

Condensed Matter & Interfaces

Andries Meijerink

Celso de Mello-Donega

Daniel Vanmaekelbergh

Ingmar Swart

Zeila Zanolli

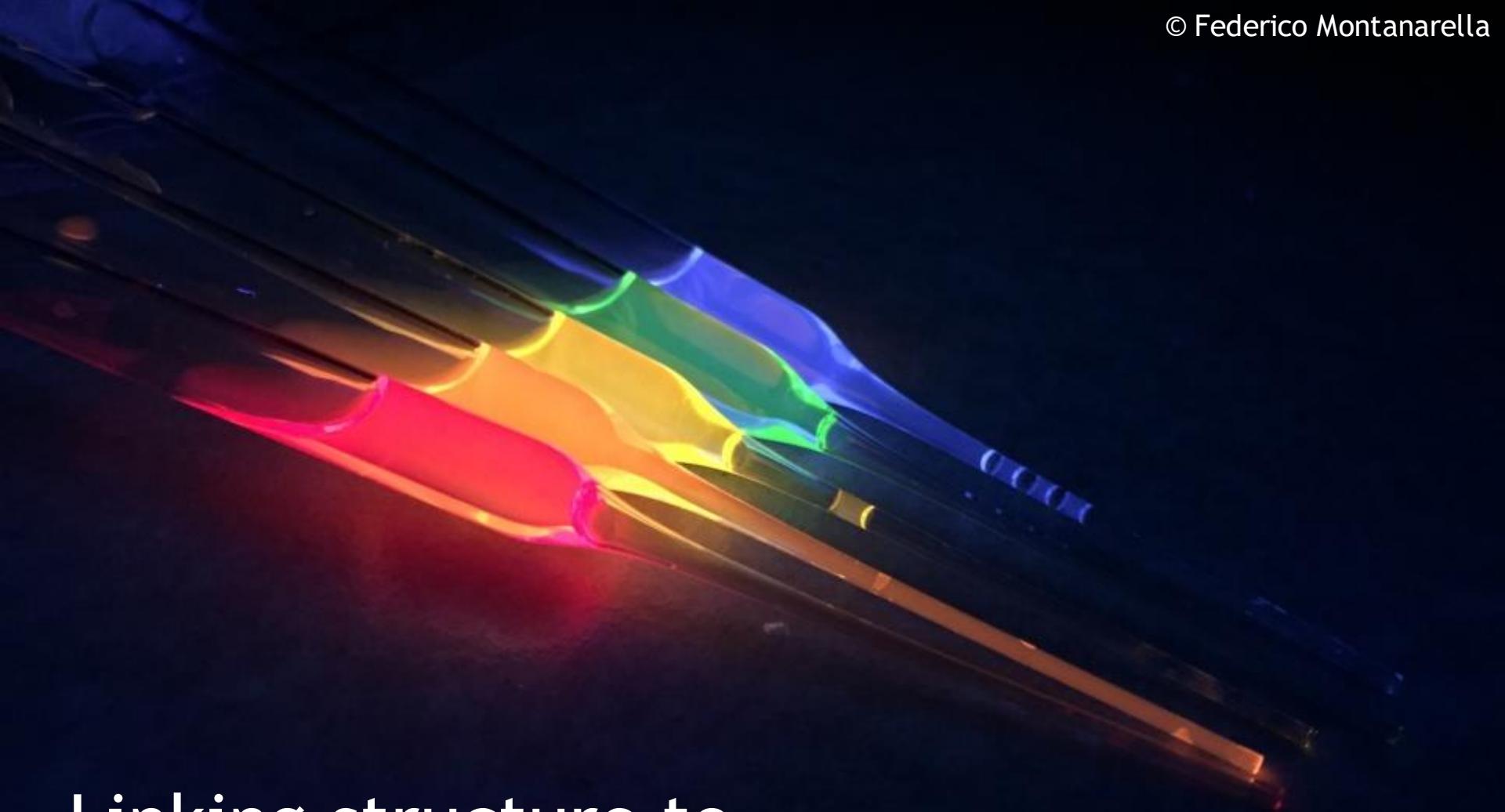
Machteld Kamminga

The workhorses of the group



- ~10 PhDs
- ~2 Postdocs

**Master and
bachelor students**

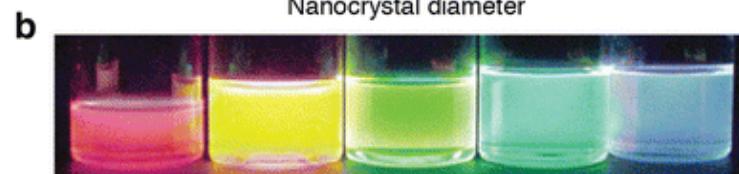
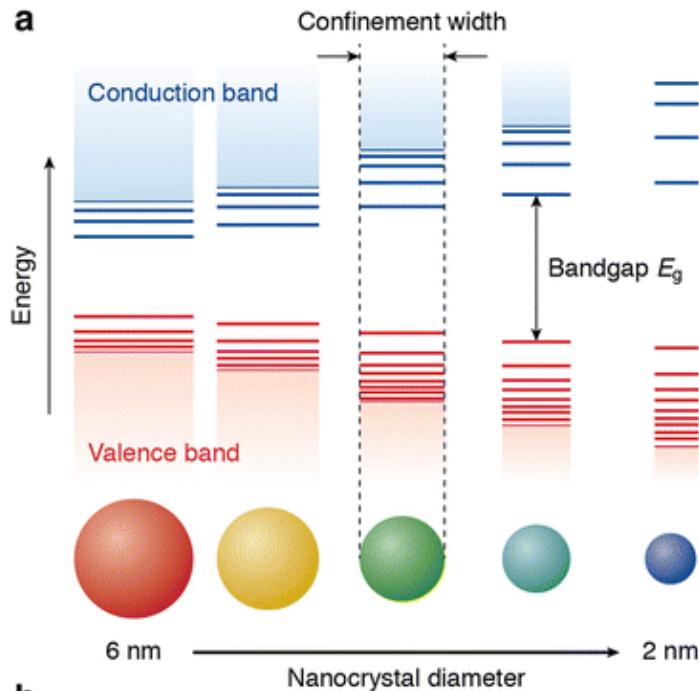


Linking structure to opto-electronic properties

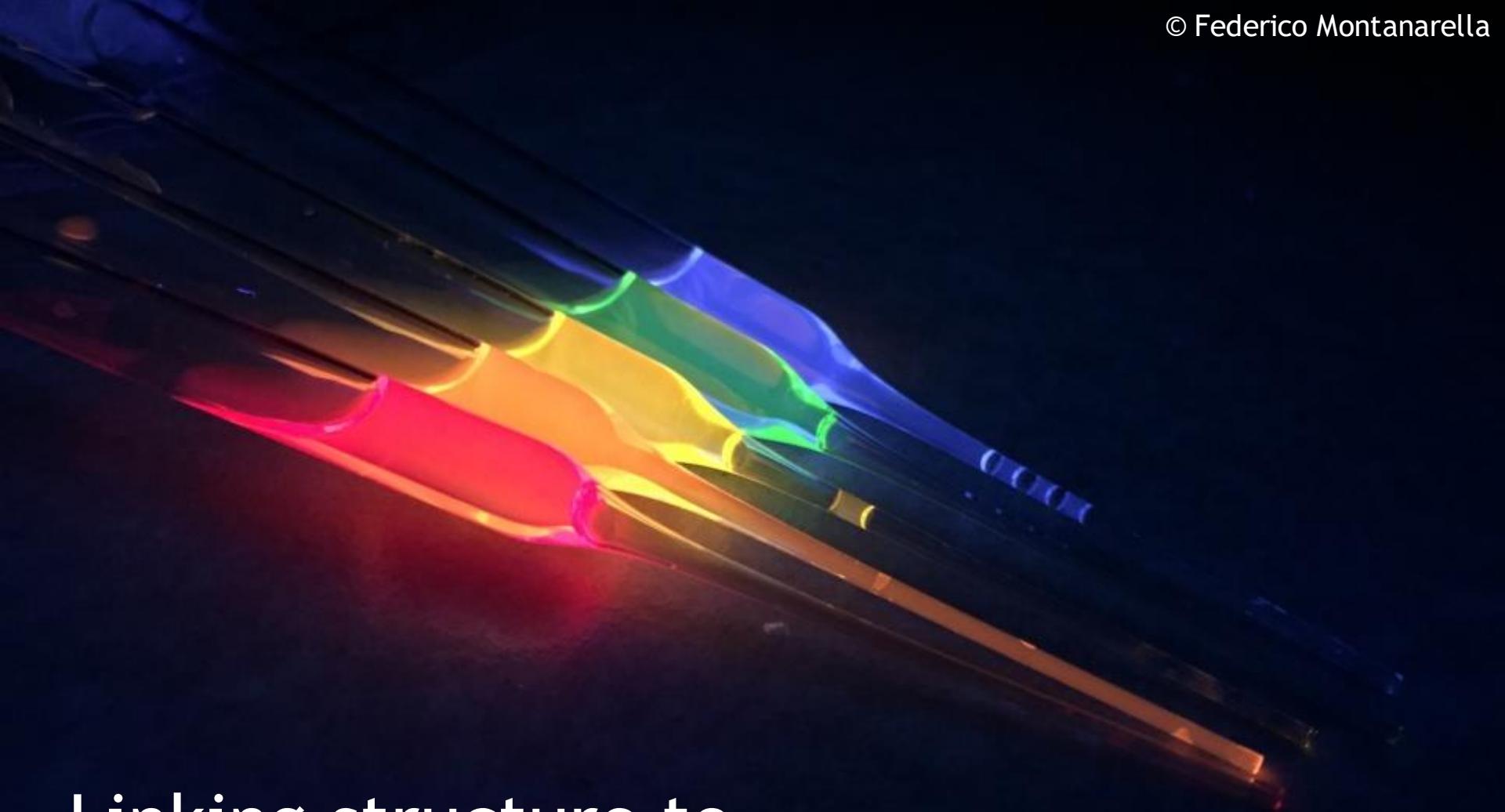
“Making, Measuring, Modelling”

