Quantum Science and Yijing Theory

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By

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Praise for *Quantum Science and Yijing Theory*

"Lu and Busemeyer masterfully bridge East and West, past and future, Yijing and Quantum Theory. By presenting inspiring connections between the nature of the universe—such as yin-yang and qubits—they shed new light on this ancient text. This human-centric perspective, where the macrocosm (the universe) and the microcosm (the human) are entangled, gives rise to tantalizing new ideas in the ongoing pursuit of understanding the human mind and its place in the cosmos. "
Goren Gordon, ***Professor of Informatics at Indiana University, USA***

"This thought-provoking book spans two seemingly disparate theories of the universe: YiJing theory and Quantum Science. Both have their own native conceptual frameworks, symbols, systems of thought, spanning East and West, across a few millenia. Despite these differences, the authors take us on a fascinating journey, showing how each theory, in its own unique way, points to the same mysterious indeterminate nature of the universe, thereby inviting us to broaden our views of what science is."
Peter Bruza, ***Professor, Queensland University of Technology, Australia***

"This book is a groundbreaking work to fully understand the “Yijiing” from the perspective of quantum theory and likewise understand quantum science from the philosophical perspective of the “Yijing”. The author of the book compares the "yin-yang" duality of the “Yijing” to a quantum qubit with a brilliant stroke of conceptual integration. This book opens up a novel interpretation path for the two classic theories of the East and the West, and the unexpected consistency in understanding the universe between modern quantum science and “Yijing” theory is sure to attract readers with the strong attraction of ancient and modern thoughts."
Yin Kai, ***Professor, Tianjin Medical University, China***

"I originally thought that the Yijing theory of the East and the quantum physics theory of the West were two parallel lines that did not intersect each other. After reading this book, I found that the author blended the two together with a unique perspective, making these two parallel lines intersect. This discovery shows that ancient Eastern culture can be integrated with modern science. Reading it can be said to be an eye-opener. This is a good book that combines the East and the West, and it is worth reading."
Wang Yafa, ***Book Author and Writer, Australia***

We dedicate this book to our parents

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PREFACE

What did the ancient creators of the ancient "Yijing" (Book of Changes) think about the relations between the human mind and the physical universe? At that time and place, Newtonian mechanics, Einstein relativity, and quantum mechanics did not even exist. However, was the understanding of the ancient Chinese cosmologists more in line with a disconnected and clockwork type of Newtonian universe, or more like a holistic and integrated quantum universe? In this book, we explore the connections, between the modern quantum science and the ancient "Yijing/Book of Changes." By examining these questions, we hope to open-up a new way to explore humanity and the mysteries of the universe.

Why should one be interested in the Yijing, a book that is thousands of years old, and how could it help to understand it using modern quantum science, which is only a couple of centuries old.

The Yijing is a classic text that elucidates the profound principles of humans and their relation to the universe and discusses some of the great truths of life. The content of the Yijing ranges from observing the heavens above and surveying the earth below to understanding the emotions and interactions of all things human. It explores the grand principles of change and constancy between humanity and the universe, encompassing transformations through history and the changes in life itself. It forms the foundation of Chinese traditional culture and is the origin of all academic thought.

Quantum science brings us to the dawn of a new era of science and technology. It provides the key to changing the future, and a key to unlocking the mysteries of the universe. Quantum theory may be able to exert its great power and provide us with a new perspective to fully understand the Yijing.

In this book, we explore the intersection and commonality between the ancient Yijing wisdom and modern (quantum) theory, in order to deepen and broaden the imagination of future science. What we have tried to accomplish is to make clear connections between some of the basic principles underlying the Yijing and quantum theory. We show how the quantum principles of superposition, entanglement, and complementarity were also contemplated some ways by the creators of the Yijing. In summary, there seems to be some quantum theory hidden inside the

Yijing. Discovering these "hidden" connections gives us a passion for deeper exploration and a sense of responsibility and mission for future research.

