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

Buxoro - 2023

O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI
BUXORO DAVLAT UNIVERSITETI

FIZIKA, MATEMATIKA VA MEXANIKANING DOLZARB MUAMMOLARI

xalqaro ilmiy-amaliy anjumani

MATERIALLARI

(I qism)

Buxoro, O‘zbekiston, 24-25-may, 2023-yil

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

Бухара, Узбекистан, 24-25 мая, 2023 год

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS OF THE REPUBLIC OF UZBEKISTAN
BUKHARA STATE UNIVERSITY

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

TASHKILIY QO‘MITA

Rais:

Xamidov O.X.	BuxDU rektori, professor

Rais o‘rinbosari:

Rasulov T.H.	BuxDU prorektori, professor
Jurayev H.O.	BuxDU Fizika-matematika fakulteti dekani, professor

Tashkiliy qo‘mita a’zolari:

Teshayev M.X.	V.I.Romanoviskiy nomidagi matematika instituti Buxoro bo‘linmasi, professor
Djurayev D.R.	BuxDU, professor
Mirzayev Sh.M.	BuxDU, professor
Qahhorov S.Q	BuxDU, professor
Boltayev Z.I.	V.I.Romanoviskiy nomidagi matematika instituti Buxoro bo‘linmasi, professor
Fayziyev Sh.Sh.	BuxDU kafedra mudiri, dotsent
Dilmurodov E.B.	BuxDU kafedra mudiri, PhD
Durdiev U.D.	BuxDU kafedra mudiri, dotsent
Mirzayev M.S.	BuxDU kafedra mudiri, PhD
Nuriddinov J.Z.	BuxDU Fizika-matematika fakulteti dekan o‘rinbosari, PhD
Turdiev H.H.	BuxDU, PhD
Bozorov Z.R.	V.I.Romanoviskiy nomidagi matematika instituti Buxoro bo‘linmasi, PhD

DASTURIY QO‘MITA

Rais:

Durdiev D.K.	V.I.Romanoviskiy nomidagi matematika instituti Buxoro bo‘linmasi mudiri, professor

Members of the organizing committee

Laqayev S.N.	SamDU kafedra mudiri, akademik
Muqimov K.M.	O‘zR FA akademigi
G‘ulomov K.G.	O‘zR FA akademigi
Karchevsky L.A.	Sobolov nomidagi matematika instituti, professor
Mutti-Ur Rehman	Sukkur IBA universiteti, professor
Xaxo‘jayev A.M.	V.I.Romanoviskiy nomidagi matematika instituti Samarqand bo‘linmasi mudiri, professor
Ikromov I.A.	V.I.Romanoviskiy nomidagi matematika instituti Samarqand bo‘linmasi mudiri, professor
Imomkulov S.A.	Navoiy davlat pedagogika instituti, professor
Imomov A.A.	Qarshi davlat universiteti, professor
Rasulov X.R.	Buxoro davlat universiteti, dotsent
Mamurov B.J.	Buxoro davlat universiteti, dotsent
Merojova Sh.B.	Buxoro davlat universiteti, PhD
Raxmonov A.A.	V.I.Romanoviskiy nomidagi matematika instituti Buxoro bo‘linmasi, PhD
Raxmatov I.I	Buxoro davlat universiteti, dotsent
Saidov Q.S	Buxoro davlat universiteti, dotsent
Niyazxonova B.E	Buxoro davlat universiteti, dotsent

Kotibiat:

Xudayarov S.S., Turdiev H.H., Ochilov L.I, Qodirov J.R.

Konferensiya tashkilotchisi:

Buxoro davlat universiteti Fizika-matematika fakulteti

2. D.I.Akramova and I.A.Akramov “Randol maximal functions and the integrability of the Fourier transform of measure”, Math.Notes. Vol 109, No 5, pp.661-678. (2021).

3. I.A.Ikromov, D.Müller, “Fourier restriction for hypersurfaces in three dimensions and Newton polyhedra;” Annals of Mathematics Studies 194, Princeton University Press, Princeton and Oxford 2016.

