226(1): Theory of Low Energy Nuclear Reactions

In order to construct the simplest possible theory of such reactions we use UFT 181 and UFT 182. Consider for example the reaction:

$$^{64}Ni + p = {}^{63}Cu + 2n \quad -(1)$$

Here, ^{64}Ni has 36 neutrons and 28 protons, and ^{63}Cu has 34 neutrons and 29 protons. So ^{64}Ni is transmuted into ^{63}Cu with the release of two neutrons. The problem is how does the proton (i.e. H nucleus) interact with the ^{64}Ni atom to cause transmutation.

In classical physics (standard model) we would expect a scattering process:

$$^{64}Ni(i) + p(i) = {}^{64}Ni(f) + p(f) \quad -(2)$$

and no transmutation, i.e the proton would be repelled by the ^{64}Ni nucleus, and no neutrons would be released. However, in LENR, the nickel is transmuted to copper with release of neutrons and energy. The energy is used in commercially available devices as a safe source of power.

Consider the theory of UFT181:

2) $$p^\mu \rightarrow p^\mu - \hbar \kappa^\mu \quad -(3)$$

in which a four momentum p^μ interacts with the matter wave κ^μ. This is a <u>minimal prescription</u>. The Einstein equation:

$$p^\mu p_\mu = m_0^2 c^2 \quad -(4)$$

is changed to the relativistic Hamilton Jacobi equation:

$$(p^\mu - \hbar \kappa^\mu)(p_\mu - \hbar \kappa_\mu) = m_0^2 c^2 . \quad -(5)$$

Now use:

$$p^\mu = i\hbar \partial^\mu \quad -(6)$$

to obtain:

$$\left(\square + R_1 + \left(\frac{m_0 c}{\hbar} \right)^2 \right) \psi = 0 \quad -(7)$$

where

$$R_1 = \left(\frac{m c}{\hbar} \right)^2 \quad -(8)$$

Here m is defined as <u>the interacting mass</u>, as in UFT181 and UFT182:

$$m = \frac{\hbar}{c} \left(\frac{\omega^2}{c^2} - \kappa^2 \right)^{1/2} \quad -(9)$$

and in ECE theory <u>is a property of spacetime</u>. Therefore in the reaction (1),

3) the effective mass of the ^{64}Ni is:

$$M^2 = m^2 + m_0^2 \quad -(10)$$

where m is its interaction mass and m_0 is its rest mass. Therefore if ψ is the nuclear wave function:

$$\left(\Box + \left(\frac{Mc}{\hbar} \right)^2 \right) \psi = 0 \quad -(11)$$

where $$\Box = \frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2 \quad -(12)$$

If the wave function ψ has no time dependence then:

$$\left(-\hbar^2 \nabla^2 + M^2 c^2 \right) \psi = 0 \quad -(13)$$

or $$-\frac{\hbar^2 \nabla^2}{2M} \psi + \frac{Mc^2}{2} \psi = 0 \quad -(14)$$

The non-relativistic limit of eq. (11) is the free particle Schroedinger equation:

$$\frac{\hbar^2}{2M} \nabla^2 \psi = -i\hbar \frac{\partial \psi}{\partial t} \quad -(15)$$

which can be written as:

$$\hat{H} \psi = E \psi \quad -(16)$$

4) where

$$\hat{H} = -\frac{\hbar^2}{2m} \quad \text{---} (17)$$

is the hamiltonian operator. The classical limit of eq. (16) is:

$$E = T = \frac{p^2}{2m} = \frac{1}{2} m v^2$$

$$\text{---} (18)$$

So the ^{64}Ni atom has kinetic energy:

$$T = \frac{1}{2} (m^2 + m_0^2)^{1/2} v^2 \quad \text{---} (19)$$

during the reaction, where:

$$m^2 = \frac{\hbar^2}{c^2} \left(\frac{\omega^2}{c^2} - \kappa^2 \right) \quad \text{---} (20)$$

has been obtained from spacetime. Here:

$$\kappa^\mu = \left(\frac{\omega}{c}, \underline{p} \right) \quad \text{---} (21)$$

is a wave four-vector of spacetime.

This kinetic energy of spacetime results in the nuclear reaction (1) and release of energy — an exothermic reaction