

# CENTER FOR BEAM PHYSICS SPECIAL SEMINAR

## “Low Emittance Proton and Ion Acceleration with Ultra-Intense Lasers”

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Abstract: Recent experiments have revealed the production of intense, collimated beams of protons and ions from the interaction of ultra-intense lasers with thin foils [1-6]. Acceleration of protons and deuterons to a few MeV has been demonstrated by a mechanism involving the strong charge-separation electric field produced at the front surface of the target foil as plasma electrons are ponderomotively driven into the target foil [3]. Higher energy protons (up to 50 MeV [4,5]), and ions (e.g., fluorine 7+ ions up to 100 MeV [7]), have been demonstrated from the rapid ambipolar plasma expansion on the rear, initially unperturbed target surface, driven by the laser-produced relativistic electrons which penetrate and envelope the target foil [8]. The latter process leads to very laminar, low-emittance beams which may be suitable for injection into accelerators [9], or for laser-based applications such as short-pulse proton radiography [5,10], Fast Ignition, and high energy density experiments. We review the present status of experiments and theory of the rear-surface ion acceleration process, and discuss the potential impact for laser-based ion sources and for HIF research.

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