Visible and near infra-red spectroscopy of laser plasmas for astrophysics.

HEAVYMETAL

Funded by
the European Union

European Research Council
Established by the European Commission

Padraig Dunne, UCD.

Observations – U Copenhagen
Experiments – UCD
Simulations – GSI Darmstadt
Spectral models – QUB

THE SPECTROSCOPY GROUP AT UCD:

Laser Plasma Physics

Astro Vis/NIR Spectroscopy

Padraig Dunne

VUV/EUV/Soft x-ray Emission & Absorption Spectroscopy

Laser/Matter Interactions

Paddy Hayden

Laser Induced Breakdown Spectroscopy

PhotoElectron Spectroscopy

Plasma Imaging

Emma Sokell

Soft X-ray Optics

Soft X-ray Sources

Fergal O'Reilly

Soft X-ray Detectors

Soft X-ray Microscopy

Tom McCormack

Colliding Plasmas

Soft X-ray Optical Modelling

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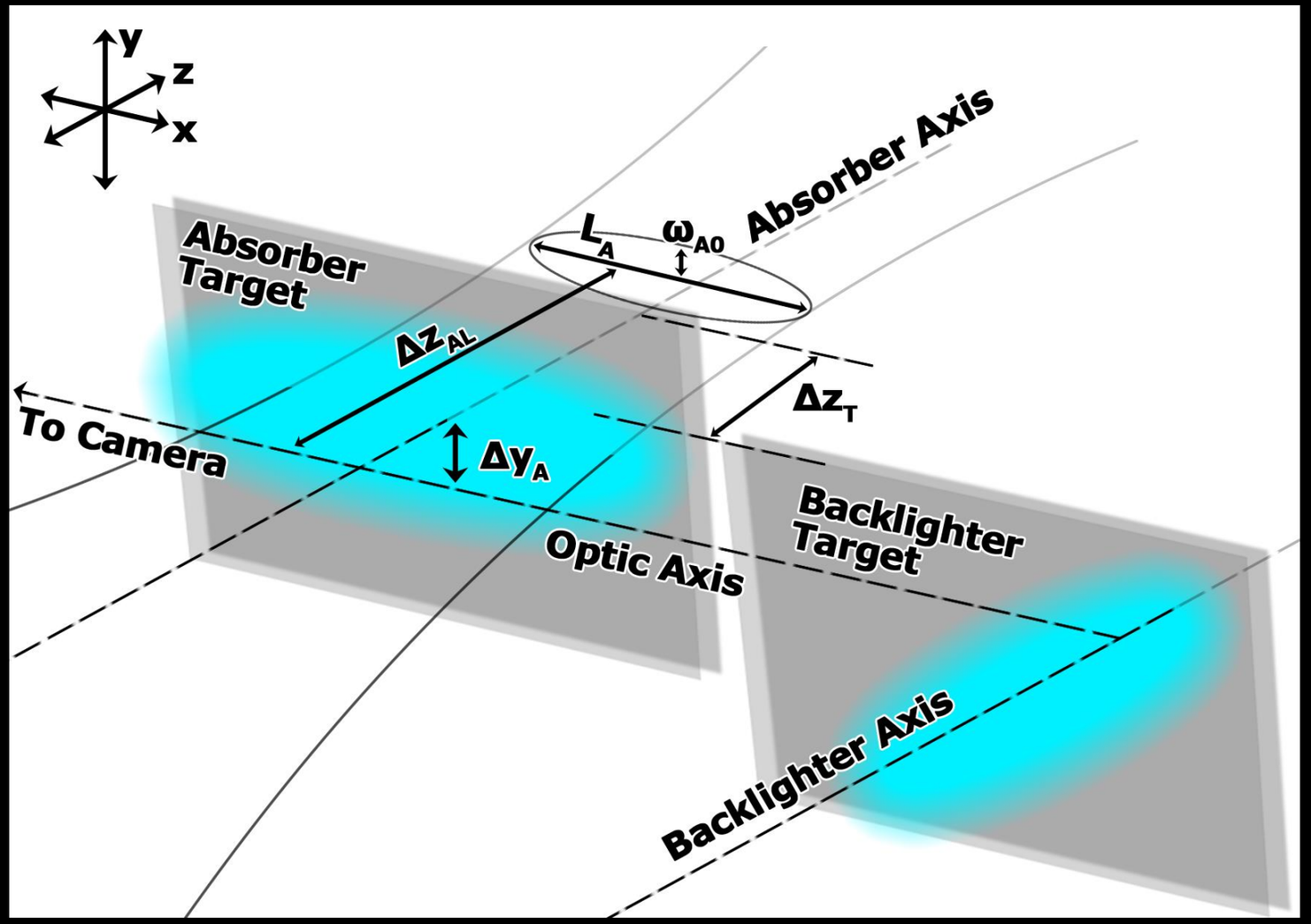
DUAL LASER PLASMA (DLP) PHOTOABSORPTION:

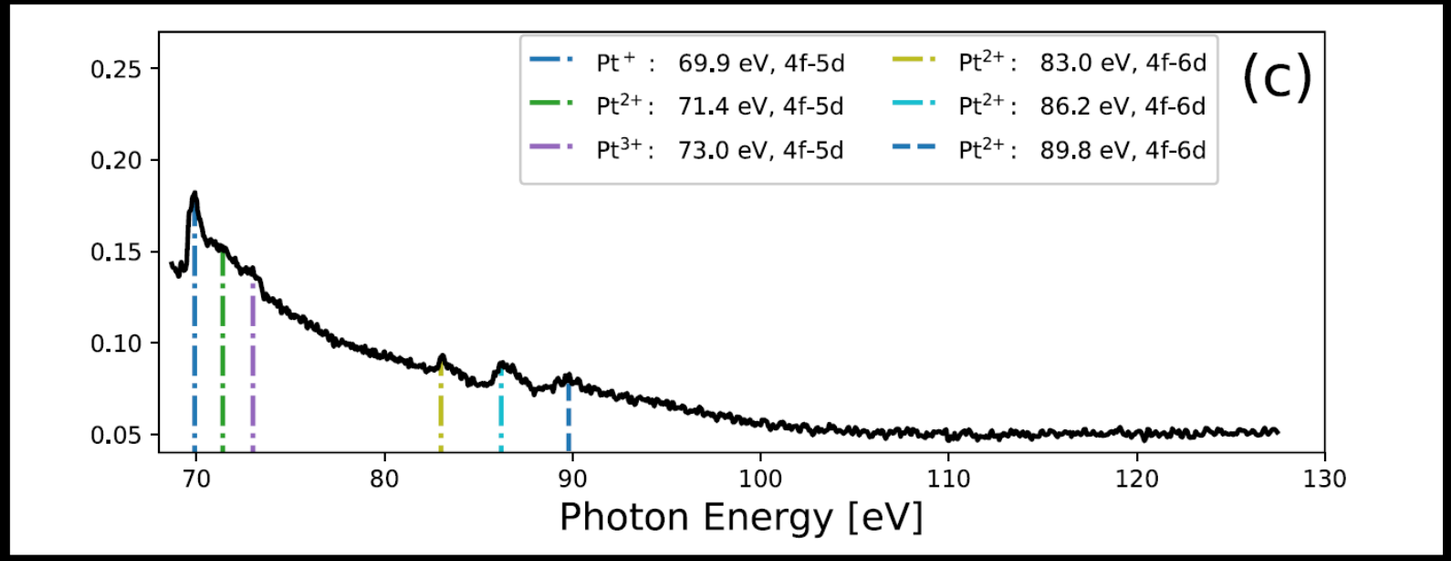
- Time delay
- Power density
- ΔZ_T = Inter-Target z-displacement
- ΔY_A = Absorber y-displacement from Optic Axis
- ΔZ_{AL} = Absorber z-displacement between Minimum Beam Waist and Optic Axis
- ω_{A0} = Absorber Minimum Beam Waist
- L_A = Absorber Plasma Length

