12/02/2026

ELI ULTRAFAST SCIENCE WORKSHOP
AT EUROPEAN XFEL

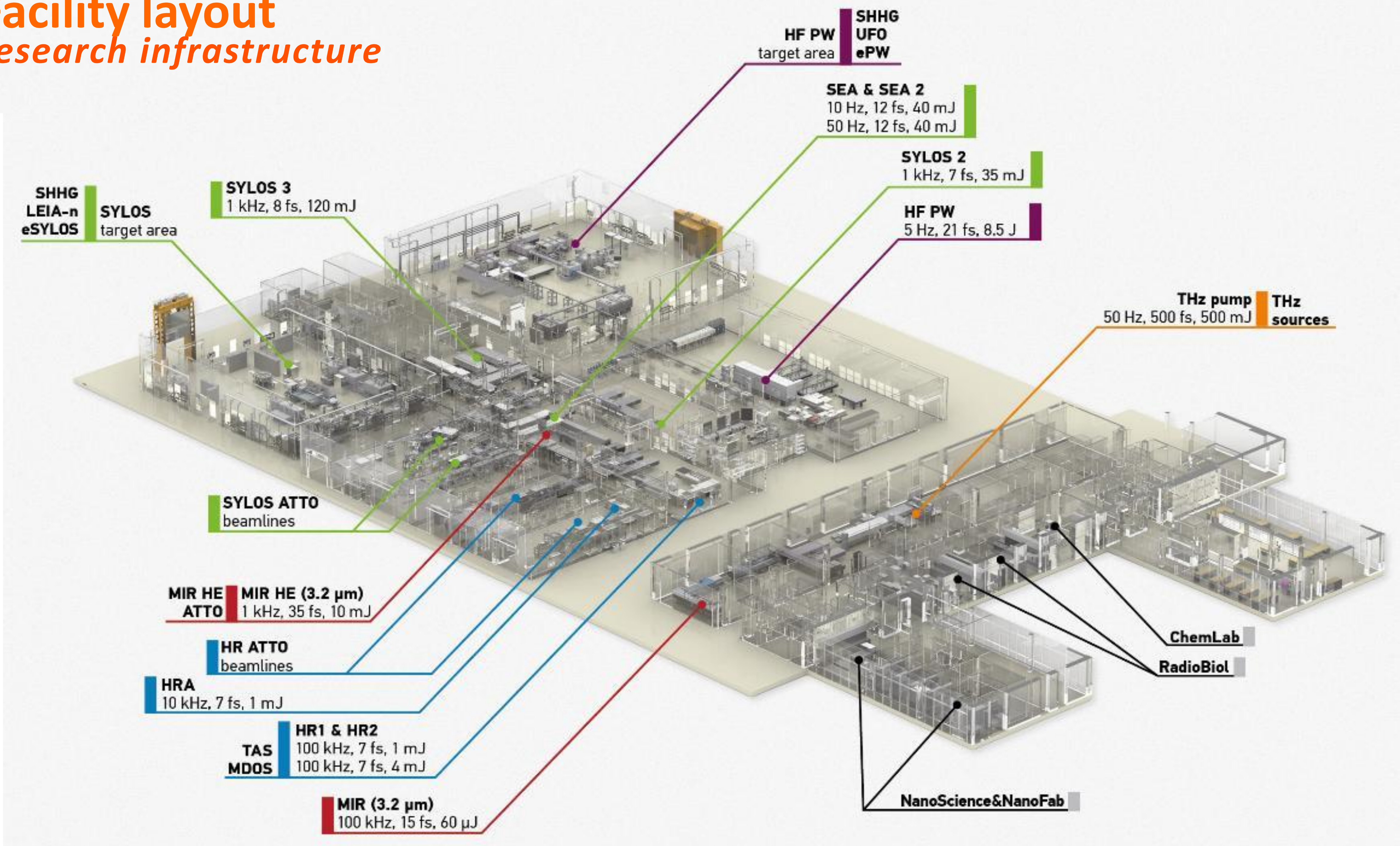
Unique Capabilities Enabled by ELI in the Ultrafast Science field

Katalin Varjú

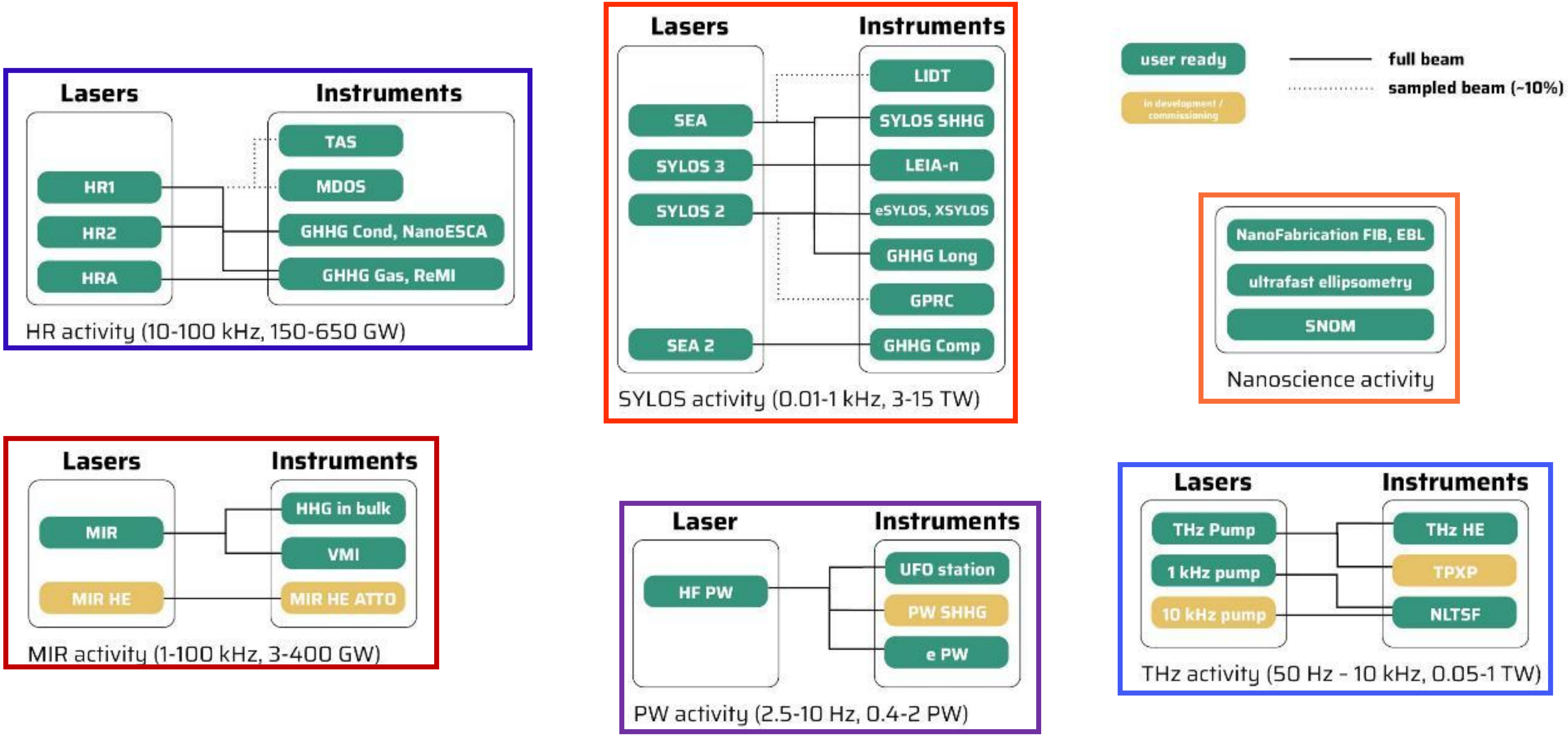
ELI ALPS, Science Director

EXTREME LIGHT INFRASTRUCTURE

Facility layout
research infrastructure



ELI ALPS Instrument Availability for Open-Access User Program

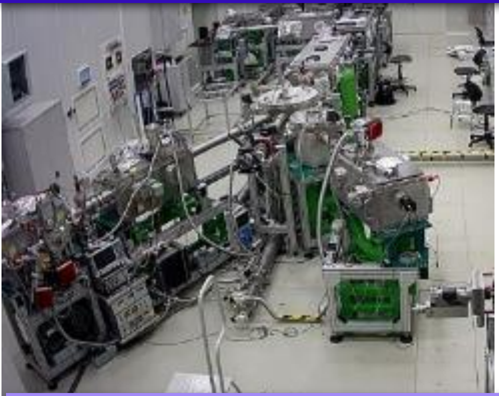


Research opportunities: capacity, capability and uniqueness

Lasers

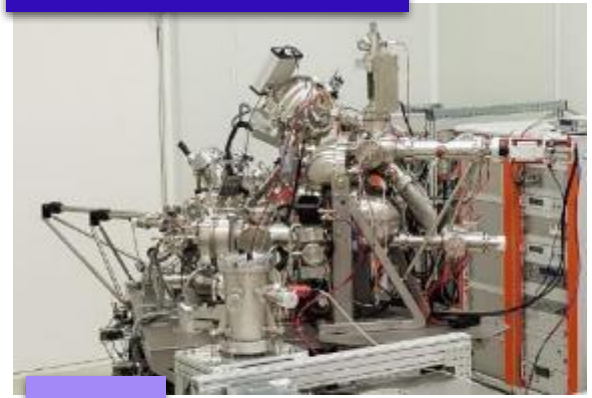
100 kHz, 1 kHz, 10 Hz, single shot
850 nm, 1030 nm, 3.2 µm
150 µJ, 1 mJ, 120 mJ, 10 J
most few cycles, many CEP-stable

Secondary Sources



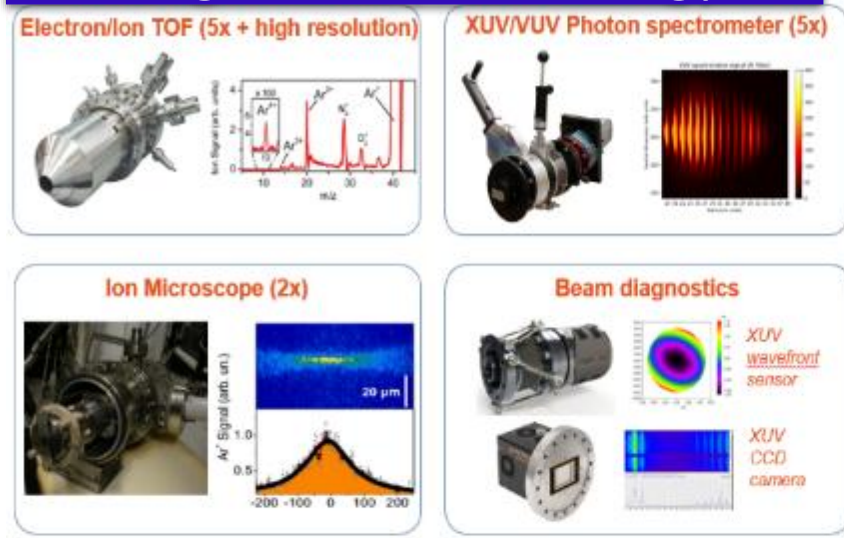
- XUV – X-ray attosecond pulses
- THz pulses
- particle bunches

Endstations

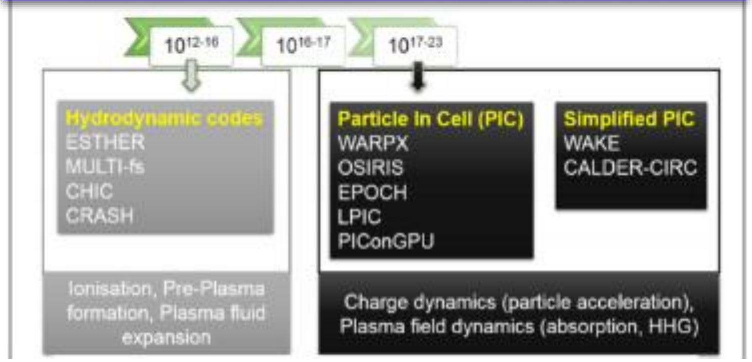


- AMO
- condensed matter
- nano-science
- femto pump-probe
- irradiation stations

Diagnostics / Metrology



Simulation tools in intense laser matter interaction



HR Lasers (100 kHz)

activefiber systems

HR 1	Long	Short
Energy	1.2 mJ	1.0 mJ
Duration	30-35 fs	6-8 fs
Rep.rate	100 kHz	
CEP	-	600 mrad

HR 2	Long	Short
Energy	6 mJ (*)	4 mJ (*)
Duration	35-60 fs	**6.2 fs**
Rep.rate	100 kHz	
CEP	-	**426 mrad**

(*) only 1.5mJ toward the HHG beamline, before the necessary upgrades

HR AL	Long	Short
Energy	1.3 mJ	1.0 mJ
Duration	30 fs	5.7 fs
Rep.rate	1-10 kHz	
CEP	<300 mrad	<300 mrad

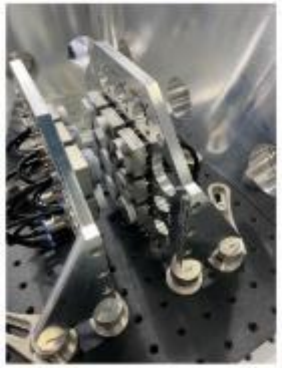
Highest average power for 2-cycle laser systems

Diagnostics

Pulse metrology including:

- Pulse duration and spectral phase (D-scan, Autocorrelator)
- CEP measurement and CEP tagging (stereo ATI)
- M^2 measurment
- Spectrometer
- Intensity contrast (Thundra+)
- Spatio-temporal coupling (Sphere ICE)

Hädrich et al, Opt.Lett 41, 4332 (2016)
Shestaev et al, Opt. Lett 45, 6350 (2020)
Nagy et al, Optica 6, 1423 (2019)
Shestaev et al, Opt. Lett. 45, 97-100 (2020)
Hädrich et al, Opt.Lett 47, 1537 (2022)
Gilicze, et al High Power Laser Sci and Eng, 13, e104 (2025).
Seres et al, High Power Laser Sci and Eng, (in print)



User portal
https://up.eli-laser.eu/laser/1723138085
https://up.eli-laser.eu/laser/1725792297
https://up.eli-laser.eu/laser/1723138118/

HR Gas Attosource request

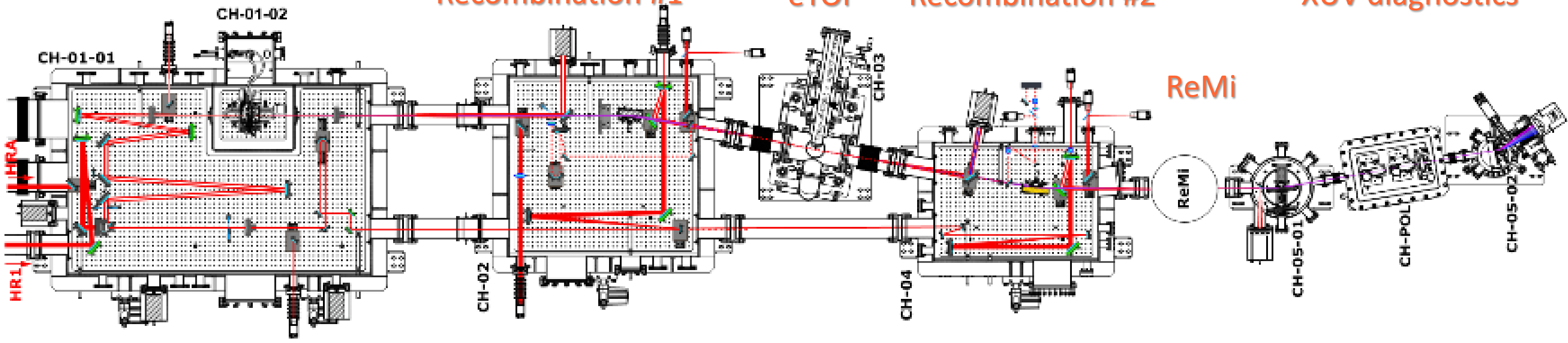
Parameters

	XUV parameters
Repetition rate	Up to 10 kHz (HR-A) 100 kHz (HR-1)
Pulse energy (max.)	600 pJ (110 pJ on target)
Pulse duration	<400 as (in <12 fs APT)
Spectral bandwidth	17 nm - 50 nm (25 eV - 70 eV)
Polarization	linear (p or s)

