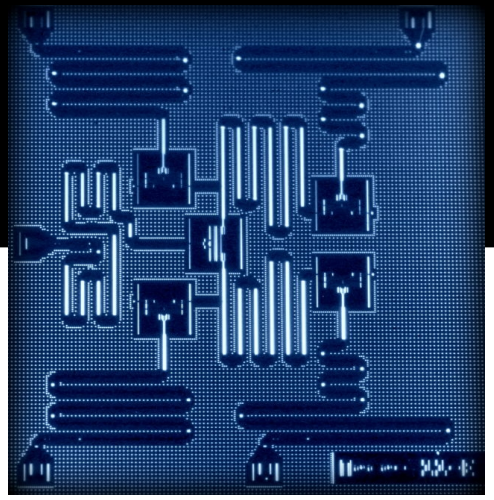
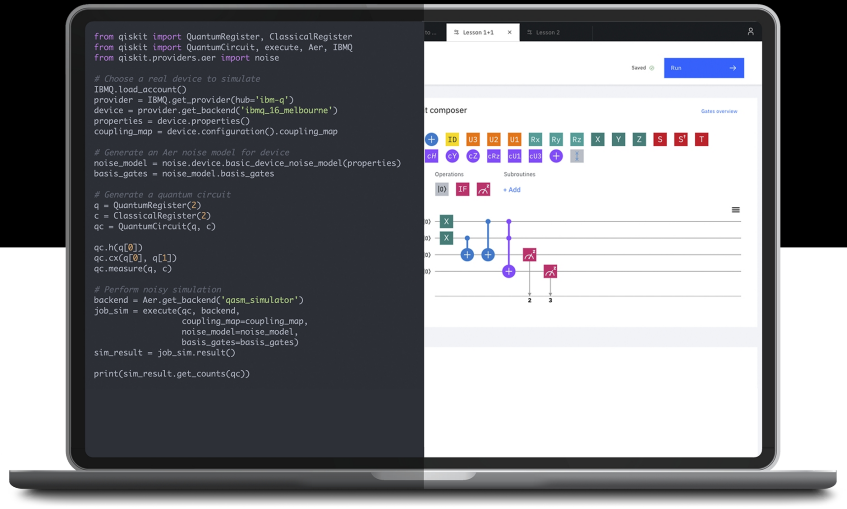
'Hello Quantum World !'





A hands-on coding approach to quantum computing

Bruno Fedrici, PhD | CPE Lyon - Spring 2021

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Bruno Fedrici, PhD

Your servant

2018 – Today

Consultant (freelance activity) – Quantum technologies

2018 – Today

Lecturer (CPE, Epitech, INSA,...) – Quantum information science, Applied mathematics

2018

Degree – Digital transformation, Université de Lyon

2014 – 2017

PhD – Physics, Université Nice Sophia Antipolis

Thesis title: Scalable solutions for quantum communication networks

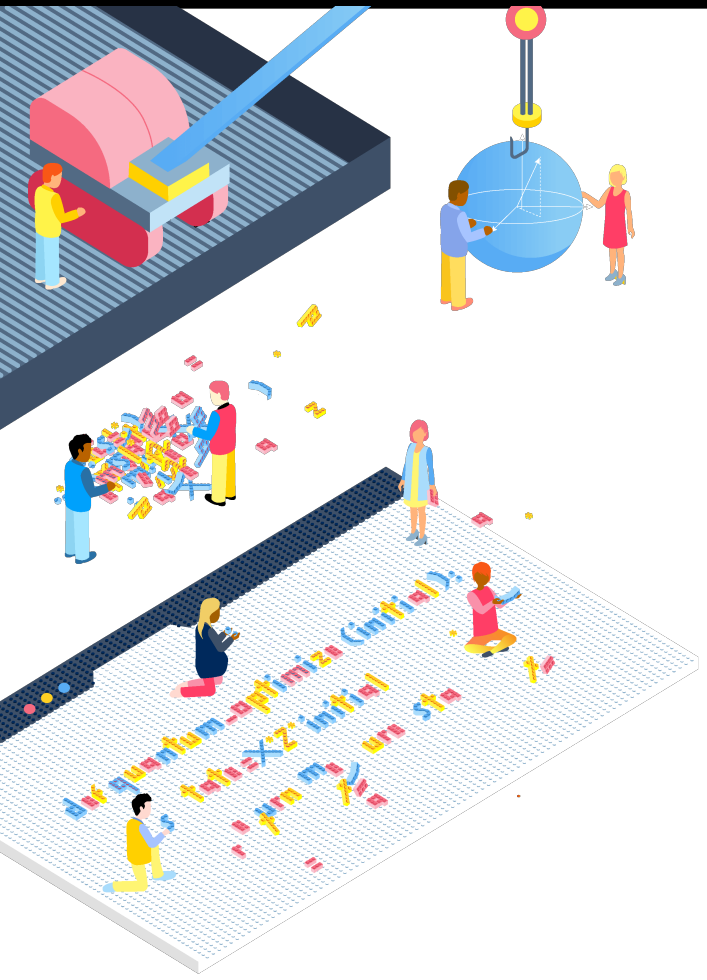
Ch0: Course Overview

Quantum computer

A system based on the principles of quantum mechanics that for certain problems could enable much faster computation than conventional computers.

