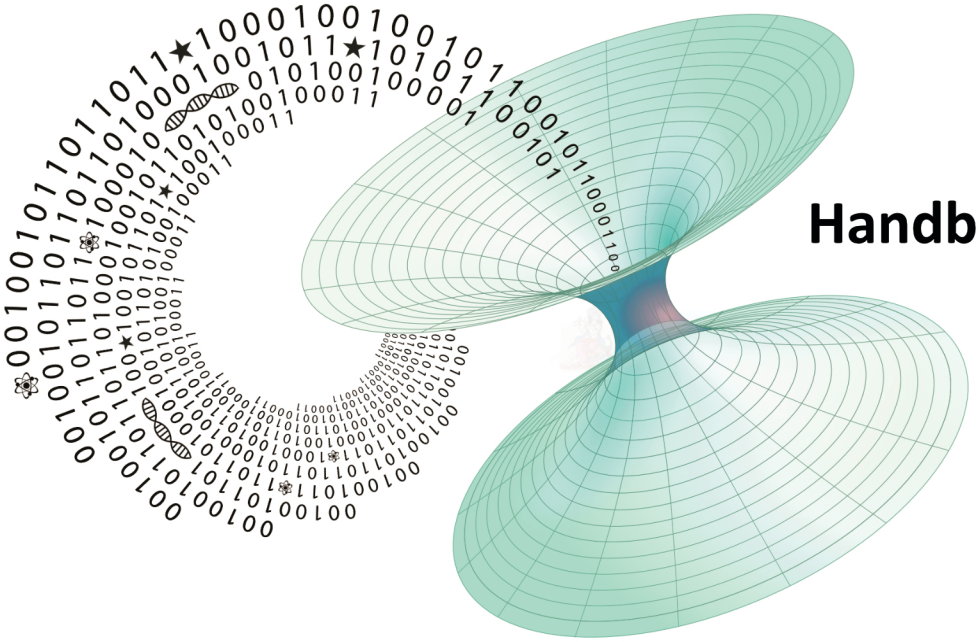

Handbook

Summer School – 2024

A Deeper Contemplation on

ORIGIN OF INFORMATION

- **State-of-art**
- **Data, Information & Wisdom**
- **Foundations**
- **Meaning & Purpose**

7 – 9 June 2024

Gurukula Kangri (Deemed to be University) Haridwar, Uttarakhand

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

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BHAKTIVEDANTA INSTITUTE
Kolkata
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GURUKULA KANGRI (Deemed to be University)
Haridwar, Uttarakhand
www.gkv.ac.in

The origin of life and the origin of information are essentially one and the same problem.

— Paul Davies
Arizona State University

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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 the blessings of our visionary, Dr. T. D. Singh, as well as the tireless efforts of our dedicated team members, which have made the 9th Summer School titled, "A Deeper Contemplation on the Origin of Information - Foundations, State-of-art, Data Information & Wisdom, Meaning & Purpose" possible in the sacred city of Haridwar, India. We extend our heartfelt gratitude to our honourable chief guest - Dr. Satya Pal Singh, Chancellor, Gurukula Kangri (Deemed to be University), Haridwar; and distinguished guests of honour - Prof. Ravindra Kumar Sinha, Vice Chancellor of Gautam Buddha University, Greater Noida; Prof. P. B. Sharma, Vice-Chancellor of Amity University, Gurgaon; Shri J. C. Jain, Chancellor, COER University, Roorkee for graciously accepting our invitation and sharing their profound insights. We also acknowledge the valuable presence of esteemed special guests - Prof. Gulshan Kumar Dhingra, Dean of Research and Development, Sridev Suman Uttarakhand University; and Prof. Surekha Dangwal, Vice-Chancellor, Doon University. We also express our deep appreciation to all the esteemed speakers for kindly accepting our invitation to share their profound wisdom.

We are highly indebted to the support and help extended by Dr. Satya Pal Singh, Chancellor; Prof. Ambuj Kumar Sharma, Vice Chancellor; Prof. Somdev Shatanshu, Former Vice Chancellor; faculty members; staff members and the students of Gurukula Kangri (Deemed to be University) for shaping this summer school into a reality. Our special thanks to Prof. L. P. Purohit, Prof. Prabhat Kumar and Dr. Sunil Kumar for their extending immense support at various fronts.

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Our special thanks to the Bhaktivedanta Institute, NCR for their dedication to reach out about the school to many young students and paying attention in making various arrangements for summer school in coordination with Gurukula Kangri (Deemed to be University), Haridwar. We also gratefully acknowledge the good wishes and prayers from friends, well-wishers, and the community of Dr. T. D. Singh's family, whose blessings have been indispensable for this school.

We are indebted to the kind donations for the summer school by Prof. Ramagopal V. S. Uppaluri, Dr. Dheeraj Prakashchand Dube, Dr. Debashis Khan, Dr. Ramjee Repaka, Dr. Pabitra Ranjan Maiti, Dr. P. Bala Ramudu, Dr. Arnab Sarkar, Dr. Bharat, Dr. Venugopal Balakrishnan, Dr. Shushant Kumar Singh, K Sushmita, Aditya Verma, Fanindhra Thirunagaru, Rahul Ganesh Regalla, Lalit, Sravya Gadamsetty, Vemula Mounika, Amizhdhan A S, Rohit Gaikwad, Dinesh, Romit, Dinesh Joshi, Mayan Yadav, Shipra Rajput, Pala Ravikanth, Kailasa Vennela, Uniyal Abhishek, Sanjiv Kumar Bhalla, Balaji, Vaisakh, Katta Saivineeth, Sri Sushant Sharma, Dr. Roshan Tiwari, Sriman Ankur Sethi, Premalatha Rajendiran, Balaji, Geetha Mohanan, Ramesh Sirigiri and many other generous benefactors.

We also like to thank all the reputed institutes - IIT Roorkee, IISER Kolkata, DIT Dehradun, COER University - Haridwar, IMS Unison University - Dehradun, Shri Guru Ram Rai University - Dehradun, UPES - Dehradun, Graphic Era (Deemed to be University) - Dehradun, Uttaranchal University - Dehradun, Graphic Era Hill University - Dehradun, Doon University - Dehradun, Aroma Ayurvedic Medical College and Hospital, Dev Sanskriti Vishwavidyalaya who helped us in promotion of the school among their circles.

We extend our heartfelt gratitude to Dr. T. D. Singh (H. H. Bhaktisvarupa Damodara Swami), a visionary leader who pioneered the synthesis of science and spirituality, and the founding director of the Bhaktivedanta Institute. His invaluable guidance has been pivotal in the

successful organisation of this school for the benefit of humanity. We are also deeply indebted to Srila A. C. Bhaktivedanta Swami Prabhupada, a visionary saint and the founder-acharya of the Bhaktivedanta Institute, for establishing this remarkable platform and vision.

While words may fall short, our gratitude is boundless. We express our sincere thanks to everyone involved, named and unnamed, from the core of our hearts. May positivity and goodwill flow from all directions. May happiness be with everyone.

Sarve jana sukhino bhavantu!

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

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

Contents

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Welcome

It gives me immense pleasure to welcome you to the Summer School on the Origin of Information that will be held at the holy city of Haridwar which is being organized jointly by the Bhaktivedanta Institute, Kolkata, and the Gurukul Kangri University, Haridwar.

Questions regarding the origins are always very important and exciting to the spirit of inquiry of the human mind for it gives meaning and purpose to human life. These questions take us to the boundaries of what we know and do not know; what can be known and what cannot be known. Important questions on the origin of the universe like, 'What started the universe?' and 'What is the origin of the universal physical constants?' are still unanswered. There are theoretical limits to how far in distance and time we can probe and observe our universe. Similarly, Heisenberg's uncertainty principle puts a theoretical limit on our observation at the microcosm level. Widely and academically respected investigations in modern times are mostly scientific in nature. However, the scientific method itself puts limits on our ability to observe both in macro and micro cosmos. Our ability to know the purpose of the universe and our role in it through rigorous scientific methods alone is highly doubtful. Similarly, the origin of life is still an unsolved issue. The origin of information in the living cell, the DNA, is still a mystery.

Therefore, a collaboration between the scientific method and traditional wisdom is imperative if we were to know if there is a purpose to the universe and ourselves in it. Such an attempt would be beneficial both to the scientific method as well as to the traditional wisdom. This summer school is an attempt to bring together a rigorous scientific approach and traditional wisdom to closely examine the origin of information.

Thank you for coming to participate in the summer school on the origin of information. We hope we have many meaningful conversations and a pleasant stay at Haridwar. The

human spirit of inquiry does not rest in peace until we have a meaningful understanding of the origins – whether it is the origin of life, the origin of the universe or the origin of information.

Thank you and heartily welcome!

