

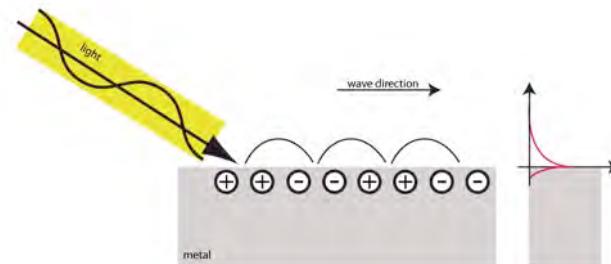


Noble metal nanoparticles as window into the nanoworld

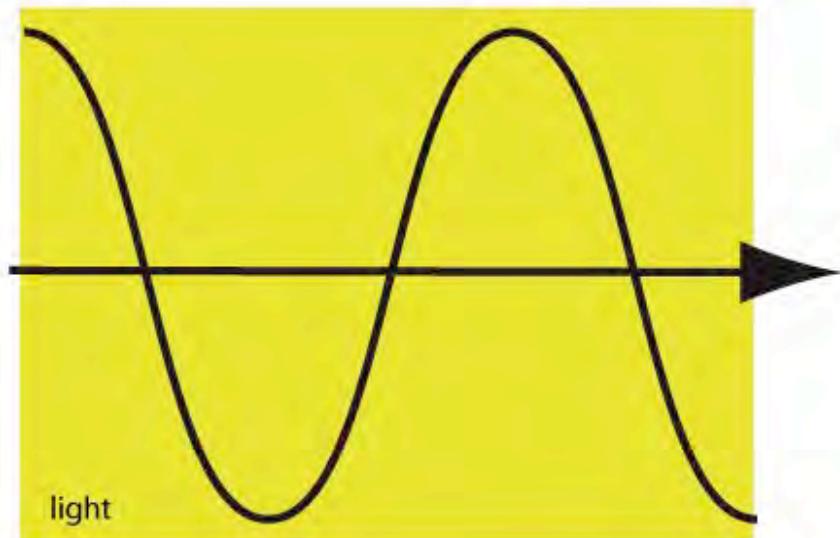
A. Csaki, Th. Schneider, J. Wirth, F. Garwe, O. Stranik,
W. Fritzsche

Institute of Photonic Technology (IPHT) Jena, Germany





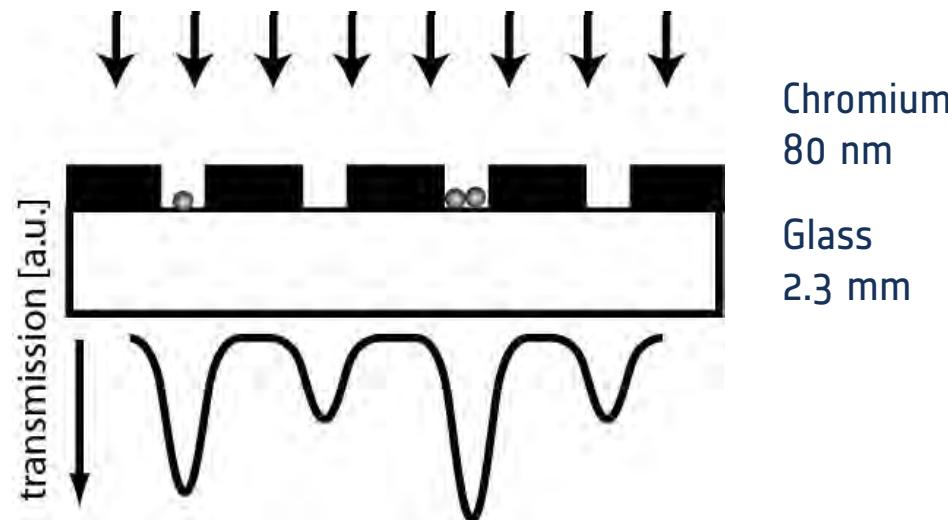
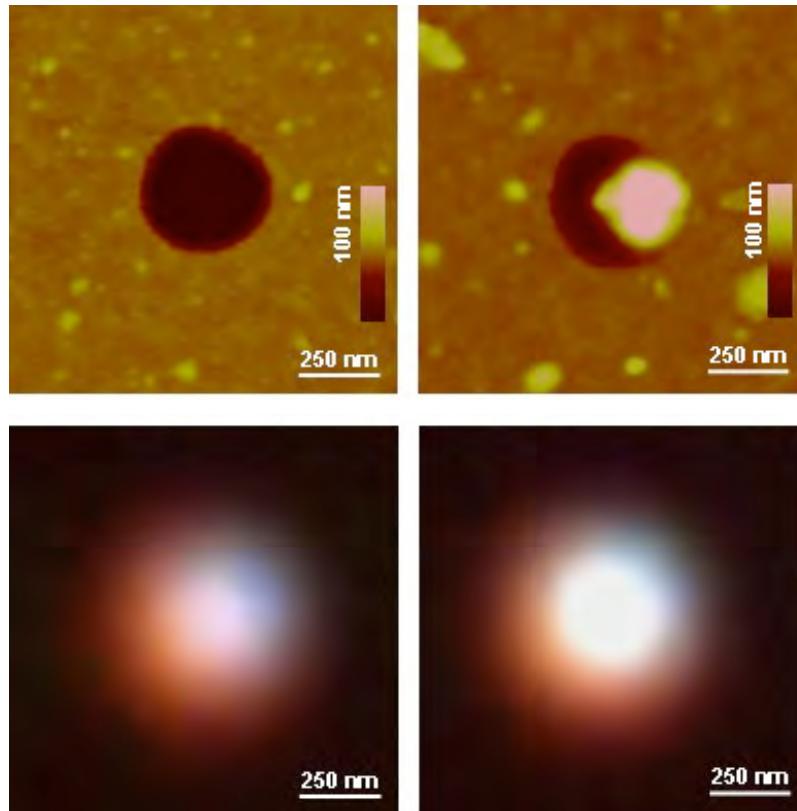
Propagating Surface Plasmons
(resonance – SPR, e.g. Biacore)