The book is composed of eight chapters that span a wide range of topics ranging from the Yijing principles based on the “Yin-Yang” duality, the understanding of consciousness from the point of view of Traditional Chinese medicine theory, and quantum principles applied to human judgment and decision making. First, we focus on topics related to the Yijing. In chapter 1, we introduce the main questions and connections that we discuss in the remainder of the book. Chapter 2 then presents a brief history of the Yijing and includes a summary of some of its main ideas along with some example applications to real life questions. The Yijing provides the foundation for Traditional Chinese medicine theory, and Chapter 2 reviews these connections. Chapter 4 describes how to understand consciousness from the point of view of the Yijing and Traditional Chinese medicine theory. Next, we turn to topics related to quantum theory. Chapter 5 reviews some of the basic principles of quantum theory in an intuitive and non-technical manner. This chapter also describes some of the puzzling findings that inspired its creation. Ultimately the decisions one draws from consulting the Yi-Jing are based on human judgment, and Chapter 6 summarizes the application of quantum principles to human judgment and decision making. It thereby provides an important bridge between the Yi-Jing and quantum theory. Chapter 7 is the primary chapter that integrates all of the previous chapters together and outlines the basic connections between quantum theory and the Yijing. Finally, Chapter 8 provides discussion for new directions to explore in the future concerning the relations between quantum theory and the Yijing.

We sincerely hope that this book can start a new dialogue between science and tradition (quantum and Yijing) and inspire exploration and discussion of the grand ideas contained in quantum theory and Yijing. We are waiting to see, and hope that many scientific researchers and readers will broaden their horizons with us, and bravely think, explore, and research. Because, walking on the road of scientific exploration, we deeply feel that we have a heavy mission and sense of responsibility to our predecessors and future generations.

ACKNOWLEDGEMENTS

Chapters 3 and 4 are based on medications, extensions, and additions to the articles.

Lu, M. and Busemeyer, J.R. (2014): Do traditional Chinese theories of Yi Jing (“Yin-Yang") and Chinese medicine go beyond western concepts of mind and matter? Mind & Matter 12(1), pp. 37{59.

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CHAPTER 1

INTRODUCTION

Compared with the vast and boundless universe, our insignificance is almost like dust. To unravel the many mysteries of the boundless universe, we humans continue to research and explore and do our best. However, due to the limited sensory and cognitive abilities of human beings, we often meditate in a daze in front of the huge universe, and use limited observation and limited thinking to reason, explore, and explain the relationship between the universe and human beings. Generation by generation of our scientific researchers have been going all out, tirelessly, and working hard despite difficulties. It must be admitted that this is also the great pioneering work of our mankind. With these ambitious goals in mind, we humbly attempt to make a small step forward by asking the following deep questions.

What connections, if any, are there between the modern quantum science and the ancient "Yijing/Book of Changes?" How is the ancient Yijing way of thinking about nature and reality related to the modern quantum way of thinking? What can be discovered by investigating these distant connections? On the one hand, can we understand the Yijing better if we examine it from the point of view of modern quantum science? On the other hand, can we learn something about modern quantum science by examining the Yijing?

Fig. 1.1 The ancient Chinese calligraphy for the word QUANTUM.

We boldly put this big question forward here today, not because of our naivety and arrogance, but because we want to use a joint research method to open up a new way to explore humanity and the mysteries of the universe. So far, there have been many philosophical discussions about the Yijing, and there are many different opinions. However, from the perspective of modern science, there is a void in the field, and there is no firm basis in the scientific details. But this does not mean that this question is not worth studying, nor does it mean that it is a mistake to address this issue. On the contrary, the more inconsistent the problem is, the more worthy of our exploration and research. After all, we are not experts in the face of all the great truths of the universe. Doing this interdisciplinary research will inevitably have loopholes, and some inappropriate arguments will inevitably lead to laughter. However, we have a research attitude that is not afraid of failure and ridicule. As a matter of fact, more and more

scientists are becoming interested in the Yijing. For example, Niels Bohr, one of the founding fathers of quantum mechanics, adopted the "Taijitu" as his coat of arms when he was knighted by the Denmark royalty. Researchers of the Yijing have also published books and articles on this relation. For example, in his popular book the "Tao of Physics," Fritz Capra explored connections between Daoism and modern physics. This means that intersecting research between Yijing and modern quantum science is desirable, such as examining the commonality and similarity of the two multidimensional topics, clarifying the ambiguity of the two, and comparing the description of the world by the two. We think it is very necessary, and even a wise choice, to take this question as deep academic discussion worthy of serious attention.

If you have read this far, then perhaps you have accepted our claim that these are potentially worthwhile and interesting, albeit unusual, questions. But then you might wonder why one should be interested in the Yijing, a book that is thousands of years old, and how could it help to understand it using modern quantum science, which is only a couple of centuries old?

