

Phase relation between Density and Potential fluctuations in Streamer

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Abstract

Streamer is a self-bunching of drift wave fluctuations in the azimuthal direction discovered in the linear plasma device, PANTA (Plasma Assembly for Nonlinear Turbulence Analysis). The streamer enhances radial transport and thus its formation is one of the important fundamental plasma turbulence processes [1]. Experimental results in PANTA have shown that the 3-wave coupling between drift-wave fluctuations and “mediator”, which is a wave propagating in the ion diamagnetic direction with azimuthal mode number of 1, plays an important role to form the streamer [2]. In the recent experiment, operational conditions in which the streamer is formed are clarified in PANTA. The streamer is formed in the condition (magnetic field (B) is 0.09 T, $n_{e0} = 5 \times 10^{18} \text{ m}^{-3}$, $T_{e0} = 3 \text{ eV}$ and neutral gas pressure of argon (P_n) is 1 mTorr). The B and P_n are the control parameter of turbulence state in the PANTA plasma and thus scanned systematically [3]. Streamer disappeared when the magnetic field/neutral pressure is above/below the critical values ($B > 0.12 \text{ T}$, $B < 0.08 \text{ T}$, $P_n < 0.4 \text{ mTorr}$, $P_n > 1.2 \text{ mTorr}$). In other words, there is a parameter window to form the streamer in the PANTA plasma. The changes of Fourier spectrum of turbulence are observed around the critical conditions. The role of the "mediator" is discussed by the bi-spectrum analysis. Fluctuation induced particle flux changes with magnetic field. Phase relation between density and potential fluctuations is also discussed.

[1] N. Kasuya *et al.*, Phys. Plasmas 15, 052302 (2008)

[2] T. Yamada *et al.*, Nature Phys. 4, 721 (2008)

[3] T. Kobayashi *et al.*, “Phase diagram of plasma turbulence in PANTA”, in *69th Annual Meeting of the Physical Society of Japan* (2014)