Quantum equation of tachyon

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As discussed in detail by **Recami&Mignani** [**R. Mignani, E. Recami // Nuovo Cimento, 30A, #4, 533 (1975); Lett. Nuovo Cimento, 11, #8, 417 (1974).**], the existence of the **tachyon** (i.e. a superluminal particle) has no conflict with the theory of special relativity.

Within the framework of **classical electrodynamics**, **Recami** has shown that **superluminal electric charges** (tachyons) can be described similarly to **subliminal magnetically charged** particles.

Meanwhile, **G. Lochak** paid attention to the fact that the Tushek-Salam gauge invariance for the **massless Dirac equation** gives rise to an equation describing the **magnetic monopoles** [**G. Lochak // Ann. Fond. L.de Broglie, 1983, #8, 345; Ann. Fond. L.de Broglie, 1984, #9, 5.**].

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The new equation which is proposed

1. obeys the local Tushek-Salam gauge invariance with allowance for the **linear mass term**, that is, it represents a development of **Lochak's magnetic monopole** theory, and
2. describes the magnetic monopoles that coincide, in the classical approximation, with the **Recami tachyons**.

Quantum equation of tachyon

$$\left\{\gamma_\mu\left(\partial_\mu - \frac{g}{\hbar c}\gamma_5 \cdot B_\mu\right) + \frac{mc}{\hbar}\Gamma\right\}\psi = 0,$$

$$\overline{\psi}\left\{\gamma_\mu\left(-\overleftarrow{\partial}_\mu - \frac{g}{\hbar c}\gamma_5 \cdot B_\mu\right) + \overline{\psi}\cdot\frac{mc}{\hbar}\Gamma\right\} = 0,$$

$$\gamma_5\Gamma = -\Gamma\gamma_5,$$

$$\Gamma = a_k\gamma_k \cdot \gamma_5, \qquad a_k a_k = 1,$$

$$\Gamma^2 = -a_k\gamma_k \cdot a_m\gamma_m = -1,$$

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Each of the equations splits into two **independent** equations in the **Weyl** representation:

$$\left[\frac{1}{c}\frac{\partial}{\partial t}-\vec{\sigma}\cdot\nabla-i\frac{g}{\hbar c}(\chi+\vec{\sigma}\vec{B})-i\frac{mc}{\hbar}\right]\xi=0$$

$$\left[\frac{1}{c}\frac{\partial}{\partial t}+\vec{\sigma}\cdot\nabla+i\frac{g}{\hbar c}(\chi-\vec{\sigma}\vec{B})+i\frac{mc}{\hbar}\right]\eta=0$$

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The fact that this equation really describes the tachyons becomes evident from the **dispersion characteristic** equation:

$$\left(\frac{\omega}{c} - \frac{mc}{\hbar}\right)^2 = \vec{k}^2$$

Dirac: $$\left(\frac{\omega}{c}\right)^2 = k_0^2 + \vec{k}^2$$

The effect of quantum tunnel resonance

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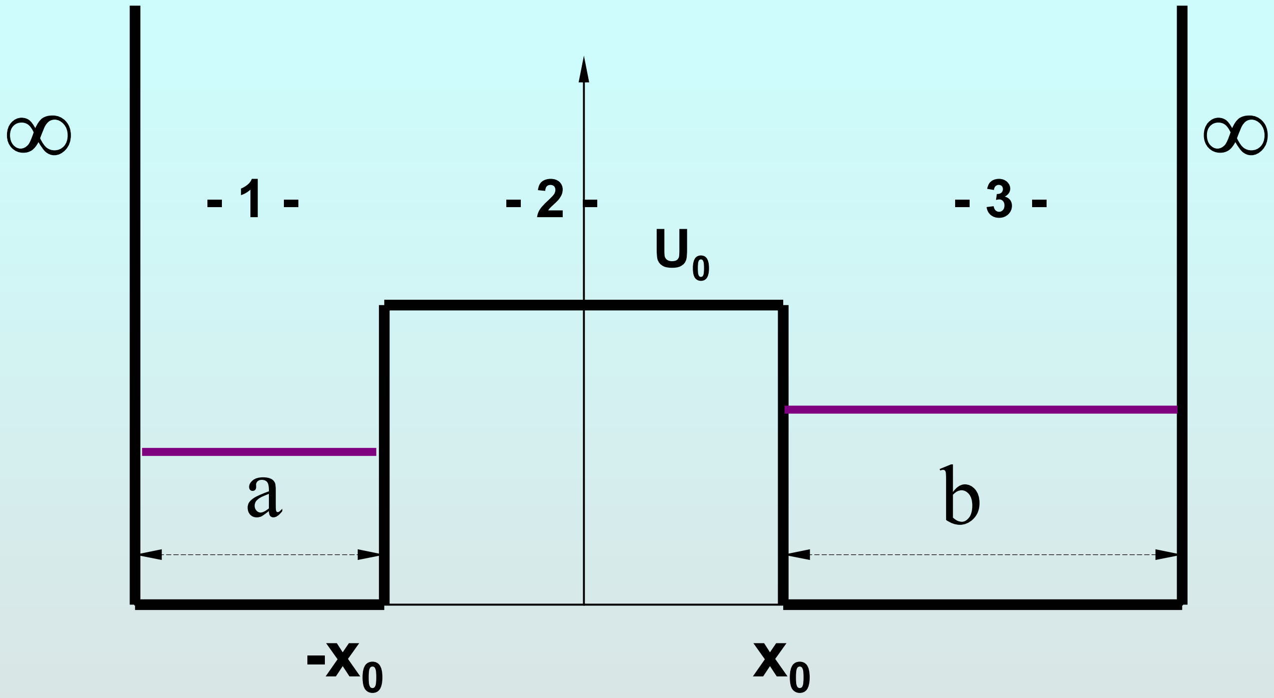
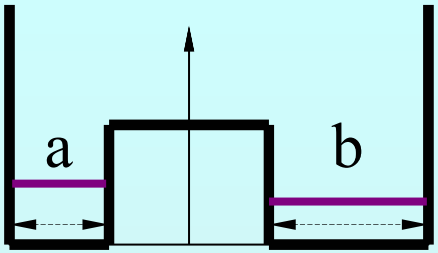
The effect of quantum tunnel resonance



The effect of quantum tunnel resonance



$$i\hbar \frac{\partial}{\partial t}\tilde{\psi}(t,x) = \hat{H}\tilde{\psi} = \left[-\frac{\hbar^2}{2m}\cdot\frac{\partial^2}{\partial x^2} + U(x)\right]\tilde{\psi}$$

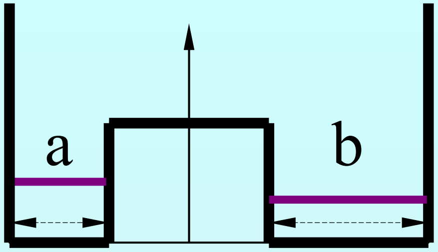
$$\tilde{\psi}(t,x) = \exp(-iEt/\hbar)\cdot\psi(x)$$

$$\psi_1 = \psi_0 \cdot \sin[k(x + x_0 + a)]$$

$$\psi_2 = \psi_0 \cdot [B_- \exp(-\kappa x) - B_+ \exp(\kappa \cdot x)]$$

$$\psi_3 = A \cdot \psi_0 \cdot \sin[k(x - x_0 - b)]$$

The effect of quantum tunnel resonance



$$f \equiv -\frac{k}{\kappa}\text{ctg}(ka) \qquad g \equiv -\frac{k}{\kappa}\text{ctg}(kb)$$

$$\kappa x_0 >> 1$$

$$A = \frac{\pm\sqrt{k^2 + (\kappa \cdot g)^2}}{\sqrt{k^2 + (\kappa \cdot f)^2}} \cdot \left[\text{ch}(2 \cdot \kappa x_0) - f \cdot \text{sh}(2 \cdot \kappa x_0)\right]$$

In resonance case: **ka=kb +π·n**, i.e. **g=f**.

