, INDIA*

Consciousness or being conscious is part of everyday life. Many branches of science try to explain consciousness. For example, neuroscientists try to explain consciousness using neuronal activity, while quantum physicists try to explain consciousness through the collapse of the wave function. Consciousness became a multidisciplinary subject and a good area of research. Many profound scientists have contributed to this research area, like Rene Descartes, Erwin Schrödinger and Hermann Von Helmholtz. The effort made by scientists and different branches of science is noteworthy but were they really able to solve the mystery of consciousness? Is science able to explain consciousness by using scientific laws? Do animals possess consciousness? What are the laws that indicate that we have consciousness? The presentation seeks to explore the mysterious phenomenon of consciousness.

Ruthvik Galem is a 2nd year M.Tech student pursuing an Integrated Dual Degree of B.Tech. in Civil Engineering & M.Tech. in Environmental Engineering at IIT Bhubaneswar. His research interests include Environmental Engineering and Air Pollution Assessment. Along with his academics, he is good at sports with national-level participation in Table Tennis. In addition, he has keen interest in the field of consciousness from both scientific and Vedantic paradigms.

Session 3: Science and Vedanta

Our [Western] science has cut itself off from an adequate understanding of the Subject of Cognizance, of the mind. This is precisely the point where our present way of thinking needs to be amended, perhaps by a bit of blood-transfusion from Eastern thought.

– Erwin Schrödinger
Nobel Laureate in Physics

3.1. Vedic Cosmology

Prof. Harekrishna Mohanta, *BITS, Pilani, INDIA*

The Vedic cosmology discussed in Srimad Bhagavatam (one of the eighteen puranas compiled by Srila Vyasadeva which is regarded as the ripened fruit of all Vedic literatures) is a classic presentation of the whole material universe (Brahmanda) in which we are living at present. Unlike the modern cosmology, the Vedic cosmology is based on the desire of a Supreme creator who wants to become many for the purpose of relishing Ananda, the Supreme bliss and also to give chance to the living entities who want to enjoy separately from Him or who want to go back to Him, to the spiritual world after getting frustrated in this material world. Creation of the material universes along with different elements, planetary systems and the population therein takes place in a systematic way with the intervention of God Almighty at different stages. After the primary creation, the Lord entrusts responsibility to Brahmaji (the first living entity born from the lotus flower sprouted from His navel) for the secondary creation, which includes the creation of different planetary systems and other cosmic objects, bodies for living entites, etc. The description of the material universe given in Srimad Bhagavatam is so concrete and detailed that we may be struck with wonder how the ancient sages of India could give such detailed information without using any of the instruments made by modern human beings. This article presents the Vedantic perspective of the process and purpose of creation of the material universe and the variety of living beings populating it. It covers the structure of the universe, passing of day and night, the phases of moon, passing of seasons, eclipses, etc. as presented in Srimad Bhagavatam.

Vedic literature describes how the Supreme Lord Sri Krishna expands as three Vishnu forms for the purpose of creation. As Maha-Vishnu or Karanodakashayi Vishnu He creates the Mahat tattva by glancing on the prakriti (material nature, consisting of pradhana and three modes – sattva, rajas and tamas). The mahat tattva in due course transforms into false ego and material activities, sense perceptions and material elements, knowledge and working capacity, controlling deities and avidya. Various universes generate forth from the pores of His body. As Garbhodakashayi Vishnu, He then enters into each and every universe and creates Brahma, the first living entity of that universe, who takes charge of the secondary creation. Brahma creates various planetary systems and populates them by creating different living entities. To help Brahma in his secondary creation, the Lord again expands as Kshirodakashayi Vishnu and enters into each and every planet to keep them in their orbits. He enters into each and every living entity as paramatma (Supersoul) and also diffuses into all the material atoms.

Srimad Bhagavatam describes innumerable universes. Each one is contained in an egg-like shell (called as Brahmanda – Brahma egg) surrounded by layers of elemental matter that mark the boundary between the spiritual and the material worlds. The shell contains an earth disk around the middle, called Bhu-mandala that divides it into upper, lower and middle regions. The Bhu-mandala is divided into a series of geographical features called as sagaras and dvipas (oceans and islands) with little resemblance to irregular earthly oceans and continents. These are geometrically perfect rings of cosmic size. Srimad Bhagavatam uses concrete themes and images in different ways to represent various aspects of the universe.

