



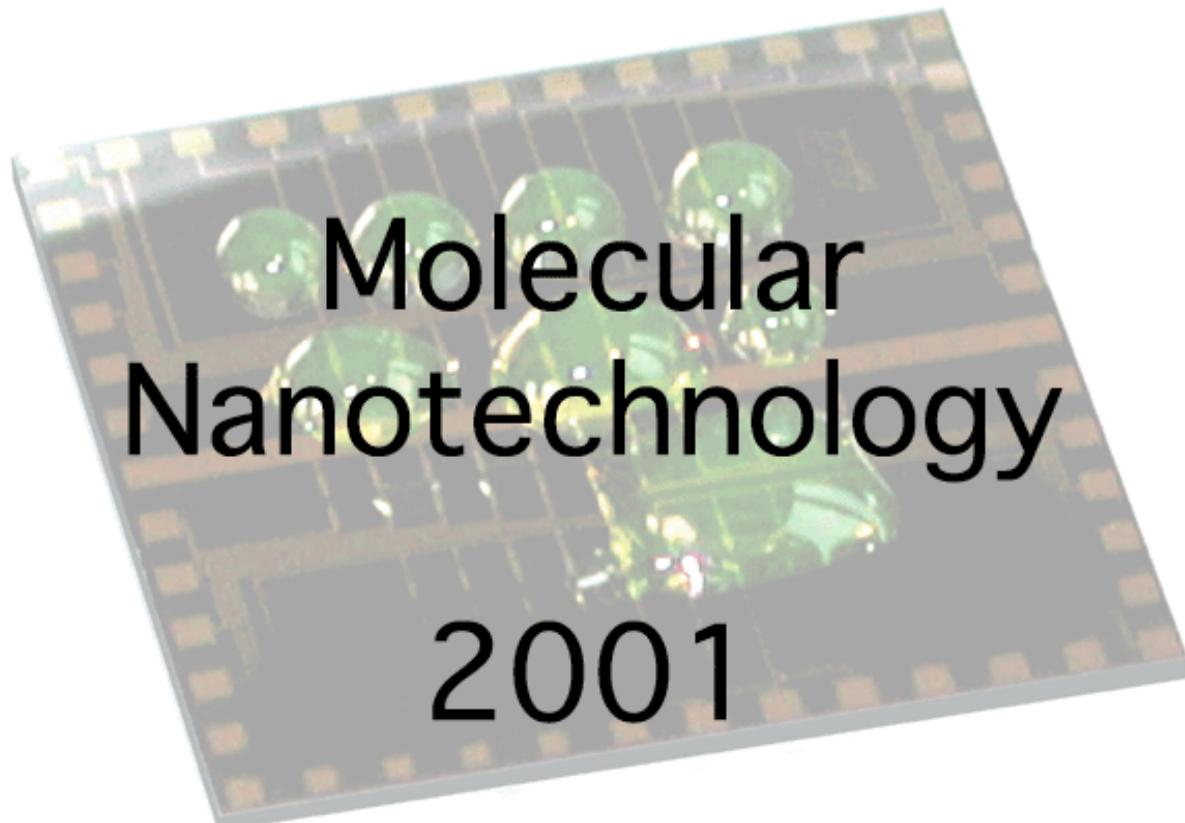
Nanoparticles and DNA on Chips – Realization of a Nanobiotechnology Toolbox

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Institute for Photonic Technology (IPHT) Jena (Germany)



Augustusburg Conference of Advanced Science
Molecular Nanotechnology 2001

- Topics
- Time/
Place
- Program
- Abstracts
- Registration
- Contact /
Information

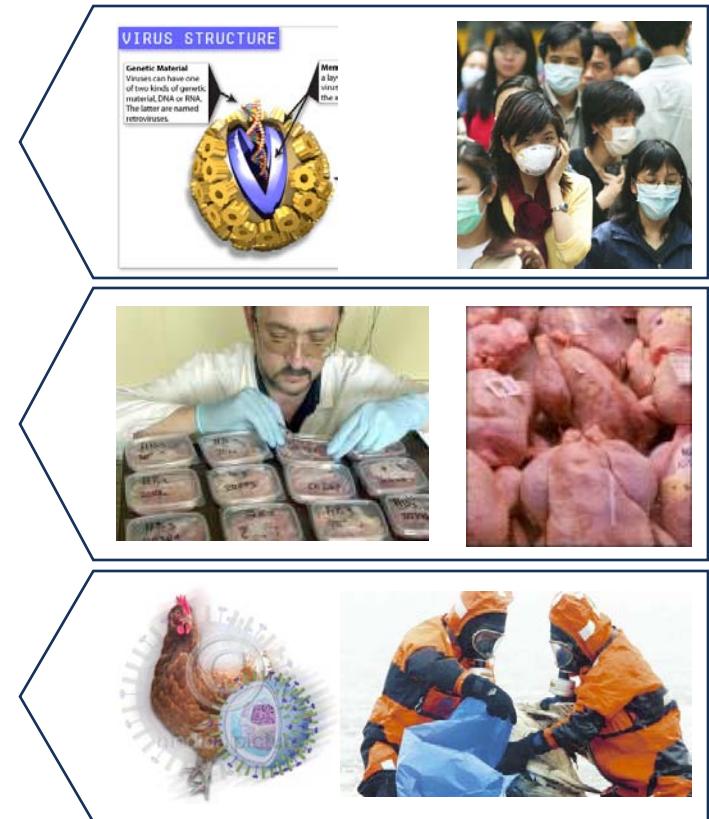


Have a look at the [photos](#) from the conference!

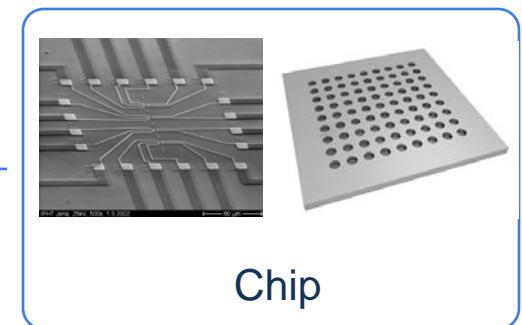
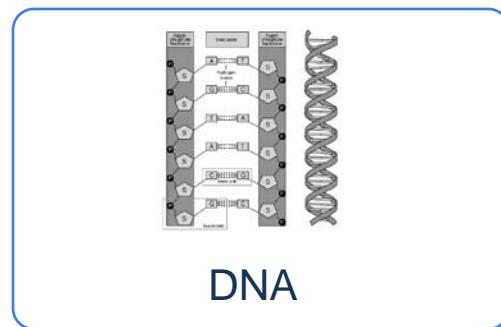
Motivation

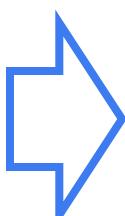
On-site (point-of-care) analytics:

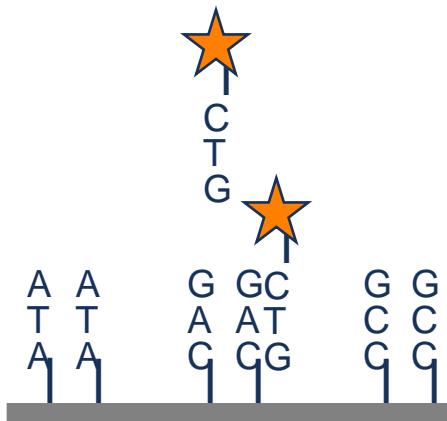
- fast results
- simple and robust assays
- clear results
- low equipment cost



Vision



 Parallel preparation of integrated nanoscale functional elements
based on DNA/Nanoparticles/Chips
for applications in bioanalytics, nanophotonics, nanoelectronics

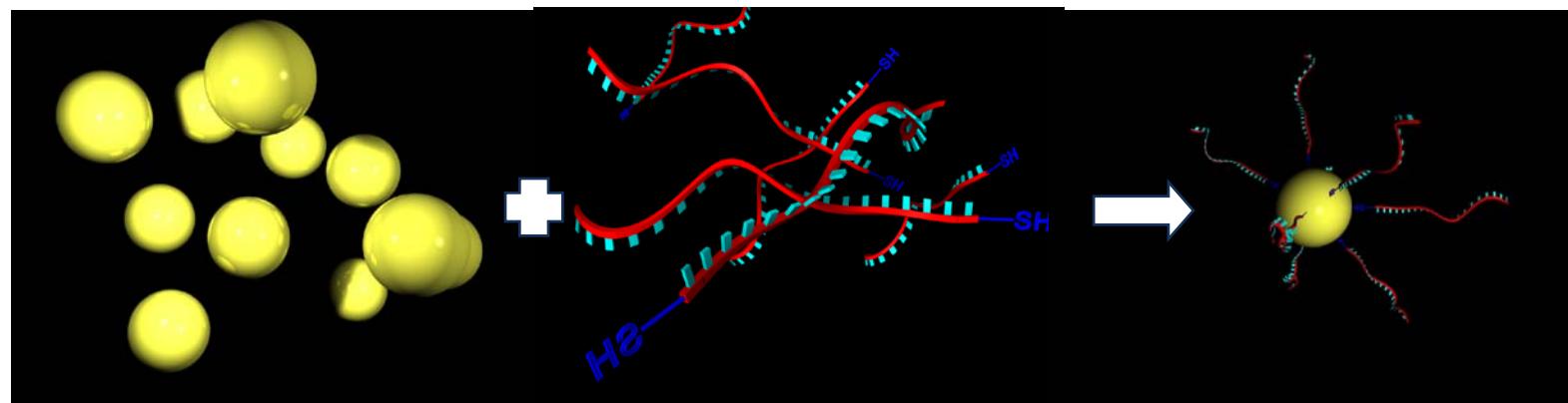


Standard: Fluorescence Dyes

- sensitive, established, qualitative
- but
- comparison difficult
 - signal variations
 - complicate detection

therefore:

