



BRIDGING THE TWO WORLDS

CONFESSIONS OF A BUDDHIST THEORETICAL PHYSICIST

By FRED COOPER

Until recently, I was not willing to discuss the relation between Science and Spirituality, not because of any distrust of my understanding of physics, but because my meditation practice had not reached the necessary maturation to feel confident about discussing spiritual matters to non-meditators. It was only about 10 years ago, after practicing for 27 years, that I was able to integrate my experience of being introduced to the nature of mind (by two of my root teachers, VV Mingyur Rinpoche and H.E. Tai Situ Rinpoche) to achieve a stable “glimpse of recognition.” After this event I felt I had the credentials in both domains to make some statements about the connection between physics and spirituality. I was encouraged to talk about this subject by one of my Tibetan gurus, the late Traleg Kyabgon Rinpoche in 2010. During that year, I gave several talks and meditation workshops on Physics and Emptiness at his request. In the present article, I am happy to share my thoughts on how physics and meditation are related based on my career as a theoretical physicist and on my training in the Mahamudra approach to meditation in the Tibetan Buddhist tradition.

In the previous century, especially in Europe, it was quite normal for scientists to have an interest in spiritual questions. It is well known that Erwin Schrödinger, considered by some to be one of the “fathers” of quantum mechanics, had a lifelong interest in Vedanta. At the close of his book *What Is Life?* he discussed the possibility that individual consciousness is only a manifestation of a unitary consciousness pervading the universe. In contrast to this open interest in Europe and Asia, the climate in the U.S. has been for scientists to refrain from discussing their spiritual interests. A notable exception is the recent article by the Russian Cosmologist Andrei Linde on the “Universe, Life and Consciousness.” In that article he asks the following intriguing questions based on his understanding of quantum cosmology: “Is it not possible that consciousness, like space-time, has its own intrinsic degrees of freedom, and that neglecting these will lead to a description of the universe that is fundamentally incomplete? What if our perceptions are as real (or maybe, in a certain sense, are even more real) than material objects?”

Outside the domain of Physics, recent neuroscience research showing the effect of meditation on brain function has led to more discussions about the potential for meditation techniques to alter our habitual patterns as a result of neuron plasticity. To the extent that this encourages people to practice mindfulness, this type of research can only be positive. The main caution here is that one can analyze mathematically Mozart or Beethoven’s music, and explain why certain techniques lead to certain emotional consequences, but this does not substitute for the experience of listening to the music directly.

In discussing science and spirituality, one has to first understand that science is an endeavor whose paradigms are continually shifting as we learn more about the phenomena that take place in this relative reality. The fact that throughout history the conceptual frameworks or paradigms of science have changed, was the subject of Thomas Kuhn’s classic “The Structure of Scientific Revolutions” published in 1962. This is a fact that is often overlooked by the general populace, and even by some scientists. When new information or data appears that does not fit into the current encoding used by scientists, then the way of describing and interpreting what is going on needs to get changed. This is what Kuhn calls a paradigm shift. This is to be contrasted with the changeless nature of “ultimate reality,” which cannot be described conceptually but needs to be directly experienced. “Ultimate reality” according to Buddhist philosophy is the direct experience of non-conceptual awareness itself.

One of the early attempts to discuss science and spirituality was the *Tao of Physics* by Fritz Capra. However, this book ignored the fact that conceptual frameworks in physics are continually changing and it failed to give a clear picture of the spiritual path. Capra relied on a conceptual framework for understanding particle physics called the “bootstrap approach”—that everything is made up of everything else. This idea eventually led to string theory, but the conceptual frame-

work for understanding particle physics soon shifted away from “bootstrap” ideas back to the idea that there are fundamental particles such as quarks and electrons interacting via gauge fields. This theory, called the “Standard Model,” unifies strong, weak and electromagnetic interactions. In spite of the flaws of the *Tao of Physics*, this book did get people interested in the question of the relationship between physics and spirituality. However, it led to the false impression that recent advances in physics “validate” the claims of spiritual traditions and that physics is based on an *unchanging* conceptual framework.

