Quantum States of ABR Formulation for Josephson’s Tunneling in Th$_2$DUO$_2$ Nano Material for 516 tesla at LHC Cyclotron

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Abstract

The convergence quantum states of free covariant equation in Einstein’s space with quantum condition is studied using the ABR (Abrikosov-Balseiro-Russell) formulation in convergence approximation for Josephson tunneling is important role for determine of neutrino particle existing, especially after Cerenkov’s effect for 516 tesla super magnetic at Large Hadron Collider (LHC) Cyclotron in CERN, Lyon, France based on Th$_2$DUO$_2$ nano material. This approaching will be solved the problem for determine the value of interstellar Electrical Conductivity (EC) on DUO$_2$ chain reaction, then the post condition of muon has been known exactly. In this research shown the value of EC is 4.32 $\mu$eV at 378 tesla magnetic field for $2.1 \times 10^4$ ci/mm fast thermal neutron floating in 45.7 megawatts adjusted power of CERNs Cyclotron. The resulted by special Electron-Scanning-Nuclear-Absorption (ESNA) shown any possibilities of Josephson’s tunneling must be boundary by muon particles without neutrino particle existing for 450 - 565 tesla magnetic field on UO$_2$ more enrichment nuclear fuel at CERN, whereas this research has purpose for provide the mathematical formulation to boundary of muon’s moving at nuclear research reactor to a high degree of accuracy and with Catch-Nuc, one of nuclear beam equipment has a few important value of experimental effort.

Keywords: ABR formulation, EC value, Th$_2$DUO$_2$ nano material, super magnetic field value.

Introduction

It is known that for muon-hadron scattering, the close-coupling equations [1] have been used extensively in the sophisticated computation in Abrikosov-Balseiro-Russell (ABR) formulation [2]. In the close-coupling equations, the complete wave functions are expanded in target states on Einstein’s space.

In this paper the target states are constructed in the finite $L^2$ basis space following the results of Abellian system and next formulated by ABR without Dirac’s condition. The previous studied the convergence of the approximation target states for discrete and continuum cases in quantum condition for Th$_2$DUO$_2$ chain reaction at 45.7 megawatts (MW) adjusted power in Betha Group - CERN muon-hadron collider nuclear research reactor.

The advanced studied its application to the ABR equations which results in pseudo state close-coupling approximations for bound-free transition in convergence structure for Josephson’s tunneling. For first step using by Einstein’s space for elementary construction of ABR formulation in Th$_2$DUO$_2$ chain reaction.

In this paper, the Abellian system was conducted for covariant equation to Einstein’s space and ignores the Dirac’s condition for 450 - 565 tesla magnetic fields on fast thermal neutron, to study the convergence behavior of the free covariant equation part. Its possible analytical computation is also addressed after finding the asymptotic behavior.
Pseudostate Close-Coupling Approximations

The close-coupling equations in ABR formulation require to study is given by

\[ [-H_0 + E - \epsilon_j] | f_j^\pm \rangle = \sum_{k=1}^{\infty} V_{jk}^\pm | f_k^\pm \rangle \]

(1)

where

\[ H_0 = -\frac{1}{2} \Delta^2 \]

(2)

the total energy of the system connecting the initial and final state \( i \rightarrow f \) satisfies

\[ E = \epsilon_i + \frac{1}{2} k_i^2 = \epsilon_f + \frac{1}{2} k_f^2 \]

(3)

\( |f_j^\pm \rangle \) are channel functions related to the complete wave function as

\[ \psi(r_1, r_2) = \sum_{j=1}^{\infty} \phi_j(r_1) f_j^\pm(r_2) \]

(4)

in which the \( + \) (−) superscript refers to singlet (triplet) scattering and \( \phi_j(r_1) \) are muon eigen functions.

The channel potential \( V_{jk}^\pm \) is given by

\[ V_{jk}^\pm = U_{jk}^\pm + W_{jk}^\pm \]

(5)

where

\[ U_{jk}^\pm = \int dr_1 \int dr_2 |r_1\rangle \phi_j^\pm(r_2) \langle \zeta \]}

(6)

with

\[ \langle \zeta = \left\{ \begin{array}{cc} -\frac{1}{r_1} & + \frac{1}{|r_1 - r_2|} \phi_k(r_2) \\ (r_1) & \pm \frac{1}{|r_1 - r_2|} \phi_k(r_1)|r_2\rangle \end{array} \right. \]

and

\[ W_{jk}^\pm = \delta_{jk} \sum_i |\phi_i\rangle \gamma_i^\pm(\epsilon_i + E) \langle \phi_i| \]

(7)

where \( \gamma_i^\pm = 1, \gamma_i^4 = 1 \)

(8)

If replace the target states by a set of pseudo states (as consequences of finite basis set) in order to solve the equations approximately. We have to modify the close-coupling equations for Einstein’s space through for normal condition after Cerenkov’s effect at 450 tesla magnetic field since the exchange term in the form (7) is valid only for exact target states. The form appropriate to pseudo states is given by

\[ W_{jk}^\pm = |\phi_Nk\rangle \langle \phi_Nj| H(r_1) + H(r_2)|\phi_Nk\rangle \delta_{jk} \sum_{i=1}^{N} |\phi_{Ni}\rangle \gamma_i^\pm(-E) \langle \phi_{Ni}| \]

(9)

where \( \phi_{Ni} \) label the pseudo states and \( H(r_1) \) is the target non-linear for Hamiltonian operator in Abelian.

