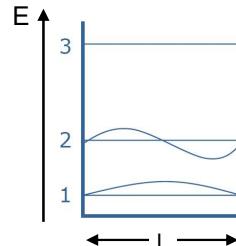




## Energy states of a quantum well

Illustration: energy states of electrons in a quantum well ("particle in a box")



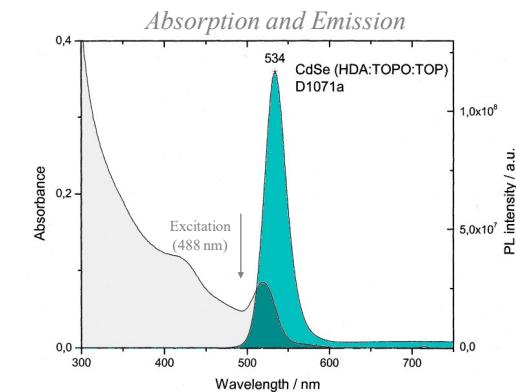
$$E_n = \frac{\hbar^2 n^2}{8mL^2} \quad n = 1, 2, \dots$$

$$E_2 - E_1 = \frac{\hbar^2}{8mL^2} (2^2 - 1^2)$$

Nano optics 19/9



## Spectroscopic properties of 5-nm-sized CdSe nanocrystals

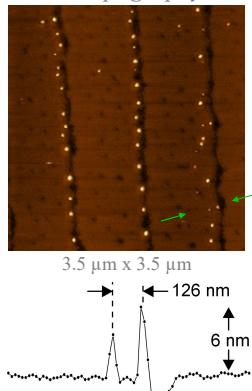


Nano optics 19/10

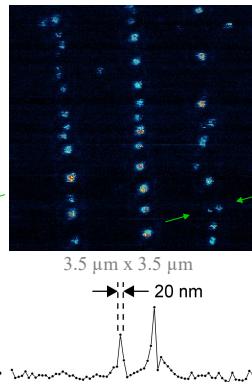


## Imaging of QD-Aggregates

Topography



Fluorescence



3.5 μm x 3.5 μm

126 nm

6 nm

3.5 μm x 3.5 μm

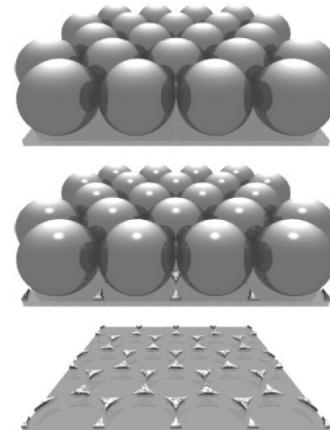
20 nm

A. Naber et al., PRL 89, 210801 (2002)

Nano optics 19/11



## Projection pattern

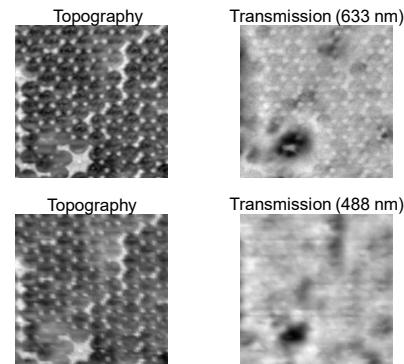


Nano optics 19/12

Fischer & Zingsheim, JVST (1981); Fischer et al., SIA (2002)



## Artifacts

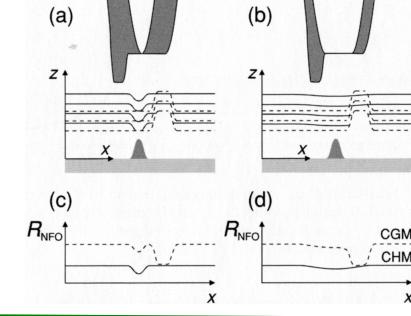
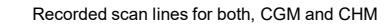
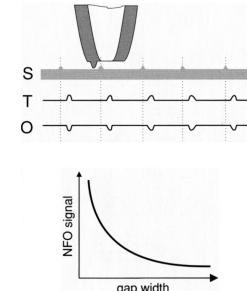


Nanooptics 19/13

## Topographic Artifacts

**Modes of operation:** constant gap mode (CGM) and constant height mode (CHM)

## CGM: Crosstalk between topographic and optical signals

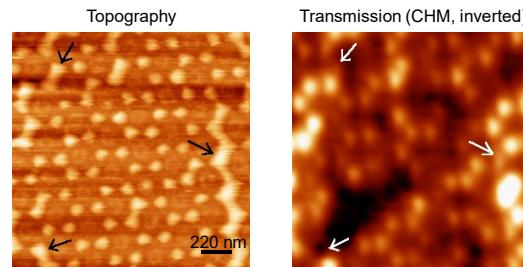


Nano optics 19/14



## NSOM Image Contrast

## Transmission image (CHM) of a regular metallic pattern



The images have not been taken simultaneously!