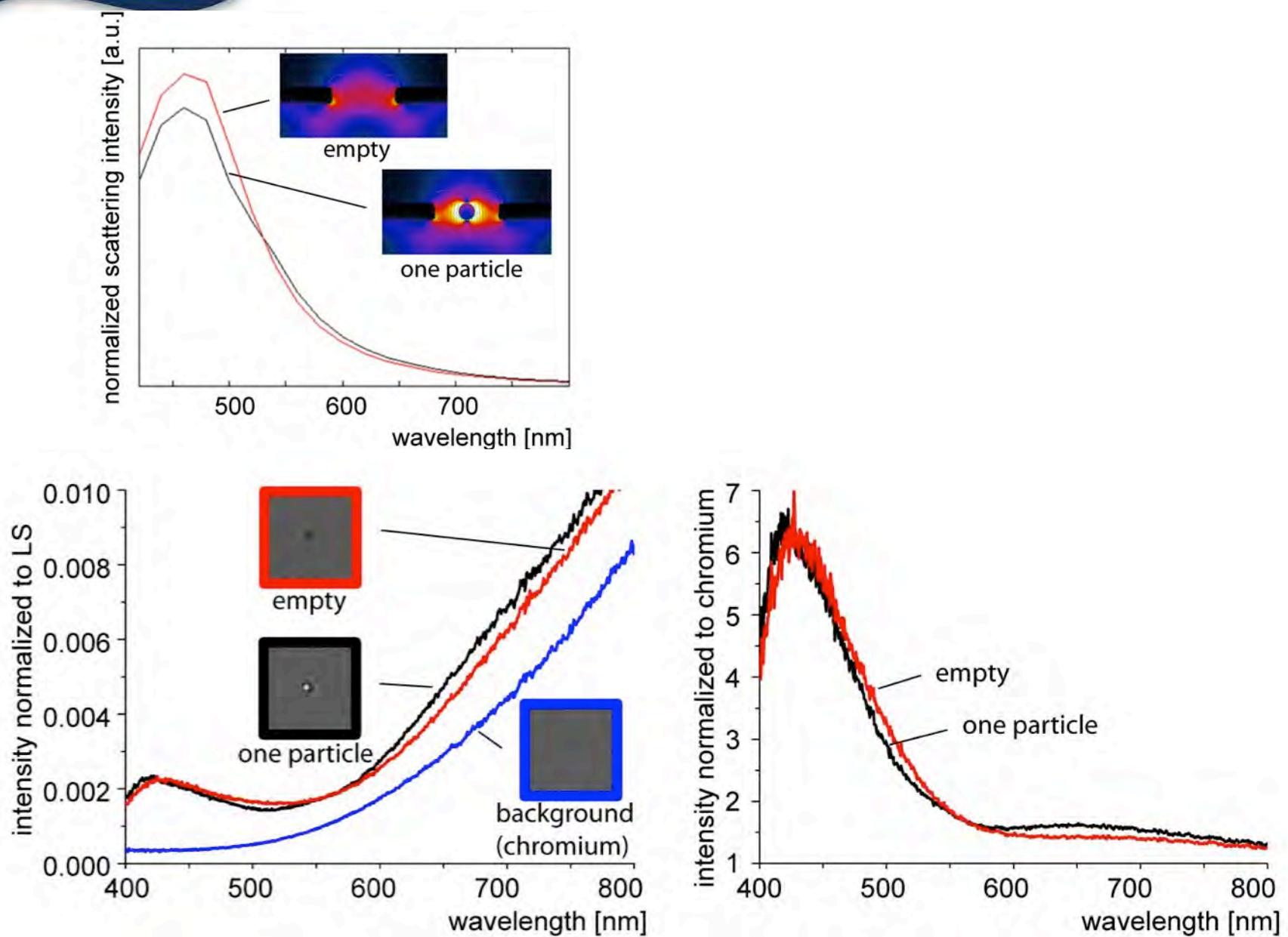


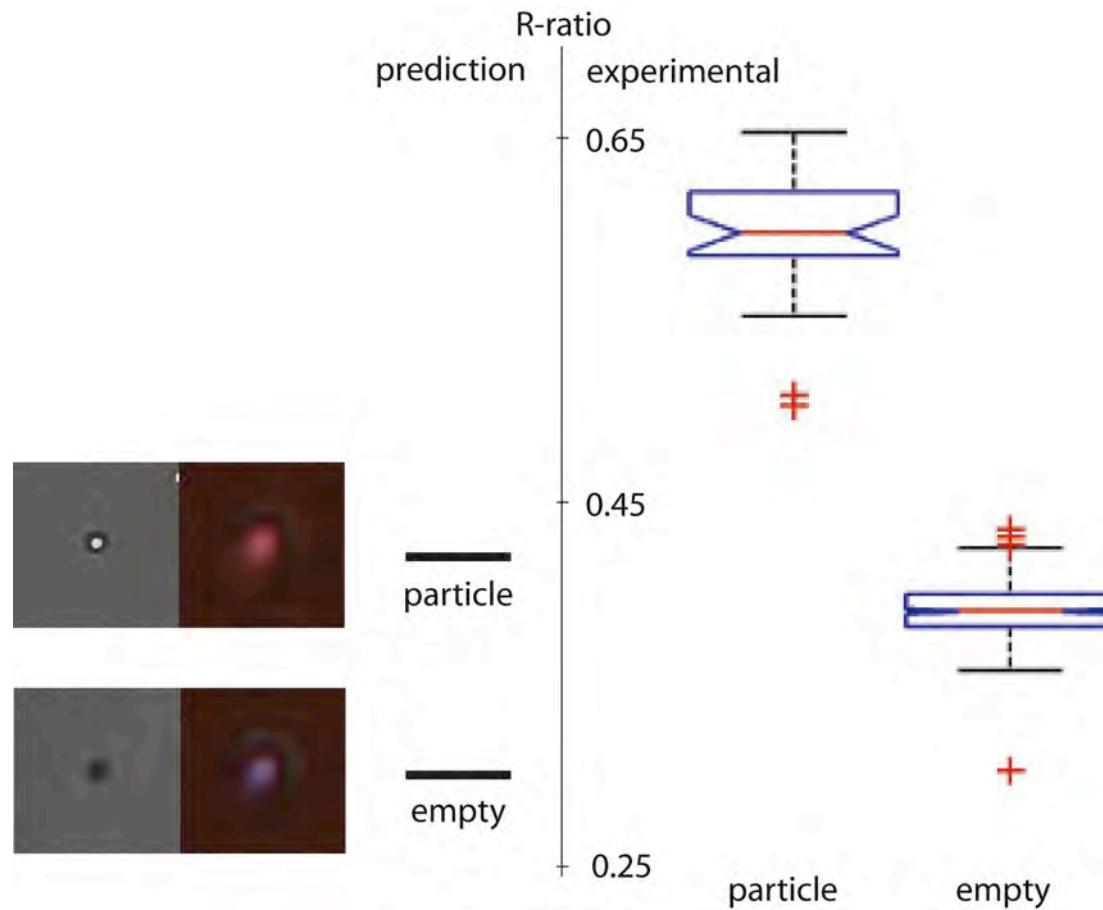
Localized Surface Plasmons (LSPR)

1. Optical detection of single nanoparticles
2. Single particle biosensors
3. Nanoparticles as nanoantennas

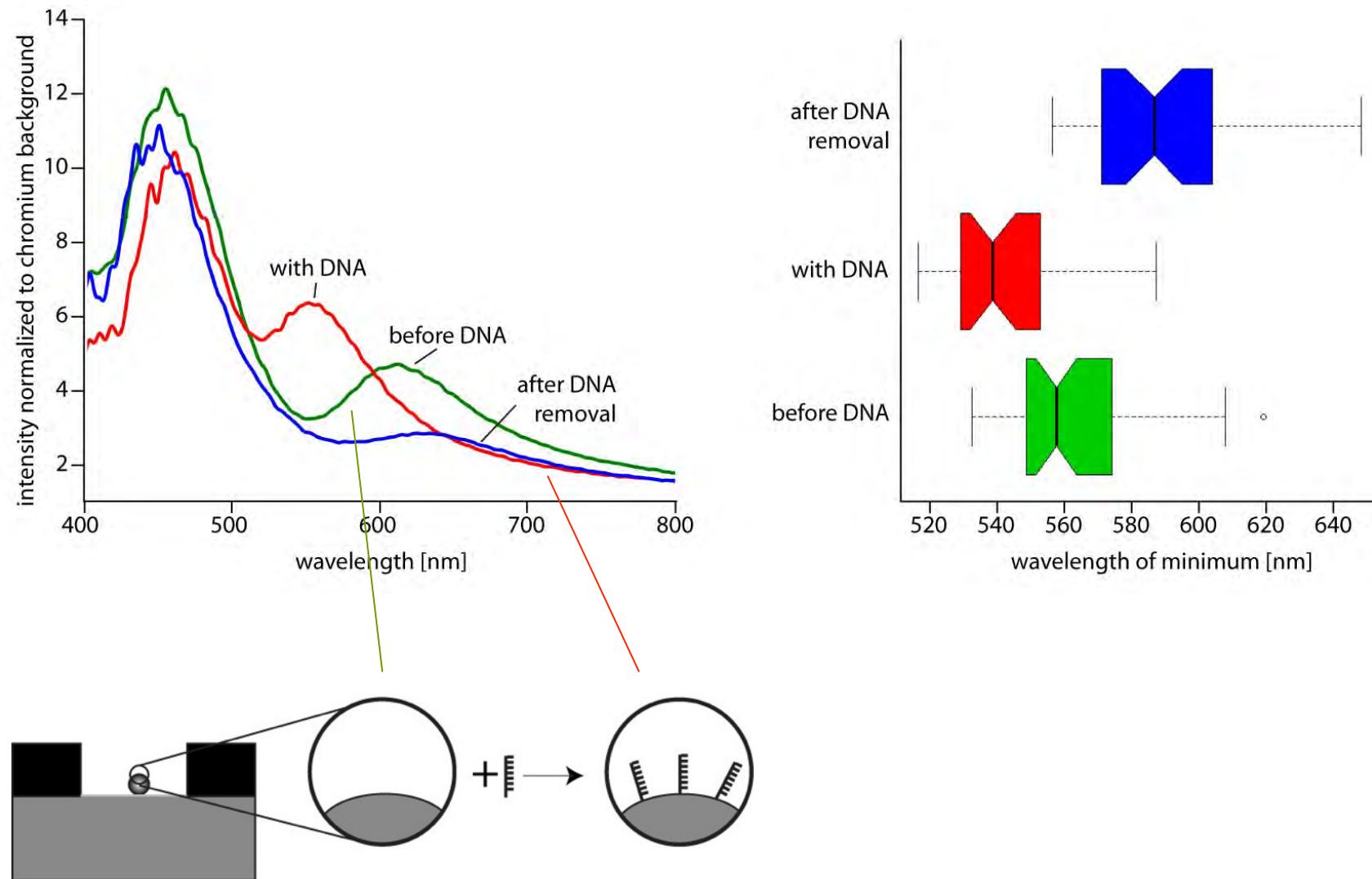
Array for optical single-particle detection

