Part II

We Postulated 1 With z-zz=0. But What Then Of The z=0 Solution?

Review from PartI

Postulate I

Abstract The universe is infinitely complicated according to the mainstream (eg.,string theory, dark matter, colors, gauges, infinite mass and charge electrons,....) but I am finding in contrast that the universe is more and more simple, in fact it is infinitely simple eg.,1. The notion of reducing everything around us to a single thing is the (infinitely) simplest idea I can conceive of. It is ultimate reductionism (eg., of complex z) to a single real number **1.**

Note algebraically 1 is written as **zz-z**=0 and as a real# as min(**zz-z**)>0 which by the way means the same thing as z-zz =C (1.1.1), δC=0 (1.1.2) with C<0. Note in that regard that z=zz+C (eq.1.1.1) is also the iteration $z_{N+1}=z_Nz_N+C_M$ with $\delta C=\delta(z_{N+1}-z_Nz_N)=0$ (Just plug the left side z in z=zz+C back into each z on the right side repeatedly.) then implying this choice of C_M defines the Mandelbrot set since ∞-∞ cannot be zero. One such sequence z_N generated from this Mandelbrot set definition also provides a Cauchy sequence z_N of rational numbers that shows that 1 is a *real* number(2). You can then use appendix B2 to define the real number *algebra* by rigorously defining min and zz-z. But that special case of that particular Mandelbrot set Cauchy sequence z_N (defining the *real* numbers) implies we use only the neighborhood of the minC *real* subset of the Mandelbrot set. This is the (minC) Fiegenbaum point $C_M\equiv\xi C$ (sect.1.2 & appendix C) since for small δz (in z≡1+δz), and (in eq.1.1.6), $C\approx \delta z=C_M/\xi$. and ξ is big. So z'≈z'z' and so z'≈**real**#**1** Thus **Postulate**1 as **min(zz-z)**>0. (and so also making 1 a real#)

Applications

Plugging z≡1+δz into z-zz=C (eq.1.1.1) gives the quadratic equation δz+δzδz=C (1.1.4) with in-general complex number solutions. Plug the solution to eq.1.1.4 into eq.1.1.2 and get δC=δ(δz+δzδz)=0 which splits into real (special relativity) and imaginary (Clifford algebra) components and 4D (and so the Dirac equations of the electron **e** and the neutrino *v* (**sect.1.1**)) which also imply the operator formalism. Also composite **e**,*v* gives the Standard electroweak Model (sect.1.2) and composite 3**e** solves for the rest of particle physics (partII). The Mandelbrot set fractalness gives us cosmology and gravity (section 7.6)

Because of the δ on the extreme left in eq.1.1.6 we can add arbitrary -K to δz in eq.1.1.4. Here δ(δz-K)=0 in eq.1.1.6 to initialize to locally flat space as in 1.1.10 (In sect.1.2 K≠δz). (davidmaker.com for backups).

End of Review

7.0 We postulated 1 In z-zz=0. But What Then Of the z=0 Solution? Boosted B Flux

We postulated z=1 and found that z=1 resulted in equation 1.2.7 and also 1.2.4 leptons and $KMQ=\xi_1=\xi_2+\xi_3+\xi_o$. But for solution (to z=zz) z=0 we also have the same eq.1.2.7 but also the $2P_{3/2}$ at $r=r_H$ (Baryons) with the same $KMQ=\xi_1=KE+3\xi_o$. sect.7.1.2 below.

But since 1 is our only postulate we must be able to derive that Baryon z=0 result from the lepton (postulate 1) z=1 result. If we can do that then we really have just postulated 1. To do that we convert the Lepton KMQ to Baryon KMQ through Boosted B Flux $\gamma BA=\gamma\Phi=\Phi'$ in Faraday's law $-\partial\Phi/\partial t=\xi_1=KMQ$. See section 7.1.2 below.

In that regard note again that ξ_1 is a constant but ∂t (denominator) is here γ boosted so that the B flux (numerator) must also be γ boosted. But magnetic flux in a loop is quantized at

$N(h/2e)=N\Phi_o=\Phi$ where N is the lepton number here which is 2 (the 2 positrons). So in $\gamma BA=\Phi'$ we can solve for γ.
γ turns out to be 917 and so with two positrons (2)917= 1836m_e we get **the proton mass**.

Numerical Details

$2\pi(2r_H)/\Delta t=c$ so (top) $\Delta t=(2\pi 2r_H)/c=2\pi(2X2.8154X10^{-15})/299792458=1.18X10^{-22}$ sec. Current only observed along 2/3 length for $2P_{3/2}$ and the time and space γ s cancel. So for the 2e charges $i=(2/3)2q\gamma/\gamma t=2X(2/3)1.60218X10^{-19}/1.18X10^{-22}=1811$Amps. So from Ampere's law (top): $B_1=\gamma\mu_0 i/(2(2r_H))=\gamma 4\pi X10^{-7}(1811)/(2X2X2.8154X10^{-15})=\gamma$**$2.02X10^{11}$T =B** at the center of the big circle.

Boosted B Flux $\gamma\Phi=\Phi'$ (sect.7.0, constant ξ_1) Inside side view Area=πr_H^2
$\Phi=B_{\|}A\rightarrow\gamma\Phi=\Phi'=(\gamma BA)=\gamma B(\pi r_H^2)=(917.2)X2.02X10^{11}X\pi((2.81406X10^{-15})^2)=$
$2X2.3X10^{-15}$Wb$\approx\Phi_\perp\approx\Phi_0=2Xh/2e$ Boson(2e) Φ_o= NIST: $2X2.067833848X10^{-15}$Wb $=\Phi_o$
So the flux quantization is responsible for the γ=917 and so the proton mass 2γ=(2)917 (7.4.1)

2 positrons and central electron in a $2P_{3/2}$ state at $r=r_H$ of new pde 1.2.7:

$$\gamma^\mu\sqrt{(\kappa_{\mu\mu})}\partial\psi/\partial x_\mu=(\omega/c)\psi$$

7.1.2 Boosted Flux As Kerr Metric Perturbation

So here we perturb this lepton Kerr metric cross term dtdθ (section 6.3) with a strong magnetic field, so not perturbing the total value of KMQ=ξ_1 but through simple particle decay transferring the mass energy of the 1 and ε into the (large) *kinetic energy* of the 3 m_e. So we merely boosted the B flux Φ and time in Faraday's law (The γs then cancel out there.) and so kept the energy ξ_1 constant. So eq.1.2.2 (numerator) rest mass energy $\xi_1\rightarrow\xi_o$ we have the $\xi=\xi_o$, z=0 case of section 1 and so $r_H=e^2/m_ec^2$. Three 1.2.7 s (2 positrons and one electron) at $r=r_H$ constitute the 3e state. We found in sect.7.1 that for $2P_{3/2}$ at $r=r_H$ ($r_{HP}=2e^2/(m_ec^2)\approx(2)2.818X10^{-15}$m for C_M (eq.B3). But we cannot keep an equivalence principle and so use the metric $\kappa_{\mu\nu}$ in eq.1.2.7 (eg.,with it's $2P_{3/2}$ state) unless we can reduce the problem individually to 2 individual 2 body problems. The noninteracting ultrarelativistic plates do this (see sect.8.2).

Clebsch Gordon Coefficients

It is well known that (and also implied by the new pde eq.1.2.7 with C_M) for the composite system of two electrons |1>|2> you get, from the analysis of the invariance of the resulting Casimir operator J^2, the resulting state $|J_A,J_B,J,M>$ with combined operator $J_A+J_B=J$. This is our para state t and 3 ortho states below. For the third spin ½ particle of far lower energy (the central electron, object B) we have |1>|2>|3> and so the Clebsch Gordon coefficients imply the decomposition $(2\otimes2)\otimes2=(3\otimes2)\oplus(1\otimes2)=4\oplus2\oplus2$ so that **three spin 1/2 particles** group together into **four spin 3/2** and only two spin ½s, **6 states** altogether, (the splitting u,d,s,c,b,t). Note then the **majority $2P_{3/2}$** (trifolium core) states. Recall also that the $2P_{3/2}$ solution to new pde at $r=r_H$ gives a trifolium shape, and $2P_{3/2}$ fills first. This fills in the broken degeneracy ortho states at the end of part II. The states close to the proton mass are filled in by the Frobenius solution below.

Uncertainty Principle

The uncertainty principle $\Delta x\Delta p\geq\hbar$ here is satisfied by the electron as well even though it is inside r_H and has a small proper mass. The electron is light but in its frame of reference its Δx is still small. In that regard from the frame of reference $\Delta r'$ of the central electron *and* deuteron electron $dr'^2=\kappa_{rr}dr^2=[1/(1-r_H/r)]dr^2$. Note if r is close to r_H (from the external frame of reference), which it is in both cases (central and deuteron electron), **dr' becomes huge**. But dr' really is Δx in the uncertainty principle $\Delta x \Delta p \geq \hbar$ so with Δx huge then Δp and so rest mass can be very small: *the electron in its own comoving local position frame of reference is still an electron!* Also the two ultrarelativistic positrons are sitting inside the same r_H region but see the electron as ultrarelativistic (velocities are relative) and so see a large Δp and so mall Δx. So the electron **fits in this r_H region in the uncertainty principle context** of both outside observer and internal frame of reference.

7.1 Derivation of Mainstream Toy Model Composite System |1>|2>|3> Interpretation. Physical Properties Of The 3e State

To explain the above 3e stability result sect.1.4 implies $r=r_{HP}$ in dt'=0 in $dt'^2= \kappa_{oo}dt^2=(1-r_{HP}/r)dt^2$ (in the new pde, nucleon radius) and so dt'=0 so that clocks stop. So we have complete proton stability in the new pde given eq. 1.2.7 $2P_{3/2}$ at $r=r_{HP}$ fills first (see review section just above).

