Advanced strategies for ion acceleration using high power lasers

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Ion acceleration driven by superintense laser-plasma interaction with dense materials, recently reviewed in Refs.\cite{1, 2}, has been attracting an enormous interest in the last thirteen years because of the several foreseen applications such as fast ignition in Inertial Confinement Fusion, medical hadrontherapy, nuclear and particle physics. Thanks to the continuous progress in high power laser technology and also in target manufacturing and engineering, several different acceleration mechanisms have been either demonstrated or proposed. Still, it is an open question to establish which mechanism is most promising for each application, as most of the requirements for ion energy, conversion efficiency, spectral width, brilliance and suitability for high repetition rate operation have yet to be met. In this talk we will summarize the state of the art and focus on some recent experimental results and related theoretical work on advanced regimes, such as radiation pressure acceleration of ultrathin targets, collisionless shock acceleration in moderate density plasmas, and sheath acceleration using structured targets. For each approach, the potential for further developments and applications will be discussed.

References