260(5): Basic Equations of the Structure of Matter

The starting equation is:

$$\underline{\nabla} \times \underline{q}^a = \kappa \underline{q}^a \quad -(1)$$

where $\underline{q}^a$ is the tetrad. This can be derived from Cartan geometry. This equation implies that:

$$\underline{\nabla} \cdot \underline{q}^a = 0 \quad -(2)$$

The ECE hypothesis is:

$$\underline{A}^a = A^{(0)} \underline{q}^a \quad -(3)$$

so eq. (1) implies:

$$\underline{\nabla} \times \underline{A}^a = \kappa \underline{A}^a \quad -(4)$$

and

$$\underline{\nabla} \cdot \underline{A}^a = 0 \quad -(5)$$

Eq. (1) implies:

$$(\nabla^2 + \kappa^2) \underline{q}^a = \underline{0} \quad -(6)$$

So $\underline{q}^a$ has a large number of important solutions. Using the minimal prescription and de Broglie hypothesis:

$$\underline{p} = e\underline{A} = \hbar \underline{\kappa} \quad -(7)$$

The quantum hypothesis is:

2)

$$\underline{p}\,\phi = -i\hbar \underline{\nabla}\,\phi \quad - (8)$$

So

$$\underline{p} = eA^{(0)}\underline{q} = \hbar \underline{\kappa} = -i\hbar \underline{\nabla}. \quad - (9)$$

Now use:

$$eA^{(0)} = \hbar\kappa \quad - (10)$$

to find that:

$$\boxed{-i\underline{\nabla}\,\phi = \kappa \underline{q}\,\phi} \quad - (11)$$

For each a, this is the quantization condition for the tetrad.

The kinetic energy is:

$$T = \frac{p^2}{2m} = \frac{\hbar^2\kappa^2 q^2}{2m} = -\frac{\hbar^2\nabla^2}{2m} \quad - (12).$$

So

$$(\nabla^2 + \kappa^2)\underline{q} = \underline{0} \quad - (13)$$

and as in UFT 259:

$$(\nabla^2 + \kappa^2)\phi = 0. \quad - (14)$$

The Hamiltonian is defined by:

$$H = V + T \quad - (15)$$

where V is the potential energy, so:

$$\boxed{\kappa^2 = \frac{2m}{\hbar^2}(E - V)} \quad - (16)$$

3) In quantum mechanics the wave function is normalized:

$$\int \phi \phi^* \, d\tau = 1. \quad -(17)$$

so the solutions of eq. (14) must be normalized, where

$$d\tau = r^2 \, dr \sin\theta \, d\theta \, d\phi. \quad -(18)$$

The expectation value of the tetrad is:

$$\langle \underline{q} \rangle = \int \phi^* \underline{q} \, \phi \, d\tau \quad -(19)$$

The expectation value of any quantity is:

$$\langle \Omega \rangle = \int \phi^* \Omega \, \phi \, d\tau, \quad -(20)$$

for example position:

$$\langle \underline{r} \rangle = \int \phi^* \underline{r} \, \phi \, d\tau. \quad -(21)$$

This set of equations can now be applied to the internal structure of the electron, proton and neutron.

In the special case of a Coulomb potential for V the well known hydrogenic wave functions can be used. These are products of spherical harmonics and a radial function. In this case:

$$V = -\frac{e^2}{4\pi\epsilon_0 r}. \quad -(22)$$

and from eqs. (16) and (22):

$$\kappa^2 = \frac{2m}{\hbar^2}\left(E + \frac{e^2}{4\pi\epsilon_0 r}\right) \quad -(23)$$

It seems that the neutron has an empty internal structure and a finite magnetic dipole moment. The internal structure of the neutron will however be governed by a Beltrami equation and Helmholtz equation of type:

$$(\nabla^2 + \kappa^2)\phi = 0 \quad -(24)$$

and its internal structure is given by the expectation value of position, eq. (21), with ϕ given by eq. (24). As in note 260(4), eq. (8), the simplest solution of eq. (24) in three dimensions is:

$$\phi = j(r)\,Y(\theta,\phi) \quad -(25)$$

so

$$\phi^* = j^*(r)\,Y^*(\theta,\phi) \quad -(26)$$

where $j(r)$ is a Bessel function and $Y(\theta,\phi)$ a spherical harmonic.

So the internal structure of the electron, proton and neutron will be given by eqs. (21), (25) and (26), with $d\tau$ defined by eq. (18). These structures can be worked out by computer algebra.

The Bessel function $j(r)$ is the solution

) of the Bessel differential equation:

$$\left(\frac{d^2}{dr^2} + \frac{2}{r}\frac{d}{dr} + \left(\kappa^2 - \frac{l(l+1)}{r^2}\right)\right) j(r) = 0 \quad -(27)$$

and the spherical harmonic is the solution of:

$$\frac{1}{\sin\theta}\frac{\partial \sin\theta}{\partial\theta}\frac{\partial Y}{\partial\theta} + \frac{1}{\sin^2\theta}\frac{\partial^2 Y}{\partial\phi^2} = -l(l+1)Y \quad -(28)$$

Unlike the hydrogenic wavefunctions, κ is a constant. The complete wavefunction must be normalized:

$$\int \phi^* \phi \, d\tau = 1. \quad -(29)$$

The latest data for the electron show that it has no electric dipole moment and is a perfect sphere (Imperial College experiment). This result refutes the standard model almost completely.

In this new ECE theory the dipole moment can be represented most simply by:

$$\underline{\mu} = e\underline{r} \quad -(30)$$

where e is the charge on the electron. So:

$$\langle \underline{\mu} \rangle = e \int \phi^* \underline{r} \, \phi \, d\tau \quad -(31)$$

6) Therefore the electron dipole moment must be described by:

$$\boxed{\int \phi^* \underline{r} \, \phi \, d\tau = \underline{0}} \quad -(32)$$

and the wave function ϕ must be chosen to give this result.

On the other hand the electron has a magnetic dipole moment due to its intrinsic spin angular momentum, despite the fact that it appears to have a very tiny volume from the Imperial College experiment. The spin angular momentum operator is:

$$\hat{\underline{S}} \phi = \frac{\hbar \sigma}{2} \phi \quad -(33)$$

and the magnetic dipole moment operator is:

$$\hat{\underline{m}} = - g_e \frac{e}{2m} \hat{\underline{S}} \quad -(34)$$

where g_e is the g factor of the electron. So

$$\langle \underline{S} \rangle = \int \phi^* \underline{S} \, \phi \, d\tau = \frac{\hbar}{2} \underline{\sigma} \quad -(35)$$

In the Z axis:

$$\sigma_Z = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \quad -(36)$$

) Therefore the wavefunction ψ must be chosen to give this result.

Finally the structure of the electron appears to be an almost infinitesimally small perfect sphere. To describe this result an orbital must be chosen to give a homogeneous ... result. The analogous result in the H atom is the 1s orbital.

So the various properties of the electron are described by a choice of solutions ψ of the Helmholtz wave equation.

Finally in this note the mass of the electron is described by the wave equation of ECE theory:

$$(\Box + \kappa_0^2)\, q^a_\mu = 0 \quad -(37)$$

where

$$\kappa_0^2 = q^{\nu}_a \partial^\mu (\omega^a_{\mu\nu} - \Gamma^a_{\mu\nu}) \quad -(38)$$

$$\rightarrow \left(\frac{mc}{\hbar}\right)^2$$

As in previous notes:

$$\frac{\omega^2}{c^2} = \kappa^2 + \kappa_0^2 \quad -(39)$$

which is the Einstein energy equation.