search for alternatives: gold nanoparticle

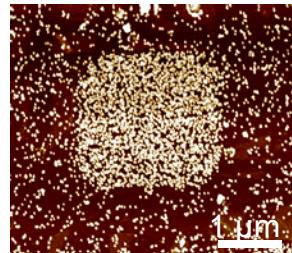
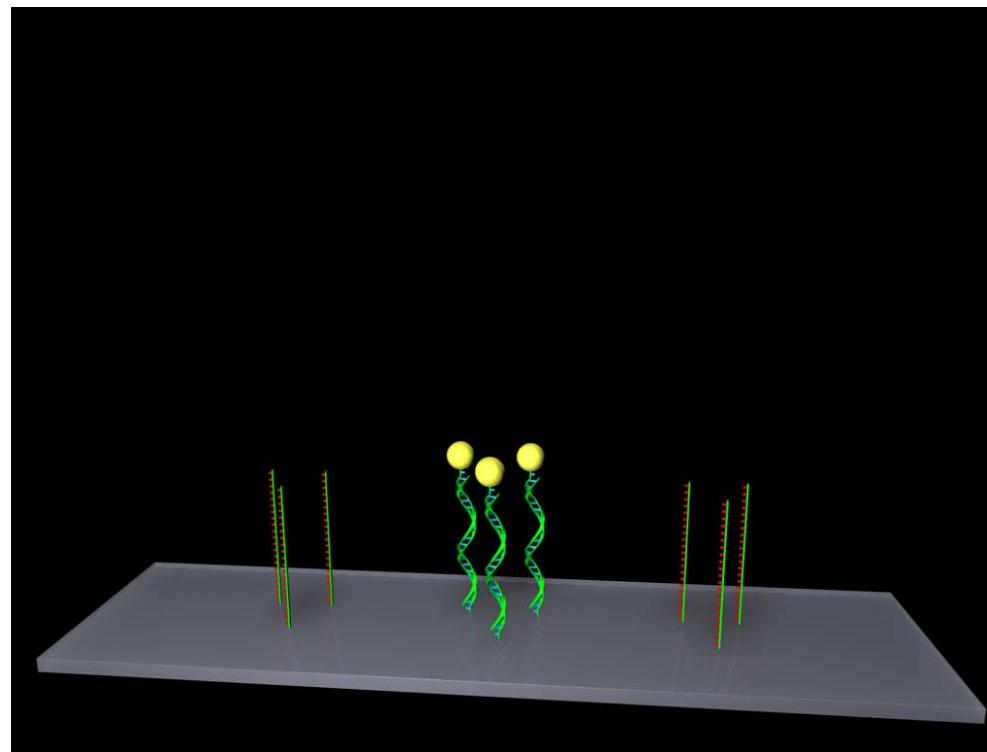


gold nanoparticle ($d=30\text{ nm}$)

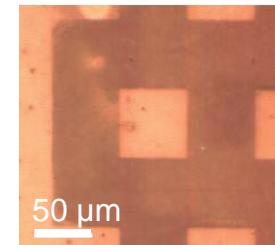
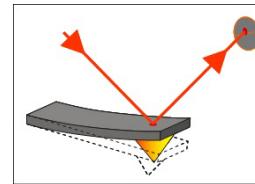
thiol-modified DNA

DNA-modified nanoparticles

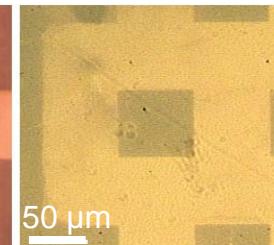
Nanoparticles for DNA-Chip-Detection



AFM



optical:



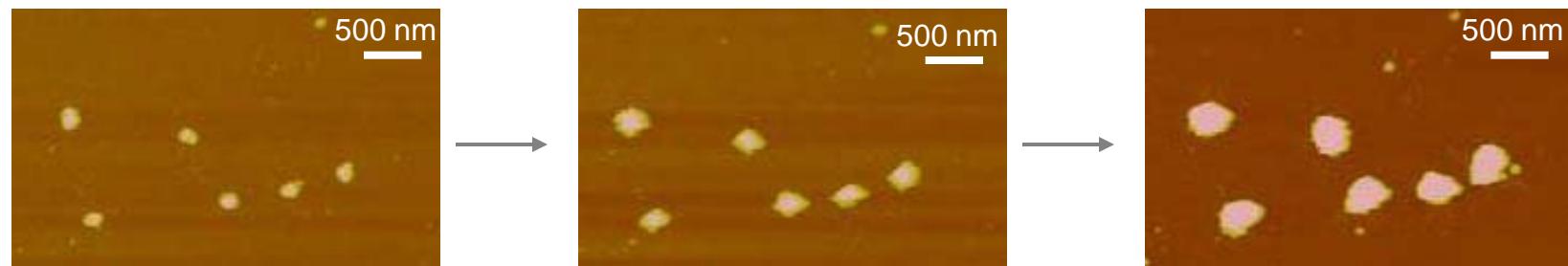
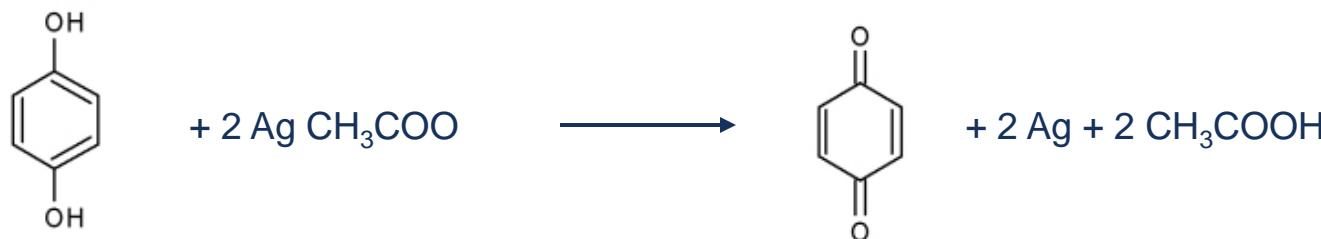
Reflection

Transmission

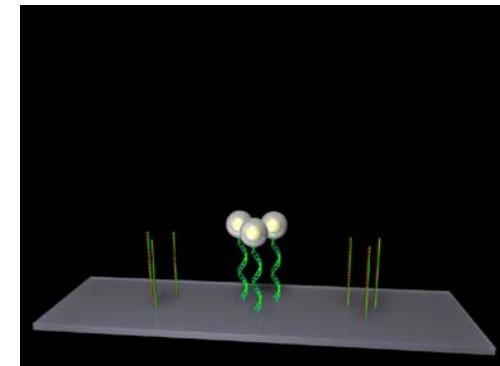
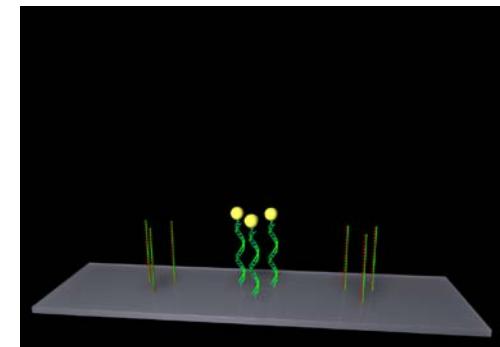
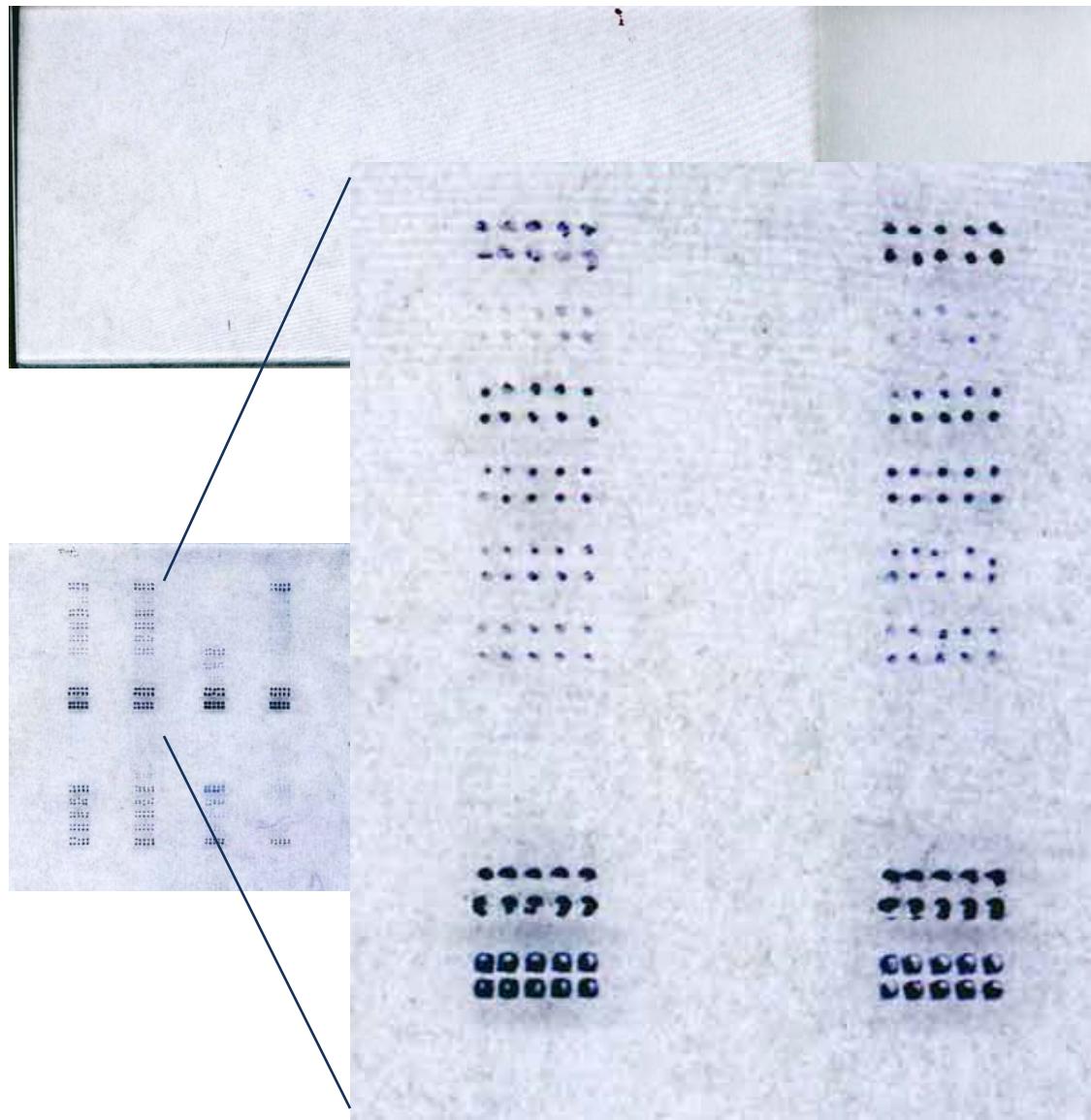
Signal Enhancement



