UGA
Université Grenoble Alpes

QUANTUM Thematic Program

UGA Graduate School

The QUANTUM thematic program offers **specific high-level training on the quantum properties of device, matter and light** shared by several Master or engineer school programs. It will offer also mobility grants open to international students and promote their integration in leading research laboratories in Grenoble or in France via full time Master internships.The research topics covered by the program range from **quantum information devices**, **quantum calculation and metrology**, **quantum sensors** to **quantum materials** or **complex systems and hardware developments for quantum information processing**.

The program is a two-year program open only to students who will be admitted in the following Master or engineer school programs.

Fisrt year (2022-2023):

➤ *Nanophysics-quantum physics* Master 1 or 2A-IPHY *Photonics and Microelectronics* second year Engineer School

Second year (2023-2024):

➤ *Quantum Information-Quantum Engineering* Master 2
➤ *Nanophysics* Master 2
➤ 3A-IPHY *Photonics and semiconductors* Master 2

HOW TO APPLY

Apply via ecandidat for EU students
➤ ecandidat.univ-grenoble-alpes.fr

Graduate School: *deadline June 10th 2022*
➤ tinyurl.com/PTQuantum

Apply to Graduate schools scholarships
➤ tinyurl.com/2p8shnev

Master programs: *deadline June 10th 2022*
➤ tinyurl.com/masteruga22

Scholarships: *deadline June 15th 2022*
➤ tinyurl.com/PTQuantum

PEF countries: *application will start at autumn 2022*
➤ tinyurl.com/ETUDES-EN-FRANCE

This project is supported by the French National Research Agency (ANR-20-SFRI-0007) under the "Investissements d'avenir" programme.

M1 NANOPHYSICS & QUANTUM PHYSICS — Year 1

Master 1 program accessible to students having a background in physics or engineering. It provides the appropriate background to pursue a second year in the M2 Nanophysics or the M2 Quantum Information Quantum Engineering (QIQE).

SEMESTER 7

Core courses
➤ Professional insertion or French foreign language
➤ Quantum physics I
➤ Solid state physics I
➤ Semiconductors physics
➤ Optics
➤ Magnetism & nanosciences

Elective courses
➤ Statistical physics
➤ Mechanics at the micro & nano-scale
➤ Surface and interface
➤ Image and signal processing
➤ Electrochemistry

SEMESTER 8

Core courses
➤ Quantum Labworks*
➤ Quantum statistics & interactions*
➤ Solid state physics II
➤ Nanophysics with local probes
➤ Modeling and numerical simulations
➤ Nanosciences I

* labelling course

Elective courses
➤ Physics of 2D materials
➤ Molecular electronics & magnetism
➤ Molecular photophysics
➤ Ray-matter interaction
➤ Thin films
➤ Materials science

+ 2 months minimum internship

2A PHOTONICS & MICROELECTRONICS ENGINEER SCHOOL PHELMA-IPHY — Year 1

This second-year engineer track accessible to students already enrolled in the first-year of the engineer school or admitted in second year (admission by title). It provides the appropriate background to pursue a second year in the *Photonique et semiconducteurs* (PhSem) or the M2 Quantum Information Quantum Engineering (QIQE) via a double degree registration (3A engineer and Master 2).

SEMESTER 7

➤ Quantum physics I
➤ Statistical physics
➤ Electromagnetism
➤ Physics of lasers
➤ Quantum physics II
➤ Physics and optics labworks
➤ Physic of semiconductors

➤ Solid State Physics
➤ Microelectronics Technologies
➤ English/Sport/ Worker training evaluation
➤ Financial Management-Marketing and Strategy

SEMESTER 8

➤ Quantum Labworks*
➤ Quantum statistics & interactions*
➤ Nanophysics
➤ Physics of semiconductor devices
➤ Electrical characterization labwork

* labelling course

➤ UE Engineering sciences
➤ Magnetism/Dielectric Physics
➤ Materials Synthesis / Symmetry and physical properties
➤ Business creation course
➤ Optical Engineering.

