On the mechanisms of generation of neutrons in Z-pinches [[1]](#footnote-1)\*)

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The mechanisms of neutron generation in Z-pinches are outlined which are used in the modern theoretical considerations. The mechanism of neutron generation is likewise analyzed, recently suggested in [1]. The complexity of interpretation of neutron generation is pointed out based entirely on acceleration or thermonuclear mechanisms. The point is that mechanism of neutron generation might change during Z-pinch discharge development.

Cross section of Columb collisions is essentially larger than cross section of nuclear collisions, that is why if plasma ions are accelerated due to some mechanisms, their movement becomes random and their distribution becomes maxwellian. As a result for the particles which gained energy in subsequent collisions the mechanism of neutron generation becomes thermal, i.e. thermonuclear. In order to describe neutron emission from high temperature plasma applying thermonuclear formalism it is necessary that product of plasma density and confinement time is enough to plasma maxwellization. This condition is usually well met in plasma focus systems.

Modeling which takes into account chaotization of movement of Z-pinch plasma ions shows that substantial amount of neutrons is generated due to MHD instability, i.e. arises due to formation of hot and dense plasma during the neck development. In plasma focus systems essential energy gain of ions happens as a result of adiabatic compression of plasma in the neck. In this case the thermonuclear mechanism of neutron generation in such systems prevails from the very beginning of discharge development.

That is why Z-pinch systems due to availability of thermonuclear mechanisms of neutron generation with the consequence that neutron yield is proportional to the current in the fourth power [2] can be considered as a basis for the creation of industrial thermonuclear reactor.

References

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2. Mikhailov Y.V., Lemeshko B.D., Prokuratov I.A. [Plasma Physics](https://www.elibrary.ru/contents.asp?id=41610498), 2019. V. 45. [№ 4](https://www.elibrary.ru/contents.asp?id=41610498&selid=41649848). P. 334.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/It/ru/DM-Frolov.docx) [↑](#footnote-ref-1)