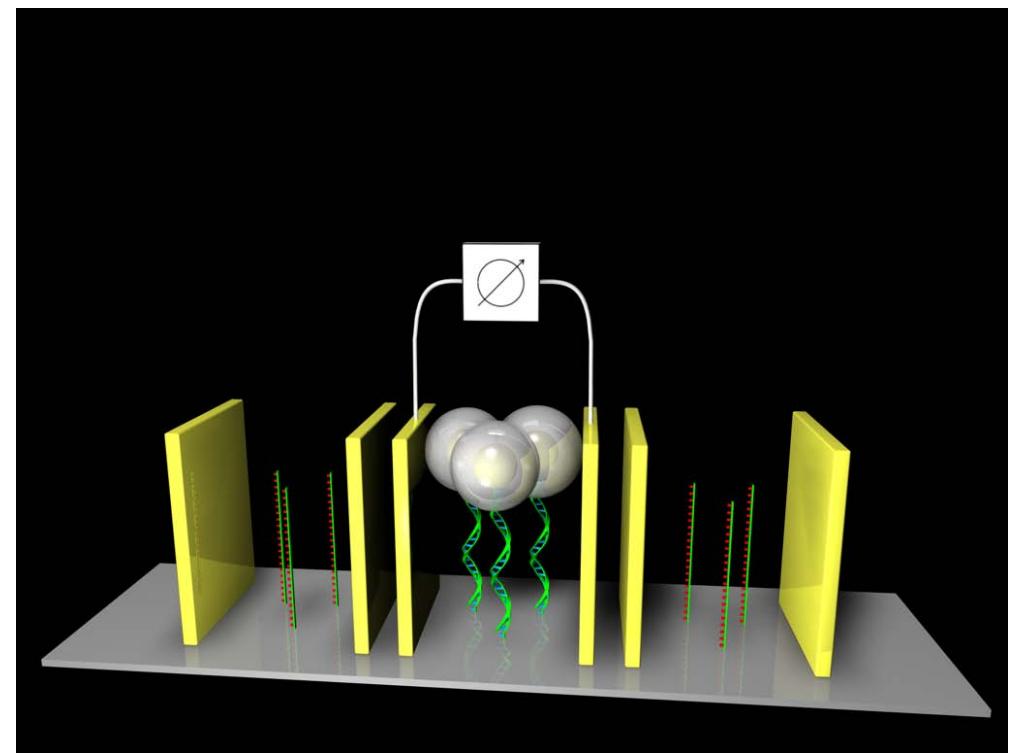
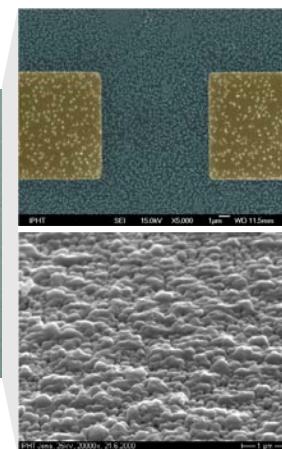
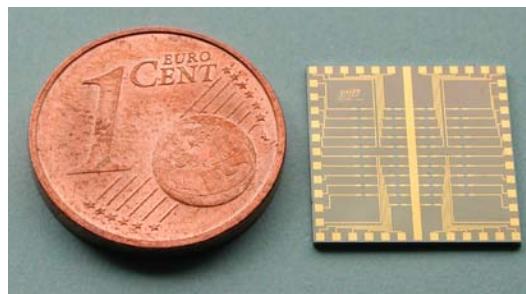
Nanolocal metal deposition: (auto) catalytic reduction of silver salts, e.g.:



Simple detection



Electrical detection



Nanoparticles...

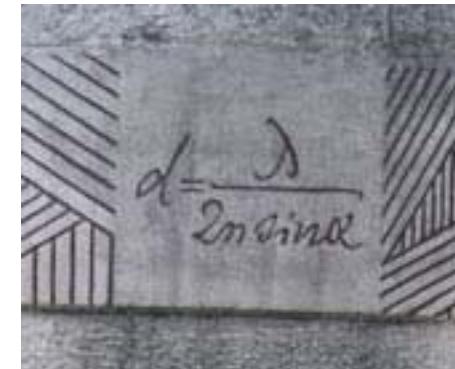
material/
composition

size

shape



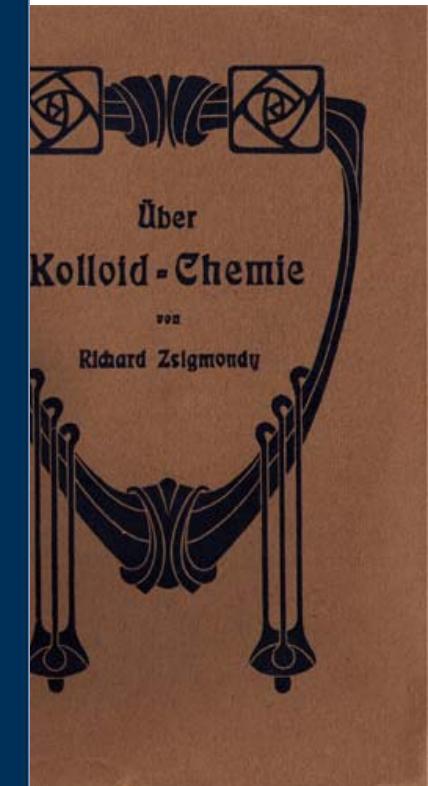
Optical resolution





100 YEARS OF NANOSCIENCE WITH THE ULTRAMICROSCOPE

THE WORK OF RICHARD ZSIGMONDY
INTRODUCED BY
CARSTEN SÖNNICHSEN AND WOLFGANG FRITZSCHE



1907

Nanoparticles...

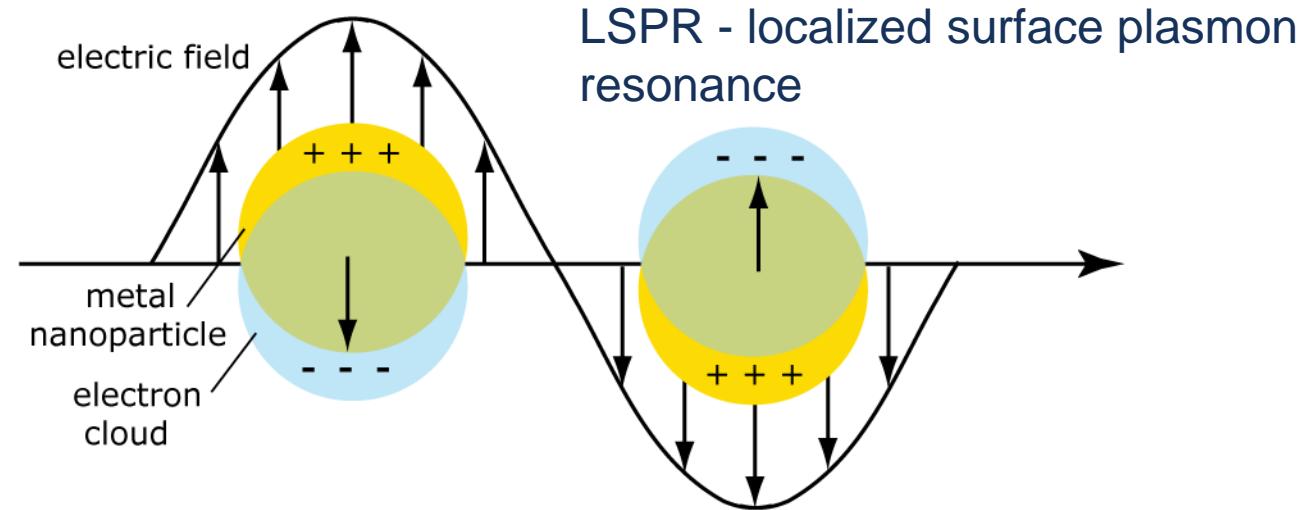
material/
composition

size

shape



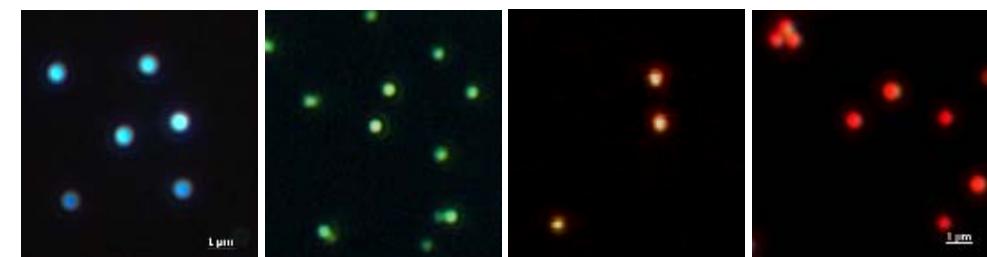
Interaction of Ag/Au Nanoparticles with Light



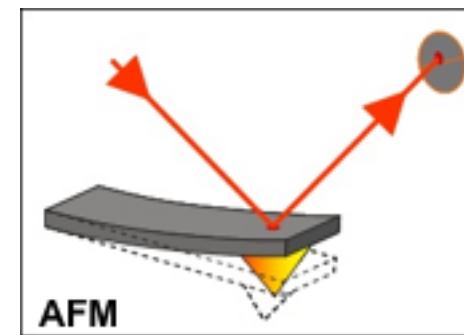
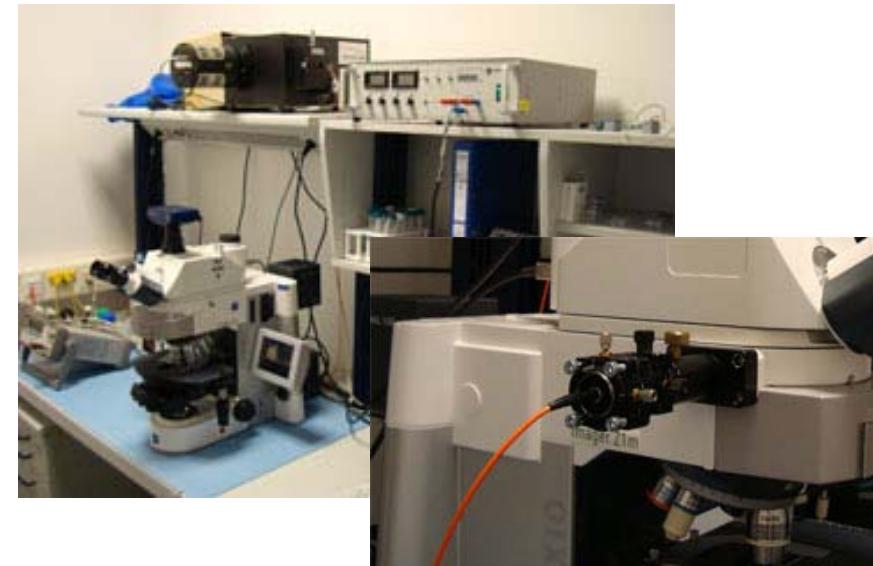
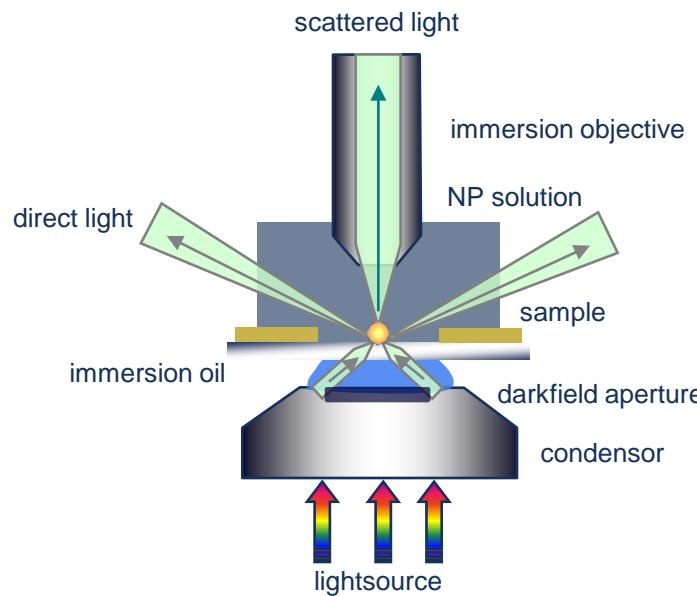
ensemble