Making: Synthesis

- Inorganic (nano)phosphors
- Superstructures of nanocrystals
- Quantum dots







Linking structure to opto-electronic properties

“Making, Measuring, Modelling”

Measuring: Experimental analysis

Optical investigations

- Absorption, emission and excitation spectroscopy
- Luminescence lifetime measurements
- Single particle spectroscopy

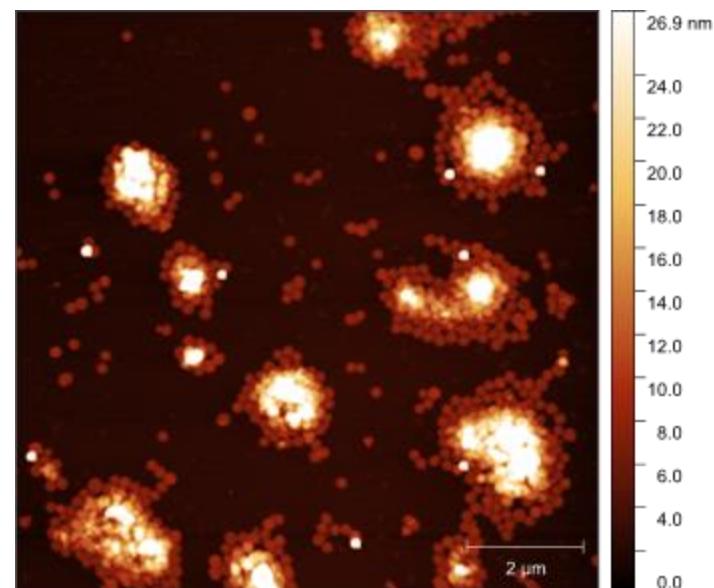
Measuring: Experimental analysis

Optical investigations

- Absorption, emission and excitation spectroscopy
- Luminescence lifetime measurements
- Single particle spectroscopy

Geometric/chemical structure

- Electron microscopy
- ICP-OES (elemental analysis)
- X-ray techniques
- Atomic force microscopy



Measuring: Experimental analysis

Optical investigations

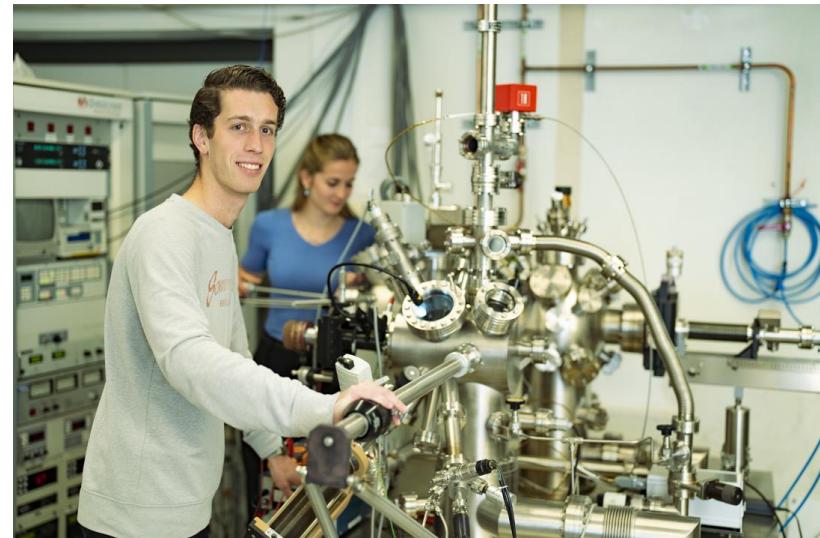
- Absorption, emission and excitation spectroscopy
- Luminescence lifetime measurements
- Single particle spectroscopy

Geometric/chemical structure

- Electron microscopy
- ICP-OES (elemental analysis)
- X-ray scattering techniques
- Atomic force microscopy

Electronic Structure

- Scanning tunneling microscopy-spectroscopy



Linking structure to opto-electronic properties

“Making, Measuring, Modelling”

Modelling: Linking experiment to theory

Topological materials

- 2D materials
- Carbon-based nanostructures
- Hybrid organic-inorganic materials

Spin texture

Structure of materials



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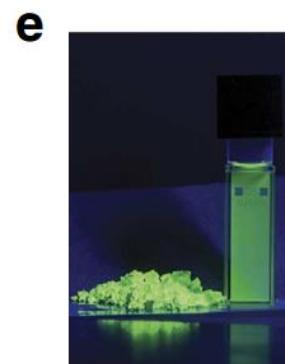
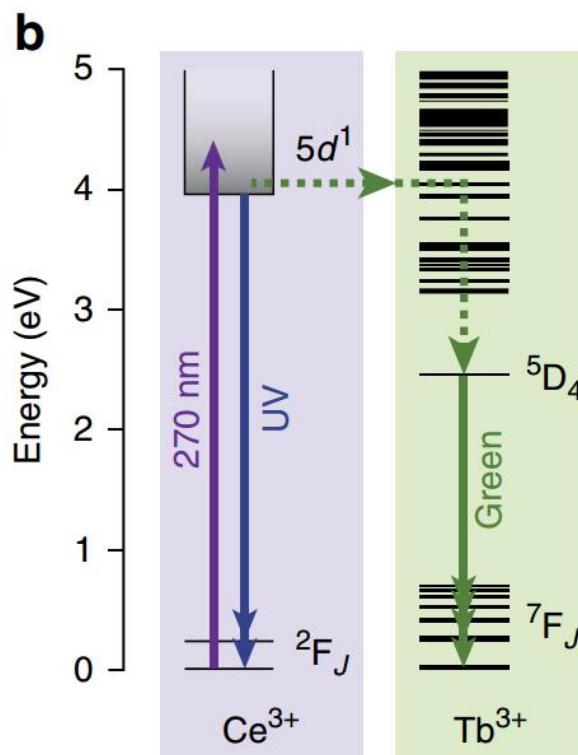
Machteld Kamminga

Andries Meijerink

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Research topics

- Phosphors for lighting applications
- Nanoparticles as (temperature) sensors
- Up- and downconversion
- Inter-particle ET



