Quantum horizon for silicon nanoelectronics

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Silicon transistors are the building blocks of modern microelectronics. We carry billions of them in our pockets every day. Following decades of uninterrupted development, transistors have gotten smaller and smaller, yet the physics laws governing their operation remain largely classical.

Under extreme conditions such as the very low temperatures, however, the switching efficiency of silicon transistors can drastically improve enabling the possibility of realizing electronic circuits with reduced power consumption. At the same time, quantum phenomena become prominent opening the possibility to turn transistors into devices capable of encoding elementary bits of quantum information, so-called qubits, through the spin state of localized electronic charges.

In Grenoble, the Quantum Silicon Group (https://www.quantumsilicon-grenoble.eu) which gathers physicists and engineers from different institutions (UGA, CEA, and CNRS), is exploring these opportunities. I will present our research progress in this fascinating and challenging area. Special emphasis will be given to the most relevant results and questions at the fundamental physics level.