Advanced scheme for high-yield laser driven nuclear reactions

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The use of a low contrast nanosecond laser pulse with relatively low intensity (3×10^{16} W cm^{-2}) allowed enhancing the yield of induced nuclear reactions in advanced solid targets. In particular the "ultraclean" proton-boron fusion reaction, producing energetic alpha-particles without neutron generation, was chosen. A spatially well-defined layer of boron dopants in a hydrogen-enriched silicon substrate was used as target. The combination of the specific target geometry and the laser pulse temporal shape allowed the production of an enormous yield of alpha-particles around 10^9 per steradian. This result can be ascribed to the nonlinear interaction of the long laser pulse with the expanding plasma and to the optimal target geometry and composition.