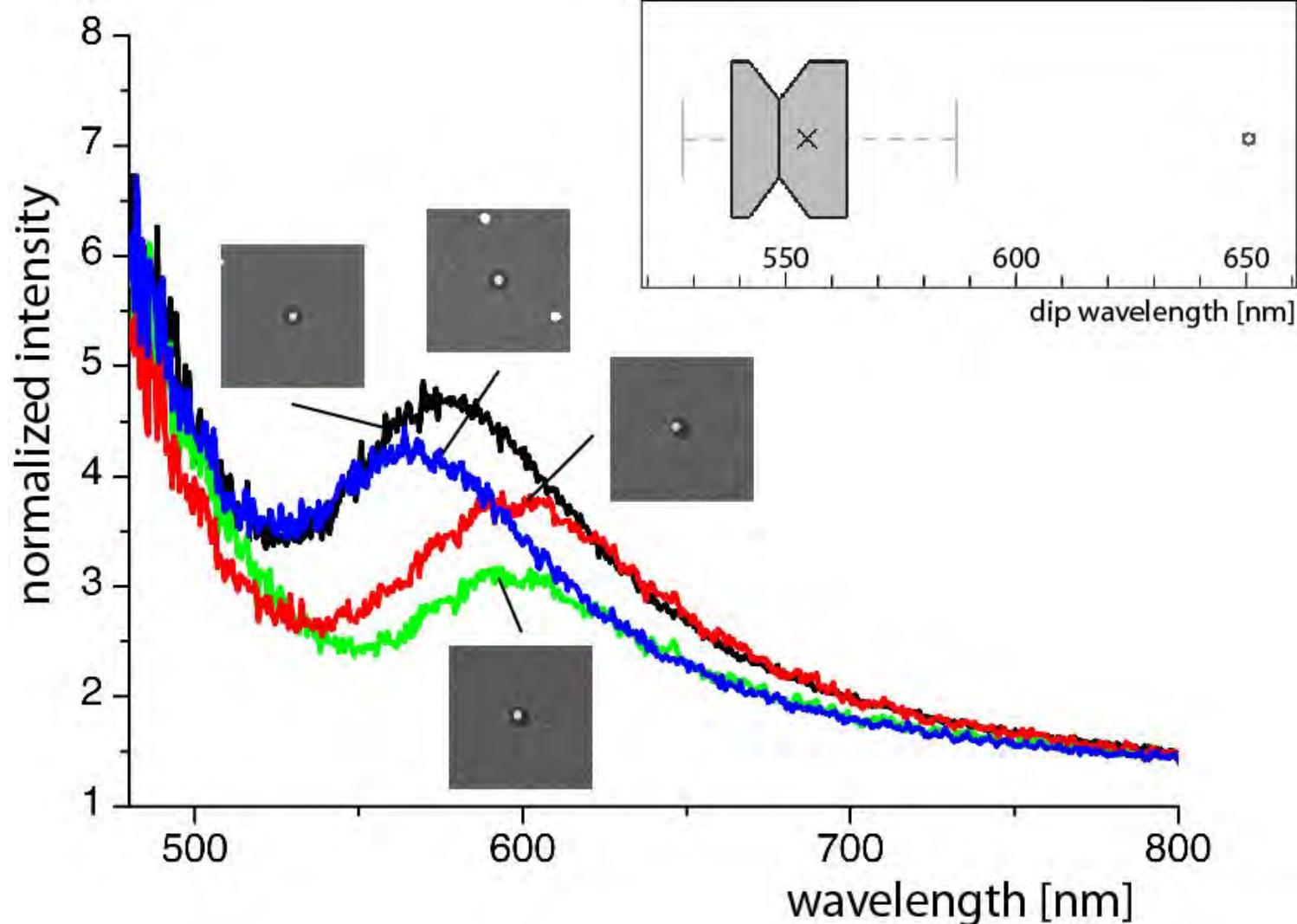


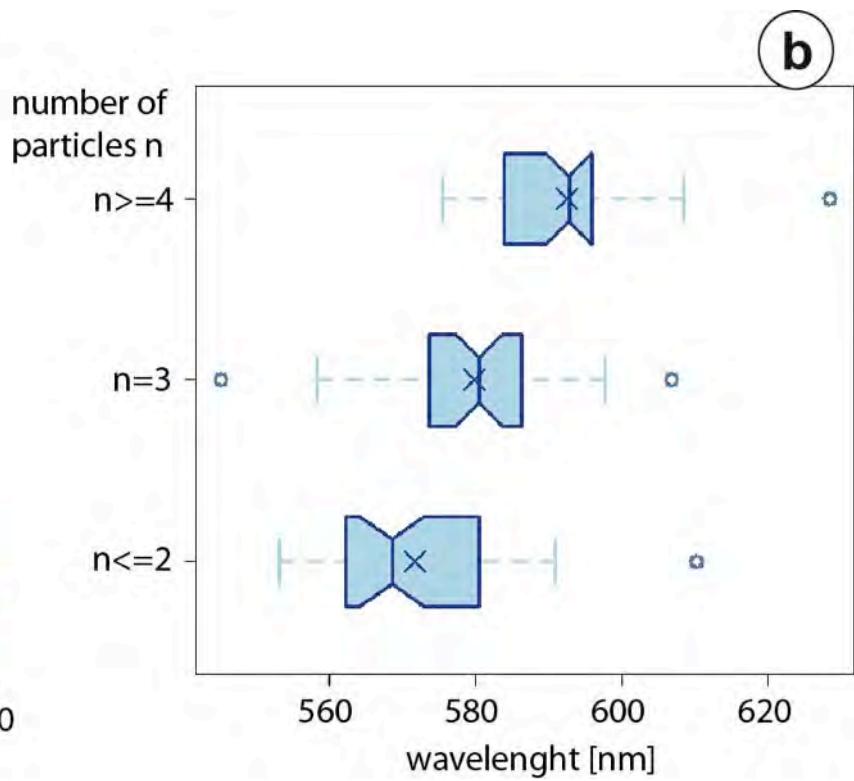
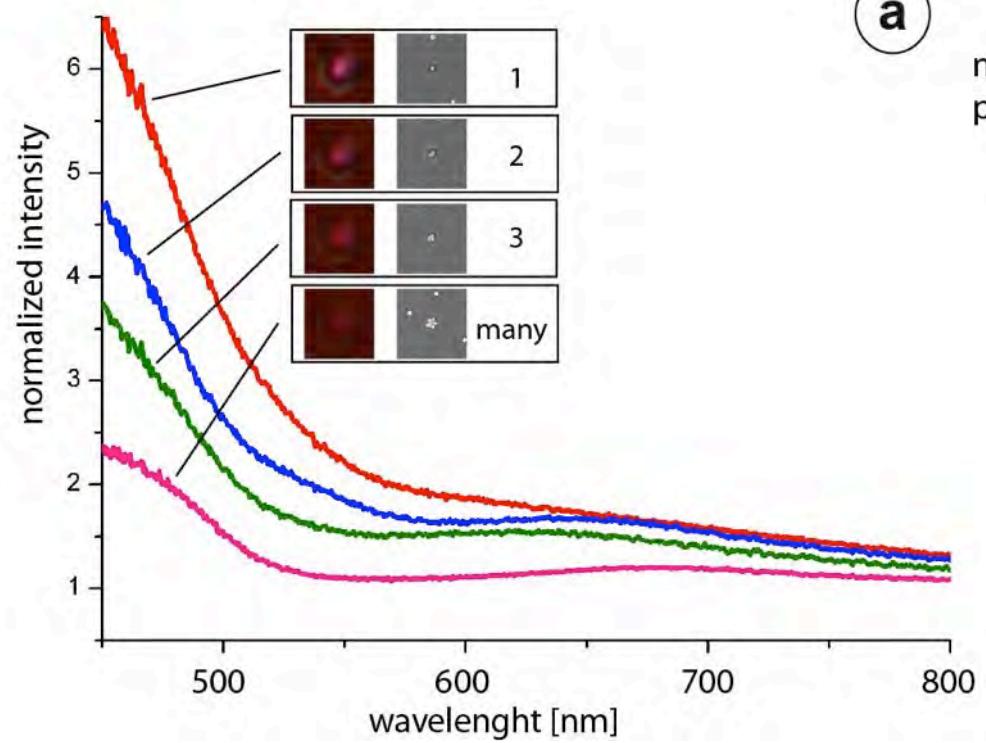




$$R - \text{ratio} = \frac{R}{R + G + B}$$





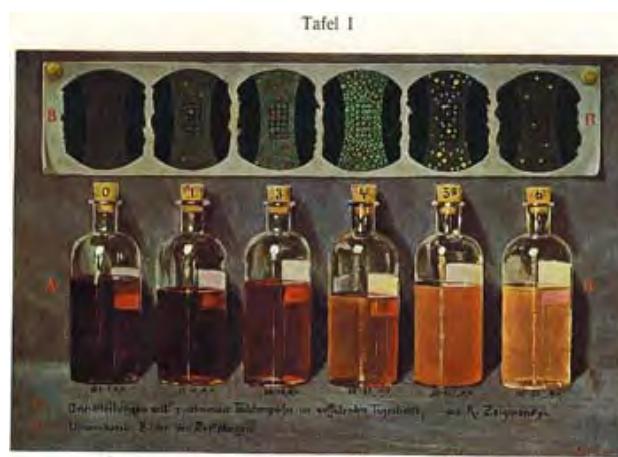


1. Optical detection of single nanoparticles
2. Single particle biosensors
3. Nanoparticles as nanoantennas

Ultramicroscope



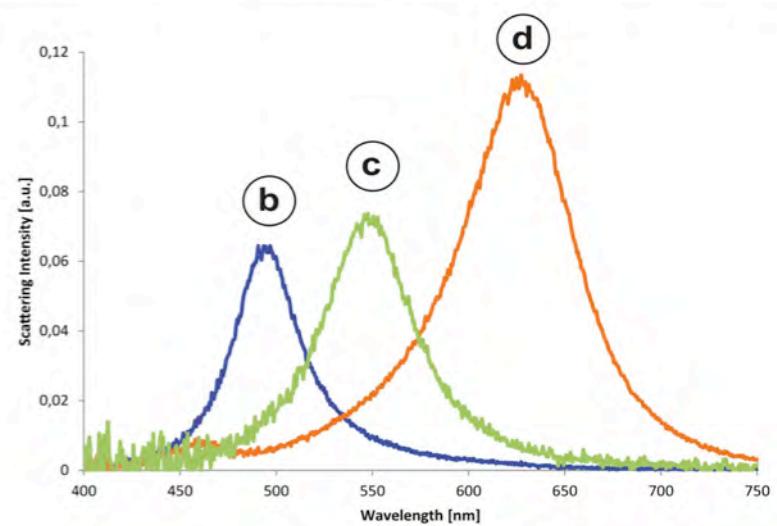
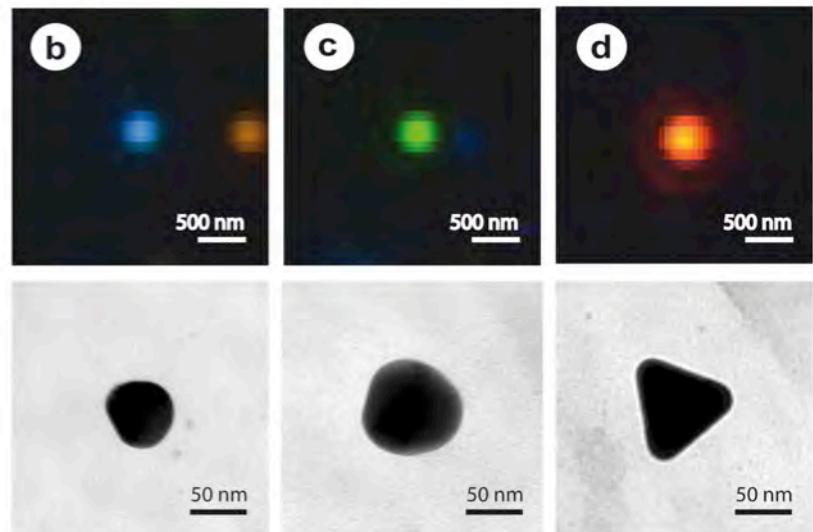
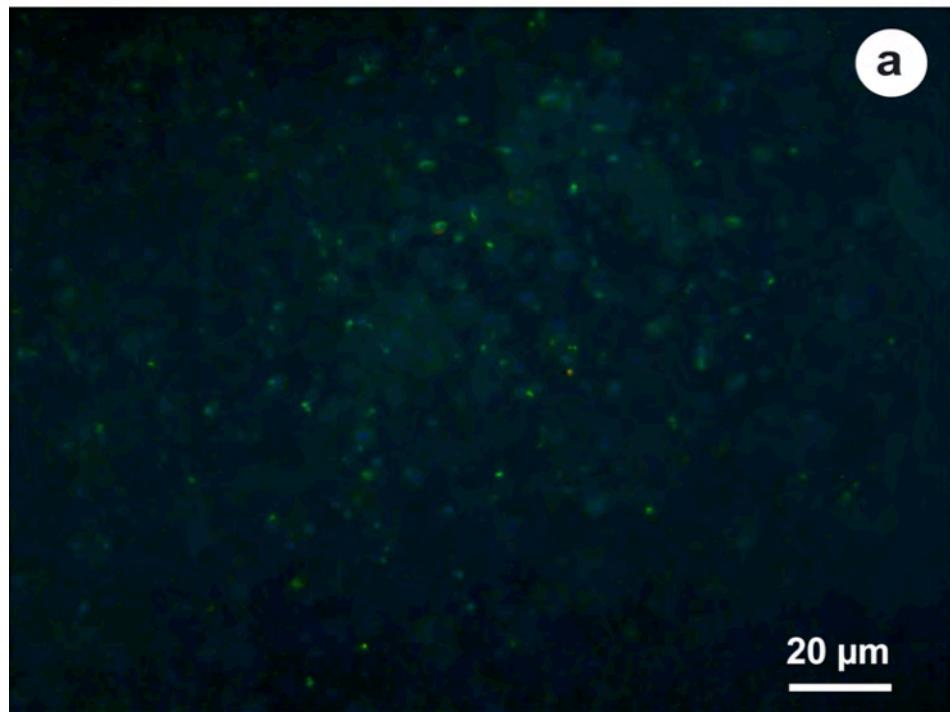
Richard Zsigmondy 1865-1929 Henry Siedentopf 1872-1940



Goldzerstreuungen mit zunehmender Teilchengröße von R. Zsigmondy.
A, Aussicht im auffallenden Tageslicht.
B, Ultramikroskopische Bilder der Zerstreuungen.



