

The Dancing Wu Li Masters

An Overview of the New Physics

 HarperCollins e-books

*This book is dedicated to you, who
are drawn to read it.*

Most of the fundamental ideas of science are essentially simple, and may, as a rule, be expressed in a language comprehensible to everyone.

—Albert Einstein¹

Even for the physicist the description in plain language will be a criterion of the degree of understanding that has been reached.

—Werner Heisenberg²

If you cannot—in the long run—tell everyone what you have been doing, your doing has been worthless.

—Erwin Schrödinger³

Contents

[Epigraph](#)

[Synoptic Table of Contents](#)

[Cast of Characters](#)

[Foreword by David Finkelstein](#)

[Introduction to the Perennial Classics Edition](#)

[Introduction](#)

[Wu Li?](#)

[Big Week at Big Sur](#)

[Einstein Doesn't Like It](#)

[Patterns of Organic Energy](#)

[Living?](#)

[What Happens](#)

[My Way](#)

[The Role of "I"](#)

[Nonsense](#)

[Beginner's Mind](#)

[Special Nonsense](#)

[General Nonsense](#)

[I Clutch My Ideas](#)

[The Particle Zoo](#)

[The Dance](#)

[Enlightenment](#)

[More Than Both](#)

[The End of Science](#)

[Notes](#)

[Bibliography](#)

[Searchable Terms](#)

[Stable Particle Table](#)

[Acknowledgments](#)

[About the Author](#)

[Praise](#)

[Copyright](#)

[About the Publisher](#)

WU LI? (Introduction)

Big Week at Big Sur

Physics (3), Esalen (4), Chinese and English (5–6), Wu Li Masters (7), scientists and technicians (10), the sodium spectrum (11–12), Bohr’s model of the atom (14).

Einstein Doesn’t Like It

The new physics and the old physics (20), Newton’s physics (22), the Great Machine (24), do we create reality? (30), the myth of objectivity (32), subatomic “particles” (34), statistics (35), the kinetic theory of gases (36), probability (37), the Copenhagen Interpretation of Quantum Mechanics (40), pragmatism (41), split-brain analysis (42), summary of the new physics and the old physics (44).

PATTERNS OF ORGANIC ENERGY

(Quantum Mechanics)

Living?

Organic and inorganic (49), Max Planck (52), “discontinuous” (53), black-body radiation (54), Planck’s constant (56), Albert Einstein (57), Einstein’s theory of the photoelectric effect (58), waves, wavelengths, frequencies, and amplitudes (60), diffraction (63), Young’s double-slit experiment (66), the wave-particle duality (70), probability waves (72).

What Happens

The procedure of quantum mechanics (74), the region of preparation (75), the region of measurement (75), the observed system (76), the observing system (76), the Schrödinger wave equation (77), observables (77), particles as “correlations” (78), wave functions (80), probability functions (81), quantum jumps (83), the Theory of Measurement (87), the metaphysics of quantum mechanics (88), the Many Worlds Interpretation of Quantum Mechanics (92), Schrödinger’s cat (94), Doubting Thomas (97).

MY WAY (Quantum Mechanics)

The Role of “I”

The “in here—out there” illusion (102), complementarity (103), Compton scattering (103), Louis de Broglie (106), matter waves (107), Erwin Schrödinger (110), standing waves (110), the Pauli exclusion principle (114), the Schrödinger wave equation (again) (114), Max Born (117), probability waves (again) (117), the quantum model of the atom (119), Werner Heisenberg (121), the S Matrix

(122), the Heisenberg uncertainty principle (123), the tables are turned (127).

NONSENSE (Relativity)

Beginner's Mind

Nonsense (131), the beginner's mind (132), the special theory of relativity (134), the Galilean relativity principle (138), inertial co-ordinate systems (138), Galilean transformations (140), the constancy of the speed of light (142), the ether (145), the Michelson-Morley experiment (145), FitzGerald contractions (148), Lorentz transformations (148).

Special Nonsense

The special theory of relativity (150), "proper" and "relative" length and time (155), Terrell's rotation explanation of relativistic contraction (159), relativistic mass increase (162), simultaneity (162), the space-time continuum (167), the space-time interval (171), Hermann Minkowski (173), mass-energy (173), conservation laws (176).

General Nonsense

Gravity and acceleration (181), inside and outside the elevators (181), gravitational mass and inertial mass (186), the geography of the space-time continuum (188), Euclidean geometry (191), the revolving circles (193), non-Euclidean geometry (196), Einstein's ultimate vision (200), Mercury's perihelion (201), starlight deflection (203), gravitational redshift (204), Black Holes (205), the illusion of "force" (208), the illusion of "nonsense" (209).

