

# Intermittent behavior of local electron temperature in a linear ECR plasma

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Intermittency is one of the important topics in the field of plasma research. Intermittent transport of coherent filamentary structures called blobs is frequently observed in the edge of many magnetically confined torus plasmas. The convection of blobs significantly enhances cross-field transport and may lead to deterioration in edge confinement. Intermittent transport of similar turbulent structures has also been studied by linear devices [1, 2]. In contrast to those preceding studies, we have recently observed an intermittent behavior of local electron temperature in a linear electron cyclotron resonance (ECR) plasma produced in the HYPER-I device at the National Institute for Fusion Science.

The occurrence of electron temperature intermittency was first observed as sporadic large-amplitude negative spikes of floating potential measured by a Langmuir probe, as shown in Fig. 1. Since floating potential is determined by the balance between the influx of electrons and ions, these negative spikes are attributable to intermittent enhancement of electron energy. In fact, the electron temperature in the large spiky events is approximately three times higher than that of equilibrium phase, which has been derived from the current-voltage characteristics obtained by a conditional averaging technique.

The probability density function (PDF) of the floating potential time series has a long tail in the negative amplitude side, showing a deviation from Gaussian statistics. Moreover, the frequency distribution of waiting time (time interval between consecutive events) exhibits an exponential distribution that is a signature of underlying Poisson process [3]. As for the spatial distribution, the 2D distribution of this phenomenon has been measured by a newly-developed High-Impedance Wire Grid (HIWG) detector [4] and ICCD imaging of a line emission from excited Ne neutrals [5]. Both measurements have given a comparable size of the circular high-temperature region that is about 30-40 mm in diameter.

In this paper, possible important role of neutral particles for the generation mechanism of the localized high electron temperature region will be discussed using ICCD imaging of He I line emissions and conditionally-averaged probe measurement.

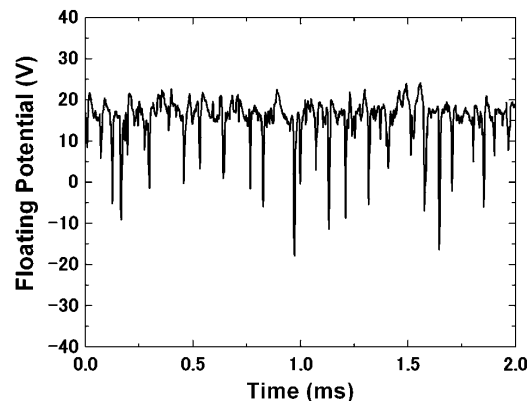


Fig. 1 Typical time series of floating potential in a Helium plasma. (Helium pressure: 1.5mTorr, Microwave power: 20 kW)

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