4. A.N.Varchenko, “Newton polyhedra and estimates of oscillating integral ” Funkcional. Anal. I Prilozeniya, 10 (1976), 13-38(Russion); English translation in Funkcional. Anal. Appl., 18(1976), 175(196).

LOCATION OF THE ESSENTIAL SPECTRUM OF THE CHANNEL OPERATOR CORRESPONDING TO THE THIRD-ORDER OPERATOR MATRIX IN THE FERMIONIC FOCK SPACE

Ismoilova Dildora Erkinovna

Bukhara State University, Bukhara, Uzbekistan

d.e.ismoilova@buxdu.uz

Denote by $\mathbb{C}$ the one-dimensional complex space, by $L_2(\mathbb{T}^d)$ the Hilbert space of square integrable (complex) functions defined on $\mathbb{T}^d$ and by $L_2^{as}((\mathbb{T}^d)^2)$ the Hilbert space of antisymmetric square integrable (complex) functions defined on $(\mathbb{T}^d)^2$, that is, $f(p,q) = -f(q,p)$ for all $p, q \in \mathbb{T}^d$

For convenience, we introduce the following spaces:

$$\mathcal{F}_a^{(1)}(L_2(\mathbb{T}^d)) := \mathbb{C} \oplus L_2(\mathbb{T}^d);$$

$$\mathcal{F}_a^{(2)}(L_2(\mathbb{T}^d)) := \mathbb{C} \oplus L_2(\mathbb{T}^d) \oplus L_2^{as}((\mathbb{T}^d)^2);$$

$$\mathcal{F}_a(L_2(\mathbb{T}^d)) := \mathbb{C} \oplus L_2(\mathbb{T}^d) \oplus L_2^{as}((\mathbb{T}^d)^2) \oplus \ldots$$

Definition 1. $\mathcal{F}_a(L_2(\mathbb{T}^d))$ *is called a fermionic Fock space over* $L_2(\mathbb{T}^d)$, $\mathcal{F}_a^{(m)}(L_2(\mathbb{T}^d)), m = 1,2$ *is m+1 -particle cut subspace of fermionic Fock space* , $\mathcal{H}_n, n = 0,1,2$ *space is called the n-particle subspace of a fermionic Fock space.*

Let

$$\mathcal{H}_0 := \mathbb{C}, \mathcal{H}_1 := L_2(\mathbb{T}^d), \mathcal{H}_2 := L_2^{as}((\mathbb{T}^d)^2).$$

We consider the third-order operator matrix defined as

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

in the Hilbert space $\mathcal{F}_a^{(2)}(L_2(\mathbb{T}^d))$. Here the matrix elements $A_{ij}: \mathcal{H}_j \to \mathcal{H}_i, i, j = 0,1,2$ are defined by:

$$A_{00} f_0 = \omega_0 f_0, \;\; A_{01} f_1 = \int_{\mathbb{T}^d} v(t) f_1(t) dt,$$

$$(A_{11} f_1)(p) = \omega_1(p) f_1(p), \;\; (A_{12} f_2)(p) = \int_{\mathbb{T}^d} v(t) f_2(p,t) dt,$$

$$(A_{22}^0 f_2)(p,q) = \omega_2(p,q) f_2(p,q), \quad V := V_1 + V_2 ,$$

$$(V_1 f_2)(p,q) = \varphi(q) \int_{\mathbb{T}^d} \varphi(t) f_2(p,t) dt, \;\; (V_2 f_2)(p,q) = \varphi(p) \int_{\mathbb{T}^d} \varphi(t) f_2(t,q) dt.$$

Here μ, λ are real positive numbers, ω_0 is a fixed real number, functions $\omega_1(\cdot), v(\cdot)$ and $\varphi(\cdot)$ are real-valued continuous functions on $\mathbb{T}^d$, and $\omega_2(\cdot,\cdot)$ is a real-valued symmetric continuous function on $(\mathbb{T}^d)^2$.

