

Contents

Dedication	v
Preface	vii
Symbols Used but Not Defined in the Text	xiii
Chapter 1. Experiments, Measure, and Integration	1
Part A. Measures	2
Experiments and weight functions, expected value of a weight function, measures, Lebesgue measure, signed measures, complex measures, measurable functions, almost everywhere equality.	
Part B. Integration	8
Simple functions, simple integrals, general integrals, Lebesgue integrals, properties of integrals, expected values as integrals, complex integrals.	
Chapter 2. Hilbert Space Basics	14
Inner product space, norm, orthogonality, Pythagorean theorem, Bessel and Cauchy-Schwarz and triangle inequalities, Cauchy sequences, convergence in norm, completeness, Hilbert space, summability, bases, dimension.	
Chapter 3. The Logic of Nonclassical Physics	21
Part A. Manuals of Experiments and Weights	21
Manuals, outcomes, events, orthogonality, refinements, compatibility, weights on manuals, electron spin, dispersion-free weights, uncertainty.	
Part B. Logics and State Functions	33
Implication in manuals, logical equivalence, operational logic, implication and orthocomplementation in the logic, lattices,	

general logics (quantum logics), propositions, compatibility, states on logics, pure states, epistemic and ontological uncertainty.

Chapter 4.	Subspaces in Hilbert Space	43
	Linear manifolds, closure, subspaces, spans, orthogonal complements, the subspace logic, finite projection theorem, compatibility of subspaces.	
Chapter 5.	Maps on Hilbert Spaces	49
Part A.	Linear Functionals and Function Spaces	49
	Linear maps, continuity, boundedness, linear functionals, Riesz representation theorem, dual spaces, adjoints, Hermitian operators.	
Part B.	Projection Operators and the Projection Logic	55
	Projection operators, summability of operators, the projection logic, compatibility and commutativity.	
Chapter 6.	State Space and Gleason's Theorem	60
Part A.	The Geometry of State Space	60
	State space, convexity, faces, extreme points, properties, detectability, pure states, observables, spectrum, expected values, exposed faces.	
Part B.	Gleason's Theorem	69
	Vector state, mixture, resolution of an operator into projection operators, expected values of operators, Gleason's theorem.	
Chapter 7.	Spectrality	73
Part A.	Finite Dimensional Spaces, the Spectral Resolution Theorem	73
	Eigenvalues, point spectrum, eigenspaces, diagonalization, the spectral resolution theorem.	
Part B.	Infinite Dimensional Spaces, the Spectral Theorem	78
	Spectral values, spectral measures, the spectral theorem, functions of operators, commutativity and functional relationships between operators, commutativity and compatibility of operators.	
Chapter 8.	The Hilbert Space Model for Quantum Mechanics and the EPR Dilemma	85
Part A.	A Brief History of Quantum Mechanics	85
Part B.	A Hilbert Space Model for Quantum Mechanics	86
	Schroedinger's equation, probability measures, stationary states, the harmonic oscillator, the assumptions of quantum mechanics, position and momentum operators, compatibility.	
Part C.	The EPR Experiment and the Challenge of the Realists	94
	Electron spin, spin states, singlet state, EPR apparatus, the EPR dilemma.	