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Generation of well-collimated mono-energetic heavy ion beams by intense laser pulses D. WU, B. QIAO, C. MCGUFFEY, F.N. BEG, UCSD — We report on the generation of well-collimated quasi-monoenergetic heavy ion beams from ultrathin foil targets irradiated by intense laser pulses. It is found that the field ionization effect plays an important role in the acceleration dynamics of heavy ion species. The heavy ions close to the laser propagation axis are ionized to a higher charge state by the strong laser field within its central focal region, which are favorable to be accelerated by the laser radiation pressure due to larger charge-to-mass ratio. The others located away from the axis are ionized to lower charge states due to the weaker laser field. By choosing an optimal coupling of laser intensity, target material and thickness, a well-collimated mono-energetic high charge state heavy ion beam can be produced. Two-dimensional particle-in-cell simulations shows 300 MeV Al^{12+} ion beam are produced from ultrathin foils by intense laser at intensities of 10^{20}Wcm^{-2}. Simulations for different target materials, such as Fe and Cu, are also carried out to verify this novel scheme.

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