	IR parameters
Central wavelength	1030 nm
Pulse energy	up to 80 µJ
Pulse duration	35 fs (long pulse mode) 6.2 fs (short pulse mode)

Layout

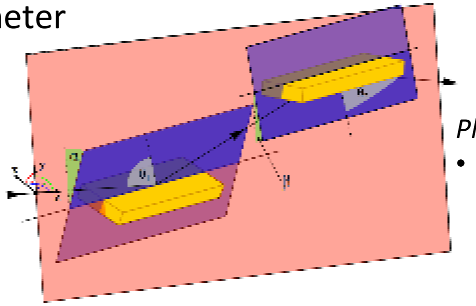
IR focusing HHG — Recombination #1 — eTOF — Recombination #2 — ReMi — XUV diagnostics



Ye et al., Ultrafast Science 2022, 9823783 (2022)

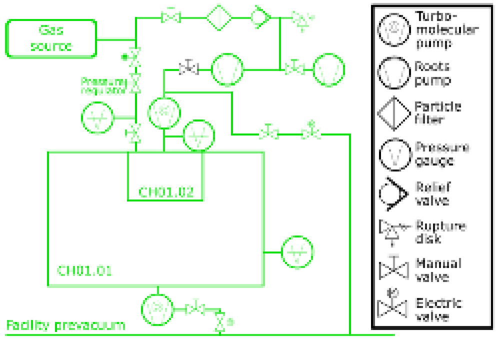
Diagnostics

- eTOF
- Calibrated XUV photodiode
- XUV flat-field spectrometer
- XUV polarimeter



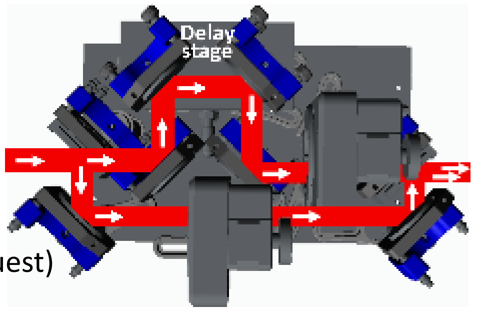
Frassetto et al., Proc. of SPIE Vol. 110380M-1 (2019)

Closed-cycle gas reusing system



Planned

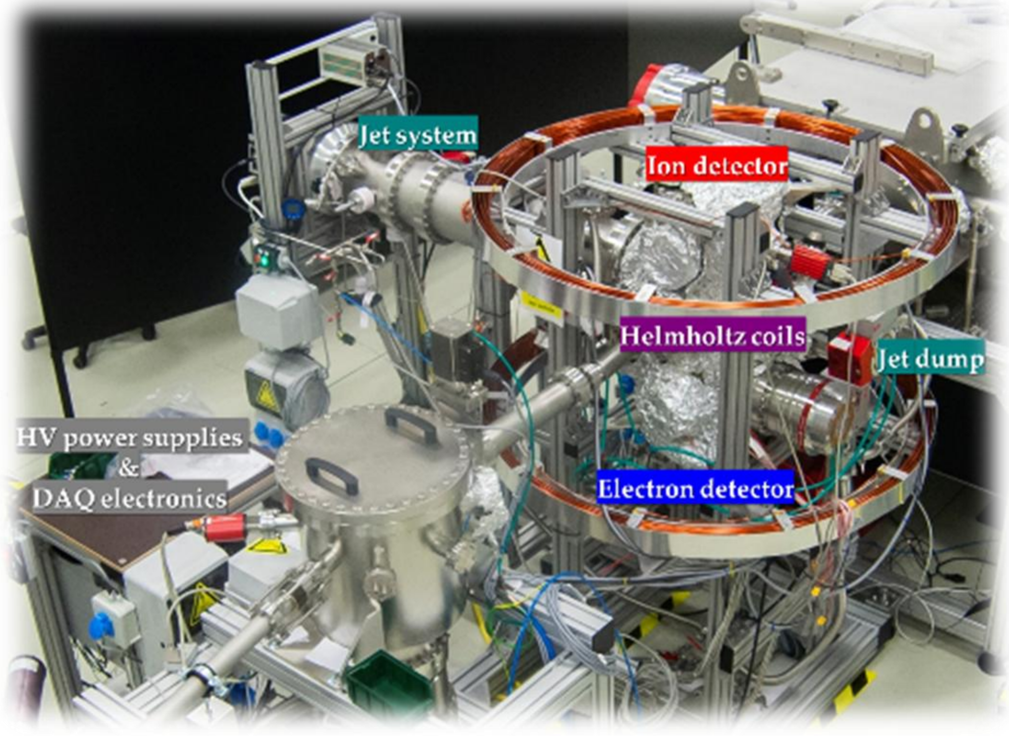
- Reflection-based intensity control



Compact modular IR wavefront splitting for XUV-XUV pump-probe spectroscopy (upon request)

User portal: https://up.eli-laser.eu/equipment/1723204031

ReMi



Parameters

	Electron detector	Ion detector
Type	RoentDek HEX75L	RoentDek HEX75b
Triple layer detector active area	100 mm	75 mm
Frequency range	up to 500 kHz	
Dark counts	less than 100 Hz	
Spatial resolution	better than 120 mm RMS	
Temporal resolution	better than 170 ps RMS	
Detection efficiency	63%	
Dead time	0 ns if dR > 15 mm	
Image linearity	35 mm RMS after software correction	
Energy range	max. 270 eV	

Diagnostics

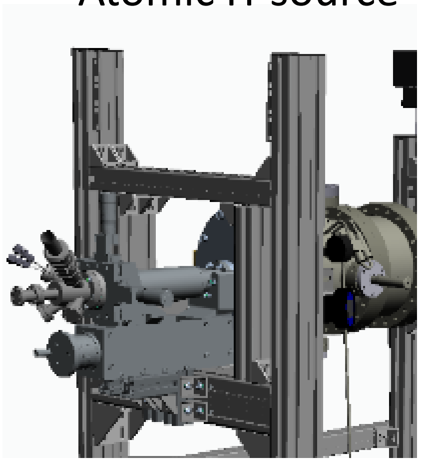
- Residual gas analyzer
- CEP tagging (in short pulse mode)

User portal: https://up.eli-laser.eu/equipment/1723204076

Custom targetry

Bubbler for volatile liquid samples

Atomic H-source



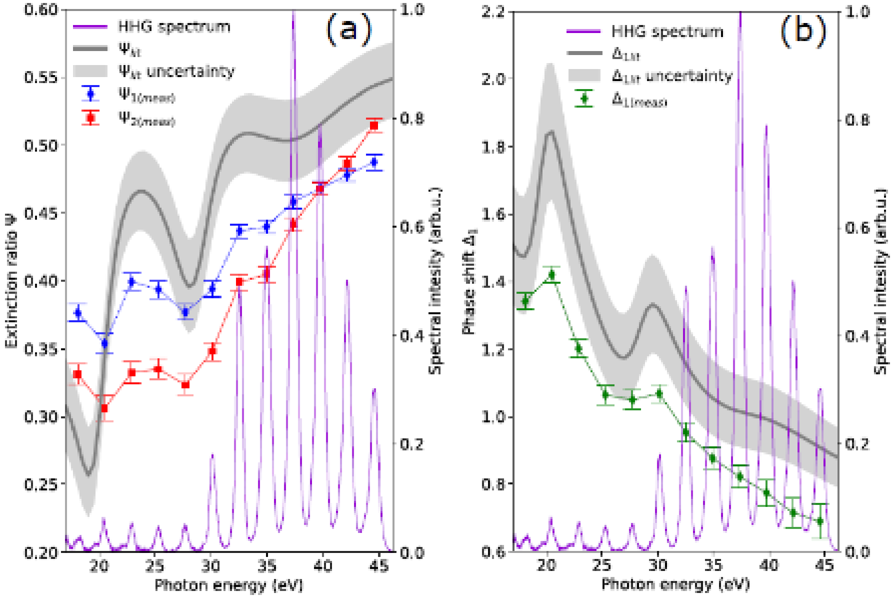
Planned

- Heated nozzle

HR Gas + ReMi experiment highlights

Combined table-top XUV ellipsometry and polarimetry

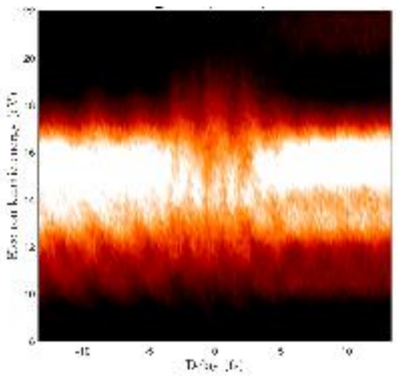
PI: Lénárd Gulyás Oldal, ELI ALPS
Experiment ID: ELIUPM3-62_POLARUV_LGO



Gulyás Oldal et al., J. Phys. Photonics 8 01LT01 (2026).

- Simultaneous determination of optical constants and polarization from light-matter interaction

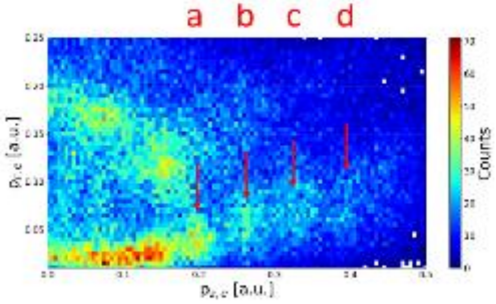
First streaking measurement (milestone)



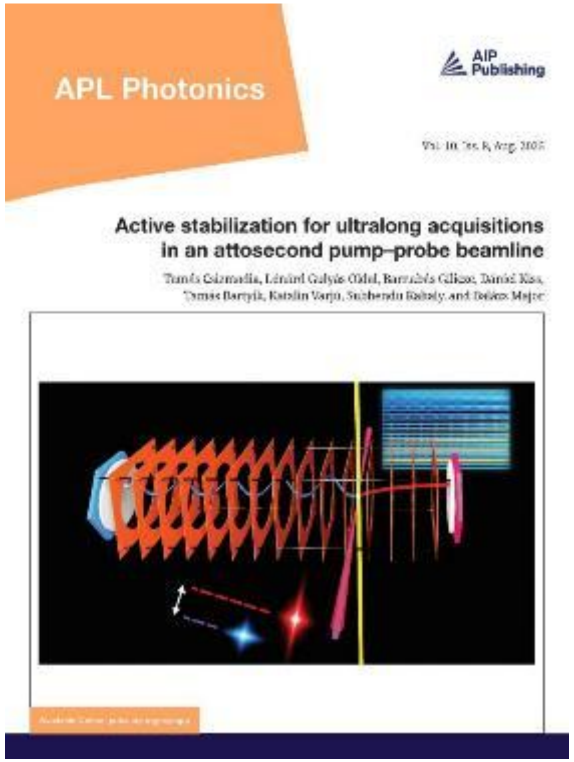
PI: Predrag Ranitović, University of Belgrade
Experiment ID: eli60072_ATTOLOCK

Angle-resolved strong-field ionization in argon target

- Analyzing angle- and energy-dependent features in a strong-field experiment



Optically locked attosecond interferometer

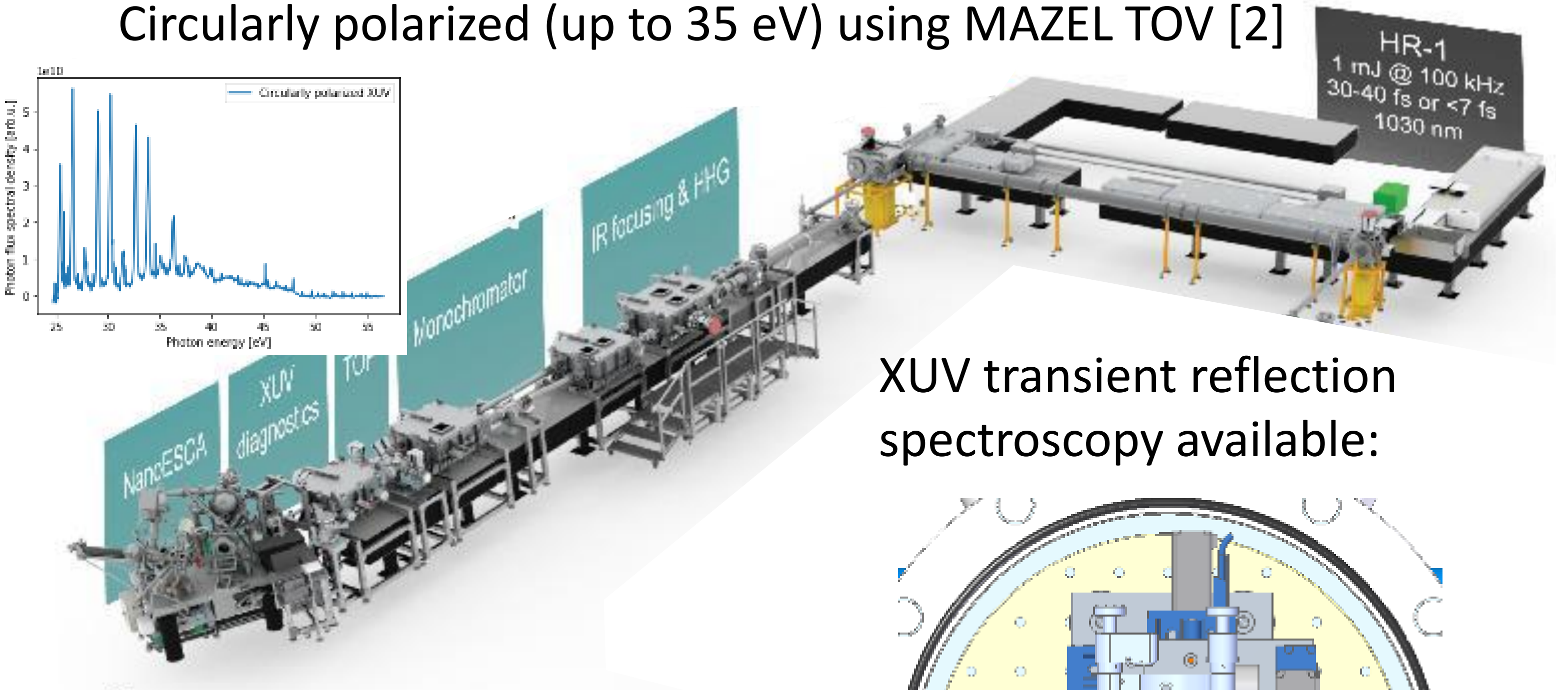


Csizmadia et al., APL Photonics 10, 080803 (2025)

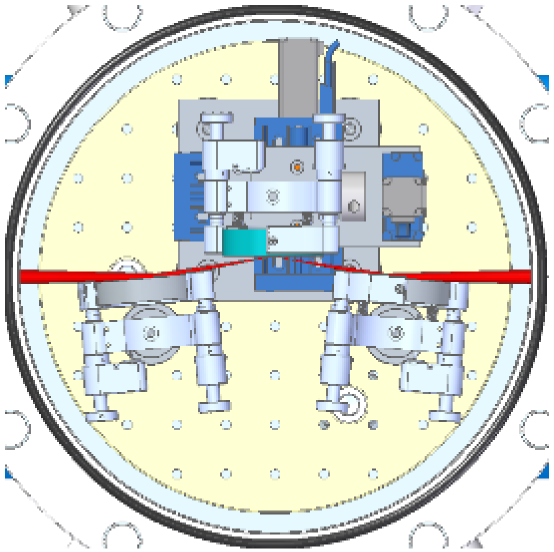
- Long-term stabilization of a noncollinear interferometer with sub-optical cycle precision via sensitive polarization control

