

Physics and chemistry of nanostructures

Progress Navolchi project

March 12th, 2012

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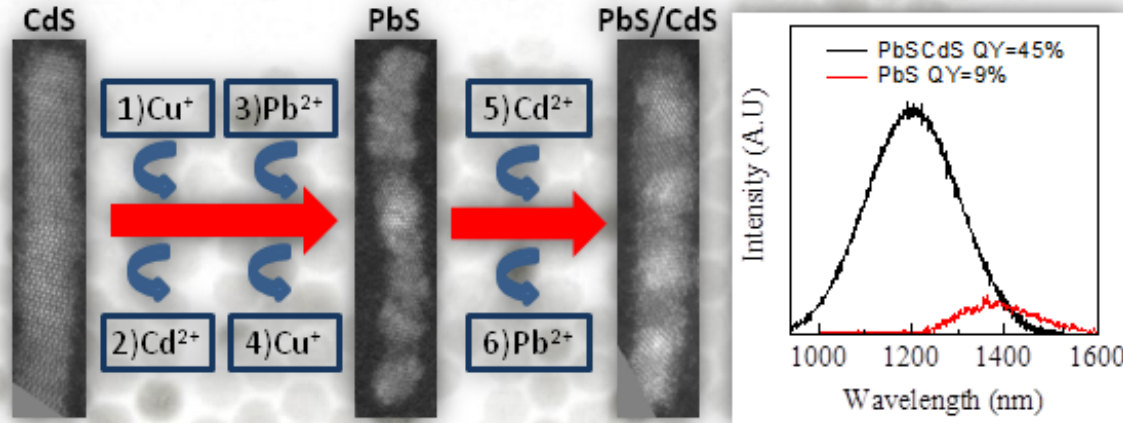
Outline

- **Materials**
 - PbS rods and PbS/CdS heterostructures
 - PbSe/CdSe heterostructures
- **Processing**
 - Thin films of PbS QDs by LBL-assembly
 - Local deposition of QDs
- **Properties**
 - Intraband absorption with PbX QDs
 - Pump-probe measurements -> amplification
- **Planning of future work**



Materials

PbS/CdS multiple dot-in-rods

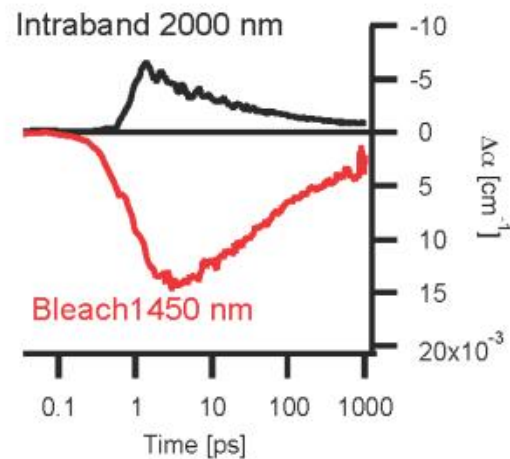
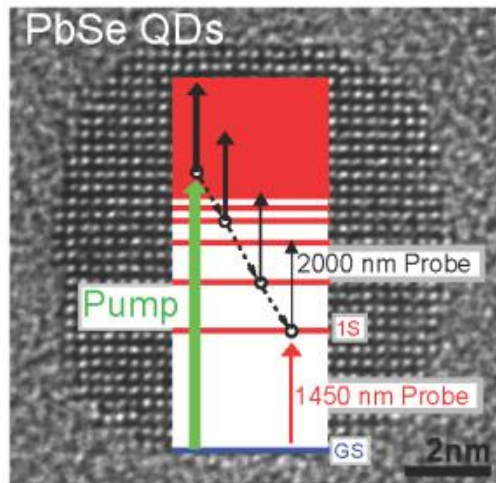


- Successive cation exchange steps transform original CdS rod into a PbS/CdS multiple dot-in-rod
- Passivation by CdS enhances PLQY to 45-55%