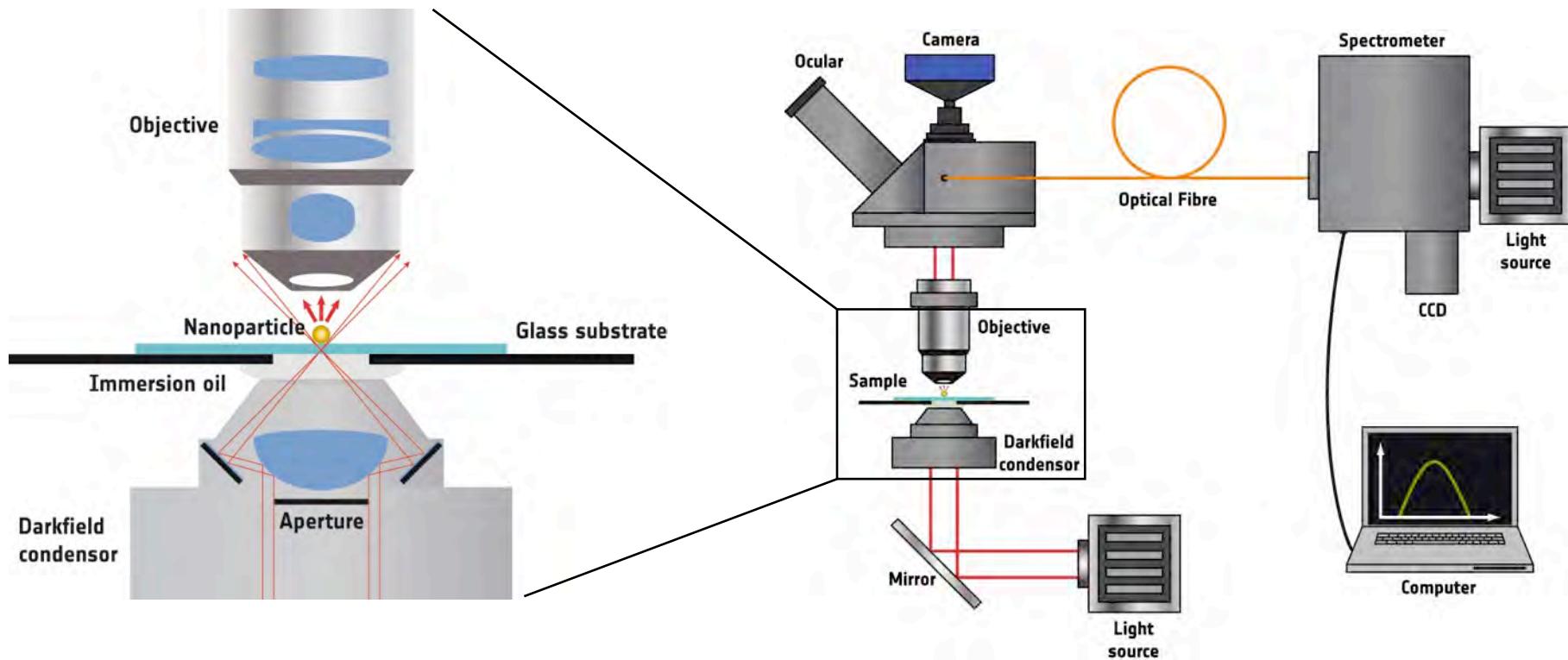
Imaging with historical Ultramicroscope

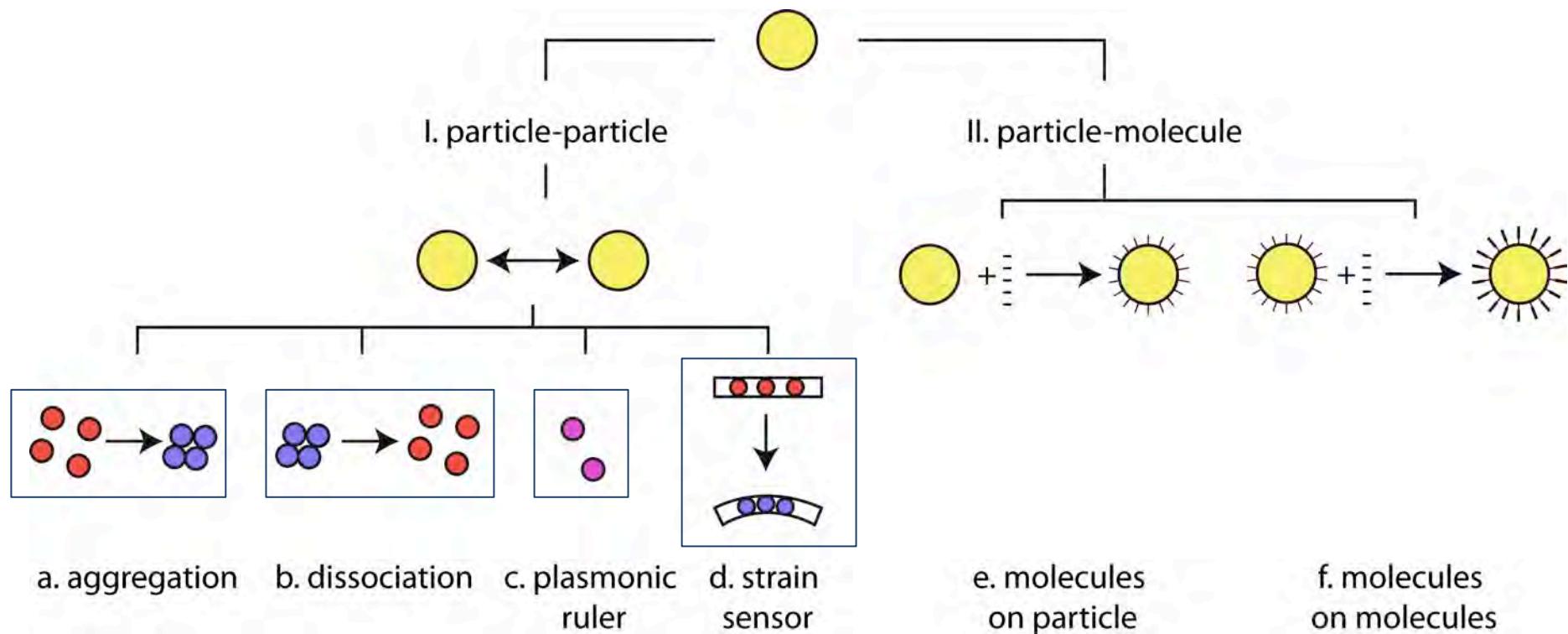


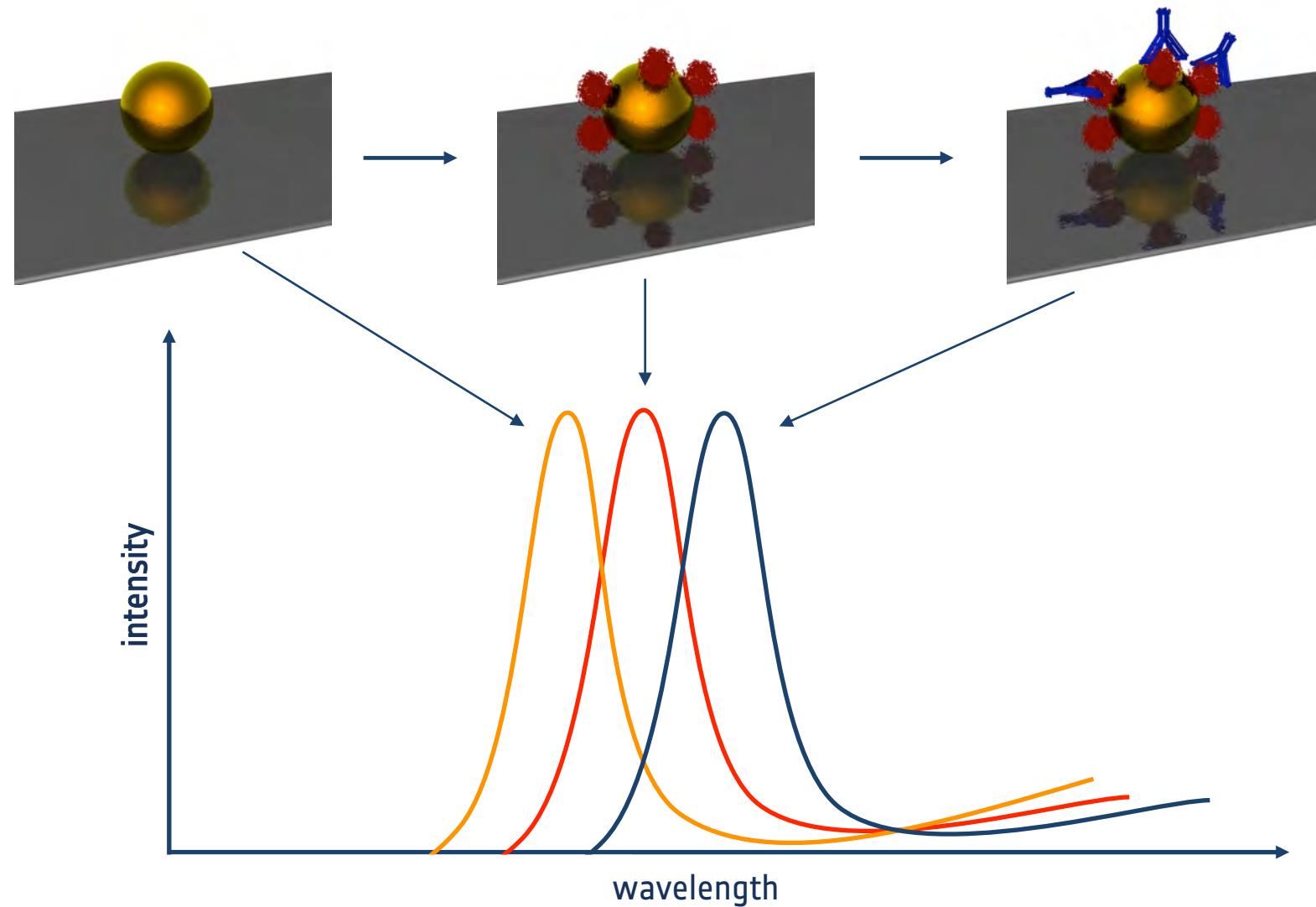


Yguerabide/Yguerabide 1998 Anal Biochem

