New options for high gain hydrogen-boron ($H^{11}B$) laser fusion

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The recently reported high gain fusion reactions of hydrogen with the boron isotope-11 have been studied by hydrodynamic multi-component plasma computations in order to distinguish between different experimental configurations. Special attention is given to different time scales of the interaction and to the role of high density energetic ion beam involvement [1]. The difference is the application of picoseconds laser pulses of duration up to few hundred picoseconds with a potential explanation between measurements and theoretical models of elastic nuclear collisions [2] in contrast to laser generated proton beams to irradiate boron enriched targets [3]. In the later case, evaluations over longer times up to 10 nanoseconds are evaluated in order to arrive at high numbers of gained fusion reactions. In view that experiments for generation of high density ion beams are available next, the long-time conditions may be of interest not only in view of medical applications e.g. for the hadron cancer therapy. The hydrodynamic computations are using the multifluid models in order to fulfil the conditions for partial properties of non-thermal equilibrium. The geometry of the studied plasmas are as for the short time interaction based on cylindrical trapping by extremely high magnetic fields up to a duration of few nanoseconds providing the conditions of high gain reactions. An alternative in the geometry is considered where the alpha [5] and proton [6] beam irradiation is towards the cylindric axis of the fusion fuel. This opens another option for a laser driven boron fusion reactor [4].

References

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