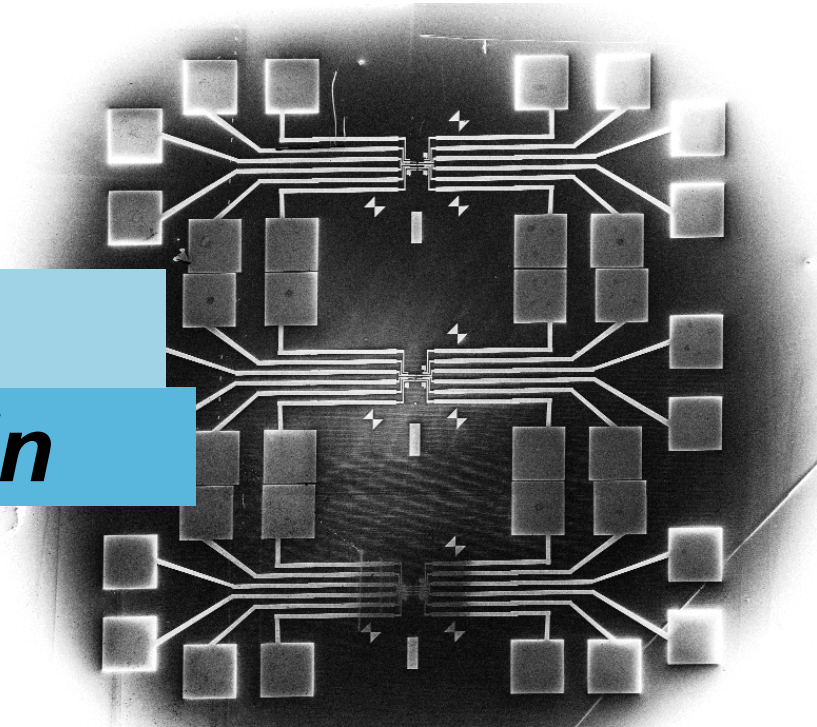


# ***Electronic Transport in Nanostructures***

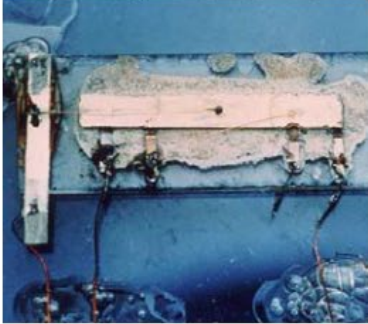


Prof. Dr. Elke Scheer

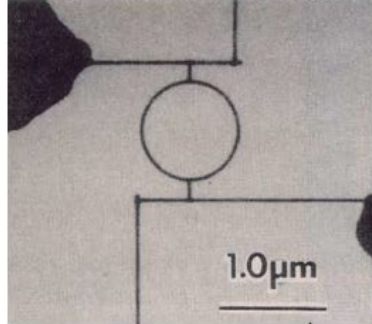
Compact lecture, Sommer Term 2022

# Nanoelectronics

erster integrierter Schaltkreis



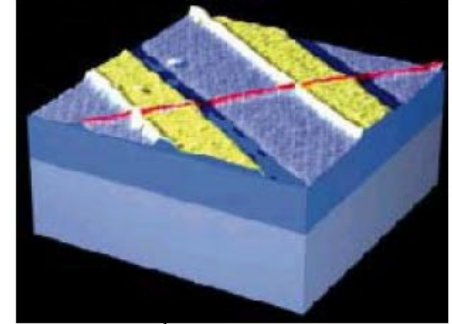
Aharonov-Bohm-Ring



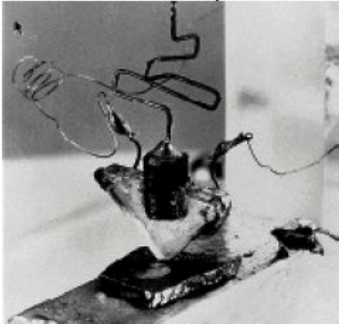