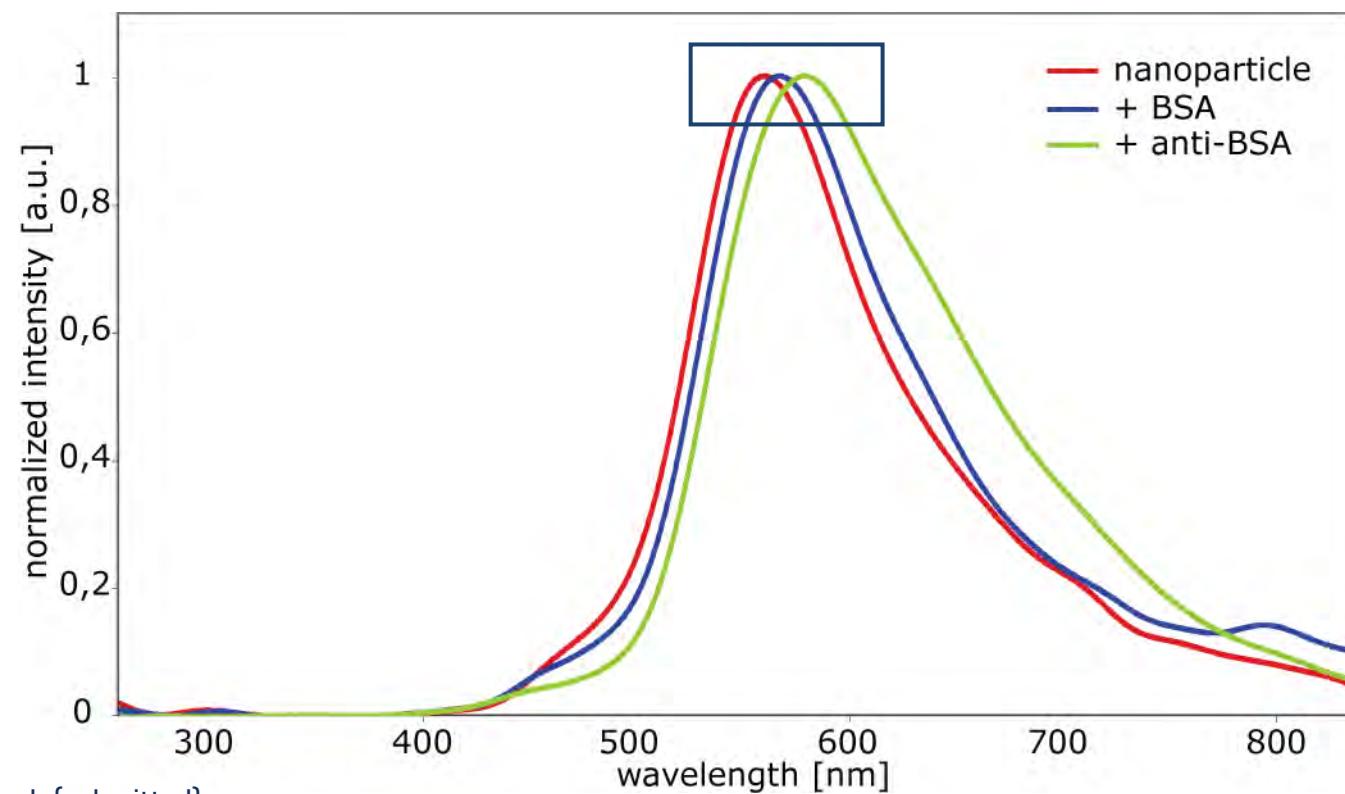
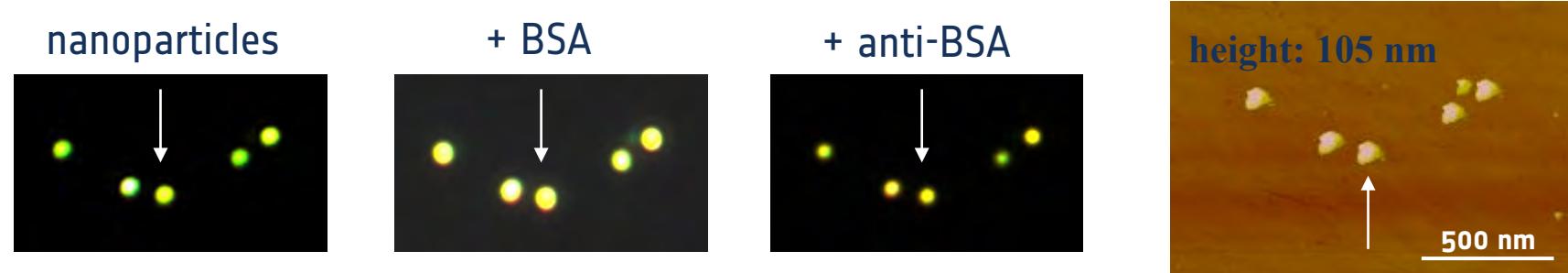
Single particle spectroscopy



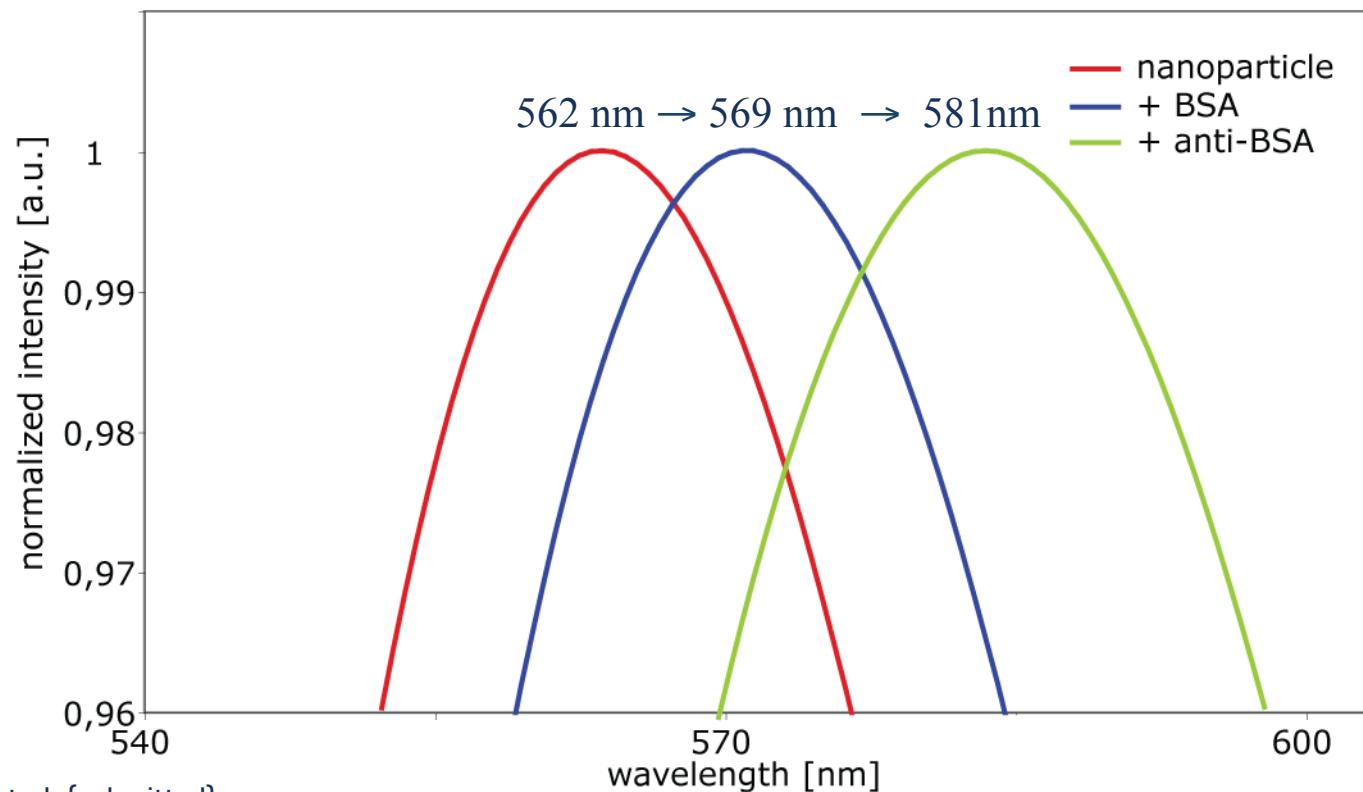
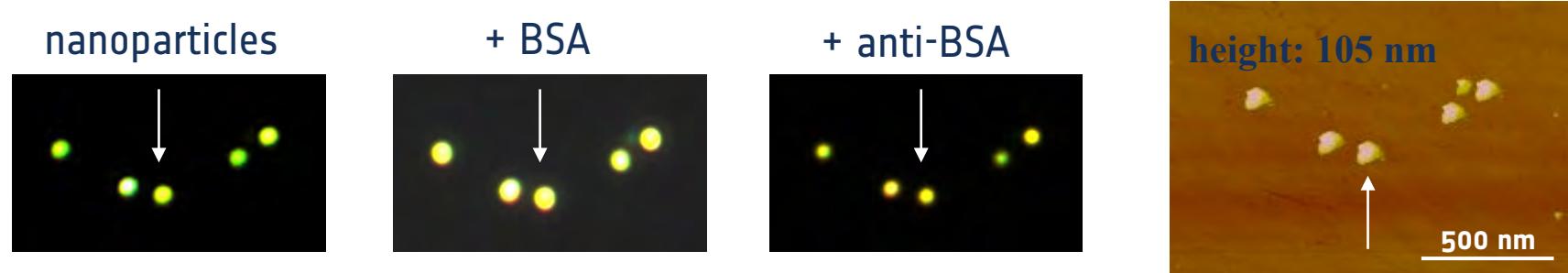


