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Neutron and x-ray emission in Z-pinch and dense plasma focus

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Abstract

Z-pinches and plasma focus devices are pulsed power linear discharge devices in which a radial plasma implosion is driven by a self-generated magnetic field. At the beginning of controlled thermonuclear fusion research, Z-pinches were the first candidates for the fusion reactor. Their successive modifications led to the formation of various configurations more suitable for practical fusion reactors, including theta-pinches and toroidal pinches, which can be regarded as the forerunners of tokamaks. However, Z-pinches have proven to be an efficient way to achieve high D-D nuclear fusion yields via the beam-target mechanism. The produced intense short pulses of neutrons and x-rays are promising tools for flash radiography of fast processes, laboratory simulations of supernova explosions, radiation testing, subcritical experiments, and many other potential applications. Despite many years of research, many of the physical phenomena that lead to efficient deuteron acceleration and high fusion yields remain unexplained.

In this lecture, we will take a look at pulsed power and Z-pinch technology, introduce different implosion loads, Z-pinch configuration, and state of the art Z-pinch research, present the experimental studies, and discuss their results. We will also mention the potential applications and future of Z-pinch research.

References

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