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

Introduction

In an age where information permeates every aspect of our lives, understanding its origins, implications, and interconnectedness has never been more critical. Information shapes our reality, influences our decision-making processes, and enhances our understanding of the universe. Despite its pervasive presence, many fundamental questions about information remain unanswered. This Summer School 2024 on "A Deeper Contemplation on the Origin of Information – Foundations, State-of-art, Data Information & Wisdom, Meaning & Purpose" aims to delve into these profound inquiries, offering a unique platform for interdisciplinary exploration and intellectual growth.

Our program will feature thought-provoking lectures from distinguished professors and scholars from premier institutes around the globe. These sessions will cover a broad spectrum of topics, including the relationship between information and the origin of life, the universe, and the laws of physics. We will also explore the intersections of information with artificial intelligence, consciousness, and Vedanta philosophy, integrating scientific perspectives with insights from the Indian knowledge system and spiritual traditions.

Key questions to be addressed include: What is information? Is it purely physical? How does bare information relate to meaning and understanding? What is the interplay between matter, energy, and information? How did information originate in our universe? These discussions will not only provide theoretical knowledge but also encourage active participation, critical thinking, and deep discussions among attendees.

The school will be held in the holy city of Haridwar, a place rich in Indian heritage and spiritual significance. This setting will enhance our exploration by providing a serene and inspiring environment. The integration of scientific and spiritual insights aims to foster a holistic understanding of information, enriching both intellectual and personal development.

By merging contemporary scientific knowledge with traditional Indian wisdom, the summer school seeks to offer a comprehensive and enlightening educational experience. Participants will have the opportunity to engage with leading researchers, fostering interdisciplinary collaboration and innovative thinking. This approach is especially pertinent in an era where interdisciplinary knowledge is key to breakthroughs in technology and science.

We hope the school will inspire new perspectives, stimulate intellectual curiosity, and contribute to a deeper understanding of the pivotal role of information in both scientific and spiritual realms. Best wishes for your journey of discovery at the Summer School 2024.

— Convener
Summer School – 2024

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. Bhaktivedanta Institute annually organizes summer schools since 2015, on various foundationally stimulating themes like "Mathematics & Spirituality", "Computation & Mind", "Space & Time - in science & spiritual traditions", "Mathematics, Logic & Spirituality", "Origin of Life Research - History, State-of-art, New Ideas, Future Visions", "Exploring the Foundations of Science & Beyond" and "Unfolding the Mystery of Memory." 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: June 7, 2024 (Friday)

08:00 am – 09:00 am	Breakfast
09:00 am – 09:25 am	Registration
09:30 am – 10:45 am	**Opening Ceremony & Welcome Address**
10:45 am – 11:00 am	Break
Session 1	
11:00 am – 11:45 am	**On Information and Its Source** Dr. A. K. Mukhopadhyay, *Former Professor of AIIMS, New Delhi, India*
11:45 am – 12:00 pm	Q & A
12:00 pm – 12:45 pm	**Informatics-based Healthcare in the Era of the Fifth Paradigm** Prof. G. P. S. Raghava, *IIIT, New Delhi, India*
12:45 pm – 01:00 pm	Q & A
01:00 pm – 03:00 pm	Lunch and Break
Session 2	
03:00 pm – 03:45 pm	**Quantum Physics, Biology and the Universe** Prof. Vlatko Vedral, *University of Oxford, UK*
03:45 pm – 04:00 pm	Q & A
04:00 pm – 04:45 pm	**Information and Consciousness: Scientific and Vedantic Perspectives** Shri Varun Agarwal, Director, *Bhaktivedanta Institute Kolkata, India*
04:45 pm – 05:00 pm	Q & A
05:00 pm – 05:15 pm	Break

05:15 pm – 06:00 pm	**Holography and Quantum Information** Prof. Kostas Skenderis, *University of Southampton, UK*
06:00 pm – 06:15 pm	Q & A
06:15 pm – 07:00 pm	**Entropy, the Second Law, and Information Theory** Prof. Arieh Ben-Naim, *The Hebrew University of Jerusalem, Israel*
07:00 pm – 07:15 pm	Q & A
07:15 pm – 08:00 pm	Break
08:00 pm – 09:00 pm	Dinner

Day 2: June 8, 2024 (Saturday)

08:00 am – 09:00 am	Breakfast
Session 1	
09:00 am – 09:45 am	**Quantum Information without Physical Body** Prof. Arun K. Pati, *TCG CREST, Kolkata, India (Former Professor - Harish-Chandra Research Institute, Allahabad)*
09:45 am – 10:00 am	Q & A
10:00 am – 10:45 am	**Formation and Processing of Spectral Tensor within a Brain** Prof. Sandeep Kumar, *IIT (BHU) Varanasi, Varanasi, India*
10:45 am – 11:00 am	Q & A
11:00 am – 11:15 am	Break
11:15 am – 12:00 pm	**A Search to Integrate Matter with Consciousness: With a reference to Information** Dr. Rajeshwar Mukherjee, *Nalanda University, Bihar, India*
12:00 pm – 12:15 pm	Q & A
12:15 pm – 01:00 pm	**Beyond Illusion and Information: Jiddu Krishnamurti's Quest for True Cognition in Advaita Vedanta** Dr. Sreetama Misra, *IIT Bhubaneswar, India*

01:00 pm – 01:15 pm	Q & A
01:15 pm – 03:00 pm	Lunch and Break
Session 2	
03:00 pm – 03:45 pm	**Information and Laws of Physics** Acharya Agnivrat Naishthik, *Shri Vedic Swasti Pantha Trust, Ved Vigyan Mandir, Bhagalbhim, Bhimnal (Raj.), India*
03:45 pm – 04:00 pm	Q & A
04:00 pm – 08:00 pm	**Spiritual Retreat 01: Knowing the Cultural Heritage of Haridwar**
08:00 pm – 09:00 pm	Dinner

Day 3: June 9, 2024 (Sunday)

08:00 am – 09:00 am	Breakfast
Session 1	
09:00 am – 09:45 am	**From Complexity to Divinity: Exploring the Intersections of Information Theory, Algorithmic Information Theory, and Transcendence** Shri Sushant Sharma, *Bhaktivedanta Institute Kolkata, India*
09:45 am – 10:00 am	Q & A
10:00 am – 10:45 am	**Cognition of Information** Dr. Sanjay Lenka, *IIT (BHU) Varanasi, India*
10:45 am – 11:00 am	Q & A
11:00 am – 11:15 am	Break
11:15 am – 12:00 pm	**AI and Consciousness** Shri Prabhakar B, *Western Digital, Bangalore*
12:00 pm – 12:15 pm	Q & A

12:15 pm – 01:00 pm	**Origin of Information in Artificial Intelligence Systems** Shri K. Vasudeva Rao, *President, Bhaktivedanta Institute, India*
01:00 pm – 01:15 pm	Q & A
01:15 pm – 03:00 pm	Lunch and Break
Session 2	
03:00 pm – 03:15 pm	**Origin of Information: Scientific & Philosophical Views** Somnath Banerjee, *PG Scholar, IIIT Bangalore*
03:15 pm – 03:30 pm	**Unraveling the Enigma: Exploring the Origin of DNA and Information** Nikhil Yenugu, *Ph. D. Scholar, IISER Kolkata*
03:30 pm – 03:45 pm	**Information Paradox in Black Holes** Mayank Mishra, *Ph. D. Scholar, IISER Kolkata*
03:45 pm – 04:00 pm	**Is Our Reality, Information Based Simulation?** Dr. Roshan Tiwari, *IISER Kolkata*
04:00 pm – 04:15 pm	**Information: Quantum Physics and Consciousness** Manali Verma, *Research Assistant, IIT Bombay*
04:15 pm – 04:30 pm	Q & A
04:30 pm – 05:15 pm	**Valedictory Session**
05:15 pm – 08:00 pm	**Spiritual Retreat 02: Knowing the Cultural Heritage of Haridwar**
08:00 pm – 09:00 pm	Dinner

Day 1

Session 1

1.1. On Information and Its Source

Dr. A. K. Mukhopadhyay, *Former Professor of AIIMS, New Delhi, India*

Science is presently preoccupied with the Relativity, Quantum Physics and the Entropy under the umbrella of inviolable constant of Velocity of light, Planck's constant on space and time, and Entropy barrier respectively, thus excluding simultaneity, continuity and identity of any two or more events. Simultaneous, continuous and identical events are, therefore, outside the scope of present science. Signal processing and related technology is customarily passed as Information Technology, without any attempt of drawing a distinction between a signal and an information.

Information has a content, an intent, and has the ability to reduce uncertainty in the environment as well as within the systems. In contrast, a signal is a space-time construct of information, and is devoid of any intention, although it represents the space-time distribution of a given energy! Whether information has any independent existence in nature, or it is a product of operation of one or the other members of the cognitive orchestra, or both, suggest us to penetrate through quantum discontinuity and quantum void in quantum physics, zero-point-energy (ZPE) in relativistic physics, and between the thoughts in psychology. Very little work has been done on this terrain of nature. In fact, posterior to quantum void and discontinuity, and across ZPE, and behind our thoughts, information is understood to have an independent existence, where it remains as contact-non addressable and content-non addressable state. Simply speaking, information remains as a nonlocal entity. Only property through which information could be traced in this terrain is a body of intentionality specific for that information.

