Transport in the Au/Ge(001) surface
- Au/Ge(001) surface, wires separated by 1.6nm
- Au/Ge(001): 1D conducting system (Tomonaga Luttinger Liquid) [1]
- AuGe: 2D conductive layer
- two perpendicular oriented wire domains
- transport through the atomic wires
- scattering of conducting electrons at defects, e.g. step edges, domain boundaries

Sample preparation and contacting the surface
- Ge(001) substrate, undoped
- Ar+ sputtering, 600eV for 30 min at T$_{sample}$=740°C
- cooling to T$_{annealing}$=145°C and deposition of about 6ML Au in 6 min
- annealing at T$_{annealing}$=540°C
- excess Au condenses into 3D islands

Measuring resistance vs. distance using a three terminal STM setup
- Au island distribution on Au/Ge(001) (SEM image)
- in situ contacting procedure monitored by SEM (max. resolution 50 nm)
- each tip is carefully lowered using the 2-piezo until an electrical contact is established
- Au tips are soft enough to only cause little damage to the surface while a good ohmic contact is provided
- Au islands are contacted, the resistance scales logarithmically vs. distance
- 2 dimensional transport

Potentiometry at the Au/Ge(001) surface
- Experimental details
  - large area STM scans show Au wire structure and Au islands
  - applied lateral potential: U$_L$=10 V
  - STP map shows featureless monotonous global gradient (room temperature)
  - no features at step edges / domain boundaries
  - Au islands show different potential than surrounding area
  - abrupt transition at the Au island / wire interface
  - resistivity vs. temperature scales linearly
  - Tentative model
    - islands couple to a 2D conducting layer / are decoupled from surrounding wires
    - 2D conducting layer is buried below the surface?

Previous work [2]
- lateral current applied perpendicular to the surface step edges
- analysis of the distribution of the electrochemical potential (µ$_{EC}$) using STP
- current parallel to the step edges: reduced mean free path due to diffusive scattering at the rough step edges
- monotonous change of µ$_{EC}$ at the step edge
- potential shows most pronounced change right in front of step edge, biggest variation within 6 Å
- potential shows variations at domain boundaries
- anisotropic resistivity for both contact geometries due to different resistances of step edges and domain boundaries
- transmission across step edges depends on change carrier’s angle of incidence relative to step edge

Discussion
- Comsol simulation for angle contact geometry
- possible contact geometries for Au islands contacted to a buried 2D conductive layer
- Comsol Multiphysics simulation reproduces mapped potential
- assumptions: conductivity of the layer is much lower than for the Au island (6·10$^5$ S/m vs. 6·10$^8$ S/m)
- single / few contact points between Au island and subsurface layer

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