Eq.1.2.7, $2P_{3/2}$ is trifolium shaped ψ*ψ so the electron spends 1/3 time in each lobe (fractional charge), lobes can't leave (asymptotic freedom), P wave scattering (jets), 6 P states (6flavors udscbt) **explaining the major properties of quarks** and so explaining the strong interaction. Note that $ds_1^2 \neq 0$ with $dt \approx 0$ so $\sqrt{2}ds^2=dr^2+dt^2$ implies, after eq.3.6 operator formalism derivatives are put in (figure 4 2nd diagram from right), the Klein Gordon equation spin 0 mesons, the carriers of the strong force. Also our Mandlebulb analysis implies that the proton mass is 937Mev (appendix C) implying ultrarelativistic internal electron motion is needed to get this mass. Given this ultrarelativistic electron (needed to obtain the much larger proton mass hard shell result P. Alberto, R. Lisboa, M. Malheiro and A. S. de Castro, Phys.Rev. .... 58 (1998) R628) at r_H the field lines must be Fitzgerald contracted to a flat "plate" and thus be high density, field lines thus *explaining the strength of the 'strong' force*. Note here we have three ultrarelativistic $2P_{3/2}$ electrons (2 positrons and one electron) needed to create the proton (which as we noted above is much heavier) at $r=r_H$. Given a central (negative) electron the two outer positron $2P_{3/2}$ state plates (at 120°) only intersect at the center and so don't see each other at all and so don't repel each other*, **explaining why the proton is still a bound state** even though the two positive positrons are both inside r_H* (along with that electron). Possible (but low probability) positron-electron annihilation inside r_H also implies, given the momentum transfer to the *third particle* with strong field plate and large mass (quadruply differential cross-section), that the resulting gamma ray will be short lived and pair creation will occur almost immediately within r_H, since $\sigma=1/20$ barn$\approx\pi r_H^2$ the cross-sectional equatorial area of the proton, guaranteeing pair creation occurs) replacing the previous pair immediately.

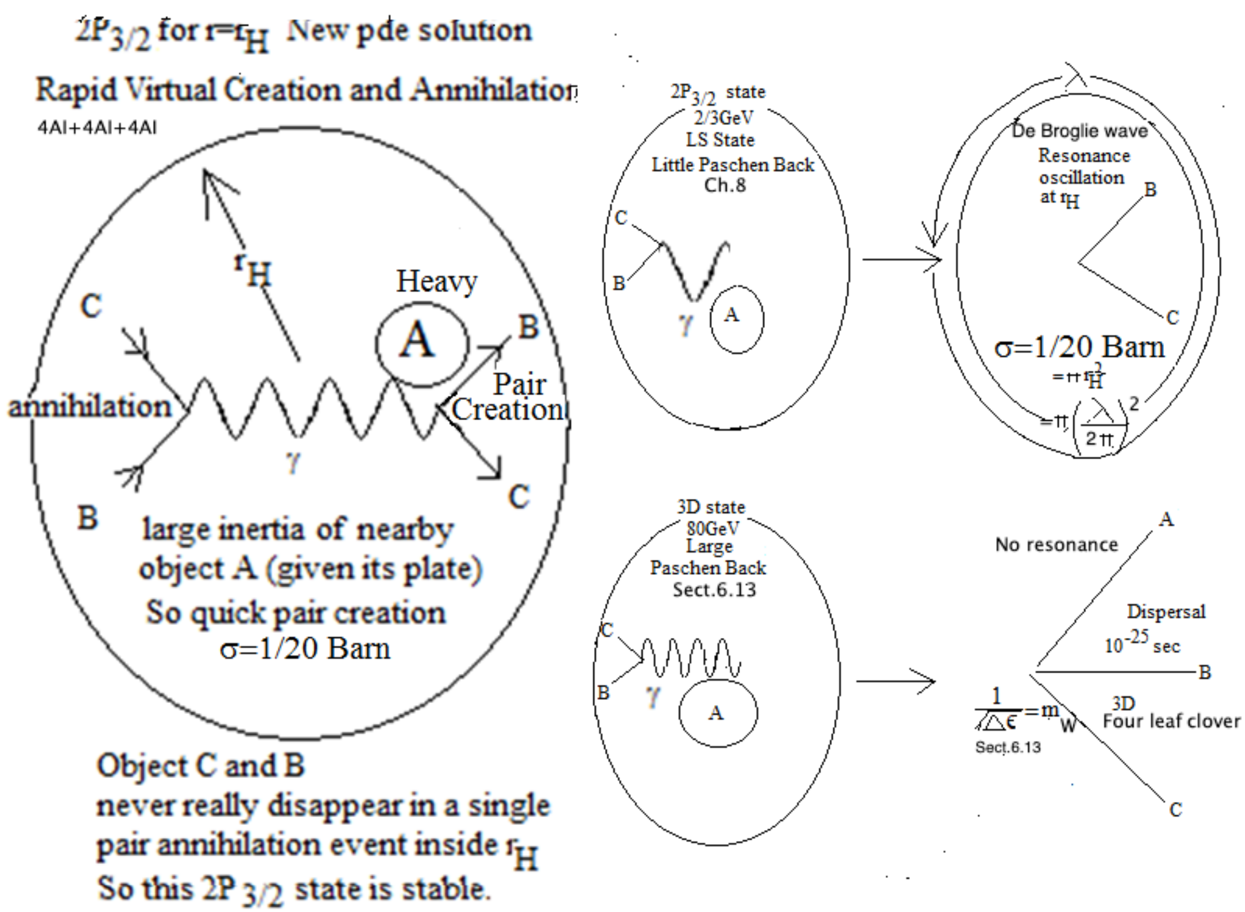


Fig1

So this is a ***virtual*** **annihilation-creation process** inside r_H, implying that **this two positron-single electron state is stable** **(yet another reason for baryon stability)**. See eq.1.2.7 also. We rigorously derive the low mass (<3Gev) hyperon eigenvalues using the Frobenious series solutions to eq.1.2.7 near $r=r_H$ (from 3^{rd}pt, $r \approx r_H$) in Ch.8-Ch.11.

7.2 Single Electron Probability Trifolium Statistics Inside r_H

A single electron in the trifolium implies that on average each of the 3 trifolium lobes has (1/3)e charge (hence the origin of hyperon fractional charge of the lobes). This allows for a toy model in which we give these $\psi^*\psi$ $2P_{3/2}$ at $r=r_H$ lobes (not particles) names (quarks, the toys.).

Eq.2 Single Electron Probability (trifolium statistics):

Consistent with the toy model and also the electron or positron moving between lobes, this time using integer charge distributed over all three $2P_{3/2}$ lobes at $r=r_H$, just randomly put the lobe charges (lobe,lobe,lobe) on top of one another Monte Carlo style to determine the probability of a given charge in each lobe. For two positrons [(+1/3,+1/3,+1/3)+(+1/3,+1/3,+1/3)] and one electron (-1/3,-1/3,-1/3) ($2P_{3/2}$) the probability of seeing a +(2/3)e lobe is twice that of seeing a -(1/3)e lobe so ((2/3,2/3,-1/3 or uud proton) eg.,proton, C and b are the ½ state components of $(2\otimes2)\otimes2$. For ($2P_{3/2}$) two positrons [(+1/3,+1/3,+1/3)+(+1/3,+1/3,+1/3)], an electron (-1/3,-1/3,-1/3) and an outlier electron ($2P_{1/2}$) (-1/3,-1/3,-/3) the probability of seeing a -(1/3)e lobe is twice as high as a +(2/3)e lobe so (-1/3,-1/3,2/3) or ddu Neutron).

It is well known that (and also implied by the new pde) for the composite system of two electrons |1>|2> you get, from the analysis of the invariance of the resulting Casimir operator J^2,

the resulting state $|J_A,J_B,J,M>$ with combined operator $J_A+J_B=J$. Using the resulting Clebsch Gordon coefficients we find the decomposition 2⊗2=3⊕1, m=1,0,-1 ortho triplet state and singlet para state, which indeed are well known.(eg., Zeeman or Paschen Back line splitting, Ch.8.).
But for a third spin 1/2 particle we have |1>|2>|3> and so the Clebsch Gordon coefficients imply the decomposition (2⊗2)⊗2=(3⊗2)⊕(1⊗2)=4⊕2⊕2 so that **three spin 1/2 particles** group together into **four spin 3/2** and only two spin ½ s, **6 states** altogether. Note then the majority $2P_{3/2}$ (trifolium core) states.
We could now quit and use the mainstream quark (our 2P lobes) applications but that theory is inadequate (eg., neutron-proton binding energy, sect.10.7) and instead will proceed to directly solve equation 2 using the Frobenius series method.
Arfken, *Mathematical Methods of Physics*, 3rd ed. Page 454
Enge, Harold, *Introduction To Nuclear Physics*, 1966, Addison Wesley, page. 45

7.3 Eq.1.2.7 B Field Flux Quantization In This Enclosed Current Loop

Note if a charged particle moves in loop in a field free region that surrounds another region, there is trapped magnetic flux ϕ in that region. Also we can include minimal interaction E&M momentum/h =k→k+eA/ħ =eBr/ħ for uniform B field. If ψ phase is a unique function on the loop then phase kr= (eBr/ħ)r=(eBrr/ħ)= e(Barea)/ħ=eΦ/ħ=n2π. Φ=4.13X10^{-15} for integer spin. Then upon completing a closed loop the particle's wave function will acquire an additional phase factor $exp\left(\frac{ie\Phi}{\hbar}\right)$. But the wave function must be single valued at any point in space. This can be accomplished if the magnetic flux Φ is quantized: eΦ/ħ= πn, n=0±1,±2,±3, so Φ_o=h/(2e). From NIST: 2.067833848X10^{-15}Wb =Φ_o. half integer spin½. Integer spin 2Φ_o=2(h/2e)=h/e for the two positrons.

7.4 Ultrarelativistic Rotator.
Side View

On the side of the rotator $r_H=R_e \int_0^{\pi/2} \left(\sqrt{1-c^2\sin^2\theta/c^2}\right)\sin\theta d\theta$ =R_e/2=2.8X10^{-15}m ≡r_H (7.1)

for the ortho 2P state observer (i.e,$2P_{3/2}$, $2P_{½}$) in the horizontal plane and $r'_H/2$= r". We must repeat this integration on the end para states, the radius is shrunk by τ+2(ε+Δε) and so is nearly a point source $S_{½}$ state (for the observer above the circle as for the deuterium central electron sect.10.7). We next show that the jump from ortho to para must then correspond to the jump from ε to τ fractal quantum state given τ is separable and so a orthogonal state transition.
$2r_H$=2(2.81X10^{-15}=2e^2/(m_ec^2), **Side view** ½($2r_H$)=r_H,
Top view $2r_H$.

