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MIND, MATTER  
AND QUANTUM  
MECHANICS

Second Edition



Springer

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*Cover Figure:* Detail from 'The Optiverse', a video of the minimax sphere eversion  
by John M. Sullivan, George Francis, and Stuart Levy, with original score by Camille Goudeseune.  
More at <http://new.math.uiuc.edu/optiverse>.

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**For Olivia**

## Preface to the Second Edition

I have been besieged by requests for copies of this book, particularly since the publication of *The Mind and the Brain* by Jeffrey Schwartz and Sharon Begley. That book gave a popular-style account of the impact of these quantum-based considerations in psychiatry and neuroscience. This is just one example of the substantial progress that has been made during the decade since the publication of the first edition of *Mind, Matter, and Quantum Mechanics* in understanding the relationship between conscious experience and physical processes in the brain.

Von Neumann's Process I has been identified as the key physical process that accounts, within the framework of contemporary physical theory, for the causal efficacy of directed attention and willful effort. It is now understood how quantum uncertainties in the micro-causal bottom-up physical brain process not only open the door to a consciously controlled top-down process, but also require the presence of this process, at least within the context of pragmatic science.

These new developments fit securely onto the general framework presented in the first edition. They are described in a chapter written for this new edition and entitled "Neuroscience, Atomic Physics, and the Human Person". This chapter integrates the contents of three lectures and a text that I have prepared and delivered during the past year. Those presentations were aimed at four very different audiences, and I have tried to adopt here a style that will make the material accessible to all of those audiences, and hence to a broad readership.

The material covered in that chapter is essentially scientific. The broader ramifications are covered in a second new chapter entitled "Societal Ramifications of the New Scientific Conception of Human Beings".

Berkeley, July 2003

*Henry P. Stapp*

## Preface to the First Edition

Nature appears to be composed of two completely different kinds of things: rocklike things and idealike things. The first is epitomized by an enduring rock, the second by a fleeting thought. A rock can be experienced by many of us together, while a thought seems to belong to one of us alone.

Thoughts and rocks are intertwined in the unfolding of nature, as Michelangelo's *David* so eloquently attests. Yet is it possible to understand rationally how two completely different kinds of things can interact with each other? Logic says no, and history confirms that verdict. To form a rational comprehension of the interplay between the matterlike and mindlike parts of nature these two components ought to be understood as aspects of some single primal stuff. But what is the nature of a primal stuff that can have mind and matter as two of its aspects?

An answer to this age-old question has now been forced upon us. Physicists, probing ever deeper into the nature of matter, found that they were forced to bring into their theory the human observers and their thoughts. Moreover, the mathematical structure of the theory combines in a marvelous way the features of nature that go with the concepts of mind and matter. Although it is possible, in the face of this linkage, to try to maintain the traditional logical nonrelatedness of these two aspects of nature, that endeavor leads to great puzzles and mysteries. The more reasonable way, I believe, is to relinquish our old metaphysical stance, which though temporarily useful was logically untenable, and follow where the new mathematics leads.

This volume brings together several works of mine that aim to answer the question: How are conscious processes related to brain processes? My goal differs from that of most other quantum physicists who have written about the mind-brain problem. It is to explain how the content of each conscious human thought, as described in psychological terms, is related to corresponding processes occurring in a human brain, as described in the language of contemporary physical science. The work is based on a substantial amount of empirical data and a strictly enforced demand for

logical coherence. I call the proposed solution the Heisenberg/James model because it unifies Werner Heisenberg's conception of matter with William James's idea of mind.

The introduction, "... and then a Miracle Occurs", was written specially for this volume. It is aimed at all readers, including workers in psychology, cognitive science, and philosophy of mind. Those fields, like physics, have witnessed tremendous changes during the century since William James wrote his monumental text. My introduction places the Heisenberg/James model in the context of that hundred-year development.

The main features of the model are described in "A Quantum Theory of the Mind-Brain Interface". This paper is an expanded version of a talk I gave at a 1990 conference, *Consciousness Within Science*. The conference was attended by neuroanatomists, neuropsychologists, philosophers of mind, and a broad spectrum of other scientists interested in consciousness. The talk was designed to be understandable by all of them, and the paper retains some of that character. Together with the introduction and appendix ("A Mathematical Model") it is the core of the present volume.

"The Copenhagen Interpretation" is an older paper of mine, reprinted from the *American Journal of Physics*. It describes the Copenhagen interpretation of quantum theory. That interpretation held sway in physics for six decades, and it represents our point of departure.

