Flux supply of a field-reversed configuration by NBI heating

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Neutral beam injection (NBI) is most effective way to maintain a field-reversed configuration (FRC) plasma. Because of its high-beta nature a commonly-used wave heating method is unfortunately inapplicable. Therefore, NBI is a key issue of steady state operation of FRC plasmas.

Recent numerical studies are focused on heating of FRCs. Takahashi *et al*. showed an FRC plasma with the trapped flux of 4.7 mWb confines well 15-keV beam ions injected tangentially to the plasma current [1]. A study of the flux supply by NBI, on the other hand, has not been as yet investigated. The theoretical model to discuss the flux supply of an FRC plasma is newly developed in the present work.

It may be thought that the presence of the beam current could augment the confinement field according to the Ampère's law, and then the flux is thought to be supplied. However, the resistive force between beam particles and electrons can cause the flux decay, when one employs the simplified Ohm's law and the Faraday's law. This suggests that the azimuthal component of electric field should be modified. Being examined the azimuthal force on the electron fluid element the thermal force [2] can contribute to the flux supply of an axisymmetric FRC. When the core plasma is heated by fast ions, the electron pressure gradient enhances; it can lead the flux supply.

Effects of thermal force on the flux maintenance will be discussed numerically, and the results will be shown in the poster session.

[1] T. Takahashi, Y. Hirano, T. Asai, T. Takahashi,Y. Tomita, N. Mizuguchi, and Y. Kondoh, J. Plasma Fusion Res. **81**, 421 (2005).

[2] S. I. Braginskii, *Transport Properties in a Plasma,* in Review of Plasma Physics, M.A. Leontovish (ed.), Consultants Bureau, vol. 1, p. 216 (1965).