Tutorial 1: Quantum computing technologies

Speaker: Maud Vinet (Leti)

Abstract:

Thanks to superposition and entanglement, quantum computing is expected to extend the high-performance computing roadmap at the condition of being able to operate a large number of qubits. First quantum reported quantum processors mostly rely on superconducting qubits. In comparison to other existing platforms such as photonic waveguides1, trapped ions2, and spin qubits3, the success of superconducting qubits can be attributed both to the fact that this technology is accessible by academic cleanrooms and that it benefits from advances in high-performance microwave instrumentation developed for telecommunication industry. On the other hand, Si-based QC appears as a promising approach to build a quantum processor; thanks to the size of the qubits, the quality of the quantum gates and the VLSI ability to fabricate billions of closely identical objects. And finally, recently trapped ions and photonic based quantum processors have also attracted a lot of interest by being taken in charge by engineering teams with technologies that could be scaled up.

In this tutorial, we will start by a reminder on quantum computing principles and then we will identify the qubits figures of merit required to build a quantum processor. We will benchmark the experimental platforms and provide a system perspective on the challenges to reach high number of qubits, let's say above 10,000.

Speaker's Bio:

Maud Vinet (CEA-Leti, University Grenoble Alpes, France) is currently leading the quantum computing program in Leti. She is a researcher and together with Tristan Meunier (CNRS) and Silvano de Franceschi (Fundamental research division from CEA), they received an ERC Synergy grant in 2018 to develop silicon based quantum computer.

She defended a PhD of Physics from University of Grenoble Alps and was hired Leti in 2001 as a CMOS integration and device engineer. From 2009 to 2013, she spent 4 years with IBM to develop Fully Depleted SOI with IBM and STMicroelectronics. In 2015, she spent 6 months with Globalfoundries in Malta, NY to launch 22FDX program.

From 2013 to 2018, she managed the Advanced CMOS integration team activities in Leti (~50 people). In 2019, she was appointed project leader for the quantum computing program in Leti.

Maud Vinet authored or co-authored about 200 papers, she owns more than 70 patents related to nanotechnology and her Google h-index is 42.