Intentionality of information brings us to the ground of consciousness (in the Sanskrit language, *Yoga-Bhumi*), a wonderland of *Rishis*, that compels us to investigate the nature of information as well as of consciousness. In 2008, the author accepted the challenge to research on this frontier, and published in *Frontier*

Perspectives A radical view of information. Its nature and science[1]. In 2012, he published, Information Holograph: the structure, the source and its operation[2], and in 2013, the author set the agenda for a science of information[3] in the International Conference, *Towards the Science of Consciousness*. Following several other related papers on information science, a comprehensive view on the Science of Information was published in 2021[4]. However, in none of the mentioned papers the source of information was addressed.

The source issue was addressed to some extent in the author's 2023 paper, *The Source and the Genesis: In the language of Science*[5]. The initial part of Genesis is described as Becoming, and the subsequent part as Creation. Spiritual *Mantra* is considered a piece of Information on the Divine. This kind of information is sourced from the 'becoming' of the operative pole of consciousness! Therefore, the *Mantra*, as Information, and the Divine are identical in substance. Creation notionally requires conjugation of a Masculine and a Feminine entity, at the abstract level. Of the members of the cognitive orchestra, `Life' and 'Mind' show feminine property, whereas Consciousness and Self exhibit masculine characteristics. The principle of creation of information follows the Principle of Homeopathy (Dr. Samuel Hahnemann), *similia similibus curantur.* In various combination, uncertainty in the interactive operation between Consciousness and Life, Consciousness and Mind, Self and Life, and Self and Mind could thus result in four types of information, creating four variants of *Gunas*, namely *Shuddha Sattwa*, *Sattwa*, *Rajas* and *Tamas*. These *Gunas* operating through the brain manifest as respective behavior of the being, and therefore could be part of observable positivistic neuroscience.

Our brain as a whole acts as a "sensor" of different information states, and we are thus enslaved in the operation of information. Making ourselves free of this enslavement of information, is an example of living in a free state (*jivanmukta*).

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5. https://ecronicon.net/assets/ecpp/pdf/ECPP-12-01053.pdf

Professor AK Mukhopadhyay has served All India Institute of Medical Sciences, New Delhi, for forty years (1979-2018) in various capacities, last twelve years as the Head of the Department of Laboratory Medicine. He is known as the Father of the Discipline of Laboratory Medicine in India. His journey in the science of consciousness begins in 1985 with the coining of the term and concept of Supracortical Consciousness. He considers himself a student of Consciousness. He reports to consciousness for all his doubt clearance. He has been a regular speaker and participant in all consciousness-related seminars and summer school programs conducted by BI Institute, Kolkata. Internationally famous as "Professor Mukho", his illustrious contributions in developing the science for, and the science of consciousness in form of Books, Published Papers, Concept building in form of innovative figures could be seen on his website, https://www.akmukhopadhyayconsciousness.com

1.2. Informatics-based Healthcare in the Era of the Fifth Paradigm

Prof. G. P. S. Raghava, *IIIT, New Delhi, India*

There has been a continuous and dynamic paradigm shift in the field of science over the last few centuries. Initially, the scientific method relied heavily on empirical observations and experimental data to formulate theories and hypotheses, marking the genesis of the first paradigm. Second paradigm, characterized by the development of theoretical models and the derivation of mathematical equations to elucidate the underlying principles. This shift towards theoretical research paved the way for significant advancements in understanding the fundamental laws of the universe. Last century witnessed a revolutionary transformation with the advent of computational technology that led to the third paradigm of science where researchers began harnessing the power of computers to simulate complex theoretical models. Perhaps the most profound transformation occurred in recent decades, where unprecedented growth of data was observed across all scientific disciplines. This exponential growth in data has catalyzed the emergence of the fourth paradigm of science, called data-intensive research.

The evolution of data-intensive science has given rise to the fifth paradigm, commonly referred to as cognitive computing. This paradigm represents a synthesis of computational science and data-intensive research, leveraging advanced algorithms and cognitive technologies to extract actionable insights from vast and heterogeneous datasets. In summary, the evolution of scientific paradigms—from

empirical observations to theoretical frameworks, from computational simulations to data-intensive research—reflects the ever-evolving nature of scientific inquiry. These paradigms are not mutually exclusive but rather synergistic, each contributing to a more comprehensive understanding of the natural world.

In this presentation, my primary focus will center on leveraging big data mining methodologies within the realms of biological and medical sciences to address critical healthcare challenges. Firstly, I will provide an extensive overview of the major biological databases available worldwide, which serve as invaluable resources for the scientific community. In addition I will highlight the importance of open source software in facilitating scientific research as well as India's notable contributions. Secondly, traditional database management systems will be discussed including their limitations.

Subsequently, I will focus on NoSQL-based database management systems, which have become increasingly prevalent for handling large-scale, unstructured data in the context of big data analytics. Over recent decades, the scientific community has witnessed remarkable advancements in artificial intelligence based techniques, particularly in the domains of machine learning and deep learning. I will highlight the groundbreaking progress in natural language processing, which has empowered the development of sophisticated language models capable of extracting knowledge from textual sources. As exemplified by ChatGPT, these language models represent a powerful tool for enhancing the efficiency and efficacy of scientific research. I have personally utilized ChatGPT to refine the content of this abstract, underscoring its utility in augmenting scholarly discourse and knowledge dissemination.

Further Reading: https://webs.iiitd.edu.in/raghava/

Raghava is professor in department of computational biology at IIIT, Delhi. He received his M.Tech from IIT Delhi in 1986 and Ph.D. from CSIR-IMTECH (Institute of Microbial Technology), Chandigarh, in 1996. He worked as Postdoctoral fellow at Oxford University UK (1996-98), Bioinformatics specialist at UAMS, USA (2003 & 2006) and visiting professor at POSTECH, South Korea (2004). He worked around 30 years (1986 to 2017) at different scientific positions in the field of bioinformatics at CSIR-Institute of Microbial Technology, Chandigarh. Raghava's group has published more than 350 research papers in reputed journals. Developed more than 300 in-silico products (web servers, databases and software packages), which is the highest contribution by a single group in the world. He is a strong supporter of open source software/web-servers; all services developed at his group are free for academic use.

These web-based services are heavily used worldwide, more than 150,000 hits per day. He is a highly cited researcher; his papers got more than 28000 citations with h-index 84. For his outstanding contributions he was awarded Shanti Swarup Bhatnagar Award (2008) by CSIR, National Bioscience Award (2006) by DBT and received J. C. Bose national fellowship (2010-2020) by DST. He is Fellow of all major scientific Academies in the country (FNASc, FASc, FNA).

Session 2

2.1. Quantum Physics, Biology and the Universe

Prof. Vlatko Vedral, *University of Oxford, UK*

In my talk I will present what I believe to be the key features of quantum physics. Among them are the unification of the wave and the particle aspects of fields and matter as well as the abolition of the divide between observers and the observed. The latter is achieved through the concept of quantum entanglement which I will review in simple terms. I will then argue that quantum physics gives us a perfectly consistent (and beautiful) picture of the whole universe. In the quantum universe there are no collapses, no quantum jumps, no discontinuities, no outcomes to unperformed measurements and in such a reality the unobserved outcomes could actually affect future measurements.

Then I will discuss the role of quantum physics in living systems and talk about some of the experiments I have been designing to probe quantum effects in chemical and biological processes. It is frequently stated that gravity itself may actually spell an end to quantum physics, but I hope to convince you that we are on the cusp of being able to test quantum features of the gravitational field. My prediction is that we will soon be able to falsify Einstein's general relativity and that this will open the door to a new physics revolution. I will finish by offering a couple of speculations on what I think will come next.

Prof. Vlatko Vedral is a professor of Quantum Information Science at University of Oxford, UK. He obtained his Ph.D. in Physics from Imperial College of Science, Technology and Medicine, London. His research interests include Quantum Mechanics, Quantum Information and Quantum Entanglement. After his PhD, Vedral was appointed Elsag-Bailey postdoctoral research fellow in Oxford. He then held a research fellowship at Merton College, Oxford returning to Imperial College

as the Governor's lecturer to start a quantum information science research group, a position he held from 2000-2004. Before returning to Oxford, he was centenary professor of quantum information science at the University of Leeds from 2004 to 2009. As of 2009, he has held joint appointments as a Professor of Physics at the University of Oxford and the Centre for Quantum Technologies (CQT) at the National University of Singapore, the latter ending in the summer of 2022. He was appointed Fellow of Wolfson College, Oxford in 2009. He has published over 190 papers including 36 Physical Review Letters, 6 Nature papers and six invited reviews on quantum information, including 4 Reviews of Modern Physics. Total citation number over 10000 (h factor = 45). He received the Royal Society Wolfson Research Merit Award in 2007. He is the author of several books, including *Decoding Reality*.

