

# Physics and chemistry of nanostructures

Progress Navolchi project

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# Outline

- **People**
- **Materials**
  - PbX/CdX heterostructures
- **Processing**
- **Properties**
  - Absorption enhancement in QD monolayers
  - Intraband absorption with PbX QDs
  - Pump-probe measurements -> amplification
- **Devices**
  - Absorbance of functionalized waveguides
- **Planning of future work**



# People

- **Yolanda Justo**
  - Obtained her PhD last December
  - Stopped working for Navolchi as from January 1<sup>st</sup>
  - Some support will continue
- **Kishu Sagar**
  - New PhD student – starts as from March 18<sup>th</sup>



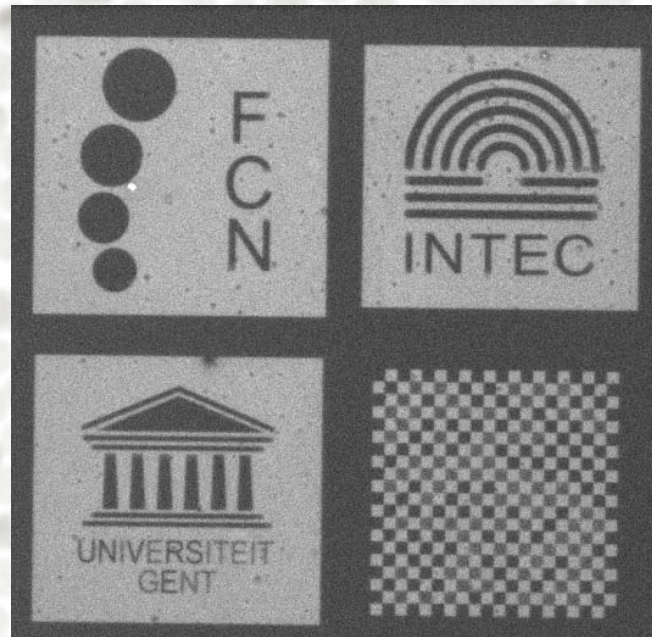
# Materials

- **Bringing in new materials**
  - **InP/CdS core/shell QDs (type 2, near IR)**
    - Will be started in the near future. Question is how far we can get them in the IR.
  - **HgX (X=S,Se,Te)**
    - Preliminary results indicate we can make them using cationic exchange



# Processing

- New approach for local deposition of quantum dots
  - Developed for PbS dots.
  - Extended to CdSe/CdS dots -> shows that PL is maintained during processing



# Properties

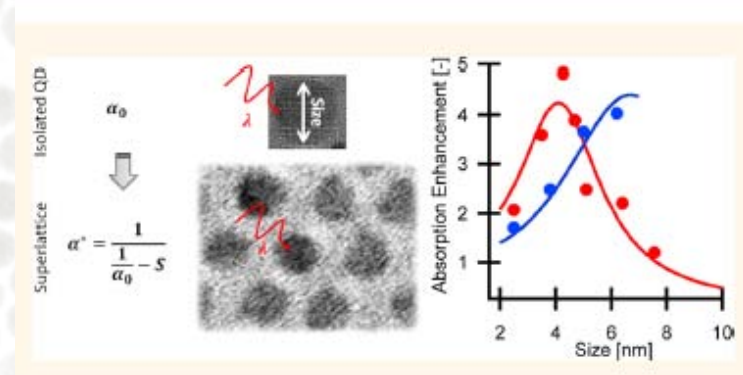
- Absorption Enhancement
  - Paper published by *ACS Nano*
- Pump-probe measurements
  - Screening of all samples sent to Valencia for amplified spontaneous emission – no indication of amplification.

## Giant and Broad-Band Absorption Enhancement in Colloidal Quantum Dot Monolayers through Dipolar Coupling

Pieter Geiregat,<sup>†,‡,§</sup> Yolanda Justo,<sup>†,§</sup> Sofie Abe,<sup>†,§</sup> Stijn Flamee,<sup>†,§</sup> and Zeger Hens<sup>†,§,\*</sup>

