Coherent control of trapped-charge induced resonances

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One of the noise sources in transistors (the building blocks of integrated circuits) is the existence of electronic defect states at material interfaces, such as trapped charges in the gate dielectric of the transistor. These charges can affect the behaviour of nano-devices quite strongly, as illustrated by random telegraph noise at low temperatures. Understanding the dynamics of trapped charge is thus essential for future nanotechnologies, but their direct detection and manipulation is rather challenging. In this work, we explore these traps by probing them with microwave pulses. We find a large number of very high quality-factor ($Q \sim 10^5$) resonances in the transistor current as a function of microwave frequency and we demonstrate both long decoherence times ($\sim 10^1$ µs) and coherent control of the defect-induced dynamics. This hints at using such a trap as a potential implementation of a quantum bit.

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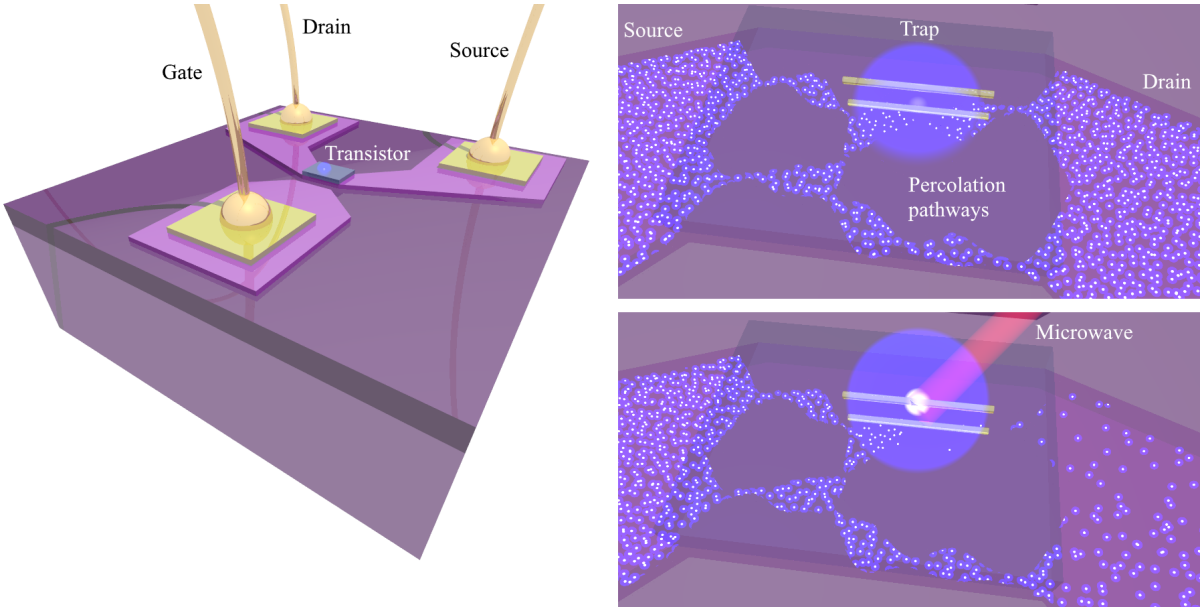

Transistor (left) with percolation paths (right) that are affected by the state of an electron trap. Microwave spectroscopy allows to interact with the traps.