
MIND and LIFE VI



Dialogues between Buddhism and the Sciences

THE NEW PHYSICS and COSMOLOGY

with
HIS HOLINESS
THE XIVth DALAI LAMA

Dharamsala, India
October 27-31, 1997

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THE NEW PHYSICS and COSMOLOGY

The **Mind and Life Dialogues** have provided unique opportunities for small groups of Western scientists to engage in concentrated, private discussions with H.H. the Dalai Lama and other representatives of the Tibetan tradition. The purpose of these meetings is to mutually inform and enrich both traditions about various issues pertaining to life and the mind. A key ingredient in these experiences has been that participants come to present their specialties and to participate in the dialogues in a spirit of truly open and free exchange.

"Mind and Life I" was held in October, 1987, in Dharamsala, India, and was the first attempt in this direction. It succeeded in opening up a deeper dialogue than had been possible under less favorable circumstances. It provided the impetus to continue the Mind and Life series into other specific topics. Edited parts of the dialogues from this meeting have been published as *Gentle Bridges: Conversations with the Dalai Lama on the Sciences of Mind* (J. Hayward and F. Varela, eds., Shambhala, 1992).

"Mind and Life II" was held in Newport Beach, California, in October 1989, in a shorter time span than the previous conference. Its intention was to focus discussion on important current topics in neuroscience with well-established North American researchers.

"Mind and Life III" was again held in Dharamsala in November 1990, in its original format. Its intention was to focus on the relationship between mental states and the healing process, as seen from both the Buddhist tradition and Western medical research. Daniel Goleman has edited and published an account of the dialogue in *Healing Emotions* (Shambhala, 1997).

"Mind and Life IV" was held in October 1992 in Dharamsala. Its intent was to focus on the delicate area of sleeping, dreaming and dying. Current knowledge about the strictly neuroscientific correlates of sleeping and dreaming were presented as well as the insights of many years of clinical work in the Western tradition of psychoanalysis concerning dreams and their role in neurosis and health. These presentations were complemented

with a description of the unique Tibetan tradition of dream yoga and "Bardo" teachings. Western clinical studies on so-called near-death states were discussed in connection with the Tibetan teachings. An account of the dialogue edited and narrated by Francisco Varela has been published in *Sleeping, Dreaming, and Dying: An Exploration of Consciousness* (Wisdom, 1997).

"Mind and Life V" was held in Dharamsala in October 1995. The dialogue focused on altruism and compassion in Western science, seen from a multi-disciplinary perspective. The meeting brought together scholars in psychology, philosophy, economics and the history of science. A historical perspective on the role of compassion in science and the bias in the study of negative rather than positive psychological states in the behavioral sciences was considered. The role of altruism in evolutionary biology and its relevance to understanding human motivation were discussed. The characteristics that determine whether people help other people in need was the focus of another presentation. Related topics concerned the conditions that give rise to genocidal violence, and the ingredients that are essential to positive socialization and the cultivation of altruism and compassion in children. Finally, the discussion focused on the relevance of altruistic motives to economic behavior. An account of the dialogue is being prepared for publication by Drs. Richard Davidson and Anne Harrington.

"Mind and Life VI" will explore contemporary understandings of the natural world that have arisen through groundbreaking advances in physics and astrophysics made during the twentieth century. These advances have exerted a profound influence on our conception of the world, changing it fundamentally from the views which reigned until the end of the nineteenth century. For example, through the careful study of atomic processes, quantum physics has raised deep epistemological and ontological questions, which are addressed with great sophistication and profundity in the Madhyamaka view expounded in Tibetan Buddhism. Likewise, general relativity, when taken together with recent discoveries concerning the distribution and movement of stars, has fundamentally transformed our understandings of space, time and the evolution of the universe. Here too, Tibetan Buddhism presents provocative theories and practices pertaining to our understanding of space, time and consciousness, which are arousing the interest of increasing numbers of Western scientists and philosophers.

While the main purpose of the meeting will be to explore the implications of the new physics and cosmology, we will also examine the methods of Western scientific inquiry and Buddhist contemplative inquiry, in order to understand the limitations as well as the power of each of these possibly complementary modes of research.