2.2. Information and Consciousness: Scientific and Vedantic Perspectives

Shri Varun Agarwal, *Director, Bhaktivedanta Institute Kolkata, India (Alumnus, IIT Kanpur)*

Today, we are surrounded by a variety of information - from digital to quantum to biological. It plays a crucial role in our learning, decision- making, communication and even in our understanding of reality. But what does the information really mean? Is information only physical? What is the relation between bare information and the meaning and understanding of information? Is information complete without understanding it? Do machines process information or understand information? In other words, is information really complete without consciousness? Are they related? What is the relation between matter, energy and information? How did information originate in our universe in the first place? The author will attempt to humbly explore some of these foundational questions about the information and its origin while weaving wisdom from ancient Indian Vedantic texts.

Varun Agarwal (also known as His Holiness Bhaktisvarupa Vrajendrakumar Swami) graduated from the prestigious Indian Institute of Technology Kanpur (IIT Kanpur), India obtaining his B.Tech in Aerospace Engineering (1999). He worked on a project of solar-powered aircraft and was ranked first in his entire department. However, his longing for something deeper about life which always bothered him finally culminated in meeting the illustrious scientist-saint Dr. T. D. Singh (His Holiness Bhaktisvarupa Damodara Swami), the Founder Director of the Bhaktivedanta Institute. Under his guidance, he began studying ancient Vedantic wisdom, dedicating himself completely for the cause of helping humanity through the

interface of scientific temper and spiritual wisdom. He is currently the Director of the Bhaktivedanta Institute, Kolkata, India. Besides his various involvements, Varun frequently travels across India, abroad and interacts with scientists and scholars all over the world including world-renowned universities of Harvard, Princeton, ETH and Stanford to MIT. He is also the Editor of Bhaktivedanta Institute's reputed science and spirituality journal, Savijnanam.

2.3. Holography and Quantum Information

Prof. Kostas Skenderis, *University of Southampton, UK*

I will present an introduction to holographic dualities and its relation to quantum information. The holographic principle states that quantum gravity is equivalent to quantum theory with no gravity in one dimension less. The best understood example is provided bythe AdS/CFT correspondence, which posits that quantum gravity in Anti-de Sitter space-time, a space-time with constant negative curvature, (the bulk theory) is equivalent to a conformal field theory in one dimension less (the boundary theory). I will introduce the holographic dictionary: I will explain how bulk observables can be computed in the boundary theory and vice versa and discuss how profound questions and concepts are mapped between the two dual descriptions. Quantum entanglement is key feature of quantum mechanics and holographic dualities link it to the very structure the bulk space-time: one may map the reconstruction of the regions of the bulk space-time to quantum error correction codes, providing a direct link between quantum information concepts and space-time reconstruction. I will finish this talk discussing the application of the holography to the very early universe, discussing how the initial Big Bang singularity may be resolved.

Kostas Skenderis completed his undergraduate studies in the Aristotle University of Thessaloniki, Greece, before obtaining a Ph.D. in theoretical Physics from SUNY at Stony Brook, USA, in 1996 under the supervision of Peter van Nieuwenhuizen. After postdoctoral appointments, he became Assistant Professor at Princeton University in 2001. From 2003-2012 he was an Associate Professor and Professor at the University of Amsterdam. In 2012 he moved to the University of Southampton to launch the Southampton Theory Astrophysics and Gravity (STAG) Research Centre. During his career, Skenderis has received several awards including the Vernieuwingsimpuls award (2003-2008) and the VICI award (2009-2014) from The Netherlands Organization for Scientific Research (NWO) and the New Frontiers in Astronomy and Cosmology Award (2012) from the John Templeton Foundation. Skenderis'

research interests include general relativity, cosmology, quantum field theory and string theory. He has worked extensively on the holographic principle, according to which our Universe can be described by a quantum field theory without gravity in one dimension less. He developed the mathematics needed to develop the holographic dictionary relating gravity to quantum field theory, the method of holographic renormalization, and he introduced and tested against observations a holographic framework for cosmology.

2.4. Entropy, the Second Law, and Information Theory

Prof. Arieh Ben-Naim, *The Hebrew University of Jerusalem, Israel*

The earliest association between information and entropy is probably the one due to Lewis (1930): *"Gain in entropy always means loss of information and nothing more."*

Clearly, Lewis is using the term "information" in its colloquial meaning; when a gas expands we have a sense of losing some locational information. In this sense, "information" is a descriptor of the state of the system, rather than a quantitative description of entropy. In 1948 Shannon published the Mathematical theory of communication. In this article, Shannon defined a quantity that measures the "extent of information," or "missing information," or "uncertainty" associated with any probability distribution. Unfortunately, Shannon called his measure *Entropy.*

In this lecture, it is shown that the *thermodynamic entropy* may be derived from the Shannon Measure of Information (SMI). The overall plan of obtaining the entropy of an ideal gas from the SMI consists of four steps:

1. We calculate the *locational* SMI associated with the *equilibrium* distribution of locations of all the particles in the system.
2. We calculate the *velocity* SMI associated with the *equilibrium* distribution of velocities (or momenta) of all the particles.
3. We add a correction term due to the quantum mechanical *uncertainty principle*.
4. We add a correction term due to the fact that the particles are *indistinguishable*.

Once we combine the results of the four steps, we get, up to a multiplicative constant, the *entropy function* of an ideal gas. The same entropy function was obtained by Sackur and Tetrode in 1912.

It will be clear that though *entropy* may be derived from SMI, and may be interpreted as an SMI, the two concepts are very different and should not be referred to by the same name.

Keywords: Entropy; Second Law; Thermodynamics; Shannon measure of information; Information Theory

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Arieh Ben-Naim is a professor emeritus at the Hebrew University of Jerusalem's Department of Physical Chemistry. Born in Jerusalem, Israel, in July 1934. Most of his research work was focused on the theory of water, aqueous solutions, and the role of water in biochemical processes. Recently the author dedicated his time to explaining and clarifying to the general public the most mysterious concept in physics: Entropy. He is the author of many books and articles on Entropy and the Second Law, the most popular of which is "Entropy Demystified," first published in 2006.

Day 2

Session 1

1.1. Quantum Information without Physical Body

Prof. Arun K. Pati, *TCG CREST, Kolkata, India (Former Professor - Harish-Chandra Research Institute, Allahabad)*

A deeply rooted view in classical and quantum information is that "information is physical", i.e., to store and process information, we need a physical body. In this talk, I will discuss whether quantum information can remain somewhere without a physical body. We answer this question in the affirmative, i.e., we argue that quantum information can exist without a physical body in volatile form. We introduce the notion of the volatility of quantum information and show that indeed the conditions for it are naturally satisfied in the quantum world. Indeed, I will show that when we make disembodied transportation of a physical body (quantum teleportation), information is neither at the sender's location nor at the receiver's location during a certain time interval. Quantum information, then, can be said to remain in a volatile form without any physical body. We argue that even if special relativity principles are not assumed, it is possible to make quantum information volatile. This will have profound implications in our understanding of the notion of information in quantum mechanics and other diverse areas of science.

Arun Kumar Pati is a Professor at Center for Quantum Engineering Research and Education (CQuERE), TCG CREST, Kolkata and an adjunct professor at IISER, Mohali. He is a Professor and Head of the Center for Quantum Science and Technology (CQST), at IIIT, Hyderabad and also Director of Quantum Ecosystem and Technology Council of India (QETCI), Hyderabad. Formerly, he was a professor of quantum information at the Harish Chandra Research Institute, Allahabad, India from January 2011 to December 2023 and scientist at BARC and Institute of Physics from 1989 to 2010. His research areas include all aspects of quantum information and quantum computation, the theory of geometric phases and its applications, and the foundations of quantum mechanics. Among his important discoveries are the No-Deletion theorem, Geometric Phases for mixed state, Remote State Preparation protocol, the No-Hiding Theorem and the Stronger Uncertainty Relations in quantum mechanics. He has more than 150 research papers in international journals and conferences on these topics. He has edited two books: (i) Quantum Information with Continuous Variables and (ii) Quantum Aspects of Life. His research papers have been highlighted in NATURE, NATURE ASIA, SCIENCE, and many national and international newspapers. He is Fellow of the Indian Academy of Science, Bangalore and National Academy of Science, Allahabad. He was Recipient of the Indian Physical Society Award for Young Physicist and awarded J C Bose National Fellowship from Department of Science and Technology, India.

1.2. Formation and Processing of Spectral Tensor within a Brain

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

This talk will present about spectral tensor, a mathematical function, which is created to describe the phenomenon of emotions and understanding. It will show the fundamental difference in the ways that computers, animals and humans analyze and synthesize information. Everybody has a distinct overall spectral tensor which governs the behavior and the process of learning. An object and an observation can also be considered as a small unit of spectral tensor. The frequencies of the two tensors - the observer's overall tensor and the tensor of the object - determine the observer's response to this tiny unit of the spectral tensor.

