

Observation and Reality Cosmology and Consciousness VII

October 4th to 6th, 2018
Gangtok, Sikkim

Introduction

This conference, a 3-day cross-cultural exchange, brings together internationally based scientists in dialogue with 30 Buddhist monastic scholars. Foundational questions in quantum mechanics, have strong resonance in debates found between different Buddhist philosophical schools. How does the experimental evidence of modern physics intersect with Buddhist conceptions of causations, the observer, and how does the act of observation influence our measurements in nature? The monastics, and scientist alike, both steward traditions that strongly encourages dialogue and the open exchange of ideas.

The conference is connected to a 4-week workshop that trained 30 monastic scholars in a first time introductory science course. The course took place before the conference, from September 3rd to 28th. The monastics represent several different Buddhist traditions and monasteries within Sikkim and will participate in the conference panel discussions, and questions and answers sessions.

About the Conference Series:

"Cosmology and Consciousness VII - Observation and Reality" is the seventh conference in a series that convenes Buddhist scholars, and Western and Indian scientists in a 3-day dialogue to promote the integration of spiritual values and scientific investigations. The first conference, "Cosmology and Consciousness - a Dialogue between Buddhist Scholars and Scientists on Mind and Matter" was held in Dharamsala, in December, 2011, and was inaugurated by His Holiness the Dalai Lama. Our second conference on "Knowing and Action" was held at the Songtsen Library in Dehradun in 2013, our third conference on "Harmony and Happiness" was held in Dharamsala in 2014, our fourth "Quantum Mechanics and Emptiness" was held at Namdroling Monastery in Bylakuppe in 2015, our fifth conference on "Regulating & Transforming Emotions" was held at Sherabling Monastery in 2016, and our sixth conference on "Compassion, Virtue and Character" was held at Norbulingka Institute in 2017.

This year, our conference is organized by the Library of Tibetan Works and Archives (in Dharamsala, India) and the Namgyal Institute for Tibetology, and made possible from a grant from the John Templeton Foundation (Philadelphia, USA) and the ongoing generous support of the Sager Family Foundation (Boston, USA). In 1999, His Holiness the 14th Dalai Lama provided a vision and directive for the exiled Tibetan monastic community in India to engage science, and to initiate science trainings that would eventually support new learning at the frontiers of science and Buddhism. This conference series seeks to build upon this inspiration.

Form is empty. Emptiness is form. Emptiness is not other than form and form is not other than emptiness. Similarly, feelings, discriminations, compositional factors, and consciousness are also empty.

- from the Heart Sutra

Day 1

Morning - Session 1 (10:00 am to 11:30 am)

Lighting of Butter Lamp and Chanting by venerable monks.

Welcome address by Mr. Tashi Densapa, Director, NIT

Keynote Address by Geshe Lhakdor, Director, LTWA

Address by Honorable Governor, President, NIT

Tea Break

Morning - Session 2 (12:00 pm to 1:00 pm)

Moderator: TBD

Introduction to Key Concepts in Physics (from Classical to Quantum)

Theodore Hodapp

Quantum mechanics represents the work of hundreds of scientists across many decades to understand the fundamental laws that govern nature at the microscopic level. It is the most precise theory ever developed and has never failed an experimental test. In this introductory discussion, we will explore differences between classical physics (laws that predict the motion of everyday objects like chairs, the Moon, and bouncing balls), and quantum physics (which predicts how electrons, atoms, and protons behave). Fundamental concepts that underlie the discussions of the next few days will be discussed.

(45 minutes + 15 minutes Q&A)

Lunch

Afternoon - Session 3 (2:15 pm to 3:45 pm)

Buddhist Schools on Particles

Geshe Thabkhe

In Buddhism the concept of part-less particles is described with noted differences between the major philosophical schools of Buddhism. My presentation will describe the different schools and how we understand particles from a philosophical perspective, with a focus on the origins of particles, how they interact, and what is the nature of particles.

