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Eastern Religions and Modern Physics – A Further Examination

A further study is made of the claims that modern physics confirms certain aspects of eastern religious philosophy, with special reference to particle physics and quantum mechanics. Some particular topics discussed are complementarity, the role of the 'observer' in quantum mechanics, questions concerning unity and interrelationship, and the existence of quantum events. The ultimate role of rationality in the universe is contrasted between East and West. In general, a negative conclusion is reached: most of the similarities are superficial only. In one or two cases there may even be conflicts with some aspects of eastern teachings.

Keywords: physics, eastern philosophy, Hinduism, Buddhism, Taoism, quantum mechanics, complementarity, elementary particles, Romantic movement.

Introduction

An ironic turn in the long-running debate between science and religion came at the end of the 1970's when several authors, in well-popularised books,[1,2] declared that modern physics indeed gives good support to religion – but eastern rather than western religion! Since then there has been much intermittent discussion of these claims. Fritjof Capra's *The Tao of Physics*[1] received a robust critique by R.K. Clifton and M.G. Regehr (CR) in the first issue of *Science and Christian Belief*.[3] My aim here is to add further weight to what Clifton and Regehr have said, but focussing less specifically on Capra's book as such (which has been followed by several others) and rather more on some of the underlying questions. It is important to sort out the wheat from the chaff in these issues, since many have been adopted by the 'New Age' movement and are thereby in a position to find a route into our society's thinking and ethos in ways which Christians would wish to contest.[4] But also, they involve many questions of understanding between faiths, and between East and West, which it is desirable to explore more deeply.

In this article I shall examine four central topics in which similarities between modern physics and eastern philosophy are claimed. These are in the areas of

1 F. Capra, *The Tao of Physics*, revised edn, Fontana, 1983.
2 G. Zukav, *The Dancing Wu Li Masters: an overview of the new physics*, Morrow, New York, 1979, is another well-known book; others are listed by Clifton and Regehr and by Lucas, see next references.
3 R.K. Clifton and M.G. Regehr, *Capra on Mysticism and Modern Physics*, Science and Christian Belief, 1 (1989) 53.
4 Helpful articles on this subject have been given by E. Lucas, Science and Christian Belief, 4 (1992).

quantum mechanics and particle physics: that is, the physics that describes the world on atomic scales or smaller. CR provide an extensive description of different interpretations of quantum mechanics. I shall not attempt to repeat this, but will try to explain the more specific points as we proceed. The topics discussed here are: (1) complementarity, which will be considered in some detail, (2) the role of the 'observer' in quantum mechanics, (3) unity and interconnectedness, and (4) quantum events.

General Aspects

The eastern traditions under consideration are those of Hinduism, Buddhism and Taoism. Within the first two of these, numerous schools of thought have emerged, many in mutual disagreement,[5] while Taoism has also modified its beliefs over the centuries. This is therefore a fertile ground to seek similarities with modern physics, or indeed any other subject, and much care is needed. To start, we should note that these religions, like others, contain several different strands of belief and practice.

The most fundamental strand in many ways is the mystical element, in which two components are of particular importance. The first of these is the idea of an encounter or union with Ultimate Reality – something which may or may not be similar to God as understood in Christianity and other religions of the West. The distinctive feature of most eastern teachings is that Ultimate Reality is *totally* beyond human comprehension. A second characteristic of eastern mysticism is its pantheistic tendencies: Ultimate Reality is what is at the bottom or heart of the universe around us, whereas in the West God is in some sense 'beyond' or separate. These essentially agree with CR's classifications of eastern mysticism.

A second strand of eastern religions is their philosophical and intellectual teachings in general. Of these, it is their philosophy of nature which is of particular interest in a comparison with physics. A third strand consists of teachings concerning techniques and methods whereby an individual can achieve salvation, 'nirvana', or whatever is upheld as the ultimate human goal. Such teachings concern lifestyle, meditation and worship and may include rigorous ascetic practices. From the practitioner's point of view, the philosophy of nature is the least important of these strands. Of prime concern is the question of nirvana (to choose the best-known term) and how to attain this. Philosophy does not necessarily feature strongly here; we may be reminded that the intellect is not presented as particularly important in Christianity either. One must enter heaven 'as a little child'.