I CLUTCH MY IDEAS (Particle Physics)

The Particle Zoo

The barriers to change (213), the hall of mirrors (215), the new world view (215), particle physics (216), bubble chambers (218), the dance of creation and annihilation (219), what made the tracks? (221), quantum field theory (222), the need to pretend (224), particle masses (226), massless particles (228), charge (229), spin (230), angular momentum (231), quantum numbers (234), anti-particles (235).

The Dance

Space-time diagrams (237), Feynman diagrams (239), the dance of creation and annihilation (again) (240), anti-particles (again) (242), the illusion of time (245), entropy (246), virtual photons (247), the electromagnetic force (251), Hideki Yukawa (252), the strong force (252), virtual mesons (254), self-interactions (254), gravity (260), the weak force (260), virtual photons (again) (261), vacuum diagrams (266), conservation laws (269), symmetries (271), quarks (272), the S Matrix (again) (272).

ENLIGHTENMENT

(Quantum Logic & Bell's Theorem)

More Than Both

Physics and enlightenment (283), Bell's theorem and quantum logic (285), John von Neumann (286).

the description of a wave function (286), “Projections as Propositions” (288), David Finkelstein (290), symbols and experience (290), logos and mythos (290), the distributive law (292), polarization of light (293), the third polarizer paradox (297), superpositions (299), quantum logic (301), “proof” (301), transition tables (303), lattices (305), von Neumann’s disproof of the distributive law (302), quantum topology (311).

The End of Science

Enlightenment and unity (312), J. S. Bell (313), quantum connectedness (313), the Einstein-Podolsky-Rosen thought experiment (314), superluminal communication (319), the principle of local causes (320), Bell’s theorem (322), the Freedman-Clauser experiment (323), the Aspect experiment (327), contrafactual definiteness (332), superdeterminism (333), the Many Worlds Theory (again) (333), summary (335), the philosophy of quantum mechanics (338), David Bohm (339), unbroken wholeness (339), implicate order (340), the “new” thought instrument (341), eastern psychologies (342), the metaphor of physics (343), Kali (345), the Path without Form (347), the circle dance (348).

Cast of Characters

Thomas Young

1803 (double-slit experiment)

Albert Michelson, Edward Morley

1887 (Michelson-Morley experiment)

George Francis FitzGerald

1892 (FitzGerald contractions)

Hendrik Antoon Lorentz

1893 (Lorentz transformations)

Electron

1897 (discovered)

Max Planck

1900 (quantum hypothesis)

Albert Einstein

1905 (photon theory)

1905 (special theory of relativity)

Hermann Minkowski

1908 (space-time)

Nucleus

1911 (discovered)

Niels Bohr

1913 (specific-orbits model of the atom)

Albert Einstein

1915 (general theory of relativity)

Louis de Broglie

1924 (matter waves)

Niels Bohr, H. A. Kramers, John Slater

1924 (first concept of probability waves)

Wolfgang Pauli

1925 (exclusion principle)

Werner Heisenberg

1925 (matrix mechanics)

Erwin Schrödinger

1926 (Schrödinger wave equation)

1926 (equates matrix mechanics with wave mechanics)

1926 (visits Bohr in Copenhagen to attack the idea of quantum jumps—and gets the flu)

Max Born

1926 (probability interpretation of wave function)

Niels Bohr

1927 (complementarity)

Clinton Davisson, Lester Germer

1927 (Davisson-Germer experiment)

Werner Heisenberg

1927 (uncertainty principle)

Copenhagen Interpretation of Quantum Mechanics

1927

Paul Dirac

1928 (anti-matter)

Neutron

1932 (discovered)

Positron

1932 (discovered)

John Von Neumann

1932 (quantum logic)

Albert Einstein, Boris Podolsky, Nathan Rosen

1935 (EPR paper)

Hideki Yukawa

1935 (predicts meson)

Meson

1947 (discovered)

Richard Feynman

1949 (Feynman diagrams)

Sixteen New Particles

1947–1954 (discovered)

Many Worlds Interpretation of Quantum Mechanics

1957

David Finkelstein

1958 (one-way membrane hypothesis)

Quasars

1962 (discovered)

Quarks

1964 (hypothesized)

J. S. Bell

1964 (Bell's theorem)

David Bohm

1970 (implicate order)

Henry Stapp

1971 (nonlocal connections re: Bell's theorem)

Stuart Freedman, John Clauser

1972 (Freedman-Clauser experiment)

Twelve New Particles

1974–1977 (discovered)

Alain Aspect

1982 (Aspect experiment)

When Gary Zukav announced his plans for this book, creating the outline with Al Huang and me watching at a dinner table at Esalen, 1976, I did not realize the magnitude of the job he took on with such joy. Watching the book grow has been instructive and rewarding, because Zukav has insisted on going through the whole evolution of the quantum relativistic physics of today, treating it as it is, an unfolding story. As a result this book is not only readable, but it also puts the reader in touch with all the various ways that physicists have worked out for talking about what is so hard to talk about. In short, Gary Zukav has written a very good book for laymen.