(25 minutes + 20 minutes Q&A)

The Double Slit Experiment

Anil Ananthaswamy

We will explore some of essential concepts in quantum mechanics by examining the double-slit experiment. The experiment, when done with single particles of light, becomes very compelling and difficult to explain using classical physics. Light sometimes behaves like a wave and sometimes like a particle, and at the heart of this wave-particle duality seems to be the act of observation or measurement, the choice of whether to observe the photon's particle nature or wave nature. The talk will discuss this duality, along with notions of indeterminism and the idea of quantum systems being in multiple states at once.

(25 minutes + 20 minutes Q&A)

DRAFT BROCHURE - ENGLISH

Tea Break

Afternoon - Session 4 (4:15 pm to 5:30 pm)

Panel Discussion 1: Causes & Effects
(45 minutes)

Introduction by Monastics Graduates (10 min)

AUDIENCE QUESTION AND ANSWER - BREAK OUT SESSION
(30 minutes)

Day 2

Moderator: Theodore Hodapp

Morning - Session 1 (10:00 am to 11:00 am)

Consciousness, Phenomena, and Observation - The relationship between subject and object in the four Buddhist philosophical schools **Khenpo Chawang**

According to two of the Buddhist schools, when we perceive the phenomena, the objects that we observe are intrinsically out in the world, and exist independently of any observation. In a third school, observations depend entirely on the mind, there is no outer reality. And finally, in the fourth school, all phenomena exist interdependently between subject and object and are thus void of existing inherently.

(25 minutes + 15 minutes Q&A)

Does the Quantum World Exist Before Observation? **Anil Ananthaswamy**

This talk will focus on a special case of the double-slit experiment called the Mach-Zehnder interferometer, done with single photons or particles of light. John Wheeler used this setup to design what he called the Delayed-Choice Experiment—in which the choice of whether to observe the particle nature or the wave nature of light is delayed until after the photon has entered the experimental apparatus and has “decided” to behave accordingly. By delaying the choice do we make the photon go back in time and undo its previous state? Or does the photon have no reality until observed?

(20 minutes)

Tea Break

Morning - Session 2 (11:30 am to 1:00 pm)

Panel Discussion 2: The nature of observation: Subject and Object *(45 minutes)*

Introduction by Monastics Graduates (10 min)

Measurement of Quantum Systems: state of knowledge and Ayattana **Areeya Chantasri**

Quantum states (including wavefunctions) are quantities describing quantum systems of interest. But how can we determine quantum states, especially when measurement destroys the states every time it is applied? We will explore ideas of generalized quantum measurement, quantum state tomography, and how they are used in some experiments. Among many interpretations; one can view quantum states as states of our knowledge which can change according to measurement results. This talk will also present possible

connections between this view of quantum theory and Buddhism's ideas of Ayattana, the six sense bases for sensation.

(25 minutes + 20 minutes Q&A)

Lunch

Afternoon - Session 3 (2:15 pm to 3:45 pm)

The problem of measurements in quantum mechanics

Ian Durham

Western philosophy traditionally distinguishes between problems of ontology (problems of existence or “being”) and problems of epistemology (problems of knowledge). Most modern physical theories are similarly very clear about what, within the theory “exists” and what constitutes knowledge. As a theory that is primarily concerned with the results of measurements, quantum theory presupposes the existence of a system that is under investigation (object) and, necessarily, a “measurer” (subject). But the theory is not clear about who or what qualifies as the subject. That is, it is not clear about which parts of the theory are ontic and thus refer to the object, and which parts of the theory are epistemic and thus refer to the subject. This is particularly problematic in cases where the act of measurement changes the very nature of the system under investigation. This is referred to as the quantum measurement problem and constitutes the fundamental tension between quantum physics and classical physics. In this talk, we briefly introduce the quantum measurement problem and some of the issues it raises.