Buddhism has generated many schools which could be called philosophical, but according to the scholar Edward Conze, knowledge for its own sake is not valued and 'we find no word to correspond to our term "philosophy" '.[6] Hinduism

5 An account of many Buddhist schools may be found in T.R.V. Murti, *The Central Philosophy of Buddhism*, Unwin, 1960.

6 E. Conze, *Buddhism: Its Essence and Development*, Harper and Row, New York, 1959, p. 15.

likewise contains 'innumerable sects, cults and philosophical systems' (Capra)[7] and 'provides different concepts, rituals and spiritual exercises. . . . the fact that many of these concepts or practices are contradictory does not worry the Hindus in the least, because they know that Brahman is beyond concepts and images anyway.'[8] Zen is the most emphatic of all on a need to break away from conceptual thinking, so as to commune directly with nature and Reality in a new mode of awareness, achieved through special meditation methods. The Zen teacher Daisetz Suzuki stated firmly that Zen is not a philosophy, even that it is not a religion.[9] Taoism, on the other hand, makes considerable use of concepts, such as yin and yang, although the Tao itself is something which lies beyond the intellect.

Areas of Difficulty

All of this underlines what many have pointed out, that it is hazardous if not impossible to assemble one set of ideas and call it 'eastern philosophy'. The best reasonable hope is to seek a few general principles. This is what Capra does in identifying what he considers the two basic themes of eastern religion, namely a doctrine of universal Oneness, and the advocacy of a 'dynamic' view of nature. Even here, several problems need to be stressed.

The first is that ideas such as these can easily become so general as to be capable of encompassing almost anything. A second problem, already indicated, is that the wide variety of teachings and pictures available may make it almost inevitable that something, somewhere, will be found resembling a given idea in physics. This is a particular trap given that similarities between eastern thought and western physics will rarely be exact. It leads to a third problem, which is that even if the parallels are successfully established, we may well end up with a kind of 'hybrid' eastern philosophy which lacks any coherence or authenticity. To avoid over-broad generalisations, specific references must be made – but to Hinduism here, Buddhism there, Taoism somewhere else. No one of these faiths, it seems, is able to furnish all the comparisons by itself. If we end up assembling a collection of eastern themes like mixed flowers in a vase will the resulting bouquet have a real organic unity?

In fairness it needs to be mentioned that in the actual East, practices do differ in this respect. While many Hindu and Buddhist believers stick to a well-defined line in their own faith, Chinese and Japanese practices are often very eclectic. A certain amount of mixing may therefore be justified, but the need for caution is obvious. And clearly, the finding of formal parallels with ideas in physics would not in itself be sufficient to imply the truth of the underlying metaphysics or the accompanying spiritual teachings.

The deepest problem is that the above religions have no *ultimate* place for intellectual things. This is perhaps the most critical difference between East and

7 F. Capra, op. cit., p. 97.
8 F. Capra, op. cit., p. 101.
9 D.T. Suzuki, *An Introduction to Zen Buddhism*, Rider, London, 1969, p. 39.

West. God in the West is in a profound sense incomprehensible to human beings, but nonetheless rational and able to reveal something of Himself to humanity in ways we can understand. Ultimate Reality in the East is beyond rationality and, indeed, beyond all words. This allows New Age neo-orientalism to fit in nicely with postmodernism in allowing a variety of contradictory viewpoints to coexist, even within a single person. Ultimate Reality is 'beyond all that'.

Complementarity and the Unity of Opposites

The first of our present comparisons lies in the claim that in quantum mechanics, the phenomenon of 'complementarity' has resemblance to ideas found in Taoism – and indeed to the 'union of opposites' element in various eastern systems. This view originated mainly when Niels Bohr, one of the fathers of quantum mechanics, devised a coat-of-arms for himself which included the well-known symbol for yin and yang (i.e. a circle divided into black and white halves by a curved boundary).[10] The motto translated as: *opposite are complementary*. The truth, however, was that oriental philosophy did not really feature much in Bohr's thought. His biographer Abraham Pais states[11] that 'the occasionally expressed belief that Bohr's views on physics were influenced by oriental philosophy is unfounded'. Bohr was not in fact normally sympathetic to religion or religious philosophy. It was the wife of a colleague who suggested the yin-yang symbol to him! Nevertheless, given this slightly fortuitous choice of coat-of-arms, a popular belief developed that quantum mechanics has an affinity with Taoism.

Complementarity in quantum mechanics refers to an important feature of the theory, namely that pairs of physical quantities possessed by a particle cannot always coexist with precisely determined values.[12] If the particle's position along some direction in space is precisely defined, then its momentum cannot be – and vice versa.[13] The smaller the uncertainty, or indeterminacy, is on the one quantity, then the larger it is on the other. Thus neither member can be perfectly present without in a certain sense excluding the other; a kind of 'oppositeness' exists between them. It is this which is claimed to resemble the yin and yang of Chinese thought. We ask therefore: to what extent are the two situations really similar?