Why consider the Yijing? As pointed out by many others (see, for example, the introduction to the Wilhem/Baynes classic book titled "The I Ching"), the Yijing is one of the most important books ever written across cultures and ages. The ideas in it initially appeared from a mysterious naturalist, called Fu Xi, over 5000 years ago, but it maintained the attention of scholars and the interest of the lay public all the way up to the current time. As we discuss in later chapters, it is a product of a long history of ancient Chinese philosophers and natural scientists. The book is widely read, and it has been translated into most major languages across the world. Two major branches of Chinese philosophy, Confucianism and Daoism, were inspired by this book.

The Yijing provides us with a way of thinking to observe and explain the world, and it provides a set of life norms and wisdom for guiding life. Its thinking is broad and profound, and although some aspects are unpredictable, it has had a powerful impact on the social life, political ideas, moral awareness, and folk customs of the Chinese people. The deeper theme of the book is to express the humanity and humane consciousness of people, the reasons why people are human, to promote rationality, and to strengthen people's consciousness of being human. It reveals the consciousness and confidence of the ancestors of the Chinese nation in humanity, showing a positive and optimistic spirit.

The Yijing has served as a major resource for several different purposes including prediction, decision making, human ethics, and a guide for a way of life. Its influence on humanity is unfathomable. Most

pertinent to us here are the principles that the Yijing describes regarding the rules for how the universe changes, and especially how these changes interact with human judgments and decisions. Essentially, the Yijing provides a theory about the laws of nature, and the rules concerning human life. Our purpose is to try to examine and understand the natural laws formulated by the authors of the Yijing from the point of view of modern quantum science.

Why then make the connection to modern quantum science? Quantum mechanics (and its quantum field extension) is the best empirically confirmed scientific theory in human history. Not only is it a foundation for physics, but it is also the foundation for microbiology and chemistry. Its practical applications, such as the laser and the transistor, have revolutionized our world. Finally, its counterintuitive ramifications have fundamentally changed the way we understand our world. The classical Newtonian "clockwork" view of nature as a deterministic causal machine was mightily struck down by many paradoxical findings observed in physics during the last century. These paradoxical findings, including some even contributed by Einstein, gave birth to a new quantum mechanical understanding of nature that was profoundly indeterministic and acausal. The history of quantum and a review of some these paradoxical findings are reviewed in later chapters.

A point we need to make clear right away is that we are not proposing that quantum mechanical physical effects necessarily underly the predictions or decisions made by consulting the Yijing. It would be fascinating if this were true, but our arguments don't rely on any such direct physical implementation. Instead, our work relies on the new understanding of causality and reality afforded by the modern quantum science.

More specifically, we base our discussion on the abstract principles of quantum theory from which quantum physics was built, but we use these abstract principles without relying on the physics per se. These abstract principles include the concepts of superposition, uncertainty, complementarity, contextuality, and entanglement. Each of these principles can be expressed in a rigorous mathematical form, but we leave these discussions for the later chapters. The main idea is that quantum theory can be more generally viewed as an abstract mathematical theory that is used to describe events observed in the world. Physical events, like detection of a photon, are one category of events that have successfully been explained by this mathematical theory, but this general mathematical theory may also have useful applications with other categories of events,

like human judgments and decisions, which are the main concern of this book.

Actually, it is not unusual for mathematics that was originally built for physical applications to be transferred outside of physics like this. For example, classical diffusion models were originally developed to describe the Brownian motion of molecules in a liquid, but later they have been applied outside of physics to finance, disease epidemics, cognitive and neural decision models, and many other applications. The same is happening now with the mathematics from quantum theory: applications have appeared in psychology, social science, finance, artificial intelligence, information retrieval, and engineering. Later chapters provide some convincing empirical evidence for these applications.

Now we introduce our main question, and briefly consider the connection between these two great theories. Later chapters expand on these introductory ideas in much more depth and breadth. The first and most basic connection concerns the “yin-yang” theory.” The Yijing explains that the universe changes according to the dynamical interactions between two polar opposite states of being, the “yin” and “yang” states. Yin represents even, black, cold, darkness, organization and unity, and so forth. Yang represents odd, white, heat, light, disorganization and dispersion, and so forth. Everything in the universe has some “yin” and some “yang.” These two polar opposites are not really separated, but instead they form a dynamic unity. The unified meaning of yin and yang, which is of fundamental significance, is revealed in the “Tai Ji" diagram (see Fig. 1.2). The light part of the circle represents yang, and the dark part represents yin. The small white dot within the dark represents the yang within every yin, and the small dark dot within the light represents the yin within every yang. For example, inside a good situation may lie the seeds of danger for bad times that could follow. Chinese culture (medicine, astronomy, geography, digital art, philosophy, and various classic works) all evolved from this basic yin-yang theory. It has had a most profound impact on Chinese people’s worldview and outlook on life.

