

CORRECT USAGE OF THE VLASOV EQUATION

Monday, 15 April 2019 17:15 (15 minutes)

This work is devoted to the study of the properties of the Vlasov equation, as well as the study of the limits of its applicability in the description of physical phenomena.

In this paper were shown, that the well-known Vlasov equation [1], widely used in the scientific literature, is only an approximation obtained from the original chain of Vlasov equations by introducing assumptions [2]. A generalized Vlasov equation is proposed, which is obtained from first principles without introducing any approximations [3].

The paper considers various types of dissipative systems: a classical harmonic oscillator and a relativistic harmonic oscillator with the presence and absence of dissipative forces. The system of gravitationally interacting particles in the relativistic and classical cases is also considered. The evolution of systems was described by the Vlasov equation by the particle method.

It was shown that in the presence of dissipations in the system, as well as in the case of relativistic motion, the classical Vlasov equation becomes inapplicable for the description of such systems, and it is necessary to use the proposed generalized Vlasov equation. In conclusion, the results are discussed.

1. Vlasov A.A., *Many-Particle Theory and Its Application to Plasma*, New York, Gordon and Breach, 1961, ISBN 0-677-20330-6; ISBN 978-0-677-20330-0
2. Perepelkin E. E., Sadovnikov B. I., Inozemtseva N. G. The new modified Vlasov equation for the systems with dissipative processes // *Journal of Statistical Mechanics: Theory and Experiment*. —2017. —Vol. 2017, no. 053207. —P. 1–22.
3. Perepelkin E. E., Sadovnikov B. I., Inozemtseva N. G. The properties of the first equation of the Vlasov chain of equations // *Journal of Statistical Mechanics: Theory and Experiment*. —2015. —no. P05019.

Primary authors: Prof. SADOVNIKOV, Boris (Faculty of Physics, Moscow State University, Moscow, 119992 Russia); Mr SUCHKOV, Denis (Lomonosov Moscow State University); Dr PEREPELKIN, Evgeny (JINR); Prof. INOZEMTSEVA, Natalia (Dubna State University, Universitetskaya st.19, Dubna, Moscow region, 141980 Russia)

Presenter: Mr SUCHKOV, Denis (Lomonosov Moscow State University)

Session Classification: Theoretical Physics

Track Classification: Theoretical Physics