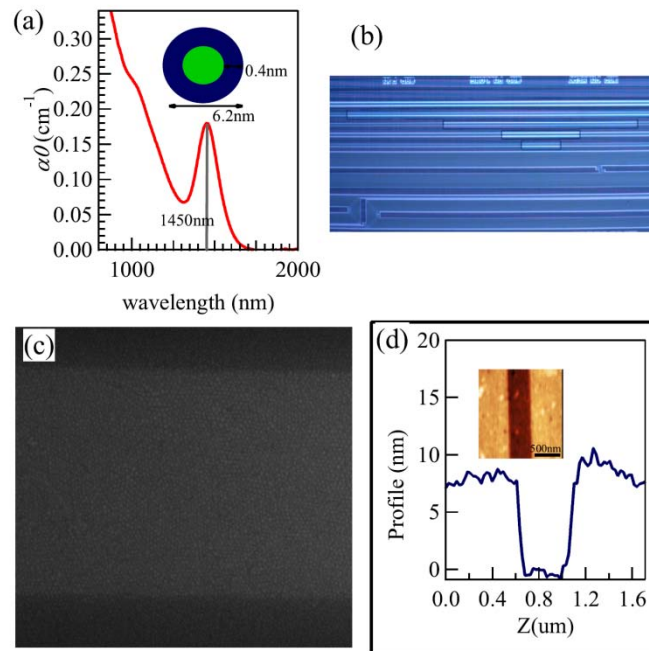
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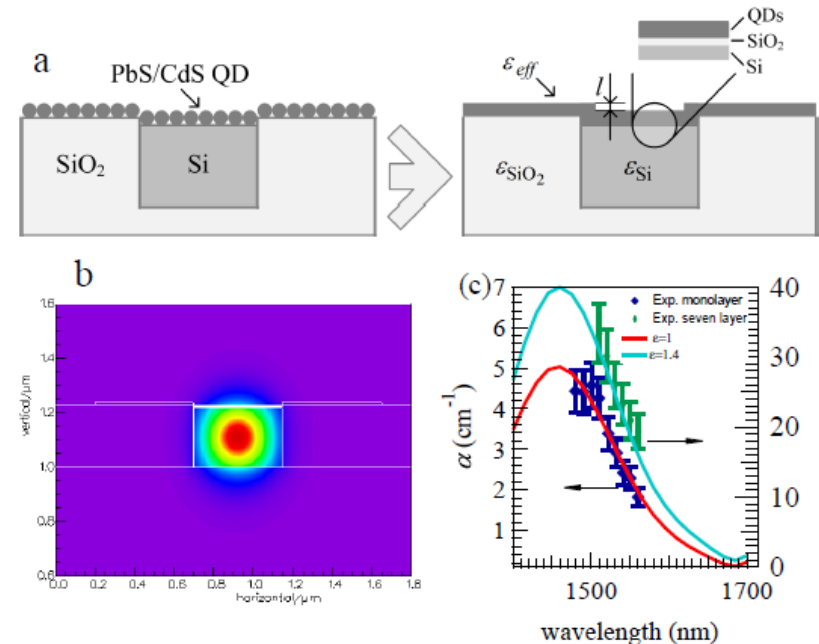
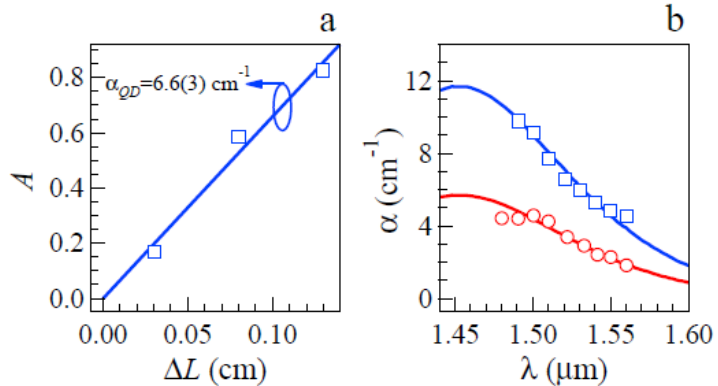
# Devices

- Absorbance in QD functionalized waveguides
  - Set of measurements finished.
  - Consistent approach for modeling hybrid SOI/QD devices proposed



# Devices

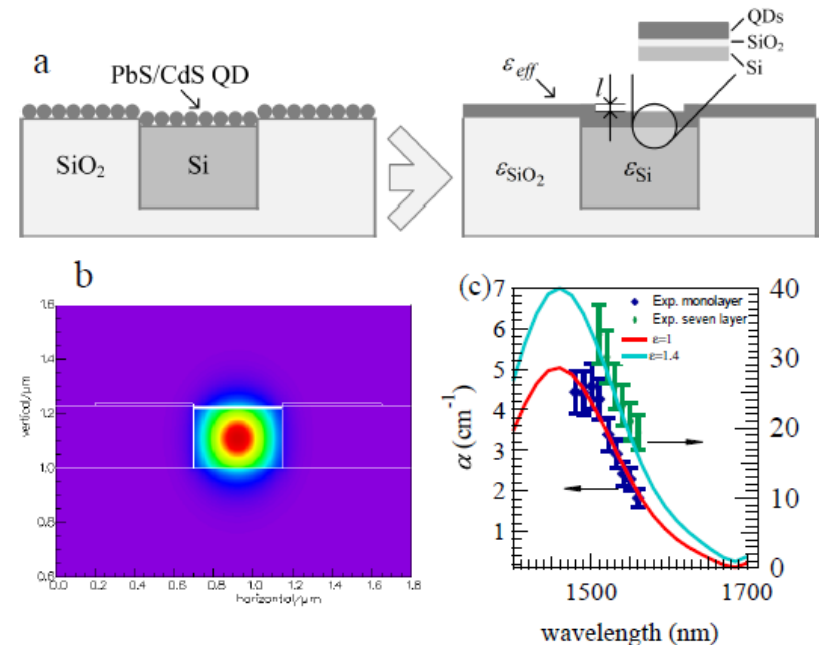
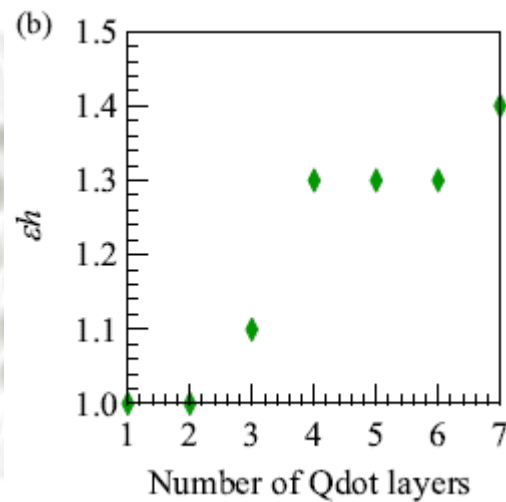
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# Future work

- **Materials synthesis**
  - Introduce new materials
- **Properties**
  - Extend absorption enhancement to multilayers and core/shell particles / compare with randomly stacked layers
  - Continuation of pump-probe studies to understand carrier relaxation and light amplification
- **Devices**
  - Finish absorbance of functionalized waveguides
- **Sample exchange with Valencia**
  - Temporarily on hold