Nano optics 19/15

D. Molenda, Diploma thesis (2001)



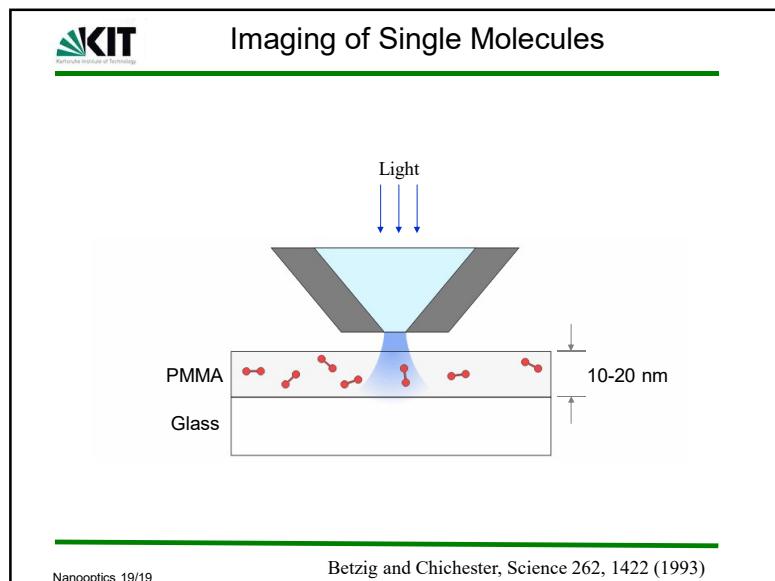
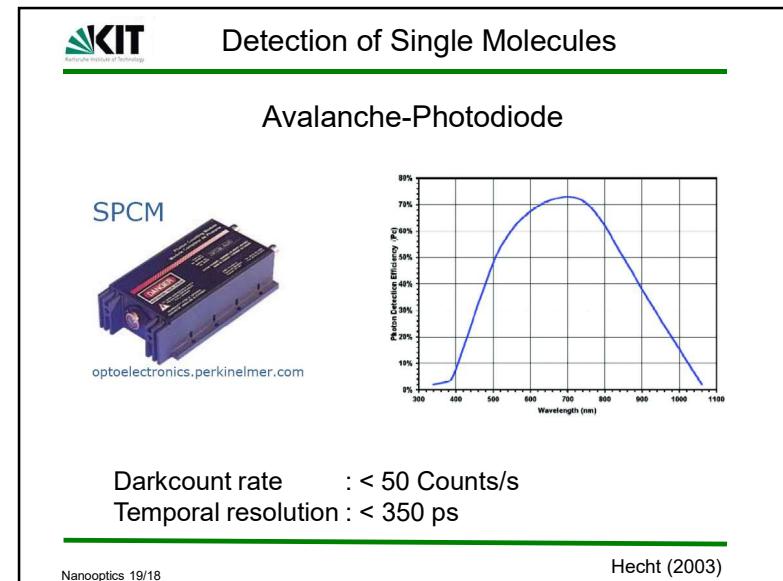
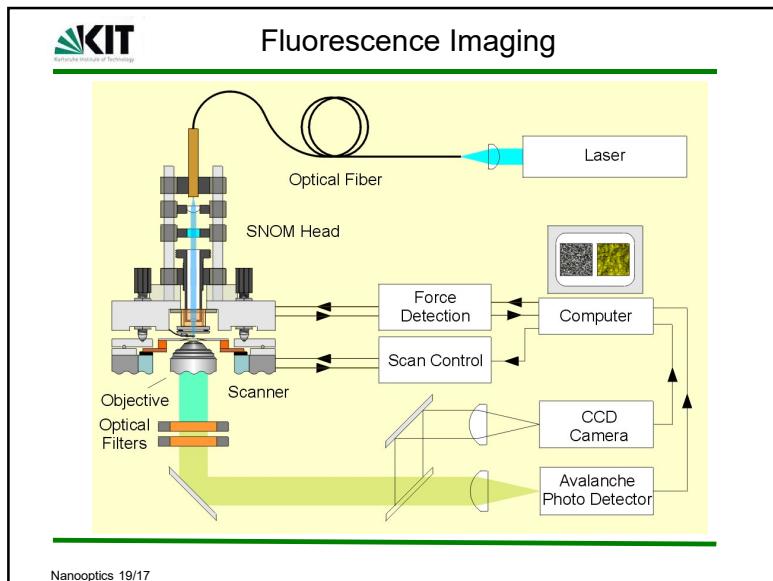
## Near-field optics

### 3. Near-field optics

### *3.5 Scanning near-field optical microscopy : Applications*

- 3.5.1 Single molecule imaging
  - 3.5.2 Imaging of single proteins in biological membranes
  - 3.5.3 Autocorrelation measurements
  - 3.5.4 Fluorescence Correlation Spectroscopy
  - 3.5.5 Observation of single protein transport through a biological membrane

Nanooptics 19/10



**Oral Exams**

### Available dates

- Mo, 06.03.2023
- Mo, 27.03.2023

Please send me an e-mail with your preferences.  
E-Mail: [naber@kit.edu](mailto:naber@kit.edu)

Nano optics 19/20