The other papers deal with closely related issues. Many of the ideas are to be found in my first published work on the problem, the 1982 paper "Mind, Matter, and Quantum Mechanics", from which this volume takes its title. An overview of the model is given in "A Quantum Theory of Consciousness", which summarizes a talk I gave at a 1989 conference on the mind-brain relationship.

"Quantum Propensities and the Mind-Brain Connection" was written for a 1991 volume of *Foundations of Physics* honoring Karl Popper. It addresses the general problem of the application of quantum theory to biological systems.

The theory of the mind-brain connection described above is based on Heisenberg's ideas, and it accepts his position that the element of chance is to be regarded as primitive. Einstein objected to this feature of orthodox quantum thought, and Wolfgang Pauli eventually tried to go beyond the orthodox view, within the context of a psychophysical theory that rested in part on work of C. G. Jung. The possibility of extending the present theory in this way is discussed in "Mind, Matter, and Pauli".

"Choice and Meaning in the Quantum Universe" first describes some attempts by physicists to understand the nature of reality, and then attempts to discern, tentatively, a meaning intrinsic to natural process itself from an

analysis of the form of that process alone, without tying meaning to any outside thing.

The mind–body problem is directly linked to man’s image of himself, and hence to the question of values. The Heisenberg/James model of mind and man is separated by a huge logical gulf from the competing Cartesian model, which has dominated Western philosophic and scientific thought for three centuries. Two of the included papers, “Future Achievements to Be Gained through Science” and “A Quantum Conception of Man”, were presented at international panels dealing with human issues, and they explore the potential societal impact of replacing the Cartesian model of man by the Heisenberg/James model. The second of these papers is the best introduction to this book for readers interested in seeing the bottom line before going into the technical details of how it is achieved.

The final chapter, “Quantum Theory and the Place of Mind in Nature”, is a contribution to the book *Niels Bohr and Contemporary Philosophy*, which is to appear this year. It examines the question of the impact of quantum theory upon our idea of the place of mind in nature. This article can serve as a short philosophical introduction to the present volume, although it was a subsequent development in the evolution of my thinking.

In the above works I have tried to minimize the explicit use of mathematics. But in an appendix prepared for this volume I have transcribed some key features of the model from prose to equations.

Among the scientists and philosophers who have suggested a link between consciousness and quantum theory are Alfred North Whitehead, Erwin Schrödinger, John von Neumann, Eugene Wigner, David Albert and Barry Loewer, Euan Squires, Evans Harris Walker, C. Stuart, Y. Takahashi, and H. Umezawa, Amit Goswami, Avshalom Elitzur, Alexander Berezin, Roger Penrose, Michael Lockwood, and John Eccles. Only the final two authors address in any detail the problem addressed here: the nature of the relationship between the physical and physiological structures. Eccles’s approach is fundamentally different from the present one. Lockwood’s approach is more similar, but takes a different tack and does not attain the same ends.

Berkeley, February 1993

*Henry P. Stapp*

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  - 9 Contribution to the panel discussion “The Permanent Limitations of Science”, sponsored by the Claremont Institute, Claremont, California, 14–16 February 1991. Other panelists: Roger D. Masters, Leon Kass, Edward Teller, Fred Hoyle, Stanley Jaki, Robert Jastrow.
  - 10 Supported by the Director, Office of Energy Research, Office of High Energy and Nuclear Physics, Division of High Energy Physics of the U.S. Department of Energy under Contract DE-AC03-76SF00098. Invited paper for the Third UNESCO Science and Culture Forum—“Toward Eco-Ethics: Alternative Visions of Culture, Science, Technology, and Nature”, held in Belem, Brazil, 5–10 April 1992. The introductory section of this paper was written in collaboration with Olivia B. Stapp.
  - 11 Supported by the Director, Office of Energy Research, Office of High Energy and Nuclear Physics, Division of High Energy Physics of the U.S. Department of Energy under Contract DE-AC03-76SF00098. Contribution to the volume *Niels Bohr and Contemporary Philosophy*, edited by Jan Faye and Henry J. Folse (Kluwer, Dordrecht, 1993).
  - 12 Based on a section from “The Volitional Influence of the Self and Mind (with Respect to Emotional Self-regulation)”, by Jeffrey M. Schwartz, Henry P. Stapp, and Mario Beauregard in *Consciousness, Emotional Self-regulation and the Brain*, edited by Mario Beauregard (John Benjamins, Amsterdam & Philadelphia, 2003).
  - 13 Based on a talk delivered at the “Future Visions” conference sponsored by the International Space Sciences Organization and the John Templeton Foundation that was held in conjunction with the annual State of the World Forum meeting 4–9 September 2000 in New York City.

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