PARTICIPANTS

Tenzin Gyatso, His Holiness, the XIVth Dalai Lama of Tibet.

David Ritz Finkelstein, Ph.D., Professor of Physics, Georgia Institute of Technology.

George Greenstein, Ph.D., Sidney Dillon Professor of Astronomy, Amherst College.

Piet Hut, Ph.D., Professor of Astrophysics, Institute for Advanced Study, Princeton University.

Tu Weiming, Ph.D., Professor of Chinese History and Philosophy, Harvard University.

Arthur Zajonc, Ph.D., Professor of Physics, Amherst College.

Anton Zeilinger, Ph.D., Professor of Physics, University of Innsbruck.

INTERPRETERS

Geshe Thubten Jinpa, Ph.D., Cambridge University, U.K.

B. Alan Wallace, Ph.D., Visiting Lecturer, Department of Religious Studies, University of California, Santa Barbara.

PROGRAM



Monday, October 27, 1997

Morning Session

Professor Zajonc is the scientific coordinator of this Mind and Life meeting. He will introduce the meeting on Monday morning by briefly describing the ways in which physics and cosmology have been approached in Western natural science.

Professor Tu Weiming will assist Professor Zajonc in formulating the questions and issues we will explore together each afternoon. Through his intimate knowledge of Asian and Western cultures and their respective philosophies, Professor Tu will assist the participants in a careful engagement with the subject matter at hand from Asian as well as Western perspectives.

***Presentation: An Introduction to the Experimental
Foundations of Quantum Mechanics
Anton Zeilinger, Univ. Prof.***

Physics since the seventeenth century has been founded on observation and experimentation. Quantum mechanics is no exception. We will therefore begin by demonstrating a few of the most essential features of the quantum nature of light. These will include a demonstration of the famous two-slit experiment which shows the wave nature of light, and contrast that with the particle-like behavior of photons upon detection. Working from wave-particle duality, we will explore the more general principle of complementarity advanced by Niels Bohr. The detection of quanta is inherently probabilistic. The statistical uncertainty common to classical science is due to a lack of knowledge. By contrast, quantum events are objectively random. What is the source and significance of their difference? The irreducible influence of the observer on the observed is yet another essential feature of quantum mechanics and is embodied in the uncertainty principle of Heisenberg. Finally, perhaps the most distinguishing feature of quantum mechanics is "entanglement" which can occur in multi-particle systems. Entangled states are those in which the notion of individual properties of objects loses meaning.

Afternoon Session

Discussion theme: An exploration of the morning's themes, from both the Tibetan Buddhist and Western scientific/philosophical perspectives. What is Buddhism's understanding of the ultimate constituents of substance? What is the relationship between observer and observed in both traditions? How can one understand the relationship between two objects after they have interacted (i.e., entanglement)? In what sense are the properties of an object inherent, or, alternatively, do they arise through the act of observation?

Tuesday, October 28, 1997

Morning Session

***Presentation: Space, Time and Quantum Paradoxes
David Finkelstein, Ph.D.***

Modern physics made two extensions of relativity in the early twentieth century. The first was Einstein's relativity of space and time. The second, which went deeper, was Heisenberg's "non-objective" quantum theory, with its relativity of ontology. Einstein's spacetime physics deals with signals. It limits how fast information can get from one system to another. It leads to a fundamental paradox: Twins can have different ages depending on their travels. Heisenberg's quantum physics deals with actions of an experimenter on an otherwise isolated system. It limits how complete the information of the one system about the other can be. It too leads to a pair paradox: Opening a second path can stop a flow. This is easily demonstrated with a laser and two slits, or with three polarizers.

The quantum paradox leads to a revised logic of actions. The laws explicitly mentioned by Aristotle still work: A or not A; not both A and not A. But we used to think that "A, and either B or not B" is equivalent to "A and B, or A and not B." This does not hold for quantum predicates. All the quantum paradoxes are examples of this anomaly.

The spacetime and quantum paradoxes both say that the result of two actions depends unexpectedly and counterintuitively on the order in which we carry them out. For both spacetime physics and quantum physics the actions in question can be exactly represented by changes in a picture due to changes in the perspective of the viewer.