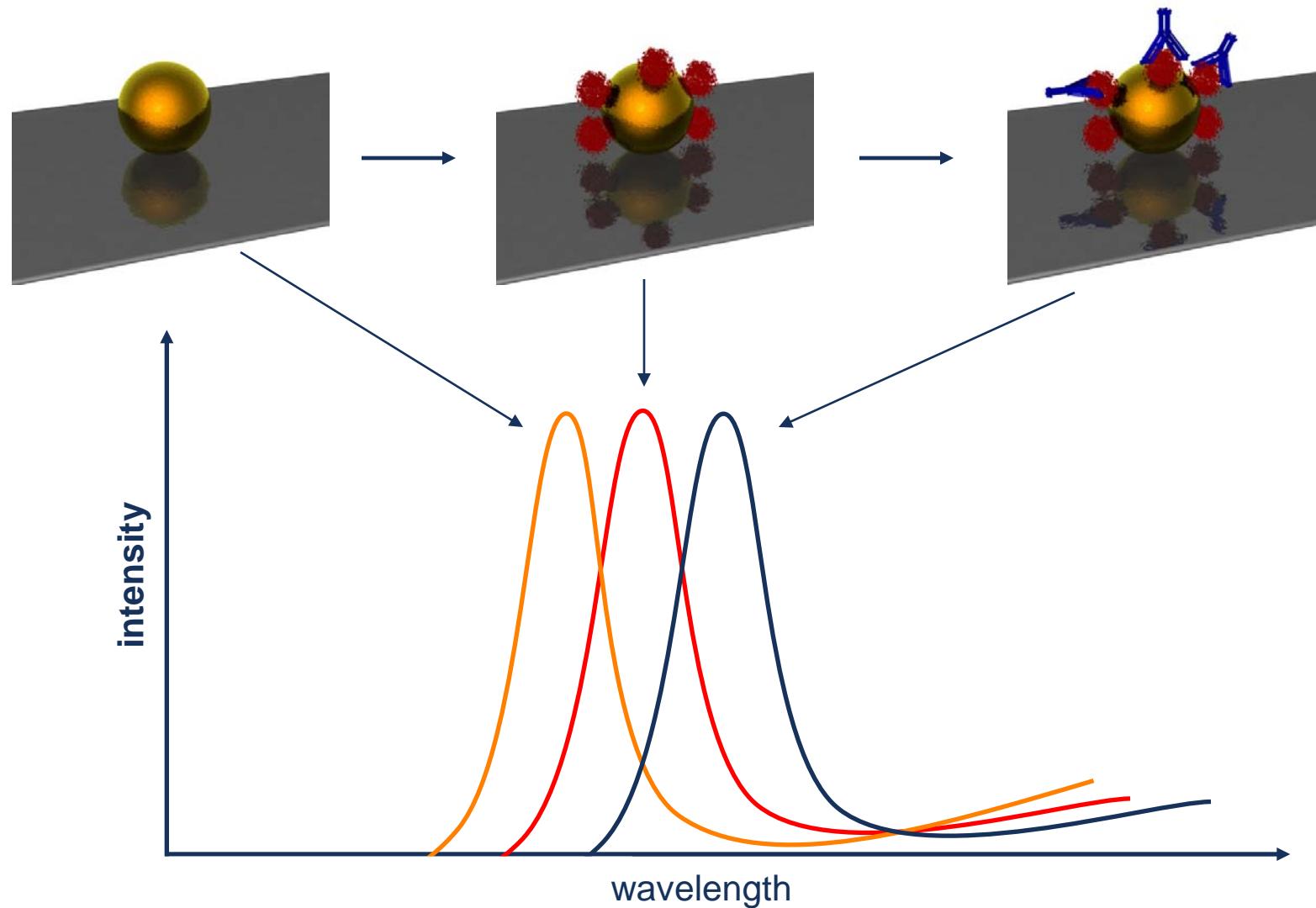
single nanoparticle



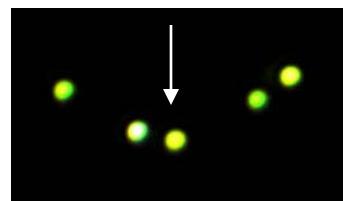
experimental setup



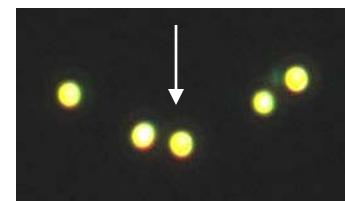
→ correlative single nanostructure analysis with AFM, dark-field microscopy and micro spectroscopy