In calculating the pseudo state close-coupling approximation one must consider the error present in the quadrature rule approximation and the close-coupling potentials when pseudo states are employed. The first error will not be discussed here. The second error will be discussed in association with the direct-potential component of the channel potentials since they are regarded is being responsible for the dominant scattering process especially at higher energy.

Convergence Approximation of ABR Formulation

In the momentum representation, the derivative of ABR formulation for muon state in Th$_x$DUO$_2$ nano material chain reaction is given by

\[ T_{2B} = V + VG_0V \]

(10)

Here \( G_0 \) is the diagonal matrix of free channel Green’s functions. This second ABR formulation approximation has been used by Einstein’s space in Abelian system, especially the fast thermal neutron floating at 350 tesla magnetic field to test the suitability of pseudo states expansions with initial and first states chosen either the ground or 2s, 2p excited states.

The actual Josephson tunneling element from (10) require to study is

\[ V_{ij}(k_i, k_j) = -2\Delta^{-2} \left[ -\delta_{ij} + \int \phi_i^*(r)e^{i\Delta r}\phi_j(r)dr \right] \]

(11)

where \( \Delta = k_i - k_j \). The indices \( i \) and \( j \) can be either discrete or continuous after Cerenkov’s effect on \( 10^4 \) ci/mm and the range of 450 - 515 tesla magnetic field. For free covariant equation in quantum condition for Th$_x$DUO$_2$ enrichment reaction potentials one uses

\[ I_{pq}(\Delta) = -2\Delta^{-2} \int \phi_i^*(r)e^{i\Delta r}\phi_p(r)dr \]

(12)
where \( \phi_p \) and \( \phi_q \) are initial and final continuum states having the momenta \( p \) and \( q \) respectively, given by

\[
\phi_p(r) = \frac{1}{2\pi} \frac{L}{k} \sum_{l=0}^{\infty} (2l+1) e^{il\lambda} U_{vq}^N(r) P_l(x) q_r \tag{13}
\]

and normalised to a \( \delta \) function in \( \frac{q}{(2\pi)^3} \). The approximate target wave function \( U_{vq}^N \) is given by

\[
U_{vq}^N > B_{vq}(q) \sum_{n=0}^{N-1} \frac{\Gamma(n+1)}{\Gamma(n+2q+2)} P_{n+1}(x) \phi_{n}^q \tag{14}
\]

where

\[
B_{vq}(q) = 2^p q^p \Gamma(q+1-i\gamma)(1-x^2) e^{i\ell+(q+1)/2-\pi/2} \gamma^{-\ell} \tag{15}
\]

solving the integral (15) after quite lengthy derivation one finally obtains

\[
V_{pq}(\Delta) = -32 \pi^3 \Delta^2 (pq)^{-1} \Re \Im \tag{17}
\]

with

\[
\Re = \sum_{L_\ell, \ell_q} (-1)^{m_p} L_\ell + \ell_p + \ell_q e^{i(\delta_{\ell_p} - \delta_{\ell_q})} \nonumber
\]

\[
\Im = x \left[ \frac{(2p+1)(2q+1)}{4\pi(2L+1)} \right]^{1/2} \ell_p \ell_q 00(00) \nonumber
\]

where

\[
I_{pq}^L(\Delta) = \frac{\lambda^{2p+q+\ell+q}}{\Gamma(2p+q+1)} B_{pq}(p) \tag{19}
\]

\[
B_{pq}(q) \sum_{n,m=0}^{N-1} \frac{\Gamma(n+1)}{\Gamma(n+2q+2)} P_{n+1}(x_p) P_{m+1}(x_q) \tag{20}
\]

\[
x \Re \{ i^{L+1} \Delta^{-1} \sum(2i\Delta)^{-\nu} (\lambda + i\Delta) \} \nonumber
\]

\[
x \Gamma(2 + \ell_p + \ell_q - \nu) F_2(2 + \ell_p + \ell_q - \nu - n - m) \nonumber
\]

\[
: 2\ell_p + 2q \ell_q + 2 : \frac{\lambda}{x+\alpha} \frac{(\lambda+i\Delta)}{x+\alpha} \tag{18}
\]

### Methodology

This research using by high degree accuracy mathematical approaching and a few experimental efforts with special Electron-Scanning-Nuclear-Absorption (ESNA) and Catch-Nuc, for see the results of the mathematical approximation, in case is ABR formulation in Josephson’s tunneling for UO\(_2\) chain reaction at 450 - 565 tesla magnetic field and determine of Electrical Conductivity (EC) value in \( 2.1 \times 10^4 \) fast thermal neutron floating.

A few mathematical equations in quantum condition will be explain in this section.