Fig 1.2 Taiji Diagram. The white part of the inner circle is yang and the black part of the circle is yin. Characters surrounding the circle are the eight gua representing (clockwise from top) heaven, water, mountain, thunder, wind, fire, earth, lake

Importantly for the Yijing, there is continuous change in each situation from one polar opposite to the other. When yang reaches its peak, it begins to change to yin and visa-versa. The dynamic changes in these two polar states obey a natural law of the universe called the Dao. For example, one needs to beware in very good times because there may be danger that a bad time might soon follow. That is to say, even if the result of divination is good and auspicious, one should not act recklessly but should be disciplined and cautious. Harmony with the Dao is achieved when the "yin-yang" states are kept in balance. In the Yijing, when a "yin" state is observed, it is coded by a line, called a "yao" composed of two spaced dashes "- -"; and when the "yang" state is observed, it is coded by a "yao" composed of a single solid line "—."

The idea that the world is built from a collection of two polar opposite states is not so farfetched, and in fact, it can be related to ideas from classical information theory and classical computers. A classical computer, and its program, is composed of a "false" state coded by the number "0" and a "true" state coded by the number "1." The computer program changes these bits discretely with a jump from "0" to "1" while executing its program. The yin state symbolized as "- -" is analogous to the "0" or "false" state of a bit in a computer, and the yang state symbolized as "—" is analogous to the "1" or "true" state of a bit in computer. However, this analogy breaks down in an important manner. The bit of a computer can only take on two definite state "0" versus "1," and it jumps discretely from one to the other. In contrast, the yin-yang states form a unity with some balance between the two polar states. At any moment within each situation there is some potential for both yin and yang. When an observation is made at some time point, there is some potential for the person to observe the yin state (and record the code "- -") or a yang state (record the code "—"). Also, rather than discrete jumps, the yin-yang dynamic continuously rotates the situation from yin to yang and vice versa.

A closer analogy is possible when we consider quantum computers, which operate on states called qubits. A qubit is the quantum computer analogue of a classical computer bit. However, unlike a classical bit, which is either "0" or "1," a quantum qubit can have an infinite number of states between "0" and "1." Here, we propose that the qubit is more closely analogous to the polar opposite yin–yang state. Later, we discuss the concept of a qubit more carefully, but for now we describe a qubit as bipolar state, like yin and yang, that has some potential to be "true" or the "1" state, and some potential to be "false" or the "0" state. If a qubit is observed at some moment, there is some probability that a "1" outcome will be observed, and some probability that a "0" outcome will be observed. Like the yin and yang state, the qubit is in a balance of potentials between the two bipolar states. Also, like the yin and yang dynamics, the qubit continuously rotates over time from potential to be "true" to a potential to be "false."

The second important connection concerns the observation by a person of a hexagram or "gua" according to Yijing theory. It is simply fascinating to know that the creators of the Yijing tried to categorise all the different possible situations that people can confront in the world into 64 categories. Of course, these categories aren't necessarily abstractions about the world, but they are designed to capture all the possible situations, and form the main distinctions needed to make predictions and decisions about all these various situations. Importantly, the gua indicates the tendencies present at the moment in the world. In this sense, the gua represents the germinating situation that will soon unfold in the world. By acting on the basis of the germinating situation, the person can take the action that is most appropriate for maintaining harmony with the dynamic law of the Dao. Each of the 64 gua are represented by 64 symbolic patterns formed by combining two trigrams, an upper trigram, and a lower trigram. Each trigram, in turn, is composed of three yao. Each yao can either be a yin symbol "- -" or a yang symbol "—." Thus the 8 lower triagrams are combined with the 8 upper trigrams to form the 64 gua, with each gua corresponding to a category of situations.