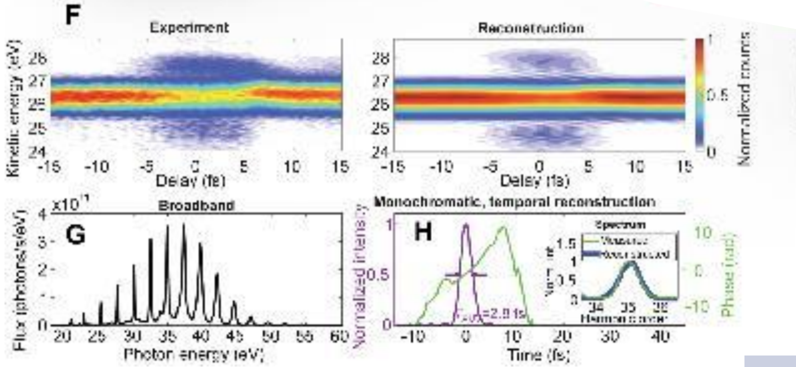
HR Condensed Attosource

Circularly polarized (up to 35 eV) using MAZEL TOV [2]



XUV transient reflection spectroscopy available:





Parameter	Available now (HR-1 short pulse mode, Ar gas, Al filter)
Repetition rate	100 kHz
Energy stability	±20 %
Pulse duration	170 as pulses (in 20 fs attosecond pulse train during broadband operation, down to 15 fs in monochromatic operation) [1].
Average power	9.5 µW XUV (3.4 µW on target) in broadband operation
Pulse energy (Min-Max range)	3 - 95 pJ (1 - 34 pJ on target) in broadband operation
Central wavelength	30 nm (42 eV) (tunable)
Spectral bandwidth	19 - 39 nm (32 - 66 eV) (tunable)
Polarization	Linear (arb. angle, not possible limitations), circular (MAZEL TOV [2])
Near field intensity distribution	Gaussian
Beam size	~100 um on target (see Ref. [1])
Standard diagnostics	• Electron TOF spectrometer • XUV photodiode (NIST 40790C) • XUV flat-field spectrometer

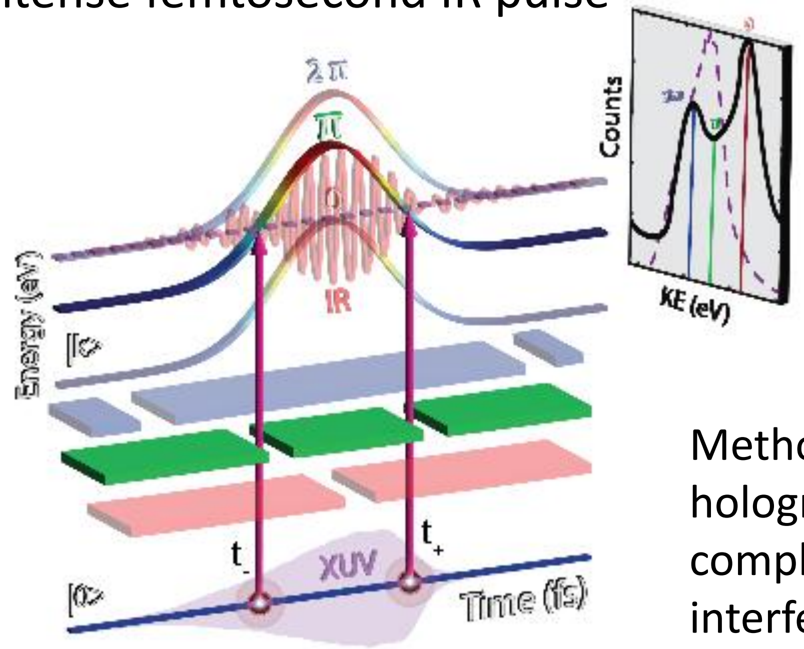
[1] T. Csizmadia et al., APL Photonics 8, 056105 (2023). https://doi.org/10.1063/5.0147576

User portal: https://up.eli-laser.eu/equipment/1415577880

[2] O. Kfir et al., Appl. Phys. Lett. 108, 211106 (2016); https://doi.org/10.1063/1.4952436

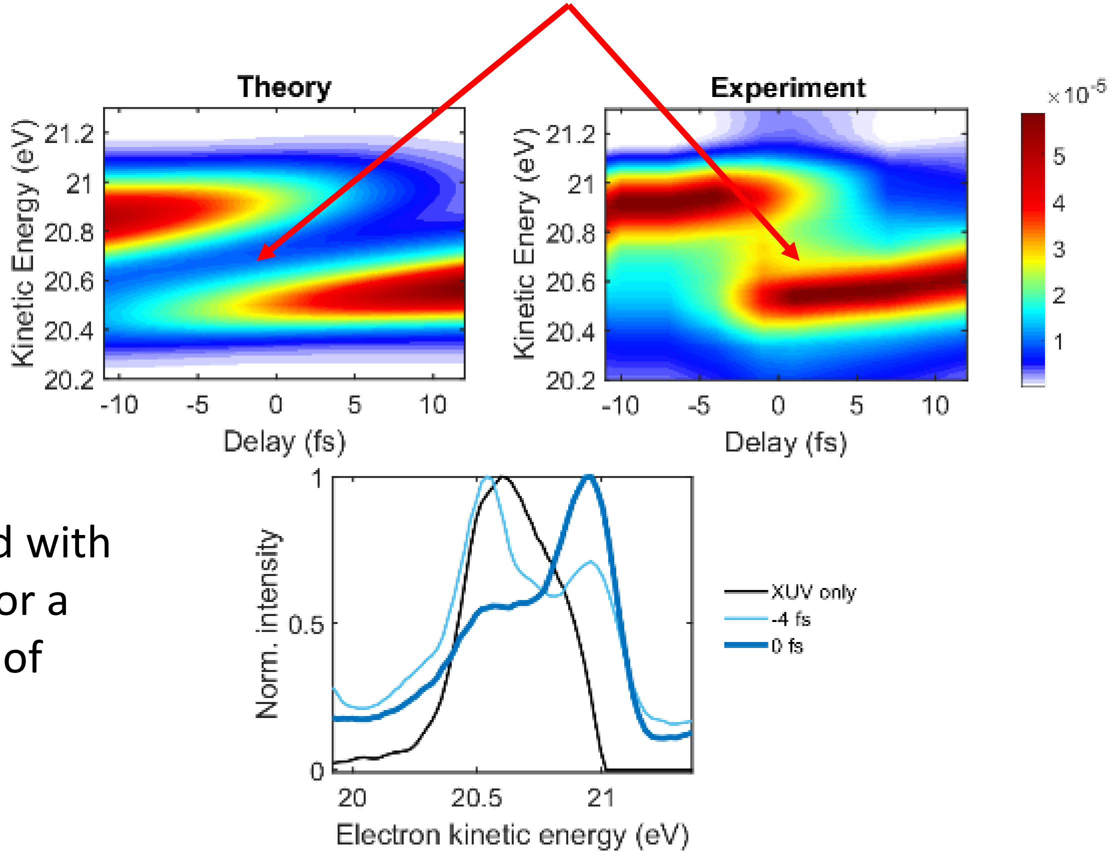
HR Condensed – experiment highlights

Double-slit experiment in time domain using chirped femtosecond XUV pulses and moderately intense femtosecond IR pulse



Courtesy of F. Vismarra

Interfering photoelectron wave packets



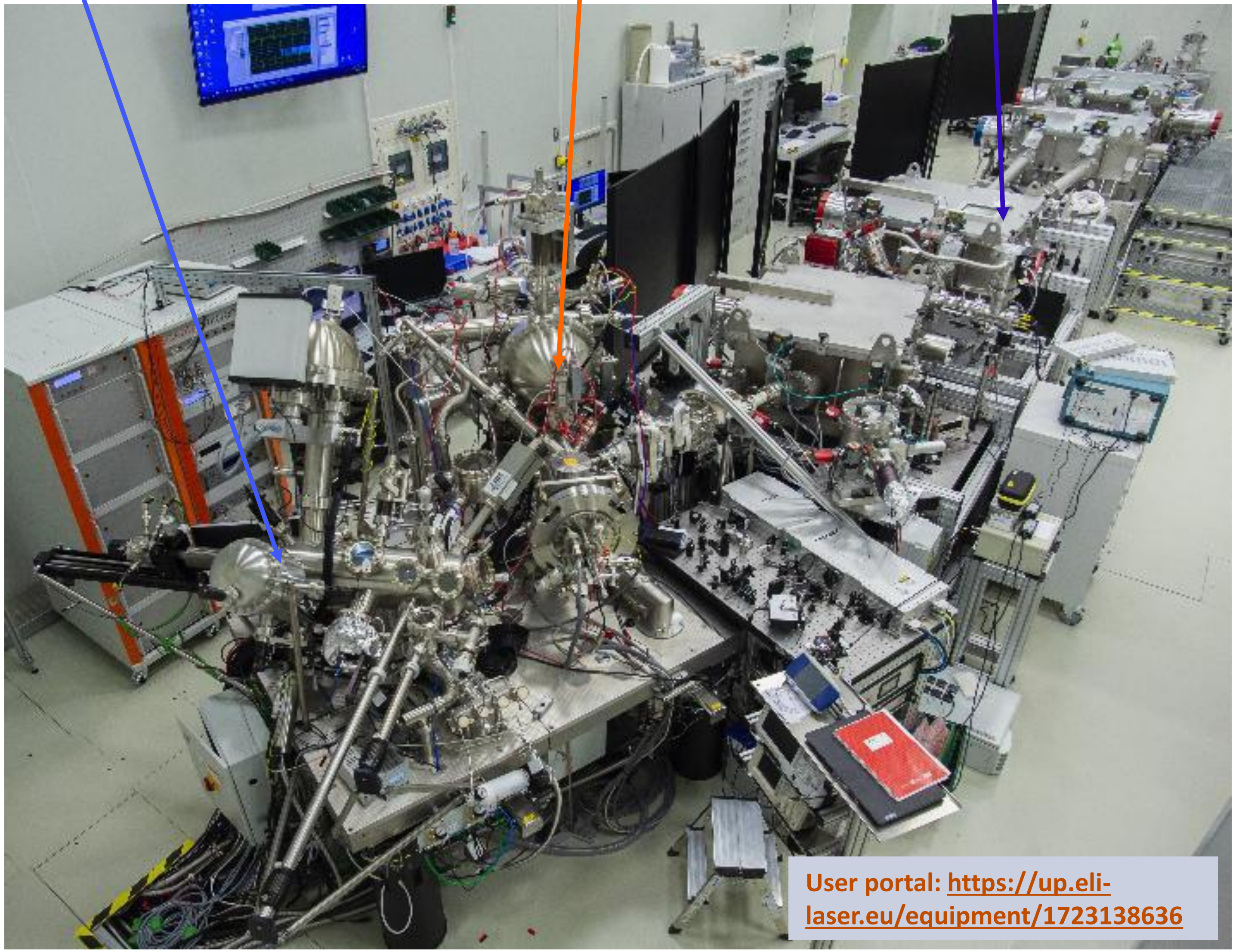
Method can be combined with holographic techniques for a complete reconstruction of interfering wavepackets.

Theory: M. Bertolino et al., Physical Review A 106, 043108 (2022). https://doi.org/10.1103/PhysRevA.106.043108

Experiment (at HR Condensed): F. Vismarra et al., Physical Review Letters 135 (3), 033202 (2025). https://doi.org/10.1103/73tl-w87y

NanoESCA endstation

Preparation chamber Analysis chamber HR Condensed beamline



User portal: https://up.eli-laser.eu/equipment/1723138636

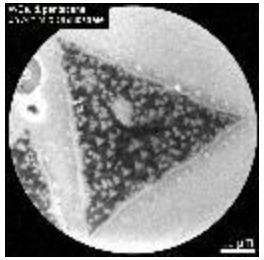
-Sample Cleaning:
- Ar^+ ion sputtering and annealing
- Cleaving on suitable samples

-Preparation:
- **e-beam evaporator:** metal and organic compound deposition
- **Gas dozer line:** used for adsorption or simple surface reactions

-Characterization (laterally averaged):
- **LEED** (Low Energy Electron Diffraction)
- **XPS**: quantitative chemical analysis of the surface monochromatic Al K_a X-ray source

-Modes:
- **PEEM:** Photoemission electron microscope – Energy filtered real or momentum space mode
- **Imaging spin filter:** Spin-resolved photoemission capability

Real space



FOV: 74 μm – WSe_2

k-space

FOV: 5.2 A^{-1} Fermi surface of Au(111)

-Internal VUV Light sources for **static experiments**:
- He lamp: HeI: 21.2 eV and HeII: 40.8 eV

-Time-resolved / pump-probe experiments

HR Condensed beamline (100 kHz):
- Pump: HR laser fundamental **IR** - (1.2 eV – 1030 nm)
- Probe: GHH generated extreme ultraviolet (**XUV**) light (20-75 eV)
- Monochromatized femtosecond XUV pulses
- RABBITT on solid surfaces - attosecond pulse trains

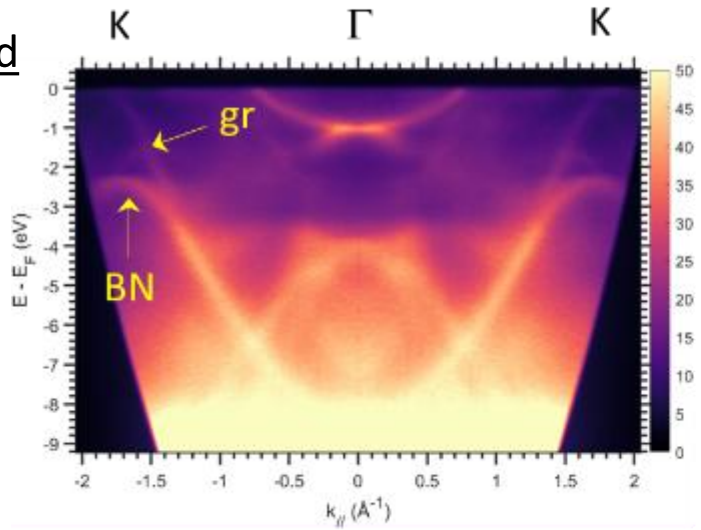
NanoESCA User Programme Highlights

NanoESCA: Preparation and band structural characterization of 2D BCN layer (Call 4)

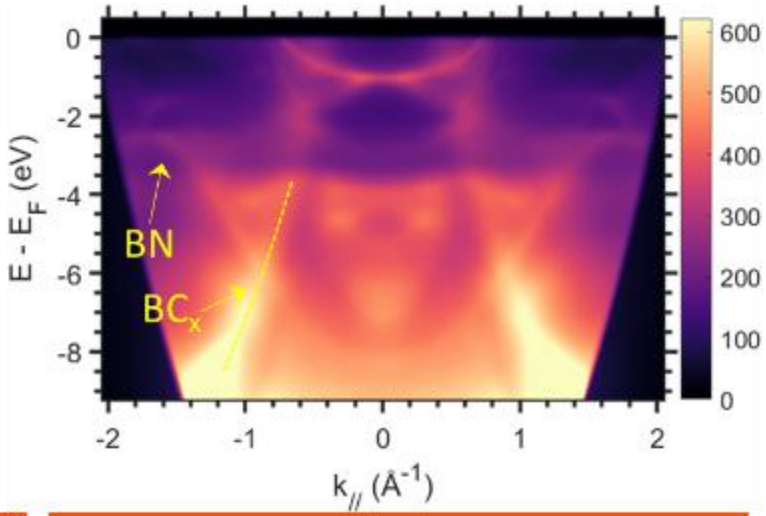
Motivation

- Graphene: a conducting 2D material
- Hexagonal boron nitride (h-BN): an insulating 2D material
- The mixing of graphene and h-BN is intensely studied to obtain a **semiconductor with a tunable band gap**
- **Challenge: strong tendency for phase separation**