As the technology is starting to shift from theory into practice, multiple potential use cases for quantum computing exist across sectors:

- Pharma/Chemistry (e.g. drug discovery)
- High-tech (e.g. model training in machine learning)
- Industrial goods (e.g. routing)
- Finance (e.g. portfolio management)
- Energy (e.g. smart grid management)



Course content

This course is an introduction to modern quantum programming for students who want to familiarize with quantum computing technologies and learn about a new paradigm of computation.

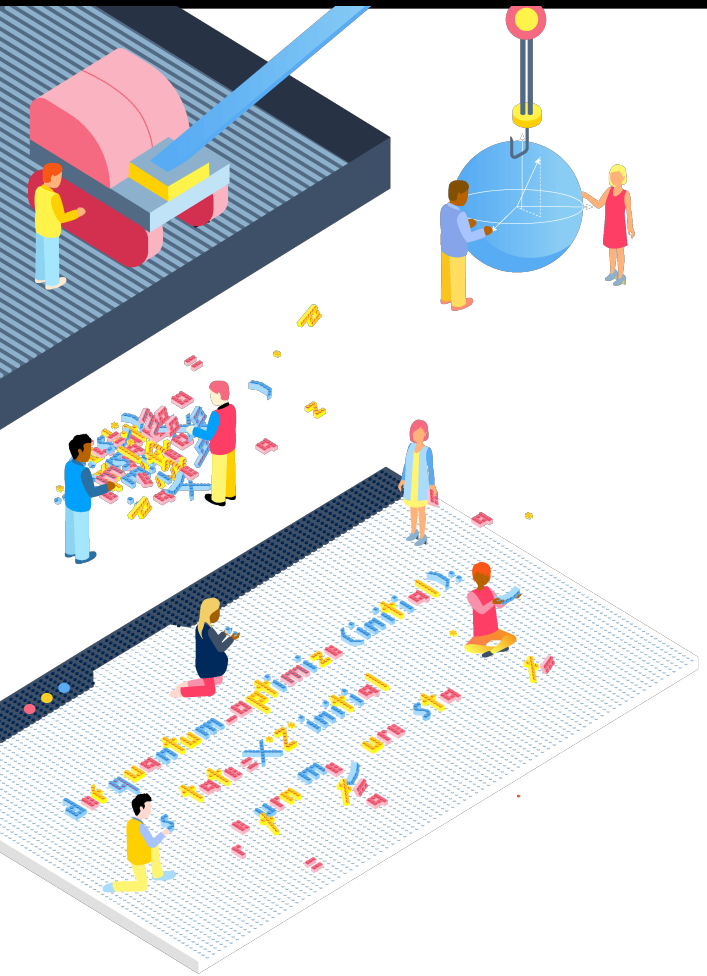
We will review:

- Quantum mechanics basics
- Circuit model of quantum computation
- Quantum programming languages
- Quantum algorithms for long-term applications
- Quantum algorithms for mid-term applications
- Quantum communication protocols
- Benchmarking QPUs

Prerequisites

A physics and quantum mechanics background is not required, but you will need an understanding of linear algebra at the level of the intro courses (M-ALG 3ETI).

Moreover, you will need some familiarity with computer programming as this course requires hands on using of open source Python packages for working with publicly available quantum processors.