- Backlighter source target

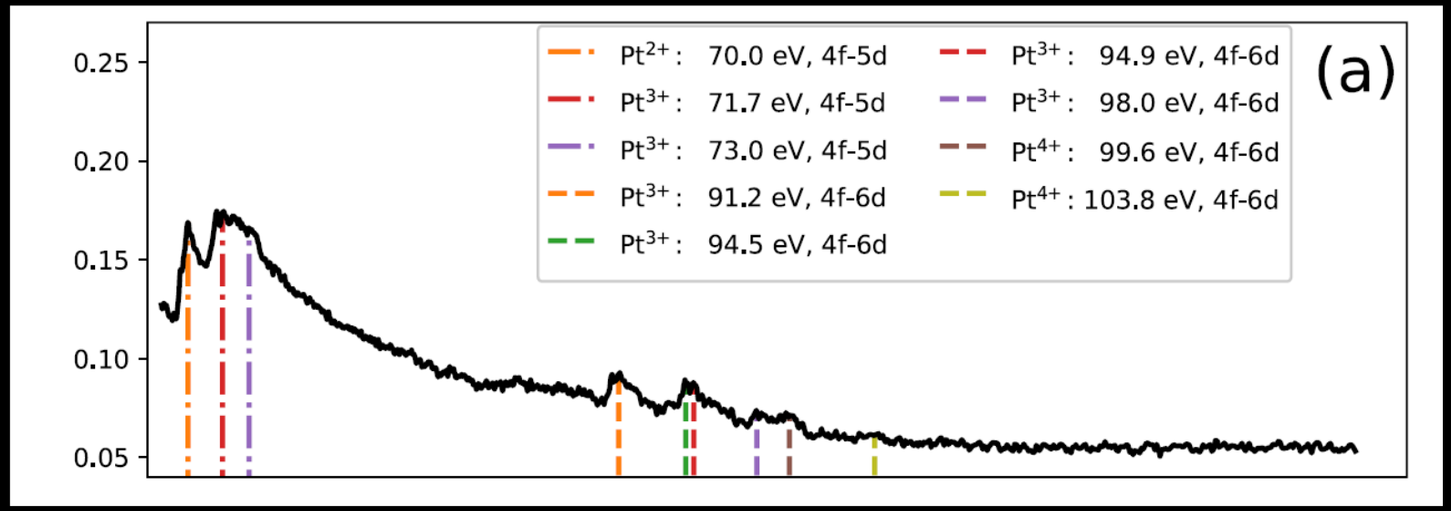


DLP PHOTOABSORPTION

Platinum spectra ~67 eV to ~130 eV



Δt = 300 ns



Δt = 100 ns

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https://doi.org/10.1088/1361-6455/acd9b7

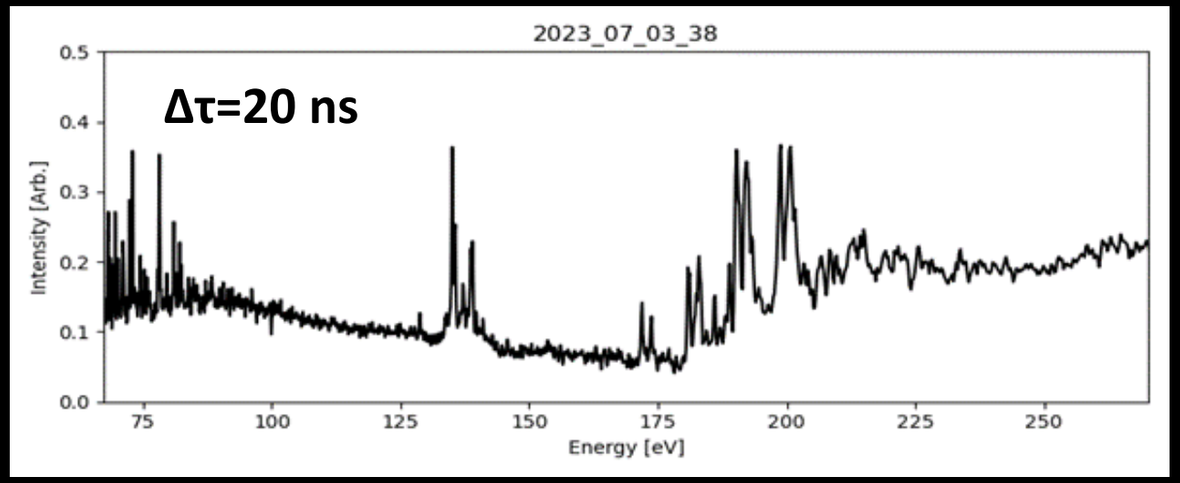
4f photoabsorption in Pt^{+} to Pt^{4+}

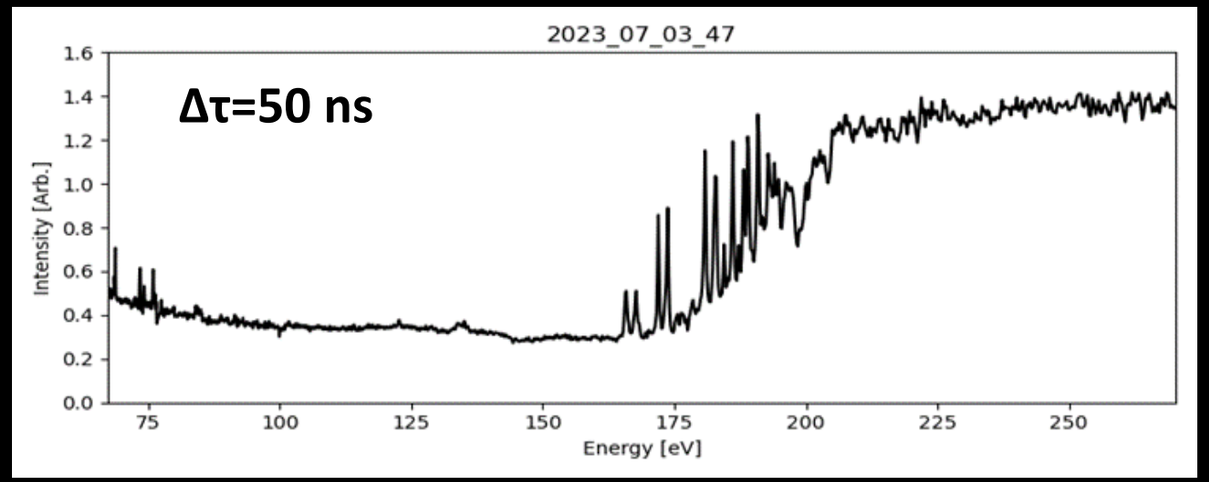
Eric Doyle*, Gerry O'Sullivan, Patrick Hayden and Padraig Dunne*