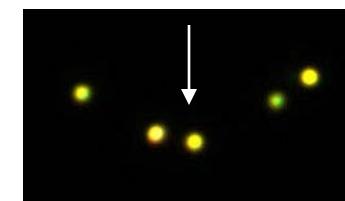
nanoparticles



+ BSA

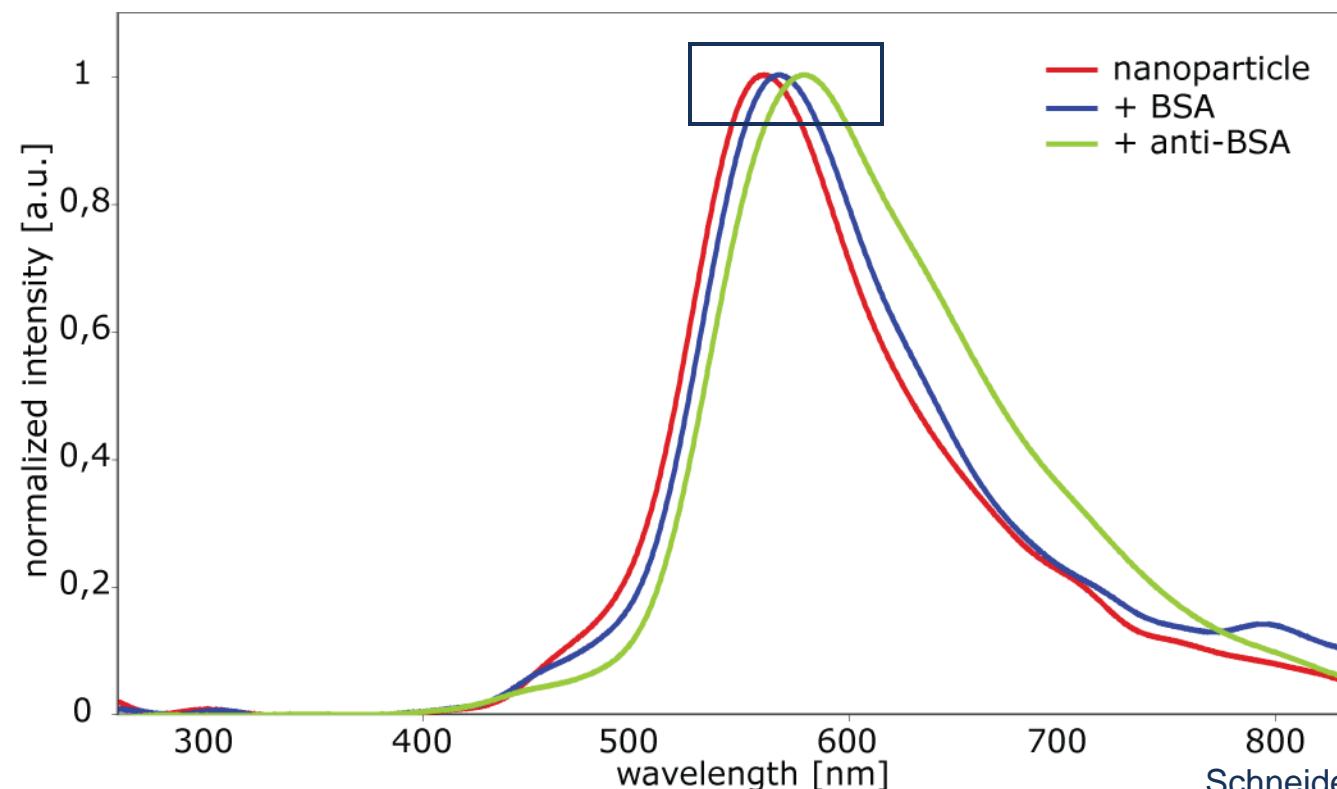


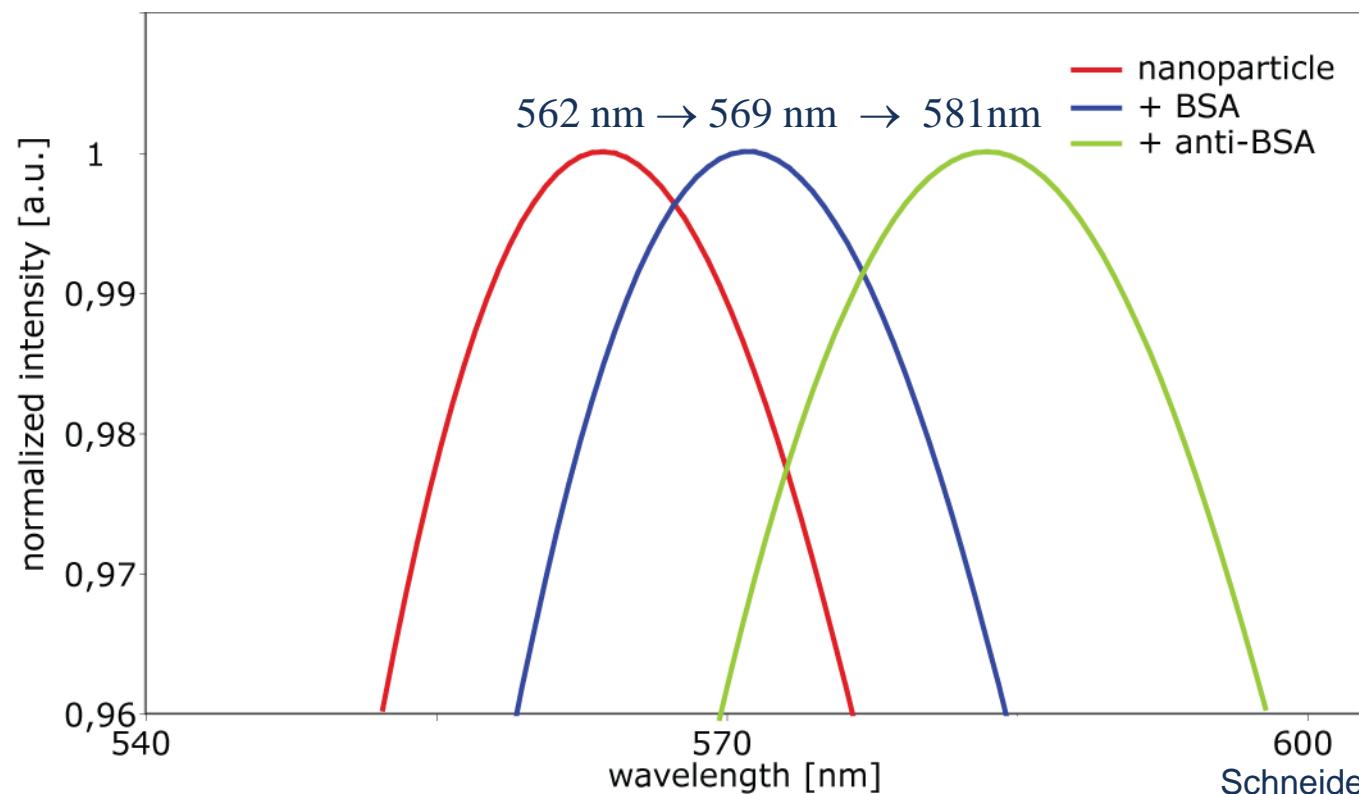
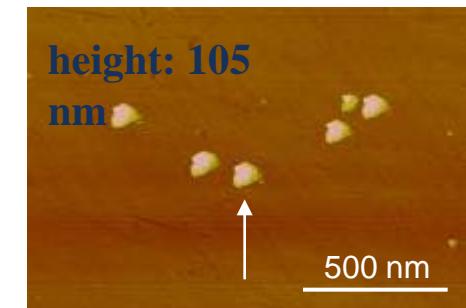
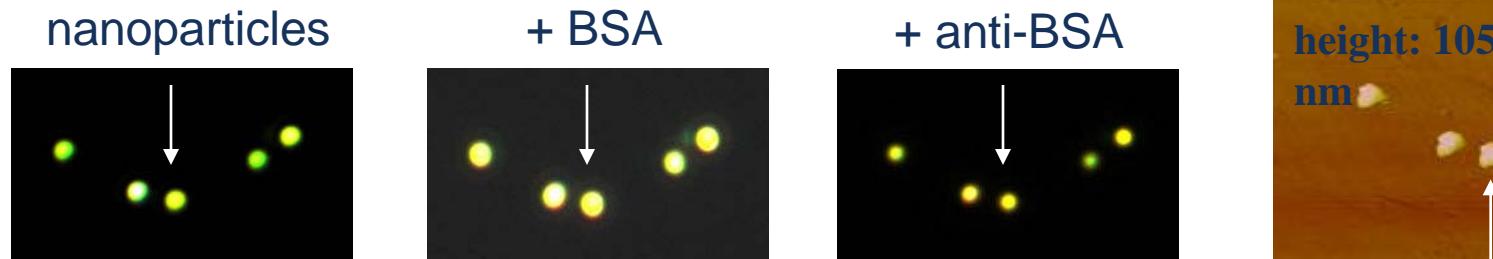
+ anti-BSA



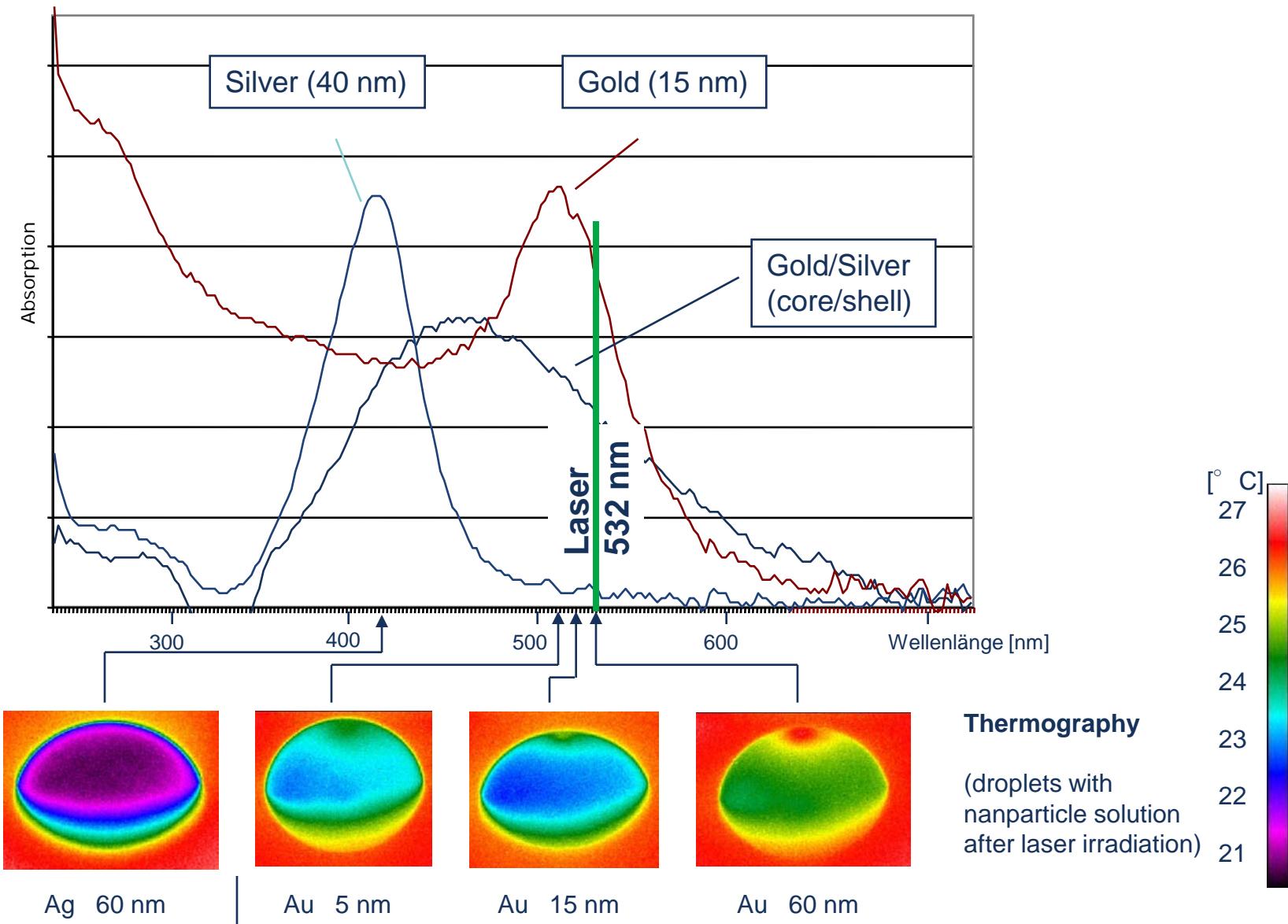
height: 105
nm

500 nm

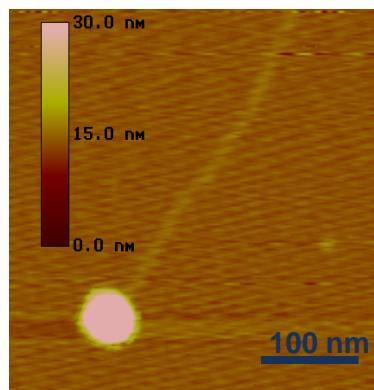
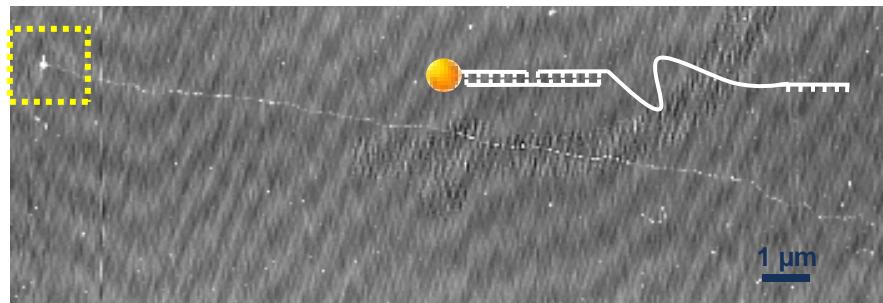




Optical Properties of Particles

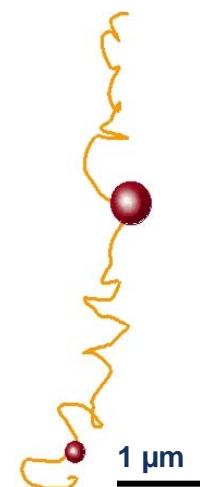
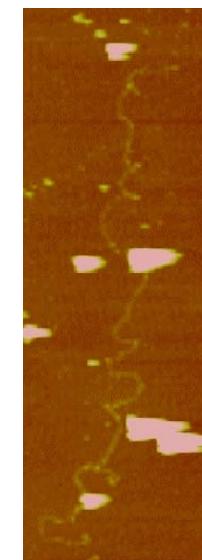


