

Table of Contents: Simulations of Quantum Computers

I. Introduction

II. Brief History of Quantum Computing

General Principles of Quantum Computing and Simulations

III. Six Postulates of Quantum Mechanics

IV. Dirac's Relativistic Matrix Mechanics

V. The Dirac Notation - Different Formulations of Quantum Mechanics

VIA. Vector and Matrix Math, Tensor Products of Vector Spaces

VIB. Simulating Spin Operators and Spin Space

VIC. Tensor Products of Vector Space

VII. Quantum Superposition, Photons, and Polarization States

VIIIA. Bell States: Two-Electron Entangled State (Quantum Entanglement)

VIIIB. The Bloch Sphere

VIII C. Explore 4 Qubit Hilbert Space, Operators, and State Evolution

IX. Experiments: Exploring the 3 Polarizer “ Paradox” , Stern-Gerlach Experiment

X. Entanglement

XI. Quantum Operators, Gates, Algorithms

XII. Gate Identities

XIII. Two-photon Interference

XIV. A Proof of Bell's Theorem, CHSH Model, and Vector States

XV. Quantitative Analysis of Phase Splitting on Mach-Zehnder Interferometer

XVI. Simulate: "Qubit Quantum Mechanics with Correlated-Photon Experiments"

Quantum Computing Algorithm Simulations

XVIII. Simple Example of Parallel Quantum Computation

XIX. Simulation of the Deutsch and the Deutsch-Jozsa Algorithms

XX. Quantum Restrictions on Cloning

XXI. Factoring Using Shor's Quantum Algorithm

XXII. Simulation of Grover's Quantum Search Algorithm

XXIIIA. An Entanglement Swapping Protocol

XXIIIB.

Quantum Mechanics Simulations

XXIV. Quantum Calculations Illuminated with Dirac Notation - Particle in 1D Box

XXV. Example of Quantum Physics: Simulating the Aharonov–Bohm Effect

XXVI. QM: Schrödinger Wavefunction, Matrix, and Wigner Phase Space

XXVII. Solution of Schrödinger Wave Equation for Propagation of an Electron

XXVIII. Basic Quantum Mechanics in Coordinate, Momentum, and Phase Space

XXIX. The Quantum Eraser

XXX. The Difference Between Fermions and Bosons

XXXI. Light Diffraction: Atomic Mask Diffraction Pattern