

## P2.4013 Automodel solutions for nonlocal transport by Lévy walks in plasmas

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.4013.pdf>

The phenomena of nonlocal (superdiffusive) transport are closely related to long-free-path carriers, called «Lévy flights» by B. Mandelbrot (see [1] and references therein). The processes of non-local transport with account of the finite velocity of carriers (i.e. of the retardation effect) are called «Lévy walks» [2, 3], including the scattering of carriers with account of their trapping (e.g., absorption and re-emission) («Lévy walk + rests», see Fig. 1 in [3]). It was shown for the Green function of non-stationary superdiffusive transport by Lévy flights that a wide class of perturbation transfer phenomena in a homogeneous medium has an approximate automodel (self-similar) solution [4, 5]. A generalization of this approach to the case of finite velocity of carriers is given in [6].

Here it is shown that the method of obtaining an approximate automodel solution for non-stationary transport by Lévy flights and «Lévy walks» has a wide range of applicability in laboratory and space plasma physics. Necessity to take into account the finite velocity of carriers means that the phenomenon belongs to the «Lévy walks». The phenomenon of nonlocality (superdiffusion) for the transport of electromagnetic (EM) waves in plasmas can be realized in the coexistence mode of (i) local (diffusive, Brownian) trapping of a carrier by strong fluctuations of scatterer's density and (ii) distant flights of a carrier between events of local trapping. Such a transport mode can be realized in (a) the propagation of diagnostic EM waves in a magnetized turbulent laboratory plasma; (b) nonlocal transport of heat and particles in such a plasma; (c) scattering of radio waves from pulsed sources (flares) in the interstellar medium. The paper presents approximate automodel solutions for some examples from the indicated class of non-local transport phenomena. References

[1]. Shlesinger M, Zaslavsky G M and Frisch U (ed) 1995 Lévy Flights and Related Topics in Physics (New York: Springer).

[2]. Shlesinger M F, Klafter J, and Wong J 1982 J. Stat. Phys. 27, 499. [3]. Ziburdaev V, Denisov S and Klafter J 2015 Lévy walks Rev. Mod. Phys. 87, 483. [4]. Kukushkin A B and Sdvizhenskii P A 2016 J. Phys. A: Math. Theor. 49 255002. [5]. Kukushkin A B, Neverov V S, Sdvizhenskii P A and Voloshinov V V 2018 Atoms 6(3) 43. [6]. Kukushkin A B, Kulichenko A A 2018 Preprint <https://arxiv.org/abs/1812.08871>.

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