TOSHKENT DAVLAT TRANSPORT UNIVERSITETI
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АМАЛИЙ МАТЕМАТИКА ВА АХБОРОТ ТЕХНОЛОГИЯЛАРИНИНГ ЗАМОНАВИЙ МУАММОЛАРИ

ХАЛҚАРО ИЛМИЙ-АМАЛИЙ АНЖУМАН

МАТЕРИАЛЛАРИ

2022 йил, 11-12 май

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«AMALIY MATEMATIKA VA AXBOROT TEXNOLOGIYALARINING ZAMONAVIY MUAMMOLARI»
XALQARO ILMIY-AMALIY ANJUMAN

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ЎЗБЕКИСТОН РЕСПУБЛИКАСИ
ОЛИЙ ВА ЎРТА МАХСУС ТАЪЛИМ ВАЗИРЛИГИ
ЎЗБЕКИСТОН РЕСПУБЛИКАСИ ФАНЛАР АКАДЕМИЯСИ
В.И. РОМАНОВСКИЙ НОМИДАГИ МАТЕМАТИКА ИНСТИТУТИ
ЎЗБЕКИСТОН МИЛЛИЙ УНИВЕРСИТЕТИ
ТОШКЕНТ ДАВЛАТ ТРАНСПОРТ УНИВЕРСИТЕТИ
БУХОРО ДАВЛАТ УНИВЕРСИТЕТИ

Бухоро фарзанди, Беруний номидаги Давлат мукофоти лауреати, кўплаб ёш изланувчиларнинг ўз йўлини топиб олишида раҳнамолик қилган етук олим, физика-математика фанлари доктори Ғайбулла Назруллаевич Салиховнинг 90 йиллик юбилейларига бағишланади

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KILLING VEKTOR MAYDONLAR GEOMETRIYASI

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Ta'rif-1. Agar G to'plamga tegishli har bir p nuqtaga bitta X(p) vektor mos qo'yilsa , bu moslik **vektor maydon** deb ataladi.

Ta'rif-2 Birorta G sohada X vektor maydon berilgan bo'lib va shu sohada $\vec{p}=\vec{p}$(t) tenglama bilan aniqlangan differensiallanuvchi γ chiziq ham berilgan bo'lsin. Agar har bir t uchun $\vec{p}'$(t)=X(γ(t)) bo'lsa γ chiziq X vektor maydonning **integral chizig'i** deyiladi.

Ta'rif 3. Berilgan X vektor maydonning t=0 da p nuqtadan o'tuvchi chiziqni $\gamma\,(\,t\,,p\,)$ bilan belgilasak, $p\ \to\ X^t(\,p\,)$ aksalntirishlar oilasi X vektor **maydonning oqimi** deyiladi.

Ta'rif 4. Agar har bir t nuqta uchun

$$x \to \gamma(\,t,x)$$

akslantirish izometrik akslantirish bo'lsa, X vektor maydon **Killing vektor maydoni** deb ataladi.

Boshqacha qilib aytganda M ko'pxillikda berilgan X vektor maydon hosil qilgan bir parametrli diffeomorfizmlar oilasi M ko'pxillikda izometrik akslantirishdan iborat bo'lsa X vektor maydon Killing vektor maydoni deb ataladi.

Uch o'lchovli Yevklid $R^3(\,x\,,y\,,z\,)$ fazosida oltita chiziqli erkli Killing vektor maydonlari bor.

$$X_1=\frac{\partial}{\partial x}\ ,\ X_2=\ \frac{\partial}{\partial y}\ ,X_3=\frac{\partial}{\partial z}\,,$$

$$X_4=z\frac{\partial}{\partial y}-\ y\frac{\partial}{\partial z}\ ,X_5=-z\frac{\partial}{\partial x}+x\frac{\partial}{\partial z}\ ,X_6=y\frac{\partial}{\partial x}-x\frac{\partial}{\partial y}$$

vektor maydonlardan quyida keltirilgan almashtirish gruppalari , mos $o_x\,,o_y\ va\ o_z$ o'qlari yo'nalishi bo'yicha parallel ko'chirish gruppalari bo'ladi, oxirgi uchtasi esa mos $o_x\,,o_y\ \ va\ o_z$ o'qlar atrofida aylanish gruppalari bo'ladi.

Biz to'rt o'lchamli $R^4(\,x_1,x_2\,,x_3,x_4)$ evklid fazosida

$$x^2{}_1+x_2{}^2+x_3{}^2+x_4{}^2=1$$

tenglamani uch o'lchamli S^3 sferada qaraymiz. Bu fazoda berilgan

$$X=-x_4\frac{\partial}{\partial x_1}+x_1\frac{\partial}{\partial x_4}$$

vektor maydon sferaga urinadi.

