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978-0-521-76415-5 - The Transactional Interpretation of Quantum Mechanics: The Reality of Possibility

Ruth E. Kastner

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THE TRANSACTIONAL INTERPRETATION OF QUANTUM MECHANICS

A comprehensive exposition of the transactional interpretation of quantum mechanics (TI), this book sheds new light on longstanding problems in quantum theory and provides insight into the compatibility of TI with relativity. It breaks new ground in interpreting quantum theory, presenting a compelling new picture of quantum reality.

The book shows how TI can be used to solve the measurement problem of quantum mechanics, and to explain other puzzles, such as the origin of the “Born Rule” for the probabilities of measurement results. It addresses and resolves various objections and challenges to TI, such as Maudlin’s inconsistency challenge. It explicitly extends TI into the relativistic domain, providing new insight into the basic compatibility of TI with relativity and the physical meaning of “virtual particles.” This book is ideal for researchers and graduate students interested in the philosophy of physics and the interpretation of quantum mechanics.

RUTH E. KASTNER is a Research Associate and member of the Foundations of Physics group at the University of Maryland, College Park. She is the recipient of two National Science Foundation research awards for research in time symmetry issues and the transactional interpretation.

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Contents

<i>Preface</i>	<i>page vii</i>
1 Introduction: quantum peculiarities	1
1.1 Introduction	1
1.2 Quantum peculiarities	3
1.3 Prevailing interpretations of QM	14
1.4 Quantum theory presents a genuinely new interpretational challenge	25
2 The map vs. the territory	26
2.1 Interpreting a “functioning theory”	26
2.2 The irony of quantum theory	27
2.3 “Constructive” vs. “principle” theories	30
2.4 Bohr’s Kantian orthodoxy	31
2.5 The proper way to interpret a “principle” theory	34
2.6 Heisenberg’s hint: a new metaphysical category	36
2.7 Ernst Mach: visionary/reactionary	38
2.8 Quantum theory and the noumenal realm	41
2.9 Science as the endeavor to understand reality	42
3 The original TI: fundamentals	44
3.1 Background	44
3.2 Basic concepts of TI	51
3.3 “Measurement” is well-defined in TI	55
3.4 Circumstances of CW generation	65
4 The new TI: possibilist transactional interpretation	67
4.1 Why PTI?	67
4.2 Basic concepts of PTI	68
4.3 Addressing some concerns	76

vi	<i>Contents</i>	
4.4	“Transaction” is not equivalent to “trajectory”	84
4.5	Revisiting the two-slit experiment	88
5	Challenges, replies, and applications	91
5.1	Challenges to TI	91
5.2	Interaction-free measurements	101
5.3	The Hardy experiment II	107
5.4	Quantum eraser experiments	112
6	PTI and relativity	120
6.1	TI and PTI have basic compatibility with relativity	120
6.2	The Davies theory	121
6.3	PTI applied to QED calculations	126
6.4	Implications of offer waves as unconfirmed possibilities	132
6.5	Classical limit of the quantum electromagnetic field	136
6.6	Non-locality in quantum mechanics: PTI vs. rGRWf	140
6.7	The apparent conflict between “collapse” and relativity	144
6.8	Methodological considerations	147
7	The metaphysics of possibility in PTI	148
7.1	Traditional formulations of the notion of possibility	148
7.2	The PTI formulation: possibility as physically real potentiality	149
7.3	Offer waves, as <i>potentia</i> , are not individuals	151
7.4	The macroscopic world in PTI	154
7.5	An example: phenomenon vs. noumenon	160
7.6	Causality	164
7.7	Concerns about structural realism	167
8	PTI and “spacetime”	171
8.1	Recalling Plato’s distinction	171
8.2	Spacetime relationalism	181
8.3	The origin of the phenomenon of time: de Broglie waves	183
8.4	PTI vs. radical relationalism	190
8.5	Ontological vs. epistemological approaches, and implications for free will	191
9	Epilogue: more than meets the eye	196
9.1	The hidden origins of temporal asymmetry	196
9.2	Concluding remarks	202
	<i>Appendix A: Details of transactions in polarizer-type experiments</i>	206
	<i>Appendix B: Feynman path amplitude</i>	209
	<i>Appendix C: Berkovitz contingent absorber experiment</i>	211
	<i>References</i>	216
	<i>Index</i>	223

Preface

This book came about as a result of my profound dissatisfaction with the existing “mainstream” interpretations of quantum theory and my conviction that the unusual mathematical structure of quantum theory indeed reflects something about physical reality, however subtle or hidden. In my early days as a physics graduate student, I was a “Bohmian”; however, I became dissatisfied with that interpretation for reasons discussed here and there throughout the book. It is my hope that, even if the reader does not come away convinced of the fruitfulness of the present approach, this presentation will serve as an invitation to further far-ranging and open discussion of the interpretational possibilities of quantum theory.

I have attempted to make much of the book accessible to the interested layperson with a mathematics and/or physics background, and to indicate where more technical sections can be omitted without losing track of the basic conceptual picture. For those in the field, I have endeavored to take into account as much as possible of the relevant literature and to use notes where a technical and/or esoteric point seems relevant. Chapters 5 and 6 are the most technical and may be omitted without losing track of the conceptual picture.

I am grateful to many colleagues, friends, and family members who gave generously of their time and energy to critically read drafts of various chapters, to offer comments, and to discuss material appearing herein. In particular, Professor John Cramer offered numerous suggestions for improvement of the manuscript, although we are not in agreement on all aspects of this proposal. His inclusion in the following list of acknowledgments therefore does not imply his endorsement of this formulation. Of course, final responsibility for the contents is mine alone.

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