Course schedule

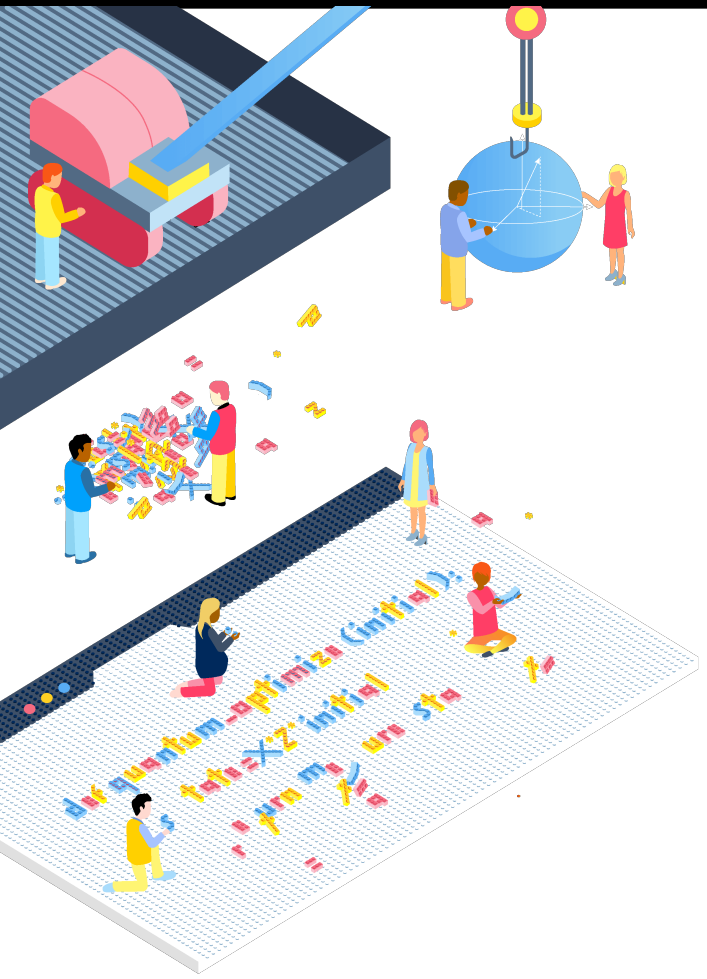
One lecture per week. 8:00 – 12:00 on Fridays:

- 26/02/20
- 5-12-19-26/03/20
- 2-9-16-30/04/20
- 7/05/20

Textbook and readings

- Quantum Computation and Quantum Information: 10th Anniversary Edition, M.A. Nielsen and I.L. Chuang, Cambridge University Press
- Quantum Algorithm Implementations for Beginners, arXiv:1804.03719
- Programming Quantum Computers: Essential Algorithms and Code Samples, E.R. Johnston, N. Harrigan and M. Gimeno-Segova, O'Reilly Media

Complementary readings will be posted online with the syllabus. These are critical.



Homework assignments

No homework.

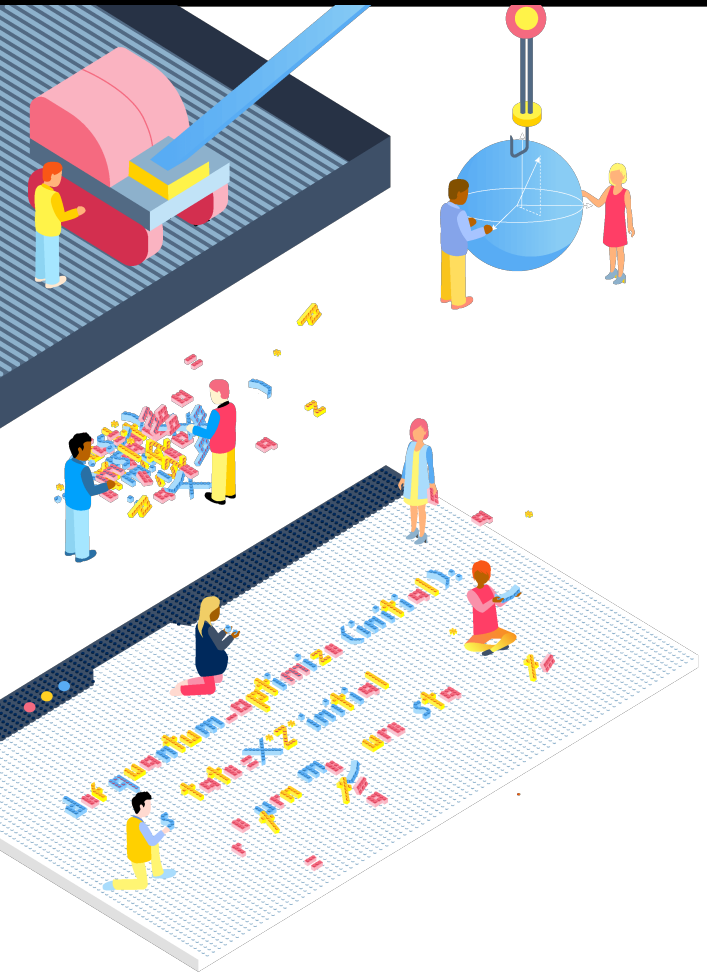
Problems and programming projects are integrated into the course.

Exams

There will not be a midterm exam, only a final exam.

For the final exam you'll be requested to read three scientific publications prior to the exam. These publications will be in close connexion with the course.

Then on May 7th I will ask you some questions on the papers' content in the form of a written exam.



Online support

Github: https://github.com/bfedrici-phd/QC-2021-CPE

Slack: https://qc-2021-cpe.slack.com

Conclusion

Friendly reminder that you live in an age in which...

...you can access a quantum computer...

...on the other side of the world...

...from your classroom...

...for free.

JUST TRY IT OUT !