Operator matrix $\mathcal{A}_{\mu,\lambda}$, $\mu, \lambda > 0$ acting by formula (1) in the Hilbert space $\mathcal{F}_a^{(2)}(L_2(\mathbb{T}^d))$ is linear, bounded and self-adjoint operator.

We introduce the following designations:

$$\widehat{\mathcal{H}_1} := \mathcal{H}_1, \quad \widehat{\mathcal{H}_2} := L_2((\mathbb{T}^d)^2), \;\; \widehat{\mathcal{H}} := \widehat{\mathcal{H}_1} \oplus \widehat{\mathcal{H}_2} .$$

We consider the second-order operator matrix defined as

$$\mathcal{A}_{\mu,\lambda}^{\mathrm{ch}} := \begin{pmatrix} A_{11} & (\mu/\sqrt{2}) A_{12} \\ (\mu/\sqrt{2}) A_{12}^* & A_{22}^0 - \lambda V_1 \end{pmatrix}$$

in the Hilbert space $\widehat{\mathcal{H}}$ and called channel operator, which plays an important role in the analysis of the spectrum of the operator matrix $\mathcal{A}_{\mu,\lambda}$.

It can be easily verified that the channel operator $\mathcal{A}_{\mu,\lambda}^{\mathrm{ch}}$ is linear, bounded and self-adjoint in the Hilbert space $\widehat{\mathcal{H}}$.

We consider the generalized Friedrichs model [1]-[3] $\mathcal{A}_{\mu,\lambda}(k), k \in \mathbb{T}^d$ acting in the space $\mathcal{H}_0 \oplus \mathcal{H}_1$ as

$$\mathcal{A}_{\mu,\lambda}(k) := \begin{pmatrix} A_{00}(k) & \mu A_{01} \\ \mu A_{01}^* & A_{11}^0(k) - \lambda v \end{pmatrix}.$$

Here

$$A_{00}(k) f_0 = \omega_1(k) f_0, \qquad (A_{11}^0(k) f_1)(q) = \omega_2(k,q) f_1(k),$$

$$(v f_1)(q) = \varphi(q) \int_{\mathbb{T}^d} \varphi(t) f_1(t) dt.$$

For any $k \in \mathbb{T}^d$ we define an analytic function

$$\Delta_{\mu,\lambda}(k;z) = \left(1 - \lambda \int_{\mathbb{T}^d} \frac{\varphi^2(t)dt}{\omega_2(k,t) - z}\right)\left(\omega_1(k) - z - \frac{\mu^2}{2} \int_{\mathbb{T}^d} \frac{v^2(t)dt}{\omega_2(k,t) - z}\right)$$

$$- \frac{\lambda \mu^2}{2\sqrt{2}} \left(\int_{\mathbb{T}^d} \frac{v(t)\varphi(t)dt}{\omega_2(k,t) - z}\right)^2$$

in $\mathbb{C} \setminus \sigma_{\text{ess}}(\mathcal{A}_{\mu,\lambda}(k))$. The function $\Delta_{\mu,\lambda}(k;z)$ usually called the Fredholm determinant corresponding to the operator matrix $\mathcal{A}_{\mu,\lambda}(k)$.

Lemma 1. For any $\mu, \lambda > 0$ and $k \in \mathbb{T}^d$ the operator $\mathcal{A}_{\mu,\lambda}(k)$ has an eigenvalue $z_{\mu,\lambda}(k) \in \mathbb{C} \setminus \sigma_{\text{ess}}(\mathcal{A}_{\mu,\lambda}(k))$ if and only if $\Delta_{\mu,\lambda}(k,z) = 0$.

From Lemma 1 it follows that for the discrete spectrum of $\mathcal{A}_{\mu,\lambda}(k)$ the equality

$$\sigma_{\text{disc}}(\mathcal{A}_{\mu,\lambda}(k)) = \{z \in \mathbb{C} \setminus \sigma_{\text{ess}}(\mathcal{A}_{\mu,\lambda}(k)) : \Delta_{\mu,\lambda}(k,z) = 0\}, k \in \mathbb{T}^d$$

holds.

