# Phase-coherent cotunneling in tailored semiconductor quantum systems

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Quantum dots fabricated by local anodic oxidation have proven to be state-of-the-art quantum systems comparable in quality to structures made by conventional electron-beam lithography. The most recent progress made in fabrication of such structures, the so-called multiple layer local oxidation [1], will be presented. A structure fabricated with this technique will be discussed that realizes a few-electron quantum dot with charge-readout and exhibits the signatures of quantum dot hydrogen and helium.

The main focus will then be on the investigation of elastic and inelastic cotunneling processes. We have recently observed signatures of electron transport within the Coulomb-blockade which can be attributed to sequential tunneling mediated by inelastic cotunneling processes [2]. These findings allow us to broaden our understanding of transport in the blockade beyond the processes observed previously.

Most recent experiments investigate a double quantum dot embedded in an Aharonov-Bohm (AB) interferometer. When the double dot system is tuned into the Coulomb-blockade regime, pronounced AB oscillations can still be observed giving evidence for a large phase-coherent contribution to the cotunneling current. At finite bias voltages we find an inelastic cotunneling onset due to an excited state in one of the two quantum dots, where the AB oscillations exhibit a characteristic phase-shift by $\pi$. Most remarkably, the inelastic cotunneling current turns out to allow for strong AB oscillations with visibilities of up to 0.9. We attribute this behavior to a two-particle AB effect. The question in how far the excitation remaining in one of the quantum dots after the inelastic process allows 'which-path' detection will be addressed.

# References

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