Descriptions of the new quantum physics in the ontological terms of the old classical physics are common and make quantum theory sound much stranger than it actually is.

Afternoon Session

Discussion themes: Some physicists are working to extrapolate quantum theory to the elements of spacetime. Is it possible that a quantum unit of spacetime, in contrast to a truly discrete unit, would not violate the observed laws of energy and momentum conservation? Is it possible that the concept of an irreducible space-time event is also relative, namely to our modes of interaction? Such considerations would suggest the process of relativization may not be over.

Wednesday, October 29, 1997

Morning Session

Presentation: *The Relation Between Scientific Knowledge and Human Experience.*

Arthur Zajonc, Ph.D.

Major conceptual changes in our view of the world have been prompted by developments in twentieth-century physics. Yet this physics continues to rest on a traditional and often unconscious understanding of what does and does not constitute science. The discoveries of quantum mechanics and relativity theory challenge one part of the conceptual framework of classical physics, but it leaves another aspect in tact and unexamined, namely the relationship of science to subjective and ethical dimensions of life. Historically science has considered itself immune to or beyond such considerations, but we can ask whether this is justified. In an effort to objectify phenomena, qualitative experience is systematically replaced by formal and abstract elements of theory. These theoretical representations are then treated as the hidden realities behind phenomena. We will explore the manner in which this takes place in two instances, one drawn from classical physics the other from quantum physics.

This systematic replacement of nature has led to an intellectual and technical mastery over nature, but we can inquire concerning possible downsides and alternatives. Might it be possible to reframe science to include subjective experience, and what would be the merits of doing so?

We will examine particular attempts to integrate subjective or qualitative experience into scientific research methodology.

Finally we will treat the ethical implications of these competing approaches in the context of this century's dramatic technical developments as exemplified by atomic energy.

Afternoon Session

Discussion themes: What is the relationship between experience/experiment and scientific theory? Likewise, what is the relationship between experience and knowledge in Buddhist thinking?

Both modern science and Buddhist philosophy possess highly developed, formal descriptions that are articulated in a technical language. What are the benefits and dangers of this approach? What is the relation between formal theory and insight or discovery? Buddhism speaks about the twin goals of wisdom and compassion. In research are these complementary endeavors, or can they be integrated into a unified approach?

Thursday, October 30, 1997

Morning Session

Presentation: *An Introduction to Modern Cosmology*

George Greenstein, Ph.D.

Advances in observational astronomy have allowed astronomers to see to the very edge of the universe, and to study celestial objects in unprecedented detail. On the basis of their observations and modern astrophysical theory, traditional questions can be framed anew.

Is the cosmos infinitely old or did it have a beginning? Is it infinitely large or does it have an edge? Remarkably, these and many other ancient ques-

tions have been given new life by modern astrophysical discoveries. A variety of studies all provide evidence that some extraordinary event occurred 10–15 billion years ago: however, it is not known whether this constituted the true origin of the universe. Similarly, Einstein's idea of curved space resolves the paradox posed by the notion of an edge of the universe, but current evidence supports the model of an infinite cosmos, and the problem of how to comprehend something infinitely large has been thrown into question by recent studies of the distribution of galaxies in space.

Dr. Greenstein will also discuss the role life plays in the universe, and the highly speculative idea that has been put forward that the universe is "fine tuned" for life.

Afternoon Session

Discussion themes: What, if any, are the implications of a "closed" versus an "open" universe? What are the fundamental assumptions of modern cosmology? How do they affect our understandings of the cosmos? A serious scientific search is underway for intelligent extraterrestrial life (SETI). Does Buddhism have a view on this possibility? Western physical science regards life as a phenomenon derived from the workings of inanimate objects. Is this a valid view? Can Buddhist thought help us formulate ways to think about something that might be infinite?