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.

1.3. A Search to Integrate Matter with Consciousness: With a reference to Information

Dr. Rajeshwar Mukherjee, *Nalanda University, Bihar, India*

The science of consciousness has become a very important area of research that has been intriguing scientists and researchers across the globe. But undoubtedly this area of research is a fuzzy area, which has perplexed scientists and researchers. The question as to whether Consciousness is fundamental or it is an emergent property is still an unsolved problem. Scientists of contemporary times are puzzled by the Hard Problem of Consciousness championed by David Chalmers which asserts that consciousness cannot be the emergent property of matter. Moreover, the wave function collapse in quantum mechanics has established that consciousness not only observes but partakes in the act of observation. This is a very tricky situation of which the scientists have no clue. However, the ancient Indian seers have profound projections in regard to the nature of consciousness. It upholds that the universe of names and forms has an absolute cause which is pure consciousness. The highest reading of the pure consciousness in the relative universe has been conceptualized by the concept of Hiranyagarbha. Hiranyagarbha is a very profound concept that explains the nature of consciousness in relation to matter and is termed the Unified Field of Consciousness. It is a significant concept that is mapped with the Zero-point field in modern physics. The paper aims at the demystification of Hiranyagarbha in a scientific spirit.

Dr. Rajeshwar Mukherjee, a distinguished scholar renowned for his pioneering research bridging Physics and Indian Philosophy, holds a Ph.D. from Kavikulaguru Kalidas Sanskrit University in Ramtek and possesses dual master's degrees in Physics and Sanskrit. Specializing in teaching Vedic texts, Indian Philosophy, and the Science of Consciousness through the lens of theoretical physics, Dr. Mukherjee offers a unique interdisciplinary perspective in his academic pursuits. Presently, Dr.

Mukherjee serves as a faculty member at the School of Buddhist Studies, Philosophy & Comparative Religions at Nalanda University.

Previously, he held the position of Assistant Director of Research at the Kaivalyadhama Research Institute in Lonavla, Pune, an institution recognized by the Ministry of Education, Government of India. With extensive experience as a Research Officer, lecturer, and Registrar at the Institute, he has been instrumental in advancing scholarly discourse and academic research. He has also contributed significantly to academia as a faculty member at the School of Indian Heritage, Ramakrishna Mission Vivekananda University, Belur Math. He has served as Visiting Faculty at the Vedic Vigyan Kendra, Banaras Hindu University, and Chairman of the Board of Studies of the Department of Yoga at HSNC University.

1.4. Beyond Illusion and Information: Jiddu Krishnamurti's Quest for True Cognition in Advaita Vedanta

Dr. Sreetama Misra, *IIT Bhubaneswar, India*

The lecture would bring out how Krishnamurti's philosophy challenges the prevailing notion of reality constructed by the mind, and show that human perception is veiled by illusion, woven from the fabric of conditioning and cultural narratives. Through introspection and radical self-inquiry, there lies a possibility for individuals to peel away the layers of illusion, transcending the confines of conceptual thought. In an age inundated with information, Krishnamurti emphasizes the limitations of knowledge in discerning truth. The core of the lecture would focus on the following:

1. That true cognition arises not from accumulated information but from a state of unconditioned awareness.

2. To explore and extend the principle of non-duality from Advaita Vedanta, emphasizing interconnectedness and envisioning a unified world transcending divisive constructs.

3. To understand how true cognition (not information) in Advaita Vedanta offers a profound antidote to the prevailing illusions and information overload of contemporary society.

Dr. Sreetama Mishra is a distinguished faculty member of Philosophy in School of Humanities, Social Sciences & Management at IIT Bhubaneswar, with a wealth of experience in teaching and research. Her areas of expertise include moral philosophy, environmental ethics, and phenomenology. Dr. Mishra holds a doctoral degree from Assam University and has been awarded a Junior Research Fellowship by ICPR, New Delhi. Before joining IIT Bhubaneswar, she was an Assistant Professor in the Department of Philosophy, Belda College (Vidyasagar University) from July, 2014 - November, 2022. She also served as a trained Programme Officer of National Service Scheme from Narendrapur Ramakrishna Mission. Throughout her career, she has received numerous accolades, including gold medals and the Upendra Sankar Memorial Prize for her academic excellence. Dr. Mishra is also a prolific author, having written articles and a book on philosophical topics in world-renowned journals. She is actively involved in academia and serves as a valuable member of the Editorial Board of the International Journal of Philosophy.

Session 2

2.1. Information and Laws of Physics

Acharya Agnivrat Naishthik, *Shri Vedic Swasti Pantha Trust, Ved Vigyan Mandir, Bhagalbhim, Bhimnal (Raj.), India*

The entire creation is governed by the laws of physics. The laws of physics are at work throughout the entire universe. It is through these very laws that we understand this universe. Whether we look at the stars in the sky or at any object elsewhere, there is an inherent contribution of the processes of emission and reflection of light. Behind both of these processes, there is also a kind of force at work. It too has its own rules. These laws never change. This is why we are able to understand the universe. It is due to the consistency of the laws of creation that we have discovered many constants in physics. These constants also indicate to us that despite the diversity in the universe, there is uniformity. For example, here, we contemplate on the laws and processes governing the creation of fundamental forces. Modern physical science acknowledges that the attraction force between two substances arises due to the exchange of' mediator particles generated between those substances. However, present-day physics doesn't understand how the presence, motion, and distance between two objects are perceived. Moreover, who provides information about the quantity of matter or electric charge between these two objects?

Without this information, the laws of forces cannot be applied, and no force of any kind can be generated. How and from where do the mediator particles carrying forces between two objects appear? Even if their origin is attributed to vacuum energy, defining vacuum energy and providing information about which mediator particles are generated, i.e., how different substances generate attraction forces between them, remains a question. The substance conveying information or the substance providing information must possess both force and knowledge. The presence of both force and knowledge is essential.

The entire creation is not a result of randomness but is an intelligently organized structure based on profound knowledge. Such an extremely intelligent arrangement cannot be observed in any human created product. Considering the nature of the subtlest to the grossest matter in this creation, even the most eminent scientists get perplexed. No man- made system is anything compared to the organized physics laws. From the subtlest to the grossest substances in creation, all influence each other based on the information (perceptions) they receive; there must be a single source for these informations or perceptions.

In this creation, we encounter various types of forces and energies. We also discuss the conversion of one energy into another. Then it’s certain that these substances are not fundamental because the fundamental can never be of various types. All these known substances are created from something that is unified, and all these substances are created and operated by that other substance which exists in the form of infinite knowledge, force, and energy in its fundamental form, separate from the forces and energies known by physics. It is conscious, omnipresent, omniscient, omnipotent, and formless. Such a substance is called Ishwar, whose main name is 'Om'. He creates the fundamental vibrations or information in the subtlest and infinitely vast inert substance of this creation by producing the para sound vibrations of the same 'Om', which can be called the seed of all kinds of sound waves. Those Rashmies like vibrations are the primary cause of all types of forces and energies.

Acharya Agnivrat Naishthik is a revered figure in the realm of Vaidic science, known for his extensive research and scholarly contributions. With a profound understanding of ancient texts and a deep insight into modern science, he has dedicated his life to bridging the gap between traditional wisdom and contemporary knowledge. Acharya Agnivrat's work revolves around uncovering the hidden scientific knowledge embedded within Vedic scriptures, particularly the Aitareya Brahmin of the Rigveda. Through his seminal work, including the monumental 'Ved

Vigyan Alok', he has elucidated complex cosmological phenomena and provided scientific interpretations of ancient texts, paving the way for new understandings in physics and cosmology. His efforts have led to the establishment of the Vaidic & Modern Physics Research Centre, aimed at furthering research in Vaidic principles and their application in solving modern-day challenges. Acharya Agnivrat's legacy serves as an inspiration for scholars and scientists for fostering a deeper appreciation for the rich heritage of Vedic knowledge.

Day 3

Session 1

1.1. From Complexity to Divinity: Exploring the Intersections of Information Theory, Algorithmic Information Theory, and Transcendence

Shri Sushant Sharma, *Bhaktivedanta Institute, Kolkata, India*

Starting with classical information theory, which focuses on the quantification and communication of information, we extend this into algorithmic information theory (AIT). AIT introduces the concept of Kolmogorov Complexity, which measures the length of the shortest possible algorithmic description of a string of data, highlighting the intrinsic complexity within information.

The development of Omega (ë), a number that represents the halting probability of the universal Turing machine is a significant milestone in AIT. ë is characterized by its algorithmic randomness, where its digits form a sequence that cannot be compressed into a shorter algorithm. This concept underscores the presence of incompleteness and unpredictability in mathematical systems, supporting the idea that there are true mathematical statements that cannot be proven within a formal system.