We introduce the following notations:

$$\sigma_{\text{two}}\left(\mathcal{A}_{\mu,\lambda}^{\text{ch}}\right) = \bigcup_{k \in \mathbb{T}^d} \sigma_{\text{disc}}\left(\mathcal{A}_{\mu,\lambda}(k)\right), \qquad \sigma_{\text{three}}\left(\mathcal{A}_{\mu,\lambda}^{\text{ch}}\right) = [m; M],$$

where

$$m := \min_{k,q \in \mathbb{T}^d} \omega_2(k,q), \qquad M = \max_{k,q \in \mathbb{T}^d} \omega_2(k,q).$$

Theorem 1. The spectrum $\sigma(\mathcal{A}_{\mu,\lambda}^{\text{ch}})$ of the channel operator $\mathcal{A}_{\mu,\lambda}^{\text{ch}}$ satisfies the following equality

$$\sigma(\mathcal{A}_{\mu,\lambda}^{\text{ch}}) = \sigma_{\text{two}}(\mathcal{A}_{\mu,\lambda}^{\text{ch}}) \bigcup \sigma_{\text{three}}(\mathcal{A}_{\mu,\lambda}^{\text{ch}}).$$

Theorem 2. The essential spectrum $\sigma_{\text{ess}}(\mathcal{A}_{\mu,\lambda})$ of the operator matrix $\mathcal{A}_{\mu,\lambda}$ coincides with the spectrum $\sigma(\mathcal{A}_{\mu,\lambda}^{\text{ch}})$ of the channel operator matrix $\mathcal{A}_{\mu,\lambda}^{\text{ch}}$, i.e. $\sigma_{\text{ess}}(\mathcal{A}_{\mu,\lambda}) = \sigma(\mathcal{A}_{\mu,\lambda}^{\text{ch}})$.

Definition 2. The sets $\sigma_{\text{two}}(\mathcal{A}_{\mu,\lambda}^{\text{ch}})$ and $\sigma_{\text{three}}(\mathcal{A}_{\mu,\lambda}^{\text{ch}})$ are called two- and three-particle branches of the essential spectrum of the operator matrix $\mathcal{A}_{\mu,\lambda}$, respectively.

References:

1. S.Albeverio, S.N.Lakaev, T.H.Rasulov. On the spectrum of an Hamiltonian in Fock space. Discrete spectrum asymptotics. J.Stat. Phys.127 (2007), no.2,191–220.

2.S.Albeverio, S.N.Lakaev, T.H.Rasulov. The Efimov effect for a model operator associated with the Hamiltonian of a non conserved number of particles. Methods Funct. Anal. Topology 13 (2007), no. 1, 1–16.

3.T.Kh.Rasulov. On the number of eigenvalues of a matrix operator. Siberian Math. J. 52 (2011), no. 2, 316–328.

ON TRAJECTORIES OF A NON–VOLTERRA QUADRATIC STOCHASTIC OPERATOR

U. U. Jamilov, Kh. O. Khudoyberdiev

V.I. Romanovskiy Institute of Mathematic, Tashkent, Uzbekistan

e-mail: jamilovu@yandex.ru, *e-mail:* xudoyberdiyev.x@mail.ru

Let

$$S^{m-1} = \left\{ x = (x_1, x_2, ..., x_m) \in R^m : x_i \geq 0, \textit{ for any } i \textit{ and } \sum_{i=1}^{m} x_i = 1 \right\}$$

MUNDARIJA
СОДЕРЖАНИЕ
CONTENTS

I SHO‘BA: MATEMATIK ANALIZ
СЕКЦИЯ №1: МАТЕМАТИЧЕСКИЙ АНАЛИЗ
SECTION No.1: MATHEMATICAL ANALYSIS