Friday, October 31, 1997

Morning Session

**Presentation: *Natural Science and Philosophy:
In Search of a World View*
Dr. Piet Hut**

The enormous success of the physical sciences stems from a sensitive interplay between theory and experiment. Viewed from afar, science may seem to have grown in a steady process. A closer look, however, reveals the fact that the underlying ideas and concepts have changed as much as the resulting predictions and applications. Science retains its vitality ex-

actly because there is a willingness to start from scratch, whenever necessary, in order to uncover a more basic layer of understanding. This implies that the conceptual structures erected in science are built in a rather unusual way: everything keeps afloat, even when the 'foundations' are taken out and replaced altogether. From a phenomenological point of view, the real basis for science lies elsewhere, in what is given in experience, before the various filters of science are applied. These filters determine what may pass through, from the full human experience to the description of scientific experimentation and observation. Through a detailed investigation of these filters, we can gain a clearer understanding of the logic inherent in the various physical sciences. We are then in a better position to compare the scientific world view(s) with other ways of viewing the world.

Afternoon Session

Discussion themes: What is the status of a scientific world view? How does it compare with the various religious world views? Would it be possible to find a common ground within religious world views, resembling something like the universality inherent in science? How does the role of experiment in science compare with the role of experience in religions? Science, after starting with an ideal of objectivity, is extending itself to contemplate the role of the subjective, across the board, from physics, to biology, psychology, and artificial intelligence. Can science find inspiration from other world views, to carry out this transition?

ABOUT THE PARTICIPANTS

His Holiness the XIVth Dalai Lama, Tenzin Gyatso, is the spiritual and temporal leader of the Tibetan people. He was born on July 6, 1935 in a small village called Taktser in northeastern Tibet. Born to a peasant family, His Holiness was recognized at the age of two, in accordance with Tibetan tradition, as the reincarnation of his predecessor, the XIIIth Dalai Lama. The Dalai Lamas are manifestations of the Buddha of Compassion, who chose to reincarnate for the purpose of serving human beings. His Holiness has traveled extensively, speaking on subjects including universal responsibility, love, compassion and kindness. In 1989, His Holiness received the Nobel Peace Prize.

David Ritz Finkelstein teaches and studies physics at Georgia Institute of Technology and edits the *International Journal of Theoretical Physics*. When he learned in college that quantum physics revises the logic for physical system, he began working to extend quantum logic to still deeper levels of physics. As offshoots and by-products of this main interest, he has contributed to early work on the topology of the gravitational field, the concept of the black hole, the gauge theory of the electroweak interactions, and quantum theory. As a result of this study he has elaborated the Copenhagen epistemology into a relativistic philosophy which he calls praxism, based on entities with modes of interaction rather than states of being.

George Greenstein is the Sidney Dillon Professor of Astronomy at Amherst College. He received his B.S. from Stanford and his Ph. D. from Yale, both in physics. Initially his interests centered on research in theoretical astrophysics, but later they shifted to writing. He is the author of numerous works interpreting science for nonscientists. His first book, *Frozen Star*, was the recipient of two science-writing awards. In conjunction with Arthur Zajonc he is the author of a recent textbook titled *The Quantum Challenge: Modern Research on the Foundations of Quantum Mechanics*, which discusses the problems of interpretation posed by quantum mechanics.

Piet Hut is Professor of Astrophysics at the Institute for Advanced Study in Princeton, where he has been since 1985. He is currently involved in a Tokyo-based project aimed at developing a special purpose computer for simulations in stellar dynamics, with a speed of 1 Petaflops. Besides his work in theoretical astrophysics, much of his research has a broadly interdisciplinary character: he has co-authored papers with computer scientists, particle physicists, geologists, paleontologists, psychologists, and philosophers. During the last few years, he has organized a series of workshops to investigate the character of intrinsic limits to scientific knowledge. There are three main questions he has focused on. To what extent can limits be seen as dictated by the structure of human knowledge? To what extent are limits given in the structure of nature itself? And to what extent are limits inherent in any attempt at mapping reality into a model?

