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# Quasimonoenergetic Proton Generation for Compact Neutron Sources

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Irradiating ultra intense ultrashort laser pulses on nano-size cluster targets, protons are accelerated due to Coulomb explosion, the energies of which are of the order of a few MeV. In terms of the reactions between Lithium and the protons, neutrons are generated. Optimizing the laser and target parameters, we maximize the coupling efficiency of neutron yields. In particular, the cluster targets are made of two or three atomic components in order to produce quasi-monoenergetc protons. The resultant neutrons are expected to have relatively low temperatures lower than a few 100 keV because of the endothermic reactions. The 50-100 nm-sized spherical targets have been optimized in structure [1] to provide a quasimonoenergetic proton source, the conversion efficiency from absorbed energy to proton kinetic energy amounts as high as 30%. Fig.1 shows such an example (the peak energy of protons can be controlled by the target and laser conditions), that has been obtained by 3-dimensional particle simulations. A most salient feature of the optimized target is the hollow structure. Controlling such that the peak of p-Li reaction rate and the quasimonoenergetic proton overlap, one can maximized the neutron production rate.

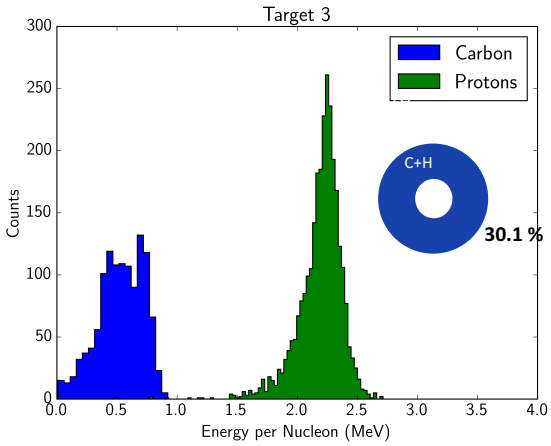


Figure 1. Energy spectrum of nano-target

References

[1] M. Murakami and K. Mima, Phys. Plasmas **16**, 103108 (2009).

[2] B. Ramakrishna, M. Murakami, M. Borghesi et al., Phys. Plasmas **17**, 083113 (2010).