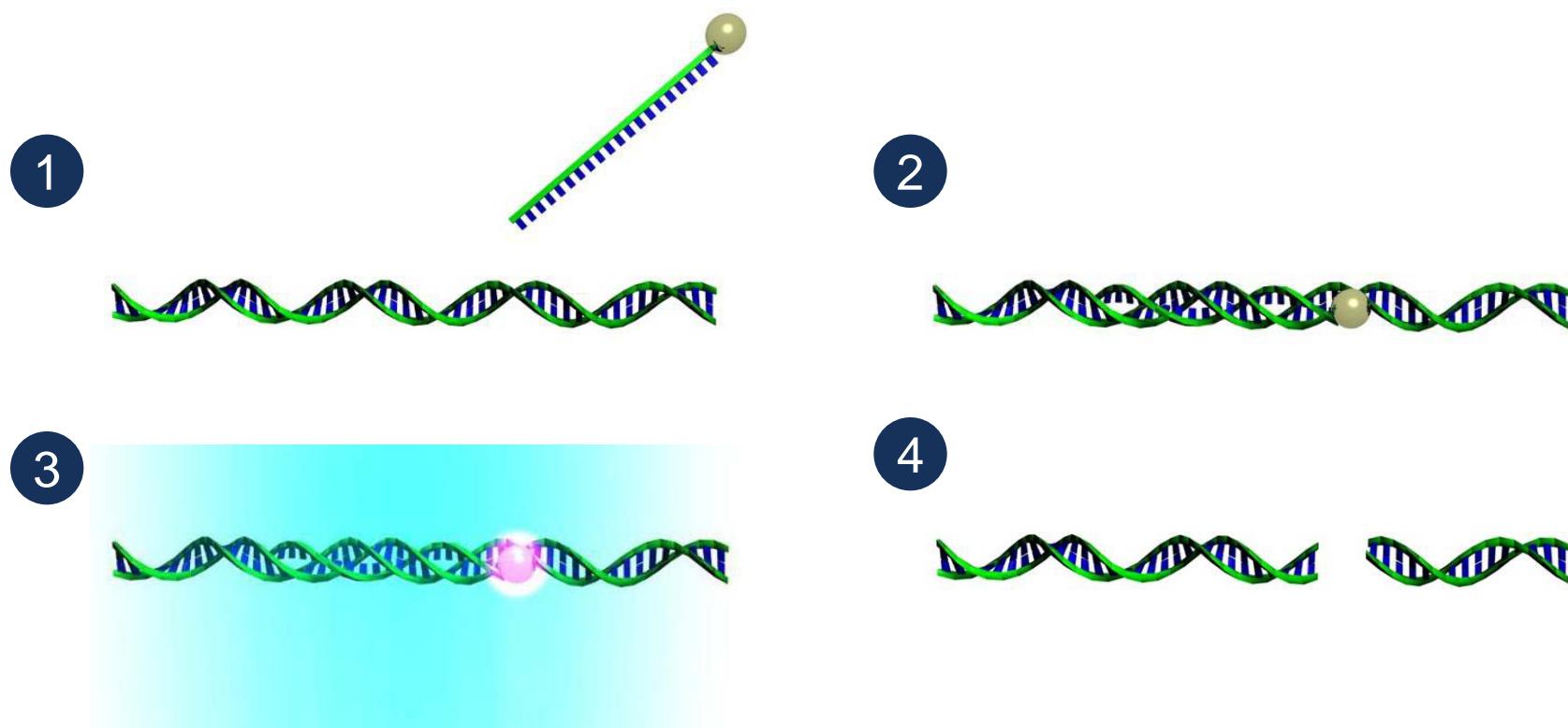
Sequence-spezifische Paarung von Partikeln

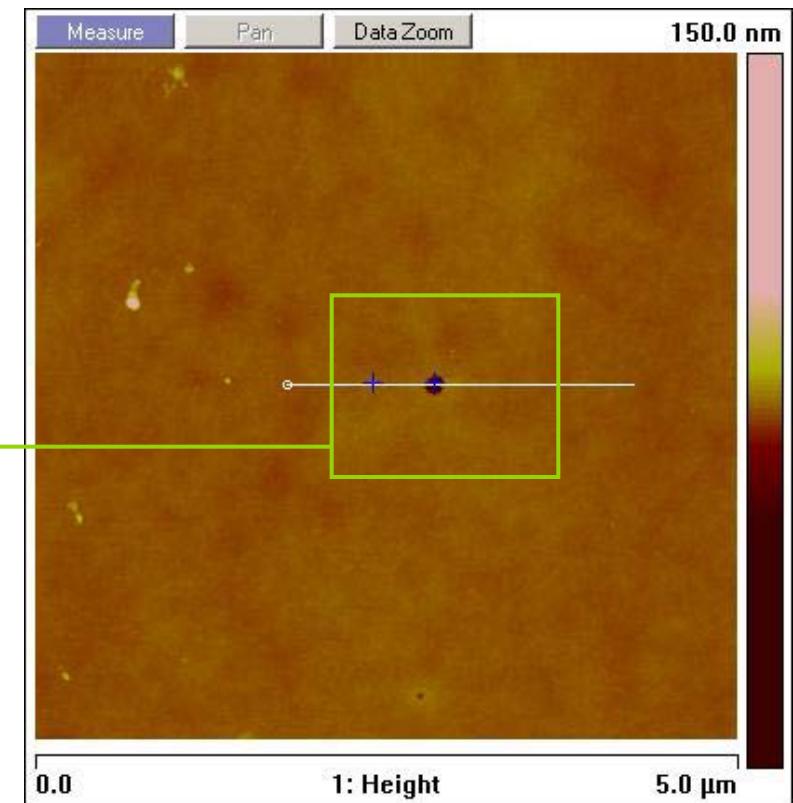
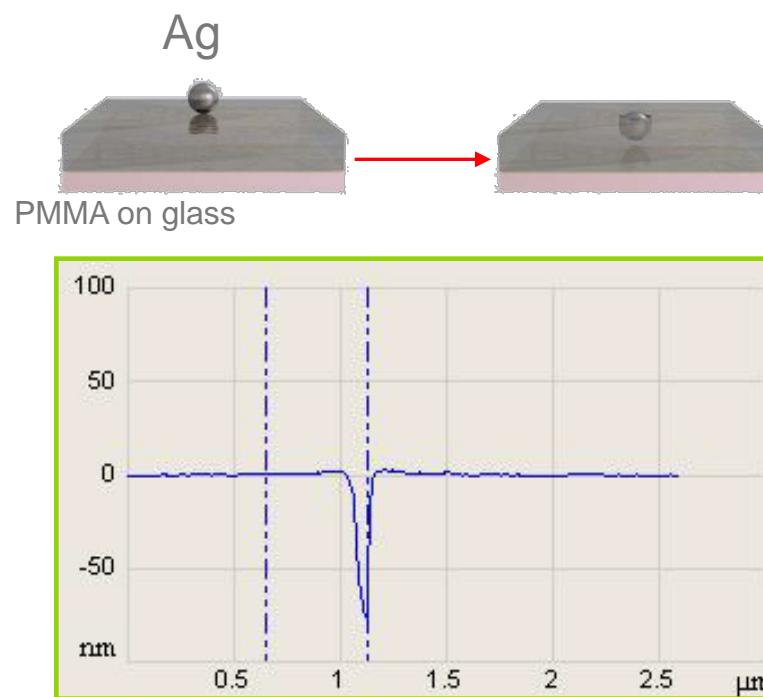


ATG

GCGATCTTAGC...
TACCGCTAGAATCG...