A fundamental idea of the Yijing is that the important changes in the world can be captured and represented by the changes in the 64 categories. In this sense, using modern scientific terminology, the dynamic law of the Dao is represented, in an abstract way, by a finite state machine (e.g., a computer) that transits from one of the 64 categories to another. Each yao of a gua can change or move across time to produce a new world situation. Following the dynamic law of the Dao, changes in the yao produce changes in the pattern for the gua, which then produces the change in the

people and world situation existing currently, in the past, and in the future. The key idea of the Yijing book is for the person to observe a gua, and then refer to the pages in the Yijing book where that gua is discussed. The discussion allows the observer to understand the current situation (i.e., category) in the world, anticipate the movement from this situation, and decide the appropriate course of action for this category of situations.

One possibly controversial issue concerns the deterministic versus indeterministic nature of the changes in the gua or world situations. As we mentioned earlier, we argue that the yin-yang states correspond more closely to a quantum qubit rather than a classical bit. For a classical computer, the observation of "1" state, for example, simply records the reality that existed in the computer before the observation was made. For a quantum computer, the qubit is not exactly in the "1" state and it is not exactly in the "0" state either; but when a measurement is made the qubit must "decide" whether it really becomes a "1" state or a "0" state. In this sense, the reality that we observe is created by the act of observation. Similarly, before a person observes a gua, the situation is in some balance of yin and yang, but the indeterministic nature of the observation of the gua forces the situation to be coded as one of two types of yao, each yao becomes either a yin, "- -" or a yang "—" code. As with the qubit, the observation does not simply record a pre-existing definite state, and instead it creates a definite yao from the potentials. Like the qubit, the yao that we observe is created by the act of observing a gua. We return to a discussion of this interesting issue in later chapters.

A crucial step in the use of the Yijing concerns the selection of a gua by person. It is during this step that the mind of the person is presumed to interact with the situation of the universe to select a gua. The person (microcosm) and the universe (macrocosm) are considered to be one unified and wholistic system. The person consulting the book focuses his or her conscious attention on a well-formed question. Then an indeterministic device (e.g., reading shells or bones, division of yarrow stalks, tossing of coins) is used to allow the person to unconsciously enter a relationship with the rest of the universe that produces an answer to the person's question. It requires a clear and tranquil mind that is receptive to the cosmic signal that needs to be perceived by the person using the indeterministic device. This part of the divination process seems to be beyond the usual cognitive processes used to perceive the world based on the five senses (seeing, hearing, touch, smell, taste). Not all people are capable of engaging and receiving this cosmic signal, and not all are receptive to its answers. We argue that these procedures maximize the establishment of "quantum pairs" and "entanglement" between the person

and the world. The procedures are designed to eliminate the factors that interfere (decohere) with this "quantum entanglement." The creators of the Yijing did not view this connection between the microcosm of the person and the macrocosm of the world as a causal connection; and instead, it was considered to be an acausal correlation between micro and macrocosms.

Entanglement is very special quantum state that is unique to quantum theory. It is this state that produces the “spooky” action at distance that troubled Einstein so greatly. This refers to the possibility of immediately predicting the value of an observation at a distant location based on observing the value of a local observation. In classical physics, such a relation must reflect a causal connection between the situations (one that travels faster than the speed of light, which is why Einstein called it spooky). According to quantum theory, and like the Yijing, there is no real “action at a distance,” and instead there is an acausal correlation between distant events. Arguably one of the most important predictions of quantum theory is the violation of what is called the “Bell inequality,” which will be discussed later. This violation is produced by an entangled quantum state. The experiments, conducted by Allen Aspect and others, that provided strong empirical support this prediction are considered be some of the most important empirical findings in science. It is also worth noting that the “quantum speedup” or “quantum supremacy” of quantum computers over classical computers is achieved using coherent states in a quantum computer. The speed of quantum computers may be sufficiently fast enough to crack the encryption codes that protect bank accounts, medical records, and military secrets. These encryptions are currently protected from classical computers because it takes them too long to crack the code.

