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Laser-Accelerated Proton Beams as Diagnostics for Cultural Heritage

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This work introduces the first use of laser-generated proton beams as diagnostic for materials of interest in the domain of Cultural Heritage. Using laser-accelerated protons, as generated by interaction of a high-power short-pulse laser with a solid target, we can produce proton-induced X-ray emission spectroscopies (PIXE). By irradiating a material sample with a high proton flux, we are able to perform the PIXE in a single shot without provoking more damage to the sample than conventional methodologies. We report about experimental results where PIXE emission from materials of Cultural Heritage interest, irradiated with the laser-accelerated proton beam, has been measured. The morphological and chemical analysis of the sample before and after irradiation are compared in order to assess the damage provoked to the artifact. Numerical simulations confirm that the temperature in the sample stays safely below the melting point. Compared to conventional diagnostic methodologies, laser-driven PIXE has the advantage of being potentially quicker and more efficient.

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