It should be noted that the field of quantum mechanics itself has always been fraught with philosophical disputes – in which Bohr himself played a vigorous part. Many stumbling-blocks in situations of this kind can arise over precise

10 *Yin* in Chinese thought denotes the dark, subtle, passive, 'feminine' aspect of reality, while *yang* denotes the light, clear, active, 'male' aspect.

11 A. Pais, *Niels Bohr's Times*, Oxford Univ. Press 1991 p. 24.

12 Triplets and other sets of quantum quantities may also display complementarity; complementary pairs are considered here for simplicity. Reference to triplets as 'opposites' would seem to be even more disputable than the case of pairs.

13 Here I am assuming the usual 'Copenhagen' interpretation of quantum mechanics, which Bohr always strove to defend, rather than some of the less popular alternatives mentioned by CR.

meanings of words, and this applies particularly to 'complementarity'. In remarking on the difficulties involved in understanding this term, Max Jammer points out that it can denote different, though related, conceptions in various writers, and even at different times in one and the same writer, including Bohr. Bohr himself 'never gave a clear-cut explicit definition of "complementarity" '. His closest approach was a 1929 declaration that in quantum mechanics, a given application of classical concepts – i.e. those used in everyday or pre-quantum physics – can preclude 'the simultaneous use of other classical concepts which in a different context are equally necessary'.[14] This is non-controversial; but already we may observe a tendency to clash with those oriental viewpoints which actually uphold and stress a simultaneous use of 'opposite' quantities. Thus in the second stanza of the *Tao Te Ching*:[15]

. . . having and not having arise together.
Difficult and easy complement each other.
Long and short contrast each other.
High and low rest on each other.
Voice and sound harmonise each other.
Front and back follow one another.

The comparison between Taoism and quantum mechanics faces a second difficulty in that a different notion of 'oppositeness' is being used in the two areas. The yin and the yang involve sets of *logically* opposite concepts: dark versus light, passive versus active, and so on. It is logically opposite pairs that feature in the *Tao Te Ching*. But there is no logical opposition between the physical concepts of position and momentum, still less between their indeterminacies. That the two quantities cannot both be precisely possessed at the same time arises from the internal mathematics of quantum mechanics rather than from the basic meanings of the terms. In quantum mechanics, 'black' and 'white', as opposed values of the *same* quantity (brightness), would not normally be termed 'complementary'.

So far, then, quantum complementarity concerns a *negative* relationship between the indeterminacies on quantities, whereas other types of complementarity concern a *positive* relationship between quantities themselves. The latter is of special interest when the quantities are logical opposites – but often the word just refers to different quantities which go well together.

Taoism appears illogical because the quantities that it demands should be combined involve genuine logical opposites. Quantum mechanics appears illogical for a different and more subtle reason. This comes from the fact that up to the early twentieth century, scientists habitually used a way of thinking inherited from Aristotle, and which to most of us would still seem to be 'common sense'. In it, properties of an object always possess definite values, and these are assumed to exist whether measured or not. The idea that a property can be *indeterminate*[16]

14 M. Jammer, *The Philosphy of Quantum Mechanics*, Wiley (1974) pp. 89, 95.
15 Lao Tsu, *Tao Te Ching*, trans. Gia-Fu Feng and Jane English, Wildwood House (1972).
16 Or 'fuzzy' to use another terminology; see the discussion by CR.

does not fit in with this way of thinking – still less, that whether it is determinate or indeterminate may depend on how the present state of the object has been prepared.

Thus, even if we dubiously allow complementary pairs of quantities in quantum mechanics to be called 'opposites', the comparison with Taoism fails since Taoism has basically nothing to do with indeterminacy. It is more concerned with the *amount* of yang and the *amount* of yin, so as to achieve a harmonious balance or interplay between them. This is a matter of 'more' and 'less', 'too much' and 'too little', rather than of 'definite' and 'indefinite'. Quantitative balance and an Uncertainty Principle[17] are two different things. In quantum mechanics, one does not normally talk in Taoist terms about a 'harmonious balance': not between position and momentum, nor even between their uncertainties. Some concept of the kind might perhaps be applied in specific experimental circumstances, but it is in general irrelevant.

