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Boron laser fusion by plasma block ignition and avalanche reaction

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Fusion reactions of protons with the boron isotope 11 (HB11) were considered as extremely difficult and impossible for a power reactor. This changed by several orders of magnitudes using picosecond (ps) laser pulses with powers >petawatt (PW) igniting fusion in a non-thermal way by direct conversion of laser energy into ultrahigh acceleration of plasma blocks [1]. This block acceleration after extensive numerical studies was exactly measured [2] and resulted in bridging the mentioned difficulties of the HB11 reaction [3]. A further improvement is due to measurements of an avalanche reaction [1] that is explained by elastic nuclear collisions in non-equilibrium plasmas [4]. Further properties of the dielectric plasma explosion process are studied by multi-fluid hydrodynamics and PIC techniques [5] including direct drive ignition of cylindrical fusion fuel at the ps interaction with the extreme powerful laser pulses. The basically nonlinear mechanism of the dielectric explosion is a plasma-dynamic absorption within a much shorter interaction length than plasma collisions or optical tunnelling can describe in agreement with experiments. These results are supporting the development of a boron laser fusion reactor [1] for environmentally clean, low cost and lasting energy production.

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