We received ***exact*** decision **A=±1**, that is the particle equiprobably occupies both "holes".

We shall notice, that the condition of a resonance depends only on a ratio of "width" of left and right "hole" and

does not depend on width and height of "barrier"

between them. The allowable width of a resonance depends on the sizes of "barrier".

Study of the gas released upon electric explosion of titanium foils in liquids

Urutskoev L.I.[1], Govorun A.P.[1], Gulyaev A.A.[1], Demkin S.A.[2], Dorovskoi V.M.[2], Elesin L.A.[2], Kuznetsov V.L.[2], Petrushko S.V.[1], Steblevskii A.V.[3], Stolyarov V.L.[2], Fedotov V.G.[4], Filippov D.V.[1]

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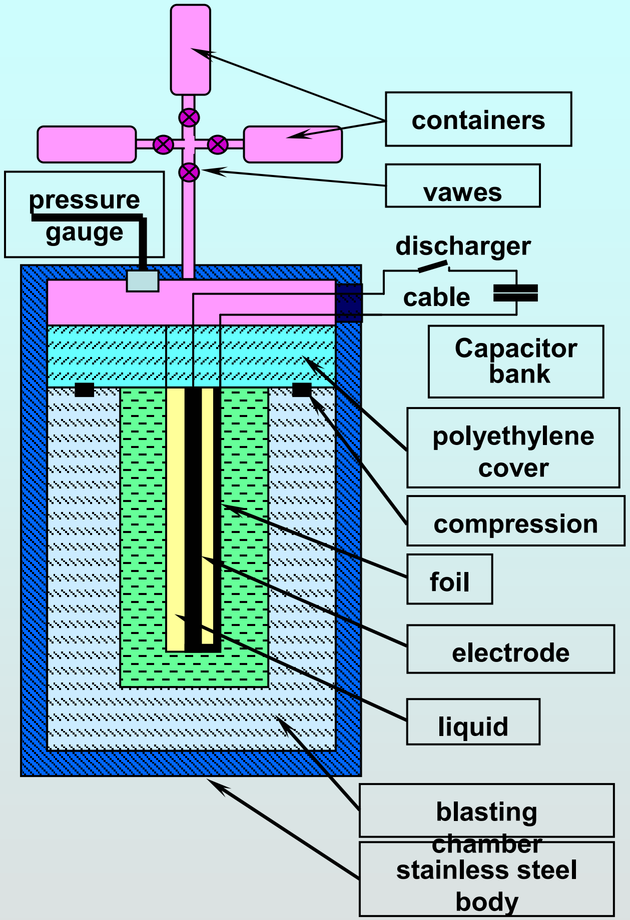

1. After an electric explosion of titanium foil in water, the sediment formed contains spherical hollow particles filled with H_2. In some particles, hydrogen pressure is so high that the particles are destroyed.
2. Noteworthy is the absence of O_2 in hollow particles.
3. An inhomogeneous content of admixtures in Ti has been detected over different topological fragments of the sample.