The creators of the Yijing seem to have been thinking that the selection/consulting process of generating a gua was something analogous to a “mind and matter” entanglement—the person’s mental state becomes entangled with the larger macrocosm of the universe. Based on this entanglement, what is happening in the macrocosm has an immediate influence on the mental state of the microcosm within the person. The idea of the entanglement between mind and matter is, quite frankly, somewhat speculative, and exactly how this “mind and matter” entanglement occurs is admittedly mysterious. However, it is not totally outside the range of discussion of physicists. On the contrary, it has been extensively discussed in the field of metaphysics by the quantum physicist David Bohm, and by the quantum physicist Wolfgang Pauli together with the psychoanalyst Carl Jung. Bohm proposed the idea that the structure of reality consists of two domains: one called the explicate order, which concerns the observable world; and the other called the implicit order, which concerns

underlying reality which "unfolds" to realize the explicate order. According to Bohm, the mental and the physical are both entangled explications arising from a common implicate order. Pauli and Jung proposed an idea called dual-aspect monism, which considers the mental and the physical as two aspects of one underlying undivided reality that is psychophysically neutral. Mind and matter are entangled within the psychophysically neutral reality, and then this reality is manifested separately in both aspects of mind and matter. All of these ideas are discussed in more depth in later chapters.

Finally, we need to consider one of the most important principles of quantum and its relation to the Yijing. That is Bohr's principle of complementarity. The complementarity principle refers to the possibility of obtaining different kinds of measurements of phenomena. The classic example is the measurement of position and momentum. Measurement of position is described as looking at a quantum state from the particle point of view, and measurement of momentum is described as looking at the particle from the wave point of view. One cannot simultaneously and precisely measure both at the same time. A measurement that increases precision for momentum necessarily decreases precision for position, and vice versa, producing what Heisenberg discovered as an uncertainty relation between the two. In other words, nature does not exactly represent a quantum state as either a particle or a wave. Instead, you can ask nature a question about its position and it will answer as a particle; or you can ask nature a question about momentum, and it will answer as a wave. According to Bohr ''The evidence obtained under different experimental conditions cannot be comprehended within a single picture but must be regarded as complementary in the sense that only the totality of the phenomena exhaust the possible information about the [quantum] objects." Admittedly, this is a somewhat vague concept, and even Einstein questioned it. Arkady Plotnisky, a scholar on this topic, tried to firm up this general idea by describing the following properties: it is defined by (a) a mutual exclusivity of certain measurements; and yet (b) the possibility of applying each one of them separately at any given point; and (c) the necessity of using all of them at different moments for a comprehensive account. Furthermore, the order of making measurements matters, so that the measurements are non-commutative. According to Heisenberg, non-commutativity is the key mathematical property that produces the distinction between classical and quantum theories.

The analogy to the Yijing is the following. When consulting the Yijing, a person needs to carefully consider a question, and only one question can be asked at any time. This consultation with the Yijing

corresponds to a measurement in quantum theory. The person needs to consult the Yijing separately for different questions at different points in time, analogous to a sequence of measurements in quantum theory. However, these different questions are needed to obtain a complete understanding. Also, like quantum theory, the order that a person asks questions can matter, so that the questioning is non-commutative, analogous to non-commutative measurements in quantum theory. As we review in detail later, human judgments are very sensitive to measurements, and these order effects can result in what appears to be very paradoxical judgments and decisions. The fact that humans tend to have non-commutative reasoning is the main justification for applying quantum probability to better understand how people make judgments and decisions.

What we have tried to accomplish in this chapter is to make some clear connections between some of the basic principles underlying the Yijing and quantum theory. We have made a case that the understanding about the nature of reality and causality from a quantum point of view seems to agree with what we find in the Yijing. Also, we have shown how the quantum principles of superposition, entanglement, and complementarity are also shared by the Yijing. In summary, there seems to be some quantum theory hidden inside the Yijing. Discovering these "hidden" connections gives us a passion for deeper exploration and a sense of responsibility and mission for future research. We firmly believe that this sense of mission will drive us to the forefront of quantum and Yijing research. Although it is difficult, confronted by many challenges, let us work hard to explore together. We firmly believe that one day, we can stand at the forefront with a smile and shake hands with everyone to share success.

CHAPTER 2

THE YIJING《ZHOU YI》

The content of the Yijing (I Ching, Book of Changes) includes two parts: the “Jin” (Classic) and the “Zhuan” (Commentary). Before the commentary, during the Zhou period, the book was called the “Zhou Yi,” and later after the commentary, the name was changed to “Yi Jin.” The character “Yi” stands for change, and “Jin” stands for classic rule. It is generally believed to be a work that emerged during the Qin and Han dynasties, incorporating various elements. The “Sutra” (Classic) part primarily consists of 64 hexagrams and 6 lines per hexagram to produce $64 \times 6 = 384$ lines, each with explanations (hexagram and line statements), used for divination purposes. The "Commentary" contains seven types of texts explaining the hexagram and line statements, totalling ten sections, collectively known as the "Ten Wings," traditionally attributed to “Kongfuzi” (Confucius). However, ever since the Song dynasty, it has been generally accepted that these texts were formed during the Qin and Han periods and were not the work of a single individual. The Yijing is not limited to divination; it encompasses rich knowledge in astronomy, geography, military strategy, science, literature, agriculture, philosophy, and more.