Inserting Ortho States By Hand Into Flux Φ=B⊥A

Recall from above r_H= 2.81406X10^{-15}m, c=299792458m/s, e=1.602X10^{-19}C, μ_o=4πX10^{-7}T-m/A, u_B=9.274X10^{-24}J/T,
To insert ortho states into the flux by hand assume a circle with another perpendicular coil moving around it with the observer above the circle. The ortho state is put in by hand by dilating the current i coil by 2X as in the *side* view, hence the ⊥ in section 7.4. The circle, since it is seen above, is then dilated by the full 1/γ Fitzgerald contraction so **2**r_H→$2r_H$/γ in BA=Φ=B(π($2r_H$)^2).

CM=e^2 in $r_H=2e^2/(m_Lc^2)$. Eq.1.2 $\delta C_M=0$ implies $\delta r_H=0$ so that $\delta(2\pi r_H^2)=0$ so minimum area r_H is given by one of the positrons carrying all the energy 2γ seen only in a vertical view (section 7.4) like in deuterium as in section 10.7.

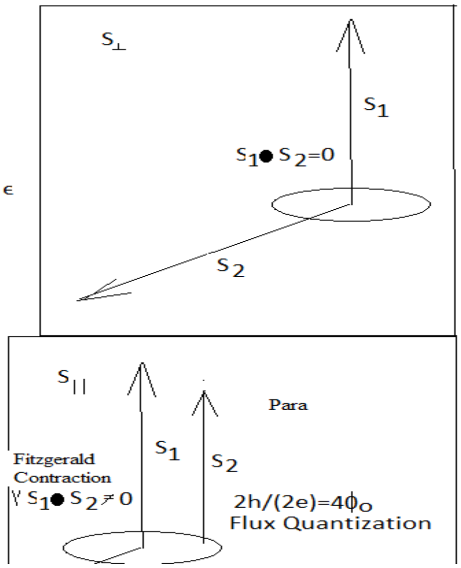
B Inside 2r_H
So *top* view of B field and flux (so $2r_H$) and flux *side* view (so $2r_H$ from eq.7.1). So for top view of B field.
$2\pi(2r_H)/\Delta t=c$ so (top) $\Delta t=(2\pi 2r_H)/c=2\pi(2X2.8154X10^{-15})/299792458=1.18X10^{-22}$ sec. Current only observed along 2/3 length for $2P_{3/2}$ and the time and space γ s cancel. So for the 2e charges $i=(2/3)2q\gamma/\gamma t=2X(2/3)1.60218X10^{-19}/1.18X10^{-22}$=1811Amps. So from Ampere's law (top): $B_1=\gamma\mu_0 i/(2(2r_H))=\gamma 4\pi X10^{-7}(1811)/(2X2X2.8154X10^{-15})=\gamma$**$2.02X10^{11}$T =B** at the center of the big circle. So what are these γ s? It depends on your frame of reference (side or top view).
(In section 7.5 below we show they are $\gamma=\varepsilon/\Delta\varepsilon$ (side) and γ=917 (top).). The average B field inside the 360° loop is just $B_{av}=2.02X10^{11}$T.

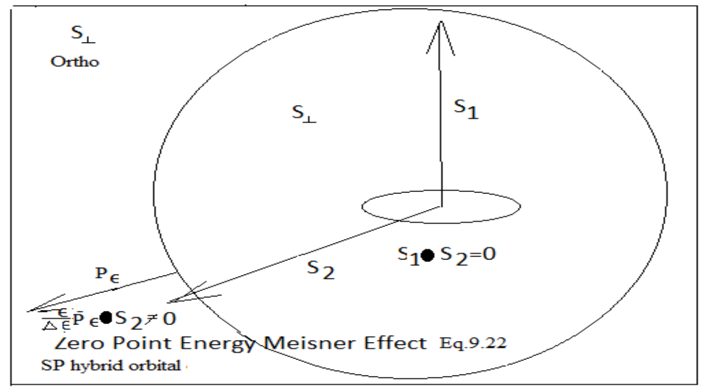
7.5 Consequences Of B Inside r_H

Explains Magnetostars
So magnetostars are then merely packed neutrons in Ising model $B_{av}=10^{11}$T $S_{||}$ viewing alignment caused by a supernova blast with no ortho state $S_\perp$ Meisner effect. But the B field plates in ordinary neutron stars that have slowed down neutron rotation are merely spread out by γ so $B_{av}/\gamma=B_N\approx 10^7$T. The rapid energy transition $\int(B^2/2u_o)dV$ between these magnetostar and ordinary neutron star states is that FRB (Fast Radio Burst) energy.
Boosted B Flux γΦ=Φ' (sect.7.0, constant ξ_1) Inside side view Area=πr_H^2
$\Phi=B_{||}A\rightarrow\gamma\Phi=\Phi'=(\gamma BA)=\gamma B(\pi r_H^2)=(917.2)X2.02X10^{11}X\pi((2.81406X10^{-15})^2)=$
$2X2.3X10^{-15}$Wb≈ $\Phi_\perp\approx\Phi_0$=2Xh/2e Boson(2e) Φ_o= NIST: $2X2.067833848X10^{-15}$Wb =Φ_o
So the flux quantization is responsible for the γ=917 and so the proton mass 2γ=(2)917 (7.4.1)
Para State S|| The next B flux quantum number (4Xh/2e) is then the next excited state so $\gamma B=B_{||}$ with then γ=917.
$\gamma 4B=(917)(4)2.02X10^{11}=7.5X10^{14}T=B_{||}$. The 4 is from the Paschen Back Para alignment. The flux quantization also makes para an excited state.
So all views side view (so r_H for flux loop and B field.). So shrink $2r_H$ to r_H (as in sect.7.4 just above due to relativistic observation γ of central electron and increase B by γ in the plates.
(side) $\Delta t=2\pi r_H/c=5.9X10^{-23}$, $i=2(2/3)1.60218X10^{-19}/5.9X10^{-23}$=3620A=1; (side)
$\mu_o i/2r_H=8.04X10^{11}$T. For S*S=1
$\gamma 8.04X10^{11}X=7.5X10^{14}$T; example: $u_BB4=9.274X10^{-24}\ 4X7.5X10^{14}=2.77X10^{-8}$J=173GeV
in section 7.6 Paschen Back calculation.

Ortho State Eq.9.22 Zero Point Energy ε Implies Meisner Effect Nonzero Ortho States
m=1,0,-1. $\gamma_\varepsilon=\varepsilon/\Delta\varepsilon$
The magnetic field in one of these protons is about 10^{11}T, so large that any spatially oscillating charge is going to be forced to induce a counter current that tries to cancel the change in flux produced by the charge motion (Faraday's law) relative to the proton. The Frobenius method applied to the new pde has this zero point energy solution eq.9.22 SP hybrid state of the proton whose oscillation provides a Cooper pair oscillation counter current in that huge 10^{11}T field that cancels it out. So at close range there are many pions ε/Δε. (up to 7) and more distant, where

the B field drops you only need one: Hence the multi pion interactions observed near the proton and resulting Yukawa force.
The ortho state with B orthogonal to A would not exist without this zero point SP state motion since the (SP hybrid so) induced P state spinor has a horizontal component so has dot product with horizontal S_2 nonzero spinor(for ortho).
These two B fields ($B_\perp$ and $B_{||}$) are put into Paschen Back (eg.,$m_s c^2 = u_B \gamma_e B(1+0+0+0)$)





The pion Meisner effect on the 2s-2P$_{1/2}$ split hydrogen atom spectral lines from New Pde
The above discussion of the large B field inside 3e implies a Meisner effect pion Frobenius solution ground state component of mass $m_{\pi o}$ But from sect.1.2 (on the properties of ξ_1) then $\xi_1 \rightarrow \xi_2 = \xi_{\pi o}$ since ξ_2 is still big and so z-zz=$C_M/\xi_2 \approx 0$ as required.
Recall in equation 1.2.2 then $\kappa_{rr} \approx 1/[1-((C_M/\xi_1)r))] = 1/[1-((r_H)/r))] \approx 1/\kappa_{oo}$.
Recall $C_M \rightarrow e^2$. So we can use $r_H = \frac{2e^2}{m_{\pi o}c^2} = \frac{2e^2}{\xi_2}$ instead of $\frac{2e^2}{\xi_1}$. But the Meisner effect pion must have an effect on the spectrum of hydrogen since it moves exterior to r_H. and the $\psi_{2,0,0}$ wave function overlaps the nucleus. Note that the pion 2 positron component with $2m_e c^2$ ψ should be detected spectroscopically since it extends outside the proton. To find this effect we first find the average value <r> which in general is given by:
$<x> = \int_{allspace} x p(x) dx$,
Where p(x) would be the probability distribution function.
Since $\psi^*\psi$ is the probability density, the *average distance* from the nucleus, or $<r>$, the expectation value for the radial position, is found by solving the following integral:

$$<r> = \int_0^{2\pi} \int_0^{\pi} \int_0^{\infty} r * \psi_{2s}^* \psi_{2s} r^2 dr sin\theta d\phi$$

=$6a_o$. See integration by parts https://socratic.org/questions/572d9c7f11ef6b7251e93ed4
So with pion 2 positron component so with $2m_e c^2$ we then use

$r_H = \frac{2e^2}{m_{\pi o}c^2}$ with 6a$_o$ average distance for 2,0,0 hydrogen atom orbital. To get the electron energy contribution we subtract off $m_{\pi o}$. The new pde energy is from 8.2a

$$E = \frac{1}{\sqrt{\kappa_{oo}}}$$

So multiplying both sides by $m_{\pi o}c^2+2m_ec^2$ and subtracting $m_{\pi o}c^2$ we get the electron contribution:

$$E_e = \frac{m_{\pi o}c^2 + 2m_ec^2}{\sqrt{1-\frac{r_H}{r}}} - m_{\pi o}c^2 = 2m_ec^2 + \frac{2e^2}{2r(m_{\pi o}c^2)}m_{\pi o}c^2 - \frac{3}{8}\left(\frac{2e^2}{rm_{\pi o}c^2}\right)^2 m_{\pi o}c^2$$

Multiply by ½ to get normalize to $2m_ec^2$ mass energy m_ec^2 and e^2/r to potential energy $e^2/2r$.

$$E_e = m_ec^2 + \frac{e^2}{2r} - \frac{3}{8}\left(\frac{2e^2}{6a_om_{\pi o}c^2}\right)^2 m_{\pi o}c^2/2$$

So the perturbation component is:

$$E = (\frac{1}{2})\frac{3}{8}[\frac{2(8.89X10^9)(1.602X10^{-19})^2}{6(.53X10^{-10})(2.406X10^{-28})(3X10^8)^2}]^2((2.406X10^{-28})(3X10^8)^2$$

$= hf = 6.626X10^{-34}27{,}400{,}000$ so that f=27Mhz.