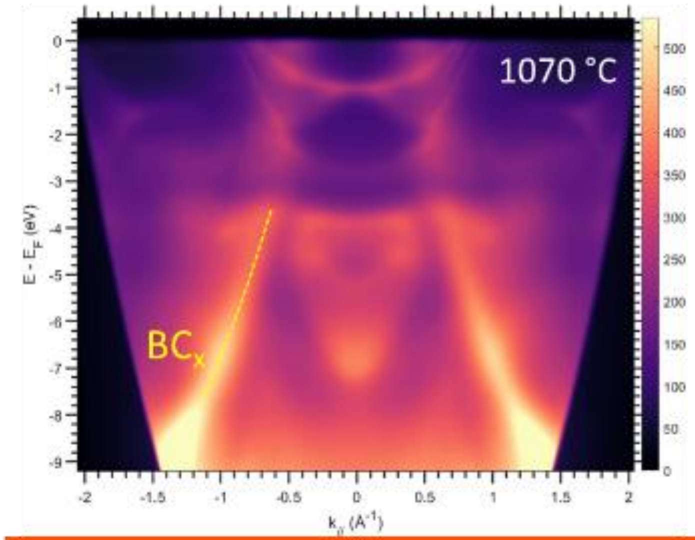
NanoESCA band structure measurements



740°C – phase separated graphene and h-BN



980°C – h-BN and 2D boron carbide (BC_x)



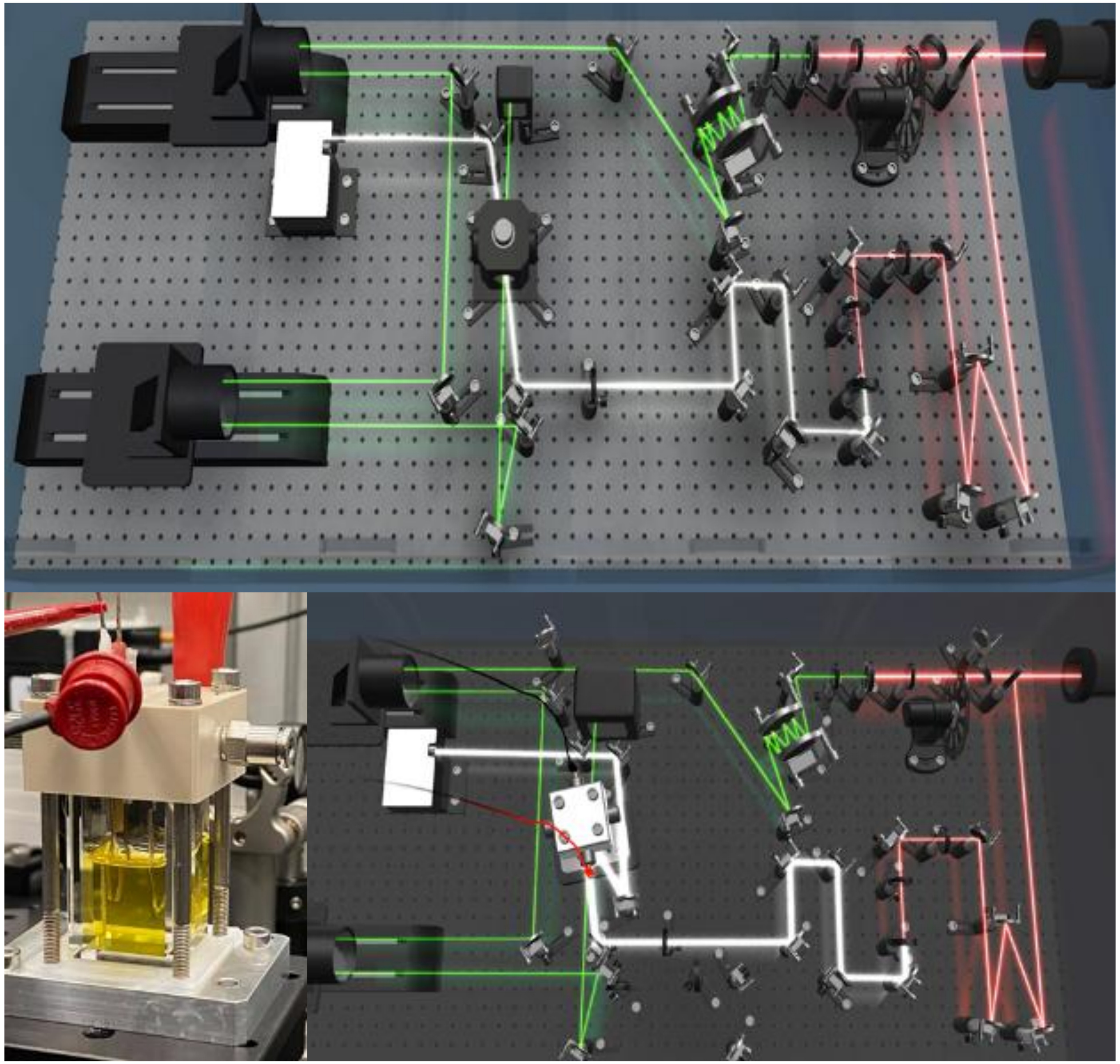
1070°C –2D boron carbide (BC_x)

Conclusions

- ❖ 1070 °C: the h-BN domains are so small that the h-BN band is not observable anymore (enhanced mixing). Excess B and C form 2D BC_x
- ❖ The formation of 2D boron carbide is unique, since no layered boron carbides exist in nature.
- ❖ Excess boron facilitates the mixing of the h-BN and graphene islands.

h-BN on Rh(111) G. Halasi, et al., npj 2D Mater. Appl. (2024) 8:48.

Femtochemistry-Transient absorption/reflection



A fraction of the main HR1 laser beam (100 kHz) after the first postcompression stage (10 W average power)

UV-Vis transient absorption/reflection:

- ~15 fs pump (excited state generation) – 515, 343 or 265 nm
- Probe (white light continuum) – 480 – 1030 nm
- Relaxation of the excited state can be monitored (up to 2 ns)
- Temperature controlled sample holder (-10°C - 135 °C)
- Both pump and probe polarization can be independently changed
- **Sample holders**: Both liquid (thin-wall flow cuvette) and thin film (electrochemical sample holder) samples can be studied

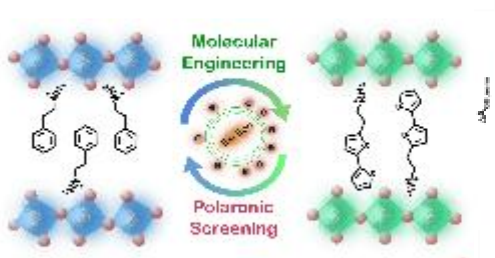
Transient spectroelectrochemical experiments:

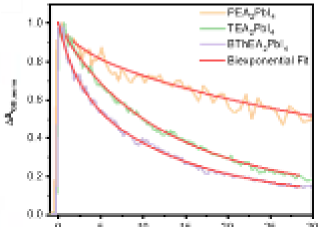
- Devices under operating conditions or with carrier buildup at interfaces
- Novel semiconductors (metal-halide perovskites)
- Electrochemical stability window must be ensured

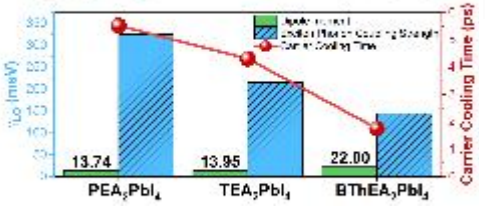
User portal: https://up.eli-laser.eu/equipment/1723072604

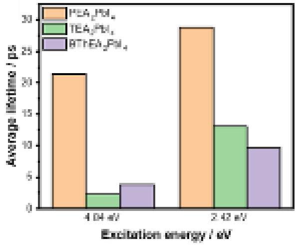
Femtochemistry- Transient absorption/reflection

Influence of spacer cations on the charge carrier dynamics of 2D perovskites thin films (*Sachin R. Rondiya/Indian Institute of Science*)





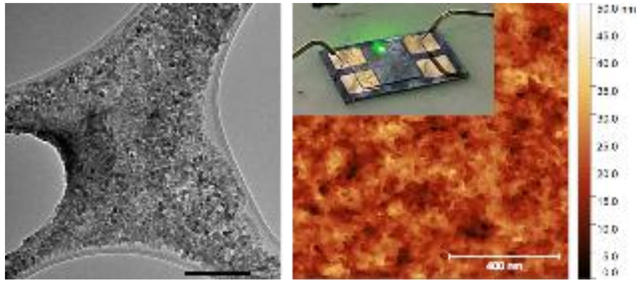


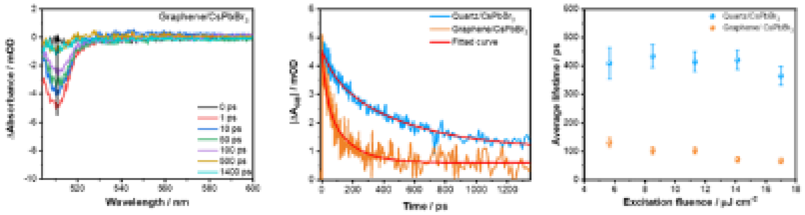


Impact of lattice rigidity on the hot carrier relaxation and carrier dynamics:

- Spacer cation influences the overall lifetime (trap-assisted recombination)
- Rise of the signal follows the trend of BThEA$_2$PbI$_4$ < PEA$_2$PbI$_4$ < TEA$_2$PbI$_4$
- Lattice anharmonicity affects the phonon damping in less rigid lattices (phonon decoherence time almost 2.5 times longer for BThEA$_2$PbI$_4$ than TEA$_2$PbI$_4$)

Study working mechanism of X-ray detectors (*Takayuki Chiba/Yamagata University*, and *Oleksandr Volochanskyi & Martin-Kalbac/Heyrovski Institute*)

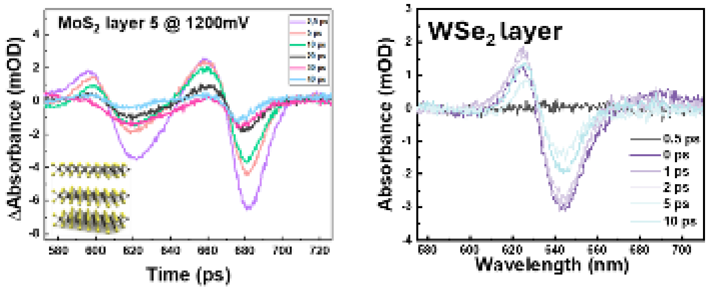


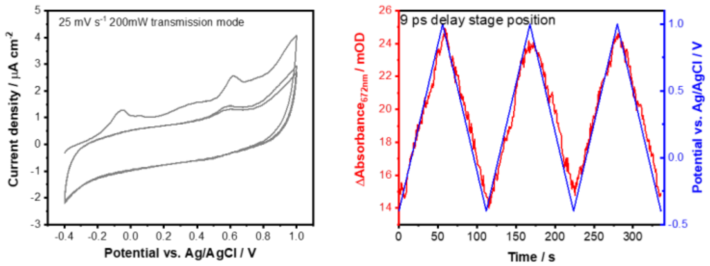


$CsPbBr_3$ nanocrystal samples deposited on graphene:

- Accelerated excited state deactivation signals carrier transfer to graphene on the ~ 30 ps timescale
- Evaluated the interplay between charge transfer, trap states in the recovery process
- The interface kept up with the increased carrier density at all excitation fluences

Effect of electrochemical bias on exciton dynamics of 2D TMDCs (e.g., MoS_2, WSe_2) photoelectrodes (*Péter S. Tóth/University of Szeged*)





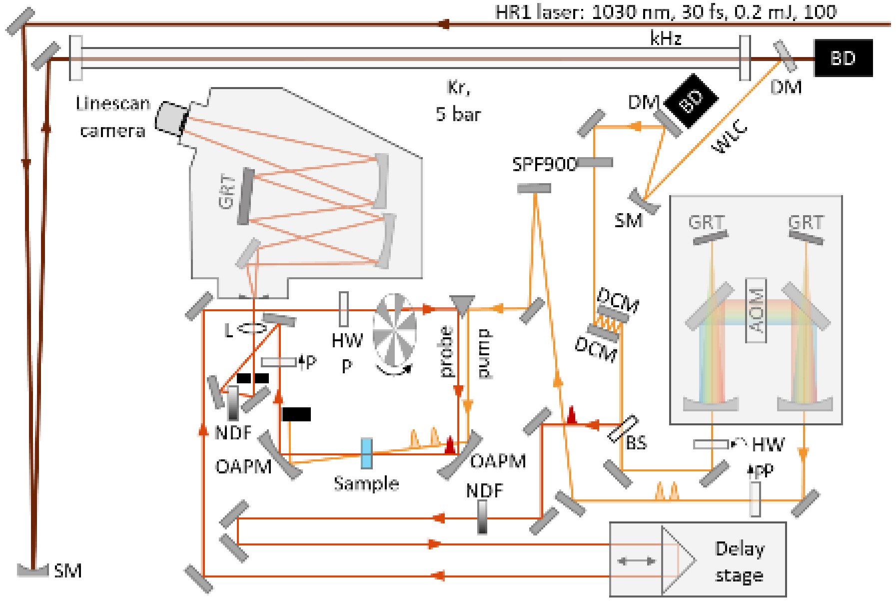
ELI-ALPS allowed us to develop a **new operando electrochemical technique** (transient spectrovoltammetry)

- Measurement of the excited state can be performed during a dynamic electrochemical method (participating carriers can be evaluated)
- Evaluate the charge storage properties (Li-intercalation) of the electrodes

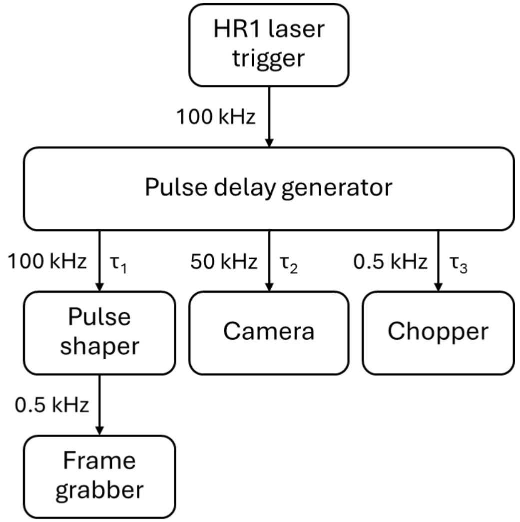
Femtochemistry – MDOS setup

A fraction of the main HR1 laser beam (100 kHz) after the first postcompression stage (10 W average power)

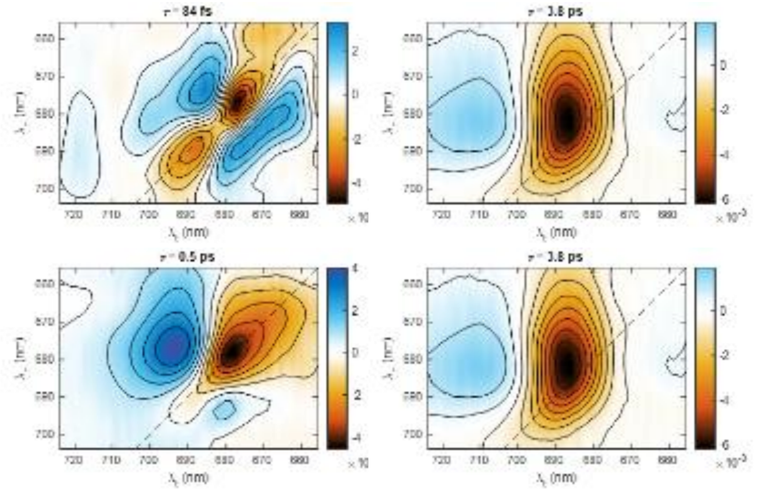
Dr. Petar H. Lambrev
HUN-REN Biological Research Centre, Szeged