Celso de Mello-Donega

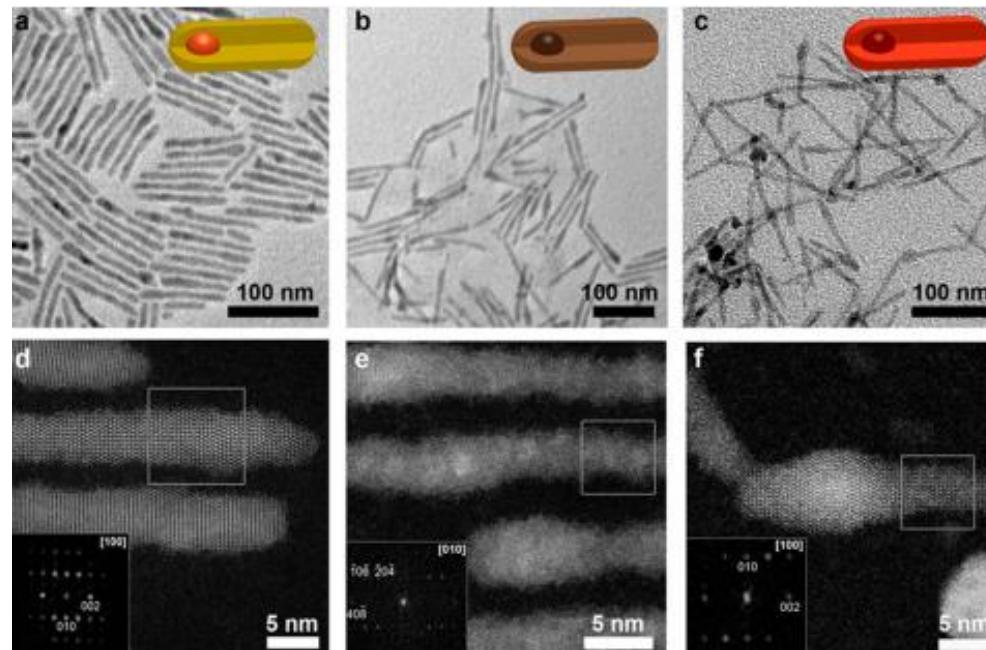
c.demello-donega@uu.nl



Research topics

- Environmentally friendly QDs
- Hetero-nanocrystals, alloy nanocrystals and doped nanocrystals
- Luminescent solar concentrators

CdSe/CdS CuSe/CuS CulnSe/CulnS



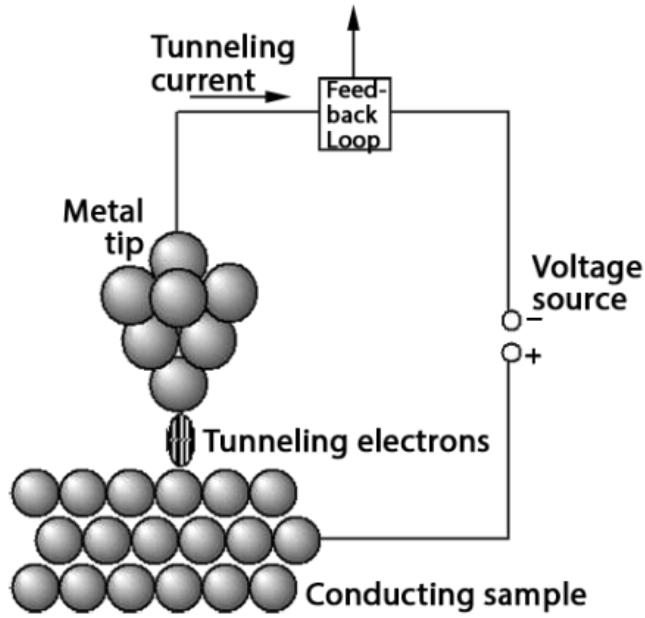
Ingmar Swart (Basement)

i.swart@uu.nl

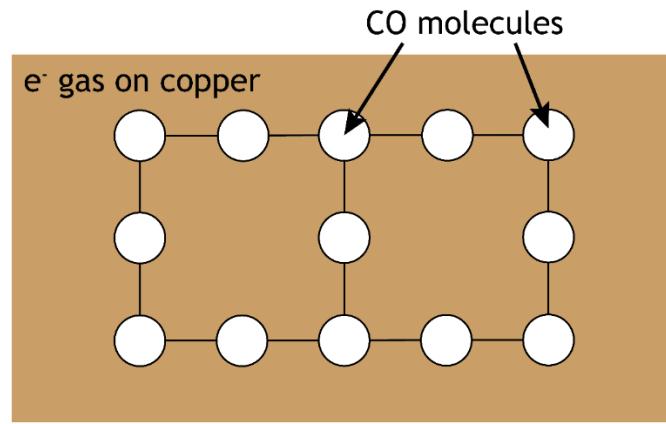


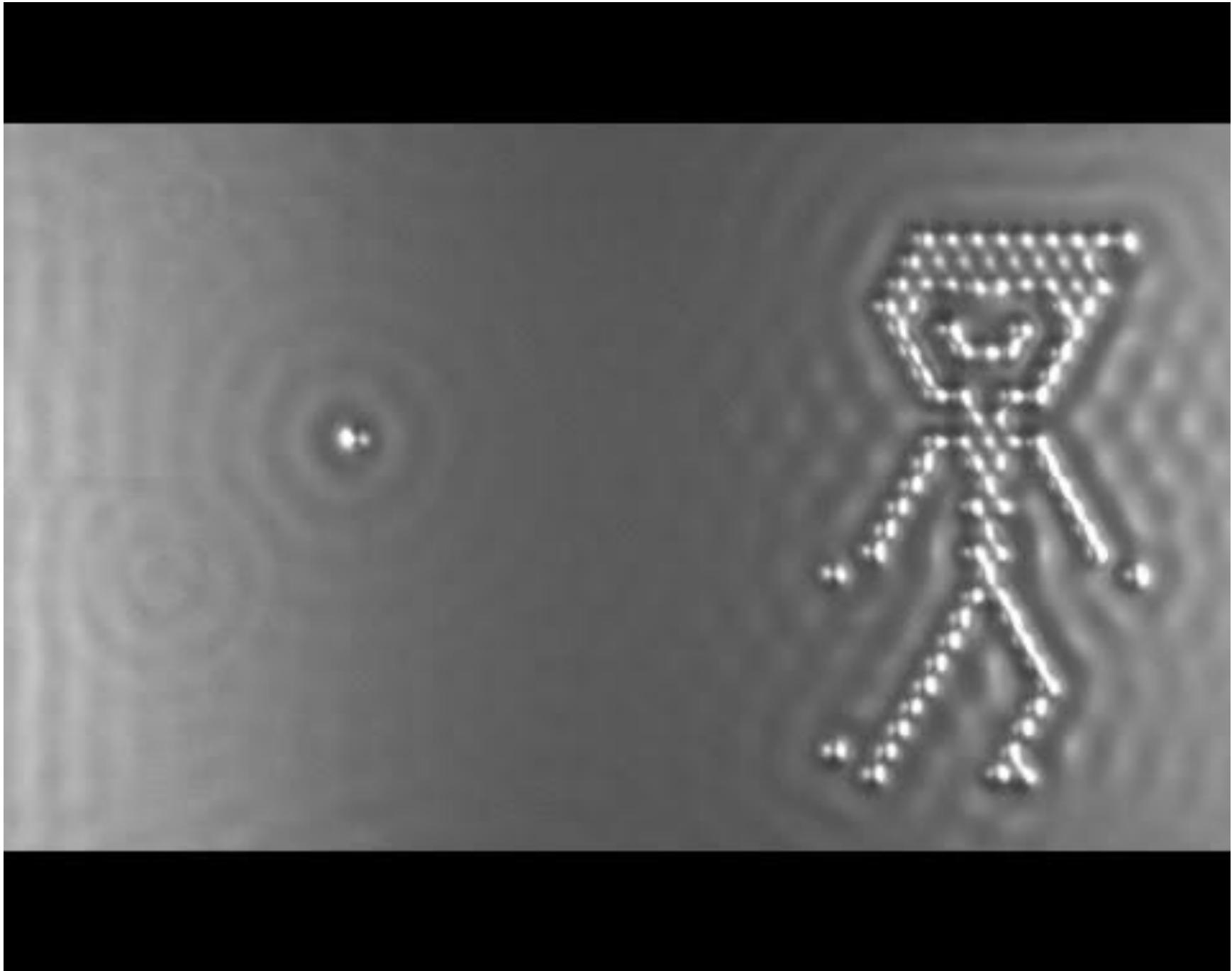
Research topics

- Molecule manipulation and artificial electronic lattices (STM)



