COMPARISON OF POSSIBLE QUANTITIES AND INTENSITES OF NUCLEAR SYNTHESIS REACTIONS IN Z-PINCHES AND TOKAMAKS [[1]](#footnote-1)\*)

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The paper presents a theoretical analysis and comparison of methods for heating plasma to thermonuclear values ​​in Z-pinch devices and tokamaks [1, 2]. The advantage of obtaining nuclear fusion reactions as a result of Z-pinch compression is shown in comparison with the methods used in modern tokamaks.

A theoretical comparison of the possible quantities and intensities of nuclear fusion reactions of these systems became possible due to the fact that earlier tokamaks have their origin from experiments with linear Z-pinches, in which neutron radiation from plasma systems was first obtained [2, 3]. Subsequently, the development of Z-pinch discharges and the creation of toroidal chambers went in different directions: research on tokamaks was aimed at creating a stationary nuclear reactor, and Z-pinches at creating a powerful pulsed source of neutron radiation.   
In theoretical terms, the modeling of Z-pinch and tokamak discharges occurs within the framework of the same physics and using the same equations. The only difference is that when simulating discharges in tokamaks, nonstationary phenomena in plasma are often neglected, while in   
Z-pinches, pulsed processes in plasma form the basis for these systems. Such phenomena include the pinch heating of the plasma due to its compression by the magnetic field of the discharge and the onset of MHD instability, leading to the generation of high-energy ions [4–6].

At present, it has been confirmed that neutrons in Z-pinches occur as a result of a thermonuclear fusion reaction and for them there is only a problem of using this plasma to generate electrical energy. For tokamaks, this problem has also not been fully resolved. The problem of plasma heating in tokamaks can be solved in the same way as it is solved in Z-pinch installations, i.e. heat the plasma by using the energy of the magnetic field created by the presence of a discharge current in the plasma.

The neutron yield in Z-pinches is proportional to the current to the fourth power and in experiments carried out on the Z-pinch facility (USA, Sandia Laboratory) is 2 x 1012 thermonuclear D–D neutrons per pulse at a current of 19 MA [7]. It is shown that obtaining the largest number of nuclear fusion reactions is an important factor when choosing a device for creating a nuclear fusion reactor.

References

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