O'ZBEKISTON RESPUBLIKASI OLIY TA'LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

BUXORO DAVLAT UNIVERSITETI 1930

FIZIKA, MATEMATIKA VA MEXANIKANING DOLZARB MUAMMOLARI XALQARO ILMIY-AMALIY ANJUMANI

MATERIALLARI

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(I qism)

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МИНИСТЕРСТВО ВЫСШЕГО ОБРАЗОВАНИЯ, НАУКИ И ИННОВАЦИЙ РЕСПУБЛИКИ УЗБЕКИСТАН
БУХАРСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

ТЕЗИСЫ ДОКЛАДОВ

(Часть I)

международной научно-практической конференции

АКТУАЛЬНЫЕ ПРОБЛЕМЫ ФИЗИКИ, МАТЕМАТИКИ И МЕХАНИКИ

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MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS OF THE REPUBLIC OF UZBEKISTAN
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ABSTRACTS

(Part I)

of the international scientific and practical conference

ACTUAL PROBLEMS OF PHYSICS, MATHEMATICS AND MECHANICS

Bukhara, Uzbekistan, May 24-25, 2023

Fizika, matematika va mexanikaning dolzarb muammolari (Xalqaro ilmiy-amaliy konfferensiya materiallari to‘plami, I qism) Buxoro-2023, 357 bet.

Mazkur to‘plam “Fizika, matematika va mexanikaning dolzarb muammolari” Xalqaro ilmiy-amaliy konferensiyasi materiallari to‘plami asosida tayyorlangan bo‘lib, matematik analiz, differensial tenglamalar va matematik fizika, algebra va geometriya, hisoblash matematikasi va mexanika, geleofizika va qayta tiklanuvchi energiya manbalari, kondensirlangan holatlar fizikasi, zamonaviy ta’limda raqamli texnologiyalar, ehtimollar nazariyasi va matematik statistika yo‘nalishlaridagi ilmiy ma’ruzalar o‘rin olgan.

To‘plamga kiritilgan maqola va tezislar mazmuni, ilmiyligi va dalillarining haqqoniyligi uchun mualliflar ma’suldirlar

Agar V dagi eng yaqin $\langle x, y\rangle$ qo'shnilar uchun $\sigma(x)\sigma(y) = 0$ bo'lsa, u holda σ konfiguratsiya *joiz konfiguratsiya* deyiladi [1], ya'ni V to'plamdagi eng yaqin $\langle x, y\rangle$ qo'shnilardan kamida bittasida konfiguratsiyaning qiymati nol bo'lishi kerak. Keli daraxtidagi (mos ravishda V_n dagi) barcha joiz konfiguratsiyalar to'plamini Ω^a ($\Omega^a_{V_n}$) kabi belgilaymiz.

Tayinlangan $\lambda = (\dots \lambda_{-1}, \lambda_0, \lambda_1, \dots) \in \mathbb{Q}_p^\infty$ parametr uchun HC modelining p-adik Hamiltonianini quyidagicha aniqlaymiz:

$$H_\lambda(\sigma) = \sum_{x \in V} \log_p \lambda_{\sigma(x)}, \qquad x \in \Omega^a.$$

Umumlashgan p-adik Gibbs o'lchovi. HC modeli uchun p-adik Gibbs o'lchovini aniqlaymiz. $\sigma_n \in \Omega^a_{V_n}$ uchun V_n shardagi σ_n konfiguratsiya natijasida band bo'lgan uchlar soni $\#\sigma_n$ quyidagicha aniqlanadi:

$$\#\sigma_n = \sum_{x \in V_n} \mathbf{1}(\sigma_n(x) \neq 0).$$

$\mathbf{z}$: $x \to \mathbf{z}_x = \left(\dots, \mathbf{z}_{-1,x}, \mathbf{z}_{0,x}, \mathbf{z}_{1,x}, \dots\right) \in \mathbb{Q}_p^\infty - V$ to'plamdagi vektor-qiymatli akslantirish bo'lsin. $\Omega^a_{V_n}$ to'plamda $\lambda_i \in \mathbb{Q}_p$ uchun quyidagicha aniqlangan $\mu^{(n)}$ p-adik ehtimollik taqsimotini qaraylik:

$$\mu^{(n)}(\sigma_n) = Z_n^{-1} {\lambda_i}^{\#\sigma_n} \prod_{x \in W_n} \mathbf{z}_{\sigma_n(x),x}, \qquad n \in N, \tag{1}$$

bu yerda $Z_n -$ normallovchi ko'paytuvchi bo'lib,

$$Z_n = \sum_{\omega_{n \in \Omega^a_{V_n}}} {\lambda_i}^{\#\widetilde{\sigma_n}} \prod_{x \in W_n} \mathbf{z}_{\widetilde{\sigma_n}(x),x}.$$

kabi aniqlanadi. Agar barcha $n \geq 1$ va $\sigma_{(n-1)} \in \Omega^a_{V_{n-1}}$ uchun