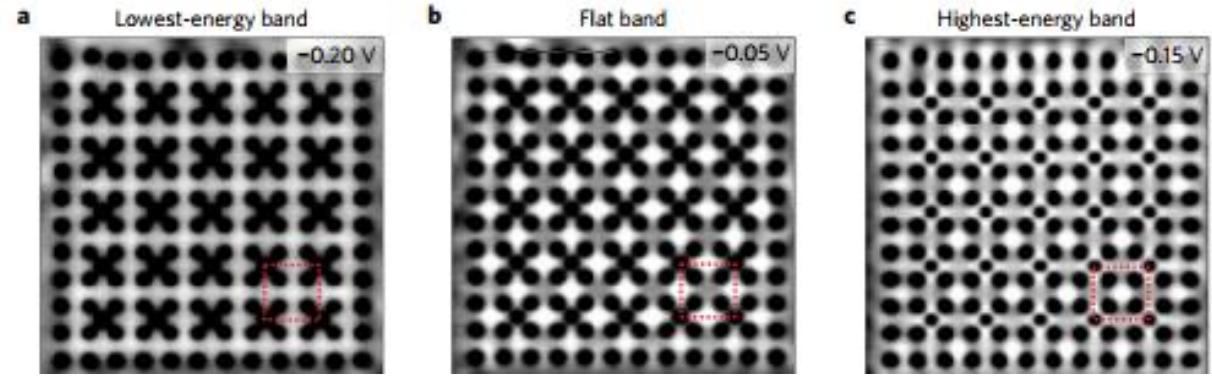
Quantum simulator



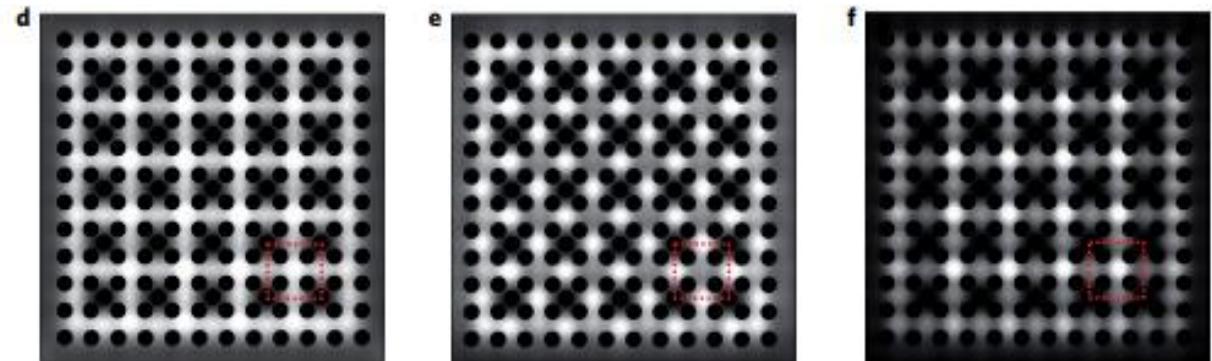


Quantum simulator

Experimental



Theory



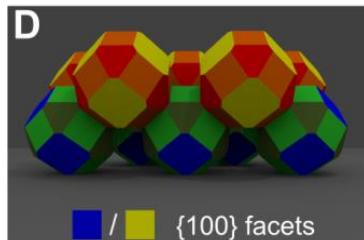
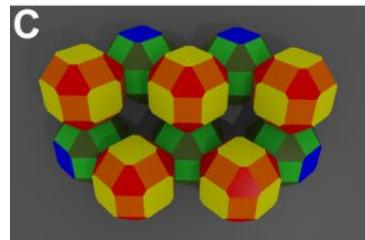
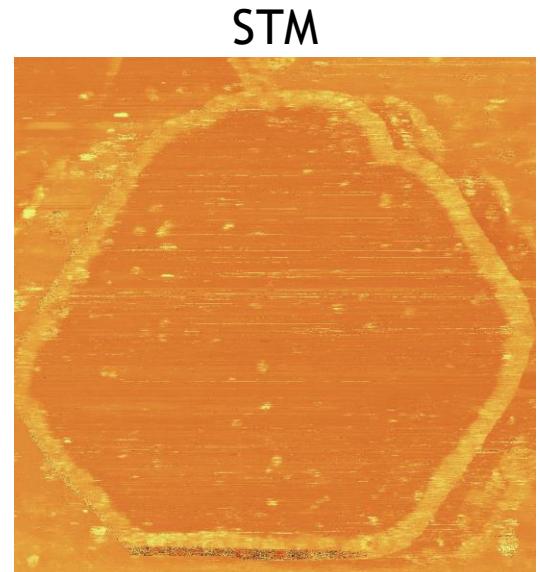
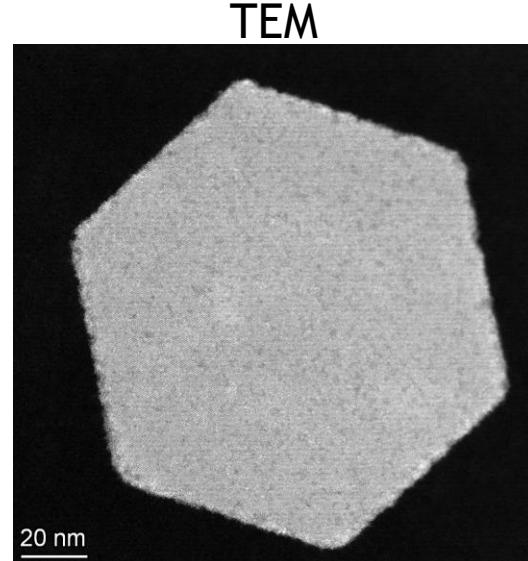
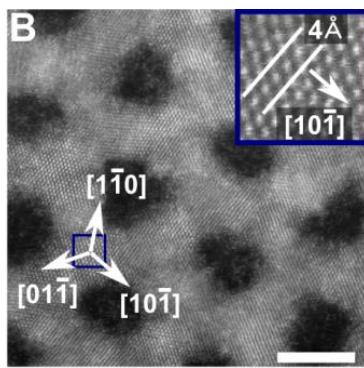
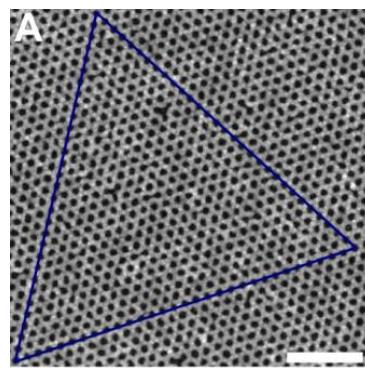
Daniel Vanmaekelbergh

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Research topics

- Artificial graphene/2D materials
- Topological materials: conducting surface, insulating interior



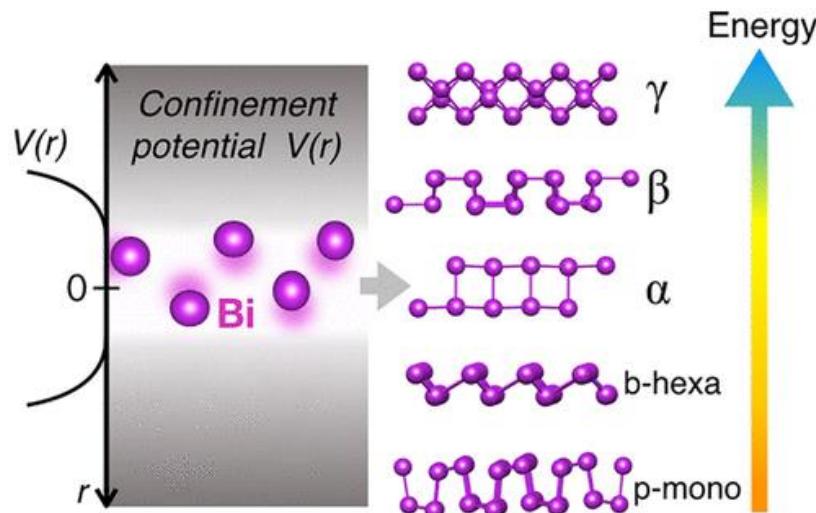
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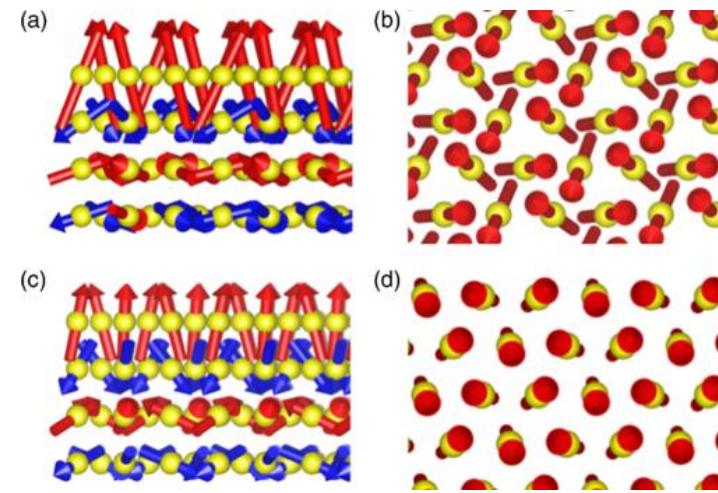


Research topics

- Ab-initio modeling (DFT)
- Topological materials
- Nano electronic/spintronic devices



Phys. Chem. Lett. 2019, 10, 23, 7324–7332



Rev. B 2018, 98, 155404

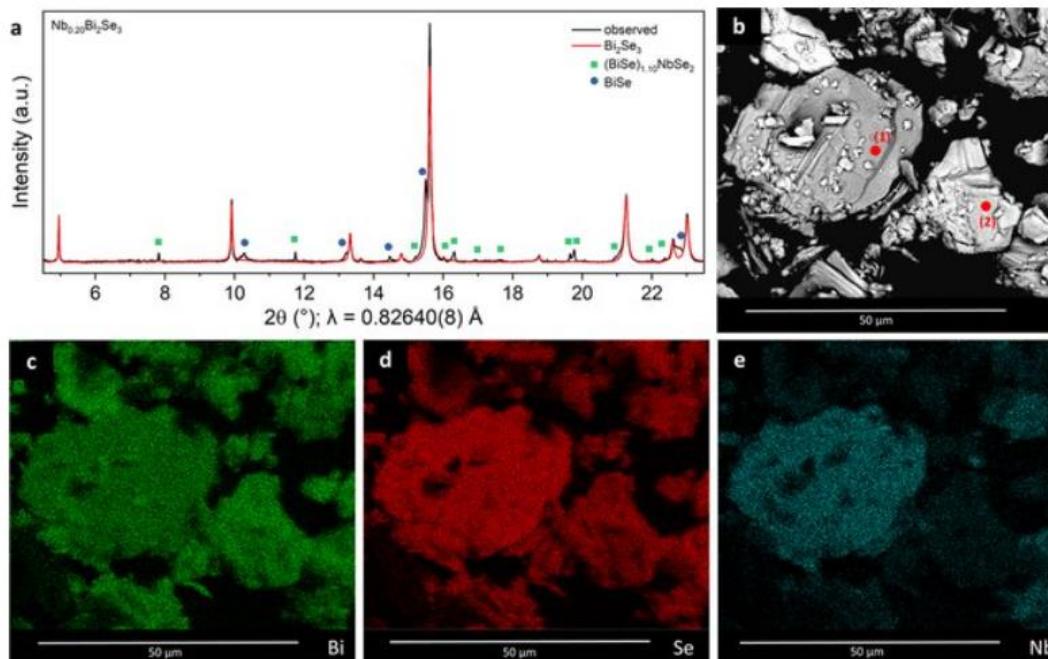
Machteld Kamminga

m.e.kamminga@uu.nl



Research topics

- Van der Waals materials
- (high-temperature) superconductors
- Magnetism in various materials

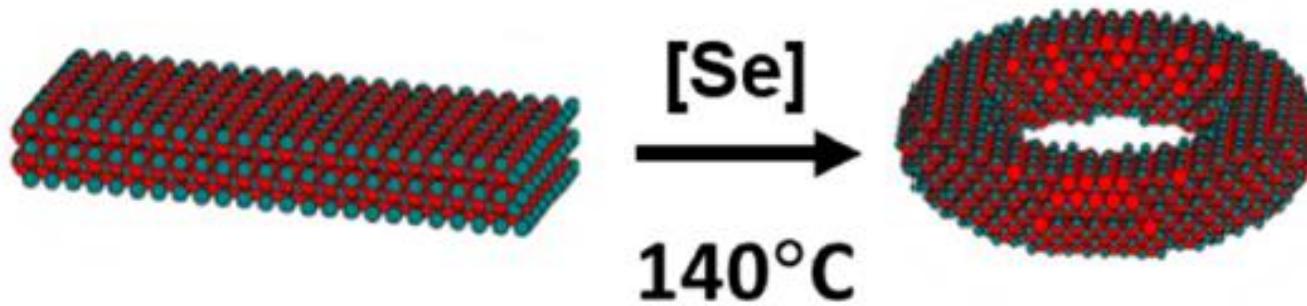


Kamminga, M.E., Batuk, M., Hadermann, J. et al. *Commun Mater* 1, 82 (2020)

Example of student project

Dazzling donuts: synthesis and characterization of CdSe nanorings

- Unusual geometry
- Changed luminescent properties

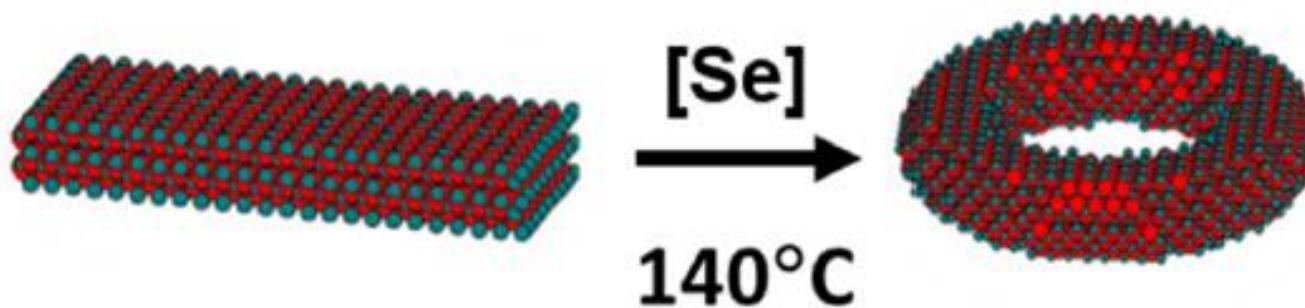


Fedin, I., et al. (2016). *Journal of the American Chemical Society*,
138, 9771-9774.

Example of student project

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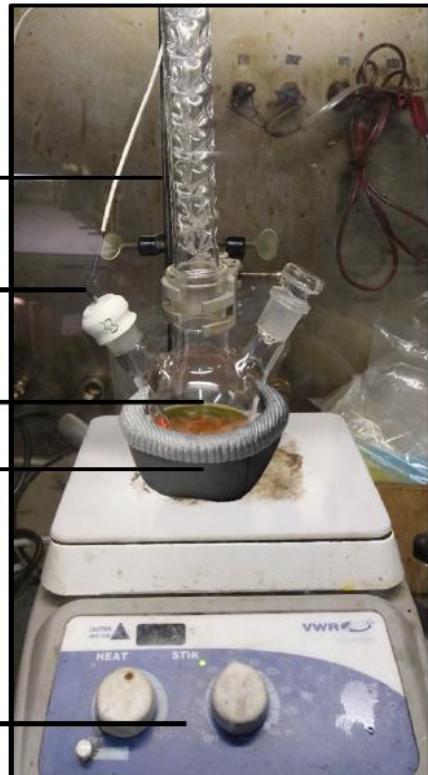
Fedin, I., et al. (2016). *Journal of the American Chemical Society*, 138, 9771-9774.

Research questions:

- How does the etching process work and can we control it?
- What is the origin of the changed luminescence?

Example of student project

1. Synthesis



Vigreux

Thermometer connected
to temperature logger

Three-neck flask

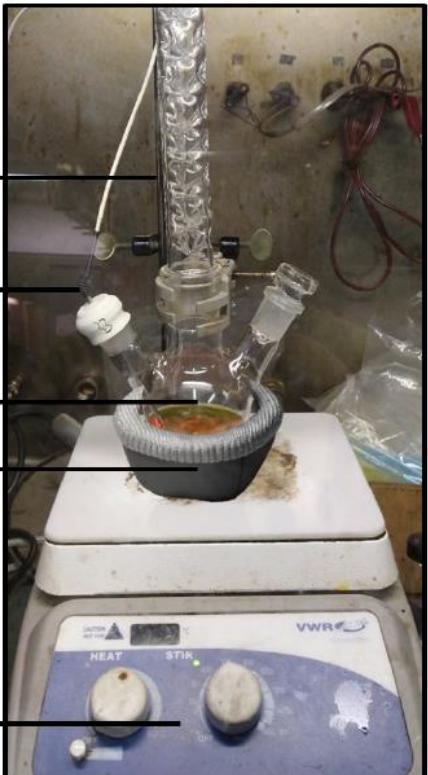
Heating mantle

Magnetic stirring plate

Example of student project

1. Synthesis

Vigreux



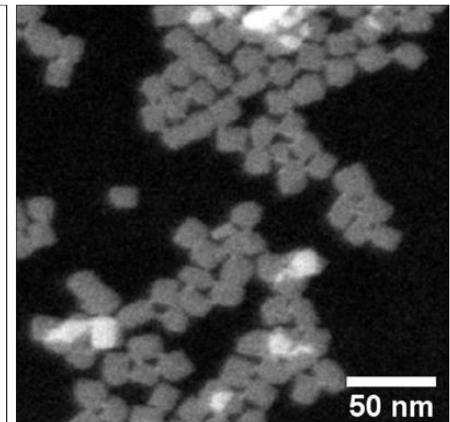
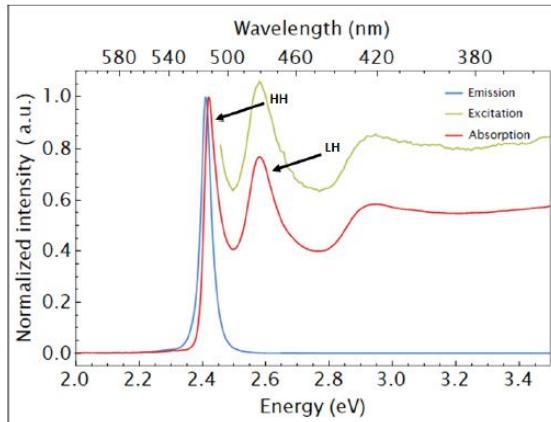
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2. Characterization



