

REEXAMINING THE QUANTUM–CLASSICAL RELATION Beyond Reductionism and Pluralism

Classical mechanics and quantum mechanics are two of the most successful scientific theories ever discovered, and yet how they can describe the same world is far from clear: one theory is deterministic, the other indeterministic; one theory describes a world in which chaos is pervasive, the other a world in which chaos is absent. Focusing on the exciting field of “quantum chaos,” this book reveals that there is a subtle and complex relation between classical and quantum mechanics. It challenges the received view that classical and quantum mechanics are incommensurable, and revives another largely forgotten tradition due to Niels Bohr and Paul Dirac. By artfully weaving together considerations from the history of science, philosophy of science, and contemporary physics, this book offers a new way of thinking about intertheory relations and scientific explanation. It will be of particular interest to historians and philosophers of science, philosophically inclined physicists, and interested non-specialists.

ALISA BOKULICH received her Ph.D. in the History and Philosophy of Science from the University of Notre Dame in 2001. Her research focuses on the history and philosophy of physics, as well as on broader issues in the philosophy of science. In 2003 she was the recipient of a National Science Foundation Scholars Award, which supported much of her research for this book. She is currently a Professor in the Philosophy Department at Boston University and an active member of Boston University’s Center for Philosophy and History of Science.

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Beyond Reductionism and Pluralism

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For my mother
Elizabeth H. Payson
(1944–2006)
And for my teacher
James T. Cushing
(1937–2002)

There is a straight ladder from the atom to the grain of sand, and the only real mystery in physics is the missing rung. Below it, [quantum] particle physics; above it, classical physics; but in between, metaphysics. All the mystery in life turns out to be this same mystery, the join between things which are distinct and yet continuous, body and mind, free will and causality, living cells and life itself.

Tom Stoppard, Hapgood, Act I Scene 5

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