Introduction

Welcome to "The Magic of Quantum Computing -Intermediate Level"

'The Magic of Quantum Computing -Intermediate Level' is an Angels School initiative designed to provide a student with a challenging course on quantum computing that matches their academic capability.

A prerequisite for this course is a successful completion of the 'The Magic of Quantum Computing" for 11–15-year-olds course. However, there is a Prep Session available should a student wish to progress directly to this course.

The Intermediate is a 16-week course and takes the student through the history of quantum physics and the implementation of quantum physics into quantum computing as prophesised by the eminent American theoretical physicist Richard Feynman, who many consider the father of quantum computing.

Many of today's businessmen, like Jeff Bezos and Elon Musk, see quantum computing as the most important technology of the future.

What you will learn on this Course

The objective of the course is to introduce the student to as many aspects of quantum physics/computing as practicable. The content will be very challenging and will include more mathematics than the earlier series. However, we will still be making it as much fun as possible with interactive quizzes and short in-class assignments.

Although our focus is not to give homework, each section will likely have optional YouTube links recommended for further student research and Tutor TipVids which are short, informal videos on the quirkier side of quantum computing.

Upon completion of the course, the student will have acquired an eclectic, up-to-date knowledge of the global quantum ecosystem.

Nature is quantum! The very strong expectation is that quantum computing will soon be producing computations and services, the likes of which, (wo)mankind never thought possible.

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The Angels School

The Layout of the course

Week 1: The Mysteries of quantum physics
Week 2: The Various Interpretations of quantum physics -Part One
Week 3: The Various Interpretations of quantum physics -Part Two

These three weeks of study provide the student with a foundation in quantum physics which will greatly assist when learning about quantum computing. Quantum computing is merely the implementation of the mysterious forces of the quantum realm into a computational environment.

Richard Feynman declared that even though we don't understand how these quantum forces operate we can harness these incredible powers and perform computations with them at the exponential power of nature.

Week 4: Quantum Spin

The entire discipline of Quantum Computing is totally focussed on the weirdness of the quantum spin. When scientists first interacted with the quantum spin, they were simply amazed with what they found.

This week reemphasises the Heisenberg Uncertainty Principle but also takes the student into a deep understanding of how the quantum spin is calculated and controlled and eventually measured.

Week 5: The Bloch Sphere -Part One
Week 6: The Bloch Sphere -Part Two
Week 7: Quantum Gates
Week 8 Quantum Algorithms

These four weeks cover the underlying tenets of quantum computing. The processes and procedures involved with the theoretical and practical aspects of quantum computing

Week 9: Linear Algebra -Basics
Week 10: Linear Algebra -Advanced

These two weeks covers the basics of linear algebra including Matrix Multiplication using many samples and test matrix multiplications. The second week covers the various operators such as Unitary and Hermitian which are fundamental to quantum computing.

Week 11: Quantum Teleportation -Part One

Week 12: Quantum Teleportation -Part Two

These weeks provide an insight into the amazing potential of Quantum Teleportation where quantum information and a quantum particle are teleported literally hundreds of thousands of miles INSTANTLY.

The student is introduced, not only to the concepts, but also to the achievements that scientists have already made in these areas

Week 13: Quantum Cryptography -Part One

Week 14: Quantum Cryptography -Part Two

Many theoretical scientists believe that the area of cryptography will have the most significant impact on future commerce and society. Never has there been an unbreakable code yet with the BB84 protocol (we spend a whole week's session on it) it will be possible.

The question of morals and ethics come into play as this technology can be used for nefarious purposes if it falls into the wrong hands.

Week 15: Quantum Technologies

Week 16: The Future of Quantum Computing

Quantum computing as a technology is still very much at its nascent stage. There is still much speculation on which quantum particle will make the best qubit and how best the industry can deal with decoherence (noise).

The student is encouraged to speculate on how they feel the future of (wo)mankind will be affected by this technology.