Considerations in Frameworks of Model UMHTS

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ABSTRACT: In the framework of the model UMHTS the dynamics of the spin sacks, both in the case of folded and in the case of flat Cu-O plates, has been considered.
Next, the model of the tunneling of electrons through this plate has been proposed.

I Introduction

The model UMHTS [1] assumes the existence of a continuous (folded or flat) plate of the negative electric charge in the plate of Cu-O layer, and an electron gas between the plates.
It is possible to calculate the electric potentials in both parts and in both cases.
An electron coming nearer the plate repulses electrons of the plate and causes the arising of the effective positive charge and the mirror charge to it at the other side of the plate (both in the case of the flat and the folded plate).
A passage of the superconducting current is possible because of the tunneling of electrons through the plate Cu-O.

II The folded plate

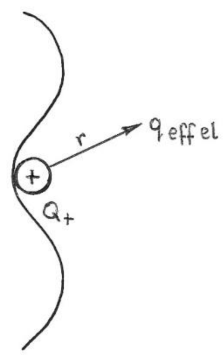

Fig. 1

The potential energy of the electrons confined in the minimum of potential (we assume that this minimum borders on the effective positive charge) is given by the formula:

$$E_p = \frac{1}{4\pi\varepsilon_0\varepsilon_r} \frac{Q_+ \; q_{eff}}{r} \tag{1}$$

$q_{eff} \neq e$, because of the interaction of the electron.

$$E_k = \frac{m_{eff} \; \dot{r}^2}{2} \tag{2}$$

$L = E_k - E_p$

The Lagrange equation:

$$\frac{d}{dt}\frac{\partial L}{\partial \dot{q}_i} - \frac{\partial L}{\partial q_i} = 0 \qquad \text{here } q_i = r$$

So we obtain:

$$m_{eff}\, \ddot{r} - \frac{1}{4\pi\varepsilon_0\varepsilon_r} \frac{Q_+ \; q_{eff}}{r^2} = 0 \tag{3}$$

$$q_{eff} = \int \varrho_{eff} \; dV \tag{4}$$

$$dV \sim r^2 \, dr \tag{4a}$$

We can write (3) in the form:

$$\int m_{eff}\, r^2 \; \ddot{r} \, dt = \int \frac{1}{4\pi\varepsilon_0\varepsilon_r} \; Q_+ \; q_{eff} \, dt$$

and

$$m_{eff} \int r^2 \; \ddot{r} \, dt = m_{eff} \left(\dot{r}\, r^2 - \int \dot{r}\, r \, dt \right) \tag{4b}$$

We assume that the whole interaction is taken under consideration by an effective mass and an effective charge.

$$\frac{m_{eff}\,\dot{r}^2}{2} = kT$$

We assume that this energy dominates.

$$\dot{r} = \sqrt{\frac{2kT}{m_{eff}}} \tag{5}$$

Neglecting the second term of (4b), because it depends only linearly on r when the first term on r^2, we have:

$$m_{eff}\sqrt{\frac{2kT}{m_{eff}}}\; r^2 = \int \frac{1}{2\pi\varepsilon_0\varepsilon_r}\; Q_+\; q_{eff}\, dt \tag{6}$$

(4) and (6) implicate that:

$$\varrho_{eff} \sim \frac{1}{r}$$

$$sgn\, Q_+\; q_{eff} = -1$$

(6) implicates that q_{eff} decreases with the temperature, which can be foreseen, because with the increase in the temperature the charge disperses.
The right member of the equation (6) is negative, so the left member must be negative too. We have so the negative root.
(6) implicates as well, that if $m_{eff} > 0$, the sack enlarges because $q_{eff} < 0$ (with the passage of time r^2 increases, what is implicated again by (6)).
If $m_{eff} < 0$, then $\sqrt{m_{eff}}$ is a complex number and time is a complex number too. Besides, the effective mass can be essentially a complex number.
Let's analyze the most general case:

$$(a + bi)\, r^2 = \int \alpha\, Q_+\, q_{eff}\, d(t_A + it_B) \tag{7}$$

Next:
$r = r_A + ir_B$

$r^2 = r_A^2 - r_B^2 + 2ir_Ar_B$

So:

$$(a + bi)\,[(r_A^2 - r_B^2) + 2ir_A r_B] \;=\; \int \alpha\, Q_+\, q_{eff}\, d(t_A + it_B)$$

We have two equations:

$$a\,(r_A^2 - r_B^2) - 2br_A r_B \;=\; \int \alpha\, Q_+\, q_{eff}\, dt_A \qquad (8)$$

$$b\,(r_A^2 - r_B^2) + 2ar_A r_B \;=\; \int \alpha\, Q_+\, q_{eff}\, dt_B \qquad (8)$$

It is seen that:

- There is the conjugation of the dimensions by the product $r_A r_B$
- $t_A > 0$ and $a\,(r_A^2 - r_B^2) + 2ar_A r_B < 0$

  There is the increase in the sack, the opposite signs – decreasing.
- $t_B > 0$ and $b\,(r_A^2 - r_B^2) + 2ar_A r_B < 0$

  There is the increase in the sack, the change of signs – decreasing.
- The existence of the conjugated terms in these dependences testifies to an existence of the pulsation of the spin sacks.

