

# Extreme Light – from attoseconds to Petawatt

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The Extreme Light Infrastructure (ELI) project is part of a European projects to create laser systems with unique parameters, both in record short pulse duration ( $< 10^{-14}$  s), comprising only a few electromagnetic wave oscillations, and in power, reaching several petawatt (1 PW =  $10^{18}$  W). By creating a large spatio-temporal concentration of the laser energy, it is possible to reach unprecedented intensities in excess of  $10^{22}$  W/cm<sup>2</sup>.

To explore the interaction physics in these novel parameters regime is one of the most exciting goals of modern high field research. We will discuss plasma phenomena in the relativistic regime. In such a plasma, because of nonlinearity of electron motion, due to a change in their mass, the light propagation is affected, particles dynamics and radiation characteristics are strongly modified.

Particular attention will be made on ion acceleration phenomena, ions source and beam properties. Will be discussed the recent experimental findings on ion acceleration in this new intensity regime. New findings pave the way for achieving a desired ion source and beam parameters for applications (e.g. cancer radiotherapy). They encourage further development of laser technology to bring the laser power to a multi-PW level and activities for optimisation of laser plasma-based accelerators.