Summary of scientific developments on LASER BORON FUSION (February 2018)

Global attention to a new route for absolute clean and low cost nuclear power was opened for laser boron fusion when a publication mid December 2017 was downloaded from Cambridge University Press 500 times during the first few weeks and the abstract was opened 36000 times. Fusion of the boron isotope 11 with hydrogen H (HB11 fusion) is well known to be extremely difficult, five orders of magnitudes more difficult than the easiest DT fusion *under conditions of local thermal equilibrium LTE* at about 100 keV (billion degrees) temperature. How can this be changed?

Ignition under *non-LTE conditions* is the way out in order to reach ignition by just now available extreme picosecond laser pulses with more than 10 Petawatt power. The forces by the electric and magnetic laser fields **E** and **B** including dielectric plasma properties are fully dominated by the nonlinear (ponderomotive) forces such that thermal pressure p is only a very minor disturbance. The laser energy is converted directly into macroscopic mechanical motion of plasma blocks. This was discovered first numerically with the completed equation of motion dominated by the nonlinear forces at UNSW in 1977 [see Figures 10.18a&b of Ref. 1] and first measured as ultrahigh acceleration by Sauerbrey [2] from the blue Doppler shift of spectral lines in the reflected light of the plasma streaming against the irradiating laser. This led to the experimental result [3][4] of comparably higher fusion reaction gains of HB11 than from DT. The gap of these nine orders of magnitudes higher energy was bridged by the measurements with theoretically understood avalanche fusion of HB11 [5].

The clean and low cost fusion power reactor could be designed [6] and the road map to this aim found the remarkable interest [7]. The latest publication including the first PIC computations to show the dielectric non-thermal explosion of the nonlinear-force driven plasma blocks was electronically pre-published [8] as confirmation of the plasma-hydrodynamic result of 1977 [1].

A part of the bridging gap by orders of magnitudes is known [9] that this was recognized 2010 as “fastest route to fusion energy” [10] by Steven Haan as a leader of the NIF-experiment for laser fusion at Livermore/California who is one of the early laureates of the Edward Teller Medal.

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[6] PCT/EP2014/003481 Patent 2014, see US 20170125129A1
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[10] Haan S. see Hora H. *Laser Plasma Physics, Second Edition* SPIE Books Bellingham WA, p. 247

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