In this article I first would like to address the question “Do Physics and Buddhism have a common ground?” Both purport to be systems for understanding the nature of reality. Physics assumes there is an objective universe in which the dynamics of particles can be encoded using mathematics. The objects that occur in the equations can be related to objects in the “real world.” Objective Reality (what Buddhists call relative reality) is what one experiences through his or her senses, extended by various instruments, which allow us to access various regions of the micro and macrocosm not accessible by our ordinary senses. The encodings of the dynamics, which are called theories or “Laws of Nature,” are empirically adequate when they accurately describe what is observed in experiments. Causality is that the world is described in terms of differential equations and that given appropriate initial conditions one can determine outcomes in the future. In Newtonian encodings it was thought originally that these led to absolute predictions about the future, but chaos theory has loosened that idea. The reason that predictability is problematic is that under many conditions the equations governing the dynamics are sensitive to initial conditions. This occurs as soon as the dynamics is defined by three or more differential equations. In these systems, if we just change slightly the initial conditions the outcomes diverge exponentially. This is one of the reasons that the weather cannot be predicted over long time periods. In the quantum domain, the causality implicit in the Schrödinger equation determines only the probability for various outcomes.

Once a physicist knows this mathematical encoding and what the basic forces are—such as strong, weak, electromagnetic and gravitational—then he or she might think that they “understand reality.” He or she then knows how things work and therefore feels content. In studying the history of physics, we find that as new data appear that is contra-factual to the current worldview then the conceptual framework for thinking about the world changes. Currently there are alternate ideas about what is the correct theory of elementary particle physics as well as what is the correct theory of cosmology. How one should interpret measurements in Quantum mechanics is also being debated. In cosmology, the original idea of a single “big-bang” starting the universe is also being challenged. Instead, the idea that there is continuous creation of universes, each with different laws of physics, has been put forth by Andrei Linde and other cosmologists, and is gaining

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traction. One point that has to be made clear is that the laws of physics are continually being updated and refined as we gain more data of both the cosmos and the micro-cosmos. When the laws are updated, the conceptual framework for understanding the physical world also changes, often dramatically.

In contrast, Buddhism makes a distinction between relative or conventional reality (that which is addressed by physics and other sciences) and absolute reality, although they are considered inseparable. Absolute reality is beyond conceptualization so that it cannot be described by words or equations. It relates to the nature of mind itself. For meditators, conventional reality is seen to be a result of interdependence (various causes and conditions coming together) and one investigates this in analytic meditation. In Buddhist philosophy one often talks about different aspects of space and time and even the concept of atoms, but this is to obtain an experiential understanding of interdependence as well as the emptiness (lack of inherent existence) of phenomena. The path in Buddhism is to realize that apart from the “nature of mind itself” all phenomena as well as the various mental states are due to interdependence (causes and conditions coming together and then dispersing). One sees that there is a causality principle but does not try to encode it using mathematics. The goal is to realize one’s true nature, the nature of mind itself, and from that non-dualistic perspective unravel the habitual patterns that cause us to solidify a sense of self and phenomena. Recognizing our primordial awareness allows us to transcend suffering by realizing that suffering is often based on a misperception of how things are. When we investigate phenomena, we realize they depend on our particular set of senses. In interacting with people, we use dualistic concepts such as self and others, friend and enemy, so that we can safely navigate our world. However, on deeper investigation, we realize that these are just conventions, and that in clinging to these conventions we forget that all composite things are impermanent. As a result, we get angry when things change, when people change, when our situations change, or when our health changes, because we don’t want impermanence. We are somehow cheated by our conventions and conceptualizations. Although physics allows one to encode change it does not address how we relate to change in terms of our emotional states. The worst culprit is when we define our self as “I” and then cling to that definition, such as I am a lawyer, doctor, or housewife, or I am clever or beautiful. This further leads to the result that anyone challenging our self-identity becomes a threat, becomes an enemy. By clinging to concepts, we don’t relate to reality directly but rather through the filter of concepts.