Zhou Yi is an ancient Chinese philosophical book, which is based on the dualism of yin and yang to demonstrate and describe the laws of the operation of things. It classifies the characteristics of all things in heaven and earth, and it includes the theory of the five elements of the heavenly and earthly branches. The Zhou Yi can even make relatively accurate predictions of the future development of things. Zhou Yi mainly has 8 trigrams (called bagua): Qian (heaven), Kun (earth), Zhen (thunder), Gen (mountain), Li (fire), Kan (water), Dui (lake), and Xun (wind).

In the book “Zuo Chuan,” in the twelfth year of Duke Zhao, Chu Lin Wang (King of Chu) commended the Yijing saying: "It is a good history, you should study it well”. It has mastered the books 《三坟》(san wan) 《五典》(wu dian)《八索》(bas hu)《九丘》(jiu qiu), (it means that the book is an excellent classic work of cultural history, which has a

foundation and inspiration for future generations to learn ancient traditional culture). During the Han dynasty, Zhou Yi ranked first among Confucian classics. From the Tang Dynasty onwards, the position of the Zhou Yi as the first of the "Six Classics" has never been challenged in any way. As the scope of the Confucian classics continued to expand, from the "Seven Classics", "Nine Classics", "Twelve Classics", and then to the "Thirteen Classics", Zhou Yi naturally changed from the first of the "Six Classics" to the foremost of all the classics.

Why should you understand the Yijing? Kongfuzi once said:

> “孔夫子**说**：“温故而知新，可以**为师**矣”
>
> (“If a person can cherish and review old knowledge so as to constantly acquire new knowledge, he will have the possibility of making achievements.”)

If you want to understand the Yijing, you must first start with the question "What is Yijing?"

Basically, all the literature in China says that "Yi" is the first of all the classics. Because whether it is the "Five Classics" or the "Six Classics", Yijing is put at the forefront. This sentence is actually humble and understated, and its essence should be: Yijing is the origin of all classic works. Because it is the general source of Chinese culture and the beginning of philosophical thought, it is the hundred schools of thought including Laozi, Kongfuzi, Zhuangzi, Mozi, and many others.

Why is there always a diversity of opinions and perspectives regarding the Yijing? The problem is that each of us only sees one aspect from one angle, and each of us only gets a part right, so it is difficult to explain it so clearly and comprehensively. Therefore, when we study Yijing, we must take a broad perspective and embrace inclusiveness. We must avoid drawing conclusions like "a blind man who touches an elephant".

How was the Yijing completed? That is a question that everyone wants to know. According to the general explanation recorded in the " Literature and Art Chronicles" in the “Book of Han” it was completed by three sages from different eras: Antiquity, middle age, and recent times. The first was "Fuxi", the second was "Zhou Wenwang" (which also includes the son of King Wen of Zhou), and the third was "Kongfuzi", which everyone is more familiar with as Confucius (See Figure 2.1).

Antiquity - Fuxi	Middle Ages - King Wen of Zhou	Ancient - Kongfuzi
		

Fig. 2.1 The three keys of the Yi-Jing are Fuxi (left), Zhou Wen Wang (middle), and Kongfuzi (right).

But in fact, the writing of Yijing spanned a very long time, and involved the contributions from many sages. But the most influential contributors are these three, so, strictly speaking, Yijing is the result of the collective creation of ancient Chinese sages (this is similar to how the Western Bible was created from the collective efforts of many sages).

The philosophical ideas of Yijing are vast and profound, and they are all-encompassing. "Its greatness has no exterior, and its minuteness has no interior" (recorded in the book “吕氏春秋” “Lü Shi Chunqiu”). These two sentences are actually very familiar to us modern people. So vast that is has no boundary; big enough, right? So minute that it has no core; small enough, right? Our modern science today likes to talk about systems, and when we think about it, isn't Yijing the greatest system in the world? According to what modern science can prove, large systems like the solar system, the Milky Way, black holes, and so on, cannot be vast enough to have no boundaries; and all the molecules, atoms, protons, particles, electrons, and so forth cannot be so small that they have no core.