As the topic of cosmology is very vast, only some of the salient features will be discussed in this article.

Dr. Hare Krishna Mohanta is an associate professor in the Department of Chemical Engineering in BITS Pilani Rajasthan. He obtained his B.E. (Chemical Engineering) in 1995 from NIT Rourkela, M.Tech (Chemical Engineering) in 1998 from IIT Kanpur, and Ph.D. in Chemical Engineering in 2006 from BITS Pilani. He has been teaching in BITS Pilani since 1998.He worked in Indian Rare Earths Ltd (a Govt. of India undertaking) from 1995 to 1996. He is a

member of the Indian Institute of Chemical Engineers (IIChE). His research interests include advanced process control, process monitoring and control, sensors and microreactors, catalysis and pyrolysis, applied wavelet analysis, reactive distillation, modeling, simulation and consciousness studies. He has published numerous peer-reviewed papers in international journals of repute and many conference papers. He is keenly interested in Vedantic studies of consciousness.

3.2. Foundations of a New Science

Sri K Vasudeva Rao, *President, Bhaktivedanta Institute Kolkata, INDIA*

"Two things fill the mind with ever-increasing wonder and awe, the more often and the more intensely the mind of thought is drawn to them: the starry heavens above me and the moral law within me," exclaimed Immanuel Kant in the 18th century. Today, after two centuries with the extraordinary progress of science, we are still wondering about the same topics, 'origin and structure of universe', and 'what is life, consciousness and meaning?' though we have tremendously improved our knowledge of universe and life. Origin of universe and physical constants is not yet resolved satisfactorily. The origin of first living cell is still a mystery. We are far from addressing the hard problem of consciousness. It appears that science is either unable or unwilling to deal with our inner nature, like feelings of ethics, morality and responsibility. Some brilliant scientists including the founding fathers of science as well as Nobel Laureates have hinted that we need a new science. This new science could be realized in bringing new fields of study within science as well as amending the way we do our science today.

Vasudeva Rao is an alumnus of the prestigious IIT Kanpur (Computer Science, 1998), and is currently the President of the Bhaktivedanta Institute. He is one of the major contributors to Bhaktivedanta Institute's publications, and also the Editor of Bhaktivedanta Institute's reputed annual journal, Savijnanam – Scientific Exploration for a Spiritual Paradigm. He travels widely across India and abroad creating awareness regarding the interface of Science and Spirituality among academic and professional circles. His deep interest in the foundations of mathematics, the fundamentals of computer science and

logic, and its relation to the nature of consciousness, nature of reality as well as ancient Indian texts has led him to meet and interact with renowned scholars at Harvard, Princeton, Stanford and MIT. He has delivered numerous talks on computer science and spirituality. Under his able guidance and supervision, more than 10 national conferences, two International conferences, and over 100 seminars and workshops on science and spirituality have been organized by the Institute in the past decade, which includes contributions from more than 20 Nobel Laureates and world-renowned scholars; in addition, over 200 papers have been published by the Bhaktivedanta Institute. He was a former Global Council Trustee of the United Religions Initiative.

About Bhaktivedanta Institute

The Bhaktivedanta Institute was founded by His Divine Grace A. C. Bhaktivedānta Swami Prabhupāda in Vrindavan in August 1974. Śrīla Prabhupāda was one of the greatest exponents of Vedic culture in the 20th Century. He strongly felt that modern civilization is completely misdirected by scientific materialism and there is an urgent need to introduce the spiritual knowledge and wisdom of the *Bhagavad-gītā* and the *Śrīmad-bhāgavatam*, the essence of all the Vedic literatures, to the scientists, philosophers, scholars and students of the world. He noticed that all the prestigious academic institutions and universities of the world were teaching many different subjects but they had left out the most important branch of knowledge—the science of the soul. He envisioned that this spiritual knowledge of life would help restore an ethical culture for modern society. Thus, there would be hope for bringing lasting happiness and world peace. He felt that introducing this spiritual culture should be the contribution of India for the welfare of humanity. Śrīla Prabhupāda appointed his disciple Dr. T. D. Singh (Bhaktisvarūpa Dāmodara Swami) as the director of the Institute from its very inception and left several instructions to him to carry forward his vision.

