31(4): Conditions under which p can Enter the Ni Nucleus

As shown in UFT427 and UFT430 there exists an entirely new force of physics:

$$F = -\frac{dm(r)}{dr}\left(\frac{m(r)}{2m(r) - r\frac{dm(r)}{dr}}\right)^{1/2} E \quad -(1)$$

where

$$E^2 = p^2c^2 + m(r)\, m^2 c^4 \quad -(2)$$

This is a force of general relativity in an m space defined by:

$$ds^2 = m(r)\, c^2 dt^2 - \frac{dr^2}{m(r)} - r^2 d\phi^2 \quad -(3)$$

In eq. (2) p is the relativistic momentum of a particle of mass m. For a particle at rest:

$$p = 0 \quad -(4)$$

so

$$E_0 = m(r)^{1/2} mc^2 \quad -(5)$$

A rest particle therefore generates the attractive force:

$$\boxed{F_0 = -\frac{dm(r)}{dr}\left(\frac{m(r)}{2m(r) - r\frac{dm(r)}{dr}}\right) mc^2} \quad -(6)$$

when $dm(r)/dr$ is non-zero. Note carefully that this force does not exist in classical physics or special relativity because in these theories:

$$\frac{dm(r)}{dr} = 0 \quad -(7)$$

In the general m space (3) however, the force F_0

) around a static particle of mass m is ubiquitous and ever present, as is the rest energy (5) of the particle.

Now consider the mutation observed in a low energy nuclear reaction:

$$^{64}Ni + p = {}^{63}Cu + En + \text{products} \quad (8)$$

Consider a stationary nickel nucleus and a moving proton. The nickel nucleus has 36 neutrons and 28 protons, and p consists of one proton. So the mass of the Ni nucleus is sixty four times greater than that of the proton and for a given m(r) and dm(r) / dr generates sixty four times the force (6).

The Coulombic repulsion between ^{64}Ni and p is:

$$F(\text{Coulomb}) = \frac{e(Ni)e(p)}{4\pi\epsilon_0}\frac{m(r)}{r^2} \quad - (9)$$

So the net force is:

$$\boxed{F = m(r)\left(\frac{e(Ni)e(p)}{4\pi\epsilon_0}\frac{1}{r^2} - \frac{dm(r)}{dr}\left(\frac{mc^2}{2m(r) - r\frac{dm(r)}{dr}}\right)\right) \quad - (10)}$$

between a moving proton and a static nickel nucleus.

Note that the force does not depend on the momentum of the proton.

Therefore the negative valued force (6) due to m space exists in a mixture of stationary Ni and p. In this case the total rest energy is:

$$E_0 = m(r)^{1/2}\left(m(Ni) + m(p)\right)c^2 \quad -(11)$$

In order for p to react with Ni the negative force of attraction in eq. (10) must overcome the Coulombic repulsion or Coulomb barrier.

This can happen under the condition:

$$2m(r) = r\frac{dm(r)}{dr} \quad -(12)$$

when the negative or attractive force due to m space goes to infinity. From eq. (12) this occurs when:

$$r = \frac{2m(r)}{dm(r)/dr} \quad -(13)$$

and if

$$\frac{dm(r)}{dr} \ll m(r) \quad -(14)$$

the distance r can be large when the negative force goes to infinity. Under the condition (13) the repulsive Coulomb force is:

$$F(\text{Coulomb}) = \frac{e(Ni)\,e(p)}{16\pi\epsilon_0}\,\frac{1}{m(r)}\left(\frac{dm(r)}{dr}\right)^2 \quad (15)$$

and is finite and much less than the attractive force. After the proton reacts with the nickel,

4) the transmutation (8) takes place. The rest energy after transmutation is:

$$E_0 = m(r)^{1/2}\left(m({}^{63}Cu) + \text{products}\right)c^2 \quad -(16)$$

The change in rest energy is:

$$\Delta E_0 = m(r)^{1/2}\left(m({}^{64}Ni) + m(p) - (m({}^{63}Cu) + m(\text{products})\right)c^2 \quad -(17)$$

and this is released as a very large amount of energy, in the form of heat and light in the visible and ultra violet region. The light is the emission of nickel, vaporized by the heat. This emission occurs in the visible and ultra violet region, but not in the gamma ray region.

The protons in a hydrogen gas do not need to be in motion for a low energy nuclear reaction to occur. This contrasts very vividly with a conventional atom smasher reaction, where protons have to be accelerated to very high momenta.