Example of student project

1. Synthesis

Vigreux



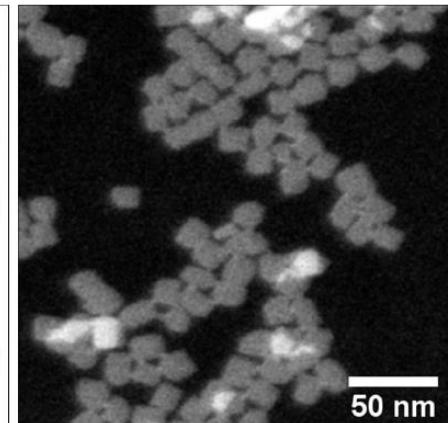
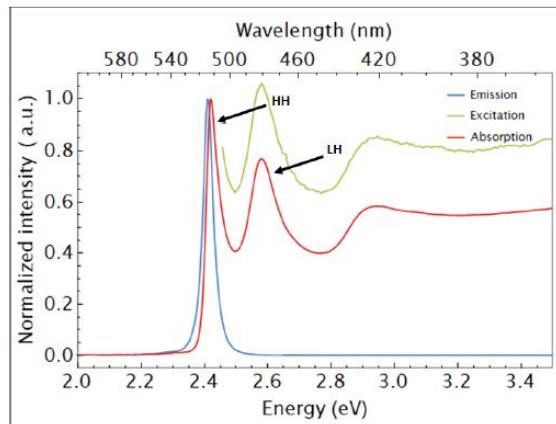
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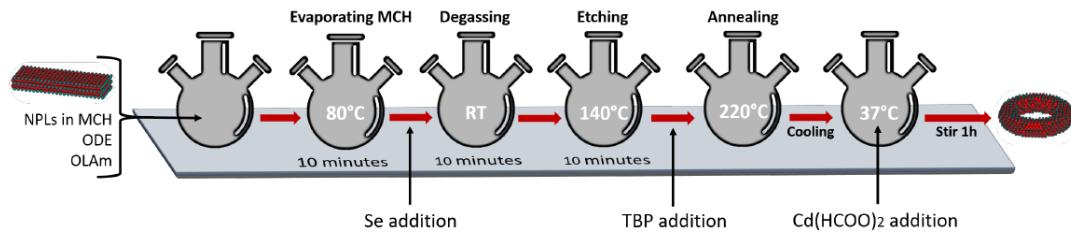
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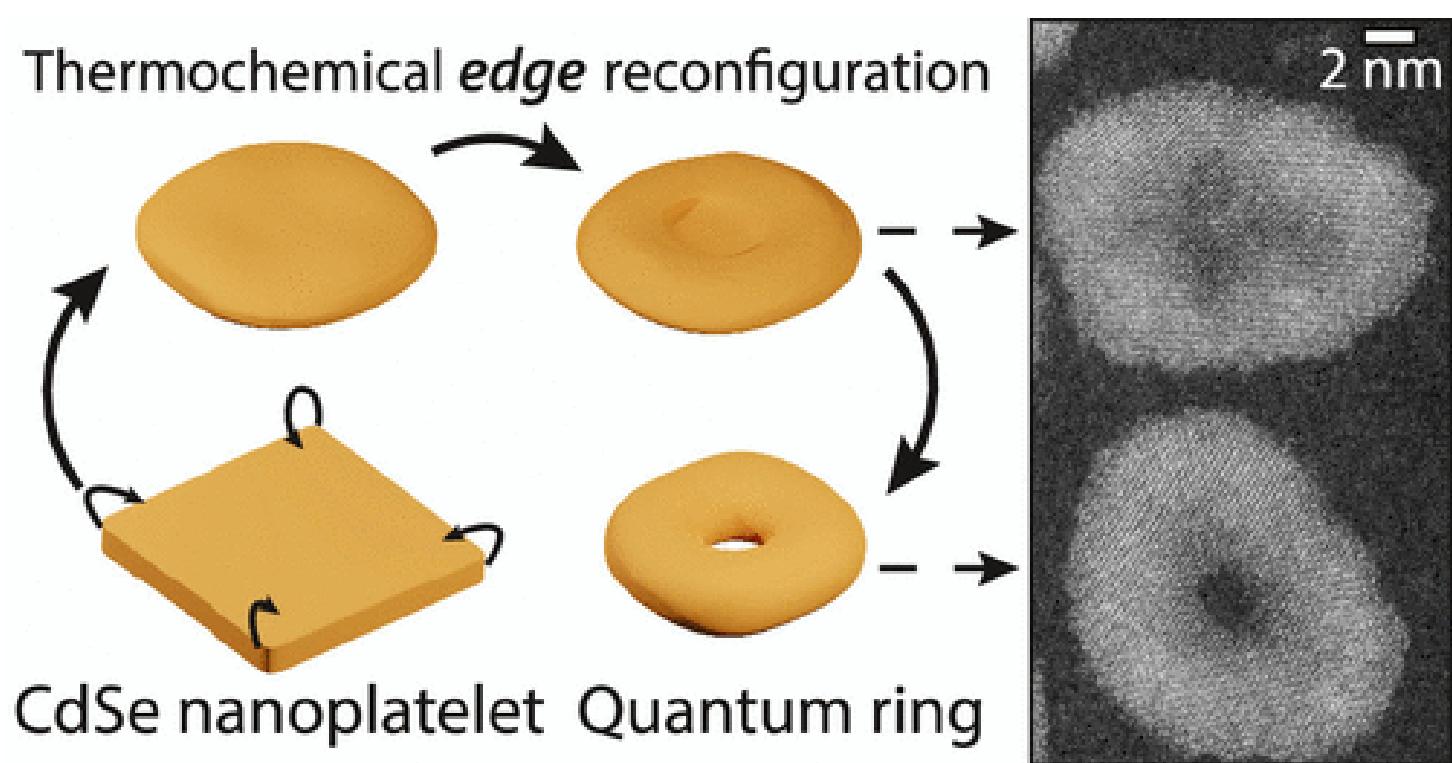