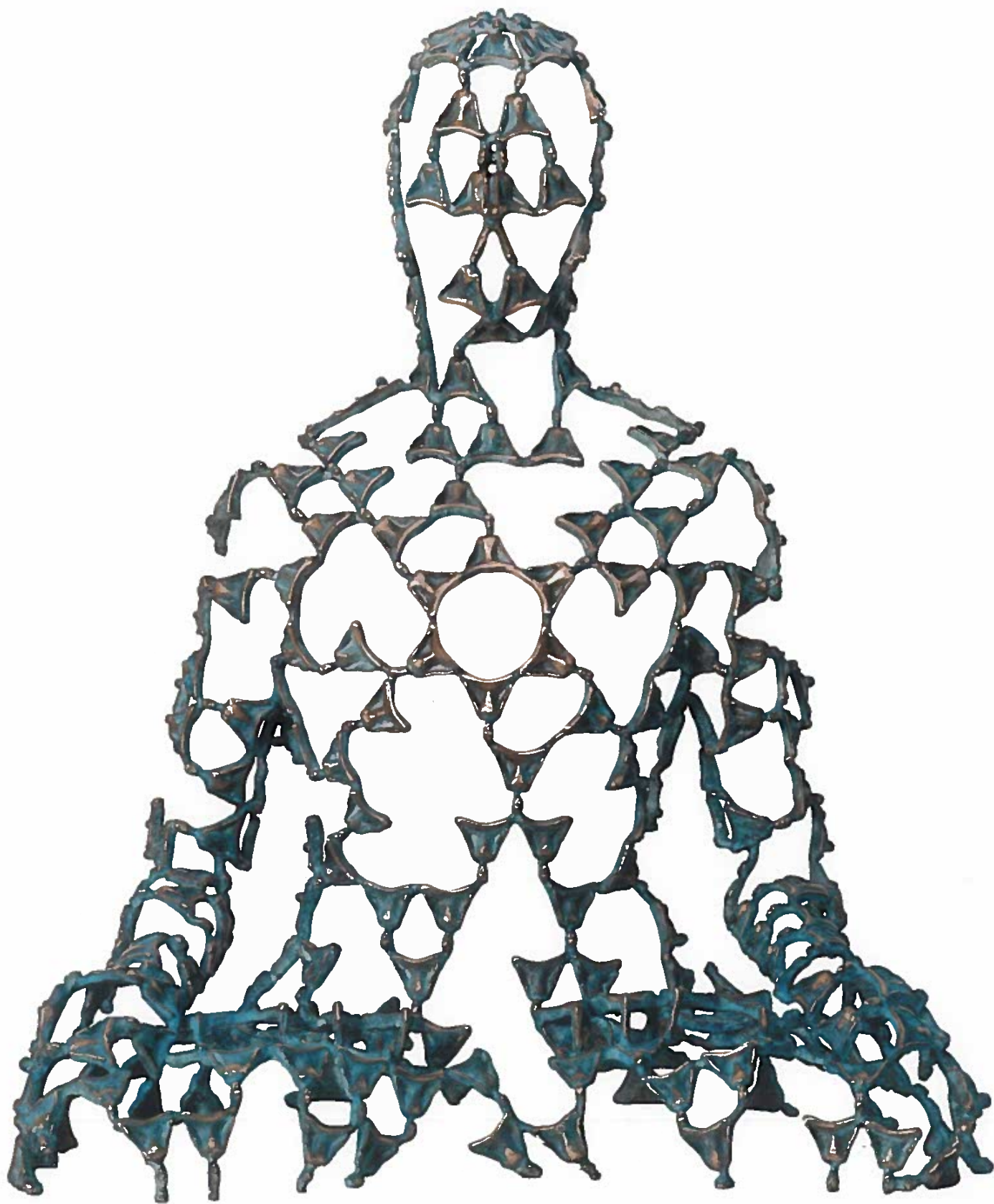
The purpose of a spiritual path is to loosen the hold of these habits of clinging to concepts so that we can see things clearly. Then we will have more freedom and less suffering by not trying to do what is impossible—wanting things to be other than they are, i.e. always changing. A physicist intellectually understands that everything is changing and