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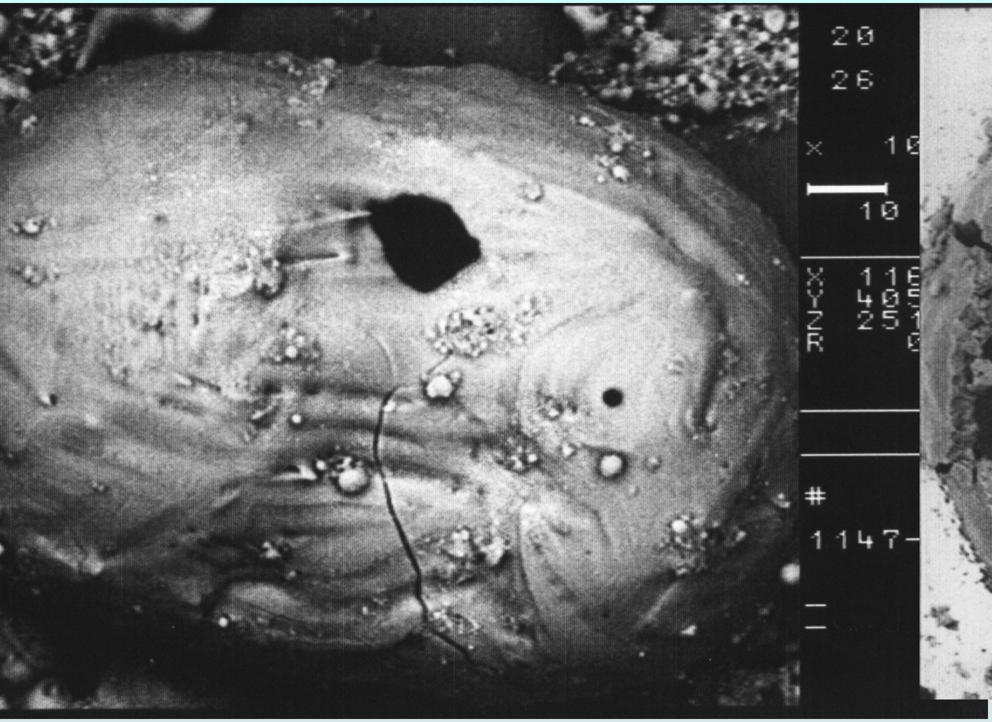

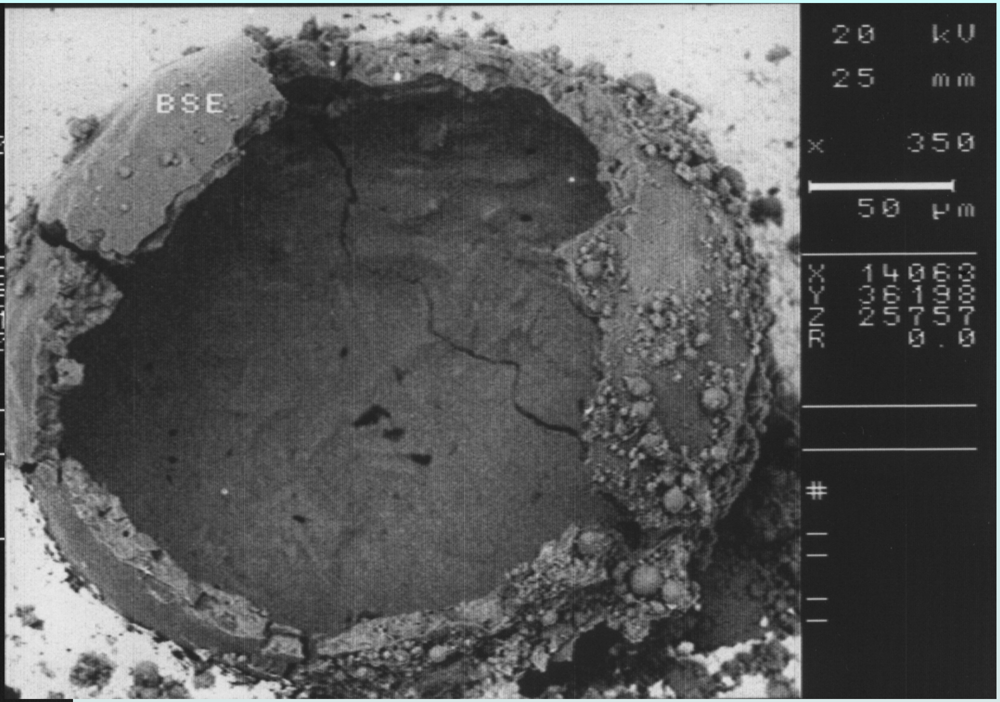

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