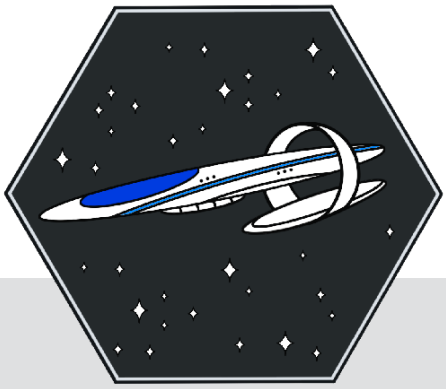
Workbook 1

Qiskit | Quantum Explorers

A Self-Paced Quantum Learning Journey

Achievement:
CAPTAIN

Quantum Computing & Qiskit 101



QUANTUM COMPUTING & QISKIT 101

Achievement to unlock: Captain

Become the captain of Earth's first faster-than-light starship and lead humanity into interstellar exploration.

A magnificent Heron-class starship, equipped with faster-than-light travel capabilities, comfortable amenities, weapons, and an enthusiastic crew needs a captain. You are an esteemed explorer and are perfect for the job.

Your starship-to-be is called the ESS _____.

(ESS stands for "Earth Starship". Share your starship's name in the #space-exploration channel on Discord!)

Complete this module to become Captain, ensure a successful launch into space, and become humanity's leading space exploration pioneer.

In this module you will:

- Learn quantum concepts like superposition, entanglement, and interference
- Understand how quantum gates work and how to run circuits using Qiskit and IBM Quantum Platform
- Program and run simple circuits and the quantum teleportation algorithm using Qiskit

SYLLABUS

Checklist of tasks to complete and materials to learn

Warm-up Activities

- [ ] **LIVE EVENT: Badge Kick-off - Quantum Computing and Qiskit 101**

  Date: July 7, 2023 [time] [video link] [demo notebook link]
  Note: all event recordings will be available at the links provided.

- [ ] **VIDEO: Quantum Computing Expert Explains One Concept in 5 Levels of Difficulty [link]**

  WIRED Youtube video featuring IBM's Dr. Talia Gershon

- [ ] **BOOK: Quantum Kittens (Beta) [link]**

  Three chapters of a non-technical book that teaches quantum computing through stories about cats

Extra help: Quantum Computing Prerequisite Math Syllabus (High School +)

Main Activites

- [ ] **QISKIT COURSE: Introduction to Quantum Computing [link]**
  A short online course for self-learners from all backgrounds (technical and non-technical). Please complete the notebooks "why-quantum-computing," "atoms-of-computation," "what-is-quantum," "describing-quantum-computers," and "entangled-states."

- [ ] **LAB: Introduction to Qiskit [link]**
  Program basic circuits using Qiskit in a jupyter notebook [solution]

- [ ] **VIDEO: Quantum Teleportation Algorithm [link]**
  Qiskit Youtube Programming on Quantum Computers S1E5

- [ ] **TEXT: Quantum Teleportation [link]**
  IBM Quantum Learning resource with code examples.

- [ ] **LAB: Teleportation tutorial with dynamic circuits [link]**

  You can set hub = "ibm-q", group = "open", project = "main", and set the device which features OpenQASM3 on device list

Extra help: Introduction to Python and Jupyter notebooks

ADVANCED SYLLABUS

Optional advanced additional materials

Qiskit textbook sections for further understanding of the basics of quantum information

- **TEXT: Single systems - Quantum information [link]**
  Alternative: **VIDEO: Single Systems [link]**

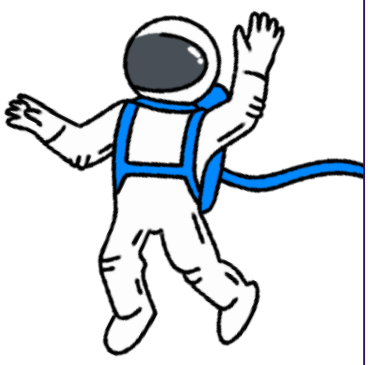
- **TEXT: Multiple systems - Quantum information [link]**
  Alternative: **VIDEO: Multiple Systems [link]**

Grover's Algorithm

- **VIDEO: Grover's Search Algorithm [link]**
  Qiskit Youtube Programming on Quantum Computers S2E3

- **QISKIT COURSE: Grover's Search Algorithm [link]**
  A chapter of the Qiskit Introductory Course

- **LAB: IBM Quantum Challenge 2020 Exercise [link]**
  Jupyter notebook with an exercise related to Grover's algorithm



RESOURCES

Supplementary Materials

- **WEB APP: Grokking the Bloch Sphere [link]**

  Application that helps the user understand the Bloch sphere

- **GAME: QiskitBlocks [link]**

  Teaches quantum computing and Qiskit in a Minetest block world [Tips]

- **QISKIT COURSE: Visualizing Entanglement [link]**

  A chapter of the Qiskit Introductory Course

- **LAB: Grover's Algorithm [link]**

  In-depth, comprehensive Jupyter notebook

- **VIDEO/QISKIT COURSE: Understanding Quantum Information and Computation [link]**

  Playlist of the course by John Watrous

  Practice Problem Sets based on the Qiskit Textbook Chapters 1-4 by John Watrous

  - [Problem Set 1]
  - [Problem Set 2]
  - [Problem Set 3]
  - [Problem Set 4]

- **GAME: Quantum Odyssey by Quarks Interactive [link]**

  Quantum Odyssey is a puzzle game that teaches gate model computing through visual cues. The demo is free to play.

  [Windows launcher] [MacOS launcher]

UNLOCK YOUR BADGE

QUIZ

Ready to test your knowledge and unlock your achievement?

Return to the Quantum Explorers portal.

Quantum Explorers Portal

PASSED?

Congratulations!

Download your badge image using the password revealed on passing the quiz.

Then share your achievement in the #level-up channel on Discord.

Badge Download

Keep an eye on the #announcements channel for details about the next modules and Badge achievements.

NOTES