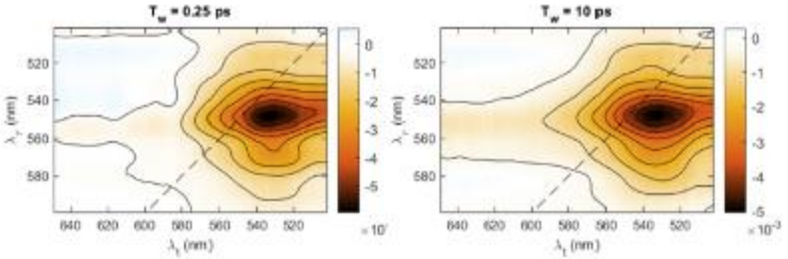
AOM – acousto-optic modulator
WLC – white light continuum
BD – beam dump
BS – beam splitter
DM – dichroic mirror
GRT - grating, L – lens
NDF – neutral density filter
OAPM – off-axis parabolic mirror
P – polarizer
SM – spherical mirror
SPF – short-pass filter



2DES of cyanobacterial Photosystem I Isolated with native lipids (*Barry Bruce/USA*)



2D electronic spectra of Fe-terpyridine and Fe-bathophenanthroline complexes (*Tamás Keszthelyi/HUN-REN Wigner Research Institute*)



User portal: https://up.eli-laser.eu/equipment/1723138316

SYLOS lasers (1 kHz)

SYLOS 2
Energy: 15 - 30 mJ (beam profile)
Repetition rate: single shot – 1 kHz
Pulse duration: 8-12 fs
Beam size: 56mm, top-hat/Gaussian
Strehl: >0.8
Pre-pulse temporal contrast: >10^{10}

SYLOS3
Energy: 20 – 104 mJ
Repetition rate: single shot – 1 kHz
Pulse duration: < 9 fs
Beam size: 60 mm FWHM, top-hat
Strehl: >0.75 (with DM)
Pre-pulse temporal contrast: >10^{9}

SEA (Experiment Alignment)
Energy: 10 – 35 mJ
Repetition rate: single shot – 10 Hz
Pulse duration: ≤ 15 fs
Beam size: 55 mm FWHM, top-hat
Strehl: >0.7
Pre-pulse temporal contrast: >10^{7}

LIGHT CONVERSION
EKSPLA

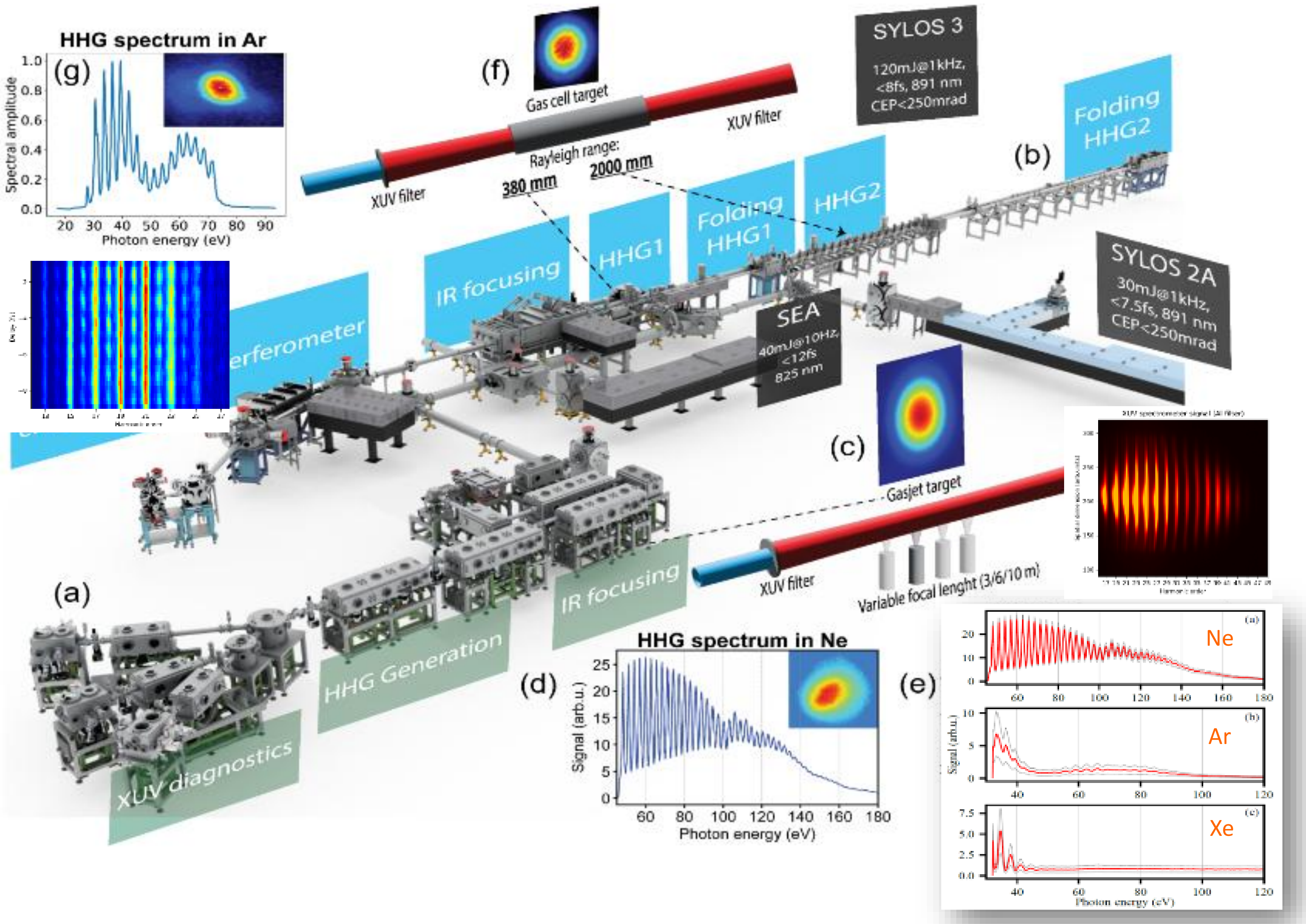
Diagnostics incl
Pulse duration: D-cycle NIR, Wizzler
Wavefront: Imagine Optic HASO Broadband
Temporal contrast: UFI Tundra
CEP: f-2f, Fringeezz
Spectrometers

User portal:
https://up.eli-laser.eu/laser/1723203757 (SYLOS 2)
https://up.eli-laser.eu/laser/1723203800 (SYLOS 3)

R. Budriūnas et al, Opt. Express 25 (2017). (DOI: 10.1364/OE.25.005797)

S Toth et al , J. Phys. Photonics 2 (2020). (DOI: 10.1088/2515-7647/ab9fe1)

SYLOS target areas – „low” intensity target areas: attosecond beamlines



High flux attosecond beamlines

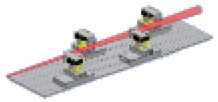
- Attosecond pulses in XUV-IR pump-probe scheme:
- ~400 nJ generated (1µJ in Xe)
- ~ 50 nJ on target @ 1 kHz
- HHG with quasi-phase matching
- XUV characterization (beam profiler, XUV photodiode, XUV wavefront sensor, XUV spectrometer, e/ion ToF)
- Flexible end station for gas/liquid/solid targets

Shirozan, Ultrafast Science (2024)
Nayak, Compact beamline manuscript (submitted)
Stanek, Applied Physics Letters (2024)
Skantzakis, Prog in Ultrafast Intense Laser Science (2024)
Nagyillés, Physics Review Applied (2023)
Appi, Optics Express (2023)

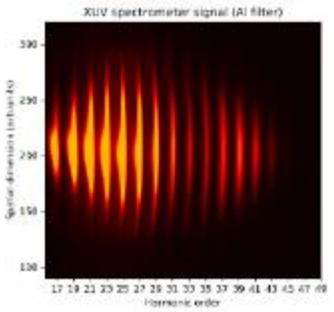
User portal:
https://up.eli-laser.eu/equipment/1723204328

Sylos Attosources User highlights

SYLOS Long



SYLOS Compact



Phasematching studies for different regimes

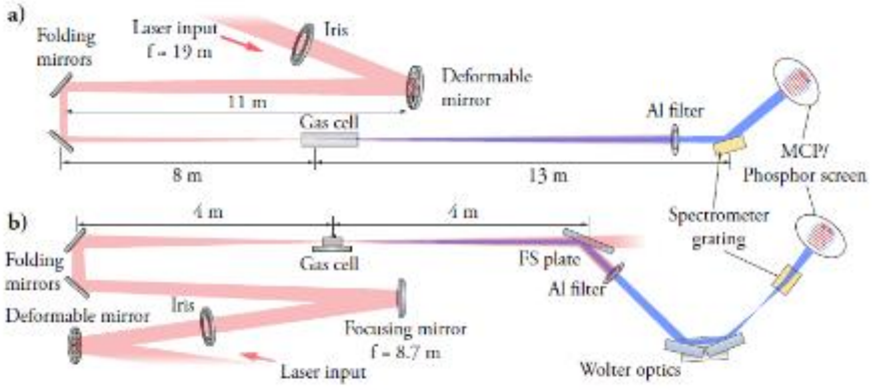
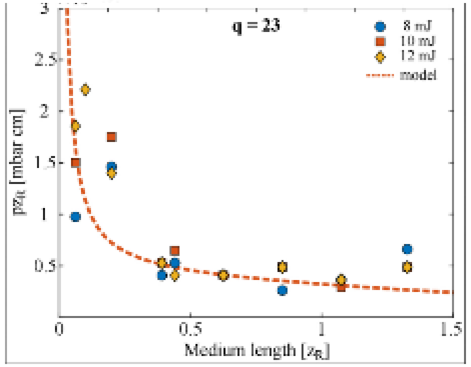
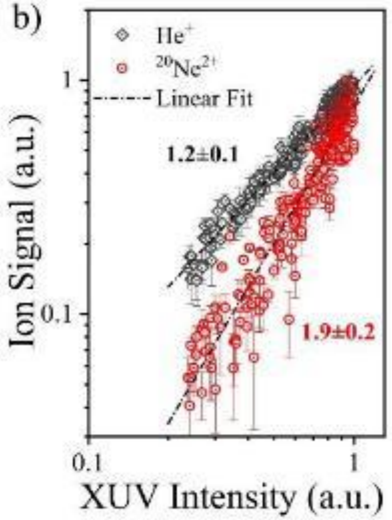


Fig. 2. Schematic of the GHHG Sylos Long Beamline of ELI-ALPS (a) and the High-Intensity Attosecond Beamline at the Lund Laser Centre (b).



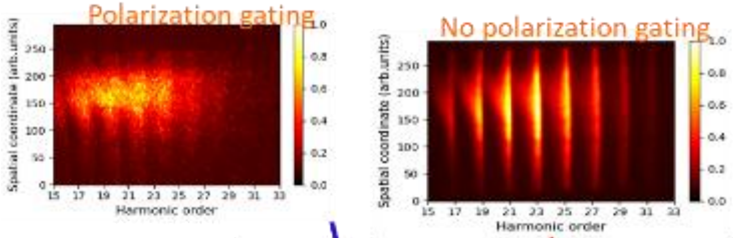
Appi et al., Optics Express 31, 31687 (2023)

Non-linear XUV process



Orfanos, et al., Two-XUV-photon double ionization of neon, PRA 106, 043117 (2022)

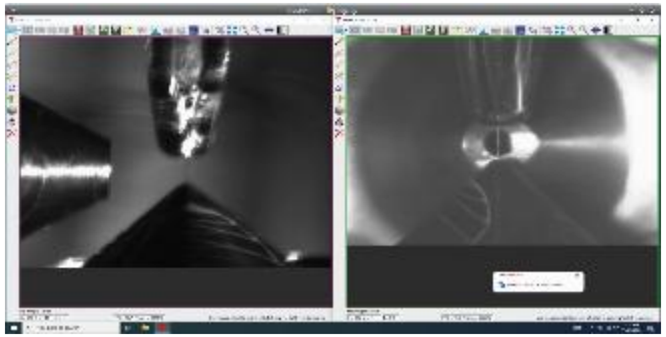
Beamline commissioning studies

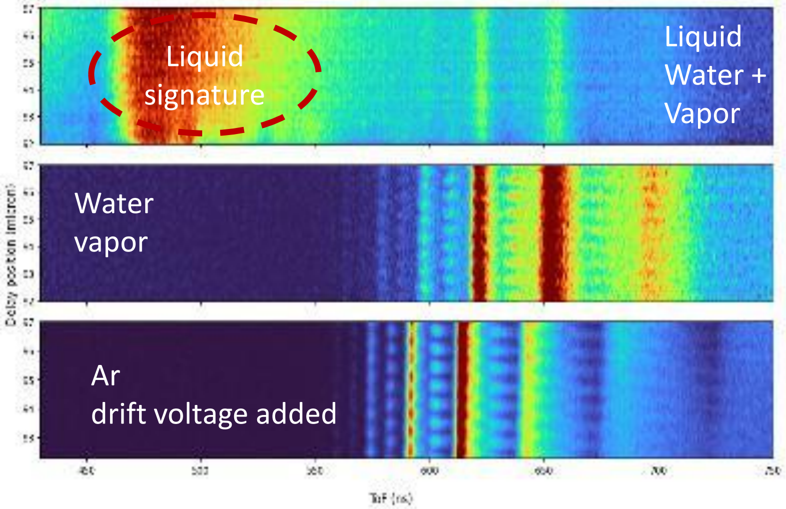


Sylos Attosources User highlights

Photoemission time from liquid water

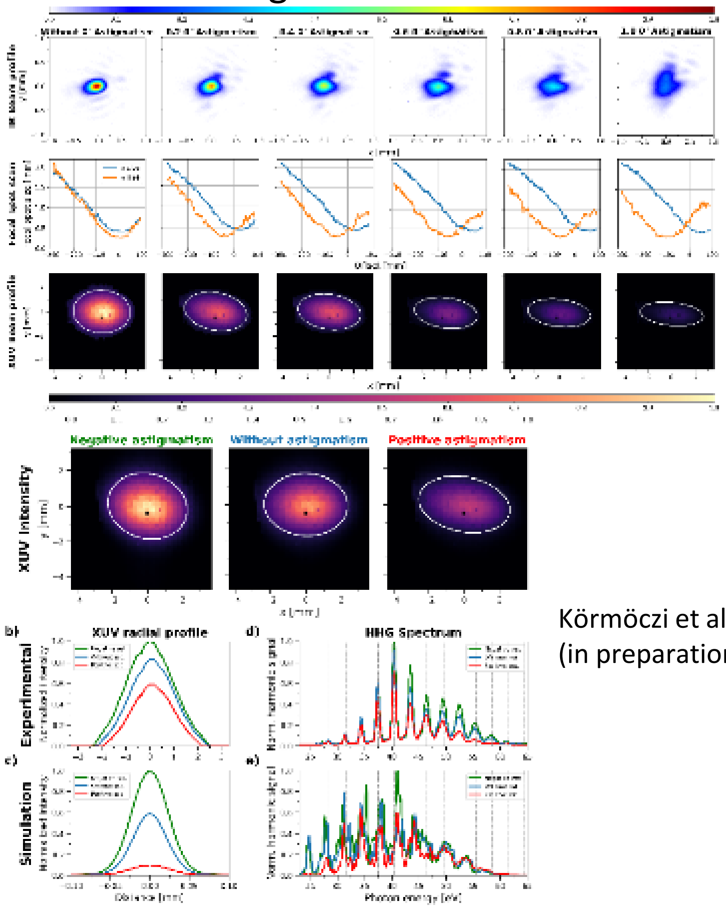
- Rabbit scans from Ar (reference), water vapor and liquid phase





HHG with astigmatic laser

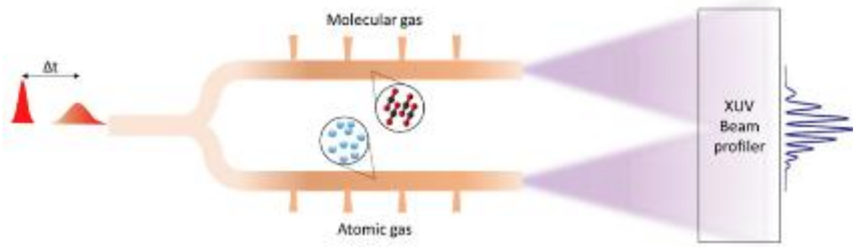
- Study of macroscopic effects when laser is astigmatic



Körmöczi et al. (in preparation)