Recall also the 1030Mhz component (Theodore Welton) is due to the electron zitterbewegung cloud itself taking up space which we get by adding the Compton wavelength directly into the Coulomb potential radius at 6a$_o$.

Thus we account for the entire Lamb shift without evaluating any higher order diagrams or introducing a infinite charge and mass electron. Also that large magnetic field inside r_H still has some perturbative effects on the hydrogen spectra through that Meisner effect pion cloud. See Ch.9 for gyromagnetic ratio derivation.

Summary Of Para and Ortho States: two γs: top view Para γ=917, Ortho side view γ=ε/Δε

S$_\perp$ SP hybrid zero point energy eq.9.22: P state so $S_1 \bullet S_2 \neq 0$, ortho: $\gamma_{\varepsilon\, m=\pm1,0}B=(\varepsilon/\Delta\varepsilon)B=B_\perp$.
=(.06/.00058)2.02X10^{11} =2.27X10^{13}T=$B_\perp$ (eg., $m_s=u_BB_\perp(1+0+0+0)$)

S$_{||}$ Flux quantization γ top $S_{||}$ view both positrons so $S_1 \bullet S_2 \neq 0$, para: $\gamma_{L=0}=\gamma B=B_{||}$.
=917(4)2.02X10^{11} =7.5X10^{14}T=$B_{||}$ (eg., $m_t=u_BB_{||}(1+1+1+1)$)

7.6 The two rapidly moving positrons: 2⊗2=3⊕1 **List of 1 Para SB$_{||}$ and 3 Ortho SB$_\perp$ States**

Here Thomas LS LST≡ -(L_{BL}*(S_{AL} or S_{CL}))K±gs perturbation is subtracted off the Paschen Back energy for both the SB$_\perp$ and SB$_{||}$ cases.

SB$_{||}$=State t **non** LS coupling **para** singlet state (the 1 single state in the 3⊕1 decomposition)
$B_{||}$=7.448X10^{15}T,=B=γ(2.02X10^{11})
0° r_H

$B_{||}u_B$(mLA+mSA+mLC+mSC)=PE	LST	PE-LST	name	Pauli Principle. L_{EM}	S
L=0 1 + 1 + 1 + 1	173	0	**173** t	even stable Singlet	**para**

SB$_\perp$ State B total **triplet** b,c,s ground state u/d LS coupling triplet **ortho** state. LS coupling
$B_\perp$≈4.043X10^{12}T (ε/Δε)2.02X10^{11} =2.27X10^{13}T
90° S_B=±1 r_{snf} 2P$_{½}$ = at r=r_H. Here single PE≡ $_{½}$ PE=½D bond=½; D=2. See sect.10.7
$B_\perp u_B$(mLA+mSA+mLC+mSC)=PE LST ≈LST-PE name Pauli Principle

m=1	1 + 1 + 1 + 1	5790	1.5+1 (2)	Ξ_b	**ortho**
m=0	1 + 1 + 0 + 0	2471	1.5-0 (2)	Ξ_s	**ortho**
m=-1	1 + 1 + 0 + 0	1314	1.5-1 (2)	Ξ_s	**ortho**
	Ground State $P_{u/d}$ =(1)938		1	$P_{u/d}$	$2P_{3/2}$ & $2P_{1/2}$

So a total of 4 states for two positrons (3ortho, 1para). 6 $2P_{3/2}$ states if you include the central electron. Since the proton is the core object for these states we can use the Frobenius solution Ch.9 perturbations below for these $r>r_H$ deviations from the spin 1 flux quantization $2\phi_E=2h/2e$ above sect.10.13 and Ξ.. We get four multiplets of the three Ξ one P. Get ud. (Chapter 8). The above are also boson energy transitions analogous to the principle quantum number photon transition emissions of the hydrogen atom.

Other Ortho Consequences

We can reverse engineer this process by modeling a large decrease in the resulting strong magnetic field:

Neutron $2P_{½}$ $1-r_H/r_H$ for charge 0 (case 2 Ch.8) is homeomorphically mapped into $1-\varepsilon$ with added outside particle KE Meisner effect additional outside charge (reducing that r_H/r_H charge so preserving angular momentum a (and so KMQ) in the Kerr metric term $(a/r)^2$. Note the negative sign still indicates inside multibody charge is still 0.

Proton $2P_{3/2}$ $1+r_H/r_H$ (case 1 in Ch.8) is then homeomorphically mapped into $1+\varepsilon$ with added particle KE. The positive sign indicates nonzero internal multibody charge. See eq.B4.

For $2P_{3/2}$ $\kappa_{00}=(1-2\varepsilon)-\Delta\varepsilon-[(C_M/m_e)r]$. The starting point of PartII. (B3)

vector ω_p. So ultrarelativistic Thomas precession $=n3m_p$ =LS energy ω is subtracted off from Paschen Back energy ω_p. It adds to 0 in the ground state. lso $L_{EM}=Nr_H\hbar\omega/c=rX[(EXH)/c](\pi r_H^2T)$ angular momentum also cancels some of the total angular momentum of objects A,C and B.

Calculation Of ξ_1

We use the equation 1.2.7 energy normalization ($m_e\equiv1$) for two reduced mass 2P3/2 ultrarelativistic positrons at $r=r_H$ with ansatz $\xi\rightarrow x_2$, in $\xi_o\rightarrow1$ in $\xi_1=\xi_3+\xi_2+\xi_o$. So $E=C_M\xi_1^2/\xi\sqrt{2}\rightarrow$ $½\xi_1^2/\xi_1=½/(x2+(2+\Delta)x+(1+\Delta))$= (partial fractions)= $½((1(-1/\Delta)/(x+1))+((1(1/\Delta)/(x+1+\Delta)$= positron1 +positron2. So for $x\rightarrow0$ then $\Delta=1/3684$ from the boosted magnetic flux calculation $2\gamma=3684$ in part II.

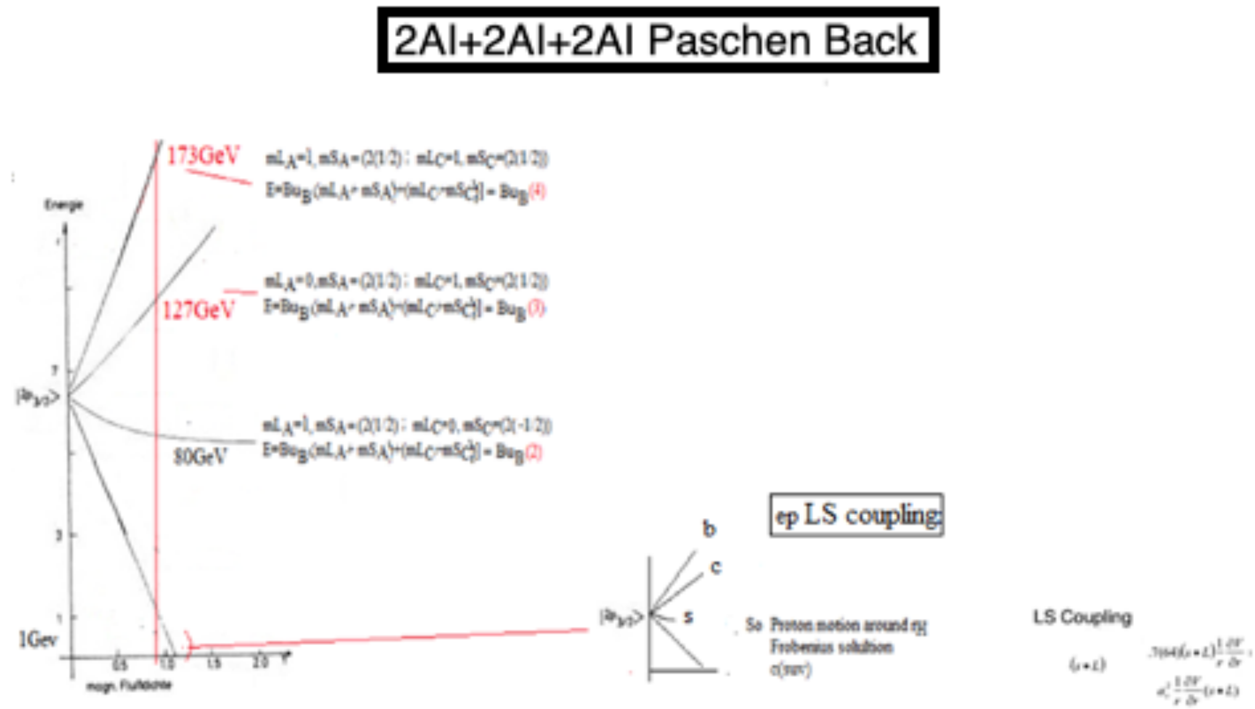


Fig.8

Chapter 8 Ground State Paschen Back

Introduction

Here we start with the ground state magnetic flux energy(u/d) set m_b=1, move on to the three orthos (s,c,b) with larger m_b s (Ξ) and finally to the very high para (t). We are actually perturbing the motions at r_H by these r in equation 9.5 and so are taking into account the constituents of the proton in this way.

Also there are then 6 magnetic flux quantization $2P_{3/2}$ states. Each flux quantization level has its own m_p and associated Frobenius solution. So we have ground state m_p=1, and excited states: $m_p=1.5=\Xi_s$, and also Ξ_c, Ξ_b, each having it's own Frobenius solution sets.

