



On Re-reading The Tao of Physics: a Personal Tribute

Pier Luigi Luisi, Prof. Emeritus ETH Zurich

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A book which is a classic is like an old friend: always there at your disposal, and each time you open a page, even at random, you find an inspiration for life today. Which also means that a classic book never gets old; it has an eternal freshness. And so it is for Fritjof Capra's *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*, and in these few lines I would like to convey to you this sense of freshness that I experienced after taking again the book in my hands after more than twenty years.

The book was first published in UK by Wildwood House in 1975, and the third edition by Flamingo states on the cover that over one million copies had already been sold in 43 editions in 23 languages. The fourth edition in English was published in 2000. There were of course some criticism (see Google or Wikipedia for that).

Regardless of these criticisms I believe that the most impressive thing of the book was its impact on the reader. I knew of some people who stated that their life had been changed after reading this book, and this holds for scientists as well as for lay people. This is the sign of a book which has the power of opening up new horizons: you see the world with new eyes, you ask yourself questions you never thought to ask, giving answers, pointing even towards a higher state of consciousness.

You need to read the preface by the author to the first and second editions in order to have some idea of the climate surrounding the birth of the book. The main point here was that at that time, namely in the nineteen seventies, the idea of contaminating the holy grail of physics with the remote, odd and still unfamiliar traditions of Taoism, Buddhism and Vedanta, was something completely revolutionary, a kind of blasphemy. This also explains two things about the first publication of this book: it did not help Fritjof's scientific career he was at that time a researcher of high energy physics in an important university in the States (he himself, an Austrian, had received a PhD in theoretical physics from the University of Vienna), and it did not help to publish the book right away. However, the book was received enthusiastically in the UK and USA, and then had an immense success all over the world.

The main message of the book, as stated above, is about the parallels between modern physics and Eastern mysticism. Why and how can these two things should have something in common? The first simple answer is that both science and religious traditions are looking for the same thing: the truth. Or, to be a little more specific, they both want to discover the nature of reality. Another important point is that the Eastern religious traditions are not generally based on the idea of a creator God, as Christianity or Islam. As such, they avoid those forms of fundamentalism typical of monotheistic religions, typified in the 'holy' Christian Crusades, or, jumping to today's problems, in the ill-digested Islamism of the IS murderers.

It is useful to remind ourselves of the argument of the book. It consists of three main parts: 1. The Way of Physics, 2. The Way of Eastern Mysticism, 3. The Parallels, plus a preface and an epilogue. Each of the three main parts is in turn divided into various chapters.

The first part: The way of physics

In Chapter 1. Modern Physics - a Path with a Heart, you find some basic concepts about the progress of science, and physics in particular, with quite important quotations from the founder fathers like Oppenheimer, Bohr, Heisenberg, which, although written in the 50s or 60s, already mention the Buddha and Lao Tsu.

This shows that the basic intuition of the parallels between physics and the Eastern religious traditions was already in the air before Capra. And Capra, talking about Hinduism, Daoism, Buddhism, writes that contemporary physics leads to a world view which is essentially mystical.

The world 'mystical' may here may need some clarification: you should not think of ascetics, or of holy sages having transcendent visions of sainthood. As Capra says (p. 23): "when I refer to mysticism, I mean the religious philosophies of Hinduism, Taoism and Buddhism", adding that although these three Eastern traditions differ and differentiate themselves in a large number of ways, "the basic features of the world view are the same".

All this brings us to the question: how can we see and know the world? This is dealt with in Chapter 2. Knowing and Seeing where one of the main emphases is on intuitive knowledge, the direct experience of reality which, in Eastern mysticism, "transcends not only the intellectual thinking but also the sensory perception" (p. 36). Of course, physicists instead are mainly concerned with rational knowledge, but Capra shows that both types of knowledge may take place in both fields - science and Eastern traditions.

One major problem is language. In Chapter 3. Beyond Language, he argues that language does not really correspond to reality. Here he uses the metaphor by Korzybski often cited by Capra "The map is not the territory" which is particularly to the point. Words are only a qualitative and coarse description of things. Light is light, but when we wish to describe it with words, it becomes either waves or corpuscles. The problem is not the light, but our wordings; "The Tao that can be told is not the real Tao". Because of this limitation, Capra emphasises the importance in science and Eastern tradition of logical paradoxes. "Whenever the essential nature of things is analysed by the intellect, it must seem absurd or paradoxical" (p. 58).



Pier Luigi Luisi with Fritjof Capra in Cortona

All this is found in more detail in Chapter 4. The New Physics, combined with many examples of these paradoxes in the theory of relativity, the notion of time-space, and the nature of light.

The second part: The way of Eastern mysticism

This section of five chapters, starting with Chapter 5. Hinduism. The term Hinduism, according to some Indian philosophers, is a term which should not be used, as it has been invented by the British colonialist to summarise the complexity of Indian religious culture. But Capra succeeds quite well in illustrating the main and common features of 'Hinduism', going from the ancient Vedic traditions to the Bhagavad Gita, then the relation between Brahman and Atman, the notions of Karma, Maya and Yoga, and the many gods and goddesses.