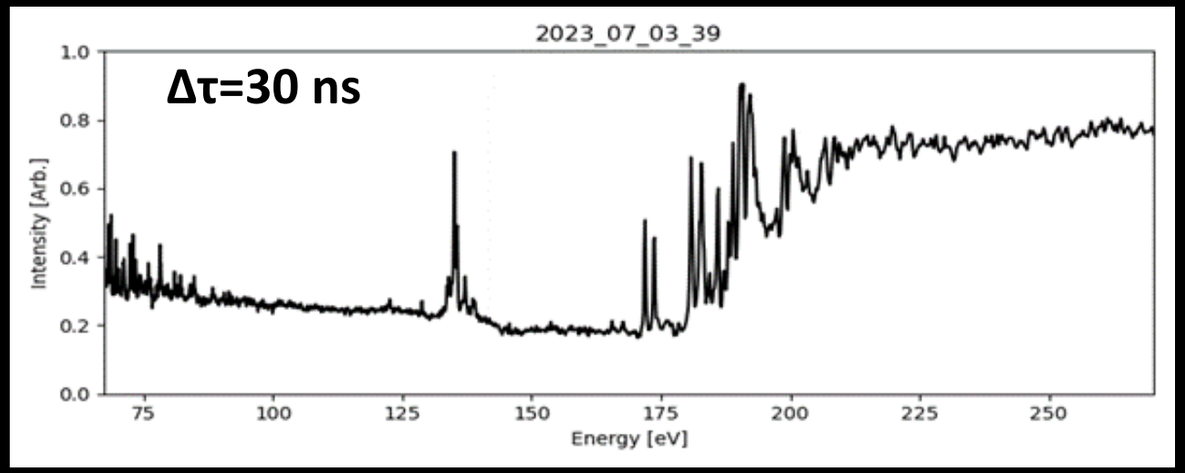
School of Physics, University College Dublin, Belfield, Dublin 4, Ireland

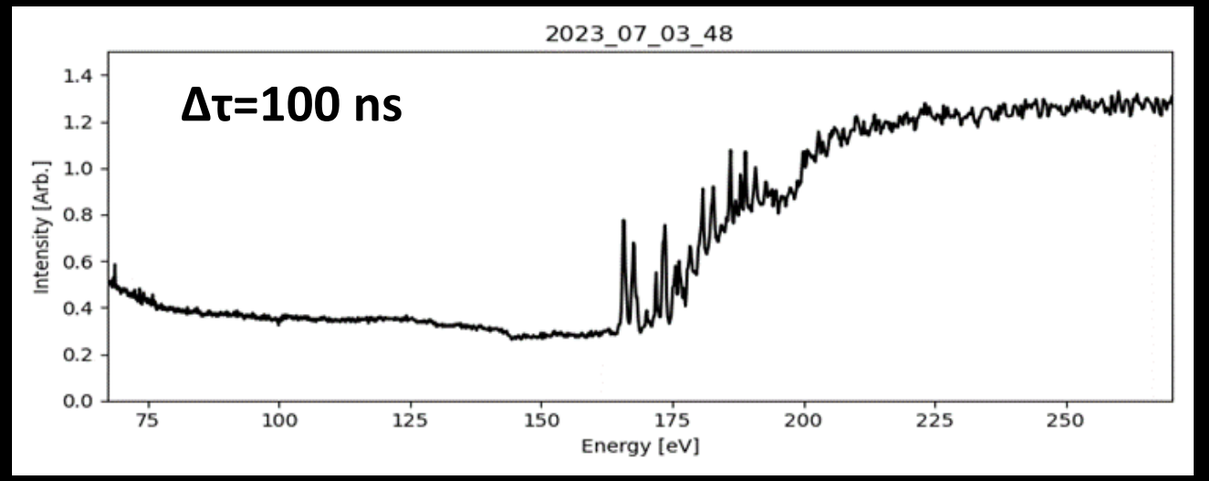
DLP PHOTOABSORPTION:

