Superdiffusion and multifractal statistics of
edge plasma turbulence in fusion devices

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Contribution is addressing to the *transport of the main plasma (subject 3)* in stochastic magnetic and electric fields in fusion devices. A lot of experimental evidence have been observed now in fusion devices that plasma turbulence is highly intermittent. Intermittent events are well-known to play a crucial role in transport dynamics. Intermittent transport resulted from rare, large events is accompanied by coherent structures such as vortices, zonal flows, streamers and blobs, leading to the losses above ones predicted by classic heat diffusive scaling. The cross-field transport in the scrape-off layer is directly related to the heat deposition width on the divertor target plate, which is crucial to determine the averaged heat flux on it. The fluctuations observed in edge plasma of tokamaks, stellarators and linear machines are self-similar, the self-similarity parameter varies little from one device to another suggesting the universality of self-similarity properties in edge of magnetized plasmas. Focusing on a probabilistic approach to plasma turbulence and transport, rather then anomalous transport coefficients, allows to consider most important questions in the prediction of transport, including self-similarity scaling and non-locality of transport in edge plasma turbulence.

We will report the analysis of edge plasma turbulence in T-10 tokamak, HYBTOK-II tokamak, linear machine NAGDIS-II and Large Helical Device (LHD). Probability density function of fluctuation in ion saturation current and floating potential measured in scrape-off layer of these machines have been analyzed. It was observed that the edge turbulence possesses multifractal statistics with typical integral time scale ~50-100 µs of coherent structures. Self-similarity parameters have been observed to depend on edge plasma domain and confinement conditions. The fractal properties of fluctuation in LHD have been analyzed regarding to the stochastic magnetic structure and profile of the connection lengths of the magnetic field lines. It was observed on T-10, multifractality level decreases in shear region in the vicinity of Last Closed Flux Surface. Correlation properties have been analysed ragarding to the multifractality parameter.