So after reading this, by now you might be a little confused. What is the use of this intricate book, the Yijing? Answering this question may make everyone's jaw drop, but after reading this book, you will suddenly realize that the Yijing is a treasure book that can uncover the secrets of life in the universe.

From ancient times to the present, human beings have been using various methods to explore the mysteries of the universe, but until today, with the development of high technology, the universe is still a great

enigma for human beings. So how did our ancestors get the key to cracking the code of the universe thousands of years ago? And not just one key, but three keys.

First Key: Fuxi and the Bagua

The first key is called "Fuxi Bagua". In China, almost everyone has seen the bagua diagram (shown below). It's found in every household, some displayed on doors, some hanging off the review mirror of the car, some hanging around a person's neck, some printed on a person's shirt, everywhere.

Speaking of this, people might ask, who is that "Fuxi"? According to ancient records, "Fuxi" was a rare sage and unusually wise man from China's ancient and distant past (some even say it is possible that he might have been an alien from another planet and pre-human civilization). It is said that he had a deep understanding of astronomy and geography. In the ancient and backward era before the enlightenment culture, he solved many problems for the people at that time. In ancient times, human beings had not yet entered an agricultural society, and people lived by fishing and hunting to survive. When going hunting, the most fearful thing would be sudden changes in nature and climate on the way, and a hunter, caught off guard, could get hurt, and sometimes even lose his life, if he has no time to dodge the weather.

At that time, however, most people knew that Fuxi was proficient in astronomical and climatic phenomena, so when they set out for fishing and hunting, they would ask him: "Tomorrow we will go far away, what will the weather be?" So, it seems "Fuxi" was the first director of the "meteorological station" on our earth, and he told the people: "Tomorrow the weather will be fine, so you can go out with confidence," or "Tomorrow you will encounter a thunderstorm if you go south, you should be careful", or "If you go northwest, you will encounter heavy rain" and so on. Of course, at the beginning, people were sceptical about his predictions, but as time went by, and as more of his predictions were verified, trust in his predictions grew, as a result, more and more people sought his advice. Eventually, as the number of people seeking his help increased, it became difficult for Fuxi to answer everyone individually. What could he do? So Fuxi entered into deep thought and came up with the use of "— "and "- -" (i.e., 1 and 0) together to represent climate change information (this invention is the prototype of the birth of Chinese characters). For example, he would use an image like that shown below

indicating rain tomorrow. This trigram is formed by three lines called yao. Each yao is formed by a yang or a yin.

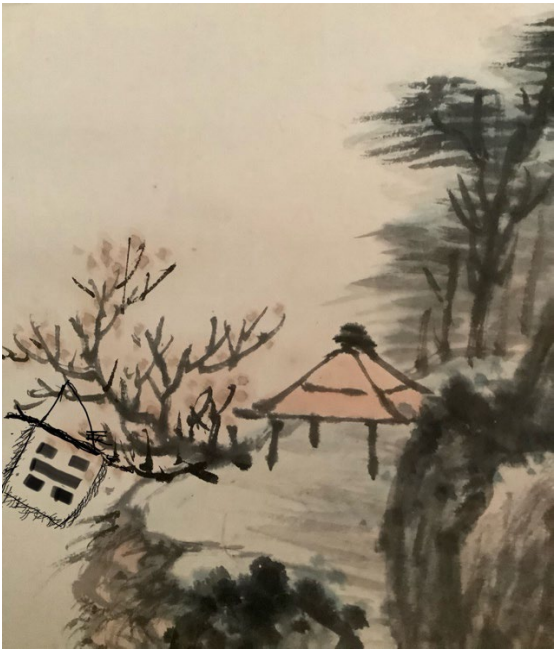

Fig. 2.2 Example bagua symbolizing rain tomorrow.

By hanging a flag with an image on a tree, he indicated to everyone that it would rain tomorrow. Different signs were used for different weather conditions. But regardless of any weather condition, an image was composed of the combinations of "—" and "--" (1 and 0), variations of the "yang" and of "yin" symbols. Altogether there are 8 trigrams called bagua. See the eight bagua (eight images) below: