

# Ultrafast Science and Applications Division

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Presentation of ELI Research  
Teams

11 May 2022

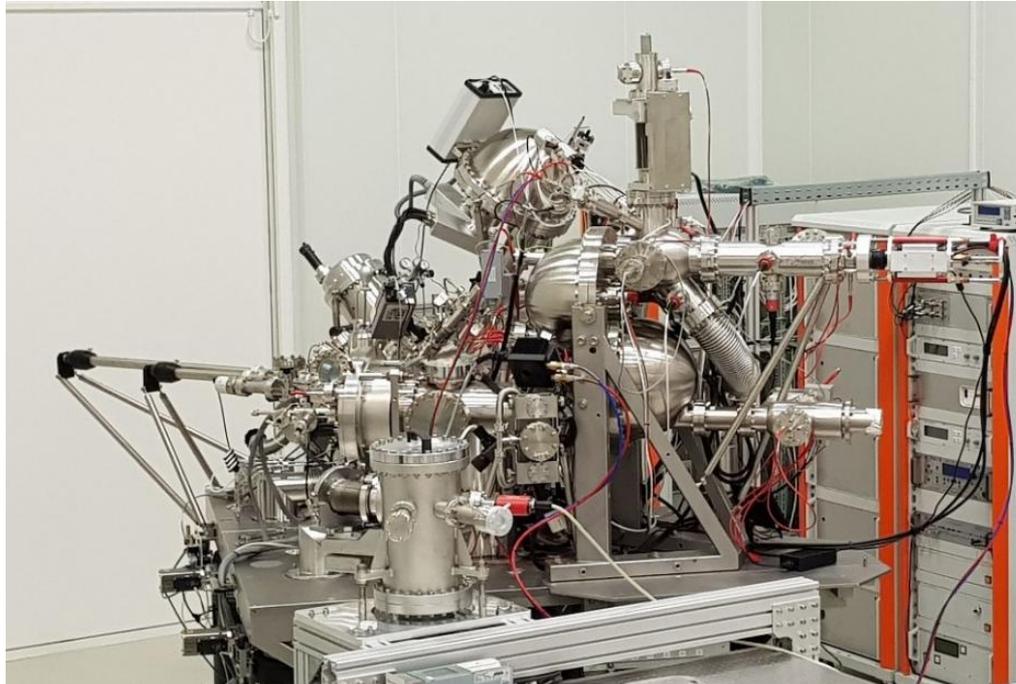


# #1 NanoESCA user endstation

both PEEM and k-space imaging, spin filter

Absolute uniqueness in combination with XUV beamline

Fields of research: all areas of surface science, plasmonics, incl. time-resolved experiments with visible and XUV light



# #1 NanoESCA user experiments

| User  | Title  | Status  |
|---|--|---|
| 1 Zoltán Kónya<br>Uni Szeged<br>Hungary                   | <b>Electronic structure of two dimensional hexagonal boron nitride on Au coated Rh(111) surface studied by NanoESCA</b>  | completed,<br>manuscript in<br>preparation      |
| 2 Pavel Markeev<br>University of Twente<br>Netherlands    | <b>PEEM measurement of ionization energy and interface quality of 2D Transition Metal Dichalcogenides and semiconducting organic nanolayer heterojunctions</b> | completed,<br>evaluation of data<br>in progress |
| 3 Péter Sándor Tóth<br>Uni Szeged                         | <b>The effects of substrate on the electronic structure of two-dimensional MoS<sub>2</sub> studied by NanoESCA and TAS</b>                                     | completed,<br>manuscript in<br>preparation      |
| 4 Teng Ma<br>Shenyang Agricultural<br>University<br>China | <b>Electronic structure of ceria islands confined on Au surface</b>  | measurements in<br>progress                     |
| 5 Zoltán Kónya<br>Uni Szeged                              | <b>Follow up experiments about the electronic structure of two dimensional hexagonal boron nitride on Au coated Rh(111) surface studied by NanoESCA</b>        | in preparation                                  |

# #1 NanoESCA user experiments

| Partner   | Title  | Status                          |
|---|--|---------------------------------|
| 6 Martin Aeschlimann<br>University of Kaiserslautern<br>Stefan Mathias<br>University of Göttingen | <b>Band structure evolution during the ultrafast ferromagnetic-paramagnetic phase transition in cobalt</b>   | partially done                  |
| 7 Martin Aeschlimann<br>University of Kaiserslautern<br>Stefan Mathias<br>University of Göttingen | <b>Spin-dependent band structure and magnetization dynamics of a 2D surface alloy formed on noble metal surfaces</b>   | in preparation                  |
| Tiju Thomas - IIT Madras<br>Ariful Rahaman – VIT Tamil Nadu, India                                | <b>IR reflective polymer/PCM encapsulations for rendering perovskite photovoltaics environmentally robust and efficient: aging, durability and efficiency studies through solar simulations, spectroscopy and ab initio analysis</b> | Experiments to start in Q2 2022 |

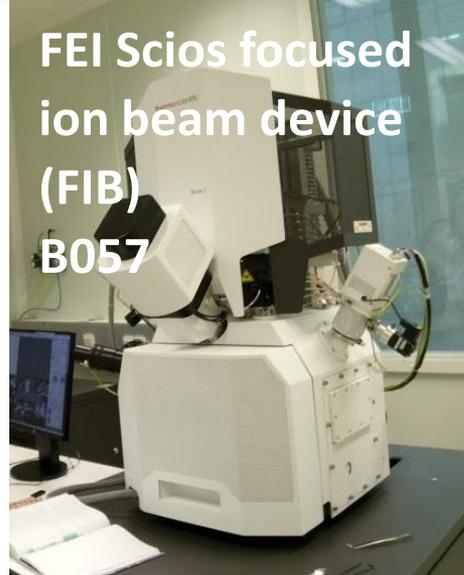
## #2 Nanofabrication laboratory



Raith e-beam lithography device (EBL) B053



FEI Scios focused ion beam device (FIB) B057



### EBL

- electron beam lithography for nanostructures
- electron microscopy (SEM)
- EDX elemental analysis

### FIB

- direct writing of nanostructures
- milling of cross-sections
- nanoscale drilling
- preparation of TEM lamella

Sample preparation - B054



Creamet thermal evaporator - B055

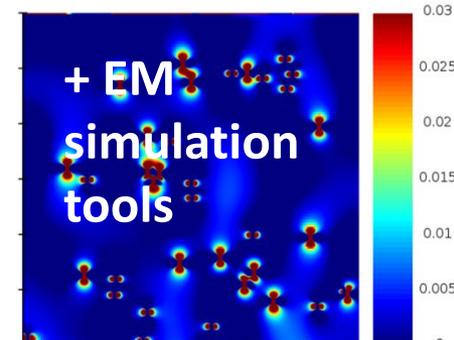


TPT Bonder - B051



All steps of nanostructure production are available in the clean room area of B050-57.

+ EM simulation tools



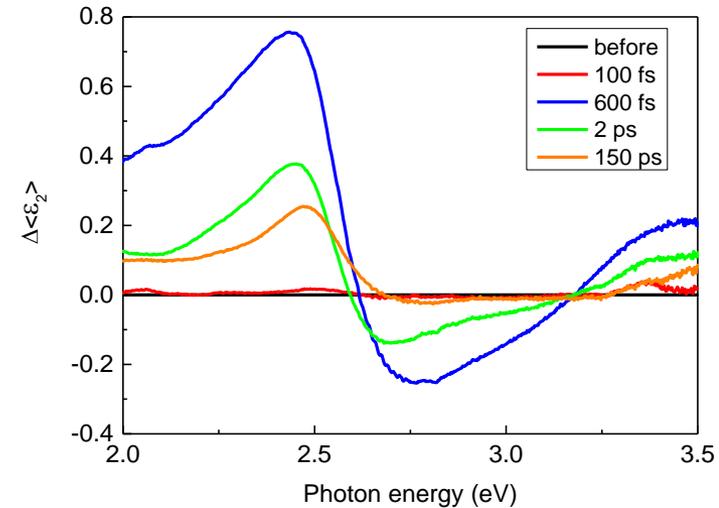
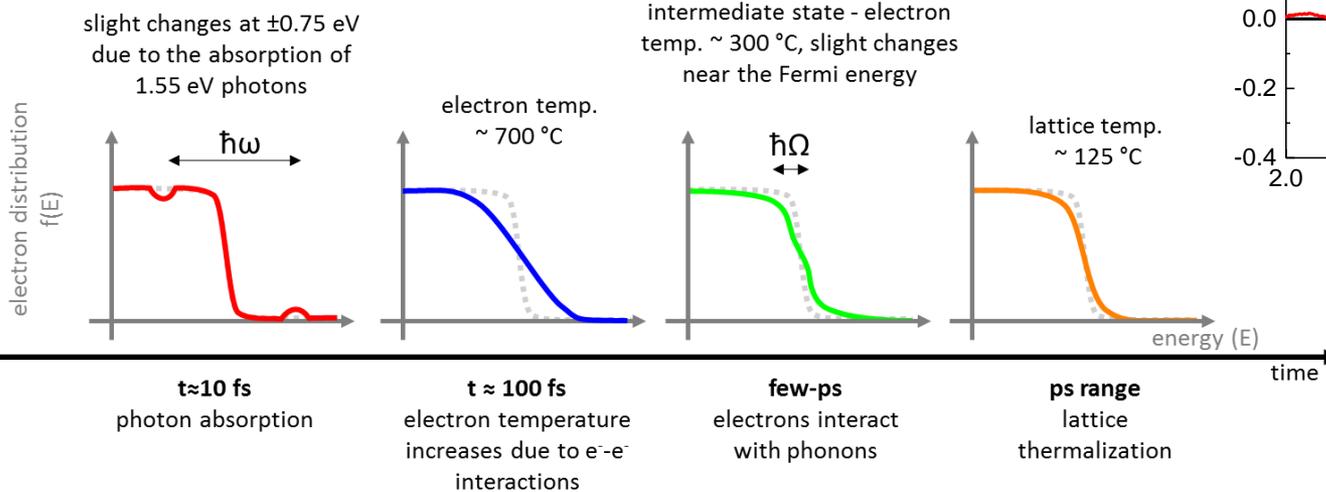
## #2 Nanofab projects

| User                   | Project   | Device used                | Status  |
|------------------------|---|----------------------------|---|
| FORTH, Greece          | MIR irradiation of solids                                     | SEM, simulation tools      | Simulations <b>in progress</b>  |
| U. Szeged (Bozóki Z.)  | Drilling holes into Si  | FIB                        | Feasibility study finalized<br>K+F contract <b>in progress</b>        |
| U. Szeged (Sápi A.)    | Nanostructured sample for sensing                             | EBL, thermal evaporator    | Feasibility experiments <b>in progress</b>                            |
| Wigner RCP Budapest    | Photoelectron spectroscopy of nanostructured samples @ HR lab | EBL, simulation tools      | <b>Finalized – Appl. Phys. Lett. paper accepted</b>                   |
| TU Graz, Austria       | Investigation of propagating plasmons                         | EBL, FIB, simulation tools | Samples <b>finalized</b>  |
| Museum of Sopron       | Identifying elemental content of ancient tools                | EDX                        | Kick off meeting <b>in progress</b>                                   |
| Wigner RCP (Sándor P.) | Preparation of plasmonic waveguides                           | EBL, simulation tools      | Samples <b>finalized</b>  |
| Wigner RCP (V. Hanus)  | Electrode samples for current control experiments             | EBL                        | <b>Optica paper out (2021)</b><br><b>sample preparation continued</b> |
|                        |   |                            |   |

# #3 Ultrafast ellipsometry of plasmonic structures - collaboration with ELI-Beamlines

**Aim:** to monitor electron distribution upon excitation of plasmons in a gold layer and in gold nanostructures

**Time resolved study at ELI-Beamlines:** monitoring changes in the dielectric function during this process



➤ temporal resolution:  $\sim 100$  fs

# #4 Radiobiology: X-ray irradiator and dosimetry



**Radiobiology specific equipments:**  
self contained **cell and small animal x-ray irradiator**  
and dosimetry system.

**Cell lab:** 2 sterile laminar flows, inverse microscope, refrigerators and freezers (ultra-freezer), micro- and high capacity ultra-centrifuge, incubator and thermostat, hypoxic chamber



# #4 Radiobiology: Molecular biology lab



- **EnSight Multimode plate reader** for high-throughput screening, fluorescence imaging, AlphaLISA/AlphaScreen, time-resolved fluorescence and intensity detection, filter- and optional monochromator-based absorbance, ultra-sensitive luminescence for low signals, temperature control etc.
- **qT-PCR machine** (Roche Lightcycler 480) and **PCR machine**, for analyzing gene expression changes through signal transduction pathways.

Cost

# #4 Radiobiology: Analytical equipment



- 2 analytical balances
- pH meter
- Lambda35 (Perkin Elmer) double-beam UV/VIS spectrophotometer**, with variable bandwidth (190-1100nm) for measurements in absorbance range up to 3.2A. Suitable for liquids analysis, solid and powder samples. With the nanodrop adapter we can perform micro-volume analysis of purified nucleic acids and wide variety of proteins



Cost

# #4 Radiobiology: Zebrafish laboratory



- **ZebTec Multilink system**
- **Viewpoint ZebraBox** (high throughput monitoring of larvae) and the **ZebraTower** (for fish monitoring) is at our disposal for automated behavior analysis.



- **Zeiss Axio Observer Z1 Inverted fluorescence microscope**
- **Pico Injector** (Harvard Apparatus Model PLI-100A)
- **Apochromatic Stereo Microscope** (Zeiss Stemi 508) for microinjection and micromanipulation

Cost

# #4 Radiobiology: Histopathology laboratory



Completely equipped histology lab for processing different type of tissues (human, small animal, zebrafish) for microscopic studies, to examine the tissue characteristics and cell structures.

Equipments:

- **automatic tissue processor**
- **paraffin embedding station with cold plate**
- **heatable forceps**
- **automated slide stainer**
- **semi-motorized rotary microtome**
- **water bath**