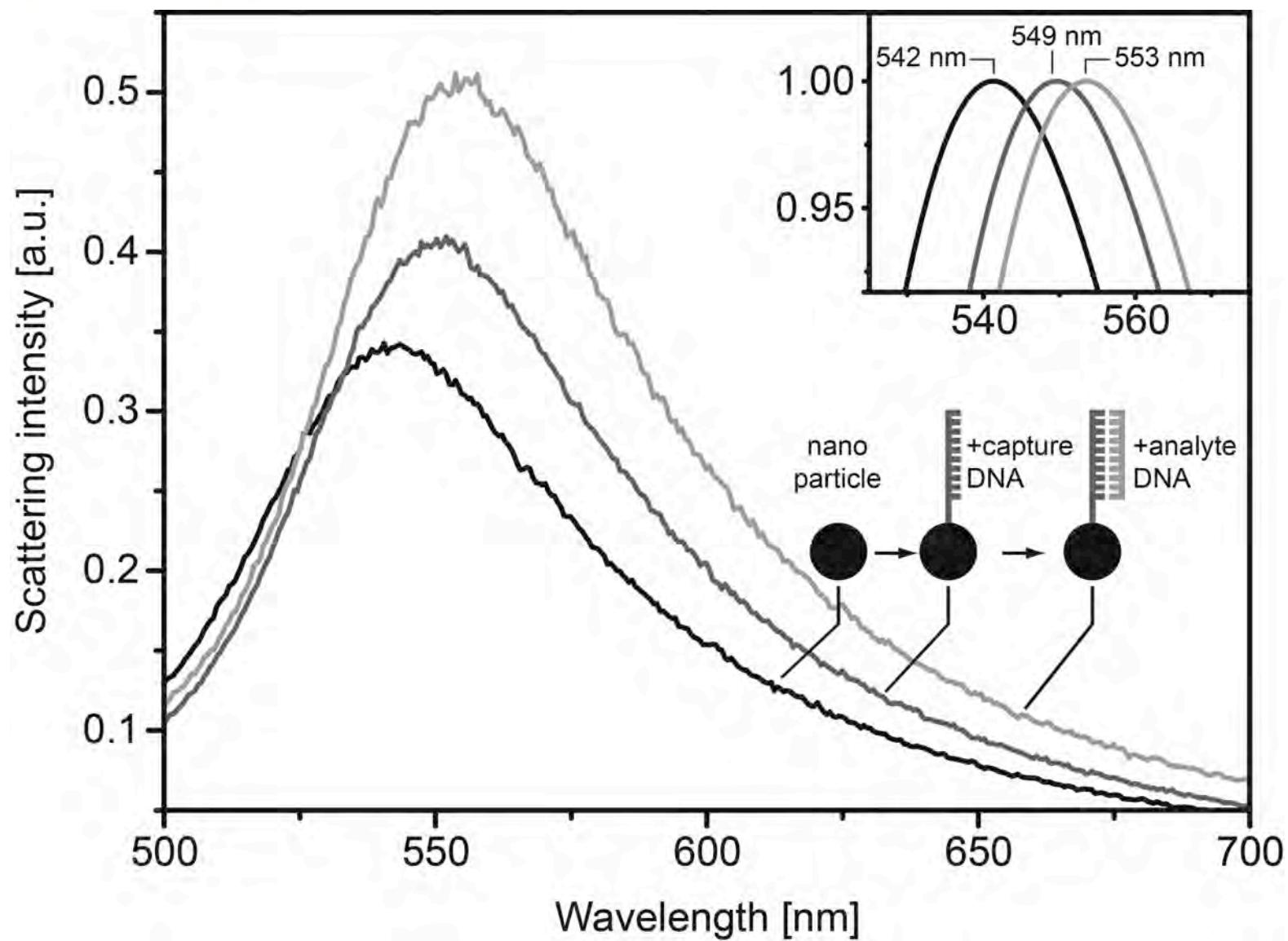


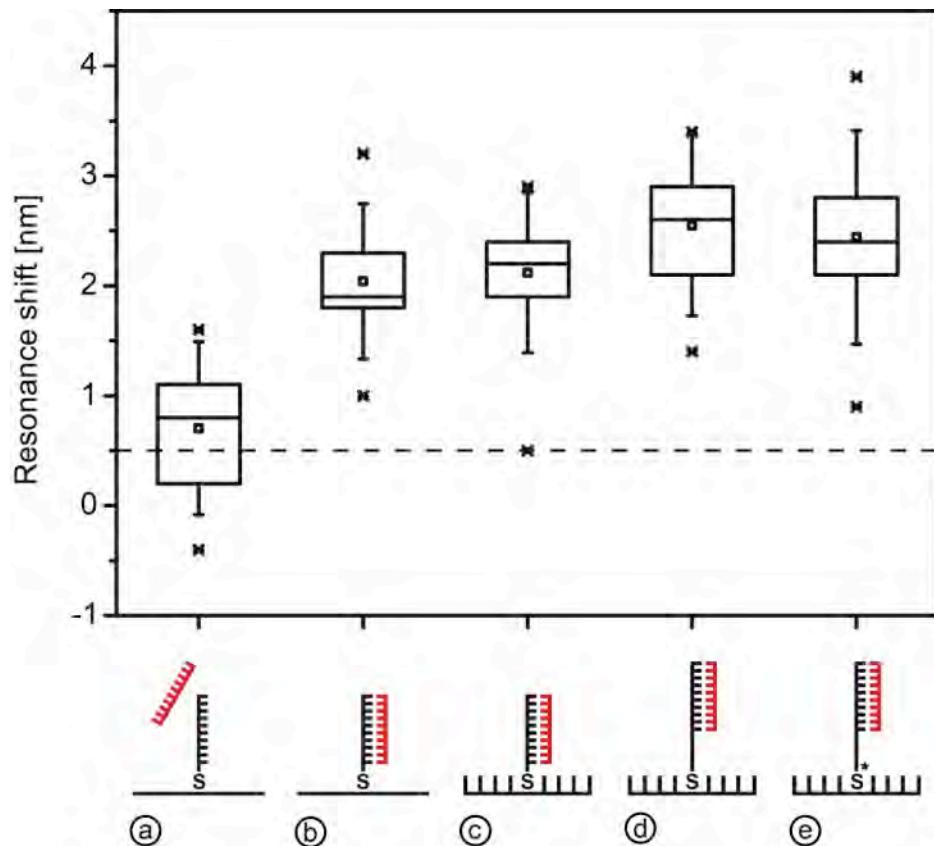
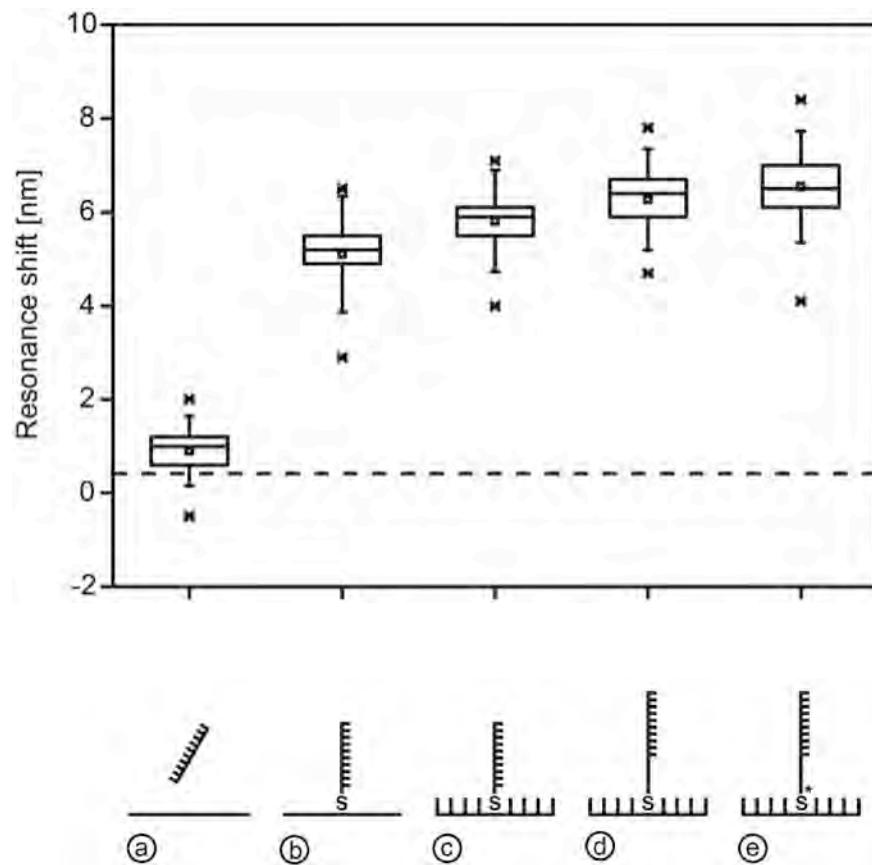
Single-particle measurements: Proteins

