

# Introduction to Quantum Technologies

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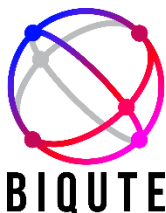
*How do I build a qubit?*

*What can I do with a quantum computer?*

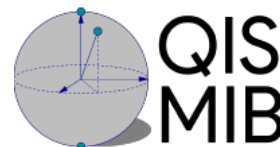
*How can I detect Dark Matter with a qubit?*

Quantum technologies have emerged as a new paradigm for computing, communication, and sensing, and represent one of the most exciting technological challenges of our time. In this seminar, we will introduce the qubit as a theoretical model, as well as the methods for controlling multiqubit coherent states through quantum gates. We will describe the key concepts behind quantum algorithms and the ideas of quantum advantage and quantum primacy.

Furthermore, we will address the experimental challenge of developing a well-behaved qubit, with a focus on superconducting qubits, and provide an overview of state-of-the-art superconducting quantum processors. Finally, we will describe the activities carried out at the University of Milan Bicocca Cryogenic Lab, including Quantum Computing (the QISMIB initiative), and engineering, manipulating superconducting qubit systems, performing quantum-limited measurements. Encoding information into quantum states will soon allow our research group to detect the same microwave photon multiple times without absorbing it, in a process known as Quantum Non-Demolition measurement. This will have remarkable implications in Fundamental Physics such as the search for Dark Matter.



<https://biquite.unimib.it/>



<https://github.com/qismib>

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