431(1): Elementary Particle Theory in m space and LENR

First consider the Einstein energy equation in flat space:

$$E^2 = p^2c^2 + m^2c^4 \quad -(1)$$

where

$$E = \gamma mc^2 \quad -(2)$$

is the total relativistic energy and

$$\underline{p} = \gamma m \underline{v}_N \quad -(3)$$

is the relativistic $\underline{p}$ momentum. The Lorentz factor is

$$\gamma = \left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} \quad -(4)$$

where $\underline{v}_N$ is the Newtonian momentum. The rest energy is

$$E_0 = mc^2 \quad -(5)$$

Now apply Schroedinger quantization:

$$E = i\hbar\frac{\partial}{\partial t}, \quad \underline{p} = -i\hbar\underline{\nabla} \quad -(6)$$

which means:

$$E\phi = i\hbar\frac{\partial\phi}{\partial t}, \quad \underline{p}\phi = -i\hbar\underline{\nabla}\phi \quad -(7)$$

where ϕ is the wave function.

It follows that:

$$\left(\Box + \left(\frac{mc}{\hbar}\right)^2\right)\phi = 0 \quad -(8)$$

where the d'Alembertian is:

$$\Box = \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \nabla^2 \quad -(9)$$

As in UFT428, Eq. (1) in m space is:

$$E^2 = c^2 p^2 + m(r) m_0^2 c^4 \quad -(10)$$

o m space changes the rest energy to:

$$E_0 = m(r)^{1/2} m c^2 \quad -(11)$$

$$= m_1 c^2$$

so the mass of the particle is changed by m space to

$$\boxed{m_1 = m(r)^{1/2} m} \quad -(12)$$

It follows that the mass of every elementary particle is determined by $m(r)^{1/2}$. The m(r) space changes the mass m of flat space to m_1. Therefore the energy for a LENR reactor comes from m space.

Similarly, the ECE wave equation is:

$$(\square + R) q^a_\mu = 0 \quad -(13)$$

where R is the scalar curvature and q^a_μ is the tetrad. In eq. (13) R is well defined in terms of geometry and spacetime. For each element of the tetrad q^a_μ it follows that:

$$R = -\left(\frac{m_1 c}{\hbar}\right)^2 \quad -(14)$$

i.e.

$$\boxed{R = -m(r)\left(\frac{mc}{\hbar}\right)^2} \quad -(15)$$

Therefore the internal structure of m(r) can be expressed

) in terms of the geometrical definition of R given
the early UFT papers:

$$R = q^{\nu}_{a} \partial^{\mu} (\omega^{a}_{\mu\nu} - \Gamma^{a}_{\mu\nu}) \quad -(16)$$

terms of the tetrad, spin connection and gamma connection
of Cartan geometry. So:

$$\boxed{m(r) = -\frac{\hbar}{mc} q^{\nu}_{a} \partial^{\mu} (\omega^{a}_{\mu\nu} - \Gamma^{a}_{\mu\nu})} \quad -(17)$$

From eqs. (12) and (17) it follows that the mass
of any elementary particle is given by:

$$\left(\frac{m_1}{m}\right)^2 = m(r) = \frac{\hbar}{mc} q^{\nu}_{a} \partial^{\mu} (\Gamma^{a}_{\mu\nu} - \omega^{a}_{\mu\nu}) \quad -(18)$$

where m is the mass in flat spacetime.
In UFT 227, the heat generated in a LENR
reaction:

$$p_1^{\mu} + p_2^{\mu} = p_3^{\mu} + p_4^{\mu} \quad -(19)$$

was described as the excess mass:

$$\Delta m = (m_1^2 + m_2^2 - M^2)^{1/2} \quad -(20)$$

which generates an excess rest energy.
In UFT 229, a change in mass is defined by:

$$m \rightarrow m + m_1 = \frac{\hbar}{c^2} \left[(\omega^2 - \kappa^2 c^2)^{1/2} + (\omega_1^2 - \kappa_1^2 c^2)^{1/2} \right] \quad -(21)$$

This change of mass generates an increase in

4) Rest energy:

$$E \rightarrow (m + m_1)c^2 - mc^2 \quad -(22)$$

which is energy from spacetime itself, i.e. energy from m space. In terms of $m(r)$, the increase in rest energy is

$$E = \left(m(r)^{1/2} - 1\right) mc^2 \quad -(23)$$

caused by the LENR reaction (19).

In order for a LENR to occur, the attractive strong force between neutrons and protons must be overcome by the force of m space:

$$F = \frac{dm(r)}{dr} \left(\frac{m(r)^{1/2}}{r\frac{dm(r)}{dr} - 2m(r)} \right) E \quad -(24)$$

where:

$$E^2 = c^2 p^2 + m(r) m^2 c^4 \quad -(25)$$

For simplicity of development, consider the nucleus to be at rest, so:

$$E = E_0 = m(r)^{1/2} mc^2 \quad -(26)$$

and it follows that:

$$\boxed{F = \frac{dm(r)}{dr} \frac{m(r)\, mc^2}{r\frac{dm(r)}{dr} - 2m(r)}} \quad -(27)$$

Under the condition:

$$r\frac{dm(r)}{dr} = 2m(r), \quad -(28)$$

discussed in UFT417 and UFT430, the positive force is

5) eq. (27) becomes enormous, and overwhelms the attractive force between protons and neutrons which binds the nucleus together. In UFT226 ff the attractive potential was modelled by:

$$U(\text{attractive}) = - \frac{U_0}{1 + \exp\left(\frac{r - R}{a_N} \right)} \quad -(29)$$

So the attractive strong nuclear force is:

$$F(\text{attractive}) = - \frac{\partial U(\text{attractive})}{\partial r} \quad -(30)$$

Therefore if:

$$F > F(\text{attractive}) \quad -(31)$$

the nucleus breaks apart.

The energy released in this process is:

$$\boxed{E = \left(n(r)^{1/2} - 1 \right) mc^2} \quad -(32)$$

Therefore low energy nuclear reactions are due to the force (27) of m space, and result in the release of energy (32) as heat. This process has been found hundreds of times to be reproducible and repeatable.

For all elementary particles, from eq. (12):

$$\boxed{\frac{m_1}{m} = n(r)^{1/2}} \quad -(33)$$