8.1 Solution to eq.2 Using Separability: Gyromagnetic Ratios And Low Energy Particles (energy<3GeV) Derived For ground state Magnetic Flux

$r \approx r_H$ Application: Gyromagnetic Ratios

After separation of variables the "r" component of equation 9 can be rewritten as:

$$\left[\left(\frac{dt}{ds}\sqrt{g_{oo}}\,m_p\right)+m_p\right]F-\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{j+3/2}{r}\right)f=0 \qquad (8.1)$$

$$\left[\left(\frac{dt}{ds}\sqrt{g_{00}}\,m_p\right)-m_p\right]f+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-1/2}{r}\right)F=0 \qquad (8.2)$$

Because the $\kappa_{00}=1-r_H/r$ is point source the object B ambient metric is local and so the vacuum is not infinite density (see also sect 6.11) as in the QED ambient metric which is homogenous. Comparing the flat space-time Dirac equation to equations 8.1 and 8.2:

$$(dt/ds)\sqrt{\kappa_{oo}}=(1/\kappa_{00})\sqrt{\kappa_{oo}}=(1/\sqrt{\kappa_{oo}})=\text{Energy}=E \qquad (8.2a)$$

Using the above Dirac equation it is easiest to find the gyromagnetic ratios gy for the spin polarized F=0 case. Recall the usual calculation of rate of the change of spin S gives dS/dt∝m∝gyJ from the Heisenberg equations of motion. We note that $1/\sqrt{g_{rr}}$ rescales dr in $\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{J+3/2}{r}\right)f$ in equation 8.1. Thus to have the same rescaling of r in the second term we must multiply the second term denominator (i.e.,r) and numerator (i.e., J+3/2) each by $1/\sqrt{g_{rr}}$ and set the numerator equal to 3/2+J(gy), where gy is now the gyromagnetic ratio. This makes our equation 8.1 compatible with the standard Dirac equation allowing us to substitute the gy into the standard dS/dt∝m∝gyJ to find the correction to dS/dt.

Thus again:

$[1/\sqrt{g_{rr}}](3/2+J)=3/2+Jgy$, Therefore for J= ½ we have:

$$[1/\sqrt{g_{rr}}](3/2+½)=3/2+½gy=3/2+½(1+\Delta gy) \qquad (8.3)$$

Then we solve equation 8.3 for gy and substitute it into the above dS/dt equation.

S States: Recall ε and Δε and S states from eq. 6.4.13. These are zero point energy states (eq.9.22) that must also be the source of the Meisner effect canceling of those large B fields. Noting in equation 6.4.13 we get the gyromagnetic ratio of the electron with $g_{rr}=1/(1+\Delta\varepsilon/(1+\varepsilon))$ and ε=0 for electron. Thus solve equation 8.3 for $\sqrt{g_{rr}}=\sqrt{(1+\Delta\varepsilon/(1+\varepsilon))}=\sqrt{(1+\Delta\varepsilon/(1+0))}=\sqrt{(1+.0005799/1)}$. Thus from equation 8.3

$[1/\sqrt{(1+.0005799)}](3/2+½)=3/2+½(1+\Delta gy)$. Solving for Δgy gives anomalous gyromagnetic ratio correction of the electron Δgy=.00116

Going to higher energies (so ε≠0 in equation 8.3) we get the anomalous gyromagnetic ratio correction of the muon. From the momentum representation of eq.8.1,8.2:

2P$_{3/2}$ states: Recall the 2P3/2 states from chapter 3. Note also that k can be positive or negative since $4\pi k=Z_{00}$ in our Lagrangian with a positive k meaning at least one charge is not canceled. Therefore $1/g_{rr}=1\pm k/r+\varepsilon$ (using our Frobenius solution expansion near $r\approx r_H$ of eq.9.5 below multiply through by (1+ε/4)((1+ε+..) ≈1+.08=1+ε' so a pion mass is then added to the protons) from the ±nature of Z_{oo}. Therefore we have two cases from equation B3 at the boundary r=k

CASE 1	$1/g_{rr}=1+k/k+\varepsilon$	charge 1	(core case)
CASE 2	$1/g_{rr}=1-k/k+\varepsilon$	charge 0	(use m from case 1)

Note: ε (9.22) is required because it is the zpe here (like ħω½ is the zpe of 1D SHM) external to the 3e region. So through the Faraday's law Meisner effect pops up to cancel that huge 10^{14}T internal B field, hence the origin of the mesonic field. So the ε in case 1 and case II is the artifact of that large internal B field of section 8.1.

Also the effect of a zero charge is to make metric component g_{oo} ($=1/g_{rr}$) contribution zero in case 2. Thus the effect of *non*zero charge is to increase the dimensionality by adding a metric component in eq.2. This provides the reason that Kaluza Klein theory (adding a 5th dimension) is so successful at injecting E&M into general relativity. But Kaluza Klein theory is not required here because finite C_M in eq.1.11 is really responsible for charge and E&M. 2D is sufficient as we showed in Chapter 1, eq.1.5. The extra 2D degree of freedom is associated with that extra real term δδz in the amazing equation 1.6.

CASE 1: Plus +k, therefore is the proton + charge component. $1/g_{rr} = 1+k/k + \varepsilon = 2+\varepsilon$. Thus from equation 8.1, 8.2 $\sqrt{2+\varepsilon}$(1.5+.5)=1.5+.5(gy), gy=2.8 (8.4)

The gyromagnetic ratio of the proton (therefore that above r≈ k stability was indeed proton stability as we concluded) mass=m_p . $dt/ds\sqrt{g_{oo}} = 1/\sqrt{g_{oo}} = E = m_p$

CASE 2: negative k, thus charge cancels, zero charge:
$1/g_{rr} = 1-k/k + \varepsilon = \varepsilon$ Therefore from equation 8.3 and case 1 $1/g_{rr} = 1+k/k+\varepsilon$

$\sqrt{\varepsilon}$(1.5+.5)=1.5+.5(gy), gy=-1.9, (8.5)

the **gyromagnetic ratio of the neutron** with the other charged and neutral hyperon magnetic moments scaled using their masses by these values respectively.

Chapter 9

The 3e Energies For particle energy <3GeV Derived Using Frobenius Series Solution Method

9.1 Series Solutions ψ Ansatz Near $r \approx r_H$

Recall equations 8.1, 8.2:

$$\left[\left(\frac{dt}{ds}\sqrt{g_{oo}}\,m_p\right)+m_p\right]F-\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{j+3/2}{r}\right)f=0$$

$$\left[\left(\frac{dt}{ds}\sqrt{g_{00}}\,m_p\right)-m_p\right]f+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-1/2}{r}\right)F=0$$

Recall from the previous section $g_{oo}=1-k/r-(\varepsilon+\Delta\varepsilon)$. Also **recall our Dirac doublet** (equation 2AI) must have a left handed zero mass component will be called case 1 and case 3 respectively below. Also we need the equivalent of the singlet equation 2 is our below case 2. Also in equation 2 at $r=r_H$ the eigenvalue is $\Delta\varepsilon+\varepsilon+1=2m_p$ for that principle quantum which then must be the same for the $2P_{3/2}$ state Here we write out the left handed Dirac Doublet Eq.2 in the general representation of the Dirac matrices. Also recall from chapter 8 that the $2P_{3/2}$ state (and its sp^2 hybrid) for this new electron Dirac equation gives a azimuthal trifolium, 3 lobe shape and thus a λ/3 spherical harmonic wavelength so that for covalent bonding $r' \approx r_H/3$ in $\kappa_{oo}=1-r'/r$. This λ/3 also is used to calculate P wave scattering (called "jets" by quark people.)

To use the f & F components of the equation 8.1, 8.2 Dirac equation we write the Dirac equation for free particle motion along the symmetry axis z (r=ratio of momentum to energy) to find the chirality of the components in the general representation of section 1.6. We then compare this z motion free particle Dirac equation eigenfunction structure with radial component structure to arrive at a sense of which components of the radial equation are left handed and which aren't. This step is a little more complicated here because we are not using the chiral representation of the Dirac matrices, but the standard representation instead. In any case given that the electron is positive energy, then (as we see below) for the positron -E gives left handed f and F implying that this object *must* have a positive charge since this left handedness(doublet, Ch.3) results from the fractalness (There is a corresponding argument for G and g). The proton indeed is positive charged. So:

$$\left[-\left(\frac{dt}{ds}\sqrt{g_{oo}}\,m_p\right)+m_p\right]g-\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{j+3/2}{r}\right)G=0\rightarrow \mu c^2u_1+cpu_3-Epu_1$$
$$\left[-\left(\frac{dt}{ds}\sqrt{g_{00}}\,m_p\right)-m_p\right]G+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-1/2}{r}\right)g=0\rightarrow cpu_1-\mu c^2u_3-Epu_3$$
$$\left[-\left(\frac{dt}{ds}\sqrt{g_{oo}}\,m_p\right)+m_p\right]f-\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-1/2}{r}\right)F=0\rightarrow \mu c^2u_2-cpu_4-Epu_2$$
$$\left[-\left(\frac{dt}{ds}\sqrt{g_{00}}\,m_p\right)-m_p\right]F+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{j+3/2}{r}\right)f=0\rightarrow -cpu_2-\mu c^2u_4-E_pu_4$$

where to get correspondence from these two Dirac equation structures we see that at +E: $u^R=\begin{pmatrix}1\\0\\r\\0\end{pmatrix}$=g, $u^L=\begin{pmatrix}0\\1\\0\\-r\end{pmatrix}$=f; -E: No ($v^R=\begin{pmatrix}r\\0\\1\\0\end{pmatrix}$ here), $v^L=\begin{pmatrix}0\\r\\0\\1\end{pmatrix}$=F, Note in general (with r≈0) here:

$\begin{pmatrix}ig\\if\\G\\F\end{pmatrix}=\begin{pmatrix}u^R\\u^L\\v^R\\v^L\end{pmatrix}=\Psi$. So we have the solution that in the standard representation of the left handed doublet is given by F and f only for –E of the electron (here a positron needed below for + proton hadron excited states) at the horizon. Dirac matrices

So for the left handed doublet: $\begin{pmatrix}F\\f\end{pmatrix}_L$ we have respectively $\begin{matrix}q\pm,\ m\neq 0,-E, forF\\ q=0, m=0,+E, forf\end{matrix}$ (9.4)

Or more succinctly equation 2 in the Dirac doublet form implies in section B2: Note our postulate implies C→0 so we are on the dr axis thus dt'=0 so $dt'^2=(1-r_H/r)dt^2$ (sect.0.1 of Ch.1). Thus $r=r_H=k$ is a stable point since the clock stops since dt'=0 and the is the Meisner effect formalism for canceling out that huge B field at a distance.