$$\sum_{\omega_n \in \Omega_{W_n}} \mu^{(n)} (\sigma_{n-1} \vee \omega_n) \mathbf{1}\left(\sigma_{n-1} \vee \omega_n \in \Omega^a_{V_n}\right) = \mu^{(n-1)}(\sigma_{n-1}) \tag{2}$$

bo‘lsa, u holda $\mu^{(n)}$ p-adik ehtimollik taqsimoti muvofiqlashgan deyiladi. Bu holda Kolmogorov teoremasiga ko‘ra Ω^a to‘plamda barcha n va $\sigma_n \in \Omega^a_{V_n}$ uchun

$$\mu\left(\sigma|_{V_n} = \sigma_n\right) = \mu^{(n)}(\sigma_{n-1})$$

tenglikni qanoatlantiruvchi yagona μ o‘lchov mavjud.

Ta’rif. [2] (1) ko‘rinishda aniqlangan va (2) shartni qanoatlantiruvchi $\mu^{(n)}$ o‘lchov HC modeli uchun $\boldsymbol{z}$: $x \to z_x$, $x \in V\backslash\{x^0\}$ akslantirishga mos keluvchi umumlashgan p-adik Gibbs o‘lchovi deyiladi.

1-teorema. [3] (1) formula bilan aniqlangan $\mu^{(n)}$ ehtimollik o‘lchovlari ketma-ketligi (2) shartni qanoatlantirishi uchun ixtiyoriy $x \in V$ uchda quyidagi funksional tenglamani qanoatlantirishi zarur va yetarli:

$$\mathbf{z}_{i,x} = \lambda_i \prod_{y \in S(x)} \frac{1}{1 + \sum_{j \in \mathbb{Z}_0} \mathbf{z}_{j,y}}, \quad i \in \mathbb{Z}. \tag{3}$$

Endi (3) tenglamaning $k = 1$ hol uchun translyatsion-invariant yechimlarini qidiramiz. Buning uchun quyidagi tenglamani yechish yetarli:

$$\mathbf{z}_i = \frac{\lambda_i}{1 + \sum_{j \in \mathbb{Z}_0} \mathbf{z}_j}, \quad i \in \mathbb{Z}_0. \tag{4}$$

Bu tenglamada $\sum_{j \in \mathbb{Z}_0} \mathbf{z}_j$ va $\sum_{j \in \mathbb{Z}_0} \lambda_j$ qatorlar yaqinlashuvchi bo‘lmasa, u holda (4) tenglama ma’noga ega bo‘lmaydi. Shuning uchun bu ikkita qatorni yaqinlashuvchi deb faraz qilamiz. U holda

$$a - \frac{1}{4} = \sum_{j \in \mathbb{Z}_0} \lambda_j, \quad x - \frac{1}{2} = \sum_{j \in \mathbb{Z}_0} \mathbf{z}_j, \quad \text{va} \quad a = p^{\gamma(a)}(a_0 + a_1 p + a_2 p^2 + \cdots)$$

kabi belgilashlar natijasida (4) sistemadan

$$x^2 = a \tag{5}$$

Tenglamani hosil qilamiz. Ma’lumki, bu tenglama

A. $\gamma(a) -$ juft;

B. $p \neq 2$ uchun $x^2 \equiv a_0 (mod\, p)$ taqqoslama yechimga ega, $p = 2$ uchun $a_1 = a_2 = 0$ shartlar bajarilganda yechimga ega bo‘ladi. U holda quyidagicha xulosaga ega bo‘lamiz:

2-teorema. Agar A va B shartlar bajarilsa, u holda birinchi tartibli Keli daraxtida sanoqli spin qiymatli HC modeli uchun translyatsion-invariant umumlashgan p-adik Gibbs o‘lchovi mavjud bo‘ladi.

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UCH O‘LCHAMLI QO‘ZG‘ALISHGA EGA UMUMLASHGAN FRIDRIXS MODELINING XOS QIYMATLARI HAQIDA

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$\mathbb{C}$ kompleks sonlar maydoni, $L_2(\mathbb{T}) -$ bir o‘lchamli $\mathbb{T} = (-\pi; \pi]$ torda aniqlangan kvadrati bilan integrallanuvchi (kompleks qiymatli) funksiyalarning Hilbert fazosi bo‘lsin. $\mathcal{H}_0 \coloneqq \mathbb{C}$ va $\mathcal{H}_1 \coloneqq L_2(\mathbb{T})$ fazolarning to‘g‘ri yig‘indisidan tashkil topgan $\mathcal{H} \coloneqq \mathcal{H}_0 \oplus \mathcal{H}_1$ Hilbert fazosida quyidagi

$$h_{\mu,\lambda} := \begin{pmatrix} h_{00} & \mu h_{01} \\ \mu h_{01}^* & h_{11}^0 - \lambda v \end{pmatrix} \qquad (1)$$

operatorli matritsani qaraymiz. Bu yerda μ, λ-nomanfiy haqiqiy sonlar, $h_{\mu,\lambda}$ operatorli matritsaning $h_{ij}: \mathcal{H}_j \to \mathcal{H}_i,\ i \leq j,\ i = 0, 1$ va v elementlari quyidagicha aniqlangan:

$$h_{00}f_0 = \varepsilon f_0, \qquad h_{01}f_1 = \int_{\mathbb{T}} \sin t\, f_1(t)dt,$$
$$(h_{11}^0 f_1)(x) = (a + 1 - \cos(2x))f_1(x), \qquad (2)$$
$$(vf_1)(x) = \cos x \int_{\mathbb{T}} \cos t\, f_1(t)dt.$$