Halbleiter-Quanten-Dots



Carbon-Nanotube-Transistor



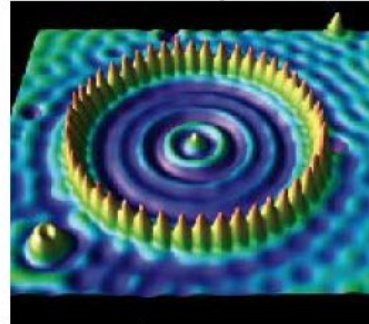
erster Transistor



Quanten Hall Effekt



STM-Manipulation



Einzel-Molekül-Transistor

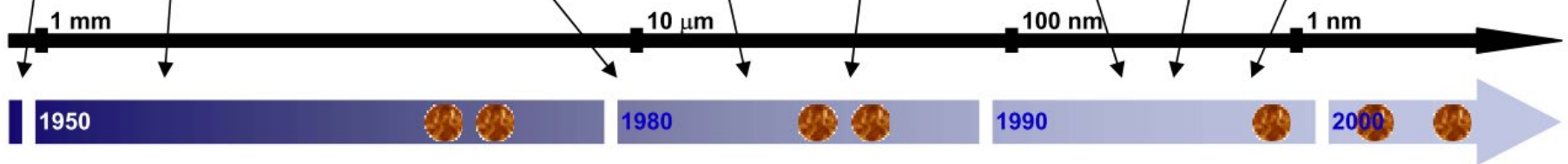
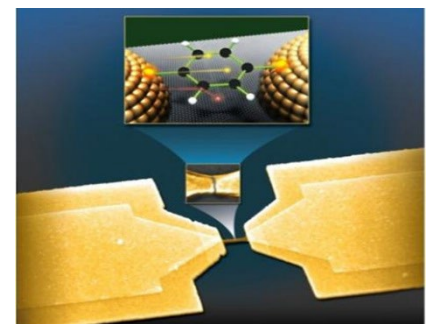
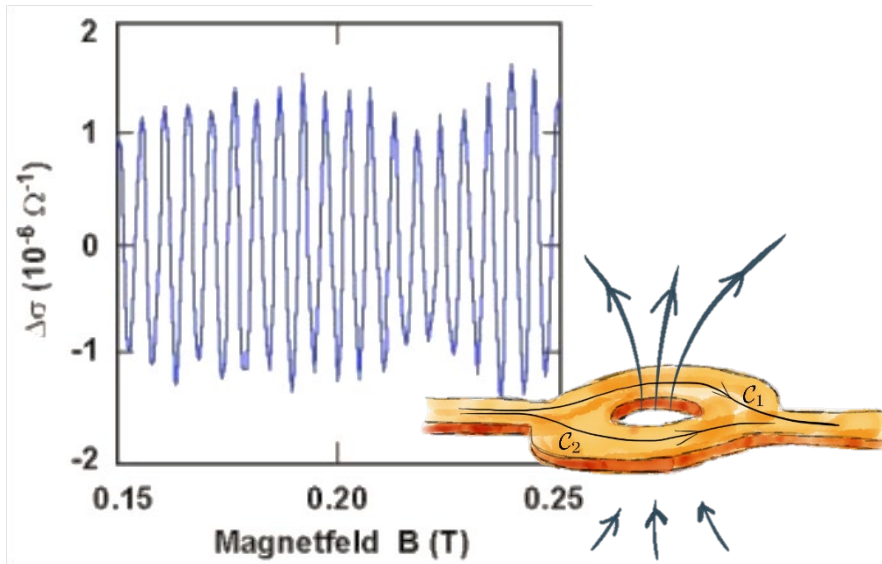
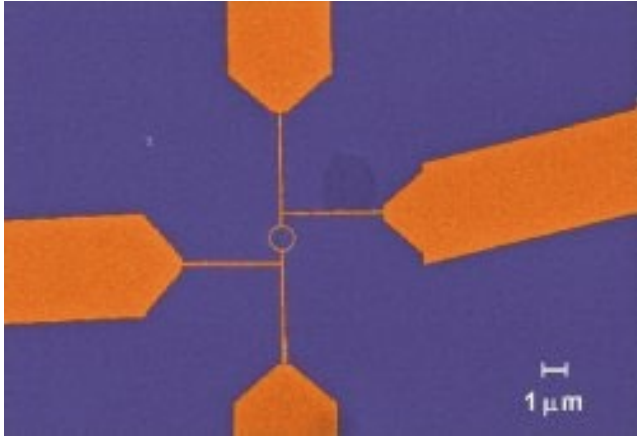