CASE 1 $1/\kappa_{rr}=1+k/k+\varepsilon=1+r_{HM+1}/r+r_{HM}/r+\varepsilon$ (core case)

CASE 2 $1/\kappa_{rr}=1-k/k+\varepsilon=1+r_{HM+1}/r+r_{HM}/r+\varepsilon$

Normalize out $1+r_{HM+1}/r$. That just divides by 2 since we (at r) are already near the event horizon

CASE 1 $1/\kappa_{rr}=1+k/k+\varepsilon=1+r_{HM}/r+\varepsilon$ charge 1 (core case)

CASE 2 $1/\kappa_{rr}=1-k/k+\varepsilon=1+r_{HM}/r+\varepsilon$ charge 0

So if $|r_{HM+1}/r|=|r_{HM}/r|$ (use m from case 1) then negative r_{HM}/r means zero charge (so $r_{HM+1}/r=r_{HM}/r$ so charge sources cancel out) and positive means charged. (see also above sect.B2).

Note in sect.1.5 we can have a zero and nonzero charge in the 3rd quadrant (where dt=dr) massive Proca boson case given the possibilities in sign we have for ±ε'/2 in ((-ε/2) ±ε'/2)dr-((-ε/2)±ε'/2)dt.

In the first quadrant ds=0 again (section 1.4) so they have to add to zero. +dr+ε/2+dt-ε/2 and –dr-ε/2-dt+ε/2 solutions. Multiply the second equation by -1, then add the two resulting equations, then divide by 2 and get dr+ε/4±ε/4+dt-ε/4±ε/4 so that ε/2→ε/2±ε/2. So we multiply each of the two ds^2 cases (above |dr+dt| discussion) by its own dz, each with its own κ_{rr}=1/(1-ε//r) →1/(1-(ε/2±ε/2)/r) (sect.4.7) implying 2 charges ε/2-ε/2=0, ε/2+ε/2=ε and so two Proca equation massive W,Z.
See B2. .See above B2:

CASE 1	$1/g_{rr}$ =1+k/k+ε	F	charge 1, m=1 (core case) 2P3/2
CASE 2	$1/g_{rr}$ =1- k/k+ε	F	charge 0, m from case 1) 2P1/2
CASE 3		f	charge 0, m=0

We solve these equations only near r≈k_H since that is where the stability is to be found (and also fortunately were these equations are *linear* differential equations). Thus our first step is to expand $\sqrt{g_{rr}}$ about this radius and drop the higher order terms.

The Frobenius series solution method can now be used to solve equations 8.1 and 8.2 at r≈r_H. See for example Mathematical Methods of Physics, Arfken 3rd ed. Page 454. First we solve the f in equation 8.1, plug that into equation 8.2 and then have an equation in only F. There we substitute a series solution ansatz F= $\sum a_n r^n$ in the resulting combined equations. We can then separate out the results into coefficients of respective rn and get recursion relations that will give us series that must be terminated at some N. Note the energy Eigenvalue 'E' will be in this series as $dt/ds\sqrt{g_{oo}}$ so we can then solve for the mass energy of these hadrons at specific J. We will need an indicial equation for the first term to start out this process. Also in this Frobenius solution method 'n' turns out to be a multiple of ½ and the series must start at n=-1. Finally to get the charge zero case the charged case must be done first and its constant masses used in the uncharged state calculations.

9.2 CASE 1 Excited States for F, m≠0, q± 2P3/2

Again case 1 is one of the equation 8.1 possibilities. Therefore let R=k_H-r, r<<R (for stability) we can write in 8.1:

$$\sqrt{g_{rr}} = 1/\sqrt{1+k_H/R+\varepsilon} \approx \frac{\sqrt{R}}{\sqrt{R+k_H+R\varepsilon}} = \tag{9.1}$$

$$\frac{\sqrt{k_H-r}}{\sqrt{k_H-r+k_H+(k_H-r)\varepsilon}} = \tag{9.2}$$

$$\frac{\sqrt{k_H-r}}{\sqrt{k_H(2+\varepsilon)-r(1+\varepsilon)}} = \tag{9.3}$$

$$\frac{(1-\varepsilon/4)}{\sqrt{2}}\left(\frac{1-\frac{r}{2k_H}+\frac{r^2}{8k_H^2}+..}{1-\frac{r}{4k_H}+\frac{r^2}{16k_H^2}+..}\right) = \tag{9.4}$$

$$((1-\varepsilon/4)/\sqrt{2})\ (1-\frac{r}{4k_H}+\frac{3r^2}{32k_H^2}-..)\approx\frac{1-\frac{r}{4k_H}}{\sqrt{2}} \qquad (9.5)$$

Note **taking the first term of this Taylor expansion of the square root makes this an approximation (<2GeV.).** Note that including the above 1±ε/4 the compensating (1±ε/4) in the next r term has the effect of a multiplying the derivative terms by 1±ε/4. This rescales r to allow us to still say that the stable boundary is still at r_H. Thus we could use it to also rescale t in the first term of equations 8.1 and 8.2 or note that (1+ε/4) (1+ε)=1+5/4ε thus renormalizing 1+ ε to 1+4/3ε =1+ε' everywhere. Also the $3r^2/32k_H^2$ terms must be included. We drop these perturbative terms until the end. Therefore substituting in equation 9.5 we find that equation 8.1 reads:

$$\left[E+m_p\right]F-\hbar c\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}+\frac{j+\frac{3}{2}}{k_H-r}\right)f=0= \qquad (9.6)$$

$$\left[E+m_p\right]F-\hbar c\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)(j+\frac{3}{2})/k_H\right)f=0;\text{ also:}$$

$$\left[E-m_p\right]f+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-\frac{1}{2}}{r}\right)F=0$$

$$\left[E-m_p\right]f+\hbar c\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}-(1+r/k_H)\left(j-\frac{1}{2}\right)/k_H\right)F=0$$

Therefore

$$f=-\hbar c\frac{\hbar c}{\left[E-m_p\right]}\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}-(1+r/k_H)\left(j-\frac{1}{2}\right)/k_H\right)F\ \text{substituting into}$$

$$\left[E+m_p\right]F-\hbar c\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}+\frac{j+\frac{3}{2}}{k_H-r}\right)f=0 \qquad (9.7)$$

We find solving for f and substituting back in:

$$\left[E+m_p\right]F-\hbar c\left((1-r/k_H4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)(j+1.5)/k_H\right)\bullet$$

$$\frac{\hbar c}{E-m_p}\left(-(1-r/k_H4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)(j-\frac{1}{2})/k_H\right)F=\left[E+m_p\right]F+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(-(1-r/4k_H)\frac{d}{k_H4\sqrt{2}dr}+(1-r/4k_H)^2\frac{d^2}{\sqrt{2}dr^2}-(1-r/4k_H)(j-\frac{1}{2})/k_H^2\right)F$$

$$+\frac{(\hbar c)^2}{E-m_p}\left((1+3r/k_H 4)(j+1.5)\frac{d}{\sqrt{2}k_H dr}-(1+r/k_H)^2(j+1.5)(j-\frac{1}{2})/k_H^2\right)F=$$

$$\left([E+m_p]+\left[\frac{(\hbar c)^2}{(E-m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2-(j-\frac{1}{2})/\sqrt{2}k_H^2\right)\right]\right)F+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(-2\sqrt{2}\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^3+(j-\frac{1}{2})/4k_H^3\right)rF+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{-1}{k_H 4\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{1}{k_H}\right)\frac{dF}{dr}+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{3}{4k_H^2}\right)r\frac{dF}{dr}+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{\sqrt{2}}\right)\frac{d^2F}{dr^2}+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{-1}{2\sqrt{2}k_H}\right)r\frac{d^2F}{dr^2}$$

Here $r=2k_H$ is a regular singular point. Next substitute in $F=\sum_n a_n r^n$ with again half integer n allowed as well:

$$\sum_M^N\left([E+m_p]+\left[\frac{(\hbar c)^2}{(E-m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2-(j-\frac{1}{2})/\sqrt{2}k_H^2\right)\right]\right)a_n r^n+ \tag{9.8}$$

$$\sum_M^N\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(-2\sqrt{2}\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^3+(j-\frac{1}{2})/4k_H^3\right)a_{n-1}r^n+ \tag{9.9}$$

$$\sum_M^N\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{-1}{k_H 4\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{1}{k_H}\right)(n+1)a_{n+1}r^n+ \tag{9.10}$$

$$\sum_M^N\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{3}{4k_H^2}\right)na_n r^n+ \tag{9.11}$$

$$\sum_M^N\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{\sqrt{2}}\right)(n+2)(n+1)a_{n+2}r^n+ \tag{9.12}$$

$$\sum_M^N\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{-1}{2\sqrt{2}k_H}\right)(n+1)na_{n+1}r^n=0 \tag{9.13}$$

Note from equation 9.12 that this series diverges. To terminate the series we now take 9.8 and 9.11 together and 9.10 and 9.13 together (since they have the same a_n). For example combining the equation 9.8 and 9.11 terms

$$\left([E+m_p]+\left[\frac{(\hbar c)^2}{(E-m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2-(j-\frac{1}{2})/\sqrt{2}k_H^2\right)\right]\right)+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{3}{4k_H^2}\right)n,$$

Replacing the normalization $m_p \to m_p(1\pm\varepsilon)$ (from section 4.8):

$$\left(E^2-m_p^2\right)+\left(\left[\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2-(j-\frac{1}{2})/\sqrt{2}k_H^2\right)\right]\right)-\frac{1}{\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}+\left(j+\frac{3}{2}\right)\frac{3}{4k_H^2}\right)N=0$$

Therefore after rearranging:

$$E=\sqrt{m_p^2+\frac{1}{k_H^2}\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)}, \qquad (9.14)$$

We have for a general Laurent series ansatz:

$$..+a_{-1}r^{-1}+a_{-1/2}r^{-1/2}+a_o r^o+a_{1/2}r^{1/2}+a_1 r^1+..=F$$

Note also that equations 9.8-9.13 imply that the coefficients of a given r^n are independent. Thus adding together the coefficients of r^n for equations 9.8–9.13 at a given n:

9.9(j-½)a_{n-1}+(9.8+9.11)a_n+(9.10+9.13)(n+1)a_{n+1}+9.12(n+2)(n+1)a_{n+2}=0 (9.15)

Method of Solving Equation 9.15

For the outside observer an F=0 finite boundary condition at infinity applies for flat vacuum value n=0, j=½ and for r^o, $r^{-½}$, r^{-1} and for complete vacuum for N=0, J=0.