Yttrium spectra ~48 eV to ~280 eV



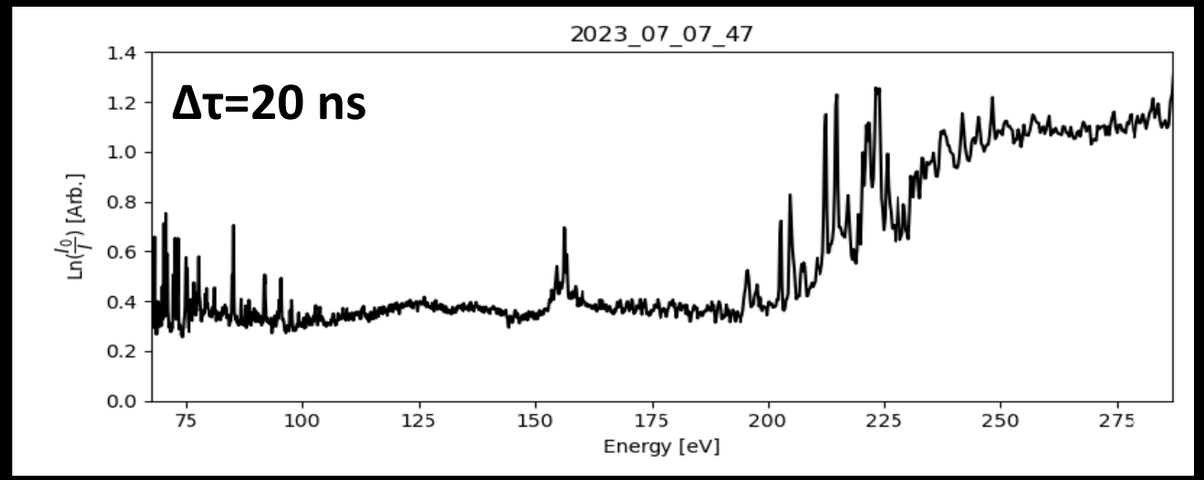


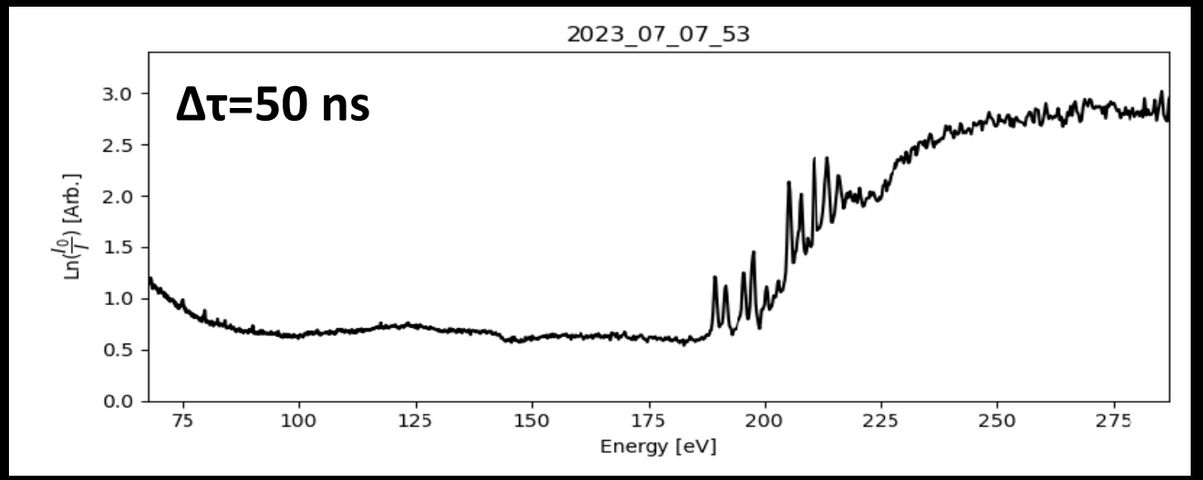


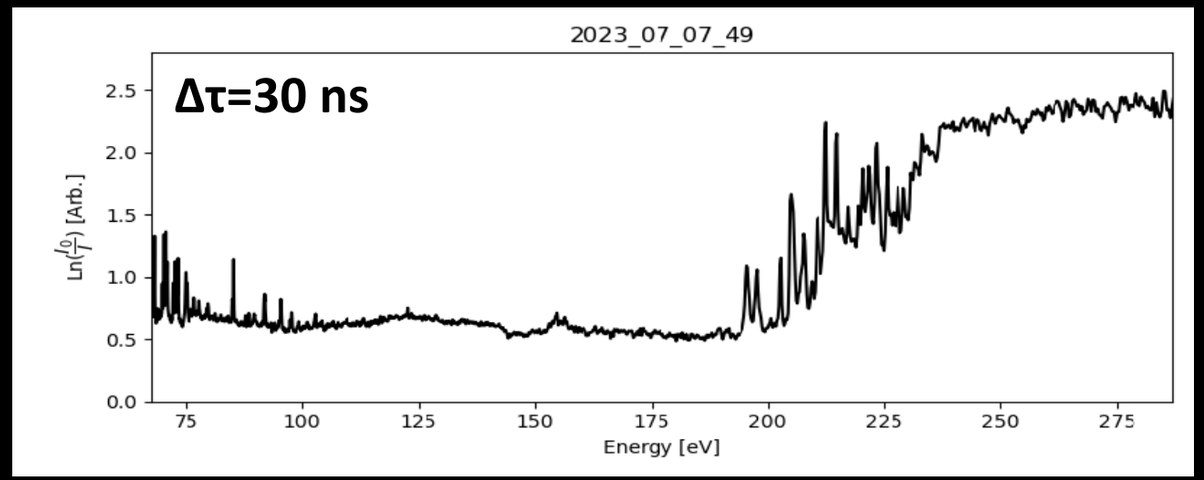


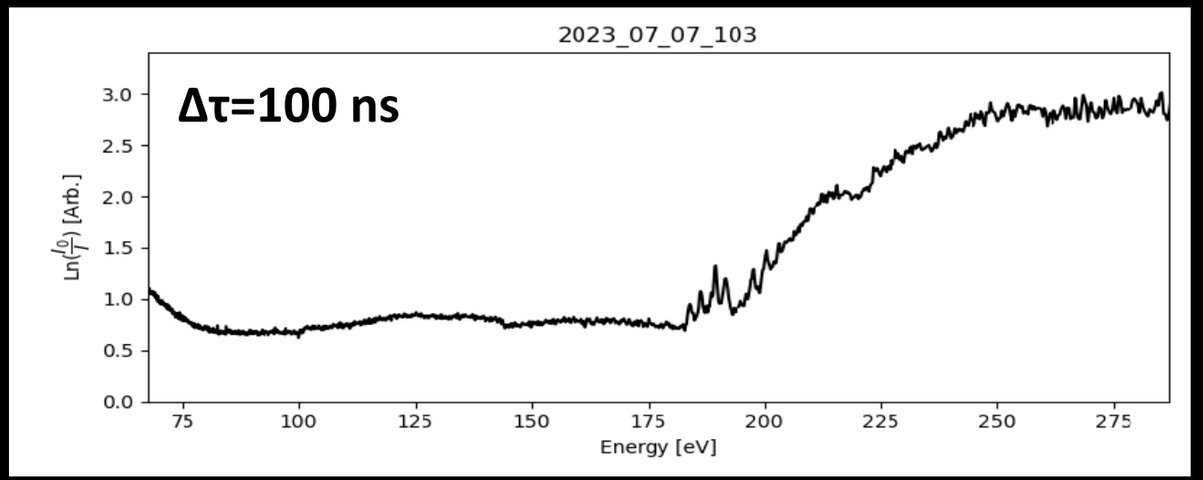
DLP PHOTOABSORPTION:

Zirconium spectra ~48 eV to ~280 eV

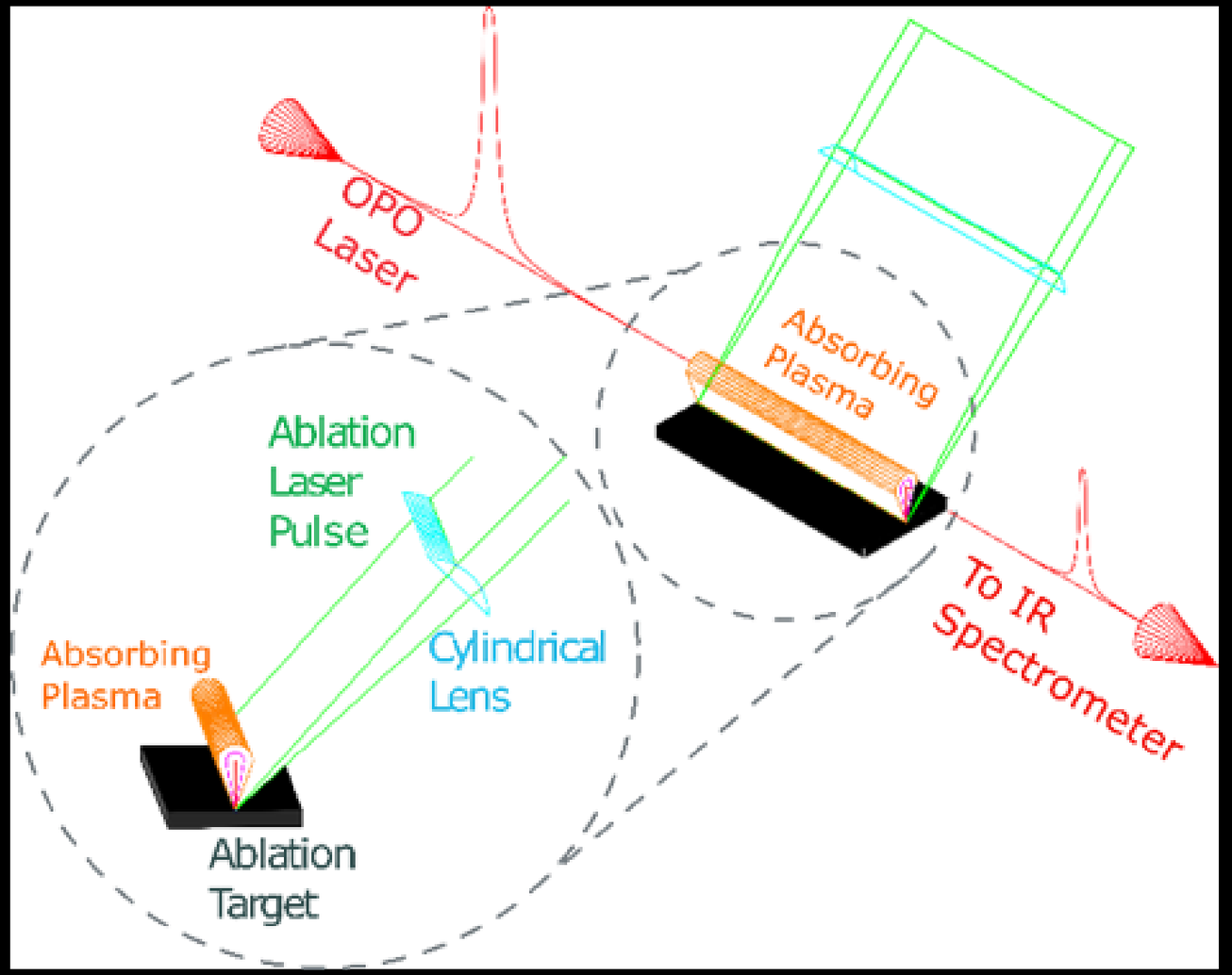






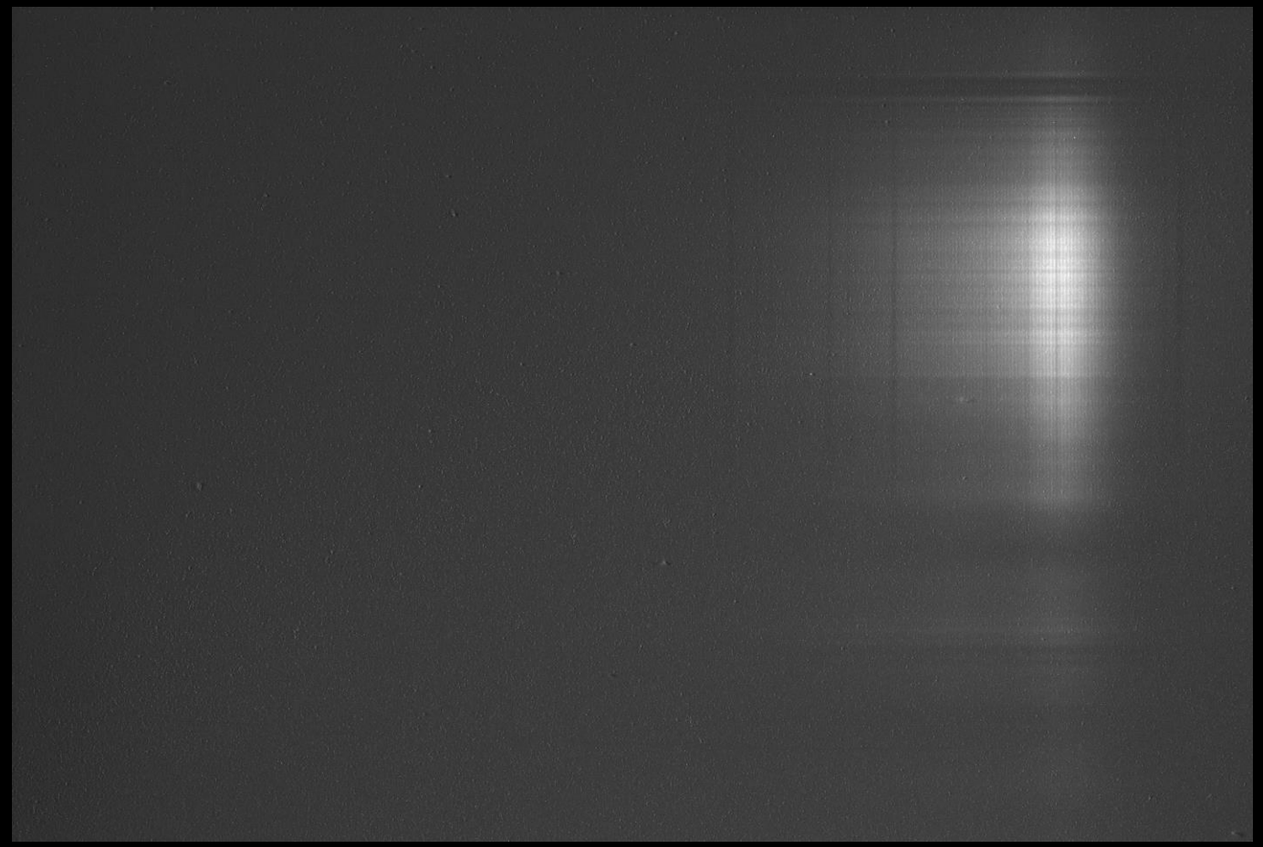


OPO PHOTOABSORPTION:



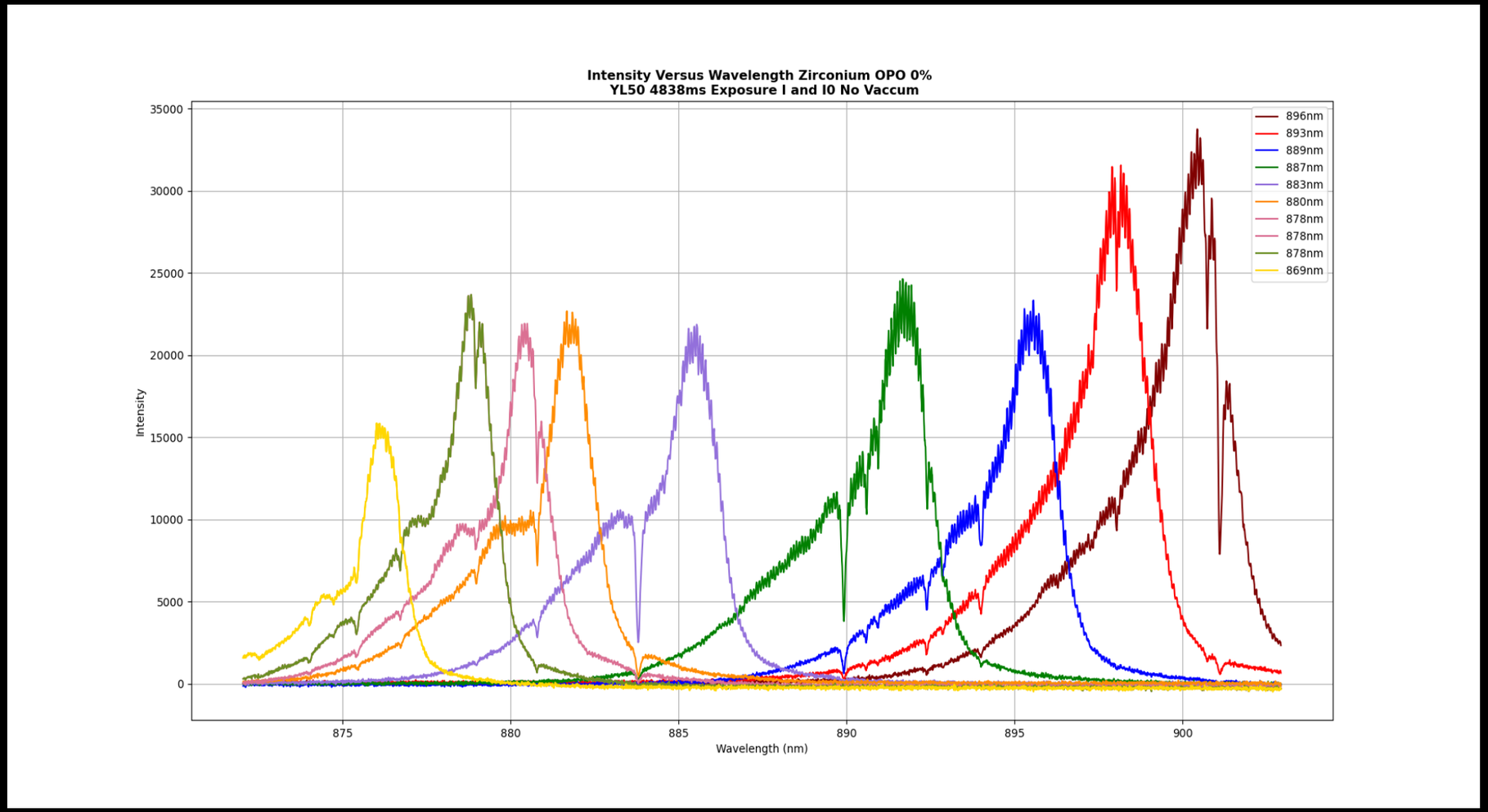
OPO PHOTOABSORPTION:

