

AN INTUITIVE NARRATIVE FOR OPEN QUANTUM SYSTEMS?

TOWARDS A NARRATIVE TO
MAKE QUANTUM MEASUREMENTS
AND OPEN SYSTEM DYNAMICS
INTUITIVE

Drafting a Quantum Intuition
that minimizes unjustified assumptions

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Abstract

Objectives

Guideline

Part A

The Axioms

*“ Quantum Mechanics is Ontologically
Deterministic but Epistemologically Stochastic.”*

A.1. The State of the Universe

A.1.1. Configuration Space and the Measurable space

A.1.2. A Fluid of Universes

A.1.3. Our Universe and the Single Measurement Axiom

A.2. The Dynamics of the Universe

A.2.1. The Quantum Action Principle

A.2.2. The Dynamics of the Density of Universes

A.2.3. The Dynamics of the Action Density

A.2.4. The Dynamics of The Wavefunction

A.3. The State of a Partition of the Universe

A.3.1. An Effective Wavefunction

A.3.2. The Conditional Wavefunction

Part B

The Measurement

“ Measuring a Quantum System means knowing the state of the system after the measurement, with probabilities due to the state before the measurement.”

B.1. The Von Neumann Chain and Perturbing the System

B.2. The Apparently Collapsing Measurement

B.2.1. Discrete Spectrum Measurement

B.2.2. Continuous Spectrum Measurement

B.3. The Generalized Measurement

B.3.1. A Strong Measurement

B.3.2. A Weak Measurement

B.4. Properties of the Wavefunction vs Properties of the Trajectory

B.4.1 The In Position Weak Values as Trajectory Properties

Part C

The Density Matrix

*“ A wavefunction keeps track of
Tangent Universes while a Density Matrix
keeps track of Parallel Wavefunctions.”*

C.1. The Way to Keep Track of Parallel Realities

C.2. The Reduced Density Matrix

C.3. The Unconditional Measurement and the Choice of Basis

C.4. Pure Unravellings

C.5. Complete Positive Maps: Any Quantum Operation is a Measurement

C.6. Noise, Decoherence and the Environment

Part D

Markovianity and Master Equations

“ The Quantum Measurement and the Decohering Noise have exactly the same mathematical formulation. Are they the same thing?”

D.1. Some Possible Quantum Markovianity Definitions

D.1.1. Past-Future Independence

D.1.2. Etc.

D.2. Continuous Measurements:

Introduction to Master and Stochastic Schrödinger Equations

D.3. The Most General Markovian Master Equations: The Lindblad Equations

D.4. Markovian Stochastic Schrödinger Equations: Pure Unravellings

D.5. The Most General non-Markovian Master Equation: The Nakajima-Zwanzig Equation

D.6. Non-Markovian Stochastic Schrödinger Equations: the Conditional Wavefunction

D.6.1 Wiseman's

D.6.2 Ours

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