Dual XUV source

- Microchip based dual HHG source for molecular spectroscopy



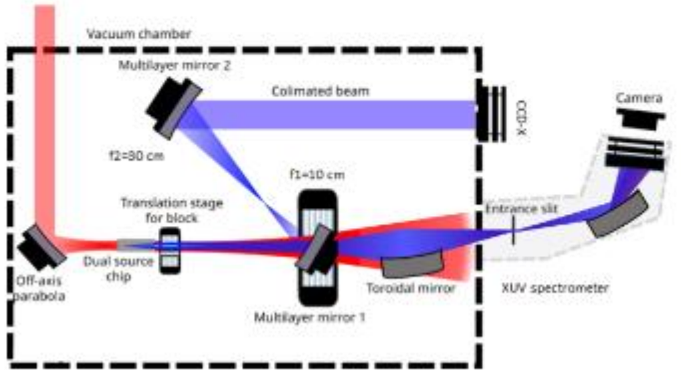
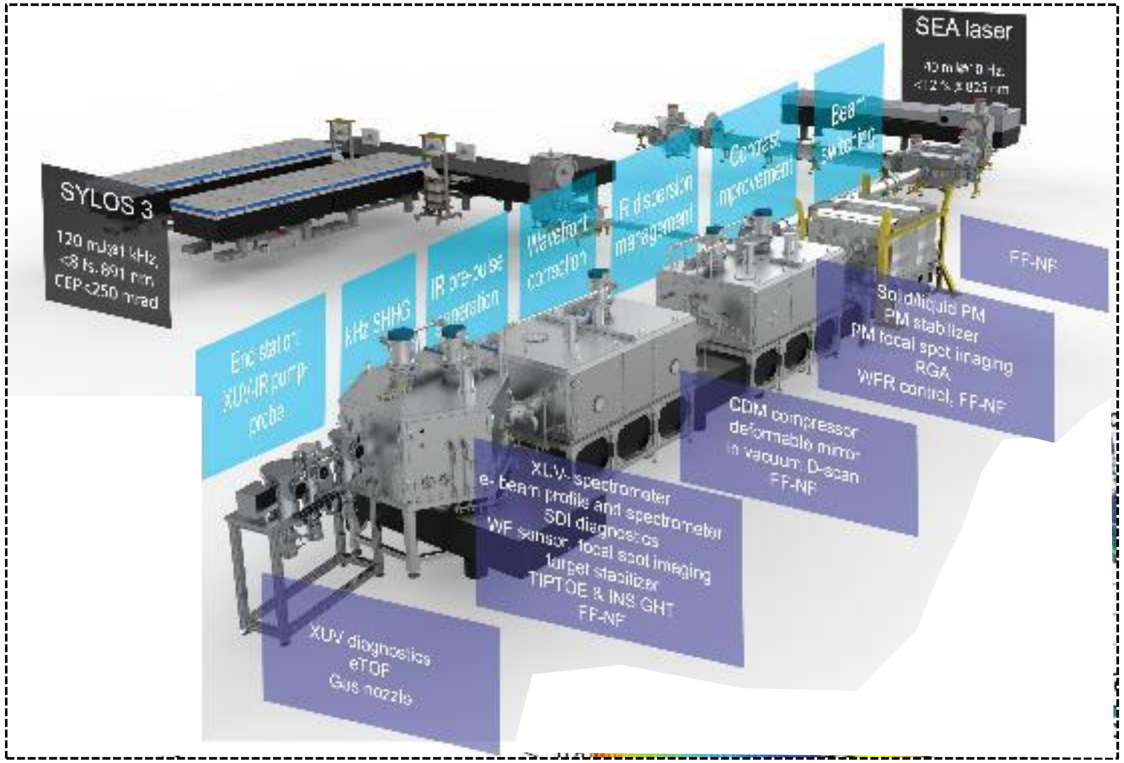


Figure 4: Schematic of the optical setup equipped with an imaging system for XUV-XUV interference detection and an XUV spectrometer for spectral diagnostics.

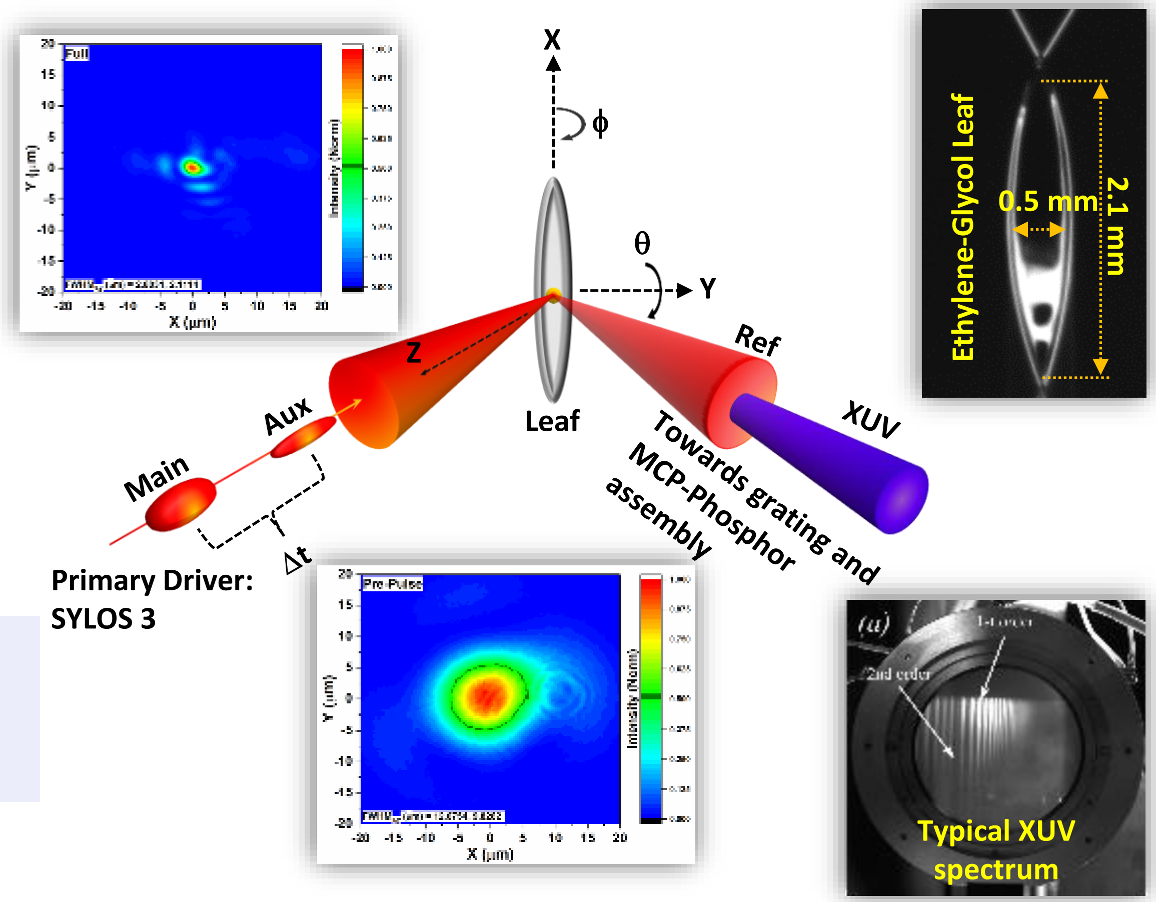
SYLOS SHHG



Shirozhan et al, “High-Repetition-Rate Attosecond Extreme Ultraviolet Beamlines at ELI ALPS for Studying Ultrafast Phenomena”, Ultrafast Sci. 4, 0067 (2025)

Shirozhan et al, “Single Attosecond Extreme Ultraviolet Pulse Source via Light-Wave-Controlled Relativistic Laser–Plasma Interaction: Thomson Backscattering Scheme”, Ultrafast Sci. 6, 0130 (2026)

Overview and specs



User campaigns:
Charged particle emission from 3D printed polymer microstructure arrays.
HHG in reflection and transmission directions from ultra-thin liquids.
Spatio-temporal evolution of giant magnetic fields in hot-dense plasma.

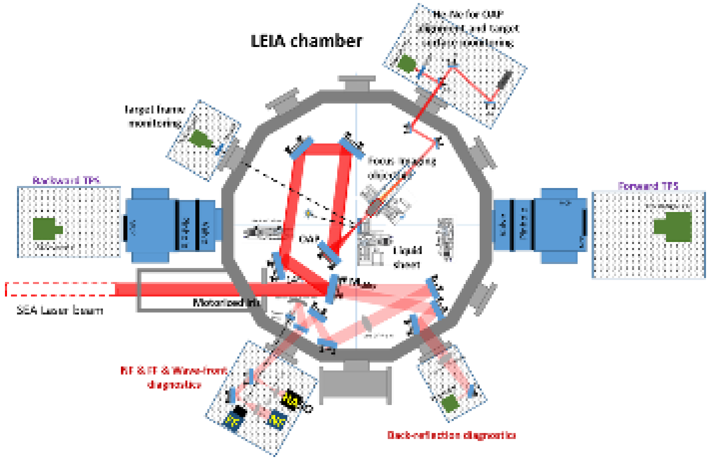
Main Beam:
Dia. ~ 65 mm; Δt ~ 8 fs; E_{tgt} ~ 65 mJ; FWHM ~ 2.8 × 2.1 μm; Estimated I_o ~ $5{\times}10^{19}$ W/cm^2

Aux (Pre-pulse):
Dia. ~ 8 mm; Δt ~ 25 fs; E_{tgt} ~ 0.8 mJ; FWHM ~ 13 × 10 μm; Estimated I_o ~ $1{\times}10^{16}$ W/cm^2

User portal: https://up.eli-laser.eu/equipment/1723204372

Particle sources driven by SYLOS

Low-Energy Ion Acceleration



***Unique* Specs**

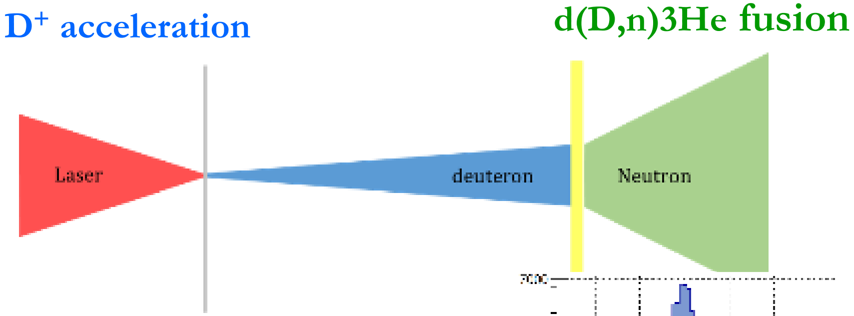
- Single-shot – *kHz repetition rate*
- *On target*, TL pulse duration: *4 fs – 12 fs*
- *On target*, energy: 12 mJ – *80 mJ*
- Angle of incidence: 2° - 75°
- *Liquid sheet* (H_2O, D_2O): *200 nm – 1 μm*
- Ion (p^+,d^+) cutoff: > 2.5 MeV
- *Ion pulse energy: >4 mJ*

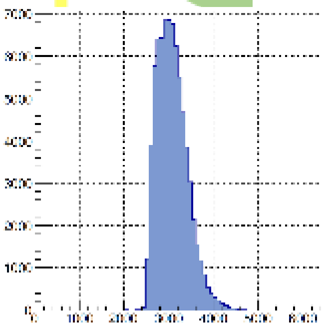
NLTL National Laser-Initiated Transmutation Laboratory University of Szeged

User portal: https://up.eli-laser.eu/equipment/1723072818

Neutron generation beamline

Pitcher-Catcher scheme





***Neutron* Performances**

Peak neutron yield (kHz): 10^8 n/sec

Peak neutron flux-rate: 10^{13} n/cm²/shot

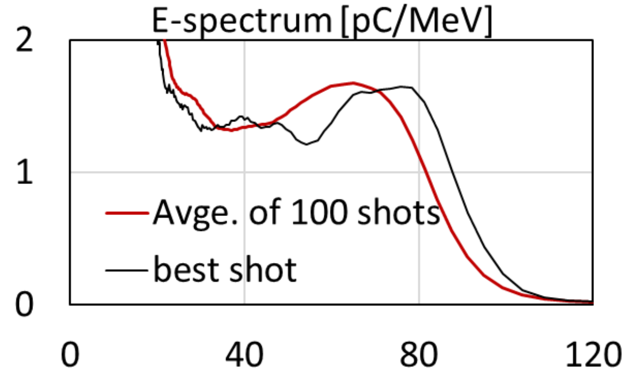
Regular operation: 0.8 Gy/h, @ 1kHz

Applications/User experiments

- **Radiobiology of fast, ultrashort neutrons**
- **Neutron-induced therapy**
- **Medical isotope production**
- **Material science for IFE**

eSYLOS LWFA e-beam

High efficiency, high energy, high charge



120 pC above 14 MeV

80 pC above 30 MeV

80 MeV+ electron energies

User campaigns:

Positron generation

CEP effects

Radiobiological Irradiation (up to *40 Gray/min at 100 Hz)*

THz generation for e-beam manipulation

User portal: https://up.eli-laser.eu/equipment/1723072743

HF PW laser (5 Hz)

Energy: 1 - 10 J

Energy stability: <0.7% rms

Repetition rate: single shot – 5 Hz

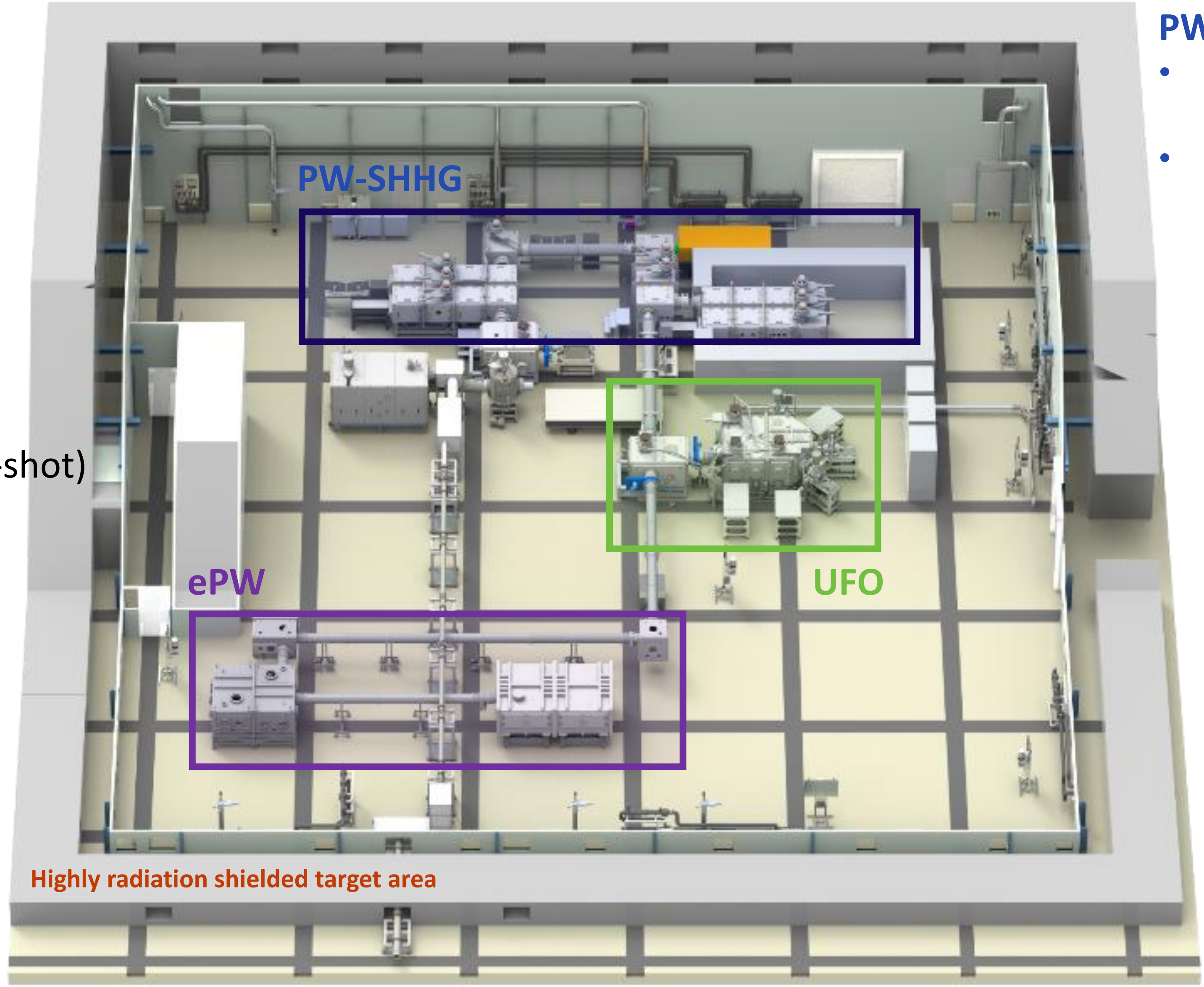
Pulse duration: 20 fs ± 1 fs

Beam size: 20 cm ± 1 cm, circular

Strehl: >0.9 (with DM)