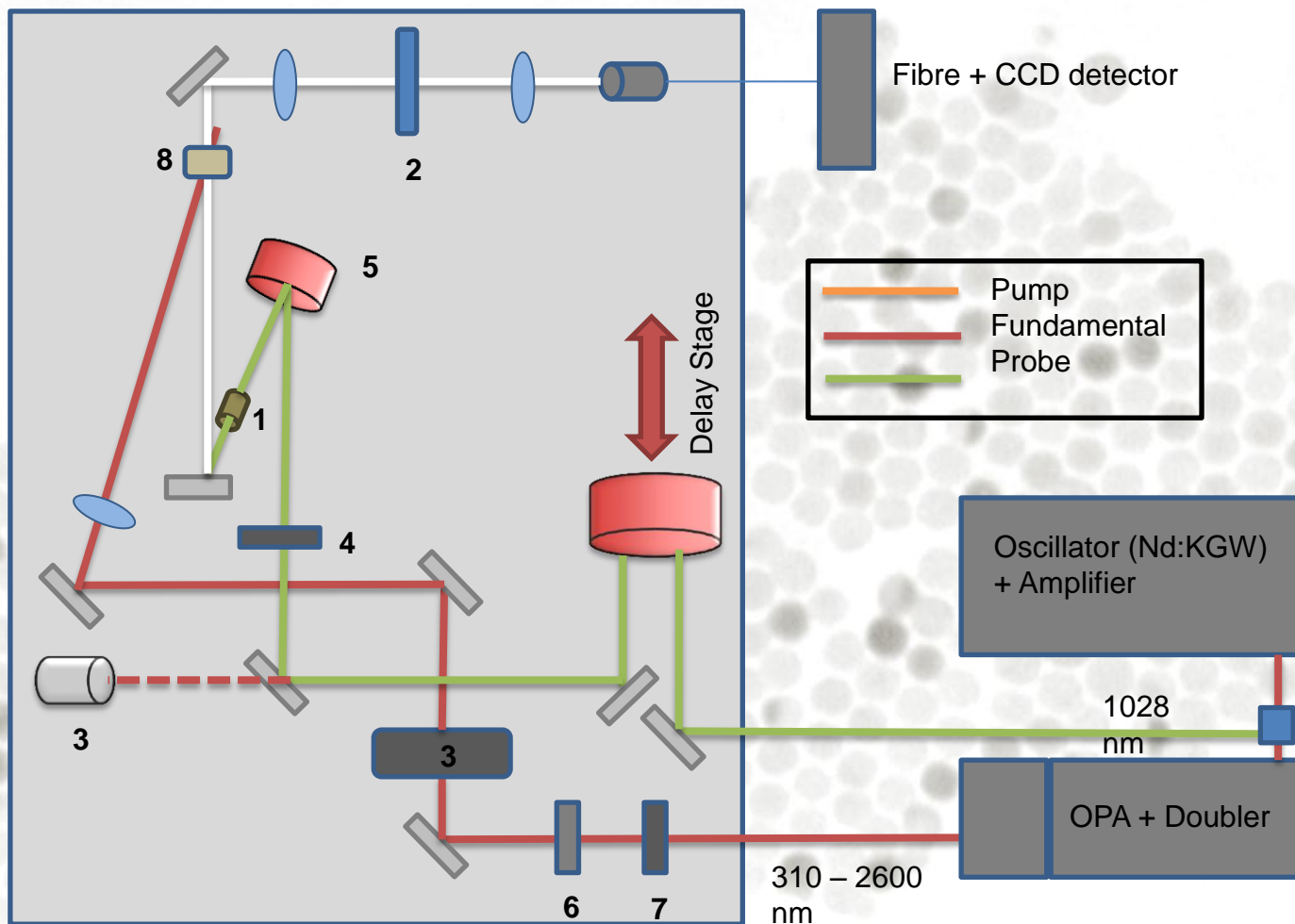
Justo *et al.*, *J. Am. Chem. Soc.* 2012, 134, 5484–5487

Properties

Intraband absorption in excited QDs



De Geyter et al., submitted to Nano Letters (March 5th)



