Possible role of laser driven energetic ion bunches in materials science and in simulation of mixed radiation

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The Laser driven particle acceleration has been of wide interest to the research community due to extremely large acceleration gradient at the impact point of high density laser on thin film. However such accelerated ions have not been exploited by researchers (although there have been some demonstration experiments), due to limitations of energy resolution of accelerated ions, high fluence requirements, more than one ion species in ion bunches, mixed radiation, etc. I will try to bring out interesting cases in materials science and related fields where these shortcomings of the laser driven accelerated ion beams are blessing in disguise in achieving the desired objectives. There are requirement in certain areas of materials science where one requires low concentration of dopants, clusters and nanoparticles buried in near surface region upto a few tens of nanometer to about a micron depth, where the laser driven energetic ion beams seem to have strong potentials and edge over the conventional accelerators. The advantage of ultra short time structure of laser driven energetic ion bunches is being briefed by another Indian colleague.

The examples of such experiments will be briefed along with the simulations of broad energy resolution energetic beams in materials of interest. Other than these, the mixed radiation e.g. simultaneous existence of energetic ions, electrons, photons and neutrons, have potentials for simulating the space radiation and its effect on space electronic chips, satellite devices, biological effects on the cells. The studies on mixed radiation have a relevance to the inputs to the nuclear disaster management.