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Overview of the ELI-ALPS project and its few cycle phase controlled laser sources

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The major laser sources of the Attosecond Light Pulse Source of the Extreme Light Infrastructure (ELI-ALPS) deliver pulses with unique parameters: unparalleled fluxes, extreme broad bandwidths and sub-cycle control of the generated fields. The high repetition rate (HR) system delivers TW peak power, < 6 fs pulses at 100 kHz. The 1 kHz repetition rate single cycle (SYLOS) system provides 20 TW pulses with a pulse duration of <5 fs. The petawatt-class high-field (HF) laser will operate at 10 Hz repetition rate with 17 fs pulse duration. The above laser systems operate in a bandwidth window of 600 nm - 1400 nm. These lasers are complemented by the mid-infrared (MIR) laser system, which provides tunable (2.5 μm - 3.9 μm) sub-4 cycle laser pulses at 100 kHz repetition rate with 15 W average power. High energy THz pulses at 50 Hz repetition rate are to be generated with a half a joule, half a picosecond laser system at 1.03 μm.

These exceptional laser sources will generate a set of secondary sources with incomparable characteristics, including light sources ranging from the THz to the X-ray spectral ranges and particle sources. The laser and secondary sources foreseen at ELI-ALPS will push the frontier of attosecond science in three main directions as coincidence measurements, investigations of highly nonlinear processes in the XUV and X-ray spectral range, and ultrafast valence-shell and core electron dynamics. The photon sources of ELI-ALPS would also provide regional and national, basic and applied science projects with experimental opportunities in radiobiology, biophotonics, plasma and particle physics.

Activities in the purpose-designed and built building complex will start with the installation of the MIR and the HR laser systems in Spring 2017. Simultaneously, we will also start the assembly of the high harmonic beamlines, the THz laboratory, and the nanoplasmonic experiments. The first XUV bursts of light with attosecond duration are expected to be generated by the end of 2017.

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