Zukav's attitude to physics is rather close to mine, so I must be a layman too, and it is more stimulating to talk physics with him than with most professionals. He knows that physics is—among other things—an attempt to harmonize with a much greater entity than ourselves, requiring us to seek, formulate and eradicate first one and then another of our most cherished prejudices and oldest habits of thought, in a never-ending quest for the unattainable.

Zukav has graciously offered me this place to add my own emphases to his narrative. Since it has been three years since we met, I must sift my memory for a while.

Migrating whales come to mind first. I remember us standing on the Esalen cliffs and watching them cavort as they headed south. Next comes to mind beautiful Monarch butterflies, dotting the fields from the first day, and covering one magic tree as thick as leaves in a grand finale. Between the whales and the butterflies it was difficult for us to feel self-important and very easy for us to play.

The very difficulty of communicating with the physicists at Esalen helped me to realize how differently most physicists think about quantum mechanics than I do. Not that my way is new, it is one of two ways already pointed out in John Von Neumann's 1932 book, *The Mathematical Foundation of Quantum Mechanics*:

1. Quantum mechanics deals with propositions defined by processes of preparation and observation involving subject and object and obeying a new logic; not with objective properties of the object alone.
2. Quantum mechanics deals with objective properties of the object alone, obeying the old logic, but they jump in a random way when an observation is made.

Most working physicists seem to see one of these ways (the second) and not the other. Perhaps personality can determine the direction of science. I think there are “thing” minds and “people” minds. Good parents, psychologists and writers have to be “people” people, while mechanics, engineers and physicists tend to be “thing” people. Physics has become too scary for such physicists because it is already so thingless. New evolutions, as profound as those of Einstein and Heisenberg, are waiting for a new generation of more daring and integrated thinkers.

While most physicists take for granted the quantum tools of their daily work, there is a vanguard already testing roads to the next physics, and a rearguard still conscientiously holding the road back to the old. Bell's theorem is mainly important to the latter, and its prominence in the book does not mean it uncovers problems in present-day quantum physics. Rather Bell's theorem drives toward a view that

most physicists already assume: that quantum mechanics is something new and different.

~~Here it helps to distinguish between a *complete* theory, predicting everything, what Newtonians look for (it does not seem that Newton was a strict Newtonian, since he wanted God to reset the world clock now and then) and a *maximal* theory, predicting as much as possible, what quantum physicists look for. In spite of their controversy, Einstein and Bohr both agreed, in their different ways, that quantum mechanics is incomplete, and even that it is not yet maximal. What they really debated was whether or not an incomplete theory can be maximal. Throughout their famous controversy Einstein argued, "Alas, our theory is too poor for experience," and Bohr replied, "No, no! Experience is too rich for our theory"; just as some existential philosophers despair at the indeterminacy of life and the existence of choices, and others feel *élan vital*.~~

One of the features of quantum mechanics that leads to such controversy is its concern with the nonexistent, the potential. There is some of this in all language, or words could only be used once, but quantum mechanics is more involved with probabilities than classical mechanics. Some people feel this discredits quantum theory, makes it less than maximal theory. So it is important to mention in defense of quantum theory that in spite of indeterminacy, quantum mechanics can be entirely expressed in yes-or-no terms about individual experiments, just like classical mechanics, and that probabilities can be derived as a law of large numbers and need not be postulated. I prefer to state the difference between classical and quantum theories not as presented in textbooks, but thus: Once sufficient data is given, classical mechanics gives yes-or-no answers for all further questions while quantum mechanics simply leaves *unanswered* some questions in the theory, to be answered by experience. I wish here also to note the regrettable tendency, in myself also, to feel that quantum mechanics must thereby deny physical existence to those answers that are found in experience only, not in the theory, such as the momentum of a localized electron. So involved are we in our symbol systems.