Here then the generalized Laurent series $..+a_{-1}r^{-1}+a_{-1/2}r^{-1/2}+a_o r^o+a_{1/2}r^{1/2}+a_1 r^1+..=F$ reduces to ..+ $a_{-1}r^{-1}+a_{-1/2}r^{-1/2}+a_o r^o=F$. Thus either set 9.9(j-½)a_{n-1} =0 or (9.10+9.13)(n+1)a_{n-1}+9.12(n+1)(n+1)a_{n+2} =0 separately in eq.9.15 or set both equal to zero:

J= ½, sets eq.9.9=0

1) N=-1, in equation 9.14 gives mass eigenvalue for Ξ
   Exact solution for all possible a_n, sets none of them to zero.
2) N=0, in equation 9.14 gives mass eigenvalue for *nucleon.* $dr^o/dr=0$ so all derivative of F terms are then zero and this solution applies inside as well.
   N=0 flat J=0 allowed flat vacuum gives $\pi^\pm$ and with free e, j= ½ muon.
3) N= -½, in equation 9.14 gives mass eigenvalue of two Σ s since a plus *and* minus square root of r.

These 9.9=0 cases have case 2 zero charge representations as well.

N=-1, Principle QM number Also a_{-2} =0

1) J=0, in equation 9.14 gives mass eigenvalue for K
2) J=1, gives deuteron mass eigenvalue (bonding) given N=0,J=0 fills first (i.e., pion). Thereafter use nuclear shell model-Schrodinger equation many body techniques with these nonrelativistic lobes with this (bound state) force acting like a outer layer surface tension, finite height square well potential . Get a aufbau principle that then gives the D,F,G,..nuclear shell model states. Alternatively can fill that first S state in with free $1S_{1/2}$ (next state to filled state) and we have j= 3/2 Ω^- filling in some (i.e., uds) of the $2P_{3/2}$ states (see Ch.9) and thereby also deriving from first principles Gell Man's 1963 eight fold way for hyperon eigenvalue classification (to finish that effort need case II zero charge and case III Λ_o as well). M_p is replaced by 2 in c hyperons, by 4 for b hyperons as indicated in fig. 16-1 for how to fill in the cbt 2P harmonic states given the requirement to use r^2 then.

Also, to include higher order r expansion term effects in equation 9.5 we must include those perturbative $1+\varepsilon/4$ and $3r^2/32k_H^2$ contributions which gives a n(n-1)/6.4 added to the "n" term component inside the radical of equation 9.14.
In our new pde δJ=o through LS spin-orbit coupling so the three spin½s and the L=1 add to a minimum. 1-½-½+½ =½ =S for the proton with possible Pauli principle non S=½ possibilities for larger mass eigenvalue.

Details of Above Solutions for Case 1
Thus besides the ground state (N=0 $F_{groundstate}= \sum a_n r^n = a_0 r^{-0}=F_0$ proton) we have the two solutions:
$F_{N=-1} =\sum a_n r^n = a_{-1}r^{-1}=F_1$., j= ½, 0., $F_{N=-1/2} =\sum a_n r^n =a_{-1/2}\, r^{-1/2} =F_2$. For j = ½. 0.
Note the energy eigenvalues (E) can be found from the solution to equation 9.14 and k_H =1 with E=1=938MeV. Thus
N= **0**, j= ½ then 9.14 gives +**Nucleon** (ground state) mass eigenvalue. Note that for the N=0, (with J= ½ and also J= 0 in section 9.5) ground state that the charge density is uniform (i.e., $\rho=K\propto r^0$) for r<k.
N=-**½** , j=½ **two** valued because of the *two* square root solutions. Equation 9.14 then gives Σ± (charged sigma particle) 1184Mev particles, F_2 eigenfunction(s). Actual 1189Mev
N=-**1**, j= ½ gives *one* charged Ξ particle. Therefore the energy from equation 9.14 is 1327 Mev (actual 1321), F_1 eigenfunction.
Case 2 and case 3 give the neutral hyperons and Λ_o respectively (see case 3 below).

9.5 Nucleon Wavefunction: J=1, q≠0, N=-1 of Case 1

Here we recall case 1, section 9.3 above and compute energy eigenvalues for J=0 and J=1.again using equation 9.14 in case 1.
J=0
N=-1, j=0 E=490 MeV from equation 9.14 case 1. $K^{\pm}$. Substitute into strangeness equation 9.34 case 1 we obtain strangeness =1.
N=0, j=0 then from equation 9.14 *E=139.7 MeV* (9.22)
case (note again m=1+ε=1.061 in 9.14 for outside). This is the nontrivial F zero point energy (and so has a fundamental SP hybrid state harmonic) for r<k=ε at $r=r_H$. since the square root in

equation 20.1 becomes imaginary then. Thus the mass of $\pi^{\pm}$ is now the vacuum (e.g., note $F \propto r^{o}$ for N=0 here) ε'at r≈k explaining why this fundamental harmonic result for π is used in all the successful nuclear force theories such as in the Skyrmion Lagrangian for example. Note that:

$$m_{\pi\pm}=139Mev=1.3(105.6MeV)=1.3\varepsilon=.08=\varepsilon'$$

N=-1,J=1 case 1. Recall for J=1 we have $\psi \propto r\sin\theta \propto Y^1{}_1(\theta,\phi)$ double lobe $\psi^*\psi$ along the z axis: From equation 9.14 we find with these inputs that E=1867Mev (9.23)

implying that (because $E\sim 2m_p$ *and* J=1) this eigenstate is responsible for the spin 1 deuteron (state). The L=1, 2P state solution(s) are symmetric and so of the form $(1/\sqrt{2})(\psi_1\psi_2+\psi_1\psi_2)=\psi_s$ and have positive parity even if the 2P ψ_1 and ψ_2 each has negative parity. The Deuteron thus has + parity (Enge, 1966).

Recall if we include the background metric in eq.6.4.11 $\kappa_{oo}=1+r_H/r+2\varepsilon'+\Delta\varepsilon$ and $\kappa_{rr}=1/(1+r_H/r+\Delta\varepsilon)$. So rescaling r→r-ε' =r'for r near r_H allows us to use our above solutions again. So in equation 8.1 $1/\sqrt{\kappa_{rr}}=\psi=1/\sqrt{(1+r_H/r'+\Delta\varepsilon)}\psi\approx 1/\sqrt{(1+r_H/r)}\psi+(\varepsilon/2)\psi$. Note if we again rescale our numerator J=1→1+(ε'/2)2 so that we have perturbed our Y_1 spherical harmonic with a $(\varepsilon/2)Y_2$ giving a measure of the oblate, non spherical structure (e.g quadrupolar ψ_D and higher. ε'/2 ≈.04 from 9.22 therefore the nonspherical component of ψ is approximately 4% of the total ψ and is often called the tensor component of the Deuteron eigenstate (Enge, 1966). This simplest multiparticle state represents the *deuteron* state and this is then the explanation for the deuteron tensor component of the nuclear force.

Also the energy of the Deuteron is given just outside the r_H boundary (so ε'→iε in 6.4.11) by $E_D=\text{Rel }1876/\sqrt{\kappa_{oo}}=\text{Rel }1876/\sqrt{(1+i\varepsilon')}+..=1876(1-i\varepsilon'/2+(3/8)(i\varepsilon')^2+..)$. So the added real term due to the ε' is equal to $1876(3/8)\varepsilon'^2=1876(3/8)(.08)^2=4MeV$. In free space ε'=0 and just outside the nucleus it gives this contribution to the Deuteron energy. Thus this $(3/8)\varepsilon'^2$ is the binding energy of the Deuteron.

Note from the equation 9.15 discussion for N *not* -1 we can only use J=1/2 and J=3/2 thus are restricted for two particles to S and P states (i.e. ½ + ½ =1) which then gives us the hyperons. For N=-1 we can use other J and can thereby construct large nuclei.

The multinucleon nuclei really are the solutions of the indicial equations of 9.15.

Recall in the shell model a hard shell nuclear outer wall is assumed with free space oscillations allowed inside this shell. The solutions to the Schrodinger equation are then spherical Bessel functions with corrections for spin orbit interaction, finite well height and tapered wells (Herald Enge, Introduction To Nuclear Physics, P.145). In any case an infinite mean free path for these oscillations is assumed to exist inside this shell. So how can there be an infinite mean free path inside this extremely high mass density region?

In that regard the above 2, J=1, N=-1 2P deuteron state can also be viewed as yet another Bogoliubov pairing interaction (such as in the SC section 4.5) giving this infinite mean free path of the electron pairs comprising a pion acting as a Cooper pair, just as in SC In the context of the section 4.5 pairing interaction model $A(dv/dt)/v^2$ is no longer as small but dv/dt becomes very large to due to the ultrarelativistic motion of the electrons inside the nucleons. In any case this infinite mean free path for these oscillations (recall Cooper pairs have an infinite mean free path) is thereby explained here as a new type of superconductivity.

Spin Orbit Interaction In Shell Model

Recall the derivation of the shell model from first principles in section 6.12. If equal numbers of Neutrons and Protons gyromagnetic ratios then gy_P-gy_N =2.7-1.9 =.8.
Since more neutrons in heavier elements: (1/1.1)(.8)=.7.
$R=r_H \equiv$½ Fermi measured from singularity at 1-½ = ½ .
From $2P_{3/2}$ at $r=r_H$ Fitzgerald contraction discussion in section 2.2: r→R=½(1-½) = ¼ Fermi ≡ $R_V(r-r_H)$ so $R_v(r-r_H)\rightarrow Kr$. From Ch1,sect 4.16 $V=1/(r-r_H)$. Spin orbit interaction= $a_o^2(1/r)(\partial V/\partial r)(s\bullet L)$=

$$a_0^2 \frac{1}{R_V(r-r_H)} \frac{\partial V}{\partial (R_V(r-r_H))}(s \bullet L) = \frac{.7}{R_V(r-r_H)}\left(\frac{-1}{(R_V(r-r_H))^2}\right)(s \bullet L) = .7(4^3)(s \bullet L)\frac{1}{r}\frac{\partial V}{\partial r} =$$

$$= .7(64)(s \bullet L)\frac{1}{r}\frac{\partial V}{\partial r} = a_o^2 \frac{1}{r}\frac{\partial V}{\partial r}(s \bullet L) = \text{45*E\&M spin orbit interaction.}$$

Thus the a_o=1Fermi. Thus the nuclear spin-orbit interaction is much larger than the E&M spin orbit interaction because the nucleons are much closer to r_H than to r=0 and the Fitzgerald contraction of the nucleon $2P_{3/2}$ state is on the order of ½.