The philosophical implications of these findings suggest profound limits to human knowledge. The existence of unprovable truths and algorithmically random sequences points to aspects of reality that lie beyond formal logical or mathematical explanation. This aligns with theological perspectives where God is viewed as the ultimate source of truth and knowledge, encompassing what is beyond human comprehension.

The complexity and inherent randomness observed in the mathematical description of the universe might reflect a deeper, underlying order. This deeper order could be interpreted as a form of cosmic wisdom or a divine principle that orchestrates the fundamental laws of nature, resonating with the concept of a transcendent reality. In summary, the exploration of algorithmic information theory reveals inherent complexities and limits within mathematical knowledge, suggesting the existence of a higher order or intelligence beyond human understanding. This interdisciplinary approach bridges the gap between information theory, algorithms, and theology, providing a unique perspective on the nature of reality and the potential existence of a divine or transcendent principle, which can be interpreted as the possibility of God.

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, Tech Mahindra 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, Gödel's incompleteness theorems and Vedanta. Currently, he is working in Nevaeh Technologies, besides undertaking the responsibility of being the Director of Cognitive Studies and Fine arts of Bhaktivedanta Institute.

1.2. Cognition of Information

Dr. Sanjay Lenka, *IIT (BHU) Varanasi, India*

Information is a selected message of equi-probable values of a system. The system is a content (meaning) or a signal system. It means information is the choice of our free will about the different content probabilities. Therefore, information is an independent quantum state and the source of information is our free will and a semantic system. Information emerges when the mind (consciousness) meets a signal of the physical world. Freewill may not produce any information if the mind does not meet any informative system (content). The nature of information is sign production. The properties of information are choice of free will and signal system. The biggest problem in comprehension and interpretation of information is indeterminacy and uncertainty which deters us

from knowing the reality. This problem occurs because we assume information is a form of consciousness only and ignore the reality of a physical world which is a highly informative system, and where variation and complexity exist as entropy. This complexity becomes a source of uncertainty and indeterminacy. This is a problem in information science. Therefore, this paper develops a semantic approach to describe how the information as the value of equi-probability among several combinatorial possibilities of the semantic system is selected by free will (consciousness). This approach is designed on the theoretical ideas of Edwin Schrodinger's linear equation and the reductionist approach of semiotics. Following this approach, this paper argues that there is a linearity between selected information and the informative system. The free will follows a way of reduction to choose the precise information among several possibilities. It also claims that the source of information is not only consciousness but also an informative system. Finally, it concludes that free will, the informative system, and the process of choice are different parts of the same reality.

Dr. Sanjaya Kumar Lenka is a distinguished visiting faculty member in the Department of Humanistic Studies at IIT (BHU). He earned his Ph.D. in Linguistics from Banaras Hindu University in 2011. Dr. Lenka also holds an M.A. in Linguistics from the same university, where he graduated as the university topper and was awarded a gold medal in 2004. Additionally, he completed an M.A. in Literature and Literary Theory (Odia) from Viswa Bharati, Santiniketan, in 2001.

Throughout his academic career, Dr. Lenka has demonstrated a profound commitment to the fields of morphosyntax, language and communication, and academic writing and speaking. His research interests include linear semantics, pragmatics, information science and semiotics, cognitive semantics, generative syntax, and morphosyntax theory. His work often focuses on mathematical modeling of conversational meaning, conditional constructions in Indian languages, the uses of meaning, and the cognition of information.

Dr. Lenka's excellence in academics and literature has been recognized with several prestigious awards, including the Agraduta Book Award for Literature in 2001 and the gold medal for standing first in his M.A. in Linguistics in 2004. Dr. Lenka has presented his research at various national and international conferences, addressing topics such as the syntax of relativization, multiple complementations of phonemes in Odia, and the impact of information technology on media. His contributions to linguistics and literature continue to inspire students and scholars alike.

1.3. AI and Consciousness

Shri Prabhakar B, *Western Digital, Bangalore*

Can artificial intelligence (AI) systems ever achieve anything close to consciousness? There is presently an intense speculation about whether they can or cannot. How the brain conjures conscious awareness from the electrical activity of billions of individual nerve cells remains one of the great unanswered questions of life. And what this consciousness actually means is not easy to define.

In the last 10 years, Artificial Intelligence (AI) has been successful in the fields such as natural language processing, computer vision, speech recognition, robotics and autonomous systems. However, these advances are still considered as Narrow AI, i.e. AI built for very specific or constrained applications. However, current research is to develop AI with capabilities well beyond the purpose of prediction outputs called as "Generative AI". The aim of generative AI is to at present mimic the human intelligence, but will likely be aimed at exceeding human capabilities in order to help humans solve complex problems that they presently find difficult to fathom. This type of AI is called "Strong AI or Artificial General Intelligence (AGI)", which can produce an intelligence that is superior to human-level intelligence, i.e. the ability to sense, understand, reason, learn and act in dynamic environments. It is this type of AGI that is the subject of speculation about AI consciousness. Assuming that an AGI can be created with such advanced capabilities that the next step would be to incorporate sufficient elements of self-awareness to derive an independent and sentient autonomous entity, what would its consciousness be like? This talk will give an overview of current Narrow AI capabilities, future research towards Strong AI and could AI become conscious?

Prabhakar Ballapalle is presently a Lead Engineer at Randstad working for WESTERN DIGITAL, one of the World's leading Storage Company. He has been working in the field of flash storage controllers for the past 7 years. Before taking up this role, he worked with many world class companies like: SEAGATE, AVAGO, LSI, AGERE etc. Also before joining the private sector, he worked as a scientist at Central Research Laboratory and contributed to many prestigious indigenous projects for defense like development of Thermal Imager, Remote Surveillance System and Radar Video Transmission System, etc. He received his M.Tech in Signal processing from IIT-Kanpur in 2000. He has more than 10 publications and three patents to his credit. His research areas include pattern recognition, artificial intelligence, speech processing, audio processing, video processing, flash storage etc. He is very actively

involved in promoting the discussions on science & spirituality among the student's community and learned circles. He is also an associate editor of "Savijnanam", Bhaktivedanta Institute journal, "Tattva-Jijnasa", Bhaktivedanta Institute Magazine and the booklet "God, Intelligent design and Fine tuning." He is currently acting as Director, Bhaktivedanta Institute, Bangalore. His areas of interest in Science and Spirituality include Science of Bhagavad-Gita, Bio-feedback and Meditation, Effect of Prayers on Mind and Body, Japa Meditation and Personality Development etc.

1.4. Origin of Information in Artificial Intelligence Systems

Shri K Vasudeva Rao, *President, Bhaktivedanta Institute Kolkata, Indi (Alumnus, IIT Kanpur)*

We are in an exciting era of Artificial Intelligence systems development. There is great race for breakthroughs and dominance. While AI systems are surprising us with what they are capable of doing in terms of variety and depth of tasks. While it is fascinating to watch the growth of AI systems, it is worth examining the origin of information in them which powers them. All the AI systems first need to be prepared before they are put to use. They are prepared by training the model in the supervised or unsupervised modes. In this talk the speaker presents his view that the origin of information in AI Systems is consciousness.

Vasudeva Rao (also known as His Holiness Bhaktisvarupa Vrajapati Swami) obtained his M.Tech. (Computer Science, 1998) from IIT Kanpur, India. After a brief tenure of working as a software professional, he decided to significantly contribute himself to science spirituality interface under the able leadership and vision of Dr. T. D. Singh, the Founder Director of the Bhaktivedanta Institute. Presently, His Holiness is the President of Bhaktivedanta Institute and actively promotes discussion on science and spirituality. He is also the Editor of Bhaktivedanta Institute's reputed annual journal, Savijnanam – Scientific Exploration for a Spiritual Paradigm and travels widely across India and abroad. His deep interest in the Foundations of mathematics, fundamentals of computer science and Logic and its relation to nature of reality as well as ancient Indian texts led him to interact and meet renowned scholars at Harvard, Princeton, ETH, Stanford, and MIT. He has delivered several talks on 'science and spirituality', 'computation and Bhagavad Gita' and others.

2.1. Unraveling the Enigma: Exploring the Origin of DNA and Information

Nikhil Yenugu, *Ph. D. Scholar, IISER Kolkata*

The challenge lies in understanding how this complex information storage system originated. The origin of DNA and the information it carries is intertwined with fundamental questions about the origins of life itself. Key questions include: How did the first DNA molecules emerge? What processes led to the development of the genetic code? Did RNA or some other precursor molecule precede DNA in the evolution of life? Researchers investigate these questions using a combination of experimental approaches, theoretical modeling, and insights from disciplines like chemistry, genetics, and astrobiology. Theories range from the idea that the first self-replicating molecules emerged through a series of chemical reactions in a primordial soup, to more recent hypotheses involving the role of minerals or deep-sea hydrothermal vents in facilitating the emergence of life.