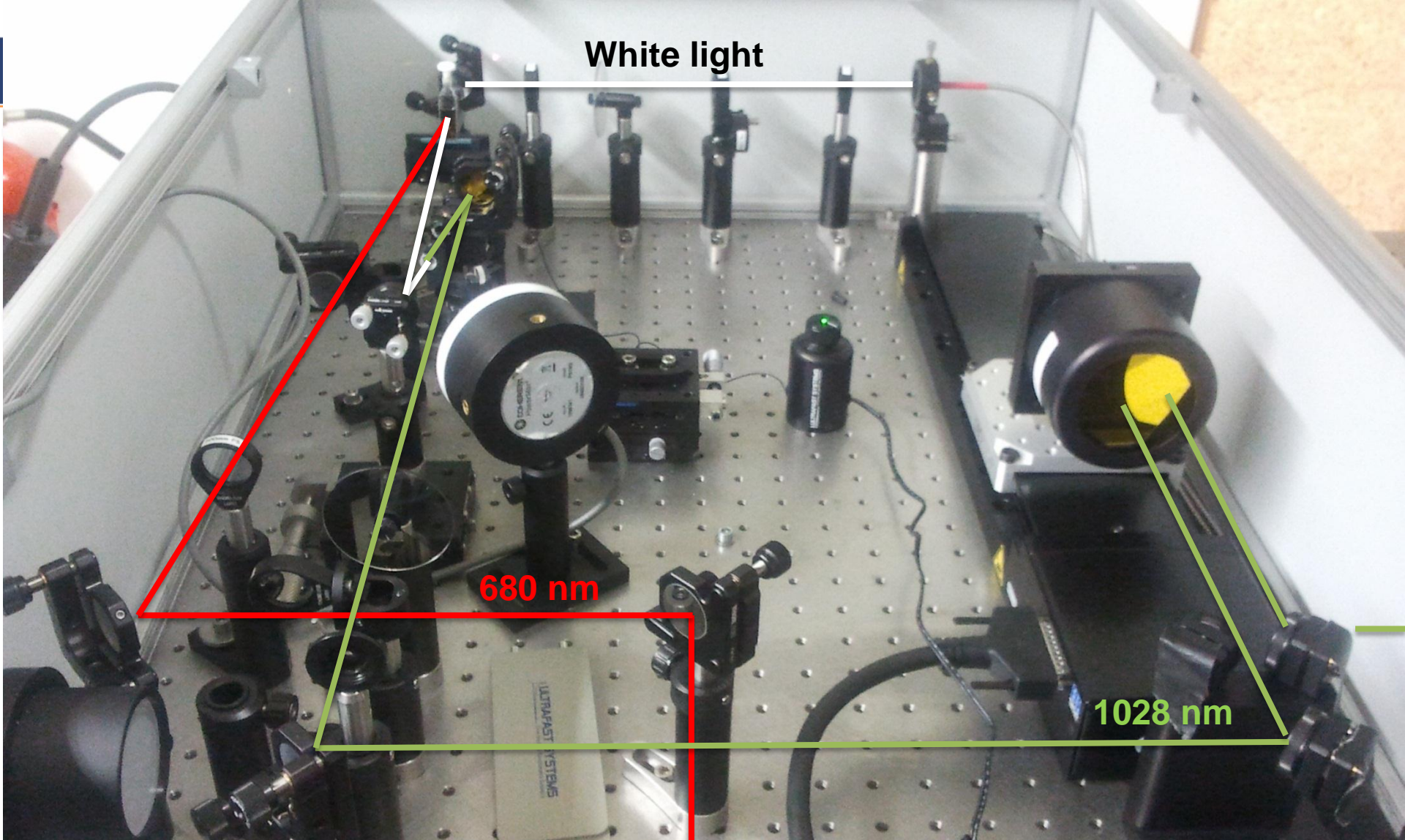
Collaboration – TUDelft, Prof. L. Siebbeles, dr. A. Houtepen



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Represented by





White light

680 nm

1028 nm

White light is created in sapphire crystal through 1028 nm pumping (fundamental of laser oscillator Nd:KGW).