Bunda ε va a fiksrlangan haqiqiy sonlar, $f_i \in \mathcal{H}_i,\ i = 0, 1,\ h_{01}^*$ operator h_{01} operatorga qo‘shma operator. Odatda (1) ko‘rinishdagi operatorli matritsaga umumlashgan Fridrixs modeli deb ataladi [1,2]. Sodda hisoblashlar yordamida

$$(h_{01}^* f_0)(x) = \sin x \cdot f_0, f_0 \in \mathcal{H}_0$$

ekanligini hosil qilamiz. $\mathcal{H}$Hilbert fazosida (1) ko‘rinishda aniqlangan $h_{\mu,\lambda}$ umumlashgan Fridrixs modeli chiziqli, chegaralangan va o‘z-o‘ziga qo‘shma operator bo‘ladi.

Chekli o‘lchamli qo‘zg‘alishlarda muhim spektrning o‘zgarmasligi haqidagi mashhur Veyl teoremasiga asosan $h_{\mu,\lambda}$ umumlashgan Fridrixs modelining muhim spektri $h_{0,0}$ operatorli matritsaning muhim spektriga teng bo‘ladi, ya’ni $\sigma_{\text{ess}}(h_{\mu,\lambda}) = \sigma_{\text{ess}}(h_{0,0})$. Aniqlanishiga ko‘ra, $h_{0,0}$ operatorli matritsaning muhim spektri $u(x) = a + 1 - \cos(2x)$ funksiyaning qiymatlar to‘plamidan iborat. Shu sababli $\sigma_{\text{ess}}(h_{0,0}) = [a, a + 2]$ bo‘ladi. Demak, $\sigma_{\text{ess}}(h_{\mu,\lambda}) = [a, a + 2]$ tenglik o‘rinli ekan. Endi $h_{\mu,\lambda}$ umumlashgan Fridrixs modelining diskret spektrini o‘rganish maqsadida mos ravishda $\mathcal{H}$ va $\mathcal{H}_1$ Hilbert fazolarida

$$h_\mu^{(1)} := \begin{pmatrix} h_{00} & \mu h_{01} \\ \mu h_{01}^* & h_{11}^0 \end{pmatrix}, \qquad h_\lambda^{(2)} := h_{11}^0 - \lambda v$$

operatorlarni qaraymiz.

1-teorema. (a) $z \in \mathbb{C} \setminus [a, a + 2]$ soni $h_{\mu,\lambda}$ operatorning xos qiymati bo‘lishi uchun uning $h_\mu^{(1)}$ va $h_\lambda^{(2)}$ operatorlardan kamida bittasining xos qiymati bo‘lishi zarur va yetarlidir.

(b) $h_{\mu,\lambda}$ operator ko‘pi bilan uchta xos qiymatlarga ega bo‘lib, ulardan ko‘pi bilan ikkitasi a nuqtadan chapda, ko‘pi bilan bittasi $a+z$ dan o‘ngda joylashgan bo‘ladi.

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BRANCHES OF THE ESSENTIAL SPECTRUM OF THE OPERATOR MATRIX OF ORDER THREE

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The essential spectrum of operator matrices is one of the topics that is deeply studied in the theory of operators, and the description of the location of the essential spectrum of this type of operators is studied among the important problems of spectral analysis [1,2].

$\mathbb{T}^1$ is a one-dimensional torus, $\mathcal{H}_0 \coloneqq \mathbb{C}$ is a space of complex numbers, $\mathcal{H}_1 \coloneqq L_2(\mathbb{T}^1)$ is a Hilbert space of square integrable (complex variable) functions on $\mathbb{T}^1$ and $\mathcal{H}_2 \coloneqq L_2^s(\mathbb{T}^2)$ be a Hilbert space of square-integrable (complex variable) symmetric functions on $\mathbb{T}^2$. Denote by $\mathcal{H}$, the direct sum of the spaces $\mathcal{H}_1, \mathcal{H}_2$ and $\mathcal{H}_3$, that is, $\mathcal{H} := \mathcal{H}_1 \oplus \mathcal{H}_2 \oplus \mathcal{H}_3$.

Let us consider a third-order operator matrix $\mathcal{A}_\mu$ acting $\mathcal{H}$ as

$$\mathcal{A}_\mu = \begin{pmatrix} A_{00} & \mu A_{01} & 0 \\ \mu A_{01}^* & A_{11} & \mu A_{12} \\ 0 & \mu A_{12}^* & A_{22} \end{pmatrix}, \mu > 0 \qquad (1)$$

with the entries:

MUNDARIJA

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