Teorema. Uch o'lchamli sferada X vektor maydonning maxsus nuqtalari

$$\begin{cases}x_1=0\\x_4=0\end{cases}$$

tenglamalar sistemasi bilan berilgan tekislikda yotuvchi $x_2{}^2+x_3{}^2=1$ aylana nuqtalaridan iborat, maxsus bo'lmagan nuqtalar uchun uning integral chiziqlari

$$\begin{cases}x_2=c_2=const\\x_3=c_3=const\end{cases}$$

tekislikda yotuvchi

$$x^2{}_1+x_4{}^2=1-(c_2{}^2+c_3{}^2)$$

aylanalardan iborat.

ADABIYOTLAR

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FINITENESS OF THE DISCRETE SPECTRUM OF THE LATTICE SPIN-BOSON HAMILTONIAN WITH AT MOST TWO PHOTONS

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Block operator matrices are matrices where the entries are linear operators between Banach or Hilbert spaces [1]. One special class of block operator matrices are Hamiltonians associated with systems of non-conserved number of quasi-particles on a lattice. Their number can be unbounded as in the case of spin-boson models or bounded as in the case of "truncated" spin-boson models. In this note we consider a lattice spin-boson Hamiltonian with at most two photons. The standard spin-boson Hamiltonian with at most two photons was completely studied in [2] for small values of the coupling constant.

Let T^3 be the three-dimensional torus, $\mathcal{H}_0 := C$ be the set of all complex numbers, $\mathcal{H}_1 := L_2(T^3)$ be the Hilbert space of square integrable (complex) functions defined on T^3, $\mathcal{H}_2 := L_2^{\mathrm{sym}}((T^3)^2)$ be the Hilbert space of square integrable (complex) symmetric functions defined on $(T^3)^2$ and $\mathcal{H} = \mathcal{H}_0 \oplus \mathcal{H}_1 \oplus \mathcal{H}_2$.

We consider a lattice spin-boson Hamiltonian A_2 with most two photons. Then [3] the operator A_2 act on $C^2 \otimes \mathcal{H}$ and has the 3×3 tridiagonal block operator matrix representation

$$A_2 := \begin{pmatrix} A_{00} & A_{01} & 0 \\ A_{01}^* & A_{11} & A_{12} \\ 0 & A_{12}^* & A_{22} \end{pmatrix},$$

where the matrix entries A_{ij}, $i, j = 0,1,2,\ i \le j$, are defined by

$$A_{00} f_0^{(s)} = \varepsilon s f_0^{(s)}, \quad A_{01} f_1^{(s)} = \alpha \int_{T^3} v(t) f_1^{(-s)}(t)dt,$$

$$(A_{11} f_1^{(s)})(k_1) = (\varepsilon s + w(k_1)) f_1^{(s)}(k_1), \quad (A_{12} f_2^{(s)})(k_1) = \alpha \int_{T^3} v(t) f_2^{(-s)}(k_1, t)dt,$$

$$(A_{22} f_2^{(s)})(k_1,k_2) = (\varepsilon s + w(k_1) + w(k_2)) f_2^{(s)}(k_1,k_2).$$

Here $s = \pm$ and $f = \{ f_0^{(s)}, f_1^{(s)}, f_2^{(s)}; s = \pm\} \in C^2 \otimes \mathcal{H}$.

We make the following assumptions: $\varepsilon > 0$; the dispersion $w(\cdot)$ is a non negative analytic function on T^3 and has the non-degenerate minimum at the points $(x_1^{(i)}, x_2^{(i)}, x_3^{(i)}) \in T^3$, $i = 1,...,n$, $n < \infty$; $v(\cdot)$ is a real-valued analytic function on T^3; the coupling constant $\alpha > 0$ is an arbitrary.

Recall that the location of the essential spectrum of A_2 for 1D case was described in [3]. The results were obtained by considering a more general model H for which the lower bound of its essential spectrum is estimated. Conditions which guarantee the finiteness of the number of eigenvalues of H below the bottom of its essential spectrum were found. It was shown that the discrete spectrum might be infinite if the parameter functions are chosen in a special form.

Let $E_{\min} := \min \sigma_{\mathrm{ess}}(A_2)$.

Theorem. For all values of the coupling constant $\alpha > 0$ the operator A_2 has a finitely many eigenvalues smaller than $E_{\min}$.

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ON AN EXAMPLE OF A SEMIRING WHICH IS NOT IDEMPOTENT

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Let $[a,b]$ be a closed subinterval of $[-\infty, +\infty]$ (in some cases we will aslo take semiclosed subintervals). The full order on $[a,b]$ will be denoted by $\prec$.

Definition 1. The operation $\oplus$ (pseudo-addition) is a function $\oplus : [a,b] \times [a,b] \to [a,b]$ which is commutative, nondecreasing (with respect to $\prec$), associative and with a zero element, denoted by $\mathbf{0}$, i. e. $\mathbf{0} \oplus x = x$ for each $x \in [a,b]$ (usually $\mathbf{0}$ is either a or b).

Let $[a,b]_+ = \{x : x \in [a,b], x \succ \mathbf{0}\}$.

МУНДАРИЖА