Contribution ID: **39** Type: **Poster**

Correlation between Beam Power and Knock-on Effect of Energetic Protons on Slowing-down Deuterons Observed in the Large Helical Device

Thursday, 5 September 2019 15:15 (15 minutes)

Energetic ions knock the thermal ions in the higher energy range via nuclear elastic scattering (NES) [1], and create knock-on tails in ion velocity distribution functions. A large fraction of the energetic-ion energy is transferred to the bulk ion in a single NES event, and the energetic-ion slowing-down properties are affected by the collisional energy-transfer process as well as Coulomb collision. Owing to the NES effect, fractional energy deposition transferred from energetic ions to bulk ions tends to increase compared with when we only consider Coulomb collision. The NES causes distortion of both energetic and bulk distribution functions, and sometimes fusion reaction rate coefficients are changed from the values for Maxwellian plasma. These phenomena could be appreciable in a thermonuclear plasma and the understanding with experimental validation would be necessary.

On the large helical device (LHD), we attempted to observe the knock-on effect by looking at a decay time of the DD neutrons after deuterium beam was terminated for several beam conditions. We devoted our attention to measure the neutron decay times produced by the DD reactions between the ˜60-keV deuterium beam and bulk deuterons. During the decay process the ˜180-keV hydrogen beams were continuously injected, and the decay times were compared for several hydrogen beam-injection patterns. We expected that the neutron decay process would be disturbed by the knock-on effect of energetic protons. We observed that the decay process was actually delayed (decay time increases) with increasing the intensity of the injected hydrogen beam power. Numerical simulations are carried out to understand the observed phenomena on the basis of the Boltzmann-Fokker-Planck model [2]. The simulations reproduced the experimentally measured phenomena with several parameters. In the presentation we will discuss the influences of the parameters assumed in the simulation and the particle loss process in the LHD plasma.

[1] J. J. Devaney and M. L. Stein, Nucl. Sci. Eng., 46 (1971) 323.
[2] H. Matsuura, et al., Plasma Phys. Contr. Fusion, 53 (2011) 035023.

Country or International Organization

Japan

Primary authors: MATSUURA, Hideaki (Kyushu University); SUGIYAMA, Shota (Kyushu University); Mr KIMURA, Kento (Kyushu University); Mr URAKAWA, Tomoki (Kyushu University); Dr NISHITANI, Takeo (National Institute for Fusion Science); OGAWA, Kunihiro (National Institute for Fusion Science); Dr KAWAMOTO, Yasuko (NIFS); TAMURA, Naoki (National Institute for Fusion Science); Prof. ISOBE, Mitsutaka (National Institute for Fusion Science); OSAKABE, Masaki (National Institute for Fusion Science)

Presenter: MATSUURA, Hideaki (Kyushu University)

Session Classification: Poster

Track Classification: Transport of Energetic Particles