LASER-DRIVEN ION ACCELERATORS: UNIQUE BEAMS AND COMPACT NEUTRON SOURCES

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Ultra-intense lasers have matured to the point where they reliably can create relativistic plasmas. The limiting breakdown voltage, a common constraint in conventional accelerators is of no concern in a plasma, and the accelerating fields, created by charge separation of electrons and ions can reach levels, million times stronger compared to RF-based accelerators.

Laser-plasma accelerators have reached ten's of MeV of ion energy in sub-millimeter structures and currents of hundreds of kiloamperes. The ion beams can be used for material modification, medical applications, non-destructive testing and most recently as a driver for a compact neutron source.

One exciting application was nondestructive testing methods and material selective imaging of compound large objects, which is possible using thermal and fast neutrons.

After presenting the underlying mechanism to create an intense pulsed and highly directed beam of neutrons and recent experimental results I will focus on a few examples of using such sources for applications that are either important for the security of our countries or will have large economical potential in industrial applications. These range from the remote sensing of illicit nuclear material in cargo to the non-destructive analysis of large civil constructions using compact laser systems. Finally, a possible path forward is sketched that will lead to a useable tool for member states to accomplish their goals securing the peaceful use of the atom.