

DOI: [10.14232/syrptbrs.2023.19](https://doi.org/10.14232/syrptbrs.2023.19)

Attosecond Science at ELI Scale

Katalin Varjú

Extreme Light Infrastructure - Attosecond Light Pulse Source (ELI ALPS) Research Institute, Szeged, Hungary



The ELI-ALPS facility supports laser based fundamental and applied research at extreme short timescales, operating specialized lasers which drive nonlinear frequency conversion and acceleration processes. The attosecond beamlines based on advanced HHG techniques will be reviewed along with first experiments.

The Extreme Light Infrastructure – Attosecond Light Pulse Source (ELI-ALPS), the Hungarian pillar of ELI ERIC [1], is the first of its kind that operates by the principle of a user facility, supporting laser based fundamental and applied researches in physical, biological, chemical, medical and materials sciences at extreme short time scales.

This goal is realized by the combination of specialized primary lasers which drive nonlinear frequency conversion and acceleration processes in more than twelve different secondary sources. Thus a uniquely broad spectral range of the highest power and shortest light pulses becomes available for the study of dynamic processes on the attosecond time scale in atoms, molecules, condensed matter and plasmas [2,3].

The attosecond secondary sources are based on advanced techniques of Higher-order Harmonic Generation (HHG) [4,5]. Other secondary sources provide THz radiation or particle beams for plasma physics and radiobiology. A set of state-of-the-art endstations will be accessible to those users who do not have access or do not wish to bring along their own equipment.

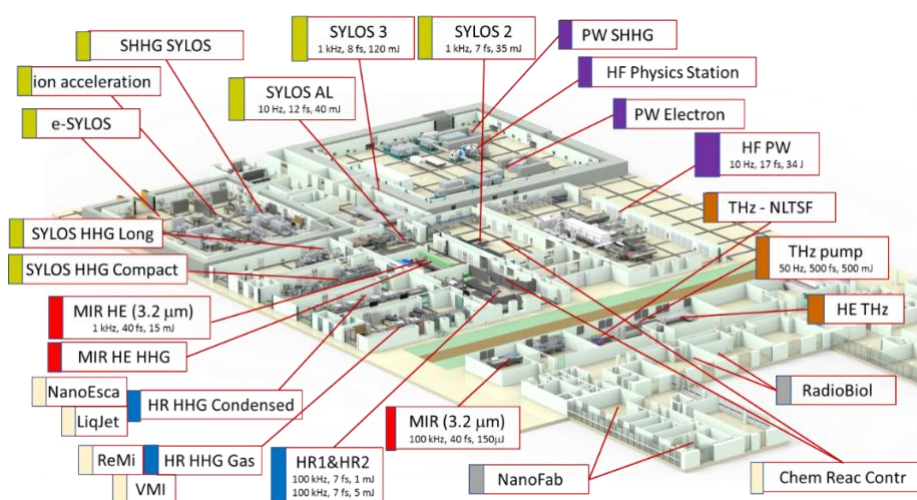


Fig. 1. ELI ALPS Primary and secondary sources with endstations



V. Symposium of Young Researchers on Pharmaceutical Technology, Biotechnology and Regulatory Science

January 18-20 2023 - Szeged, Hungary

ELI-ALPS implementation will conclude in 2023, in the meantime various research technology equipment pass commissioning and come online gradually. The talk will give a general overview of the implementation status and access possibilities of the facility, and will focus on the technical aspects of attosecond science driven by high average power few-cycle laser pulses.

At the current phase of the project ELI-ALPS welcomes the submission of proposals [6] for scientific experiments that will support the ramping up of the broad selection of light sources and experimental stations available. ELI-ALPS provides beamtime as well as technical and scientific support for the experiments.

References

1. <https://eli-laser.eu/>
2. S. Chatziathanasiou et al., "Generation of Attosecond Light Pulses from Gas and Solid State Media", *Photonics* **4**, No 26 (2017)
3. M. Reduzzi et al., "Advances in high-order harmonic generation sources for time-resolved investigations", *Journal of Electron Spectroscopy and Related Phenomena* 204, Page 257-268 (2015)
4. S. Kuhn et al., "The ELI-ALPS facility: the next generation of attosecond sources.", *Topical Review, Journal of Physics B* **50** 132002 (2017)
5. S. Mondal et al., "Surface plasma attosource beamlines at ELI-ALPS", *JOSA B* **35**, A93-A102 (2018)
6. <https://www.eli-alps.hu/en/Users-2/User-Call-2>