

**PANJARADAGI MODEL OPERATORINING DISKRET SPEKTIRI.**

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**Annotatsiya:** Bir o'lchamli panjaradagi ikki zarrachali gamiltonianning spectral xossalari o'rganilgan.

**Abstract:** Spectral properties of two particle hamiltonian on dimensional lattice.

**Аннотация:** Рассматривается система двух произвольных квантовых частиц на одномерной решетке.

**Kalit so'zlar:** Bir o'lchamli panjaradagi ikki zarrachali gamiltonian, xos qiymat, karrali xos qiymat.

$T = (-\pi, \pi]$ ,  $L_2(T)$  –  $T$  da aniqlangan kvadrati bilan integrallanuvchi funksiyalarning Hilbert fazosi.  $L_2(T)$  fazoda quyidagi formula orqali tasir qiluvchi

$$h(k) = h_0(k) - v \quad (1)$$

operatorni qaeaymiz, bu yerda  $h_0(k)$  quyidagi

$$\varepsilon_k(p) = \frac{1}{m_1} \varepsilon(p) + \frac{1}{m_2} \varepsilon(k - p), \quad \varepsilon(p) = 1 - \cos 2p$$

funksiyaga ko'paytirish operatori va  $v$  esa

$$v(p - s) = \mu \cos 3(p - s) + \lambda \cos 4(p - s)$$

yadroli integral operator.  $m_1$  hamda  $m_2$  lar mos holda 1- va 2- zarrachalarning massalari.

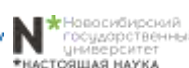
**1-lemma.** (1) formula orqali aniqlangan  $h(k)$  operator o'-o'ziga qo'shma va chegaralangandir.

Ma'lumki, Veyil [1] teoremasiga asosan  $h(k)$  operatorning muhim spektri  $h_0(k)$  operatorning spektri bilan ustma-ust tushadi ya'ni  $h(k)$  operatorning qo'zg'atuvchi qismi kompakt ekanligidan uning muhim spektri o'zgarmasdan qoladi. Shuning oqibatida  $\sigma_{ess}(h(k))$  to'plam  $\varepsilon_k(p)$  funksiyaning qiymatlar sohasidan iborat buladi, ya'ni

$$\sigma_{ess}(h(k)) = \sigma(h_0(k)) = [m(k); M(k)]$$

bu yerda  $m(k) = \min_p \varepsilon_k(p)$ ,  $M(k) = \max_p \varepsilon_k(p)$ .

$v \geq 0$  ekanligini hisobga olsak, u holda quyidagi tengsizlikka ega bo'lamiz



$$\sup(h(k)f, f) \leq \sup(h_0(k)f, f) = M(k)(f, f), \quad f \in L_2(T).$$

Shuning uchun  $h(k)$  operator muhim spektrdan o'ng tomonda xosqiyamatga ega emas, ya'ni

$$\sigma(h(k)) \cap (M(k), +\infty) = \emptyset.$$

**1-faraz.** Faraz qilaylik,  $m = m_1 = m_2$  va  $k = \pm \frac{\pi}{2}$  bo'lsin.

Quyidagi belgilashlarni kiritamiz

$$\mu^0(k) = \frac{1}{s_3(k; m(k))}, \quad \lambda^0(k) = \frac{1}{s_4(k; m(k))},$$

$$s_2(k; z) = \int_T \frac{\sin^2 3s ds}{\tilde{\varepsilon}_k(p) - z} \quad s_3(k; z) = \int_T \frac{\sin^2 4s ds}{\tilde{\varepsilon}_k(p) - z},$$

$$\tilde{\varepsilon}_k(p) = \frac{1}{m_1} + \frac{1}{m_2} - \sqrt{\frac{1}{m_1^2} + \frac{2}{m_1 m_2} \cos 2k + \frac{1}{m_2^2} \cos 2p}.$$

**1-teorema.** 1-farazimiz bajarilsin.  $U$  holda ixtiyoriy  $\mu, \lambda \in R_+$  sonlar uchun  $h(k)$  operator karraligi bilan hisoblanganda to'rtta xos qiymatga ega va ular

$$z_1 = z_2 = \frac{2}{m} - \mu\pi \quad \text{va} \quad z_3 = z_4 = \frac{2}{m} - \lambda\pi$$

bo'ladi.

**2-teorema.** 1-faraz bajarilmasin.  $U$  holda ixtiyoriy  $\mu, \lambda \in R_+$  sonlar uchun  $h(k)$  operator karraligi bilan hisoblanganda  $2 + \alpha(\mu, \lambda)$  ta xos qiymatga ega, bu yerda

$$\alpha(\mu, \lambda) = \begin{cases} 0, & \text{agar} & \mu \leq \mu^0(k), & \lambda \leq \lambda^0(k) \\ 1, & \text{agar} & \mu > \mu^0(k), \lambda \leq \lambda^0(k) \text{ yoki} & \mu \leq \mu^0(k), \lambda > \lambda^0(k) \\ 2, & \text{agar} & \mu > \mu^0(k), & \lambda > \lambda^0(k). \end{cases}$$

### Adabiyotlar

1. Рид М., Саймон Б., Методы современной математической физики. М.: Мир.1982, 4, Анализ операторов.
2. М.Э.Муминов, А. М. Хуррамов, Спектральные свойства двухчастичного гамильтониана на одномерный решетке. Россия. Уфимский математический журнал. Том 6. № 2 (2014). С.102-110.

