(https://elisa.hi.is/)

Electrons in Lithography and Imaging for Science and Application

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History and Vision

Aiming to strengthen the platform for foundation science on electron driven processes in patterning and imaging on the nanoscale, and its translation to applications, imec took an initiative in pulling together researcher and stakeholders in this field at a merged conference **LE2AP+LEELIS 2024** (https://www.le2ap-leelis.org/home/home).

The **LE2AP+LEELIS 2024 (https://www.le2ap-leelis.org/home/home)** merged the communities of researchers from the MCS ITNs **ELENA** (https://elena.hi.is/) (Low energy electron driven chemistry for the advantage of emerging nano-fabrication methods) and **SIMDALEE2** (http://simdalee2.isibrno.cz/) (Sources, Interaction with Matter, Detection and Analysis of Low Energy Electrons), both focused on the physics and chemistry of electron driven processes in nanoscopic fabrication and imaging. Strengthening this initiative, the long standing conference series **LEELIS** (https://www.nwo-i.nl/en/agenda/leelis-iii-workshop-on-low-energy-electrons-lithography-imaging-and-soft-matter/) (Low-energy electrons: lithography, imaging and soft matter) joined – a conference series built on a strong tradition in understanding how electrons interact with matter, from their generation in photon-, electron-, ion-, or atom-beam environments to their transport, absorption, and scattering in molecular systems, thin films, and photoresists and in imaging.

In parallel, the **BEACON** (https://beacon3d.net/) community (Beam Induced Nano-Manufacturing, formerly **FEBIP**) has pushed the frontiers from direct-write nanomanufacturing and localized modification towards functional 3D nano-printing through focused electron and ion beams, offering a collaborative platform with the long standing **FEBIP** conference series.

Now **ELISA 2026** takes this a step further, uniting the long-standing and complementary **LEELIS** and **BEACON** communities, that have evolved around different yet deeply connected perspectives on electron-based science and technology.

With **ELISA** we seek to establish a lasting, bi-annual forum for the translation of the fundamental science of electron–matter interactions into practical fabrication strategies, enabling unique applications in materials science, micro-/nanoelectronics, and sensing.

By joining forces, **ELISA 2026** bridges **understanding and application** over **physics and chemistry**, **modeling, metrology and instrumentation**. This fusion creates a broader and more integrated platform – one that connects fundamental insight with technological innovation, encourages collaboration across disciplines, and sets the stage towards new breakthroughs in lithography, imaging, and nanofabrication.

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Electron interactions with liquid micro-jets: Reactivity and Spectroscopy

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Electron-induced interactions in liquid-phase systems is a topic of considerable interest, impacting many fields such as fundamental research, radiation chemistry, semiconductor fabrication and materials science. Usually, such studies have been conducted in bulk liquids or thin films and were often encountering limitations related to electron scattering, charge recombination, and diffusion-controlled reactions [1].

In this work [2], we demonstrate a novel home-made experimental setup utilizing liquid micro-jet technique to investigate electron-induced processes. The novelty of the experiment lies in the ability to deliver a controlled liquid sample into a high-vacuum environment and irradiate it directly by focused electron beam with tunable energy of up to 1keV.

Reactivity. An important key feature of our experimental setup in Prague is recirculating micro-jet, allowing a solution with target molecules to be passed through vacuum while being exposed to an electron beam. After several passes, the sample is extracted and submitted to an off-line chemical spectroscopic analysis for probing and quantifying the induced reactivity. We demonstrate a few example systems where electron-induced reactivity had taken place, giving a proof of concept for electron driven experiments in liquid-phase.

Spectroscopy. A custom home-made electron gun system has been originally designed and coupled to a high-resolution hemispherical electron energy analyzer, utilizing liquid micro-jet system at PLEIADES beamline of Synchrotron SOLEIL near Paris. We performed an electron-induced energy loss spectroscopy (EELS) of H_2O obtained for both gas- and liquid-phase in a region of a few hundred eV incident electron energy. We discuss the experimental challenges and characteristics of preliminary results obtained for H_2O Figure 1, as well as several other molecular systems.

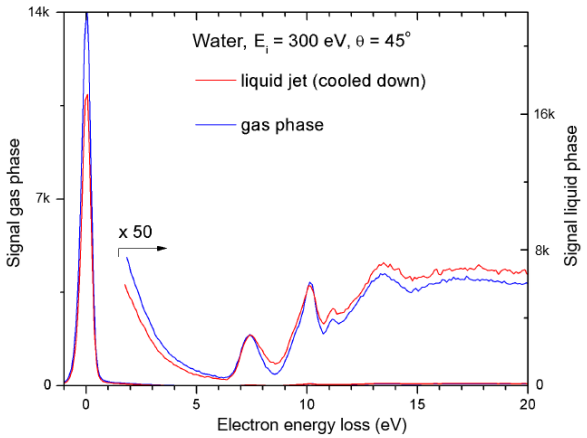


Figure 1 - EELS measured at 45° scattering angle and 300 eV incident electron energy.

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References

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