Special seminar

Universität Konstanz

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P603

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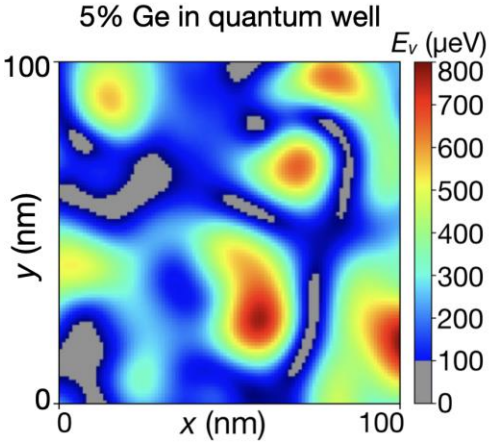
Quantum-dot qubits in Si/SiGe: effects of disorder in a nearly perfect materials system



Qubits are normally formed from the lowest energy states of a quantum dot. However, in SiGe/Si/SiGe quantum wells, the so-called valley states of the conduction band can have small energy splittings that compete with the preferred spin degree of freedom. To overcome this problem, the most common strategy has been to grow ever-sharper heterostructure interfaces. In this talk, I will show that SiGe alloy disorder largely undermines this approach, as it leads to high variability of the valley splitting. Somewhat unintuitively then, we propose to mitigate the effects of dangerously small valley splittings by enhancing the alloy disorder. Other engineering strategies such as Ge concentration oscillations and shear strain are also considered. To conclude, I will focus on a current hot-topic for quantum-dot qubits: intermediate-range quantum communications via spin shuttling, and I will discuss the effects of valley-splitting variability and alloy disorder in this context.

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