(25 minutes + 20 minutes Q&A)

A Brief History of Quantum Nonlocality

Howard Wiseman

In plain quantum theory, the result of a measurement at one point in space can instantaneously change the quantum state at points arbitrarily far away. Albert Einstein was worried about this “action at a distance” and thought that plain quantum theory needed to have something added to it to fix the problem. Surprisingly, John Bell came up with a theorem (a mathematical proof) that such a fix is impossible: if the predictions of quantum theory are correct, then no theory of the type Einstein wanted can be valid. Moreover, recent experiments have confirmed the relevant predictions convincingly.

(25 minutes + 25 minutes Q&A)

Tea Break

Afternoon - Session 4 (4:15 pm to 5:30 pm)

Panel Discussion 3: Appearance versus Reality

(45 minutes)

Introduction by Monastics Graduates (10 min)

AUDIENCE QUESTION AND ANSWER - BREAK OUT SESSION

(30 minutes)

Day 3

Moderator: *Anil Ananthaswamy*

Morning - Session 1 (10:00 am to 11:00 am)

The Two Truths

Geshe Lhakdor

Form or any other existent phenomena is merely attributed by thought and naming as they appear or arise. When left without deeper investigation, it operates in a satisfactory way. It functions and is therefore not at all non-existent. Form and so forth thus has two aspects or identities: its conventional nature and its ultimate nature. The relationship between the conventional nature and the ultimate nature are like water and wetness. They are different but are of one entity, in that you cannot have the one without the other. The way the higher Buddhist schools explain ultimate truth or emptiness is not only more powerful in counteracting the misconception of the true existence of persons and phenomena, but also does not contradict phenomena's conventional reality.

(40 minutes)

Panel Discussion 4: What is objectively out in the world?

(20 minutes)

Tea Break

Morning - Session 2 (11:30 am to 1:00 pm)

Interpretations of Quantum Mechanics

Ian Durham

(20 Minutes)

Because quantum theory is not clear about which of its parts refer to things that exist and which of its parts refer to things that constitute knowledge, it requires interpretation. That is, since the theory does not specify what exists versus what is knowledge, physicists and philosophers must interpret what the theory is telling us. This has led to a wide range of interpretations of the theory. In this talk, we briefly summarize the various classes of interpretations and discuss how each class attempts to address the quantum measurement problem.

Bell's Theorem, Causation and Interpretations

Howard Wiseman

Bell's theorem can be stated in different ways, but one way, that may be of particular interest here: using ideas of causality. We will state, using very little mathematics, seven reasonable-sounding assumptions about the world and about causality, that, when taken together, lead to conclusions that have been refuted by experiment. Thus at least one of these assumptions must be wrong. This talk will discuss which assumptions are rejected by different versions of quantum theory.

(20 minutes)

Panel Discussion 5: Interpretations of Quantum Mechanics

DRAFT BROCHURE - ENGLISH

(50 minutes)

Lunch

Afternoon - Session 3 (2:15 pm to 3:45 pm)

Panel Discussion 6: Nature and Fundamental Principles of Physics and Buddhism

(55 minutes)

Introduction by Theodore Hodapp (10 min): Physics (and science in general) is governed by basic assumptions that allow it to be continuously improved, and refuted when assumptions are shown to be incorrect. This panel will explore some of these basic assumptions and seed a conversation on how science “knows what it knows.”

AUDIENCE QUESTION AND ANSWER - BREAK OUT SESSION

(35 minutes)

Tea Break

Afternoon - Session 4 (4:15 pm to 5:30 pm)

Panel Discussion 7: Quantum Physics and Ethics, Spirituality

(50 minutes)

Introduction by Howard Wiseman (10 min)

Closing Remarks - Geshe Lhakdor

(25 minutes)

Conference Presenters

Anil Ananthaswamy is a journalist and author. He teaches an annual science journalism workshop at the National Centre for Biological Sciences in Bengaluru, India. He writes regularly for the *New Scientist*, and other outlets such as *Nature*, *Quanta* and *Scientific American*. His first book, *The Edge of Physics*, was on cosmology and astroparticle physics, and his second book, *The Man Who Wasn't There*, explored the neuroscience of the human sense of self. His latest book, *Through Two Doors at Once*, tells the story of quantum mechanics told from the perspective the double-slit experiment.