The European Romantics

However, there is actually no need to go to the Orient to find the idea of a 'reconciliation of opposites': it was a central theme with several nineteenth-century European writers of the Romantic movement.[18] Many of the Romantic poets and authors had a considerable interest in the science of the time. The poet Johann Goethe was intensely occupied with anatomy, botany and the properties of light, Percy Bysshe Shelley attempted amateur chemical experiments, and both Samuel Taylor Coleridge and the philosopher Georg Hegel (somewhat later) found important significance in magnets. Magnets are found to unite inseparably, within one and the same entity, both a north and a south pole – two 'polar opposite'! Thus we find in the writings of Coleridge:[19]

> Every power in Nature and in Spirit must evoke an opposite . . . and all opposition is a tendency to reunion. This is the universal law of Polarity – of essential Dualism. . . .

William Blake stated in his 'Marriage of Heaven and Hell' that 'without contraries there is no progression'. Hegel declared that 'positive and negative . . . are at bottom the same.'

The idea is once more that opposites act together and actually *require* one another. Writers such as these were to some degree aware that similar themes existed in eastern thought, but they adopted them independently because they were in line with their own thinking. Like the Taoists, the Romantics were very much concerned with nature; on the other hand they were sufficiently the

17 An Uncertainty Principle in quantum mechanics states that the more precisely one of a pair of complementary quantities is measured, the less precisely the other can be measured at the same time. Position and momentum form the best-known example of this.
18 See D. Newsome, *Two Classes of Men*, Murray, 1974.
19 S.T. Coleridge, *The Friend*, I, quoted in Newsome, op. cit.

descendents of the eighteenth-century Enlightenment to be anxious, even more than the Taoists, to theorize about what they were doing.

Still, it is clear that if we were to try to establish a parallel here with quantum mechanics, similar objections would hold as in our examination of the thinking of the East. The Romantics were concerned with uniting genuine logical opposites; indeterminacy did not come into the discussion; and moreover their purposes rose rather higher than the establishment of a 'better theory'. Their art was intended to 'do' something to you by forming some kind of elevated emotional consciousness.

The value of the Romantics' ideas (and those of Taoism) may be debated, but it is clearly in no way affected by the fact that they are not really quantum mechanics in disguise. Indeed, the most obvious Romantic (and Taoist) example of 'union of opposites' is to do with male and female; is there really any parallel here with quantum mechanics? In fact the whole thrust of the two areas of thought is different. In quantum mechanics, it is shown that supposedly compatible quantities (e.g. position and momentum) are actually incompatible. In Taoism and sometimes Romanticism the aim is to show that supposedly incompatible quantities (i.e. 'opposites') are actually compatible.

Alternative Modes of Description

Even more basic differences are found in another aspect of complementarity. One common usage of the word is to indicate the presence of alternative view-points, both needed in describing a situation.[20] Quantum complementarity partially shares this meaning, but with a crucial qualification. In quantum mechanics, when describing the state or behaviour of a particle, we are *not* obliged to hold in mind both members of a pair of complementary quantities. It is usually best to analyse a given problem exclusively in terms of just one of the pair. For example, in evaluating the behaviour of an electron in an atom, it is normal to work solely in terms of the so-called 'wave-function', a mathematical quantity which expresses the problem wholly in terms of the electron's *positional* properties. Momentum need not be explicitly mentioned. The interactions of high energy particles, on the other hand, are usually studied best in terms of their momentum, with position being ignored.

What this means is that position and momentum in quantum mechanics are not just alternative observable quantities; they also define two 'alternative languages' – that is, two viewpoints ('representations') in terms of *either* of which a particle's behaviour can be described. We choose whichever is more convenient in a given problem. But in principle, either could be used, for each on its own can provide a description that is *complete*. The description of the particle in the momentum representation is exactly equivalent to the corresponding description

20 A theological application of the word in this sense is explored by P.P. Duce, *Complementarity in perspective*, Science and Christian Belief 8 (1996) 145.

in the position representation. The one can be transformed mathematically into the other hand. In Taoism, on the other hand, there is no suggestion that the yin and yang define optionally alternative view-points or modes of description. *Both* have to be ingredients of a full view of a situation.

Here, I would propose, is a final demonstration that quantum mechanics and Taoism are very different at heart. It is not good enough to say, 'Modern physics unites opposites, eastern religions unites opposites; therefore they are basically the same.' There are different types of 'opposites', and different approaches to the idea of uniting them. All that quantum mechanics shares in common with eastern religions here is the provision of a 'new regime', in which the problem of apparently conflicting quantities is faced and resolved. But the nature of this different regime is crucially important.

Physics, ultimately true to its Greek philosophical heritage, cannot tolerate paradox or contradiction. When we deal with very small objects, quantum mechanics at first generates puzzles relative to everyday physics, but these come from the attempt to retain too many old ways of thinking in the new context. The problem is dealt with by the consistent employment of new ideas with new equations and, where necessary, new physical quantities. Eastern religions, by contrast, seek to attain a different level of consciousness altogether. Paradox – particularly in Buddhism – may be used as a deliberate mental technique to achieve this. The intention is:

> . . . to pass beyond the world of opposites, a world built up by intellectual distinctions and emotional defilements, and to realize the spiritual world of non-distinction, which involves achieving an absolute point of view.[21]

All opposites, and the language and thinking which express opposites, are to be *transcended.* This is very different from physics. Taoism, however, is more of a philosophy of nature and sees the Tao as a spiritual principle whose property is to *unite* the opposites, forming something organic and harmonious. This is different again. But physics in the end always seeks a new theory rather than a new consciousness – a much less ambitious goal.

Observer and Observed

Quantum mechanics gives a new account of the process of 'observing a particle'. As already mentioned, one novel feature is indeterminacy: a given particle property cannot in general be ascribed a definite value. However, when the property is measured by a piece of apparatus, its value is obliged to become definite, at least temporarily. The particle in fact switches, with a strong element of randomness, into a state corresponding to some specific value of the measured quantity. All of this differs markedly from the Aristotelian stand-point of classical physics, and implies a new kind of relationship between the observer and the observed. Clearly, the observation affects me, the observer, since through it my knowledge

21 D.T. Suzuki, quoted in F. Capra, op. cit., p. 158.

has become changed – this was true also in classical physics. In quantum mechanics, however, the observation affects also the observed object.

Capra et al. portray this situation as a significant step towards the eastern view that all things are not merely related but are One – and in particular that the observer is never really separate from the observed anyway. But are the mystics and the physicists really talking about the same thing? In the context of eastern mysticism, the idea is that the human ego shall ultimately be dissolved and merge into the Absolute. There is then no longer a distinction between 'I' and 'not-I', because the 'I' (or the experience of it) has ceased to exist. Quantum mechanics, however, is not about the human ego (as Capra himself concedes), and it goes nowhere near the kind of merging of identities of observer and observed which mystical experience demands. In physics, the observation affects the observed system so that there is indeed a two-way relationship between observer and observed. But there is certainly no loss of identity of the observer in the process. All this is spelt out clearly by CR.

In fact it is by no means clear that modern physics takes any real step into the mystical camp. Human consciousness might conceivably be bound up with quantum observations: this remains a debated issue. If such were to turn out to be the case, then physics might indeed have something to learn from those eastern traditions which have made a particular study of consciousness – but even this does not necessarily bring us very near to *mystical* consciousness. Most physicists, in fact, would tend to the more ordinary view that quantum processes are merely physical processes, of a slightly uncertain nature, which humans sometimes happen to observe. They would also occur if no human observer were around. Similar processes were presumably taking place long before conscious beings appeared on earth.

Still more to the point is the fact that the most distinctive characteristic of quantum observations is of rather little consequence to the eastern mystic. It is on the whole unimportant to the mystic whether or not an act of observation affects the observed object! The mystic is really interested only in the *consciousness of the observer*, aiming to induce this to transmute into a new, ego-less mode.

So again it would seem that a superficially promising parallel between eastern thought and modern physics evaporates when scrutinized. To be sure, one may seek to adopt terminology which makes a similarity sound plausible: for example, by talking about the observer 'participating' in the situation, or about the observer and observed forming a 'system'. But such things were true at some level even in classical physics. It is the *nature* of the 'participation' that is important. Mysticism and quantum mechanics involve different types of participation, and it seems to go in opposite directions in the two cases. In the one, the consciousness of the human observer is radically transformed. In the other, it is the observed object which changes its state.

Unity and Interconnectedness

At a less advanced level than that of mystical union between human beings and the Absolute, there are a variety of proposals in eastern philosophy that an

essential unity exists between all of nature, that all things and events are 'essentially interconnected' and interrelated. By this, it is meant among other things that an object does not possess an existence of its own, but only in relation to other objects. It is part of an overall pattern, and inseparably so. *Relationships* are thus one of the prime elements of existence: the relationship almost has a precedence over the entities that are related.

More consideration is first needed of what is meant by the 'unity' of all things. Is it the unity of a pattern, the existence of physical forces between things, or something deeper? Many eastern writings insist that the only unity that counts is that of 'being', or perhaps this should be written 'Being' since we are here talking at the level of the Absolute. Has physics any comment to make on this? The answer, fairly clearly, is no. Physics is not capable of analysing 'being', let alone determining whether one object's being is the same as another object's being. Physics is about structures and patterns and behaviour. Being is certainly not a scientific topic, and there is no way that similarities between physics and eastern teachings in this area can even exist to be discussed, let alone to be affirmed or denied.

The idea of interrelatedness appears at first sight more promising. If an essential physical interrelatedness between all observable things could be established, perhaps there would after all be grounds for believing that they form a unity – although this could say nothing about unobservables such as Brahman or the Tao. And indeed, quantum mechanics does describe systems of particles which seem much more closely interconnected than anything in classical physics. In classical physics, the physical state of a given object in a system can always be described, if we wish, without mention of the other objects in the system. (We just specify its position, velocity, and so on: all are definite quantities.) However, quantum mechanics presents us with particle systems in which this is no longer true. Such systems are *intrinsically* two-particle systems (say); they are termed 'correlated' or 'entangled' states. Here, the state of neither particle is well-specified without reference to the other; for example, given momentum values of the first particle might always go with given momentum values of the second. Ignore the second particle in this context, and no full description of the first can be given.

Correlated systems can contain any number of particles. Of course, single-particle systems exist too; it is mainly these which we have talked about up to now. Quantum mechanics, then, appears to go some way here towards certain eastern views of nature, but certainly not the whole distance. Interrelatedness is a compulsory element in many schools of eastern thought, but in quantum physics it is 'optional'. The existence of isolated particles remains permitted. In the universe many particles do exist in highly correlated states, but others exist in states so weakly correlated with other particles that they are to all intents and purposes single, independent objects.

On the other hand, there are Buddhist teachings which explicitly *deny* some kinds of unity. This is traditionally illustrated by a chariot. It is an illusion, we

are told, to think that on looking at a chariot, such a thing actually exists. The wheels are there, the axles, the shafts, the sides and the floor. But these parts are *all* that have existence – if indeed even they do; the chariot 'as a whole' does not, and is an element of the human imagination. The message is that 'wholes' are illusory, and it is underlined in another Buddhist text which states that 'like light, a mirage, a lamp, an illusion, a drop of water, a dream, a lightning flash; thus must all compounded things be considered.'[22]

It would seem that within Buddhism the 'unity of all things' is really at the level of Being; unity at certain less deep levels is even strongly denied. This presents serious problems with regard to correlated quantum systems, for the latter do possess a genuine physical unity. Any bound physical object – an atom, for example – is a correlated quantum system. It behaves as an integral entity in its own right, and is treated as such in quantum mechanics, even while being made up of subcomponents, namely protons, neutrons, and electrons in the case of an atom. Atoms moreover exist as essentially permanent physical objects. Contrary to the above-quoted demands of Buddhism, a stable atom is without doubt a 'compounded thing'. Here, then, in presenting finite physical systems which are integral entities, quantum mechanics actually seems to part company with Buddhism.

A further comment can be made here about quantum observations. During the process of making an observation, for so long as all the available outcomes of the observation are still possible, the observer and observed particle may perhaps be in an entangled quantum state.[23] So far so good – there may be a genuine interrelationship – but then the observation 'happens' as a 'quantum event' (see next section). A single outcome emerges, to some degree randomly, and the observer and observed are disentangled and separate again.

A point of issue in this area lies in a confusion already touched on, namely between *unity* and *interrelatedness*, terms which Capra seems to treat as essentially equivalent. This seems very dangerous. Any so-called 'system' comprises entities which are interrelated, but this as such does not necessarily mean that they form an integral whole. Classical physics encompasses innumerable systems in which the interrelationship consists of the forces acting between the objects concerned. Indeed, forces exist at some level between all objects in the universe. If this is what is meant by the interconnectedness of all things, then it is certainly not new to modern physics. Neither does it logically imply any deeper kind of unity, although some philosophies may choose to interpret it thus. Correlated

22 The Diamond Sutra. The chariot picture is from the 'Questions of King Menander'.

23 This is related to the celebrated 'Schrödinger's cat' situation: a cat is in an indeterminate state of being alive, together with an undecayed radioactive atom, or else dead together with the atom in its decayed state. (A suitable apparatus is set up to arrange this 'entangled' state.) But is the cat an observer in the quantum sense? Most physicists would assume that the observation effectively occurs – i.e. the different possibilities become actualised in a definite happening, leading to the cat either dying or not – long before the cat itself becomes involved. However the details of all this still remain unclear.

quantum systems are the only ones I know of where the interrelationship goes beyond the 'classical' level.

Quantum Events

Perhaps the most convincing similarities between eastern views and the modern physicist's view of the universe come from the more general pictures. The universe is indeed full of particles which move around and interact, combine and re-separate, and which in suitable conditions are created and destroyed. Atoms and molecules form, interact, join together and maybe decay. This, in very broad terms, does resemble certain Hindu and Buddhist portrayals of the universe. (But without any conflict with the teaching of Christianity and other western religions, one must add, since the latter have little to say about the nature of the universe at this level.) How significant, then, is all this?

One feature of the early schools of Buddhism was indeed an emphasis on '*events*' as a primary element of being. The kind of event which we are thinking of is something essentially discontinuous in time. This notion is certainly absent from classical physics, which treats all processes as intrinsically continuous in time, being governed by the mathematical continuity of the associated laws of nature. Processes may take place very quickly, but always with an essential gradualness when considered on a sufficiently fine time-scale. In contrast, quantum mechanics requires something discontinuous to happen when an observation or measurement or a similar process takes place. Such quantum processes are normally considered as taking place frequently in physics and chemistry, whether or not a human observer is watching. The entire development of the universe has occurred in this manner. All this has some similarities with early Buddhism, which viewed physical existence not as continuous but in an 'atomistic' way. Not only did matter exist as tiny, discrete atom-like entities in space, but even these had only an intermittent temporal existence, rather like the frames of a cinema-film.[24] The impression of continuity was held to be illusory. Nevertheless, strong causal principles connected the momentary 'existences' of things together.

The aspect of quantum mechanics that does not fit so well into this picture is the random element, which goes very much against the spirit of Buddhism. Buddhism holds causation to be central; things happen in strict dependence on what went before.[25] The cinema-film discontinuities applied to the existences of things, rather than to their behaviour. Of course, quantum mechanics is not all randomness. The 'Schrödinger equation' governs most aspects of the behaviour of a particle – that is to say, in between the occurrence of event-type processes –

24 See for example Murti, op. cit., p. 75.

25 One probably cannot overstress this. Writers who state that modern physics forces us to see the world 'very much in the way a Hindu or Buddhist or Taoist sees it' (Capra) ignore that the eastern believer is taught emphatically, as a philosophy of life, the strict causal law of karma: *as you sow, so shall you reap*. No room for chance!

and here it gives a behaviour which is continuous with time. There is, in other words, a mixture of continuity and discontinuity in the world of quantum physics: determinism and randomness. But the randomness certainly does not seem to be welcome in Buddhism.

The fact that science now presents a very 'unmaterial' picture of the world at the atomic level comes as a considerable culture-shock to our everyday notions. We are faced now with a world of restless particles, undergoing discontinuous 'event-processes'. Particles can be created and destroyed. It can no longer even be said that the particles comprising matter occupy definite positions at definite times. They must be imagined as occupying overlapping regions of space, within which the presence of one particle cannot exclude the simultaneous presence of another. Abstract mathematical equations seem to be the unifying feature of the whole affair.

What makes this elusive and unsolid microscopic world turn into a world of solid and impenetrable objects when viewed on a larger scale? It is that particles exert forces on each other, and that forces can add up. Even by the time we are talking about entities as big as atoms, it turns out that the set of electrons in one atom exert strong repulsive forces on those of a second atom if it moves too close to the first. Thus the two atoms do not in practice occupy the same region of space. And the discontinuous nature of individual particle processes becomes unnoticeable when large numbers of such processes take place.

The 'cinema-film' model of nature was abandoned in later schools of Buddhism, which moved to a view that all pictures of nature are of a purely pragmatic kind. Western thinkers too have had difficulties in formulating a satisfactory philosophy of the material world of nature. On the one hand, the created universe has to have sufficient 'solidness' to exist and have a being of its own. On the other hand, if everything becomes too solid and predictable, the world of the 'spirit' may be lost. The universe then becomes a machine that seems to grant no room for human freedom. This is a well-aired issue which cannot be discussed here. My own opinion would be that quantum randomness does not as such provide a solution, and certainly does not provide a recipe for the spiritual. However it does allow scope for new avenues of discussion.

'Science and Reality'

It should be made clear, in any discussion of science and 'being', that science (and particularly physics) regards an object's *behaviour* as an essential part of its being. One cannot remove from an electron its mass, its electric charge, and all the other factors which determine its behaviour, and declare that behind all these pragmatic phenomenological 'accidentals' lies the 'true being' or 'essence' of the electron. In physics, an electron's behavioural attributes constitute an indispensible framework for 'what it is'. Take them away and you are left with nothing! This is very different from mystical viewpoints which regard the properties and observable features of objects as unreal, a distraction, or at best a

passing aid in a person's quest for true Being. Science regards behaviour – and in particular, regular behaviour – as *built into* the nature of the physical world.

The central doctrine that developed in Buddhism seeks to show that anything definable lacks reality because it exists only in relationship to something else. True Being – the Absolute – is undefinable. Murti states that '. . . cause and effect, substance and attribute, whole and parts, subject and object etc., are mutually dependent, relative; hence they are not things in themselves.'[26] and with this he includes the concepts which we use to describe nature. Rejecting even a complementarity between intuitive and intellectual modes of thinking, he states '. . . thought is inherently incapable of revealing the real, for it looks at it through conceptual patterns, through differentia and distinctions; it sunders and distorts the real.'[27] But the western scientist would wish to see the situation in a less all-or-nothing way. No one of the scientifically describable aspects of reality may be complete in itself, but they are surely real enough as far as they go?

I think that one part of the problem here – and what an eastern thinker might particularly wish to criticise – concerns a certain type of 'left-brain' thinking in which concepts and intellectually defined quantities are manipulated by the thinker as reified objects. The Taoist would say that this is quite unbalanced: all yang, where is your yin? The Buddhist would refer back to words such as those of Murti. But the scientist finds such ways of thinking perfectly valid: in doing calculations, for example, or in devising new theories. Of course it is important, in the end, to attach the concepts to the actual universe by means of experiment. Then we are confident of being 'in touch with reality'.

At bottom, there is one very important sense in which science has always affirmed an underlying unity of all things in nature: *the same set of physical laws applies universally*. To a Christian, these laws have been provided by God. They can also to some approximation be known by human beings. This brings out what is arguably the most important difference between West and East: in the eastern traditions discussed here, unity both within observable nature and between nature and Ultimate Reality is at the level of common Being; while in the West it is on the basis of a shared rational principle.[28] And in the East, rationality is ultimately downplayed, whereas in the West there is no ultimate unity of being between creation and the Creator.

Conclusions

Our conclusion is that the similarities claimed between modern physics and eastern religious thought are mostly superficial. They can be made to sound partially convincing by the employment of suitable words, such as 'complementarity',

26 Murti, op. cit., p. 138.
27 Murti, op. cit., p. 331.
28 Corresponding to the Christian theological term 'logos'. Of course, Christians also believe that God's Spirit can act within nature.

'participation', and so on. However, this conceals crucial differences between the two areas. Quantum complementarity differs importantly from Taoism, and the relationship between observer and observed in quantum mechanics is by no means the same as asserted in much eastern mysticism.

It is true that modern physics and many types of eastern philosophy both reject some of the more rigid thought-patterns arising from Aristotelian philosophy. This in itself, of course, does not imply that modern physics and eastern thought are equivalent, particularly in view of the differences that exist between different eastern philosophies. We can agree that some aspects of the behaviour of elementary particles are in accordance with ideas that can be found in some areas of eastern thinking: quantum 'events' represent a possible example of this. But there is certainly no conflict with western traditions here.

In other aspects, though, there may even exist difficulties in reconciling eastern teachings with science, both classical and modern. I mentioned the issues of 'compounded things' and of randomness in this connection. Underlying everything is the role of rationality in the universe, which seems particularly problematic with traditions which deny the ultimate validity of concepts. Murti's view[29] is that within Buddhism there is no real problem with science as such, regarded in a pragmatic way; the actual issues concern philosophy and metaphysics. But such a standpoint risks reducing science purely to a descriptive level, a position which I would argue does not do science justice. This whole area, it seems to me, deserves much more extensive study, and of a much more thorough and objective kind than it has largely received so far.

Western faiths, in short, have little to fear at present from any claims that the eastern beliefs are more 'scientific' than the western. Such claims lack a firm base, and the ultimate anti-rationalism of much eastern mysticism presents profound problems. It seems strange to argue that rational science can actively support philosophies that in the end jettison rationality.

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29 Murti, op. cit., p. 125.

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