Pointing stability: <2 urad (shot-to-shot)

ASE temporal contrast: $>10^{12}$



Highly radiation shielded target area

PW-SHHG
- Plasma mirror contrast cleaning
- **mJ-level atto** pulses

UFO
- Plasma mirror contrast cleaning
- Versatile experimental end-station

ePW
- Plasma mirror contrast cleaning
- **Electron:** GeV+
- **X-ray:** 20 keV+

User portal: https://up.eli-laser.eu/equipment/1746206741

MIR activity ~ 3μm

FASTLITE

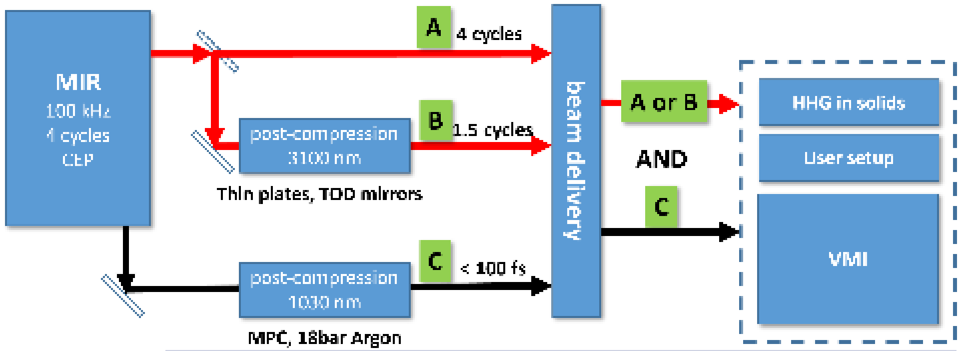
N. Thiré et al. Optics Express 26(21) (2018) 26907

Laser metrology:
- Scanning SH-FROG
- TIPTOE
- Autocorrelator (NIR, SWIR, MIR)
- Single-shot CEP detection (Fringeezz, Fastlite)
- Beam profilers
- Wavefront sensor

MIR 100 kHz few-cycle CEP stable source at 3.2 μm
- 100 μJ, 42 fs (4 cycles), 100 mrad CEP
- 60 μJ, 15 fs (1.5 cycles), 200 mrad CEP

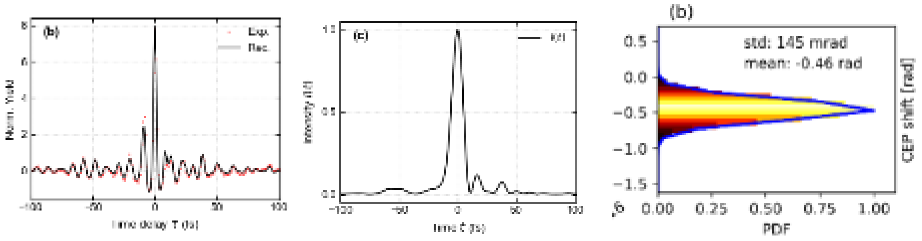
NIR pump beam synchronised (pump-probe) at 1030nm
- 200 μJ, 100 fs
- Optional 515 nm, 100 fs

VIS-UV HHG metrology:
- UV-VIS spectrometer (Avantes 200-1100 nm)
- VUV spectrometer #1 (UFI, 50-200 nm, under commissioning)
- VUV spectrometer #2 (VS7550-VUV, 105-1000 nm)
- Optical Spectrum Analyser (Yokogawa 350-1200 nm)



User portal: https://up.eli-laser.eu/laser/1723138152/

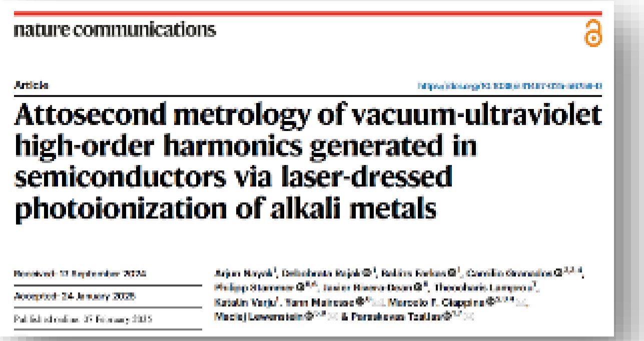
Recent: 1.1-cycle, 30 μJ, CEP-controlled (from Call#9)



MIR activity ~ 3μm

Temporal characterization of solid state harmonics

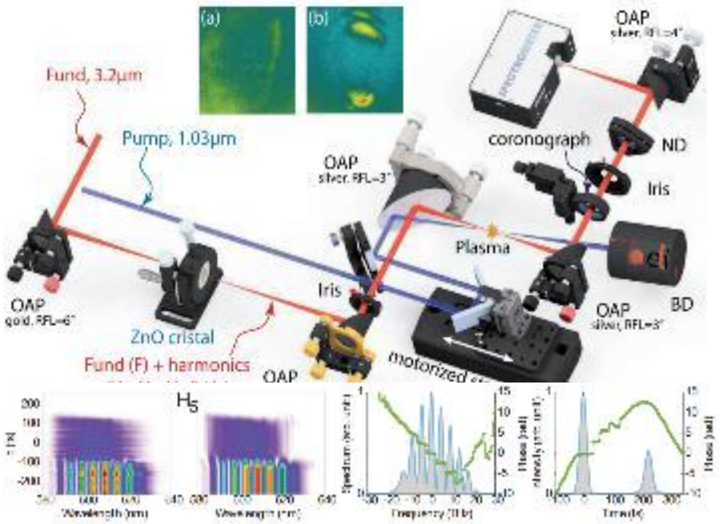
A. Nayak et al. Nature Comm. 16 1428 (2025)


nature communications

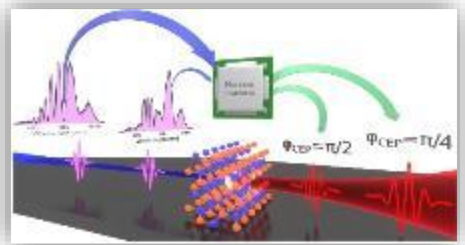
Article

Attosecond metrology of vacuum-ultraviolet high-order harmonics generated in semiconductors via laser-dressed photoionization of alkali metals

P. Béjot et al. Opt.& Las.Tech. 190 (2025) 113039



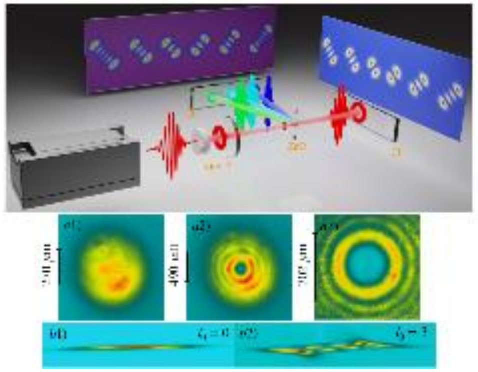
Machine learning on CEP via HHG in solids



Harnessing AI/ML for estimating mid-IR CEP from bulk high harmonics

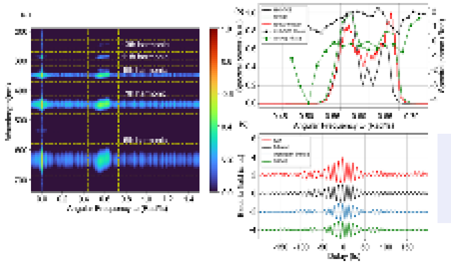
Optics Express 32, 46500-46510 (2024)

Harmonic vortex beams from solids

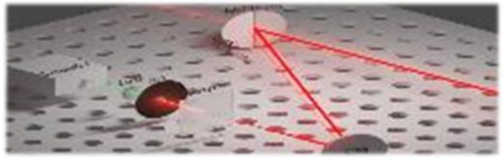


D. Rajak et al. Submitted to Nature Physics

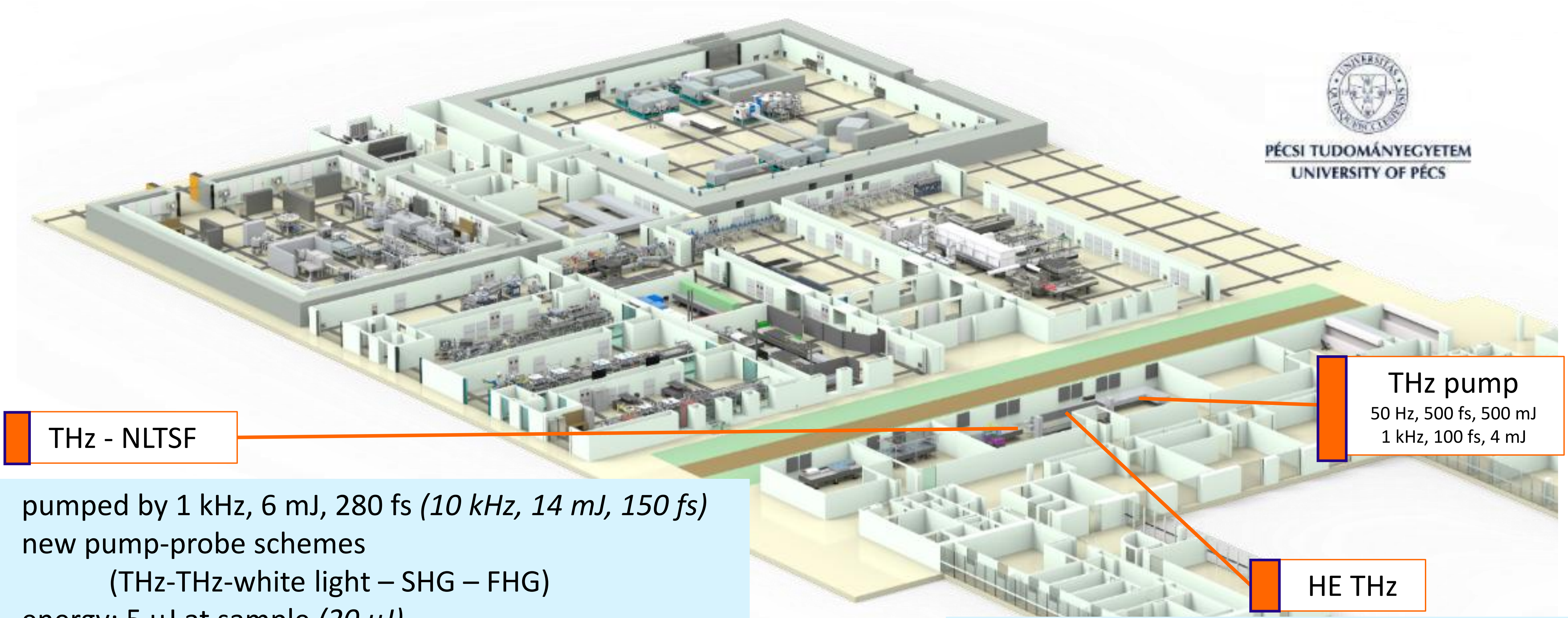
HHG-TOE experiment



M. Awad et al. Optics Express 28 2 (2024) 1325



THz activity



PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS

Amplitude

- pumped by 1 kHz, 6 mJ, 280 fs *(10 kHz, 14 mJ, 150 fs)*
- new pump-probe schemes
  (THz-THz-white light – SHG – FHG)
- energy: 5 µJ at sample *(20 µJ)*
- peak THz field at sample: 450 kV/cm *(1 MV/cm)*

https://up.eli-laser.eu/equipment/1723204511/

https://up.eli-laser.eu/equipment/1723138599/

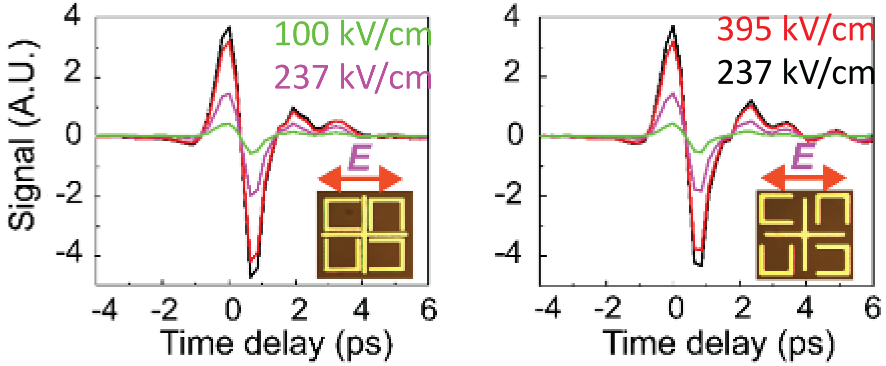
- energy 0.35 mJ, 2.5 MV/cm @50 Hz
- useful spectral content 0.15 – 1.5 THz

- new pump-probe schemes incl.

THz pump—XUV probe endstation: TPXP

THz science – user activities

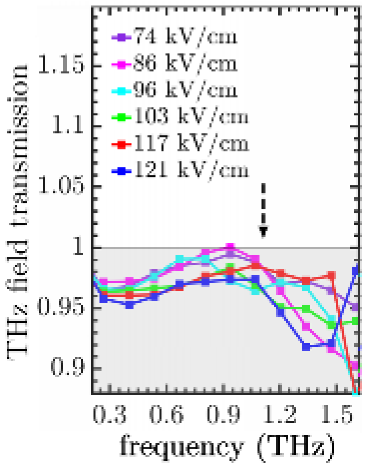
Metal-on-Si metasurfaces



THz-induced slow-light dynamics mediated by impact ionization in Si

[Mallick et al., ACS Appl. Opt. Mater. 3, 1357 (2025)]

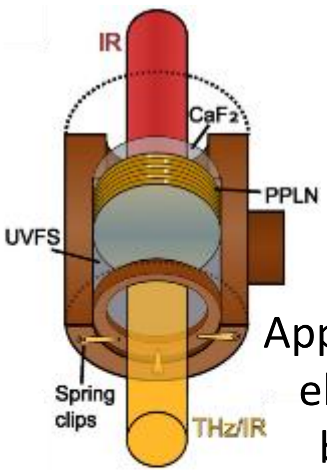
InSb thin film on GaAs



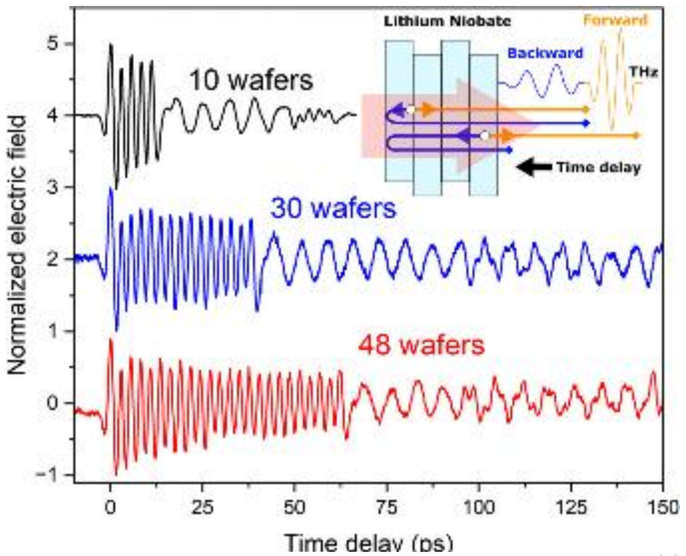
Impact ionization dominates at higher field, decreasing transmission.

