Invited: **Ultrafast Sources at ELI-ALPS and the scientific opportunities**

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Intense ultra-short pulses have sophisticated generation processes, complex metrology schemes and their applications are ubiquitous, spanning atomic-molecular physics, chemistry, material science, biophysics and the generation of new light and particle sources. The subsequent emergence of coherent attosecond (as) XUV sources [1,2], the shortest known electromagnetic pulses produced in a controlled way on a laboratory scale, has allowed unprecedented spatio-temporal resolution in photonics studies of ultrafast processes [3]. The interactions generating such pulses span a wide range of laser matter parameter space. The application of such pulses extend to all the four phases of matter (gas, liquid, solid and plasma forms with different dimensionalities) covering non-relativistic to relativistic phenomena encompassing classical to quantum descriptions [1,4].

ELI-ALPS, the Hungarian pillar of the Extreme Light Infrastructure project in Europe, benefits from all these diverse scientific developments and houses state of the art high repetition rate lasers that drive different sophisticated beamlines for generating secondary light and particle sources [5,6,7]. The complexity of the multi-parameter laser matter interaction space demands optimal and clever experimental designs for brighter and shorter attosecond pulses. It also necessitates a complete insight on the competing HHG processes. In this presentation I would talk about the diverse sources that are in the process of implementation at ELI-ALPS and either are or would be available for user experiments soon. While stressing the uniqueness of these sources I would also talk about the application possibilities and scientific opportunities that such sources would provide.

References

[1] A. Nayak et.al., Physics Reports. **833** (2019) 1-52.
[2] F. Krausz and M. Ivanov, Rev. Mod. Phys. **81** (2009) 163.
[3] M. Reduzzi, et.al., J. Electron Spectros. Relat. Phenomena **204** (2015) 257.
[4] S. Chatziathanasiou, Photonics **4** (2017) 26.
[5] S. Kühn, et.al., J. Phys. B At. Mol. Opt. Phys. **50**, (2017) 132002.
[6] D. Charalambidis, et al., Progress in Ultrafast Intense Laser Science XIII, Springer Series in Chemical Physics (ed. Yamanouch, K.) (Springer, Cham, 2017).181–218.
[7] S. Mondal, et al., J. Opt. Soc. Am. B **35**, (2018) A93.