Contribution ID: **3418** Type: **not specified**

P4.1042 Magnetic reconnection driven by plasmoid instability in coaxial helicity injection current drive on HIST

Thursday, 11 July 2019 14:00 (2 hours)

See full abstract here
http://ocs.ciemat.es/EPS2019ABS/pdf/P4.1042.pdf

The Spherical Torus (ST) is a promising candidate for an advanced fusion reactor due to the compactness. Elimination of the central solenoid coil to allow an approach to lower aspect ratio configurations requires for the non-inductive plasma start-up. The transient coaxial helicity injection (T-CHI) is a leading candidate for its method. One of the most important issues in T-CHI is whether it can establish closed flux surfaces due to the magnetic reconnection in the high Lundquist number S regime. Understanding the flux closure during the start-up process is the primary purpose of the T-CHI experiment on the Helicity Injected Spherical Torus (HIST: R=0.30 m, a=0.24 m, A=1.25) [1]. Also, the CHI provides a good platform for pursuing MHD relaxation and magnetic reconnection physics. Magnetic reconnection is an essential element in understanding of self-organization phenomena such as sawtooth oscillations and Taylor relaxation in fusion plasmas and also eruptive mass ejection of solar flares in astrophysical plasmas. To prove the flux closure issue in the CHI start-up, we have investigated the fast magnetic reconnection driven by multiple plasmoids [2].
In the CHI experiment on HIST, we have found that two or three small-size plasmoids are generated in elongated toroidal current sheet with the full width ~0.05 m, a long length L=0.6-1 m and a high density ne= 0.3-2x1020 m-3. The frequency of the regular oscillation of the reconnected magnetic field observed in the H discharge is analyzed to be 175 kHz, which well correlated with that of electron density. The magnetic oscillation originated from the reconnection point propagates outwardly in the radial location by the Alfven speed of 30 km/s. The frequency depends on the gas species (H, D and He) and the external toroidal (guide) field strength. In the He discharge, the oscillation is much slower than that in the H2 discharge, leading to the formation of the doublet-type closed flux surfaces. These findings could verify that the plasmoid reconnection in the elongated current layer in the presence of the strong toroidal field allows the fast flux closure in the T-CHI.

References [1] M. Nagata, et al., Phys. Plasmas 10, 2932 (2003). [2] F. Ebrahimi and R. Raman, Phys. Rev. Lett. 114, 205003 (2015).

Presenter: NAGATA, M. (EPS 2019)

Session Classification: Poster P4

Track Classification: MCF