3. Repeating etching procedure



Example of student project

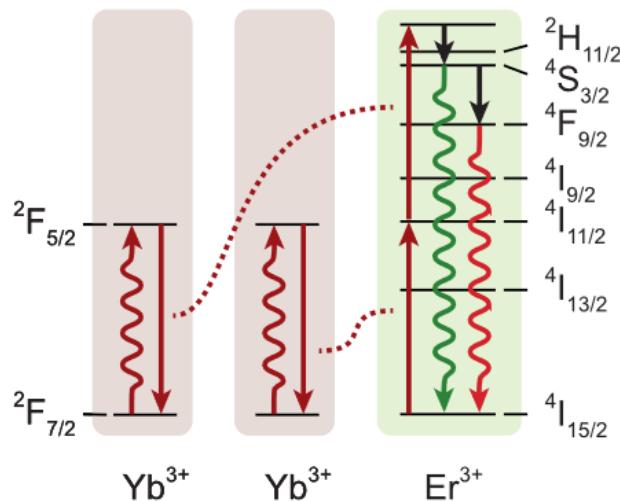
4. Understanding etching procedure



Another example

$\text{NaYF}_4:\text{Er}^{3+}/\text{Yb}^{3+}$ NCs for nanothermometry

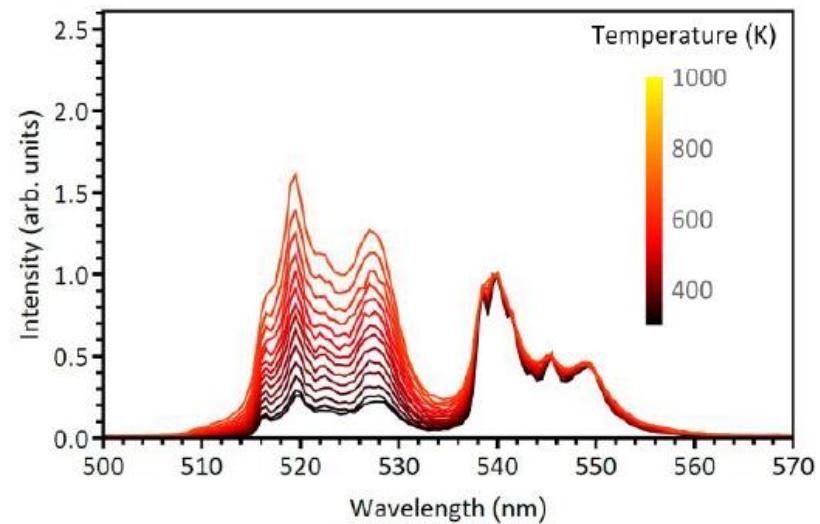
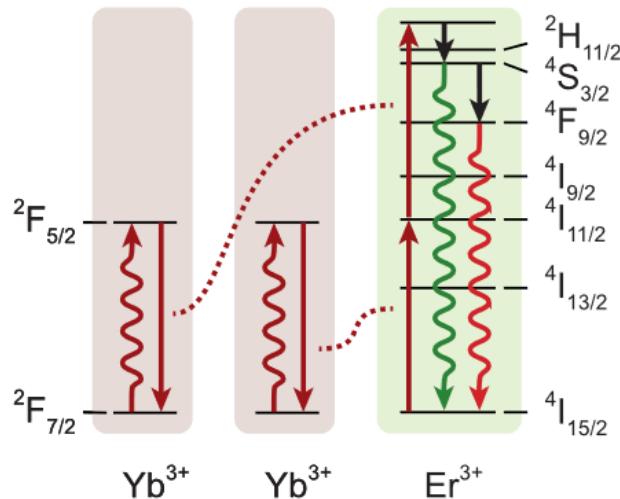
Excite Yb^{3+} at 980 nm → Upconversion step → Green Er^{3+} luminescence



Another example

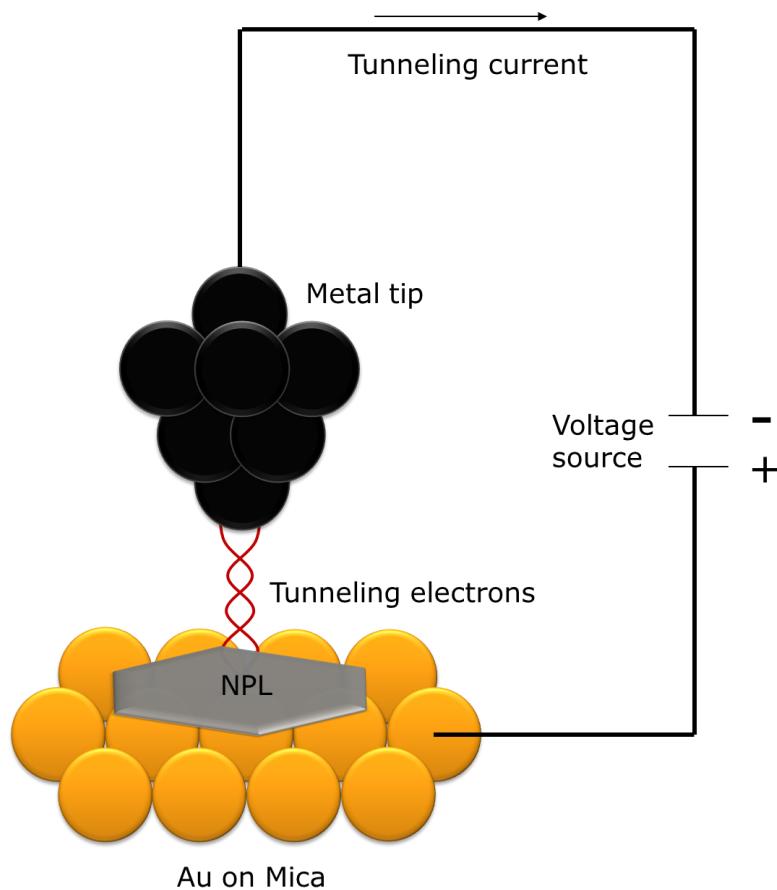
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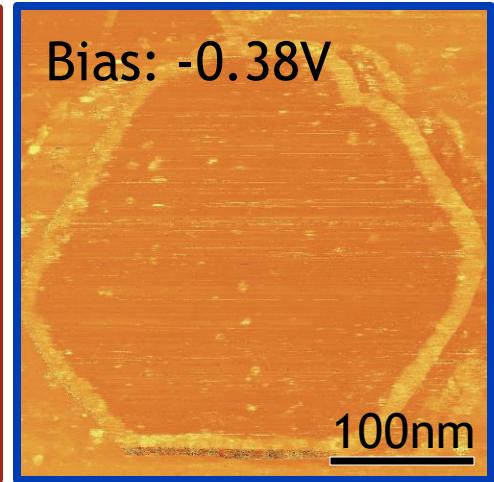
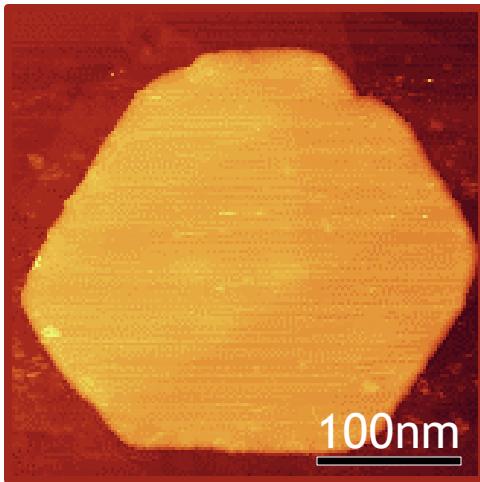
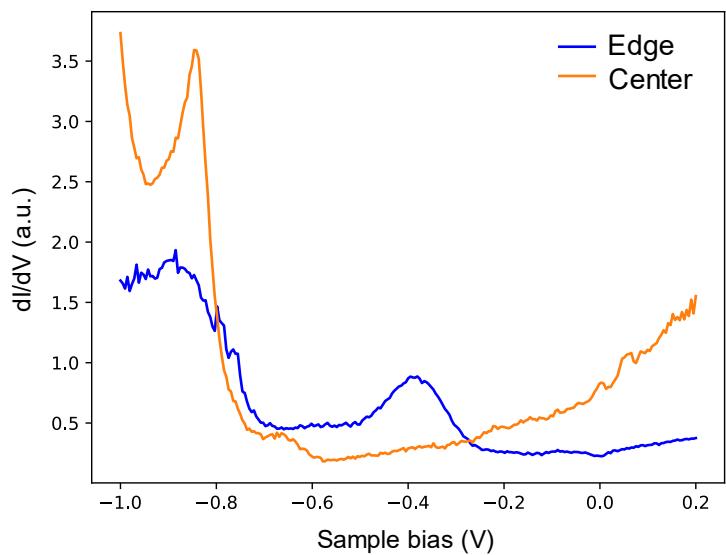


Temperature dependent emission

Another example



Another example



Contact Information

Visit our website

<http://www2.projects.science.uu.nl/wwwcmi/>

Contact a group leader for more information about potential research projects.