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Represented by



Rods 4 x 12.8 nm

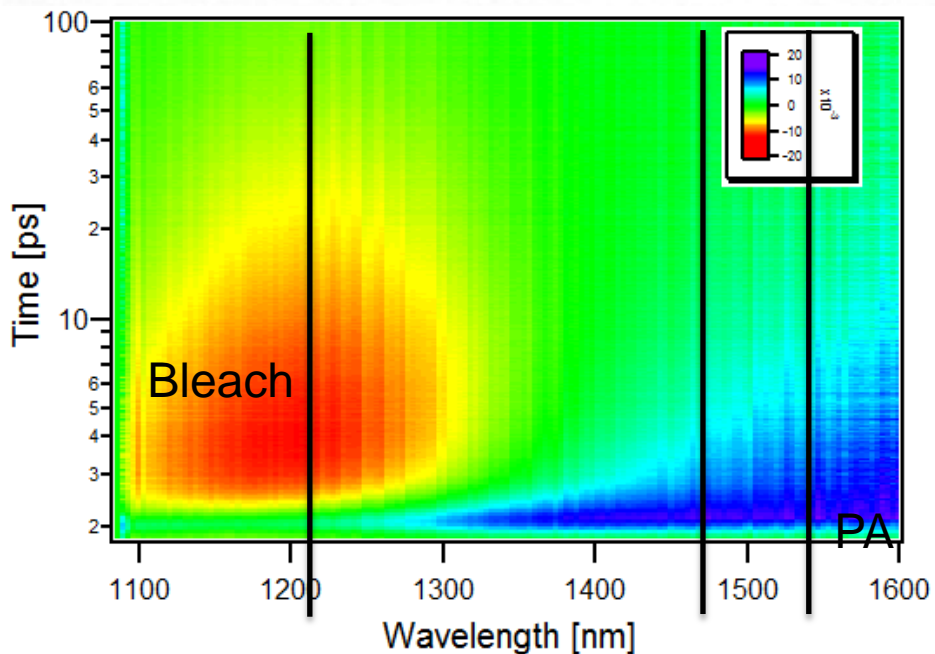
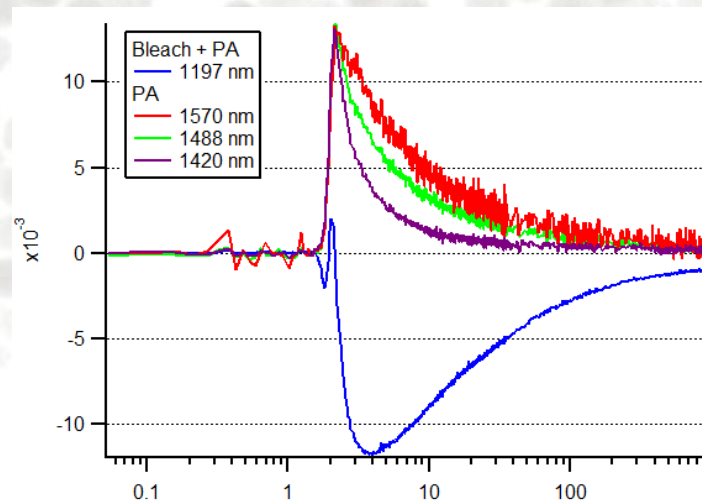


Photo-induced absorption

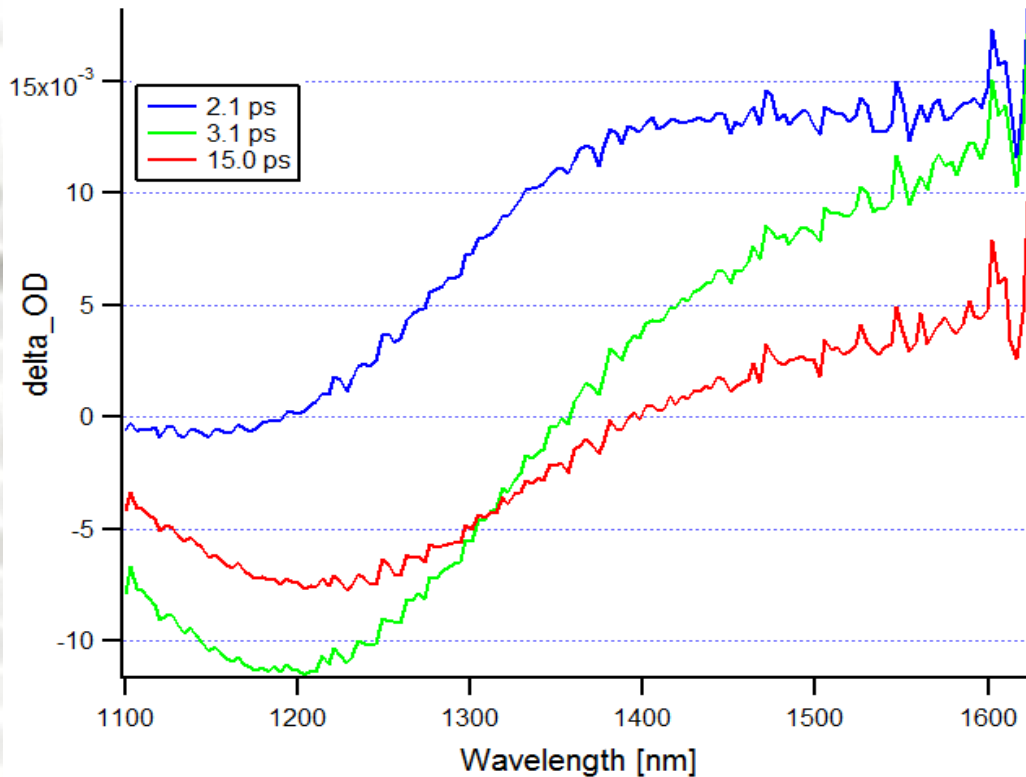
Ultrafast build-up of PA signal and decay dynamics depending on probe wavelength ?