Understanding the mystery of the origin of DNA and the information it encodes not only sheds light on the early evolution of life on Earth but also has implications for astrobiology—helping scientists identify potential habitats for life elsewhere in the universe and guiding the search for signs of extraterrestrial life. As research progresses, the origin of DNA continues to captivate scientific inquiry, offering profound insights into the nature of life and its emergence on our planet and beyond. In my short presentation, we shall discuss from a probability standpoint on what forms the structure of living systems? What is the probability of a new emerging life-form in the evolutionary timeline? Does the genetic information be developed from molecules or should it require an interruption of intelligent-design?

Yenugu Nikhil is a third 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 has a keen interest in studies in the interface of foundations of science, science of mind, information and consciousness.

2.2. Information Paradox in Black Holes

Mayank Mishra, *Ph. D. Scholar*, *IISER Kolkata*

What is information in quantum physics, and how does it differ from that in classical physics? Discuss the law of conservation of quantum information, which states that quantum information is never lost. Black holes, as predicted by Einstein's equations of general relativity, are regions causally disconnected from the outside, preventing any information from being accessed. Stephen Hawking demonstrated that black holes radiate and possess a temperature, leading them to evaporate over time. After complete evaporation, it seems that the information is lost forever, creating a paradox: how can quantum information be lost if it is supposed to be conserved?

Mayank Mishra is doing his Ph.D. in Physics from the Indian Institute of Science Education and Research (IISER) Kolkata (joined 2022). He completed his M.Sc. in Physics from National Institute of Technology (NIT) Calicut, Kozhikode in 2021. His research interests include Neutron Star, Black Hole Thermodynamics, and High Energy physics. Apart from that he is also interested in exploring spiritual knowledge from our age old wisdom literatures.

2.3. Is Our Reality, Information Based Simulation?

Dr. Roshan Tiwari, *IISER Kolkata*

Is our reality fundamentally based on information, manifested as a simulated construct? Key aspects such as quantum indeterminacy, quantum entanglement and rendering processes have given us a hint of our existence within a simulated environment, operating inherently on an information-based framework similar to computers. We examine the role of entropy in the context of information dynamics. The information entropy and the information content associated with any system, event, or process in the universe tend to reduce over time in contrast to entropy increase according to the second law of thermodynamics. This leads us to contemplate the processes of information compression, akin to the compression of data in a computer. Synthesizing concepts from quantum mechanics, information theory, and thermodynamics provides a comprehensive exploration of the tantalizing prospect that our existence may be intricately intertwined with the flow and manipulation of information within a simulated cosmos.

Roshan Tiwari obtained his Ph.D. in Physics in 2023 from the Indian Institute of Science Education and Research (IISER) Kolkata and joining as a Postdoc at Wroclaw University of Science and Technology, Poland. He completed his B.Sc. in Physics from Banaras Hindu University (BHU), Varanasi, in 2014. His research interests include spectroscopy, bioinspired-waveguides, microscopy, sensing, optical trapping and statistical analysis. He has published several papers and proceedings in international journals. He is also interested in the connections of unexplored aspects of science and spirituality.

2.4. Information: Quantum Physics and Consciousness

Manali Verma, *Research Assistant, IIT Bombay*

Quantum physics offers insights into the nature of information through concepts such as quantum entanglement and quantum superposition. According to Quantum field theory, there is no empty space, instead the fields exist everywhere in the universe from minus infinity to plus infinity. Fields are the basic structure the universe comprises, having a particular energy, about which when provided any external source, will be treated as an excitation. Information is nothing but excitations in these fields giving rise to higher-order structures and patterns that are carried forward. Information is inherent in the fabric of the universe, shaping the dynamics of existence at all levels. Some theories propose that consciousness and information are intertwined, with consciousness serving as the substrate upon which information manifests and interacts. Contemplating the origin of information invites us to explore the deepest mysteries of existence and consciousness. As we continue to unravel the nature of information, may we approach this journey with humility, curiosity, and a reverence for the interconnectedness of all things.

Manali Verma is currently working as an RA in the Indian Institute of Technology-Bombay. Her research interests include Quantum Field theory, Quantum optics, Quantum diamond microscopy and magnetic sensing. She is also interested in exploring the role of consciousness with the current Quantum theories…

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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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About Gurukula Kangri (Deemed to be University)

Gurukul Kangri (Deemed to be University), located in Haridwar, Uttarakhand, is a prestigious institution deeply rooted in the ancient Indian tradition of Gurukul education. Founded in 1902 by Swami Shraddhanandaji, a disciple of Swami Dayanand Saraswati, Gurukul Kangri is dedicated to the pursuit of knowledge, spiritual growth, and the holistic development of its students.

The university's picturesque campus sprawls over acres of lush greenery on the banks of the Ganges River, providing a serene and conducive environment for learning and self-reflection. Steeped in history and heritage, Gurukul Kangri maintains the essence of traditional Indian education while embracing modern methodologies and technologies.

Gurukul Kangri offers a wide range of undergraduate, postgraduate, and doctoral programs across various disciplines, including Arts, Science, Commerce, Management, Engineering, Pharmacy, and Ayurveda. The university is renowned for its emphasis on academic excellence, research, and innovation, nurturing students to become leaders in their respective fields.

One of the distinguishing features of Gurukul Kangri is its commitment to character-building and value-based education. The university instills in its students a sense of integrity, social responsibility, and respect for cultural and spiritual heritage. Through a blend of academic rigor, extracurricular activities, and community engagement, Gurukul Kangri endeavors to shape well-rounded individuals who are equipped to navigate the complexities of the modern world with wisdom and compassion.

The faculty at Gurukul Kangri comprises eminent scholars, researchers, and practitioners who are dedicated to imparting knowledge and fostering intellectual curiosity among students. With state-of-the-art infrastructure, well-equipped laboratories, libraries, and research centers, the university provides ample opportunities for students to engage in experiential learning and cutting-edge research.

Beyond academics, Gurukul Kangri encourages students to participate in co-curricular and extracurricular activities, including sports, cultural events, and community service initiatives. These activities not only promote holistic development but also foster camaraderie, leadership skills, and a sense of belonging among students.

Gurukul Kangri takes pride in its alumni network, comprising accomplished professionals, entrepreneurs, scholars, and leaders who have made significant contributions to society across various domains. The university's alumni serve as role models and mentors, inspiring current students to strive for excellence and make a positive impact on the world.

As a beacon of knowledge and enlightenment, Gurukul Kangri (Deemed to be University) continues to uphold its timeless values while embracing the evolving needs of the contemporary world. With its unwavering commitment to academic excellence, ethical values, and holistic development, Gurukul Kangri remains a revered institution that empowers generations of students to realize their fullest potential and contribute meaningfully to society.

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About Haridwar

Haridwar, situated in the Indian state of Uttarakhand, is one of the most revered pilgrimage sites for Hindus. Nestled along the banks of the holy Ganges River, this ancient city is renowned for its rich cultural heritage, spiritual significance, and stunning natural beauty.

The name "Haridwar" translates to "Gateway to God," aptly reflecting its status as the entry point to the four sacred shrines in the Himalayas, collectively known as the Char Dham—Badrinath, Kedarnath, Gangotri, and Yamunotri. According to Vedantic tradition, Haridwar is one of the seven holiest places, or Sapta Puri, where drops of the elixir of immortality, Amrita, accidentally spilled from a pitcher during the battle between the gods and demons. This unique event is commemorated by the Kumbh Mela, a massive religious gathering that occurs every twelve years and attracts millions of devotees from around the world.

One of the most iconic landmarks in Haridwar is Har Ki Pauri, a ghat along the Ganges where pilgrims flock to take a dip in the river's sacred waters. The ghat is particularly famous for the Ganga Aarti, a daily evening ritual in which priests perform elaborate prayers and offerings to the river. The sight of hundreds of floating diyas (oil lamps) on the river, accompanied by the chanting of hymns and the ringing of bells, creates an ethereal and mesmerizing atmosphere.

Haridwar is also home to several ancient temples that draw countless devotees. The Mansa Devi Temple, perched atop the Bilwa Parvat hill, is dedicated to Goddess Mansa Devi and offers panoramic views of the city and the surrounding landscape. Another significant temple is the Chandi Devi Temple, located on the Neel Parvat hill, which is accessible by a scenic cable car ride. Both temples are integral to the religious circuit and hold immense spiritual importance.

In addition to its cultural pilgrim’s attractions, Haridwar offers opportunities for exploration and adventure. The Rajaji National Park, situated nearby, is a haven for wildlife enthusiasts and nature lovers, offering safaris and treks through its diverse ecosystems that are home to elephants, tigers, leopards, and a variety of bird species. The town also serves as a starting point for treks to the Garhwal Himalayas, providing a gateway to some of the most breathtaking trekking routes in India.