In Chapter 6. Buddhism, he explains that The Hindu notion that all things are interconnected is also the basis of Buddhism. Here we find in the world of Nagarjuna the notion of emptiness, and the corresponding concepts of non-self, impermanence and compassion. We proceed then in Chapter 7 to Chinese thought with a description of the two main schools, Taoism and Confucianism, with the notion of yin/yang, the I Ching and its hexagrams (famously commented on by C.G. Jung), and the Taoist *Tao Te Ching*, attributed to Lao Tsu (who possibly lived in the fourth century BC). To Taoism Capra devotes the entire Chapter 8 as this is centred on intuitive knowledge and intuitive wisdom, a notion particularly present in Zen Buddhism. This is discussed further in Chapter 9, where it is characterised by learning through paradoxes, the so-called Koan method, well known for its question: "What is the sound of one hand clapping?".

The third part: the parallels

The common denominator of all these traditions, according to Capra, "is the awareness of the unity and mutual interrelation of all things and events, the experience of all phenomena ...as manifestation of a basic oneness." This general concept is very important for Capra, and is, among others, the basis of his latest book, *The Systems View of Life*, written with myself.

A closer look at the parallels forms the eight chapters of the third part, which is of course the most challenging both for the writer and for the readers. Thus, Chapter 10. The Unity of All Things, treats the well known problem of the duality between subject and object based mostly on the Copenhagen interpretation of quantum physics, which actually shows that this separation cannot hold. This touches on the notion of objectivity in the traditional science tradition, and on the notion of experience, as the subjective dimension, in the Eastern religious traditions. This is taken up and expanded

in Chapter 11. Beyond the World of the Opposites, where we find again the dual character of light, the dichotomy yin/yang, the concept of complementarity, and the uncertainty principle.

The rather robust Chapter 12 deals with space/time, and here we see that what in Newtonian physics were considered two clear, distinct things, become with relativity one unit (the famous curved space-time). And all of this is never static, but is instead the expression of a dynamic universe, discussed in Chapter 13, where together with the transformation of particles, one into the other, or of mass into energy, (you may remember the famous equation $E=mc^2$), we also find again I Ching and the Buddhist notion of impermanence. There are not things, but only events and processes.

All these points are re-iterated in Chapter 14. Emptiness and Form, where the notion of field, and in particular the quantum field, is emphasised. Here Capra dwells on the Eastern notion of form/emptiness, seen as two aspects of the same reality (p. 238). Movement, change and transformation are emphasised in Chapter 15. The Cosmic Dance, where the dance of Shiva is taken as a metaphor for the continuous transformations of particles and mass/energy.

One cannot talk about modern physics without mentioning quarks, and here comes Chapter 16. Quark Symmetries (new Koan?), with a hard section concerning baryons and mesons, and a very interesting section on symmetry. Another challenging chapter for the common reader is the following one, Chapter 17. Patterns of Change, with a rich display of Feynman diagrams, and with a link to the I Ching hexagrams.

Chapter 18. Interpenetration, is in a way a conceptual summary of all the previous concepts, with emphasis on the interconnection of matter, mass, energy, so that reality cannot be reduced to solid building blocks with certain fundamental properties, as in the Newtonian concept, but "has to be understood entirely through its self-consistency, as expressed in the "bootstrap theory", so that Capra concludes: "the view of nature came ever closer to the Eastern world view and is now in harmony with Eastern thought, both in its general philosophy and its specific view of matter".

At this point, at the end of this article, the reader may say that it is not proper to condense a book like *The Tao of Physics* in a simple article of only 1500 words. I couldn't agree more, and I would say: this is why you should get a copy of the book and read it fully.

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Dr. Luisi, after his graduation at the Scuola Normale Superiore in Pisa, made his academic career at the Swiss Federal Institute of Technology in Zürich (ETHZ), Switzerland, where he became professor of Chemistry in the department of material sciences. Since 2003, till 2012, he has been working at the University of Rome3, Italy, as professor of Biochemistry. His research focussed in the origin of life, and the synthetic biology of minimal living cells. In Zurich he initiated the field of enzymology in reverse micelles, later the self-reproduction of micelles and vesicles. Author of over 500 reviewed papers, and a dozens of books, which include themes on philosophy of science and spirituality. The last books are resp. *The systems view of life*, with Fritjof Capra, and the second edition of his *The emergence of life*, both for Cambridge University Press..

At the ETHZ, he created (1985) the Cortona-week, an interdisciplinary residential week for graduate students, who are working with artists, psychologists, religious leaders, to open up their horizon and foster a new generation of world leaders with a more integrated and balanced view of life. See www.cortona-week and www.cortona-india.org.

He has been associated from the start (1987) with the Mind and Life Institute, created by Francisco Varela and the Dalai Lama, devoted to the dialogue between modern science and Buddhism.