understands the different levels of space and time. When he sees a cup, he knows intellectually that “cup” is just a convenient way of describing what we use to drink liquids, and it is mostly space filled with some matter whose composition depends on the size scale we are observing. As we go to shorter distances we see molecules, then atoms, then nuclei, then quarks. The discipline of physics might then lead to the satisfaction of knowing how things work on a subatomic and even cosmic level. It does not offer a path to use that knowledge to then experientially understand “emptiness” and then use that to undo the habitual patterns that prevent us from being directly present. These differences between Buddhism and physics can be understood in terms of the Buddhist categories ground, path, and fruition.

The “ground,” or basic assumption in physics is that one can encode the interaction between particles as well as fields via mathematical equations. In particular, scientists use differential equations to describe how different variables change continuously in time and in space. This encoding gets modified as new phenomena are discovered that either contradict the current encoding or are not covered by the encoding. The objects in the equations have correspondences in the physical world. There have been two different ideas about space and time: that things evolve in a background space-time as in Newton’s Laws or that space and time are emergent phenomena. Leibniz and Einstein presented the notion that the interaction between particles and fields simultaneously create the space and time continuum.

In Buddhism, the ground is that we all have the ability to view the world from a non-dualistic perspective, i.e. we all possess the same “nature of mind” which can be somehow described by the terminology non-conceptual spaciousness and knowingness. This nature of mind, or “base awareness,” is not affected by thoughts and feelings, which are the “clarity aspect” or ‘outflowing awareness’ aspect of the mind. The nature of mind can be hinted at by using the terminology—the union of emptiness and clarity, or emptiness and compassion, or by the more mundane terminology “base awareness” in contrast to “outflowing awareness.”

The path (of training) in physics might be described as follows: one first has to discipline the mind by learning branches of mathematics relevant to physics: analysis, geometry, differential equations, probability theory, topology, etc. One then learns kinematics or how one describes motion, position, velocity, orientation, classical and quantum mechanics, classical and quantum electrodynamics (field theory), and statistical physics. After that, one makes incremental exercises in extending existing solved problems and hones one’s skills. Then when one is faced with new phenomena or data one lets go of the straightforward rational approach and “surrenders to the muse.” One has to allow for all parts of one’s experience (intellectual, visceral and imaginative) to respond to the challenge. This is a totally non-rational process, the result of which has to be put into a rational presentation in terms of equations so that it can be shared with



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other scientists. This process may or not be successful, and its success depends on “grace,” or as the Greeks would put it “successfully courting the muse of Physics.”

The path (of training) in Buddhist meditation according to Sutra Mahamudra is that one first trains the mind to be focused (calm abiding meditation) and then one uses that ability to observe awareness itself (insight meditation). Calm abiding meditation is developing mindfulness and the ability to focus the mind without wandering. One observes objects of the five senses, and then our thoughts, and finally one rests in objectless meditation. Once stability in calm abiding meditation is established, then one progresses to insight meditation. Insight meditation is observing the observer and verifying for oneself experientially what is the nature of awareness. Is it a conceptual spaciousness imbued by knowingness? Is it inside or outside the body? One has to verify what it is or is not directly. This is akin to learning algebra and geometry and then learning calculus, topology and group theory. After we do analytic meditation on the nature of mind, we then let go of our insights and just rest in the results of the investigation—rest in the calmness and clarity.

The fruition for a physicist is gaining intuitive conceptual and non-conceptual understanding and wonderment of the phenomena one is trying to understand. There is always more to be learned about even the simplest phenomena. As in meditation, in order to understand one phenomenon perfectly you have to understand everything, which is quite impossible. So there is always more to be learned about quantum mechanics, quantum gravity and cosmology.