Moreover, if we take under consideration that:

$$q_{eff} \;=\; q_{effA} + iq_{effB}$$

and:

$$q_{effA} + q_{effB} \;=\; Q$$

and next:

$$Q_+ \;=\; q_{+A} + iq_{+B}$$

and:

$$q_{+A} + q_{+B} \;=\; q$$

and interposing it into equation (8) we obtain so big series of conjugations that it is obvious that the pulsations (oscillations) are possible. The case of an enlargement of the sack means that the repulsion of the electrons is stronger than the attraction by the positive charge. These latest equations mean that the charge flows from the real dimensions to the complex dimensions and vice versa.

3. We assume that the electron gas is a homogenous plate of charge.

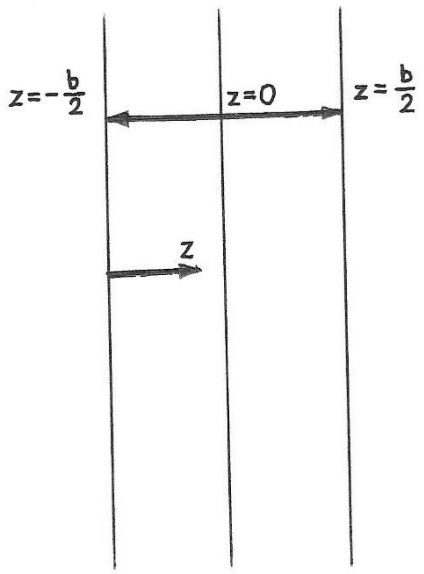

Fig. 2

The Laplace equation:

$$\Delta \varphi = \alpha \varrho$$

$$\varphi = \frac{1}{2}\alpha\varrho^2 + b\varrho + c$$

b= 0, because of the symmetry
c = 0, because of the calculation of the potential.

We have:

$$V_p = -\frac{\varrho_{eff}}{2\varepsilon_2} z$$

$$E_k = \frac{m_{eff}\,\dot{z}^2}{2}$$

The Lagrange equation:

$$m_{eff}\ddot{z} - \frac{\varrho_{eff}}{\varepsilon_2} z = 0$$

We have the equation of the harmonic oscillator:

$$\ddot{z} = \frac{\varrho_{eff}}{m_{eff}\varepsilon_2} z$$

$\frac{\varrho_{eff}}{m_{eff}} < 0$ - the harmonic oscillations; the condition of the passage to the fields described by the formula
$z = z_0\, cos\omega t + z_0\, sin\omega t$ is: $z_0 \geq \frac{b}{2}$.

$$\frac{\varrho_{eff}}{m_{eff}} > 0$$

$$z = e^{\frac{t}{\tau}} + e^{-\frac{t}{\tau}} \qquad (9)$$

We take under consideration the increasing term – different for $z < 0$ and different for $z > 0$.
It means the pumping the charge to the minima of potential in the fields.
We have:

$$z + r = \frac{b}{2} \Longrightarrow z = \frac{b}{2} - r \qquad (9a)$$

If the flow of the charge to the fields doesn't need the passage through the potential barrier, the condition (9) must be fulfilled and the barriers of potentials on the boundary of both zones can't appear even in the case of the enlargement of the sack.
So:

$$r = R_{gr}$$

and:

$$\left|\frac{\varrho_{eff}}{2\varepsilon_2}\left(\frac{b}{2} - R_{gr}\right)^2\right| \geq \left|\frac{1}{4\pi\varepsilon_0\varepsilon_r} \; \frac{Q_+ \, q_{eff}}{R_{gr}}\right| \qquad (10)$$

R_{gr} – the maximal size of the sack.
An electron is absorbed from the sack by the charge Q_+. At the beginning an exciton is created. The electron is caught from the continuum states and it falls on the lower and lower discrete states.
The values of energy are given by the formula:

$$E_n = -\frac{\mu Z_1 Z_2 e^4}{2\hbar^2 n^2}$$

Z_1, Z_2 are the coefficients of effective charges.

Simultaneously this electron begins to enter into the composition of the positive charge placed symmetrically at the other side of the folded plate. It is the mechanism of the tunneling.

<u>Recapitulation</u>

The case of the collapse of the spin sack is described by the strong effect of the tunneling. The case of repulsion or pulsation corresponds to the influence of the repulsion between the negative charges, which isn't taken under consideration directly in the Lagrangian.
The influence of the negative charge manifests indirectly by the integral of its density. Although we neglected the interactions of the spin we obtained concrete results. We should remember that spin is charge in the sense of the Dirac equation.
We obtained the qualitatively consistent results both in the case of the flat and the folded plate.

Acknowledgments:

I present the calculations with all details because I am ashamed of fellow-workers theorists who hid it. The details of calculations are most important if somebody wants to verify the results.

References:

[1] Z. Morawski, "Mechanism of High Temperature Superconductivity", this website