WS101-5: Laser-driven proton beams for precise nanoparticle synthesis and cultural heritage diagnostics

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The advent of high-power ultra-short lasers has opened up the field of laser-driven particle acceleration, in particular proton and electron acceleration. The investigation of these laser-accelerated beams and its use is currently challenging many research laboratories worldwide, in particular for the improved characteristics of these sources such as compactness, versatility and tunability. As such, this new acceleration technique has a strong potential of being employed in diverse applications.

Currently, the main applications for laser-accelerated protons include astrophysics [1], being used as bright ultra-short neutron source [2], in medicine [3] or as injector for large scale accelerators [4]. High-intensity lasers and their secondary sources have also a strong potential in Materials Science applications [5]. Recently, some interesting applications in this field have been emerging, e.g. the use of these sources for application in picosecond metrology [6], taking benefit of the short bunch duration. These secondary sources have also a strong benefit for stress testing materials, both, using electrons [7] or protons [8], in particular if the materials to be stressed needs to be employed in a harsh environment. Laser-driven protons are potentially also usable as diagnostics in the Cultural Heritage, in particular the Particle-Induced X-Ray Emission (PIXE), where the intense, short and large proton beam should allow for a quicker analysis of the artifacts [9]. Another recent application is the use of laser-generated protons for Advanced Material Synthesis, profiting from the quick and intense heating generated by the laser-accelerated protons which provides ideal conditions for a short, and therefore more precise, nucleation phase in a Laser-Driven Proton Ablation synthesis process [10].

In this talk I will present different applications using laser-generated protons in Material Science embracing several domains such as Cultural Heritage and Advanced Material Synthesis, and where the characteristics of laser-accelerated particles are of advantage.

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