Advanced Laser Driven Radiation and Particle Sources:
From Atto-Science to Hadron Therapy

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The lecture gives an overview of advanced laser driven secondary sources and selected applications of them in tracking and visualizing structural dynamics with the highest spatiotemporal resolution. High intensity, short pulse laser-matter interactions lead to the generation of radiation and particle pulses, the use of which challenges dynamics in the attosecond time regime and structures in the sub-nm spatial regime. Generation processes include high order harmonic generation (HOHG) and laser weak field emission/acceleration (LWFA). Applications of such sources encompass the study of I) ultrafast dynamics in atoms and molecules, from electron and reaction dynamics in small systems to charge migration in biological molecules; II) magnon, electron-electron scattering and plasmon dynamics in surface and condensed matter; III) Biomedical applications, such as radiobiology and biological imaging; IV) material science. Currently Europe is implementing the Extreme Light Infrastructure (ELI), the largest laser user research infrastructure (RI) distributed in the Czech Republic, Hungary and Romania. ELI will provide to users access to unique lasers, laser driven sources and workstations, offering unprecedented research opportunities in the above mentioned areas.

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