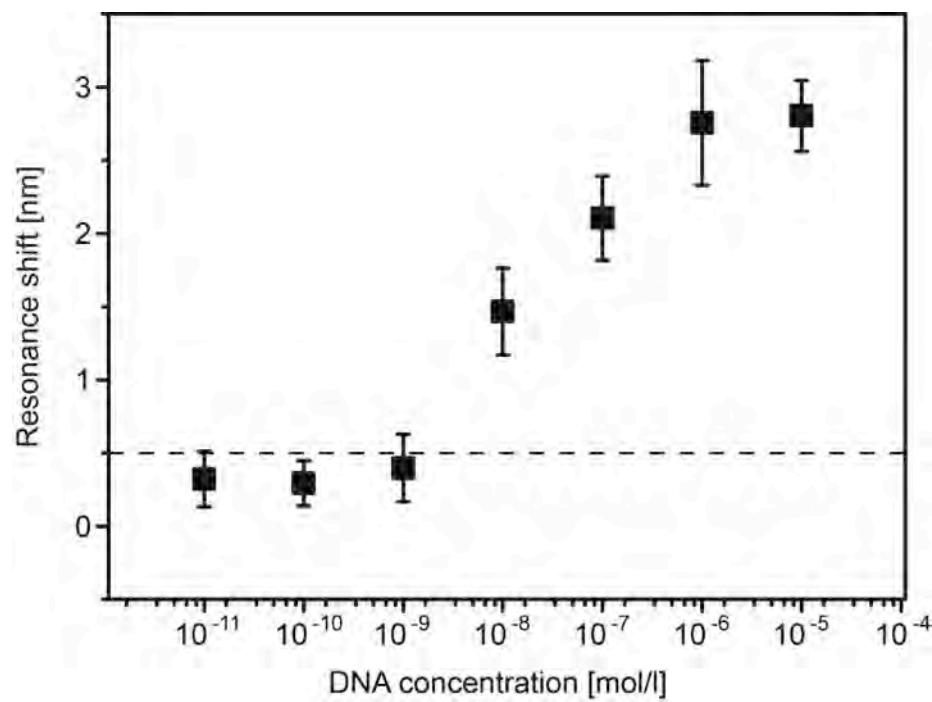


Single-particle measurements: Proteins

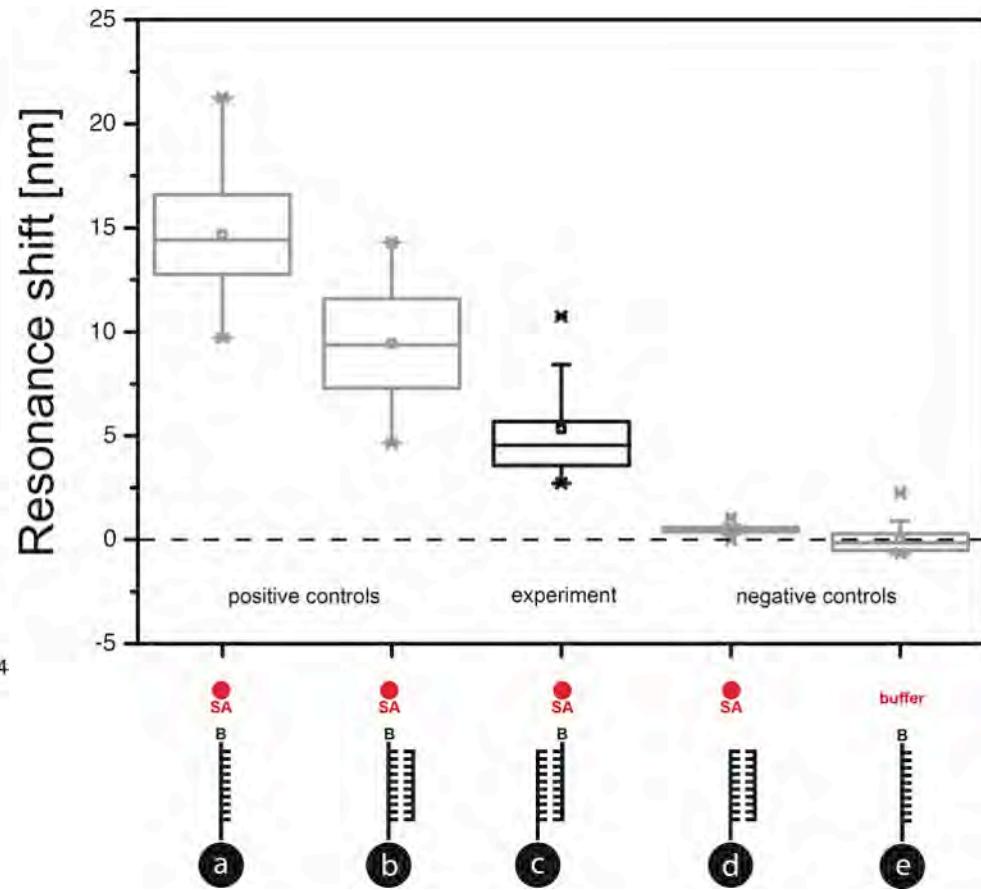




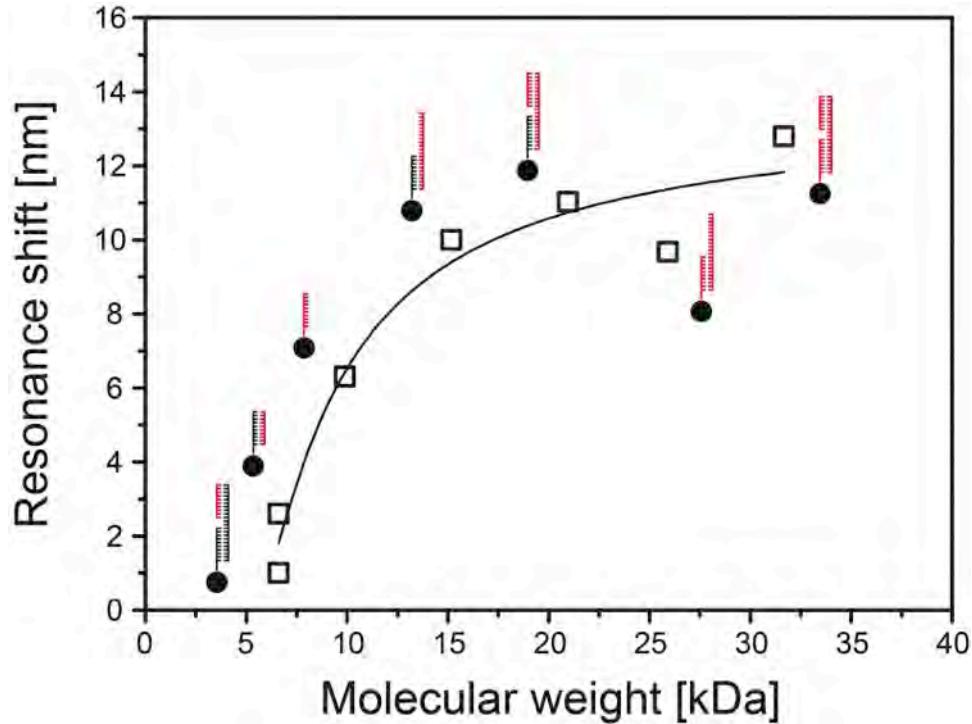
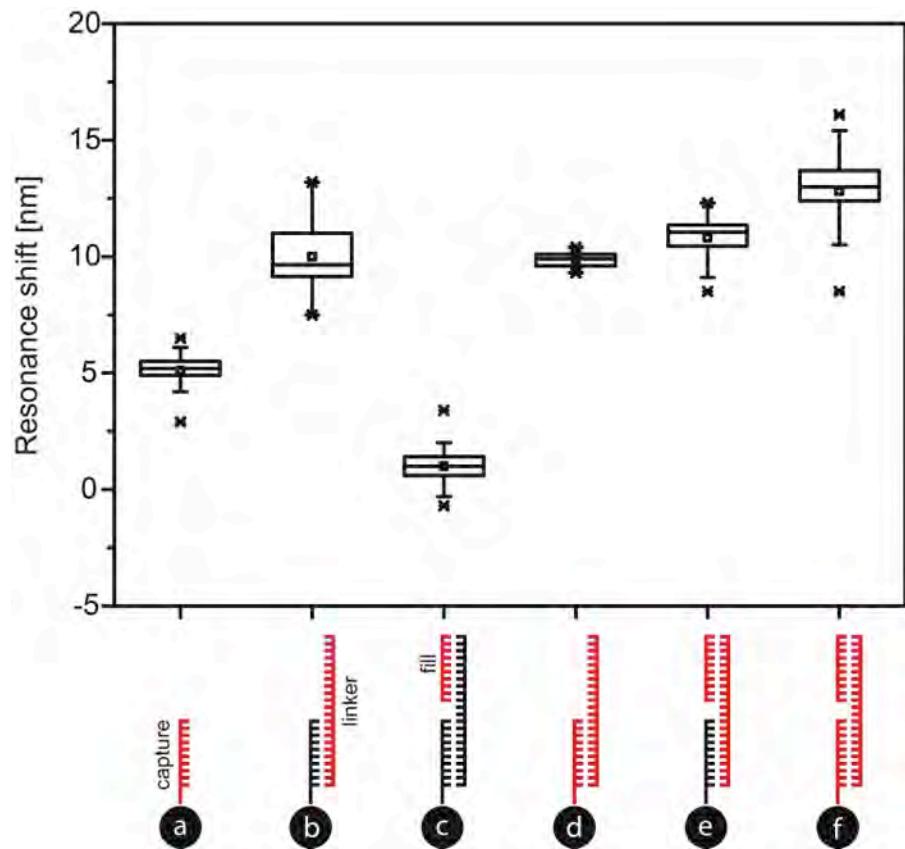