Zirconium ~1.38 eV to ~1.39 eV



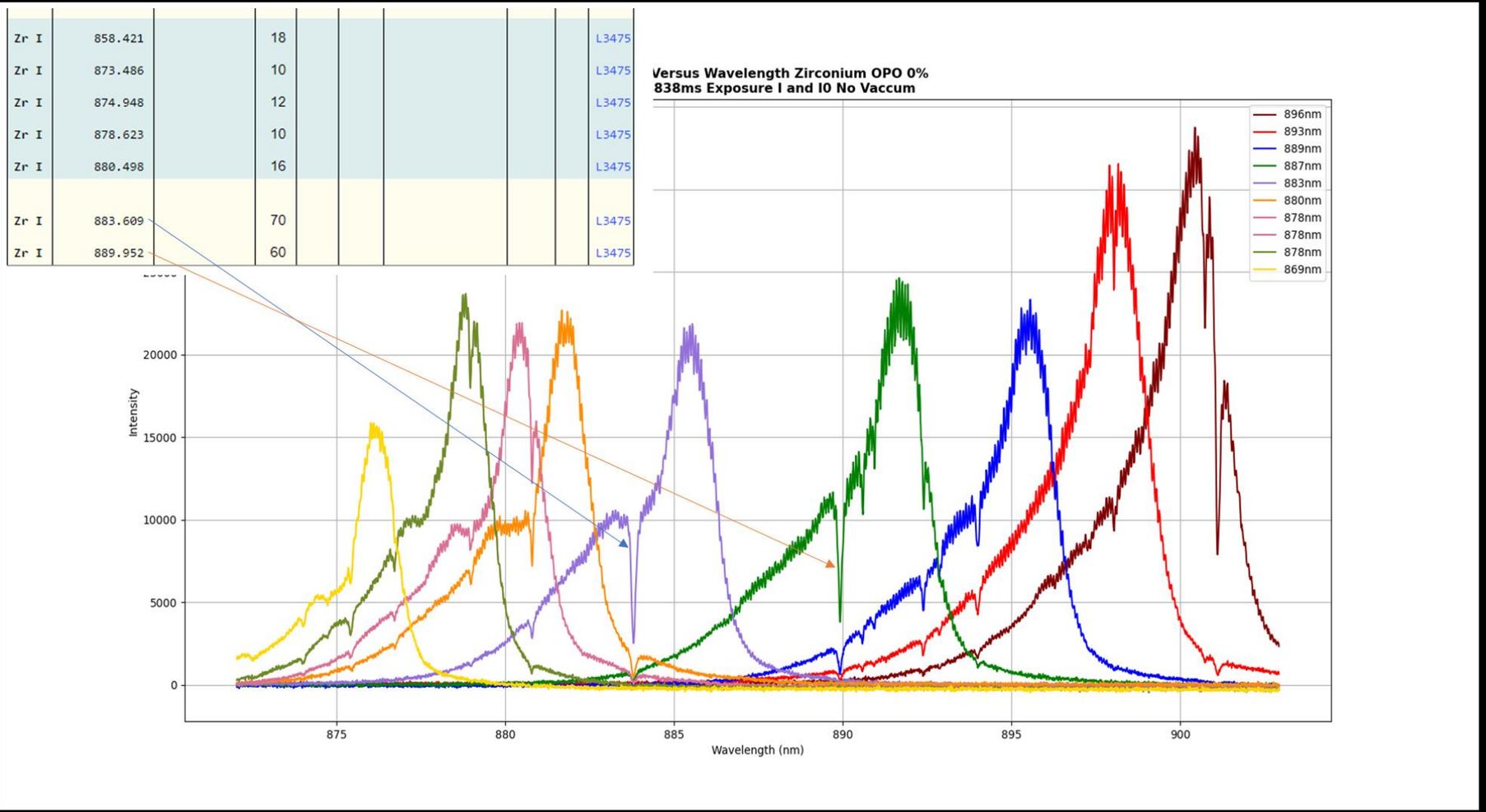
OPO PHOTOABSORPTION:

Zirconium spectra ~1.38 eV to ~1.42eV



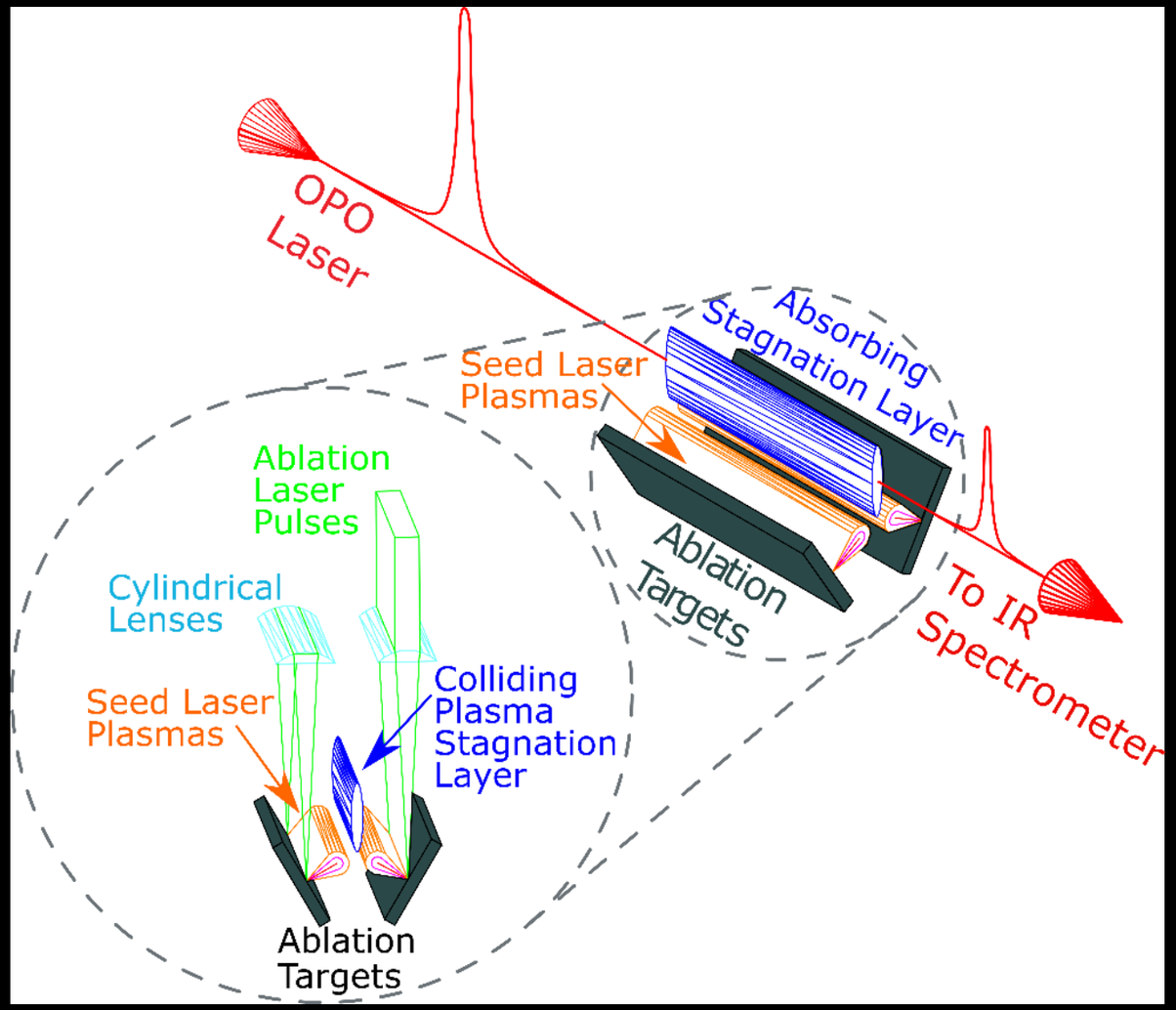
OPO PHOTOABSORPTION:

Zirconium spectra ~1.38 eV to ~1.42eV

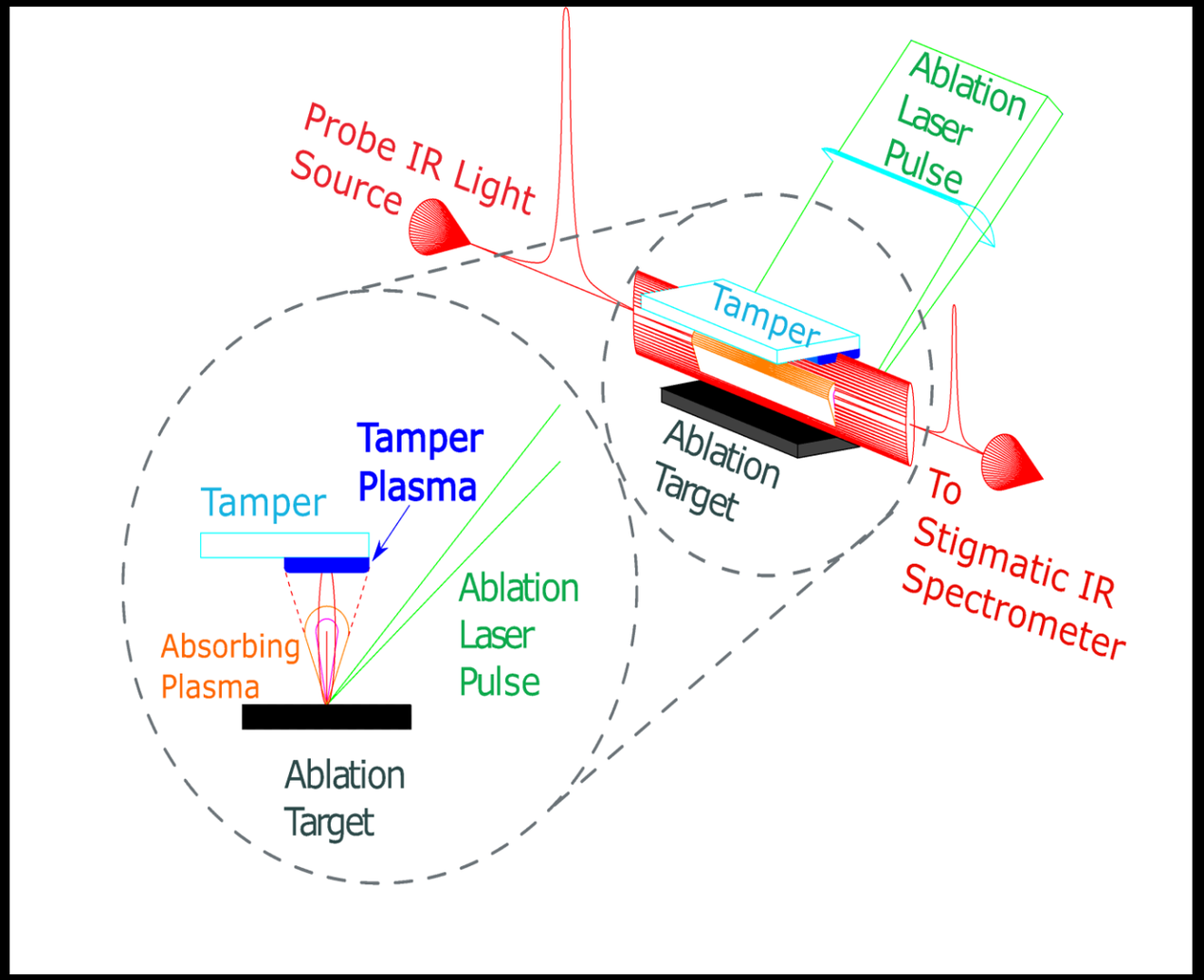


OTHER PHOTOABSORPTION SCHEMES:

Colliding Plasmas



Tamper Plasmas



WHERE TO NEXT?

