ON DD AND PROTON-BORON NUCLEAR SYNTHESIS IN A COMPACT SCHEME OF PLASMA ELECTRODYNAMIC (OSCILLATORY) CONFINEMENT [[1]](#footnote-1)\*)

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In recent years, on the basis of nanosecond vacuum discharge (NVD) we have been investigating the not quite usual scheme of inertial electrostatic confinement (IEC) [1] - this is an IEC scheme with reverse polarity [2]. It contains the injection of electrons into the anode space, the formation there of a virtual cathode (VC) and the corresponding potential well (PW) [2]. Ions oscillate in the PW, reaching energies up to ~ 100 keV at the moments of head-on collisions. In a result, at the moments of ion collapse at the "bottom" of the PW, both DD synthesis and p + 11B aneutronic synthesis take place. Meanwhile, the presence of harmonic ion oscillations partially contributes to VC retention also (see Figs. 3–5 in [2b]). Therefore, in whole, the confinement in our scheme of NVD [2], in fact, would be more correct to call electrodynamic (or oscillatory) one. This report presents a review and analysis of the main works concerning to the IEC scheme with reverse polarity, starting with the first theoretical work [3]. Later on, in order to get away from the beam – beam scheme in a conventional IEC [1] and to increase the synthesis efficiency, it was proposed to inject electrons into the anode space to create VC with parabolic PW, and switch to the periodically oscillating plasma spheres (POPS) regime [4]. In the experiment, POPSs were demonstrated for He+, Ne+, and Н2+ only (oscillation frequencies ν ≤ 700 Hz, PW depth φ PW  ≤ 300 V) [5]. Nevertheless, the nuclear fusion power density P ~ φPW 2/ rVC4 scaling was obtained [4], which pointed to the high efficiency of miniature systems namely (rVC - VC radius, φPW - PW depth). This even made it possible to talk about a possible multi-module reactor with POPS modules (~ 107) [4,5], however, it was not possible to create such a module in LANL with either grids or the Penning trap then. As a result, over time, it became clear that it was our NVD in which rVC is small (~ 0.1 cm) and the PW is very deep (≤ 100 kV), in those same years [6] already became the realization of certain hopes associated with the advanced POPS [4,5]. In an experiment with a cylindrical NVD, deuteron oscillations were obtained with a frequency of ~ 80 MHz, and PW with a depth of (~ 100 kV) [2]. This provided record values ​​for fusion power density, and made it possible to obtain the yields both of DD neutrons [2, 6] and α – particles from aneutronic synthesis p + 11B [7].

References

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