Contents

Preface — V

Part I	The Recent Debate on Scientific Realism
1	Scientific Realism and Its Relation to Common Sense 3
1.1	Key Arguments Surrounding Scientific Realism — 4
1.2	Scientific Realism without Common Sense Realism? —— 13
2	Entity Realism 19
2.1	From Theories to Entities —— 20
2.2	Is Manipulability an Adequate Criterion of Reality? —— 23
2.3	From Manipulation to Explanation —— 28
3	NOA and the Vices of the Realism Debate —— 33
3.1	In Defense of Interpretation —— 33
3.2	The Principle of Fairness — 40
3.3	NOA, Entity Realism, and the Homely Line 44
Part II	Causal Realism
4	Causal vs. Theoretical Warrant —— 49
4.1	Criterion 1: Non-redundancy — 50
4.2	Criterion 2: Material Inference — 54
4.3	Criterion 3: Empirical Adequacy —— 59
4.4	Causal Realism's Advantages over Entity Realism —— 62
5	Causal Warrant for the Neutrino: A Case Study —— 67
5.1	Bohr and Pauli on Beta Decay — 67
5.2	The Impact of Fermi's Theory and the Need for Direct Detection —— 69
5.3	The Detection of the Neutrino by Reines and Cowan —— 72
6	The Problem of Unconceived Alternatives — 79
6. 1	Previous Attempts to Undermine the PUA —— 80
6.2	Causal Knowledge as a Criterion for the Realist — 85
6.3	Causal Realism, Unconceived Alternatives, and the Atomic
	Hypothesis —— 92



Part III The Quantum Challenge

7	Causal Realism in the Context of Bell-Type Experiments — 105
7.1	Bell-Experiments: Causal Warrant for Superluminal
	Causation —— 105
7.2	Causal Realism and Underdetermination in Quantum
	Mechanics —— 114
7.3	Some Experimental Constraints on Explanations for EPR —— 122
8	Delayed-Choice Experiments and the Metaphysics of
	Entanglement —— 137
8.1	Delayed Choice in the Double-Slit Experiment —— 139
8.2	The Quantum Eraser —— 140
8.3	Delayed-Choice Entanglement Swapping —— 145
9	Particle Physics without Particles? On Causal Realism in Quantum Field
	Theory —— 149
9.1	Against Localizability: Malament's Theorem and Its
	Generalizations — 149
9.2	Against Countability: Unruh Effect and Interacting Fields — 154
9.3	Defending Localizability and Countability — 161
9.4	Concluding Remarks on Realism, Fundamentalism, and
	QFT —— 169

Bibliography — 175

Index —— 187