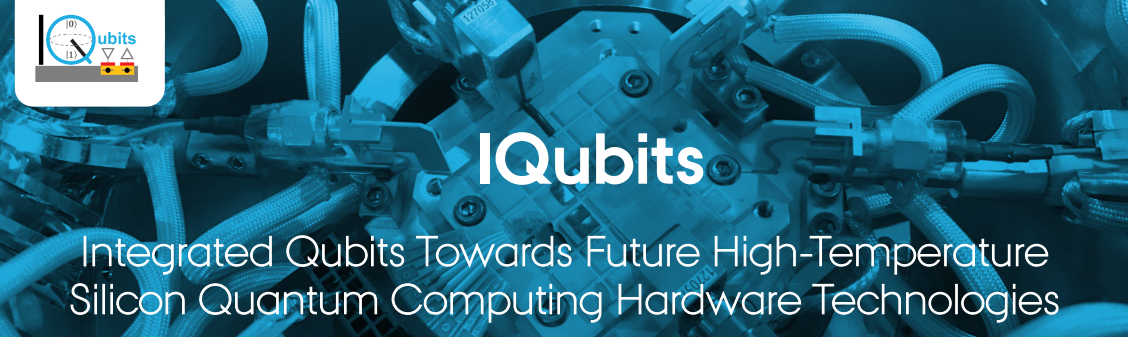


IQubits

Integrated Qubits Towards Future High-Temperature Silicon Quantum Computing Hardware Technologies

WP2

Qubit design and atomistic modelling and simulation

WP3

Integrated qubit ICs in state-of-the-art FDSOI foundry technology

WP4

Design and fabrication of standalone scaled Si and III-N Qubits

WP5

Qubit and qubit IC testing and test setup development

IQubits is a EU H2020 FET Open collaborative research project organized in four technical work packages (WPs) addressing the development of integrated qubits and control and readout circuits, all on the same chip in commercial Silicon semiconductor technology, as fundamental building blocks enabling the quantum technology leap from research laboratories to large-scale production of future emerging quantum computing hardware technologies.

Future Emerging Quantum Technologies

Quantum technologies have the potential to solve computational problems unsolvable with classical computers, such as the synthesis of new drugs to treat incurable diseases, and many other challenges of Science.

Current developments of hardware quantum technologies are primarily limited to integrated quantum bits (qubits) fabricated in research laboratories and operating at extreme cryogenic temperatures in the order of tens or hundreds milli-Kelvin, with control and readout circuits external to the chip with the qubits, i.e. the quantum chip.

Extreme cryogenic temperatures and inherent limitations to the integration due to the multi-chip approach, introduce dramatic barriers to the scalability of hardware technologies necessary to secure integration, control and readout of hundreds, thousands and even million qubits required for future emerging quantum computing technologies.

Scientific objectives of IQubits

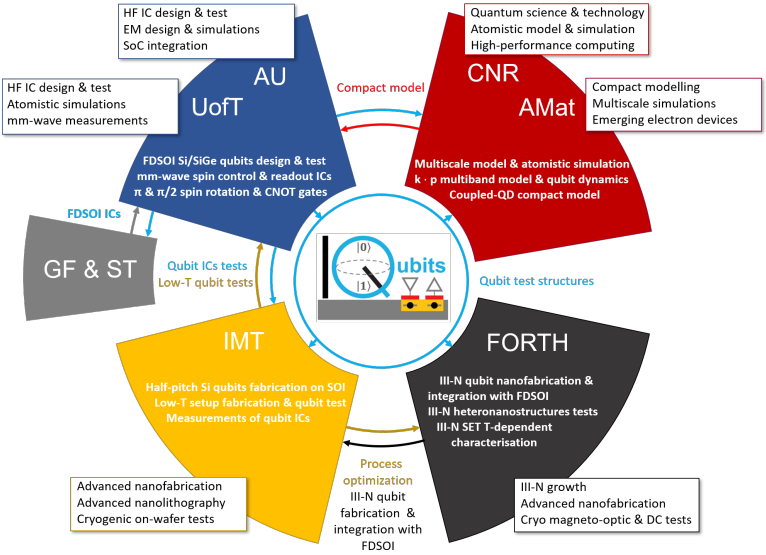
The objective is to break through these major scientific and technological barriers by developing integrated qubits, control and readout circuits that can operate at higher cryogenic temperatures and can be integrated together onto the same chip in commercial ultra-scaled Silicon technologies, so paving the way for quantum technology large-scale production. The primary scientific objectives are:

- Developing and demonstrating experimentally high-temperature Si and SiGe electron/hole-spin qubits and qubit control/readout integrated circuits in commercial 22nm FDSOI CMOS technology
- Verifying the scalability of these qubits to 10nm dimensions through fabrication experiments
- Proving through atomistic simulations that at 2nm dimensions they are suitable for 300K operation

IQubits consortium

IQubits gathers together world-wide leaders in a wide range of disciplines such as quantum physics, materials science and engineering, device physics, computational science, electrical engineering, measurement science and instrumentation. The project is coordinated by Aarhus University and benefits of the independent scientific and industrial guidance of an Advisory Board made up of distinguished world-wide academic and industrial experts from Europe, North America and Asia.

Synergy



IQubits research consists of synergistic efforts across a wide range of topics spanning quantum physics, materials science and engineering, device physics, numerical modelling, nanofabrication, manufacturing, electrical and electronic engineering, instrumentation and measurement science.

The Consortium is characterized by a unique combination of advanced competencies and facilities as well as access to FDSOI CMOS manufacturing through world leading foundries, such as GlobalFoundries (GF) and STMicroelectronics (ST).

University of Toronto, a key partner of the Consortium, allows also a synergic cooperation between the EU H2020 and Natural Sciences and Engineering Research Council of Canada (NSERC).

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