Haridwar's vibrant markets and bustling streets reflect the city's rich cultural tapestry. Local bazaars, such as the Bara Bazaar and Moti Bazaar, are famous for

their handicrafts, jewelry, unique cultural items, and Ayurvedic products. The cuisine of Haridwar, deeply rooted in traditional North Indian flavors, with specialties like aloo puri, kachori, and a variety of sweets that are a must-try for visitors.

The city seamlessly blends its ancient heritage with modern amenities, making it a unique destination that caters to both the devout and the curious traveller. Haridwar's serene ghats, sacred temples, and natural beauty, combined with its cultural vibrancy, create an environment that offers a profound sense of peace and spirituality. For those seeking a deeper connection with India's traditions and natural wonders, Haridwar stands as an enduring testament to the country's rich spiritual legacy.

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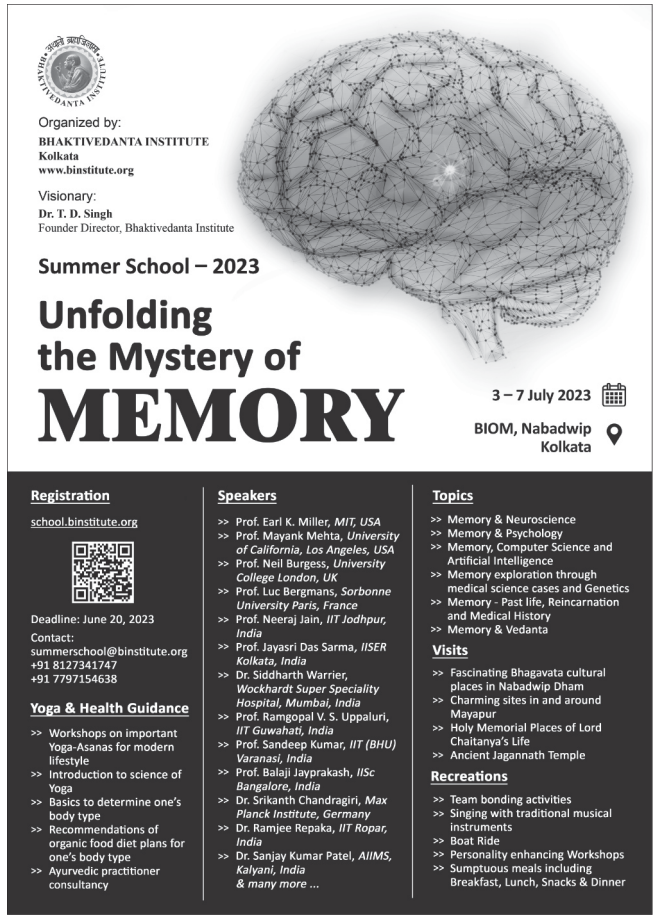
Previous Summer Schools



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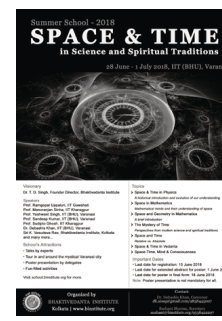

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Appreciations by past Summer School Participants

The way every lecture was presented, strong arguments were given to prove their points and they really widen my thinking.

– Prajwali Praveen Khirid

I liked how you connected spirituality to science and explained it very clearly and scientifically.

– Anitha Mandala

These kind of arrangement for delivering value education even at this pandemic influence where people are so much in depression and exhaustion being unable to be free to communicate properly outside. I am very much impressed with the beautiful arrangement made by BHAKTIVEDANTA INSTITUTE who worked so hard by themselves for the welfare of everyone. Thank you.

– Brajalika Devi

What was most amazing was that everyone, in their own way has to the best of their ability tried to expand, explain the existing facts and give a theory to what may be... And that's the first step to any research. This platform has been a yardstick to measure up against the best in the field, a way to glance at it through a window of safety (i.e. student's life) and prepare for what's expected in the field to come up successful if we step into research.

– Akash Dilip Tejwani

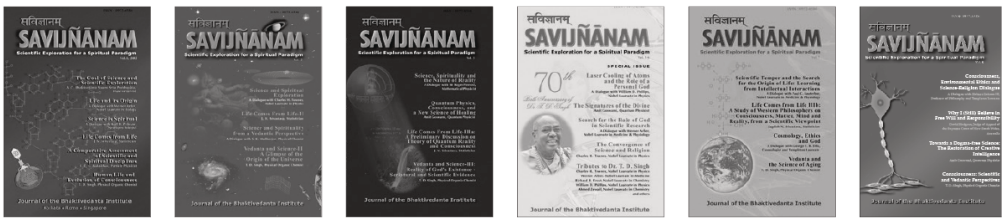
I liked the in depth knowledge and dedication of each of the teachers for their research.

– Siddharth Panwar

I really loved the explanation of Vedic perspective and why Science can't explain origin of life. Especially the session by Prof. Wickramsinghe and Prof Tour.

– Ravi Garg

Bhaktivedanta Institute's Publications



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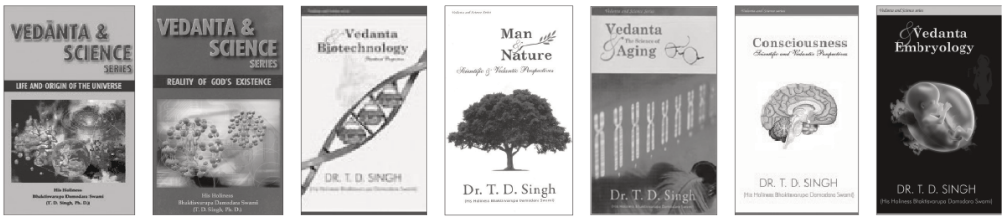

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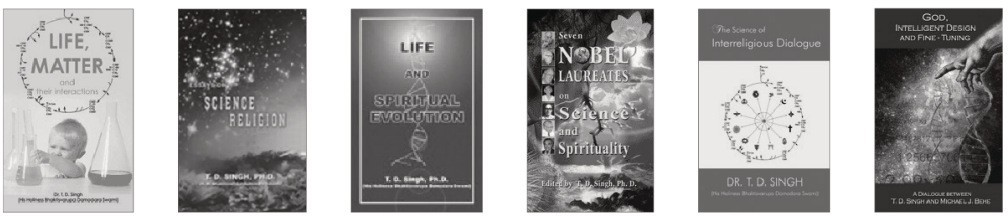

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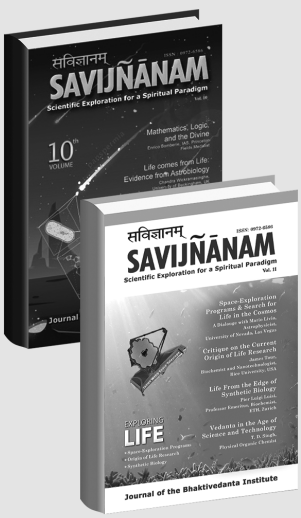

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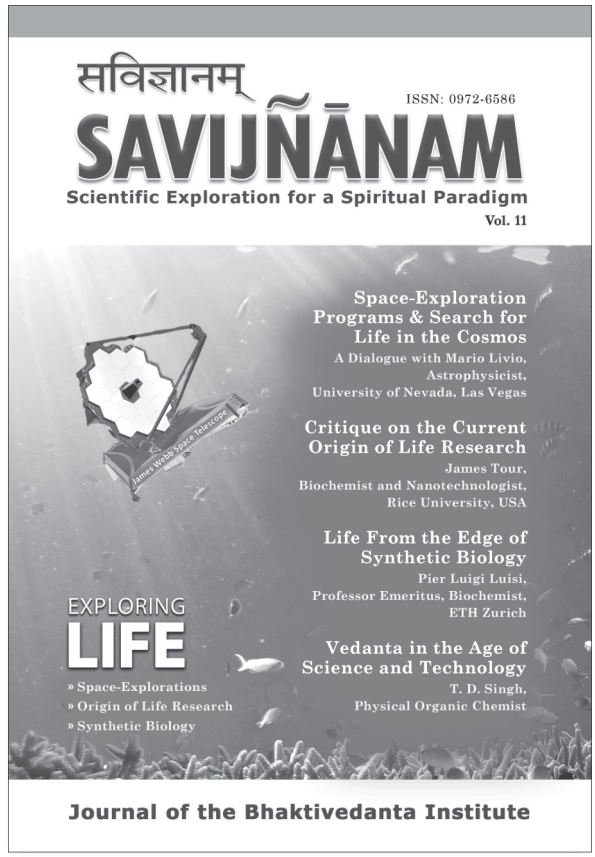

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- Prof. Mario Livio, *Astrophysicist, University of Nevada, Las Vegas.*
- Prof. James Tour, *Biochemist and Nanotechnologist, Rice University, USA.*
- Prof. Pier Luigi Luisi, *Professor Emeritus, Biochemist, ETH Zurich.*
- Dr. T. D. Singh, *Founding Director of Bhaktivedanta Institute, Kolkata.*

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