After a week of talking, the conference was still working on the elements of quantum logic, and never did get far into the new quantum time concepts we wanted to try out, but it made it easier to move on to the next set of problems, which occupy me today. Quantum mechanics is characterized by its unanswered questions. Some logicians, Martin Davis for one, have suggested these may be related to the undecidable propositions dominating logic since Gödel. I used to know better. Nowadays I think they may be right, the common element being reflexivity and the impossibility for finite systems of total self-knowledge. The proper study of mankind is endless, it seems. I hope these ideas work out and Gary Zukav writes a book about them. He does it well.

DAVID FINKELSTEIN
New York
July 1978

When I wrote *The Dancing Wu Li Masters: An Overview of the New Physics*, I had never written a book and I had never studied physics. In fact, I didn't like science and I had no mathematical aptitudes. Yet while I was writing *The Dancing Wu Li Masters*, I knew it would be published and that it would be very well received. I also knew that it would sell very well for many years after its publication. I did not need to have faith in these things. I knew them. I could see them. It was clear to me that all I needed to do to make them happen was to continue writing. In other words, to do was my part. I knew that without my part, none of what I saw would happen, and that with my part, it was already accomplished.

I was the key. Everything depended only upon my doing what I was already doing—writing about physics, studying physics, discussing physics, and writing about it again each day. That was no problem for me because I loved doing those things. I woke thinking about the ideas in *The Dancing Wu Li Masters* and I went to sleep thinking about them the same way that some people wake in the morning and go to sleep at night thinking about a Beloved. Every decision about what word or words to use, what ideas to include, and how to present a discussion was made with the reader in mind. “The reader,” no matter whom I pictured in that role, was always someone who was intelligent—perhaps more intelligent than I. He or she was keenly interested in all that I had to share, but had no background in science or mathematics.

I do not know how I knew these things while I was writing *The Dancing Wu Li Masters*—that it would be published, that it would be well received, and that it would sell around the world for a very long time—but they were realities to me. I also knew that I would not remain interested in physics indefinitely, even though it was my passion at the moment. Because of that, I decided to leave behind me the best gift that I could for those who would come later. A spirit of giving pervades this book, and that is one reason why, I believe, *The Dancing Wu Li Masters* has been so appreciated by more than a million readers, in many languages, around the world.

Another reason is that *The Dancing Wu Li Masters* contains within it the seed of the thought that consciousness lies at the heart of all that we can experience, all that we can conceive, and all that we are. It also points toward the possibility that intentions create the reality that we experience. These thoughts were pondered by many of the founders of quantum mechanics as they discussed complementarity, the Uncertainty Principle and other aspects of the mathematical formalism that became known as the quantum theory. They are still pondered by philosophically inclined physicists today.

When I began writing *The Dancing Wu Li Masters*, I could only suspect or deduce things about the role of consciousness and intention in the creation of experience, but I soon discovered that some of the founders of quantum mechanics had suspected and deduced the same things decades before me. This was exciting enough, yet as I became more engaged in the writing, I began to encounter phenomena that I never could have imagined. For example, I realized that the book that I was writing was more intelligent than I was. It was also funnier than I was, and it had a grander comprehension than I did. For example, I prepared an outline for each chapter before I began to write. The outline contained the central idea of the chapter, what I wanted to include in the chapter, how I intended to order the content of the chapter, and how I intended to present the ideas in the chapter.

In every instance, I would write not for long before I had to choose between following the outline that I had prepared and going with the energy that developed as I wrote. I always went with the energy. If I had planned a certain discussion, but another one occurred to me that felt more exciting, I used the second discussion. I substituted examples, words, and ideas as they occurred to me for those that I had put into my outline. And I was amazed at the experience of a chapter coming to an end—at how clear it was for me, and how often the ending of a chapter surprised and delighted me.

As I wrote more chapters, I noticed something else, too. The chapters fit together perfectly—even though I had not planned them that way. I might have been able to take credit for this if I had followed each of the outlines that I had prepared. But I never followed my outlines. I always followed the flow of energy and excitement that I felt as I wrote.

Who orchestrated this? Who planned for a chapter—one that I completed before I began research on a later chapter—to fit into a later chapter as though I had written them together? Where did the humor in the book come from—the humor that took me away from the torment of my daily judgements about myself and others? Where did the gratitude originate that replaced my worries about paying the rent, which obsessed me when I was not writing?

Eventually, the reality of these miracles became a part of my awareness. So did the contrast between the painful life that I lived when I was not working on *The Dancing Wu Li Masters* and the fulfillment that I felt when I was. At last, I decided to live my entire life the way that *The Dancing Wu Li Masters* was being written—spontaneously, intelligently, and joyfully. Eventually I learned how to do this, and how to explain how to do it.

