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Statistical description of the fluctuation particle fluxes in the plasma edge

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Plasma turbulence studies carried out in the last few decades have shown that the measured distributions of amplitudes of the fluctuational particle fluxes in the laboratory plasma as well as in the solar wind have non-Gaussian probability density functions. These distributions are leptocurtic and have slowly decreasing exponential tails. Fractional stable densities (FSD)

$$q(x;\alpha,\beta,\theta)=\int_0^\infty g(xy^{\beta/\alpha};\alpha,\theta)g(y;\beta,1)y^{\beta/\alpha}dy,$$

was applied for it description, where $0<\alpha\leqslant 2$, $0<\beta\leqslant 1$, $|\theta|\leqslant\min(1,2/\alpha-1)$ and $g(x;\alpha,\theta)$ and $g(y;\beta,1)$ respectively is strictly stable and one sided strictly stable distribution. This distributions have heavy slowly decreasing exponential tails too. As is well known [1] through the FSD the solution of the generalization diffusion equation

$$\frac{\partial^\beta p(x,t)}{\partial t^\beta}=-D(-\Delta)^{\alpha/2}p(x,t)+\frac{t^{-\beta}\delta(x)}{\Gamma(1-\beta)}$$

is expressed. Here $\frac{\partial^\beta}{\partial t^\beta}$ is Riman-Liuville fractional derivative and $(-\Delta)^{\alpha/2}$ is Laplacian of the fractional order.

The probability density function of the fluctuational particle fluxes in plasma peripheral region of stellarator L-2m is studied in the work. The parameters of fractional stable distributions were statistically estimated from measured signals [2]. It is shown that fractional stable distributions give a good fit to the probability density functions of amplitudes of fluctuating particle fluxes. The Hurst parameter was calculated for all the discharges under study. Its values lie in the range 0.64 to 0.75, which agrees with results obtained in other devices. Algorithms for data processing and the algorithm for estimation of parameters of FS densities, along with results of calculations, will be presented in the report.

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References

[1] V. V. Uchaikin. International Journal of Theoretical Physics **39** p. 2087 (2000).

[2] V. E. Bening, V. Yu. Korolev, V. N. Kolokol'tsov, V. V. Saenko, V. V. Uchaikin, and V. M. Zolotarev. J. Math. Sci., **123** p.3722 (2004)