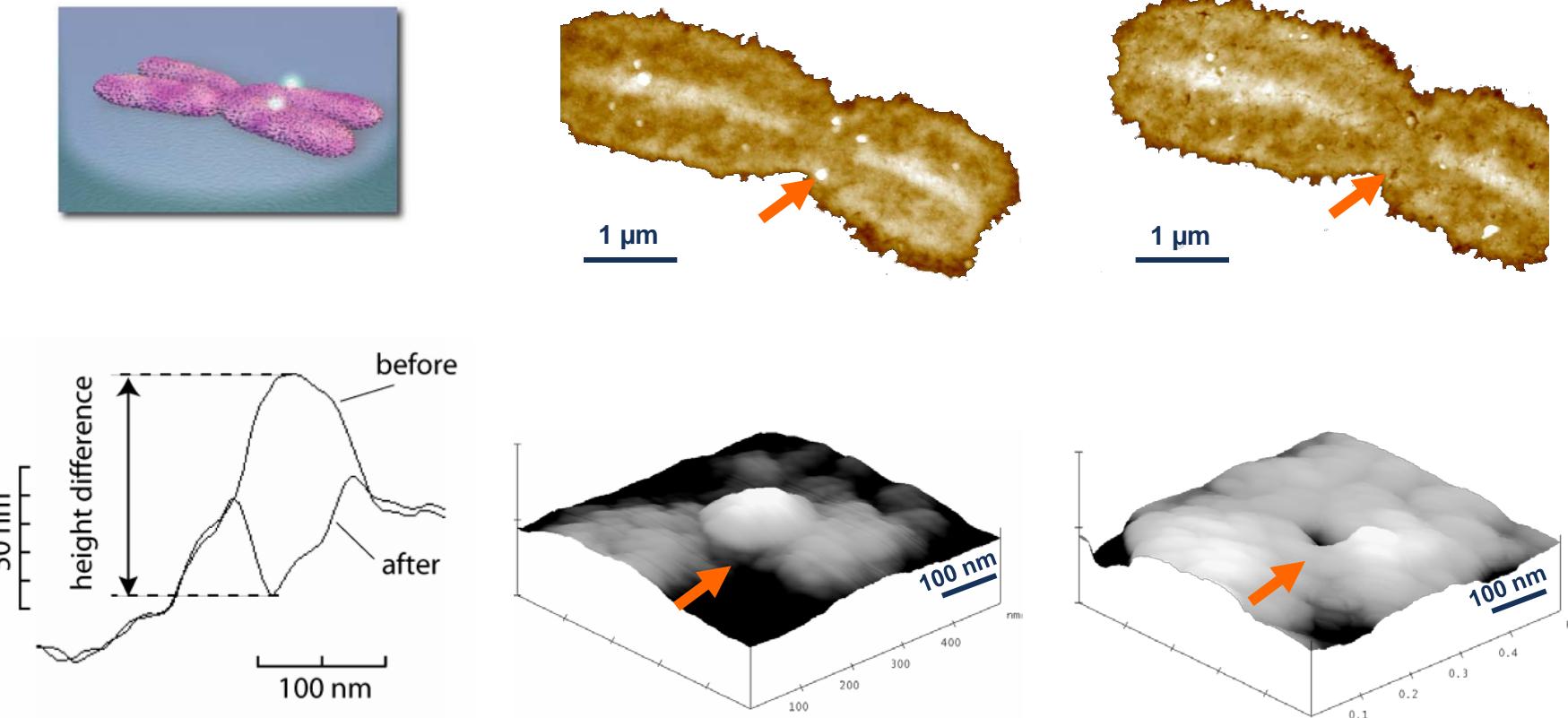


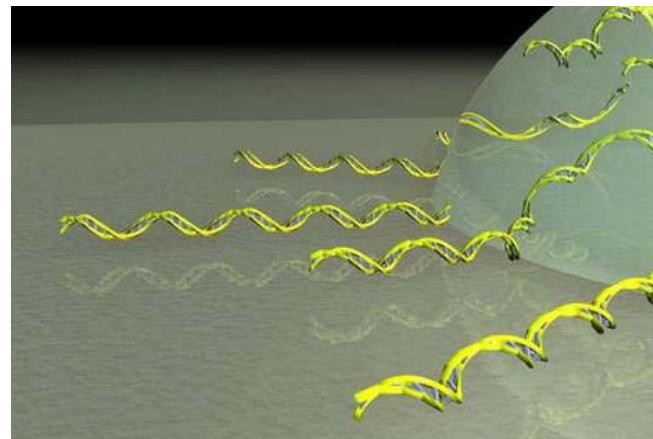
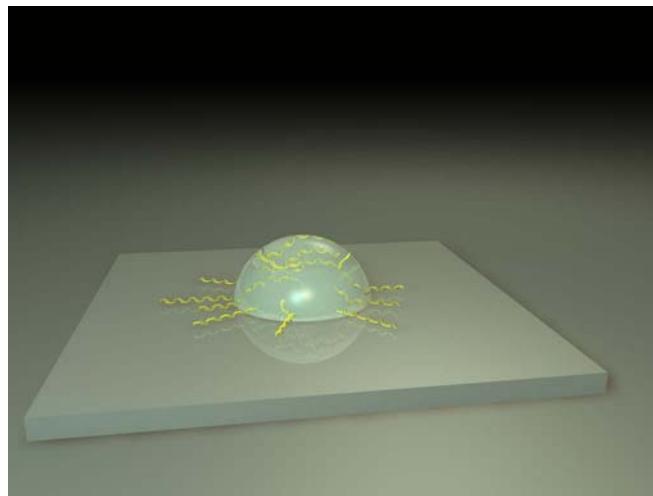


Optically-induced nanolocal damages

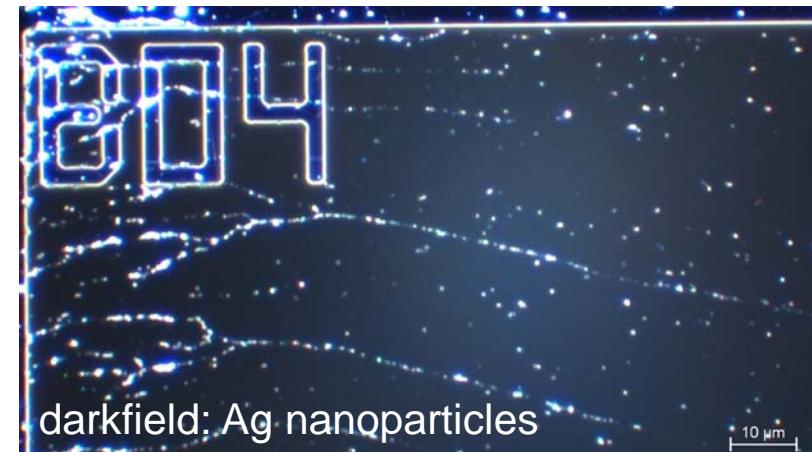


Frank Garwe, Karsten König (JenLab GmbH)

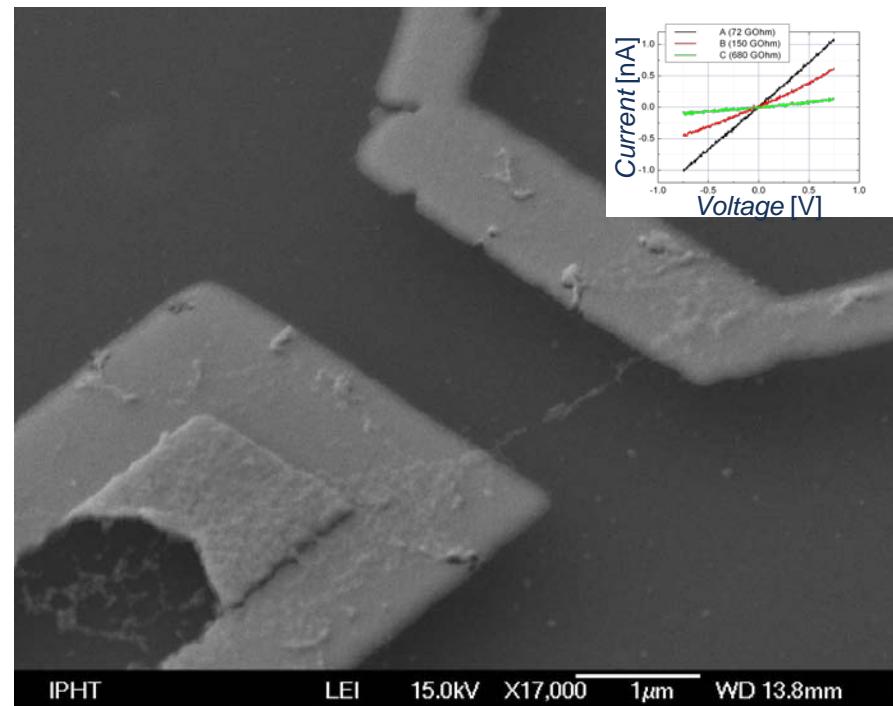
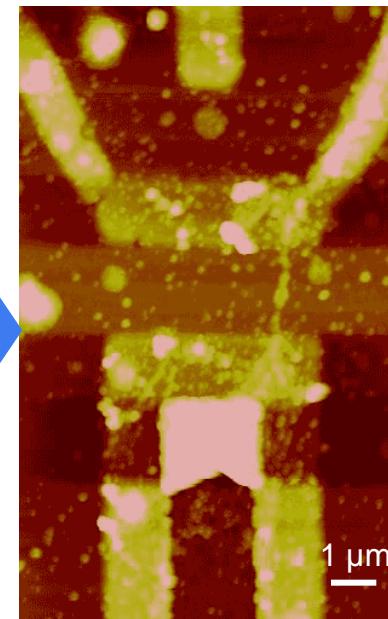
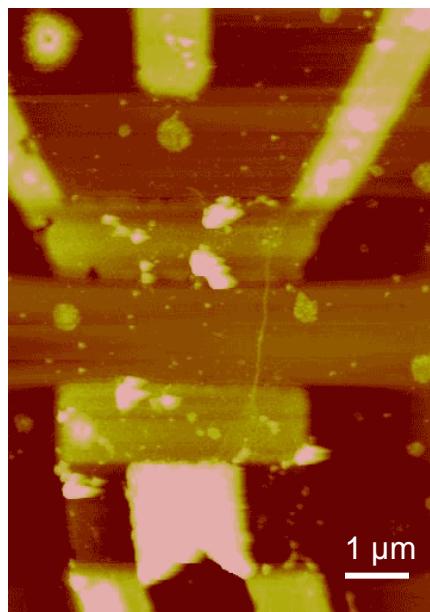
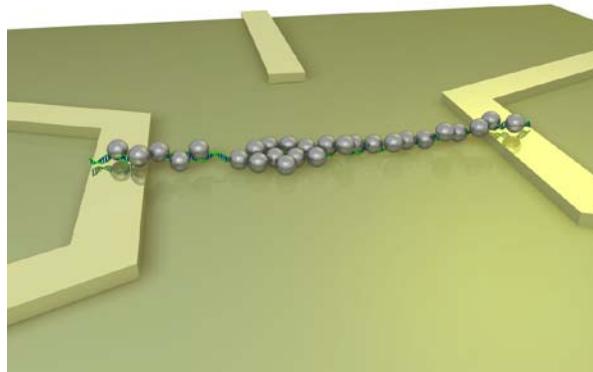


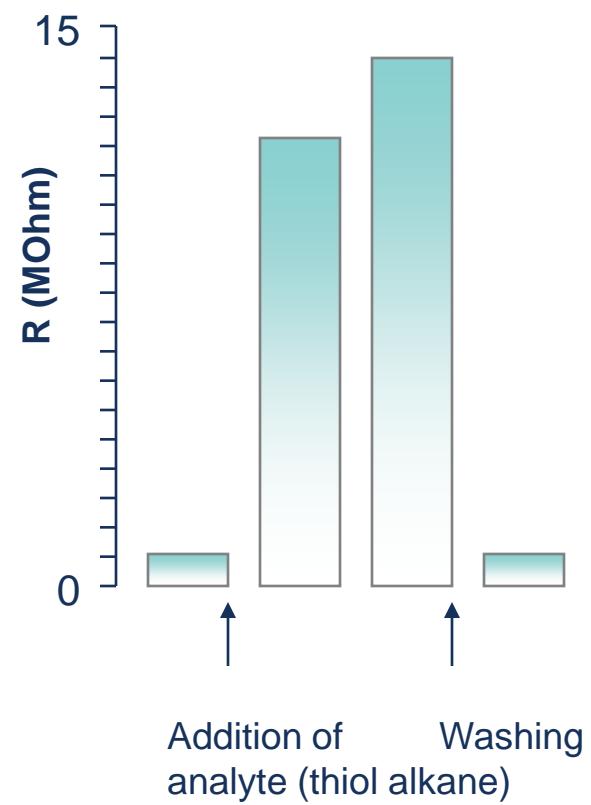
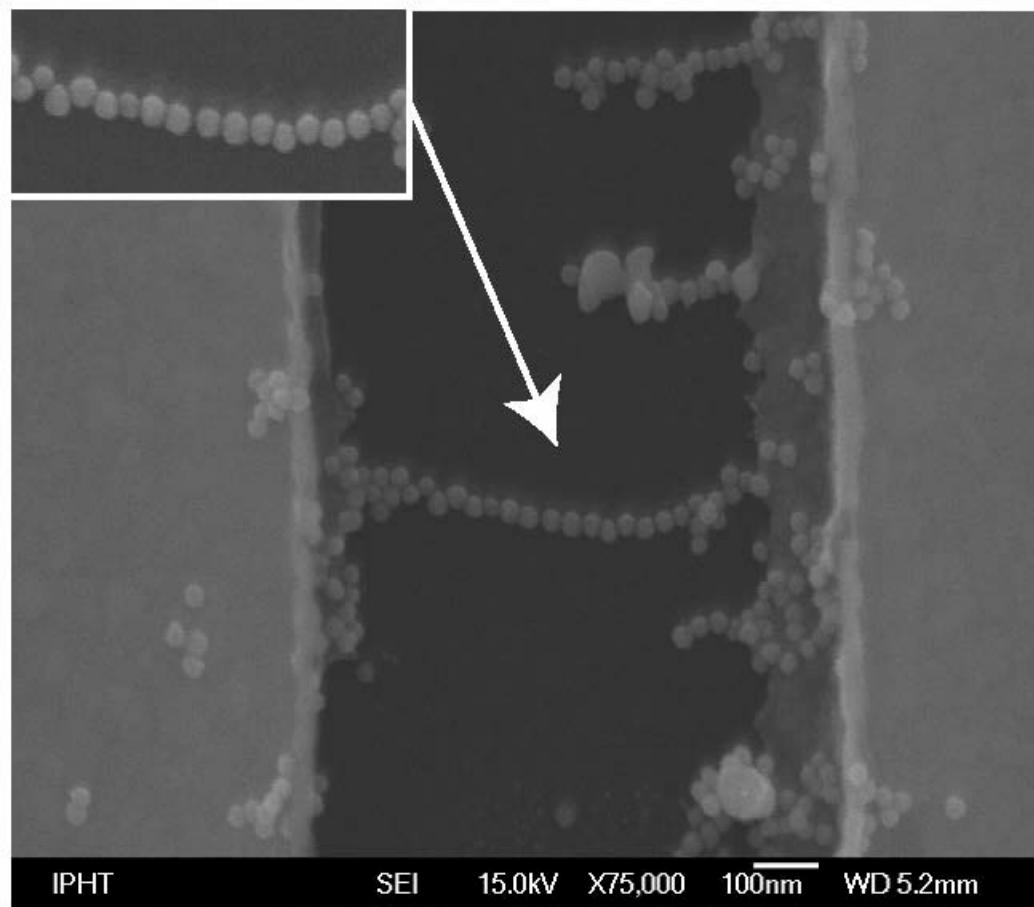


