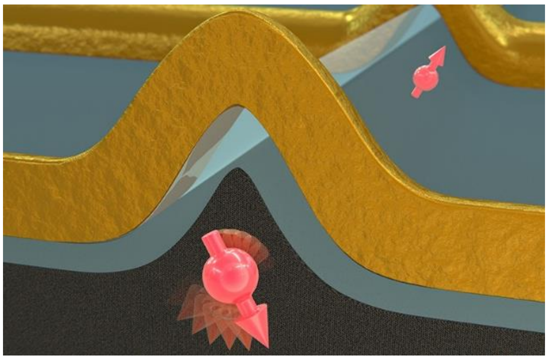
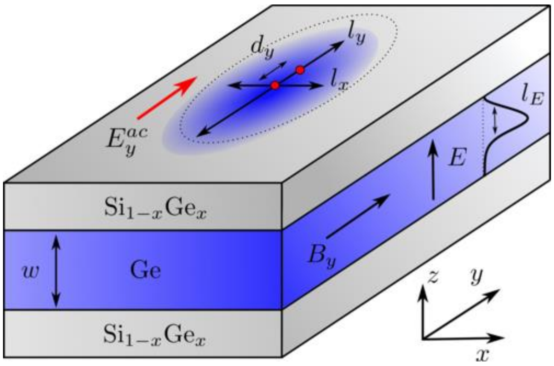
University of Basel

NCCR SPIN

Spin-based Quantum Computing: Qubit Platforms





When:	*Spring 2023*,	starting date February 23
	Lectures:	*Thursdays, 4:15 pm*
	Exercises:	*Fridays, 2:00 pm*
What:	4 credit points,	weekly assignments, grade 1-6
Where:	*Online course, sign-up here*	
Teachers:	*Stefano Bosco*	stefano.bosco@unibas.ch
	& colleagues from the NCCR SPIN network	
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Quantum mechanics was first developed about a hundred years ago and has since become one of the great overarching theories. Remarkably, quantum-mechanical principles such as superposition and entanglement enable novel types of computer, ***quantum computers***, capable of solving otherwise intractable problems.

In this course, we will discuss how ***semiconductor spins*** can be used for quantum information processing. We will review basic operations of one and two qubits, keeping an eye on how to implement them in semiconducting devices. We will study spin qubits in quantum dots [1], and focus on standard industry materials silicon [2] and germanium [3], currently among the most promising platforms for a large-scale quantum computer.
Basic ideas will be analyzed, coupling qubits and prospects for scaling and integration will be discussed, and the state-of-the-art including current research topics will be introduced.

This course is tailored to master and PhD students, with theoretical or experimental background, aiming to widen their perspectives into the fast-growing field of spin-based quantum information processing.

[1] D. Loss and D. P. DiVincenzo, Phys. Rev. A **57**, 120 (1998).
[2] L. Vandersypen and M. Eriksson, Phys. Today **72**, 38 (2019).
[3] G. Scappucci, C. Kloeffel, *et al.*, Nature Reviews Materials **6**, 926 (2021).