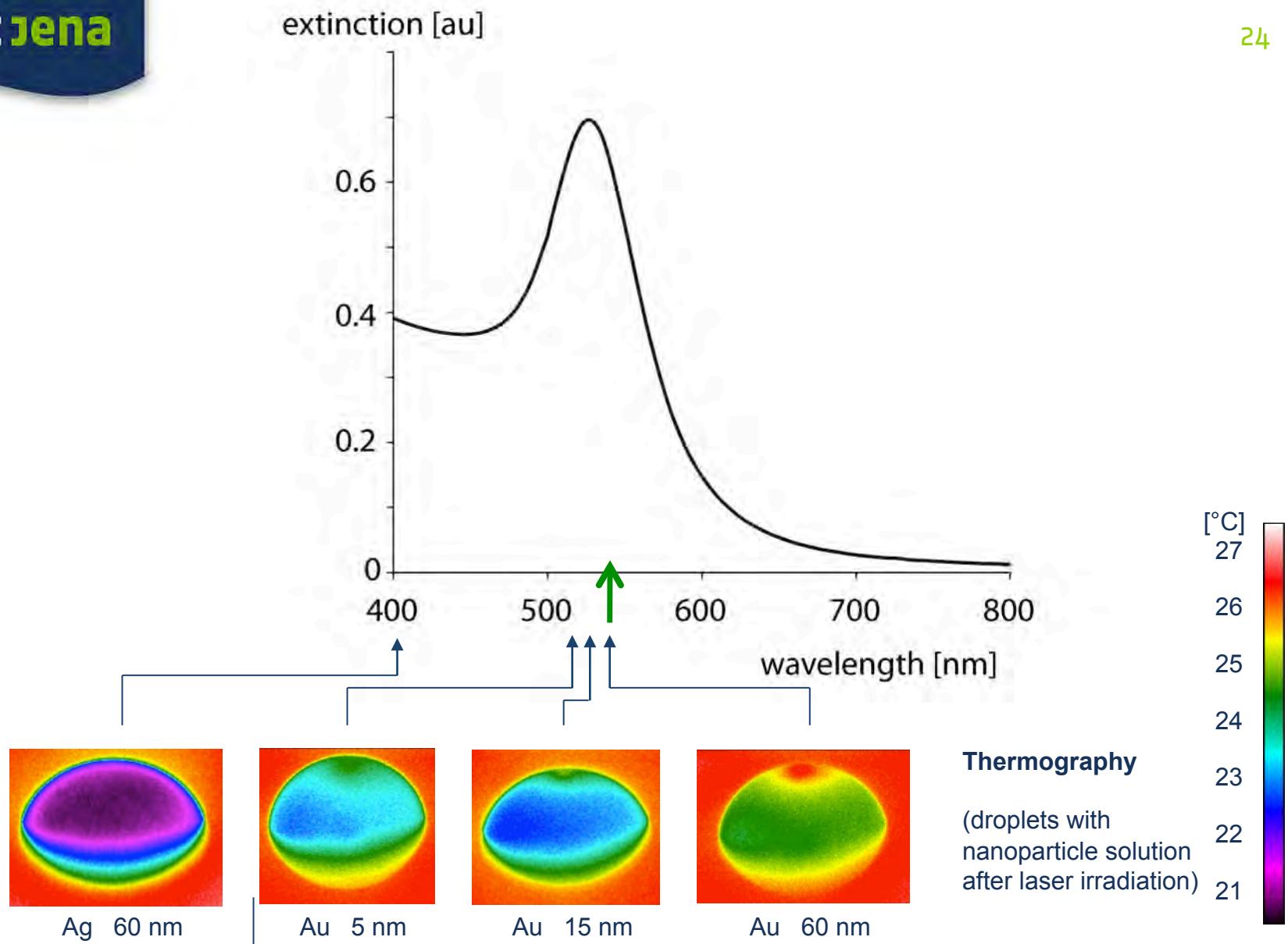
Concentration dependency

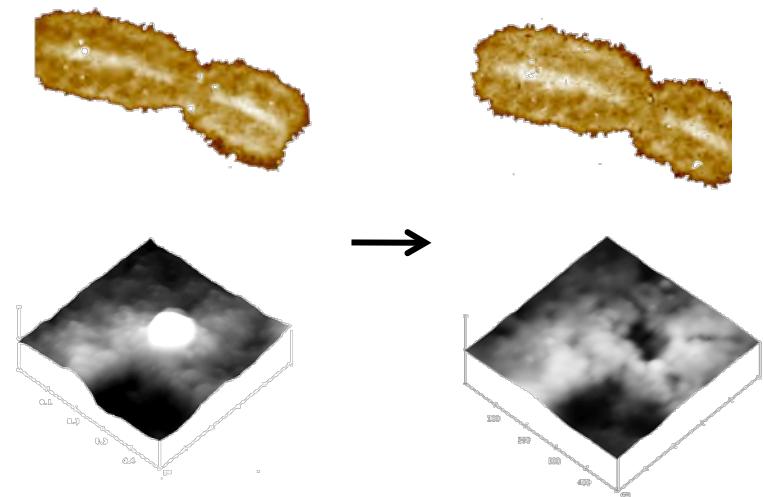


Additional label (20 nm gold particle)

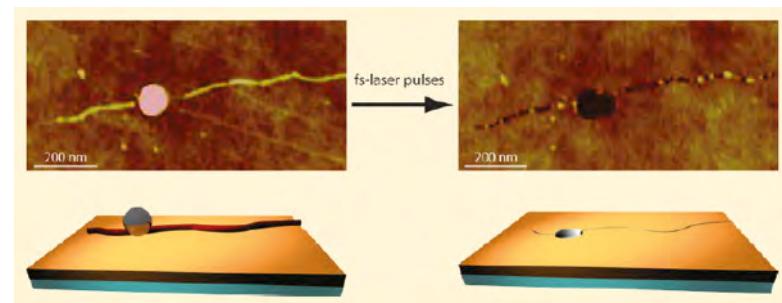


1. Optical detection of single nanoparticles
2. Single particle biosensors
3. Nanoparticles as nanoantennas





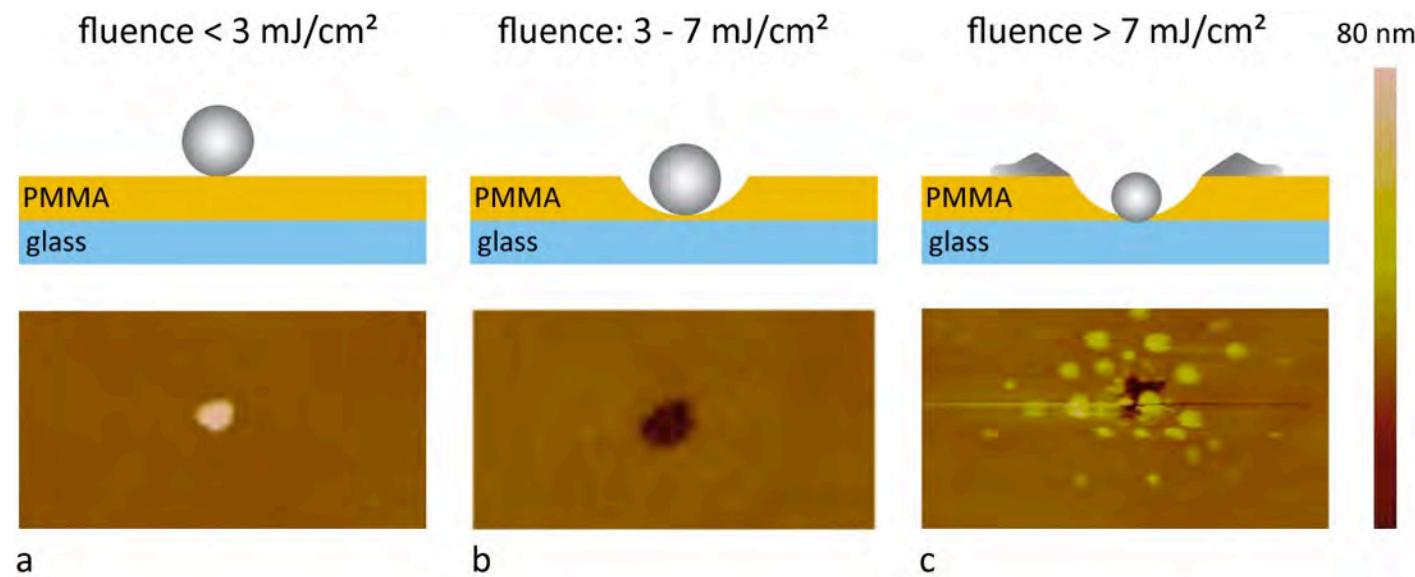
metaphase chromosomes



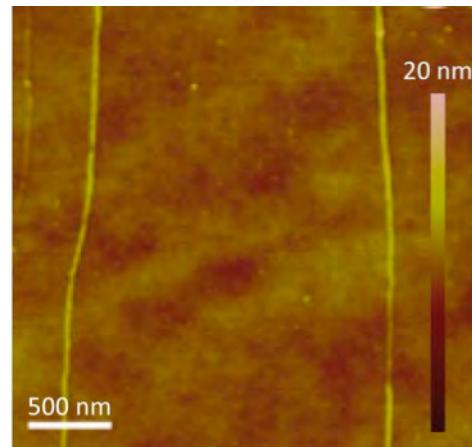
DNA

•Csaki, A. König, K. et al. (2007): Nano Lett. 7(2) 247-253
•Garwe, F., et al. Nanotechnology (2008): (5), 055207

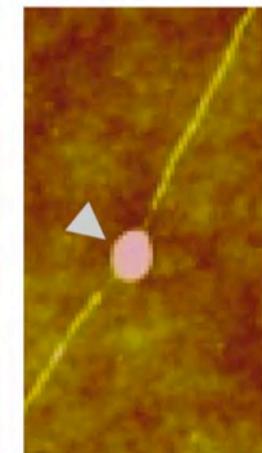
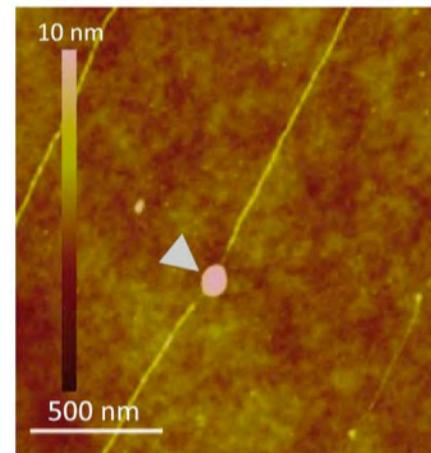
Wirth J, et al. (2011) Nano Lett. 11 (4)1505-1511



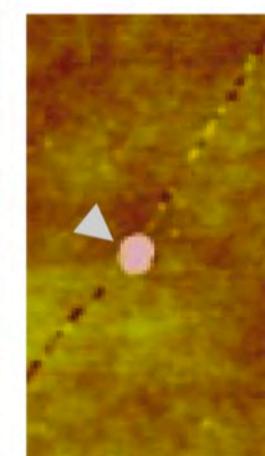
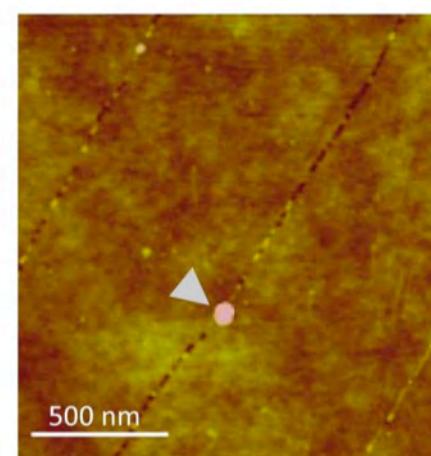
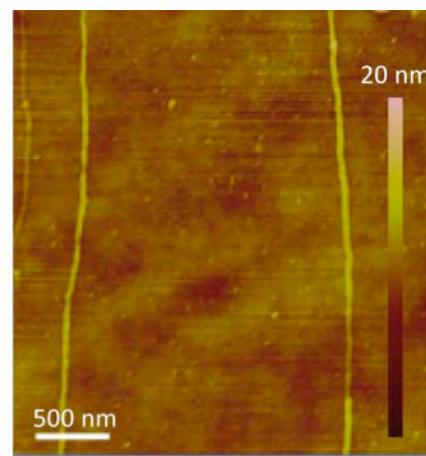
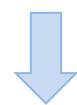
Lambda-DNA



Ag-nanoparticles on Lambda-DNA



fs - laser pulses
[100 fs @ 800 nm]



Acknowledgements

F. Jahn

former members:

A. Steinbrück

A. Wolff

T. Schüler

G. Festag

S.Julich

A. Nykkytenko

IPHT:

F. Garwe

G. Brönstrup

J. Popp

S. Christiansen

V. Deckert

R. Kretschmer

M. Urban

M. Sossna

K. Schuster

A. Schwuchow

S. Schröter

R. Pöhlmann

External collaborations:

M. Köhler (TU Ilmenau)

J. Toppari (Jyväskylä)

M. Heller (UCSD)

J. Krenn (Graz)

T. Mappes (KIT)

A. Breitenstein (ScanBec/BioSolutions GmbH)

J. Hainfeld (Nanoprobes Inc.)

T. Asmus (Heraeus Sensor Technology GmbH)