At the time I did not have the vocabulary to articulate what I was experiencing, or the ability to understand it. It was not until later that I was able to understand that writing *The Dancing Wu Li Masters* was my first experience of authentic power—of meaning, fulfillment, and purpose. It was also my first experience of nonphysical assistance.

Now there is a vocabulary to express what I experienced. It is the vocabulary of authentic power—the alignment of the personality with the soul—and of multisensory perception: the expansion of human perception beyond the limitations of the five senses. I could not see at the time that my experiences were part of an evolutionary transformation that was, and still is, reshaping human experience. This transformation and the vocabulary to express it are the content of *The Seat of the Soul*, which I wrote ten years after *The Dancing Wu Li Masters* was published.

This same evolutionary transformation continues to reshape human experience, one human at a time. As multisensory perception—the ability to access information that the five senses cannot provide—emerges in millions of humans, they naturally become interested in the relationship between consciousness and physical reality. *The Dancing Wu Li Masters* is a nourishing book for these individuals, and will continue to be, because it explores that relationship with enthusiasm and integrity.

The last reason, I believe, that *The Dancing Wu Li Masters* is still so popular is that it is fun to read. It is an enjoyable way to learn about quantum mechanics, especially for people who have no mathematical or scientific background. It brings the early history of the quantum theory to life in a refreshing and exciting way, and that history will not change. The development of the quantum theory is one of the most well-documented intellectual adventures in the history of humanity. For those who come to this history as a newcomer, as I did, without preparation or prior interest, as I did, but with an open and excited mind, as mine was, *The Dancing Wu Li Masters* is the perfect book.

This Perennial Classics edition celebrates the contributions that *The Dancing Wu Li Masters* has made for more than two decades to those who delight in the rigors of intellectual exploration into the most meaningful questions that philosophy and science can pose. It is a product of that delight.

I hope that you enjoy it.

With Love,
Gary Zukav

Introduction

My first exposure to quantum physics occurred a few years ago when a friend invited me to an afternoon conference at the Lawrence Berkeley Laboratory in Berkeley, California. At that time, I had no connections with the scientific community, so I went to see what physicists were like. To my great surprise, I discovered that (1) I understood everything that they said, and (2) their discussion sounded very much like a theological discussion. I scarcely could believe what I had discovered. Physics was not the sterile, boring discipline that I had assumed it to be. It was a rich, profound venture which had become inseparable from philosophy. Incredibly, no one but physicists seemed to be aware of this remarkable development. As my interest in and knowledge of physics grew, I resolved to share this discovery with others. This book is a gift of my discovery. It is one of a series.

Generally speaking, people can be grouped into two categories of intellectual preference. The first group prefers explorations which require a precision of logical processes. These are the people who become interested in the natural sciences and mathematics. They do not become scientists because of their education, they choose a scientific education because it gratifies their scientific mental set. The second group prefers explorations which involve the intellect in a less logically rigorous manner. These are the people who become interested in the liberal arts. They do not have a liberal arts mentality because of their education, they choose a liberal arts education because it gratifies their liberal arts mental set.

Since both groups are intelligent, it is not difficult for members of one group to understand what members of the other group are studying. However, I have discovered a notable *communication* problem between the two groups. Many times my physicist friends have attempted to explain a concept to me and, in their exasperation, have tried one explanation after another, each one of which sounded (to me) abstract, difficult to grasp, and generally abstruse. When I could comprehend, at last what they were trying to communicate, inevitably I was surprised to discover that the idea itself was actually quite simple. Conversely, I often have tried to explain a concept in terms which seemed (to me) laudably lucid, but which, to my exasperation, seemed hopelessly vague, ambiguous, and lacking in precision to my physicist friends. I hope that this book will be a useful *translation* which will help those people who do not have a scientific mental set (like me) to understand the extraordinary process which is occurring in theoretical physics. Like any translation, it is not as good as the original work and, of course, it is subject to the shortcomings of the translator. For better or worse, my first qualification as a translator is that, like you, I am not a physicist.

To compensate for my lack of education in physics (and for my liberal arts mentality) I asked, and received, the assistance of an extraordinary group of physicists. (They are listed in the acknowledgments). Four of them in particular, read the entire manuscript. As each chapter was completed, I sent a copy of it to each physicist and asked him to correct any conceptual or factual errors which he found. (Several other physicists read selected chapters.)

My original intention was to use these comments to correct the text. However, I soon discovered that my physicist friends had given more attention to the manuscript than I had dared to hope. Not only were their comments thoughtful and penetrating, but, taken together, they formed a significant volume of information by themselves. The more I studied them, the more strongly I felt that I should share these comments with you. Therefore, in addition to correcting the manuscript with them, I also

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