

# **TIAN REN HE YI (天人合一): AN ONTOLOGY FOR THE QUANTUM WORLD <sup>1</sup>**

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*Abstract: The project aims at finding out whether there is a way among the historical ideas of Chinese philosophy through which we can understand the relationship between a quantum system and its observer that appears puzzling, or even paradoxical, in the simple physicalist ontology which contemporary physicists (and scientists in general) take for granted. If successful, the effort may revitalize a fundamental conception between nature and human in traditional Chinese philosophy – Tian Ren He Yi (the unity of heaven and men) – by showing how it contributes to a better understanding of, if not solving, profound metaphysical problem in quantum theory – the measurement problem. More specifically, the project aims at finding out whether we can use the doctrine of Tian Ren He Yi (天人合一) to rehabilitate one of the most neglected but brilliant interpretations of quantum theory, the Wigner Interpretation, which makes consciousness the realm in which definite values of physical observables obtain.*

## **I. The Problematic in the Interpretations of Quantum Theory**

THERE SHOULD be little doubt that the quantum mechanical description of reality is *fundamental* and *approximately true*, by which I mean all physical systems are quantum systems which obey laws whose principal features are given by quantum theory (I include all branches of physics which are based on quantum theory, such as quantum field and superstring). By ‘approximately true’ I simply mean it is not at all likely that any future and improved theories of physics will turn out to be fundamentally non-quantum mechanical. If there was still hope before the EPR

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<sup>1</sup> *Editor's note:* At the 2009 APA Eastern Division meeting in New York City, Professor Neville delivered a talk calling for innovative approaches to advance the philosophical engagement of Chinese philosophy, with the emphasis on “addressing contemporary first-order problems.” Dr. JeeLoo Liu, the president of the Association of Chinese Philosophers in America (ACPA), was inspired by his talk, and brought the idea to organize special sessions on these new projects at the 2010 APA Eastern meeting. Dr. Hyung Choi, Director of Mathematical & Physical Sciences at the John Templeton Foundation, learned about this idea and was highly supportive of it. He secured a grant for the ACPA to further develop this “new projects” program. Part of the outcomes of this program was the production of six white papers that lay out future research directions for scholars interested in Chinese philosophy. Five of these papers are particularly focused on Chinese cosmology or Chinese metaphysics, as one of the aims of the John Templeton Foundation was to define the interface between science and metaphysics. Our hope is that these white papers will spark more interests in Chinese metaphysics and make Chinese metaphysics more relevant to the scientific worldview of our times. We will continue to publish the rest of these papers in our next issue for more future discussions.

experiments that either *classical realism* or *locality* may be recovered in the future, such hope is all but dashed by now (cf. Wheeler & Zureck 1983).

Given the above, we also recognize that which is completely described by quantum theory may not be all there is in reality. In other words, quantum theory is very unlikely to be complete (or better still, it may in principle be *limited*). Einstein raised this prospect in his paper with Podolsky and Rose (i.e. the EPR paradox, cf. Bell 1987) by arguing thus: any measurement experiments, including quantum measurements, must be processes of obtaining pre-existing values of the measured quantities; and yet if quantum theory is correct, what is possible for a quantum measurement to acquire cannot be what the system possesses before the measurement. Thus, quantum theory as a physical theory is intrinsically incomplete (or limited). Von Neumann's study of quantum measurement reveals this problem in a different way (cf. van Neumann's classic paper in Wheeler & Zureck 1983). Two distinct processes must take place in any measurement of a quantum system (which one must remember includes every physical system in reality); one is the quantum mechanical evolution and interactions among all systems (the measured as well as the measuring plus the environment) which obey the 'Schrödinger equation.'<sup>2</sup> The second is the infamous 'collapse of the wave packets,' by which, and only by which, a quantum measurement is completed and a definite value of the measured observable obtained. The collapse sounds like a physical process, and yet it is neither accounted for by quantum theory nor suggested by anything remotely promising. This is the reason we cannot attribute the measured value (obtained after the collapse) to the observable in any form before the measurement (hence the EPR paradox).

A further twist deepens the mystery of quantum theory. It is well known that while the wave packet, which obeys the Schrödinger equation, does not tell us which value an observable has at a certain time; it does provide an accurate probability distribution of all of its possible values. If that were the only obstacle, there should be no mystery or paradox to speak of in quantum theory; the situation would have been entirely similar to classical statistical mechanics, in which definite values of the observables in question are not known or predictable, but their probabilistic distributions are. Quantum probabilities, as it was soon discovered, are nothing like the probabilities in statistical mechanics. While classical probabilities are compatible with the assumption that measured observables possess definite values (but we are ignorant of them before measurements), quantum probabilities are emphatically not! This is why, when John Bell made this assumption together with the assumption that no signal can be transmitted faster than the speed of light (i.e. special relativity holds), he derived results contrary to the ones derivable from quantum theory; and all experiments verified the quantum mechanical results (cf. Bell 1987).

Attempts to close the gap or complete the theory in one form or another – some of which were only realized as such attempts years later – began almost as soon as quantum theory took shape. What is later known as the Copenhagen Interpretation, the brain child of Niels Bohr and his 'disciples' which includes Heisenberg, Born et

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<sup>2</sup> I used quotation marks to indicate that the phrase does not refer to the actual equation but acts as a tag for whatever quantum mechanical law that governs the change of quantum states.

al., imposes a *de facto* division between classical, i.e. macroscopic, systems and quantum, i.e. microscopic, systems such that measuring devices only belong to the former. Philosophical problems abound for this interpretation, despite its practical virtue which contributed to its adoption by most working physicists. The mystery of quantum systems remains but at least it remains where it should be located, at the boundary of observability. Philosophically minded physicists, as well as philosophers who are fascinated by the mystery of quantum theory, made further attempts to expel the mystery or resolve the paradox. There emerges a vast category of interpretations which can be called ‘hidden-variable’ interpretations (cf. Wheeler & Zureck 1987). The motivation for such interpretations is simple if not a bit naïve: if a quantum system does not possess before measurement a definite value for the measured observable, it must have some other, hidden so to speak, variables which do have definite values. These variables are hidden because they are by default unobservable (otherwise according to quantum theory they cannot have definite values before measurements) and therefore can never be discovered by any experimental means. They are postulated solely for the sake of recovering certain features, such as determinism and locality, without which the paradox persists. The virtue of such interpretations is that they appear to be the most sensible extensions of classical physics and completely take out the mystery or paradox of QM. The downside is that they seem to be utterly *ad hoc*. The one rule that these interpretations must obey is that they have to be *empirically equivalent* to quantum theory, producing no experimentally testable predictions that disagree with the quantum mechanical predictions, or whatever predictions they produce that disagree with quantum theory must be in principle unobservable.

Eugene Wigner, a Nobel laureate in physics, proposed a bold interpretation of quantum theory which takes ‘observation’ in a quantum measurement literally, namely, the definite value of the measured observable becomes definite only when it is registered in the consciousness of the observer. In other words, it is the consciousness which collapses the wave packet and completes the measurement. Since quantum theory tells us no interactions of quantum systems can – in terms of physical possibility – collapse a superposition (superposed wave packets), as a consequence of the von Neumann account of quantum measurement; something else must be involved, something non-physical. There is really nothing else present in a measurement, unless one believes in ghosts and gods, which is not physical. In this sense, the interpretation is simple, natural, and very bold<sup>3</sup>.

One can, on the other hand, hardly fail to realize that it would be a tall challenge to defend such an interpretation. How exactly does consciousness cause a collapse of the wave packet? What kind of causation are we talking about? How should we understand consciousness in this account? The registration in consciousness of a measured result that ends a measurement: what is the nature of it? If consciousness is beyond the realm of physics, what is it and how can we account for it? Is it plausible

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<sup>3</sup> Wigner’s interpretation is primarily given in E. P. Wigner, *The problem of measurement*, *American Journal of Physics* 31, 6–15 (1963), which is included in the *Collected Works*, vol. 6, p.165, see also *Collected Works*, vol. 3, part II, and vol. 6.

at all to embrace such a dualism? Is not the ontological cost too high? Besides, even if we can answer all these questions, how can we deal with the individuation problem of consciousness? Whose or which consciousness is responsible for the collapse of the wave packet in a measurement if more than one person made the observation at the same time? The definite result obtained by the observation: does it belong to the measured system or is it merely a mental item in the observer's consciousness? In other words, can the measurement of results be objective? If it only belongs to the observer, how can it be relevant to the way in which the measured system behaves afterwards?<sup>4</sup> Since its proposal these and other complexities have prevented people from taking Wigner's interpretation seriously.<sup>5</sup>

## II. Tian Ren He Yi (the Unity of Heaven and Man)

The belief that heaven or nature and men are connected by a profound unity (henceforth TRHY) is neither recent nor only found in traditional Chinese philosophy. Yet as a dearly cherished and richly developed doctrine widely held for many centuries, TRHY has been uniquely Chinese. One of the few fundamental beliefs held in common among the otherwise radically different philosophical and religious traditions of Confucianism, Buddhism, and Daoism, is this belief that despite all appearances to the contrary, the 'heaven,' which is really nature in its uncorrupted form, and the 'men,' which is the consummation of nature, are profoundly united in principle; as such they are essentially one and the same. Here 'essentially one' or 'of one essence' is the key notion; somewhat similar to the case of personal identity over

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<sup>4</sup> This question may appear to be more difficult than it actually is. There is a long tradition in the history of philosophy dealing with the question of whether the observed results belong to the objects themselves or to the observers. Among the more prominent figures we have Locke and his theory of secondary qualities; and if we go to Kant, the question is even more seriously treated in his philosophy. Therefore, Locke has no problem giving a theory of how powers inherent in objects themselves may evolve in time in such a way that the observed results about secondary qualities form coherent experiences. The one peculiarity about the quantum measurement situation is that we now have one theory, the quantum theory, for the unobserved system (the evolution of wave packets) and another theory for the observed system (the evolution of a classical system), whereas neither Locke nor Kant would even consider a theory for either the powers or the Ding-an-sich.

<sup>5</sup> There are still two other interpretations I have not mentioned; one is the many world or many mind interpretation, and the other is the decoherence theory. The former seems too fanciful to me, and we now realize the latter by itself is not a complete interpretation. There is indeed a process of decoherence in a quantum measurement, but a complete decoherence only happens at the ideal limit of infinite number of degrees of freedom. While one may argue that most measuring devices and their environments do approximate such sizes, there are many measurement settings in which, apart from the presence of a conscious mind, only a very limited number of degrees of freedom exist. Yet measurable results are obtained. So, decoherence is not necessarily a condition for quantum measurement.

time, where two different, and sometimes radically different, particulars at two different times can be one and the same person.<sup>6</sup>

A brief summary of this doctrine in traditional Chinese philosophy proceeds as follows<sup>7</sup>. In Confucianism, the doctrine derives from the conviction that the foundation of morality lies in the principles which govern the movement of heavenly bodies. The contrasts between the spaciousness and longevity of heaven with the short and narrow lives of men, the gentleness and regularity of the movement of heavenly bodies with the aggressiveness and inconstancy of human desires, the majestic music of heavenly sounds with the mean noise of human gatherings - all seem to point to the inevitable conclusion that the ideal of morality derives from the principles of heaven, which is also the principle of men. It is only through the contemplation of the true nature of men, which is nothing but Nature (or the principle of heaven) may we discover moral principles, and only by following such principles in our actions may we bring forth the kingdom that men truly deserve. In Zen Buddhism, the ideal state of emptiness, a state of the soul that is uncontaminated by human desires and social conventions, is precisely a that state which is closest to the heaven, which is nearly empty and which contains the true principles for everything. The doctrine of TRHY serves both as the ideal and the justification for the Buddhist way of life. And finally and most importantly, in Daoism, which might be said to hold the 'patent' of TRHY, we find many key concepts which originate from the doctrine.

Why should people practice 'wu wei (non-action),' and why is it that only by wu wei can one achieve 'wu bu wei (nothing is left unaccomplished)?' It is precisely because nature and men are one and the same. Man's desires and the actions which allow him to satisfy them force him away from nature and therefore make him deviate from his own nature. Wu wei is not really doing nothing but following the true nature of man, which is one with nature, and therefore everything gets done (wu bu wei). Small states without much wealth also fit man's nature, because only in such states can he be one with nature, which is what he should be in the first place. TRHY also appears in such classics as *Zhou Yi* and *Huang Di Nei Jin*, from the latter stems the glorious tradition of Chinese medicine. In cosmology, man is represented by the earth in contrast to the heaven, and the unity of the heaven and the earth is the central theme of the cosmological part of *Huang Di Nei Jin*. Being at the center, the earth mirrors heaven which surrounds it. In this sense it is a microcosmic instantiation of the same principles or patterns (i.e. *Li*) of heaven. This is their macrocosmic instantiation; two different instantiations which have radically different appearances but share (or obey) the same *Li*, the evidence of which can be found everywhere in heaven or on earth with discerning eyes. In Chinese medicine, the working of the human body is also in accordance with the *Li* of heaven and earth, which we might as

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<sup>6</sup> Just as one does not have to be an essentialist to believe in the possibility of personal identity over time (despite great physical and psychological changes); neither does one have to be an essentialist to believe in the identity of heaven and a human.

<sup>7</sup> The references I primarily used for this proposal are Fung Yu-Lan 1988, Chan 1963, and Needham 1956.

well call Nature. Again, with a sense of relativism that one finds in widespread uses in Daoism, the human body is now the microcosm - and heaven and earth are the macrocosm; the idea of principle versus instantiation applies once again between Man and Nature.

What is the 'Li,' which is often translated as 'principles' or 'laws'? Controversies aside, we may follow Needham by taking 'Li' to refer to the most fundamental patterns of the distribution of the Ying, the Yang and the Five Elements among different substances of Nature. If so, this doctrine of TRHY can be understood as shared patterns of distribution among radically different token configurations of the Ying/Yang and the Five Elements, such as heavenly bodies, earthly creatures, and human beings.<sup>8</sup> While TRHY had never been seriously challenged in history, it reached its pinnacle in a unification of different schools in Zhu Xi's *Dao Xue* (or *Li Xue*). In his theory, Zhu finally made it clear that Li represents abstract patterns or laws (the Platonic forms, if you will) and Chi represent the universal substance (energy, if you will) in which particulars are formed via the unification of the Li and the Chi. 'Unification' here should really be understood as 'instantiation' or 'actualization' in our current (mostly Aristotelian) philosophical parlance. And TRHY became in Zhu Xi the belief that the Li is the same for Heaven and Man.<sup>9</sup>

### III. TRHY and Wigner's Interpretation of QM

Whether or not we can find anything useful in the doctrine of TRHY, as briefly sketched above, which could be used to rehabilitate and therefore defend Wigner's interpretation of quantum theory, will depend, *inter alia*, on whether or not we can answer the kind of questions raised towards the end of Section 1 with the help of TRHY. One of course should not expect that the answers can be directly read off the available content of the doctrine; and one perhaps should also not expect that the sort of answers we can give 'with the help of TRHY' are exactly those that philosophers of quantum theory have already found lacking for Wigner's interpretation. What must be done in this endeavor includes:

1. A search for a perspective or an interpretation of TRHY, or a part of it, so that its faithfulness can withstand the scrutiny of experts in Chinese philosophy, on the one hand, and on the other, it provides a reorientation of the problematic interpretation of QM such that defensible answers can be given.

2. A robust defense of the selected perspective, if found, must be given in contemporary (analytic) philosophy, so it cannot be simply dismissed as being

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<sup>8</sup> I avoided using 'human bodies' because it gives the impression that we exclude psychical or mental aspects in this context, which is entirely misleading. No mind-body distinction, which we inherit from the Cartesian tradition, should be applied here. If TRHY applies to Man and Nature, 'Man' stands for the whole human being, not just its physical aspects.

<sup>9</sup> In the earlier part of this summary, I may have unconsciously used the same language to expound the doctrine of TRHY. Strictly speaking it was only after Zhu Xi, this way of talking about the doctrine became available. Above I am guilty of anachronism.

irrelevant or indefensible. For example, if the perspective is a dualist one, a defensible version of dualism must be given. One cannot simply shelter it by branding it a Chinese sort of dualism thereby leaving it undefended.

3. Any reorientation must appear plausible in the context of contemporary physics. We would judge it a failure if it creates major ruptures in the fabric of quantum theory. The process of reorientation must not result in new or reconstructed theories.

With this proviso in mind, let us see how the questions can be approached. Everything in this section is tentative, of course, for much research and thinking have to take place before a definite answer to the ultimate question, which partly entitled this project, namely, “a new ontology for the quantum world?” can be given.

The first set of questions, which seem to block Wigner’s interpretation, are really about the nature of causality in the process in which consciousness collapses wave packets. A dilemma primarily derived from the perennial mind-body problem seems to arise here. If the mind which carries consciousness is nothing over and above the physical, the collapse of wave packets that ultimately terminates a quantum measurement can never happen (i.e. superposition all the way as long as what is involved is exclusively physical or that which obeys the ‘Schrödinger law’). But if the mind is something beyond the physical, how is a causal interaction between it and the measured system, which is supposed to collapse the wave packets, possible? What kind of causality occurs in the latter case?

If we want to go with Wigner’s interpretation, the first option, treating the mind as equally physical, is not open to us. So the question becomes whether we can come up with a plausible notion of causation which applies to processes between the mental and the physical as dualist elements. The mind which collapses the wave packets (which are physical) must be conceived as either a different substance – for substance dualism – or a totally distinct sort of property – for property dualism. For a plausible notion of causal interaction, substance dualism has considerable more difficulty than property dualism. Even so it is still a big challenge even for the latter. The main problem for a causal theory of property dualism is the tension between a genuinely dualist metaphysic and a plausible model of causal interaction. The more plausible the latter – the more likely property dualism degenerates into some sort of physicalism, which is obviously monistic.

Joseph Needham rejected the way in which Li in the neo-Confucian school is interpreted as ‘laws or principles of nature’ or as ‘Plato’s form’ (cf. Needham 1956, ch. 16). The closest notion he found in the western thought was ‘patterns’ or actual patterns because as we mentioned earlier, Zhu Xi, the most prominent neo-Confucian, related the notion of Li to such things as the veins in jade. The doctrine of TRHY when understood as the unity of Nature and Man would see the fundamental ‘patterns’ of Nature and of Man as the same. Here the notion of Man certainly includes his mental aspect. Even though the mental and the physical are so radically different that it is more sensible to see them under a dualistic light, and yet because of TRHY, the difference is rather superficial or only in appearance. In Zhu Xi’s terms, it is the difference of *Chi* but not of *Li* since causal principles are about Li not about

Chi. Hence, I do see a way of articulating a sensible metaphysical account for the kind of causal interactions which constitute the collapse of the wave packets.

To get things started, we can already conceive of the collapse of the wave packets by and in consciousness as a special causal process which does not involve energy transfer. On the one hand, this is consistent with the existing understanding that the collapse of the wave packets is a process of actualizing a probability or propensity, which naturally does not require any transfer of energy. On the other hand, it is also consistent with TRHY in neo-Confucianism such that the transaction between the mind and the quantum system is not really a process taking place between 'two things.' Since ordinary causal processes are among actualized objects or events, those causal processes we are dealing with here are already outside the domain of ordinary physical causation which is necessarily accompanied with energy transfer of some sort.

The distinction between event causation and agent causation is already a well-established concept in contemporary philosophy, and agent causation carries the sort of controversial dualism we mentioned above on its back. If TRHY can relieve the tension in dualism, then agent causation in this new light may just gain a new lease on life.

With this approach to a solution of the questions concerning causality, we can begin to deal with the next set of questions, which ask about the nature of measurement observation. What is an observation (in the sense of epistemology) if not a combined act of our body and mind which results in a cognitive registration of some effect in the world? If so, the result of an observation is first and foremost an epistemic state, a state of knowledge, which represents the corresponding state in the world under proper observational conditions. How can an observation determine if the result was not there in the first place, created by a chain of physical causation? How can the representing be counted as the represented? Is not this a categorical mistake? Many regard Wigner's interpretation a non-starter simply because of these sorts of difficulties.

Here I think the doctrine of TRHY, when properly updated, can help us to make great strides in removing such difficulties. In updating the doctrine we notice it has been used as a great equalizer of all the distinctions and separations which common sense inculcate in us. One of the most recalcitrant differences is the mind-body division, which implies *inter alia* - the fundamental difference between epistemic states and natural/physical states. Therefore, if we follow the spirit of TRHY, we would not, and should not, dogmatically adhere to the division between the state of knowledge and the state of nature, nor between the representing and the represented. The observational results are no mere reflection of what is there in the world, already determined before the observation. They are rather a part of reality comprising both the physical and the mental. Moreover, because the Li is in everything and it is one and the same between Nature and Man, what is observed, though primarily mental, is also part of reality, and therefore part of a measured system. Much careful work needs to be done before this can be fully rendered into a coherent view, but the direction is clearly marked and quite promising as it is.



The next question is how high the metaphysical cost is to espouse such a dualist view of reality? One person's cost may be another person's profit, and the kind of dualism sketched above is by no means the kind of divisive dualism that has been deemed too costly in contemporary western metaphysics. Part of the attraction in using TRHY to rehabilitate Wigner's interpretation is it may provide a more sensible version of mind-body dualism from which the interpretation can no longer be easily dismissed. Therefore I expect the doctrine of TRHY will allow us to remake Wigner's interpretation into one of the most viable interpretation of QM.

This new TRHY informed dualist view of the quantum world allows us to consider further issues such as the individuation of consciousness or the objectivity of quantum measurement results, etc. The final form of such solutions will depend on the final form of the dualist view. Since these are the toughest perennial problems in the metaphysics of any tradition or kind, which have never received satisfactory answers no matter what dualist worldview one adopts, we should not have too high an expectation for their solutions.<sup>10</sup>

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<sup>10</sup> This is probably one of the chief motivations of contemporary philosophers to enlist with the monists or the physicalists.