Areeya Chantasri is a postdoctoral researcher working with Prof. Howard Wiseman, at Griffith University, Australia. She graduated with a PhD in Physics from University of Rochester, New York, USA. Her PhD dissertation is related to questions in Quantum measurement theory. Areeya grew up in Thailand and learned Buddhism from a very young age. She is intrigued by scientific questions on how nature works and in philosophical questions about our minds, life, its meanings, and our existence. She also has interests in communicating science to public audience, and has participated in programs teaching high school students about quantum physics.

Khenpo Chowang is a Buddhist philosopher and teacher, and currently teaches at Gonjang Nyingma Shedra in Gangtok, Sikkim. From 1978 to 1985, he served as Head Lama (teacher) in a local government (public) school in Sikkim, and in 1985, he was appointed as Khenpo of the Sikkim Institute of Higher Nyingma Studies. In 1990, Khenpo Chowang completed a PhD in philosophy from the Vishwa Bharati Shantiniketan, W.B. Before that he completed his Acharya course from Central Institute of Higher Tibetan Studies in Sarnath, India. Central Institute for Higher Tibetan Studies in Sarnath, India. In 2016, he retired after 30 years of service as a Buddhist philosophical teacher at the Nyingma Institute in Sikkim. Khenpo Chowang is a published author, with a book "A complete history of Sikkim" (2003) and he regularly participates in state and national seminars.

Howard Wiseman is a professor of physics at Griffith University in Australia. His research is in quantum theory, but he collaborates often with experimentalists. At one extreme, his work seeks to understand what quantum physics implies about the nature of the world. At the other extreme, it has potential applications e.g. in making better measurements, or in making communication more secure. He also has an interest in histories and legends, especially those that relate to Britain around 1500 years ago, and has written a semi-fictional book "Then Arthur Fought" based on his research.

Geshe Lhakdor is the director of the Library of Tibetan Works and Archives in Dharamsala, India. A distinguished Buddhist scholar, he was the English translator for His Holiness, the 14th Dalai Lama, for 16 years and has co-translated several of His books. He graduated from the Institute of Buddhist Dialectics, after 13 years of rigorous study. He also has a Master of Philosophy from the University of Delhi and a Geshe Degree (Doctor of Divinity) from Drepung Loseling Monastic University. He serves on several governing bodies and advisory boards in the Tibetan community, often at the direct recommendation of His Holiness the Dalai Lama, and is presently the chairman of the Education Council of the Central Tibetan Administration.

Geshe Thabkhe was born in central Tibet in 1979 and become a monk at the age of ten. In 1997 he came into exile, in India, and joined Sera Jey Monastery and in 2018 he completed his Geshe Lharampa (Doctor of Divinity). In 2004 he started attending science classes organized at his monastery by the Science Meets Dharma program and in 2007 joined annual workshops and leadership trainings organized by the Science for Monks program. In 2008, Thabkhe joined the Emory Tibet Science Initiative and was among the first batch of monks to study at Emory University. After returning from three years of study at Emory, in 2013, Thabkhe started teaching regular physics classes at his monastery.

Theodore Hodapp develops and directs education and diversity projects for the American Physical Society. Over the past 14 years he has developed programs to educate high school physics teachers, increase the number of women studying physics, and work to increase participation by underrepresented groups. Prior to this position he was a professor of physics at Hamline University. He also worked in industry, and national laboratories. His original scientific work was in experimental quantum optics.

Ian Durham is a physicist whose interests lie mainly in the deeper questions about the inner workings of the universe and the nature of reality. His two main areas of research focus on the intersection of quantum mechanics, relativity theory, and information theory, referred to as relativistic quantum information, and the foundations of physics, particularly the foundations of quantum mechanics and the nature of time. His research often touches on concepts in pure mathematics, astronomy, and even geology and engineering. He is a Professor and Chair of the Department of Physics at Saint Anselm College in Manchester, New Hampshire, an hour north of Boston.