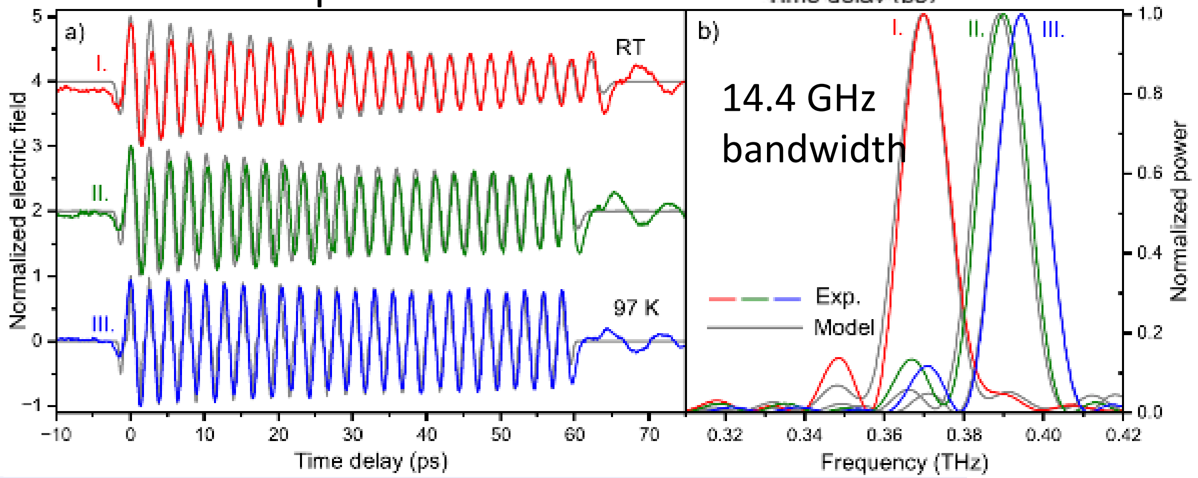
[Garcia-Rosas et al., in preparation]

Periodically poled, cryogenically cooled $LiNbO_3$ wafer stacks produce energetic 0.42 mJ multicycle narrowband THz pulses.



Application: electron bunch manipulation

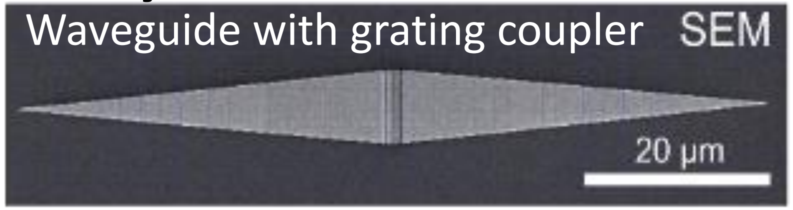




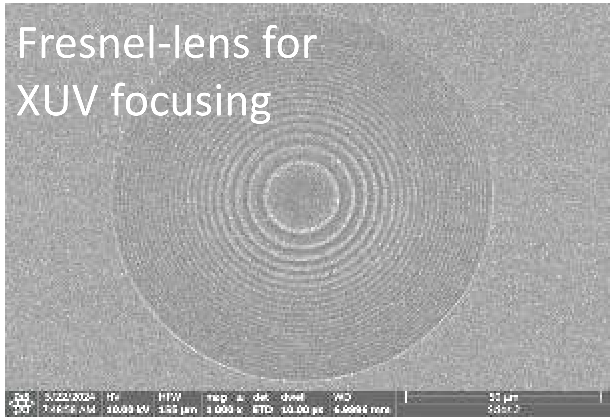
[Dalton et al., Appl. Phys. Lett. 125, 141101 (2024)]

Nanofabrication unit, optoelectronical sample preparation, condensed matter analysis

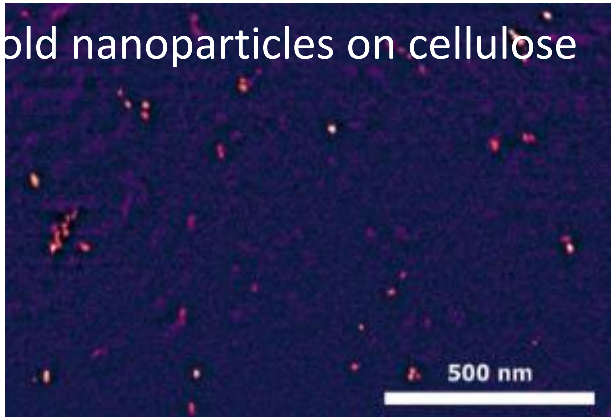
EBL, FIB - results



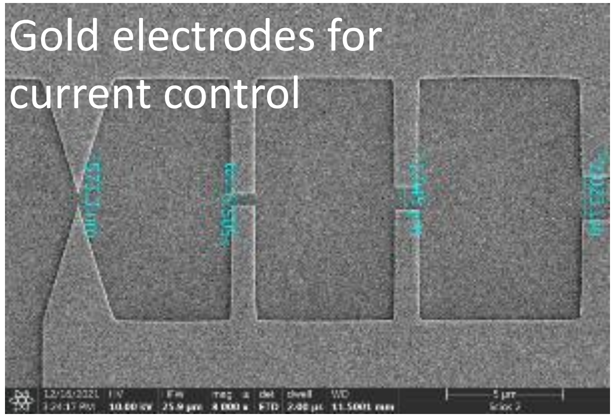
K. Komatsu, Nano Lett. 2024, 24, 8, 2637–2642



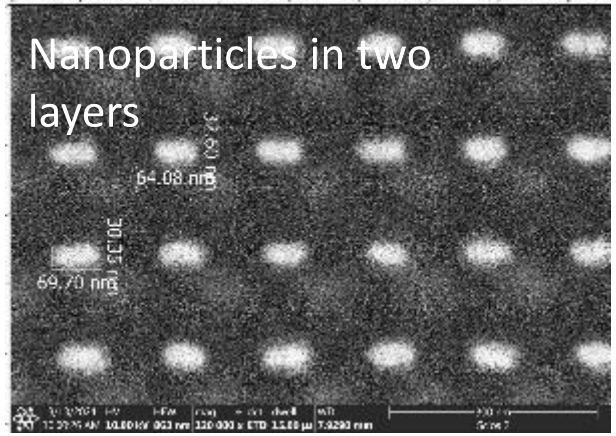
A. Kulter et al., „Transmissive extreme ultraviolet metagrating for attosecond applications" @ Ultrafast Phenomena Conference in August2026

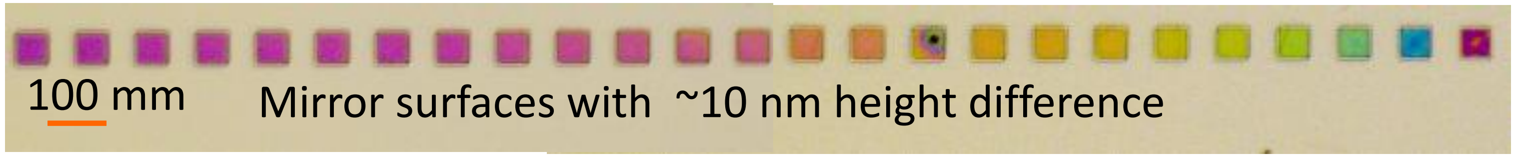


M. Mustapic, Mater. Adv., 2026, 7, 798-812



B. Feher et al., Sci. Adv. 11, eadv5406 (2025)



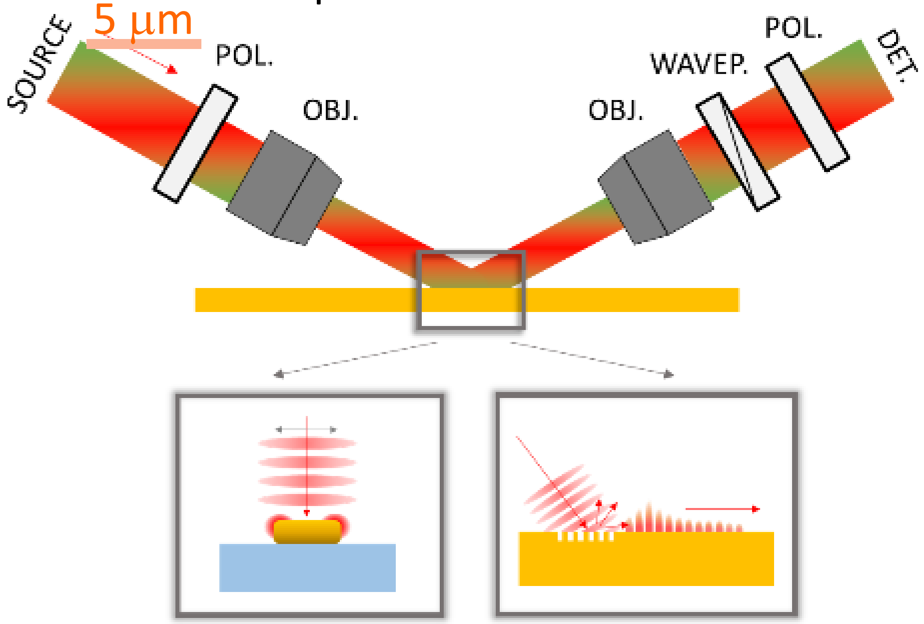


ELIUPM3-95_NFL_PROTONANO_MCS

ELIUPM3-85_NFL_MICROSENSE_SK

Nanoscience and plasmonics
Ultrafast surface science

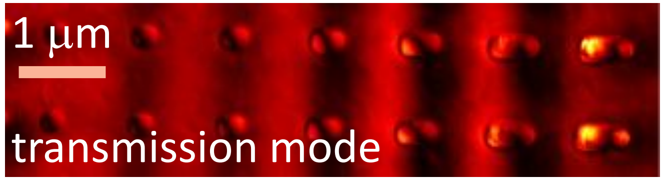
Ultrafast ellipsometer with <30 fs temporal resolution for tracking different plasmonic processes



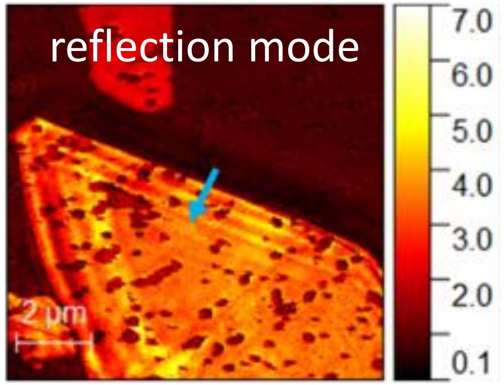
Budai, Pápa et al., Nat. Comm, 13 (1) 6695 (2022)

User portal: https://up.eli-laser.eu/equipment/1723072949

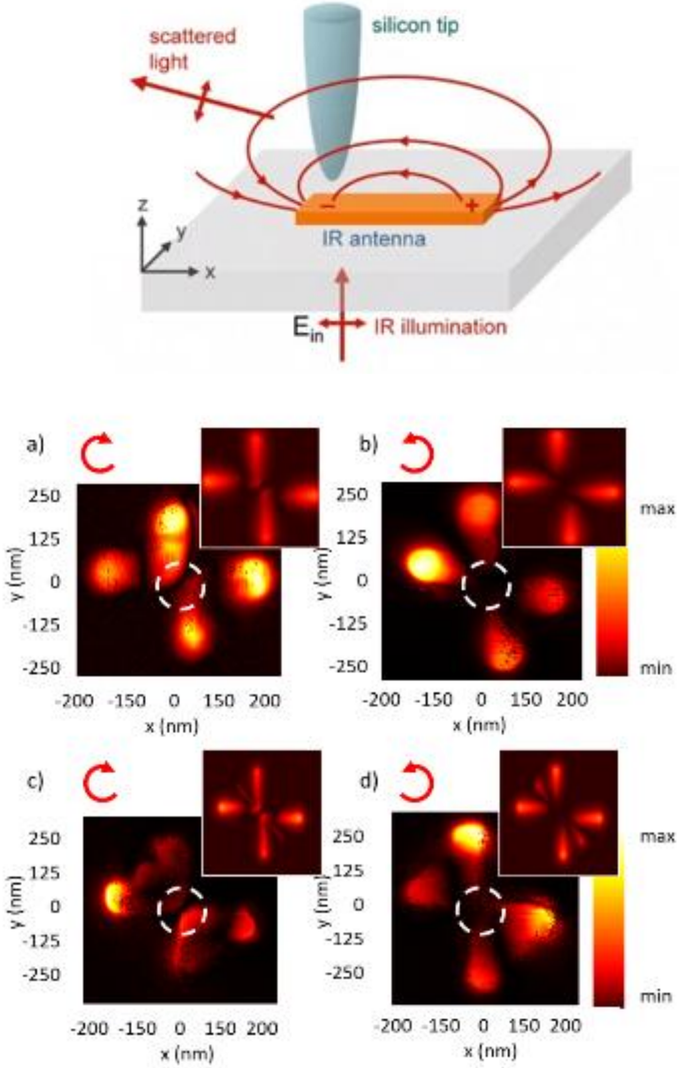
Scanning Near-field Optical Microscope



Near field amplitude distribution of plasmonic gold nanoparticles excited by 1550nm excitation wavelength



selected region of mechanically exfoliated Si/MoS_2 sample with 633 nm laser excitation.



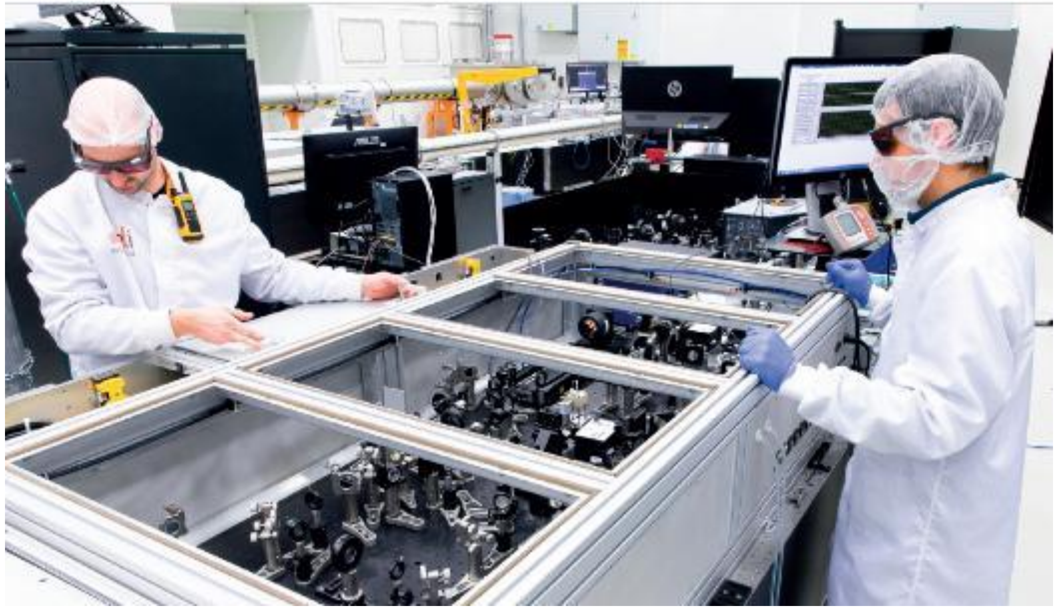
Plasmonic circular dichroism

Join ELI ALPS' staff

Open positions

@ junior, postdoc and technician level

science_dir@eli-alps.hu



ELI-ALPS

Thank you

ELI
EXTREME LIGHT INFRASTRUCTURE

User Portal: https://up.eli-laser.eu/

Call#8: 17th March, 2026

Call#9: 22nd Sep, 2026

ELI User Meeting 2026; 24-26 June, Prague