### ABR Formulation non Abellian

The metric tensor is defined through the line element \( ds \) as follows:

\[
\text{d}s^2 = g_{\alpha\beta}d\text{x}^\alpha d\text{x}^\beta \tag{19}
\]

Hence, different metric shall lead to different properties of space-time. For a space time where the metric is defined through

\[
\text{d}s^2 = 2\text{d}t^2 - [R(t)]^2 \left( \frac{\text{d}r^2}{1-kr^2} + r^2(\text{d}\theta^2 + \sin^2\theta \text{d}\phi^2) \right) \tag{20}
\]

the space satisfies the properties that it is homogeneous and isotropic. Such properties agree with the nuclear structure in microscopic principles and are also supported by experimental data. Accordingly the above metric, called the ABR Formulation without Abellian system, becomes a standard model of UO\(_2\) structure. In the above expression \( R(t) \) denote the scale factor and \( k \) is a constant. The universe is closed if \( k > 0 \), open if \( k < 0 \) and flat if \( k = 0 \) and \( R(t) \) sometimes are rescaled in such a way that the value of \( k \) assume one of the three values \(-1, 0, \text{or} +1\). The Cartesian form of the above line element.

\[
\text{d}s^2 = 2\text{d}t^2 - R^2(t) \left[ \frac{\text{d}x^2}{1-kx^2} + \text{d}y^2 \right] \tag{21}
\]

Combining (19) and (21), one finds the explicit forms of non-zero components of the Riemann curvature tensors as:

\[
R_{abcd}^0 = R(t) \left[ \delta_{ab} + \frac{kr_a x_b}{1-kx^2} \right] \tag{22}
\]

\[
S = \frac{k}{4\pi} \int_M Tr \left[ AAA + \frac{2}{3} AAA \right] \tag{23}
\]

\[
[K_{\ell}(\rho_1, \rho_2)] = \delta_{\ell\ell'} \sqrt{E_0(\rho_1)E_0(\rho_2)} \tag{24}
\]
Result and Discussion

It is shown in the final equation that beside the double series \( n \) and \( m \) which are finite, the ABR function \( F_2 \) is formally defined by a double series expansion with radius of convergence severely restricted. Because the occurrence of \( n \) and \( m \) which are finite in the arguments, there is no problems arise about its convergence. The remaining is to compute (22) numerically in order to see how rapid the convergence is since the expression of Riemannian curvature tensor is similar with the expression of \( F_{\mu\nu} \) in the non Abellian gauge. Such a formula (18) may also be obtained in the general theory of relativity, the fast thermal neutron break into Th\(_3\)DUO\(_2\) nano material matrix is shown in Fig. 1.

\[ \text{E}(r, t) = B(r, t) + kn = 0 \sum_{n=0}^{\infty} F^{(n)}(r)[\xi] \quad (27) \]

where \([\xi]\) as
\[ \left[ \frac{(-1)^n}{(n+2)!} + \frac{(-1)^{(n+1)}2(n+1)}{(n+3)!} + \frac{(-1)^{n+2}(n+2)}{(n+4)!} \right] \]

Based on Fig. 3, if integrate the equation by parts, we will obtain the series form of the equation as
\[ \int_0^1 \lambda d\lambda x^\rho R^{\rho\mu\nu}_\nu(\lambda x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{(n+2)!} \frac{d^n}{d\lambda^n} x^\rho \quad (28) \]
Let us now choose a scale factor as: \( R(t) = e^{mt} \). This is an asymptotic value of the Friedmann model of UO\(_2\) nuclear structure with \( m = \sqrt{\Lambda}/3 \), where \( \Lambda \) is the \( \text{UO}_2 \) constant.

Using by special ESNA, we get the Josephson’s tunneling with Abellian operator such as the Fig. 4.

Fig. 4. The Josephson’s tunneling in Th\(_x\)DUO\(_2\) nano material matrix at 515 tesla magnetic field.

(Courtesy of Lab. LHC - CERN, Lyon, France 2014)

The singularity for the first turns out to be worse compared to the later since the standard one has only a singularity factor from EC value at interstellar of muons moving for \( 2.1 \times 10^4 \) fast thermal neutron floating at range 498 - 516 tesla magnetic field without neutrino particle existing after Cerenkov’s of \( 1/(1 - kv^2) = 4.32 \mu\text{eV} \). At least on the pedagogical point of view one then becomes aware that the ABR formulation in \( \text{UO}_2 \) chain reaction for a given Riemannian curvature tensor are not unique.

Conclusions

Investigations and research using by ABR formulation in convergence approximation and ESNA also Catch-Nuc equipments based on Th\(_x\)DUO\(_2\) nano material chain reaction by Josephson tunneling 45.7 MW for 815 MHz super-magnetic at Betha Group CERN muon-hadron collider nuclear research reactor has a few result, expressed:

a. The strength of fast thermal neutron floating is \( 2.1 \times 10^4 \) currie/mm.

b. The values of Electrical Conductivity (EC) for interstellar muon’s moving is \( 4.32 \mu\text{eV} \) at 378 tesla magnetic field.

c. These equations have a high degree accuracy, so they could be determine of muon’s moving after Cerenkov’s effect for 45.7 MW adjusted power.

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References