The Bhaktivedanta Institute is a center for Advanced Studies in Science and Vedānta and focuses on a consciousness-based paradigm. This spiritual paradigm has a unique potential to resolve the mind-body problem, the question of evolution and life's origin and many other philosophical and ethical concerns. Thus, this paradigm will have profound significance for science, religion, and their synthesis. One of the primary objectives of the Bhaktivedanta Institute is to present this paradigm for the critical attention of serious scholars and

thinkers throughout the world. As such, the Institute supports a closer examination of existing scientific paradigms in cosmology, evolution, physics, biology, and other sciences. The Institute also promotes scientific, philosophical and religious dialogues among scientists, scholars and theologians of the world covering various common conceptual grounds of science and religion for the purpose of creating a better and harmonious understanding among all people. In order to achieve these goals, the Institute organizes international conferences regularly and publishes books and journals. Interested persons may contact the secretary of the Institute at:

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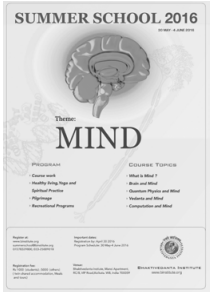

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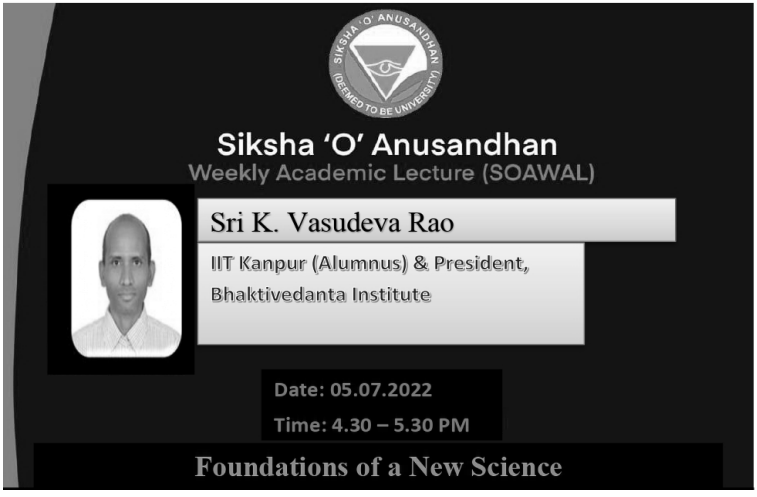

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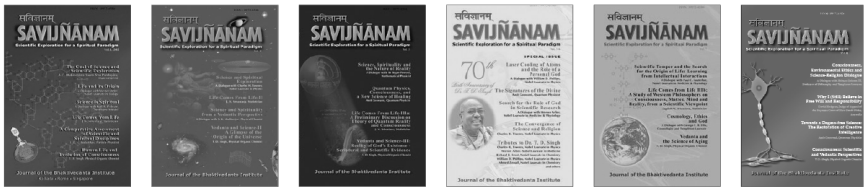

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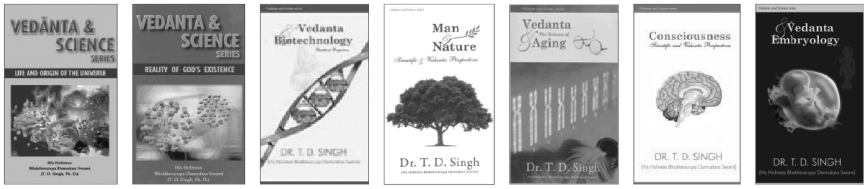

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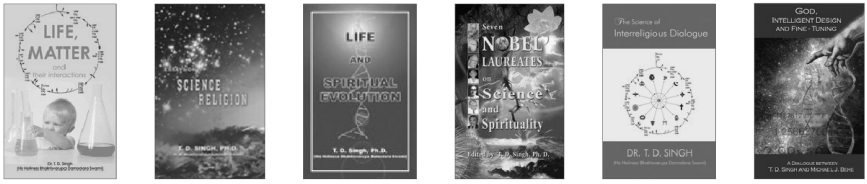

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