433(3): The Masses of Elementary Particle Beams

Consider the energy equation of m theory:

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

where $E$ is the relativistic energy, $p$ the relativistic momentum, and $m(r)$ the function that determines the nature of spacetime through the infinitesimal line element:

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

in plane polar coordinates, with generalization to other coordinate systems such as spherical polar. The quantization of eq. (1) takes place through:

$$p^\mu = i\hbar \partial^\mu \quad -(3)$$

so:

$$\left(\frac{E}{c}, \underline{p}\right) = i\hbar \left(\frac{1}{c}\frac{\partial}{\partial t}, -\underline{\nabla}\right) \quad -(4)$$

It follows that:

$$-\hbar^2 \frac{\partial^2 \phi}{\partial t^2} = -\hbar^2 c^2 \nabla^2 \phi + m(r) m^2 c^4 \phi \quad -(5)$$

i.e.

$$\left(\Box + m(r)\left(\frac{mc}{\hbar}\right)^2\right)\phi = 0 \quad -(6)$$

where the d'Alembertian is:

$$\Box = \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \nabla^2 \quad -(7)$$

Therefore $\phi$ is the wave corresponding to the particle of mass m.

In general, $\phi$ depends on r and t and is a moving wave. If $\phi$ is considered to be a standing wave then:

$$\nabla^2\phi = m(r)\left(\frac{mc}{\hbar}\right)^2\phi \quad -(8)$$

and in this case $\phi$ depends only on r. Now define the expectation value of $m(r)$:

$$\langle m(r)\rangle = \int \phi^* m(r)\phi \, d\tau \quad -(9)$$

Depending on the wave function $\phi$ there are n values of $\langle m(r)\rangle$. There are n different particle masses.

Using the Einstein/de Broglie equations:

$$\langle E\rangle = \hbar\omega \quad -(10)$$

and

$$\langle \underline{p}\rangle = \hbar\underline{\kappa} \quad -(11)$$

it follows that:

$$m^2c^4 = \frac{\hbar^2}{\langle m(r)\rangle}(\omega^2 - c^2\kappa^2) \quad -(12)$$

so the particle masses are:

$$m^2 = \frac{\hbar^2(\omega^2 - c^2\kappa^2)}{\langle m(r)\rangle c^4} \quad -(13)$$

It follows that:

$$\langle n(r)\rangle\left(\frac{mc}{\hbar}\right)^2 = \left(\left(\frac{\omega}{c}\right)^2 - \kappa^2\right) \quad -(14)$$

where

$$\langle n(r)\rangle = \int \phi^* n(r)\,\phi\, d\tau \quad -(15)$$

From eq. (13):

$$E_0 = mc^2 = \hbar\left(\frac{\omega^2 - c^2\kappa^2}{\langle n(r)\rangle}\right)^{1/2} \quad -(16)$$

The interaction between a proton and a neutron is mediated by seven particles as follows:

| Name | Particle | Antiparticle | $mc^2$ / (MeV) |
|---|---|---|---|
| Pion | $\pi^+$ | $\pi^-$ | 139.57018 |
| Pion | $\pi^0$ | $\pi^0$ | 134.9766 |
| rho meson | $\rho^+$ | $\rho^-$ | 775.11 |
| rho meson | $\rho^0$ | $\rho^0$ | 775.26 |
| Omega meson | $\omega$ | $\omega$ | 782.65 |

The rest energies of these seven particles are defined by the expectation value (15), and the wave function is defined by eq. (6), where $n(r)$ is the original $n(r)$ function, which must be chosen to give the number of observed particles for a given nucleon interaction.