Contribution ID: **57** Type: **Poster**

Evaluation of beam-beam fusion reaction rate considering local beam profile in toroidal plasmas

Wednesday, 4 September 2019 15:15 (15 minutes)

NBI heating is a reliable method to heat the plasma to high-temperature. Energetic beam ions are generated, and nuclear fusion occurs if we choose the deuterium as a beam ion. Many D-D fusion reaction experiments have been performed in tokamaks[1] and helicals[2]. The neutrons by D-D fusion reactions are measured to study the confinement of energetic beam ions and neutron counts are compared with the numerical simulation considering the beam-thermal, thermal-thermal, and beam-beam fusion reactions. On the other hand, trapped beam ions locally distributed on the flux surface, and it is necessary to evaluate the beam-beam fusion reaction considering the local distribution of the beam ions if the beam density increases.
We study the beam-beam fusion reaction in toroidal plasmas (a simple tokamak and LHD) considering the local beam ion distribution on the flux surface. We apply the GNET code, which can solve the drift kinetic equation for the beam ions in 5D phase space. We evaluate the velocity space distributions in 5D phase space, then, estimate the D-D reaction rate; the neutron and tritium emission rate.

References:
[1] Y.Neyatani, et al., Fusion Engineering and Design 36(1997)429-433.
[2] M.Homma, et al.,Plasma and Fusion Research 11(2016)2403109.

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Session Classification: Poster

Track Classification: Effects of Energetic Particles in Magnetic Confinement Fusion Devices