<https://www.uu.nl/en/research/debye-institute-for-nanomaterials-science/education/phd-programme>

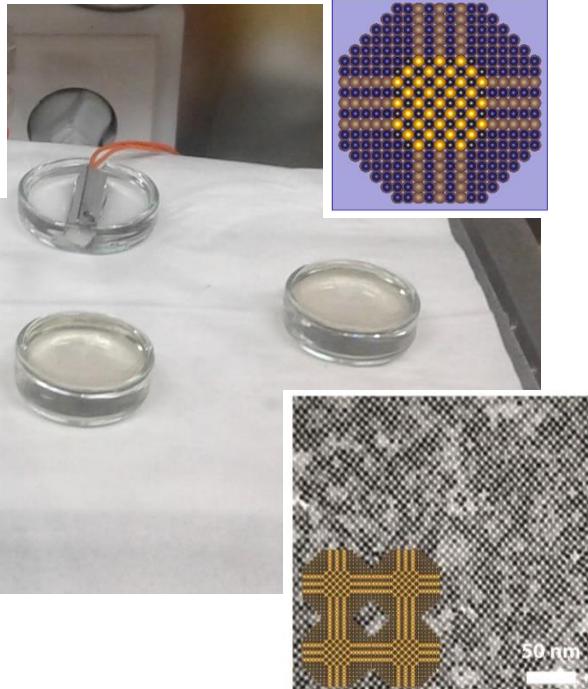
a.meijerink@uu.nl
c.demello-donega@uu.nl
d.vanmaekelbergh@uu.nl
i.swart@uu.nl
z.zanolli@uu.nl
m.e.kamminga@uu.nl

Contact Andries Meijerink for general questions

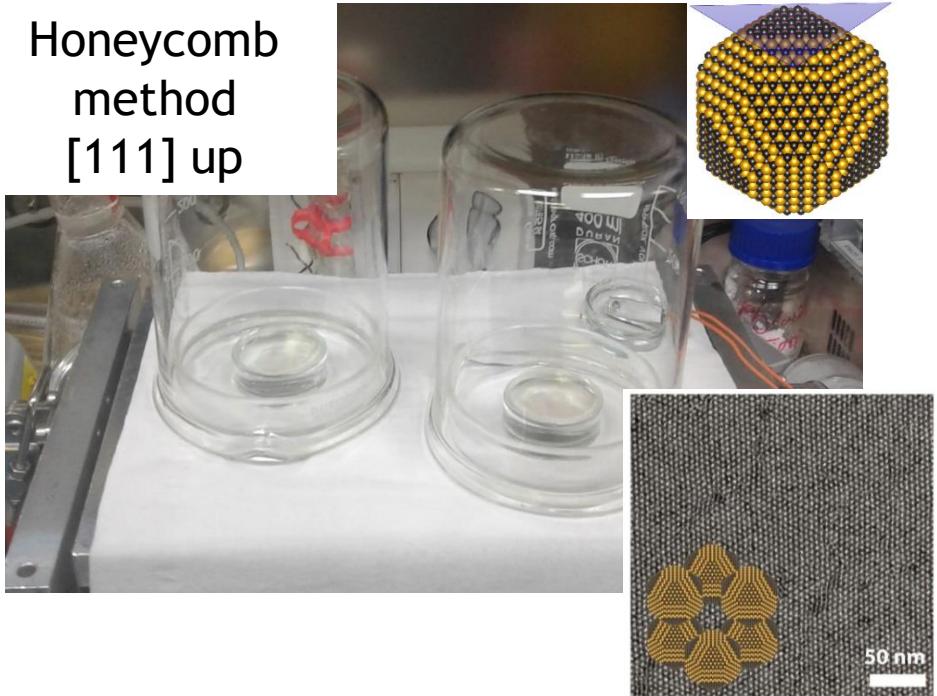
PhD candidates are quite willing to explain their (or others) topics.
E-mail addresses can be found on the website.

j.f.vliem@uu.nl

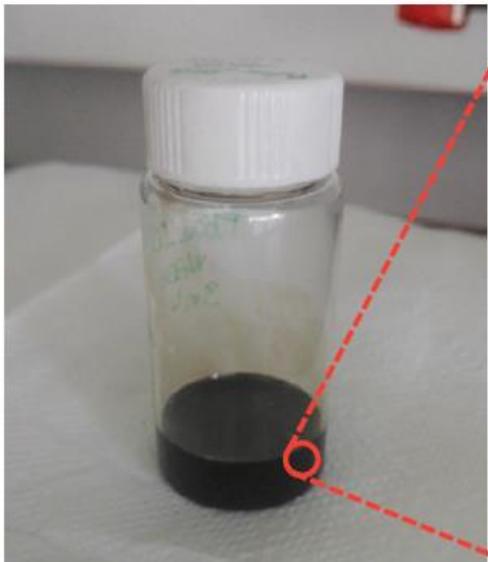
Square method [100] up



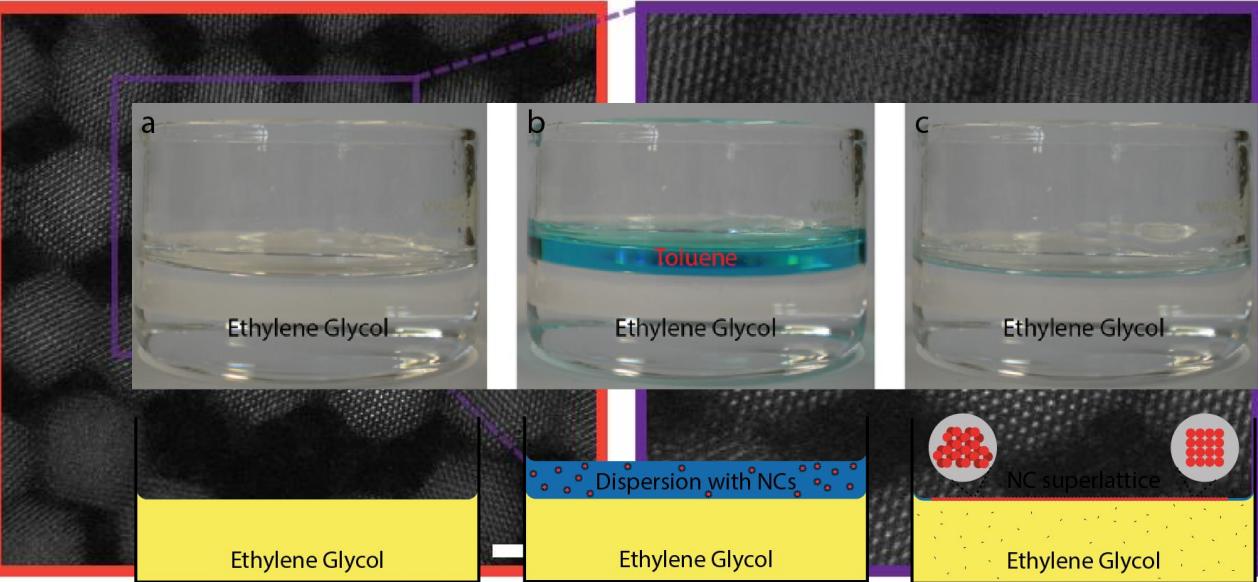
Honeycomb method [111] up



a

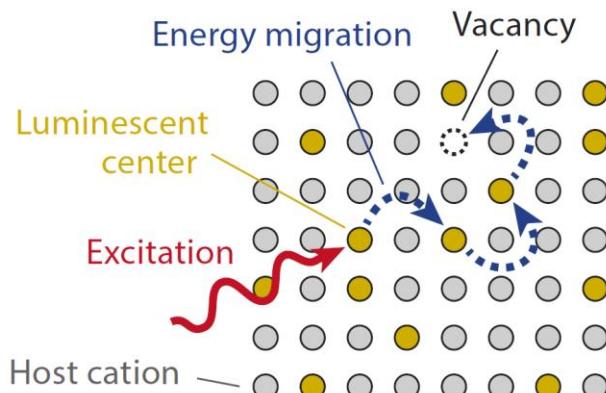


b

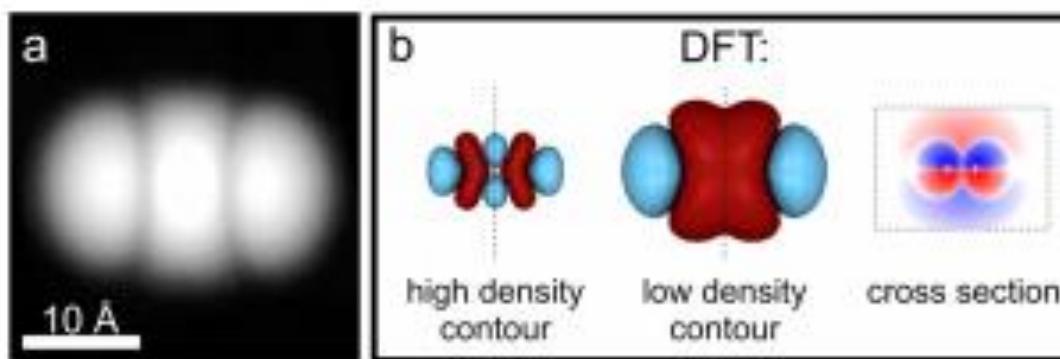


Modelling

- Monte Carlo simulations of excited state dynamics



- Ab initio wavefunction-based calculations of excited states on (in)organic materials



Social activities