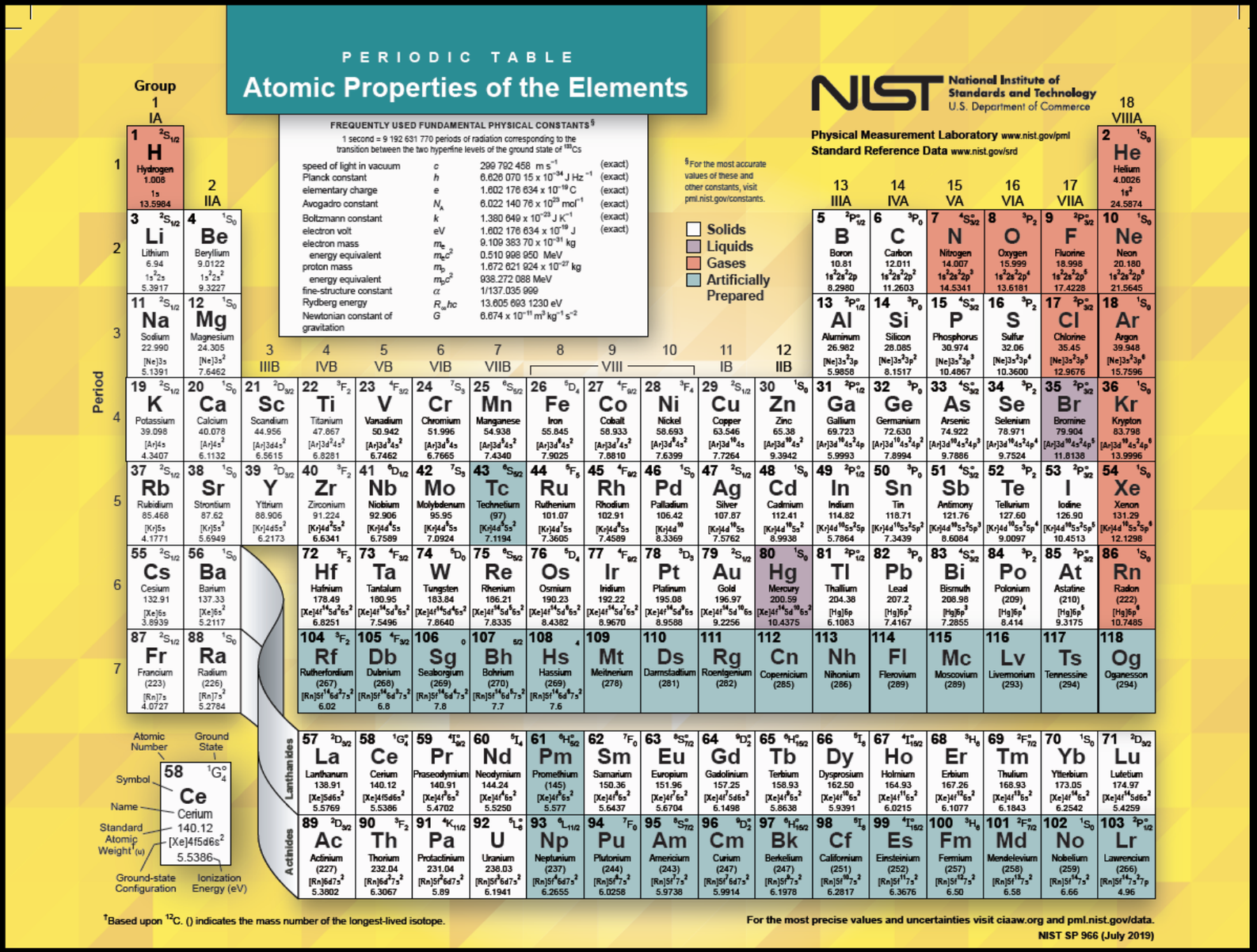
Build the UCD HEAVYMETAL team:

- 5 PIs
- 2-3 Post docs
- 5 PhD students

Develop new techniques:

- Colliding Laser Plasma
- Tamper Plasma
- Broadband OPO
- Fibre-optic setups
- Super Continuum source
- Dual-Comb Spectroscopy

- Near-UV Continuum for Photoabsorption.



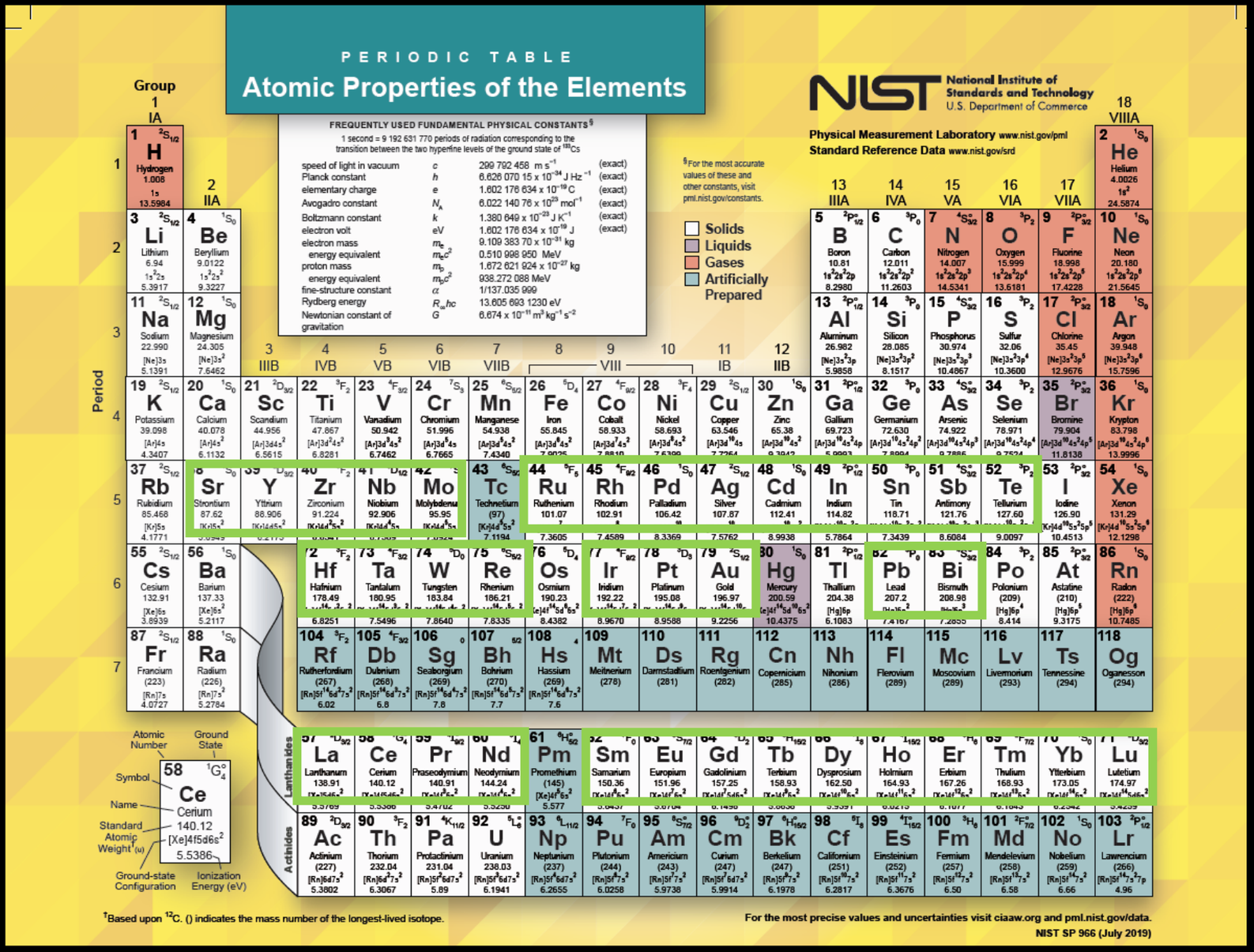
WHERE TO NEXT?

Observe any element that is solid, non-lethal & can be made in a planar form.

Emission & Absorption Spectroscopy from SXR – NIR

Iterate with QUB Theory:
Cathy Ramsbottom,
Connor Ballance & their teams.

Collaborate with the HEAVYMETAL team & beyond.



Thank You.

RISING TO THE FUTURE
UCD Strategy 2020-2024

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