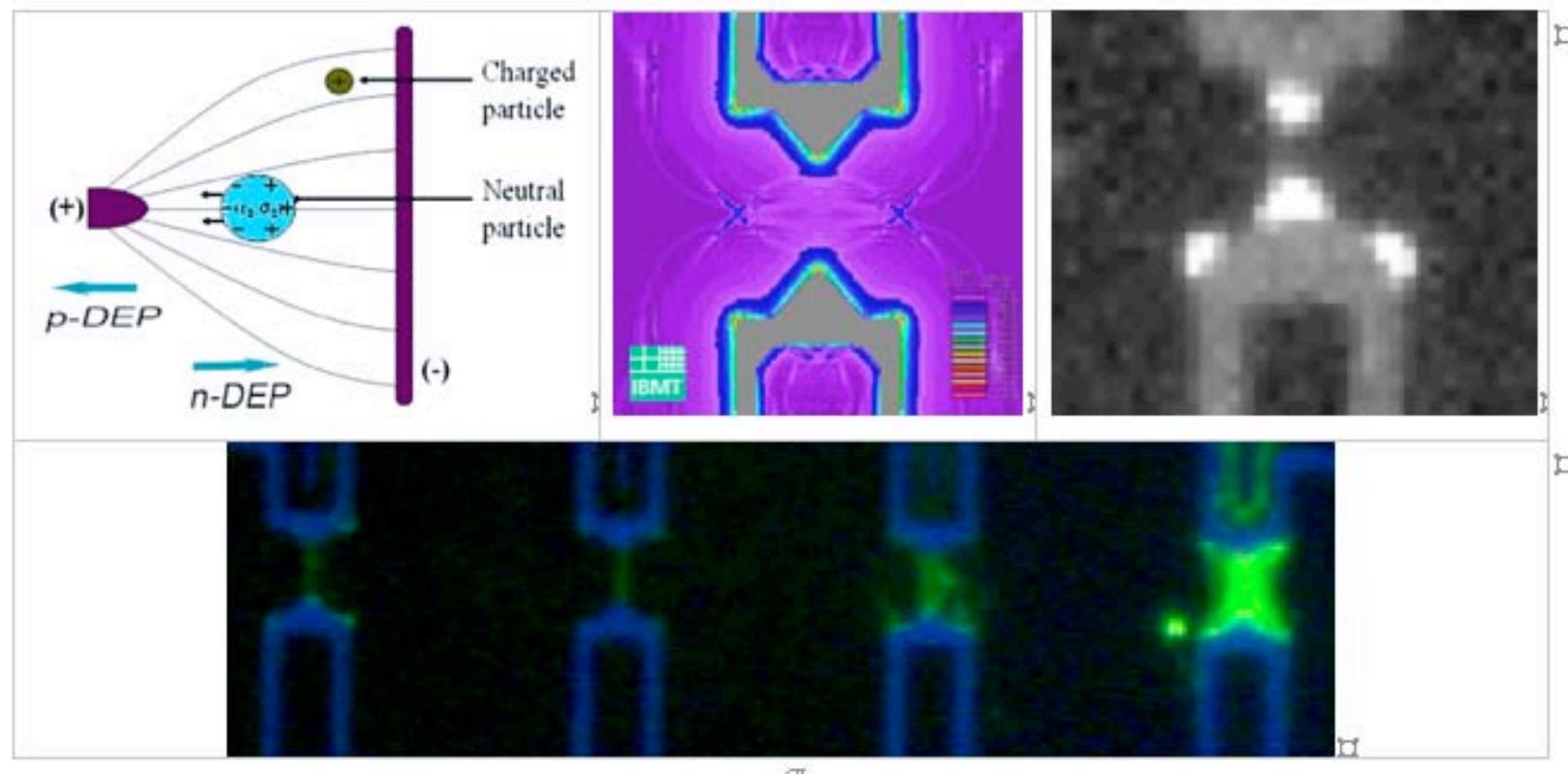
principle of receding meniscus



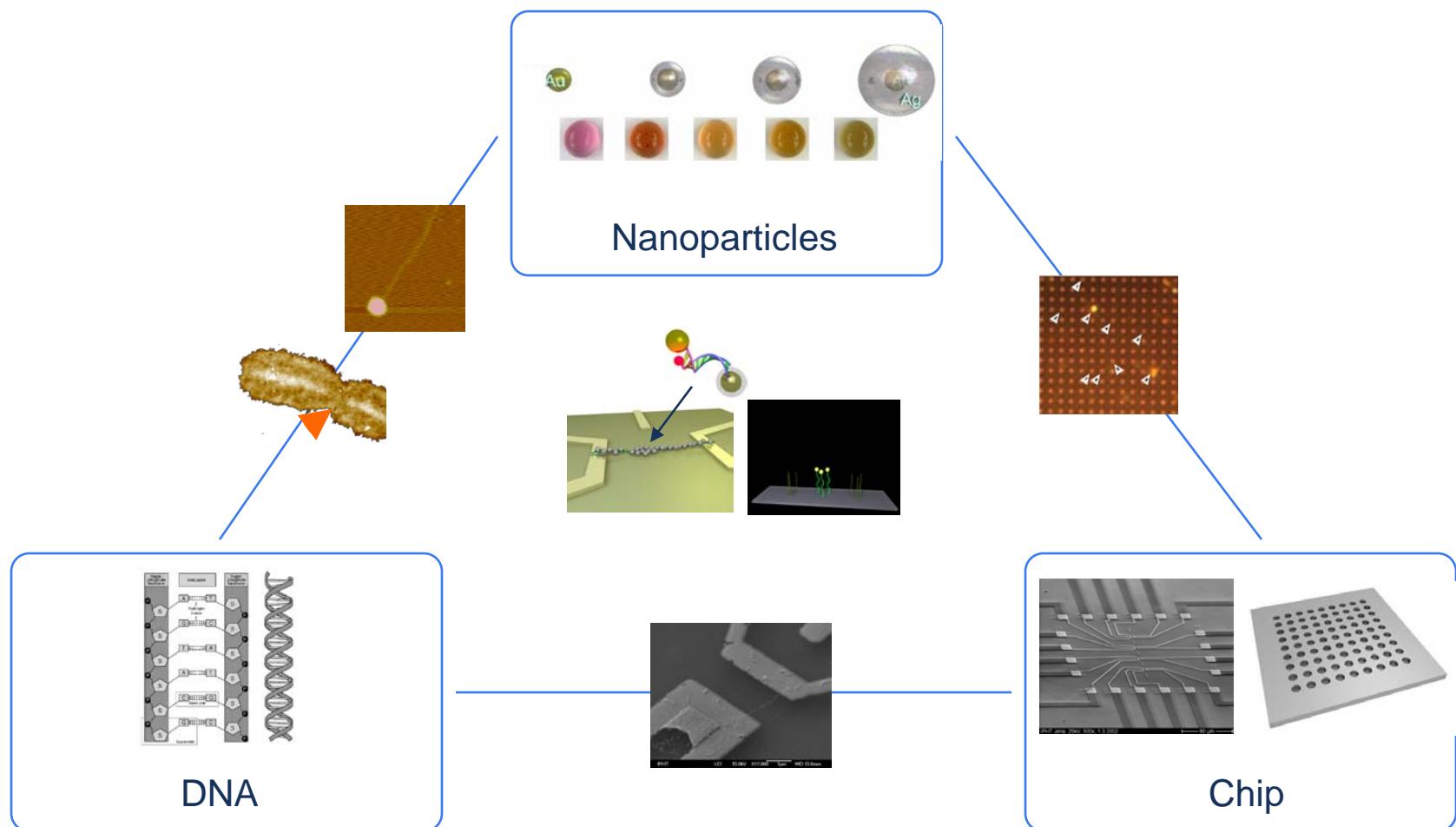
Single DNA-Particle-Hybrid-Structures







Conclusion and Outlook



**Combination of Top-Down with Bottom-Up by Nanobiotechnology
allows a parallel preparation of integrated nanoscale functional elements
based on DNA/Nanoparticles/Chips
for applications in bioanalytics & nanophotonics**

Acknowledgements

A. Csaki

R. Möller

A. Steinbrück

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H. Porwol

J. Popp

M. Köhler (TUI)

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J. Hainfeld (Nanoprobes Inc)

T. Munder (HKI)



WO 00/39325, WO 01/18242
DE 101 20 349 A1, DE 103 30 717.6

DNA-Plasmonics

JenLab GmbH:

F. Garwe, K. König

M. Raschke (MBI)

A. Weise (FSU/Humangenetik)



PCT/EP 01/14591

DNA-Nanotechnology

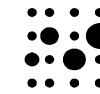
G. Maubach

FLI (former IMB):

K. Böhm, E. Unger

FSU/Physik:

W.Krech, D.Born,
T.Wagner



Volkswagen Stiftung



SIXTH FRAMEWORK
PROGRAMME

DE 198 52 543 A1
DE 100 36 072