The fruition in Buddhism is experiencing non-conceptually the nature of the mind, which then allows one to unravel the habitual patterns that lead to suffering. This results in immense freedom in our lives. When one abides in the nature of mind one realizes that thoughts, feelings and concepts are part of the radiance of the mind and not separate from the mind.

In both disciplines the fruition depends on “grace.” Being open to inspiration that leads to a fundamental change in how one intuitively either objective reality in physics or subjective reality in Buddhist meditation (nature of mind). In both disciplines receiving grace is never guaranteed.

The next subject I want to address is how the path of meditation has helped me be a better scientist and conversely how being a theoretical physicist has helped me on the Buddhist path.

Concerning the first question, calm abiding meditation develops mindfulness. This allows me to listen to a talk by a fellow scientist without my mind wandering and without the internal chatter of judging and comparing getting in the way of obtaining information. When I was a science manager, doing loving kindness and compassion meditation helped create an atmosphere of trust in the work place. This enabled people to trust in sharing ideas without worrying about being “attacked” or denigrated or in the worst scenarios, fear of having their ideas stolen. Also, when doing research, I know

that physics works in a conceptual framework that is not “real.” It is just an encoding that is empirically adequate (explains correctly what is known at the time). This knowledge has helped me to not take my work so seriously and I am not so attached to a particular scenario as having to be the correct one. I have also become less attached to obtaining a pre-conceived outcome for my research.

Concerning the second question: as a physicist, I certainly know that chairs are not solid objects and when we look at deeper levels we then see molecules, atoms, nuclei, quarks and electrons. If we try to go to shorter distances and times, space and time lose meaning because of quantum fluctuations of the metric that defines space and time. During the earliest times in the history of the universe, as we go back to pinpoint the origins of the Big Bang, energy densities became so high that the gravitational interaction between elementary particles becomes as important as the strong interaction (important in nuclear physics) and the electromagnetic interaction. As a result, quantum mechanics, which governs the laws of elementary particles, modifies Einstein’s classical theory of gravity (during that time period) in such a manner that both space and time fluctuate. The uncertainty principle of Heisenberg tells us that space fluctuates when the momentum is very high and time fluctuates when the Energy is very high. Consequently, what we take for granted, that we are defined by being here in a particular place at a particular moment of time, is only an accident of our not being entities that were conscious during the creation of this particular universe. So we realize that how we describe reality is relative to what scale we are looking at. Knowing this is helpful when understanding intellectually the “emptiness” of phenomena. Our concepts even of space and time are just a convenient relative description.

As a result of my physics training, as a meditation teacher I am able to give more precise analogies to what we observe when we meditate. When we recognize that thoughts and feelings arise from the mind and return to the mind, I can use the analogy of particles and anti-particles that arise from the quantum vacuum and return to the vacuum. The proliferation (or lack of proliferation) of thoughts in the mind can be explained by whether the present thought is strongly (or weakly) coupled to associations stored in the mind-body apparatus. So in certain situations, physics provides a more precise vocabulary for describing experiences that one has in meditation. However, these are analogies not explanations. These physics-based descriptions are more precise than the qualitative analogies such as “thoughts arise from the mind and return to the mind just like waves arise from the ocean and return to the ocean.”

Many meditators want very much for “science” to validate meditation. I think there is some value in knowing that neuroscience has shown hints that meditation can reduce habitual patterns and increase our response to suffering (compassion centers). This then gives people hope that they can change their negative habitual patterns because of

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neuron plasticity. This is wonderful. But you also have to inform these people that just as you need to go to college and then graduate school to master the discipline of physics, you need to make a similar effort and invest quite a bit of time to develop stable calm abiding and insight meditation. Only

then will you be able to start undoing your habitual patterns. In my experience unless one has a natural proclivity toward spiritual growth, the motivation for such growth will only occur when a life crisis provides the incentive for undoing one's negative patterns.