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A MANY-KIND PARTICLE SYSTEMS IN THE BOLTZMANN — GRAD LIMIT

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The evolution of states of many-particle systems is determined by an infinite system of integral and differential equations known as the BBGKY hierarchy of equations [1].

States of many-particle systems are described by an infinite sequence of particle distribution functions that satisfy the Cauchy problem for the BBGKY hierarchy of equations. A solution of the Cauchy problem for the BBGKY hierarchy of equations can be represented in the form of the iteration or the functional series, or the non-equilibrium cluster expansion [2, 3].

We consider an one-dimensional many-kind system of particles of lengthes $2\sigma_i > 0$ and masses $m_i > 0$ interacting as hard rods via a pair short range potential Φ.

In the paper, we present the probability approach to describe the state of the particle system in the Boltzmann — Grad limit. We take Maxwell velocity distribution function as the initial one. A solution of the problem on description of the state is a solution of the Cauchy problem for the diffusion equation.

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FEJER KERNELS OF p-ADIC SOLENOID

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Let p be a prime number. Consider a ring of p-adic integers $\mathbb{Z}_p$ as a set of series

$$u = \sum_{k=0}^{\infty} u_k p^k, \quad u_k \in \{0, 1, \dots, p-1\}$$

with summation and multiplication in p-adic number system. It is a locally compact group and hence it has a Haar measure $d_p u$. The factor group $\mathbb{R} \times \mathbb{Z}_p / \{(n, n) \ : \ n \in \mathbb{Z}\}$ is called a p-adic solenoid and denoted by Σ_p (see [1]). As a set with a measure $\Sigma_p \cong [0,1) \times \mathbb{Z}_p$. It is a compact group and has a natural measure $dx \cdot d_p u$. Pontryagin's dual group of the p-adic solenoid is $\widehat{\Sigma_p} = \mathbb{Q}^{(p)} = \bigcup_{n=0}^{\infty} p^{-n}\mathbb{Z}$. That means any $f \in L_2(\Sigma_p)$ can be expanded into a Fourier series

$$f(x,u) = \sum_{\alpha \in \mathbb{Q}^{(p)}} \widehat{f}(\alpha)\chi_\alpha(x,u),$$

where $\chi_\alpha(x,u) = \exp(2\pi i\alpha\, x)\exp(-2\pi i\{\alpha\, u\}_p)$ are characters of Σ_p, $\{\cdot\}_p$ is a fractional part of a p-adic number $\{\cdot\}_p$ and

$$\widehat{f}(\alpha) = \int_0^1 \int_{\mathbb{Z}_p} f(x,u)\overline{\chi_\alpha(x,u)}\, dx d_p u$$

are Fourier coefficients. Hence Dirichlet kernels for Σ_p are

$$D_{m,n}(x,u) = \sum_{\alpha \in (-m,\ m) \cap p^{-n}\mathbb{Z}} \chi_\alpha(x,u), \quad m,n \in \mathbb{N}_0.$$

We proved in [2] that the Lebesgue constants have the asymptotics

$$L_{m,n} := \|D_{m,n}\|_{L_1(\Sigma_p)} = \int_0^1 \int_{\mathbb{Z}_p} |D_{m,n}(x,u)| dx d_p u \sim \frac{2}{\pi^2}\ln(m^2 p^n),$$

when $m \to +\infty$, $n \to +\infty$. Consequently the Fourier series is divergent in $L_1(\Sigma_p)$ and it is reasonable to consider Fejer kernels

$$F_{m,n}(x,u) = \sum_{\alpha \in (-m,\ m) \cap p^{-n}\mathbb{Z}} \left(1 - \frac{|\alpha|}{m}\right)\chi_\alpha(x,u), \quad m,n \in \mathbb{N}_0$$

that will be discussed in our talk and I will prove

Theorem 1. *For all nonnegative integers* n,m $\|F_{m,n}\|_{L_1(\Sigma_p)} = 1$.

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SOLVING MATRIX DISCRETE THE FIRST ORDER EQUATIONS BY MEANS OF ALGEBRAIC MATRICIANT

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Let $K_0^{m\times m}$ be an algebra of matrix sequences with multiplication in the form of Laplace convolution. For matrix $X = [x^{ij}]_{i,j=1}^m$ denote $\widetilde{m}_n(X) = \max\limits_{1\leqslant i,j\leqslant m} \left|x_n^{ij}\right|$.

Definition 1. The sequence $\widetilde{m}(X) = \{\widetilde{m}_0(X), \widetilde{m}_1(X), \dots, \widetilde{m}_n(X), \dots\}$ is called a majorizing sequence for matrix $X \in K_0^{m\times m}$.