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"A Novel Approach to Aneutronic Fusion"

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Abstract: The rapid advance of both high-intensity laser pulse technology and of laser-plasma interaction physics creates new opportunities for fusion energy production. We propose a novel laser fusion scheme operating out of thermal equilibrium utilizing synergy between: a) short, high-intensity, laser-generated particle beams, and b) a laser-produced plasma target. I will report on our first implementation from 2011/12 experimental run published in 2013 using a synchronized combination of high-energy and high-intensity laser pulses in the pico- and the nanosecond regimes.

I report on the experimental investigation of the clean aneutronic fusion reaction p + 11B -> 3 alpha +8.7 MeV initiated within this approach by a laser-accelerated proton beam in a boron target, showing high fusion reaction rate for optimized interaction conditions. Beyond fusion, our approach demonstrates a new method of exploration of low-energy nuclear reactions in plasma environment with interesting applications in astrophysics. This work was an outcome of qualitative ideas about potential reaction mechanism. More detailed modeling of the behavior of laser generated boron fireball could greatly enhance the fusion yield.