+ 10 weeks minimum internship

M2 NANOPHYSICS

Year 2

This Master 2 program offers fundamental and applied courses on the physical properties (growth, nanofabrication and advanced characterization of nanostructures. It covers topics from crystal growth, quantum transport, photonics, nanomagnetism, spintronics and nanofabrication techniques. The program combines high level courses and trainings on top-equipments of research laboratories and clean rooms facilities of the Grenoble area.

Core courses
➤ *Advanced characterization techniques for nanostructures*
➤ *Elaboration of nanostructures / Physics of 2D materials*
➤ *From Nanofabrication in research labs to VLSI*

Applications
➤ *Advanced semiconductor devices*
➤ *Nanomagnetism and spintronics*
➤ *Nanomaterials and energy*
➤ *Nanophotonics-Plasmonics*

Specializing courses (quantum thematic program)
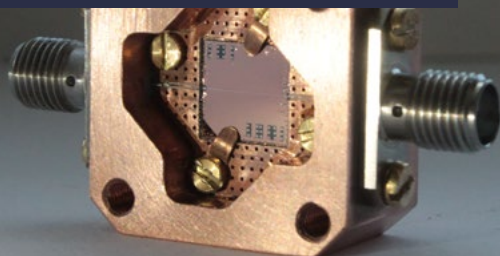➤ *Quantum condensed matter*
➤ *Quantum optics*

Thematic and interdisciplinary projects
➤ *Modeling in Nanoscience, seminars, project*

+ a 5 months minimum Master thesis

M2 QUANTUM INFORMATION & QUANTUM ENGINEERING

Year 2

This Master 2 program offers an ambitious program of lectures covering the whole spectrum from fundamental quantum physics to experimental implementations, new paradigms in computer science, and enabling technologies. The master is open students willing to work on fundamental quantum problems, and simultaneously contribute to the emergence of quantum technologies.

Fundamentals
➤ *Open Quantum systems*
➤ *Quantum optics**
➤ *Quantum Condensed Matter**

Implementations
➤ *Solid state qubits*
➤ *Nanomagnetism and spintronics*
➤ *Quantum algorithms*

Advanced instrumentations
➤ *Microwave and cryoelectronics*
➤ *From nanofabrication in research labs to VLSI*
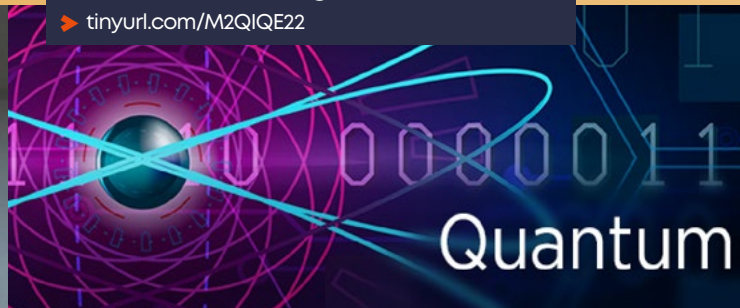
Thematic and interdisciplinary projects
➤ *Seminars, Practicals (IBM-Q Experience)*
* Labelling course

+ a 5 months minimum Master thesis

M2 PHOTONICS & SEMICONDUCTORS

Year 2

This Master 2 program is a joint program between UGA's "Physics" Master's program and the Grenoble INP - UGA Phelma engineer school. Its program is focused on the fabrication, physics and modeling of devices for photonics, electronics and optoelectronics. These devices (transistors, lasers, CMOS imagers, photovoltaic cells, frequency converters, etc.) are the subject of intensive research in both academic and industrial environments, because of their importance in many sectors, such as information technology.

Elaboration and characterization of materials
➤ *Photolithography*
➤ *Physics of technological processes*
➤ *Material characterization techniques*

Photonics
➤ *Nonlinear optics*
➤ *Guided optics*
➤ *Optical signal processing*
➤ *Quantum optics **
➤ *optoelectronics devices*
➤ *THz optoelectronics*

Semiconductors
➤ *Physics of advanced MOS components*
➤ *Reliability of components and circuits*
➤ *Quantum condensed matter **
* Labelling course

+ a 5 months minimum Master thesis

Quantum