Limiting energy gain in deuterium plasma at powerful injection heating

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The concepts of fusion neutron source are currently developed for hybrid fusion–fission systems and the waste transmutation ones. For such systems it is supposed to use the deuterium-tritium (D–T) reaction. The need to use tritium technologies is a deterrent factor in this promising direction of energy production. Therefore potential possibilities of using systems that do not require tritium developments are of a significant interest.

A deuterium-deuterium (D–D) reaction can be considered for the use in demonstration fusion neutron sources. The product of this reaction is tritium, which will burn in the plasma with the emission of fast neutrons. ​​D–D reaction is significantly slower then D–T reaction.

Our study shows an increase in neutron yield using a powerful injection of the beam of deuterium atoms. The calculations show possibilities to realize the essential neutron yield from the tritium-lean deuterium-based plasma. The estimates of the parameters needed for the realization of a source of fusion neutrons are presented on the basis of recently developed model [1–3].

Requirements to magnetic confinement systems are discussed respectively with the proposed concept. Regimes with power gain *Q* ~ 0.5 are possible at yhe temperature of thermal components *T* ~ 100 keV, injection energy *E*0 ~ 1 MeV, and magnetic field up to 10 T.

References

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