Tu Weiming was born in Kunming, China, and educated in Taiwan and North America. He joined Harvard University as Professor of Chinese History and Philosophy in 1981 and is the director of the Harvard-Yenching Institute. He has lectured at Peking University, Taiwan University, Chinese University in Hong Kong, and the University of Paris. His books include *Neo-Confucian Thought: Wang Yang-ming's Youth; Centrality and Commonality, Humanity and Cultivation*; and *Confucian Thought: Selfhood as Creative Transformation*. A member of the Committee on the Study of Religion at Harvard, the chair of the Academic Sinica's advisory committee on the Institute of Chinese Literature and Philosophy and a fellow of the American Academy of Arts and Sciences, Professor Tu Weiming is currently interpreting Confucian ethics as a spiritual resource for the emerging global community.

Arthur Zajonc is Professor of Physics at Amherst College. He has been a visiting professor and research physicist at the École Supérieure in Paris, the Max Planck Institute for Quantum Optics, and the Universities of Rochester, Innsbruck and Hannover, where he did research in the areas of atomic and laser physics, quantum optics and the experimental foundations of quantum mechanics. In addition, he lectures widely on the history and philosophy of science, and the relationship of science to contemporary life. For the past two years he has been on leave from Amherst College to serve as a Program Director at the Fetzer Institute in Kalamazoo, Michigan, in the area of science, consciousness, and spirituality. He is the author of *Catching the Light: The Entwined History of Light and Mind*, co-author with George Greenstein of *The Quantum Challenge* and coeditor of *Goethe's Way of Science*. He is President of the Anthroposophical Society in America and the Lindisfarne Association.

Anton Zeilinger is Director of the Institute for Experimental Physics and Professor of Physics at the University of Innsbruck in Austria and a member of the Austrian Academy of Sciences. He was awarded the European Optics Prize in 1996. His research interests are in the foundations of quantum physics. His research group aims to demonstrate the novel counterintuitive quantum phenomena through experiment. This work is paralleled by theoretical investigations into the structure of quantum mechanics and epistemological investigations into the kinds of statements about the world that can be made in view of quantum physics.

INTERPRETERS

Geshe Thubten Jinpa was born in Tibet in 1958. He received his early education and training as a monk at Zongkar Choede Monastery in South India. Later he joined Shartse College of Ganden monastic university, where he received the Geshe Lharam degree. He also holds a B.A. honors in Western philosophy from Cambridge University. He recently finished his doctoral thesis at Cambridge on the concept of self in Tibetan thought. Since 1985 he has been a principal English translator to H.H. the Dalai Lama. He has translated and edited several books by the Dalai Lama including *Good Heart: The Dalai Lama Explores the Heart of Christianity* (Routledge, 1996). He is the Margaret Smith Research Fellow in Eastern Religion at Girton College, University of Cambridge, UK.

B. Alan Wallace has devoted himself since 1970 to the study and practice of Tibetan Buddhist philosophy, psychology and meditation. Trained for ten years in Buddhist monasteries in India and Switzerland, he has taught Buddhist theory and practice in Europe and America since 1976, and has served as interpreter for numerous Tibetan scholars and contemplatives, including H.H. the Dalai Lama. He is presently a Visiting Lecturer in the Department of Religious Studies at the University of California, Santa Barbara, where he has been asked to start a program in Tibetan Buddhist studies. He is the author of *The Bridge of Quiescence: Experiencing Buddhist Meditation*, *Choosing Reality: A Buddhist View of Physics* and *Tibetan Buddhism from the Ground Up*.

ACKNOWLEDGEMENTS

This event has been made possible through support from:
the Hershey Family Foundation, Concord, Massachusetts
and the Fetzer Institute, Kalamazoo, Michigan

*We also gratefully extend our appreciation
to the following organizations for their assistance:*

The Private Office of His Holiness the Dalai Lama
The Glenmoor Cottage, Dharamsala
Middle Path Travel, New Delhi
Maazda Travel, San Francisco
Sincerely Yours, Boulder Creek, California
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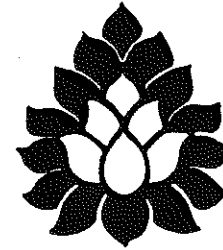
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*"This is my simple religion. There is no need for temple;
no need for complicated philosophy.
Our own brain, our own heart is our temple;
the philosophy is kindness."*

His Holiness The Dalai Lama



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