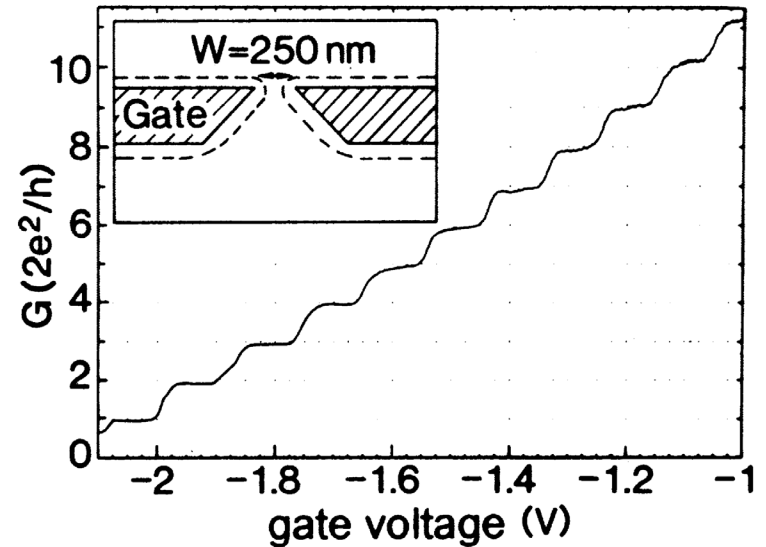
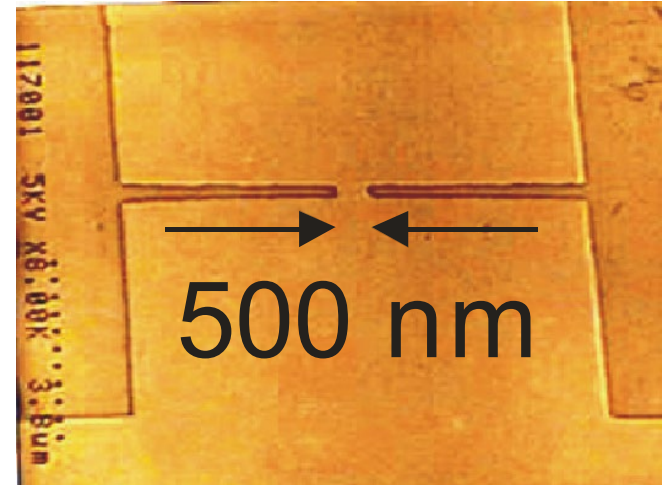
figure courtesy of S. Oberholzer, University of Basel

# Wave properties of electrons



## Elektronic Interference phenomena

# Quantization of charge



Ohm's Law  $\rightarrow$  Conductance quantization

[Graphics: left: own data, right: Courtesy D. Wharam, v. Wees et al. PRL 1988]

# Content of lecture

1. Introduction
2. Electrons in solids, reduced dimensions
3. Quantum transport, Landauer and Landauer Büttiker model, transmission coefficients of real systems
4. Quantum interference: Aharonov-Bohm effect, universal conductance quantization
5. Coulomb-Blockade: electron box, single electron transistor, electron turnstile
6. Mesoscopic superconductivity Andreev reflection, proximity effect, Josephson devices
7. Molecular electronics: if time permits

## Zeitlicher Ablauf

	<b>Tuesday 10:00-11:30 P1138</b>	<b>Thursday 11:45-13:30 P912</b>
<b>12.4.-14.4.</b>		
<b>19.4. -21.4.</b>	Lecture	Lecture
<b>26.4. -28.4.</b>	Lecture	Lecture
<b>3.5.-5.5.</b>	Lecture	Lecture
<b>10.5. – 12.5.</b>	Lecture	Lecture
<b>17.5.-19.5.</b>	Lecture	Lecture
<b>24.5 – 26.5.</b>		
<b>31.5. -2.6.</b>		
<b>7.6. – 9.6.</b>	Lecture	Lecture
<b>14.6. – 16.6.</b>		
<b>21.6. – 23.6.</b>	Lecture	
<b>28.6. – 30.6.</b>	Lecture	
<b>5.7. – 7.7.</b>		
<b>12.7. – 14.7.</b>	Lecture	Lecture
<b>19.7. – 21.7.</b>	Lecture	Lecture

## Literature/Lehrbücher

S. Datta: Quantum Transport: Atom to Transistor

S. Datta: Electronic Transport in Mesoscopic Systems

A. Erbe & E. Scheer:  
Skriptum zur Vorlesung Ladungstransport in Nanostrukturen

Y. V. Nazarov & Y. Blanter:  
Quantum transport

Di Ventra: Electrical Transport in Nanoscale Systems

J.C. Cuevas & E. Scheer:  
Molecular Electronics, An Introduction to theory and experiment

R. Waser: Nanoelectronics and Quantum Technology