Bleach at emission wavelength

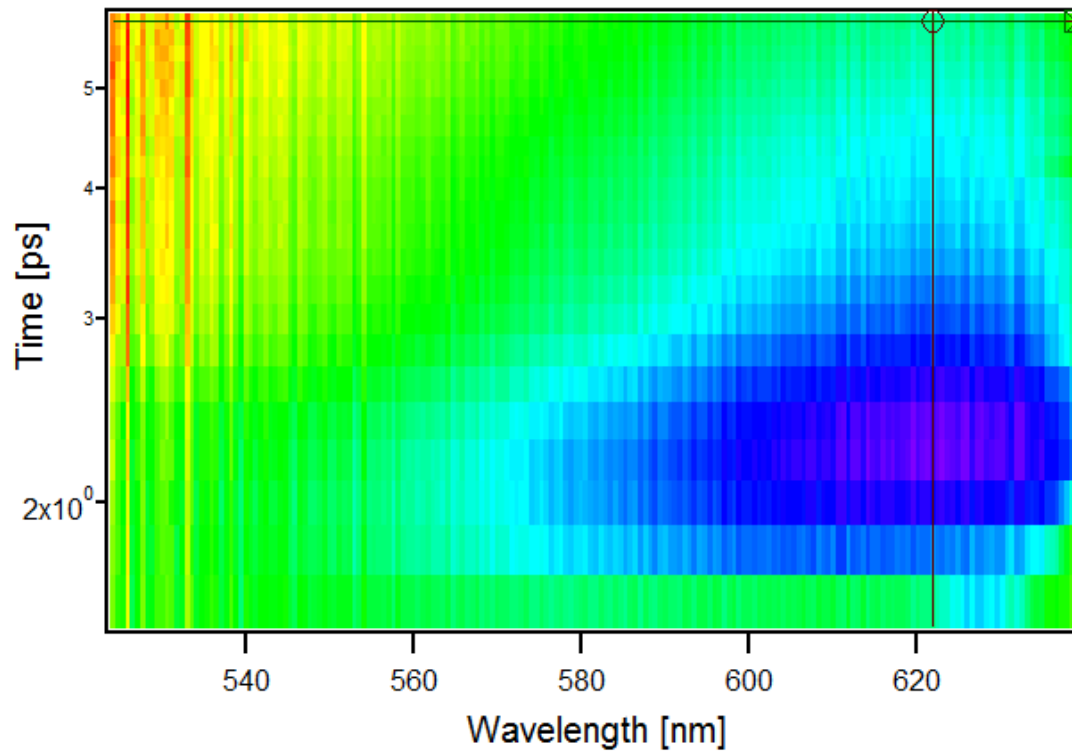
Bleach is clearly impaired by this PA buildup. Traces seem to suggest weakened Auger recombination.



Rods 4 x 12.8 nm



PA also extends to the visible !



Future work

- **Continuation of Transient Absorption spectroscopy**
 - Collaboration with theory group to get insight in intraband absorption
 - Shift of analysed materials to 1550 nm
- **Photodetection studies on PbS layers**
 - First succesful photodetection demonstrated
 - Work continuous
- **Sample exchange with Valencia**
 - Under preparation