At close range there are higher energies available so the 4mev (=be) in equation 9.3 (if we include r^2 contributions) becomes the binding energy for the deuteron in g_{oo}=1-k/r+be in 8.1 particles, F_2 eigenfunction(s). Actual 1189Mev
N=-**1**, j= ½ gives *one* charged Ξ particle. Therefore the energy from equation 9.14 is 1327 Mev (actual 1321), F_1 eigenfunction ≡Ξs the fundamental structure for m=1.5. So we reapply the analysis all over again for mp->1.5 insteard of 1.
Case 2 and case 3 give the neutral hyperons and Λ_o respectively (see main Frobenius series solution paper).
The multinucleon nuclei are the solutions of the indicial equations of 9.15.
Recall in the shell model a hard shell nuclear outer wall is assumed with free space oscillations allowed inside this shell. The solutions to the Schrodinger equation are then spherical Bessel functions with corrections for spin orbit interaction, finite well height and tapered wells (Herald Enge, Introduction To Nuclear Physics, P.145). In any case an infinite mean free path for these oscillations is assumed to exist inside this shell. So how can there be an infinite mean free path inside this extremely high mass density region?
In that regard the above 2, J=1, N=-1 2P deuteron state can also be viewed as yet another Bogoliubov pairing interaction (such as in the SC section 4.4) giving this infinite mean free path of the electron pairs comprising a pion acting as a Cooper pair, just as in SC In the context of the section 4.5 pairing interaction model $A(dv/dt)/v^2$ is no longer as small but dv/dt becomes very large to due to the ultrarelativistic motion of the electrons inside the nucleons. In any case this infinite mean free path for these oscillations (recall Cooper pairs have an infinite mean free path) is thereby explained here as a new type of superconductivity.

Particle Lifetimes
Recall from section 1.1: $\kappa_{oo}=1-r_H/r$ so $r-r\kappa_{oo}=r_H$ analogous to $dr-ct\kappa_{oo}=ds$ so $r_H=ds\equiv|dZ|$. From section 6.7 there are three Dirac equation contributions with one being the ultrarelativistic m_v contribution. For that contribution we put Dirac αs into dr+idt=dZ the free space Dirac equation. Dividing by ds gives mass on the right side in that Dirac equation. Because the motion of the m_v =1eV (Ch.3) particle is ultrarelativistic in these hadrons we apply figure 1-1 dr=dt so θ=45° and

so $dZ/ds = e^{i\pi/4}dr/ds$ for the ultrarelativistic m_ν (on earth contribution of Ch.3). Note that $(e^{i\pi/4})^2=i$. We add another contribution (for spin ½, N=-1) to get zero charge case II below. For added $2P_{1/2}$ (K,±π mesons) there are 3e in r_H below (sect.10.3). Thus we obtain:

hyperons, **Kaons** and **±π**: $e^{i\pi/4}2e^2/m_\nu c^2= e^{i\pi/4}r'_H=R_H$

Recall that domain $r=r_H$ was the most stable, the proton state. This stability condition can be restated in terms of excess energy above the proton rest mass. Next substitute this m and ultrarelativistic m_ν in the r_H in equation 9.14 with this r'_H in the relativistic solution of equation 2 described in Ch.1,sect.1.

$$E=\sqrt{m_p^2+\frac{1}{R_H^2}\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)}$$

$$\approx m_p\left(1+\frac{\left(e^{i\pi/4}\right)^2\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)}{2m_p^2r'^2_H}\right).$$

Add to above to 9.14 result to get for the total energy:

$$m_p\left(1+\left(\left(\frac{e^{i\pi/4}}{r'_H}\right)^2+\left(\frac{1}{r_H}\right)^2\right)\frac{\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)}{2m_p^2}\right)$$

Plug $(\hbar c/e^2)^2=(1/\alpha)^2$ back in eq.8.1 and normalize $m_\nu c^2$ to 1/hz with 1/h. Next plug into the time propagator e^{iHt} and get for the r'_H (decay) term:

$$=\exp i\left(\left(\left(m_pc^2/h\right)+\left(e^{i\pi/4}\right)^2\left(m_\nu c^2/h\right)\frac{m_\nu}{m_p}\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)\right)\left(\frac{\hbar c}{2e^2}\right)^2\right)t$$

$$=\exp i\left(\left(\left(m_pc^2/h\right)+i\left(m_\nu c^2/h\right)\frac{m_\nu}{m_p}\frac{i\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)}{(2\alpha)^2}\right)\right)t \qquad (9.23)$$

$=\exp i\left(\left(\left(m_pc^2/h\right)+i\Delta\right)\right)t$ giving hyperon, Kaon, ±π decay times.

The second term Δ is also the excess mass above the proton mass.

For neutrons (939Mev) the excess mass above the proton mass (938Mev) is $m_p/1000$ and $R_H \to 1000R_H$, $\Delta\to\Delta'$

$$E^2=m_p^2+\frac{1}{1000^2}\frac{1}{(1000R_H)^2}\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)$$

gives the neutron decay time.

For m_μ muons j=½, N=0 and the excess mass is $m_p/8.87\equiv m_\mu$.

$$E^2=m_p^2+\frac{1}{8.87^2}\frac{1}{(8.87R_H)^2}\left(j^2+1.7071j-1.10355-(j.5303+.8269)N\right)$$

gives time for muon m_μ decay.

For π^o decay time $m_\nu\to m_e$ (E&M decay) along with $8.87\to 7=m_p/m_{\pi o}$ in the above equation.

For resonances $m_\nu\to m_e$ (E&M decay) in 9.23 gives time of decay.

Note the second term here contains a ii=-1 and so it is a exponential decay term e^{-Et} with .693/E=t the "half life".

Thus we get π^o, ±π, K mesons and hyperon, muon, neutron, resonance half lives from (these modifications of) equation 9.23.

9.7 CASE 2 Excited State F, charge=0. 2P1/2

Recall from 9.4 that case 1 implies $E_q \rightarrow m$ in case 2 (in 9.4). Also $1/g_{rr} \approx 1-k_H/k_H+\varepsilon = \varepsilon$ for $-\varepsilon$. Net charge=Zero. Thus let $R=k_H+r$, $r<<R$, $r'=k_H\varepsilon+r$

$$\left[\left(\frac{dt}{ds}\sqrt{g_{oo}}m\right)+m\right]F-\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}+\frac{j+3/2}{r}\right)f=0$$

$$\left[\left(\frac{dt}{ds}\sqrt{g_{00}}m\right)-m\right]f+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-1/2}{r}\right)F=0$$

$$\sqrt{g_{rr}}=1/\sqrt{1-k_H/R+\varepsilon}\approx\frac{\sqrt{R}}{\sqrt{R-k_H+R\varepsilon}}=$$

$$\frac{\sqrt{k_H+r}}{\sqrt{k_H+r-k_H+(k_H+r)\varepsilon}}\approx\frac{\sqrt{k_H+r}}{\sqrt{k_H\varepsilon+r(1+\varepsilon)}}\approx\frac{\sqrt{k_H}}{\sqrt{k_H\varepsilon+r}}=\frac{\sqrt{k_H}}{\sqrt{r'}}$$

Also $(dt/ds)\sqrt{g_{oo}}\rightarrow E$ in the Dirac equation 18.1. Therefore equation 19.1 reads: $r'=k_H\varepsilon+r$

$$[E+m]F-\hbar c\left(\sqrt{\frac{k_H}{r'}}\frac{d}{dr}+\frac{j+\frac{3}{2}}{k_H+r}\right)f=$$

$$[E+m]F-\hbar c\left(\sqrt{k_H/r'}\frac{d}{dr}+\frac{j+\frac{3}{2}}{k_H+r}\right)f=0$$

$$[E+m]F-\hbar c\left(\sqrt{k_H/r'}\frac{d}{dr'}+\left(1-\frac{r}{k_H}\right)\frac{j+\frac{3}{2}}{k_H}\right)f=0 \text{ and}$$

$$[E-m]f+\hbar c\left(\sqrt{\frac{k_H}{r'}}\frac{d}{dr}-\left(1-\frac{r}{k_H}\right)\frac{j-\frac{1}{2}}{k_H}\right)F=0 \qquad \text{Thus}$$

.

$$f=-\frac{\hbar c}{|E-m|}\left(\sqrt{k_H/r'}\frac{d}{dr'}-\left(1-\frac{r}{k_H}\right)\frac{j-\frac{1}{2}}{k_H}\right)F \qquad \text{Therefore}$$

$$[E+m]F-\hbar c\left(\sqrt{k_H/r'}\frac{d}{dr'}+\left(1-\frac{r}{k_H}\right)\frac{j+\frac{3}{2}}{k_H}\right)f=0 \quad \text{Using} \qquad r=r'+k_H\varepsilon$$

$$[E+m]F-\hbar c\left(\sqrt{k_H/r'}\frac{d}{dr'}+\left(1-\left((r'-\varepsilon k_H)/k_H\right)\right)\frac{j+\frac{3}{2}}{k_H}\right)\frac{-\hbar c}{|E-m|}\left(\sqrt{k_H/r'}\frac{d}{dr'}-\left(1-\left((r'-\varepsilon k_H)/k_H\right)\right)\frac{j-\frac{1}{2}}{k_H}\right)F=0$$

Multiplying both sides by $|E-m_p|$ we obtain:

$$\frac{E^2-m^2}{(\hbar c)^2}F+\left(\sqrt{k_H/r'}\frac{d}{dr'}+\left(1-\frac{(r'-k_H\varepsilon)}{k_H}\right)\frac{j+\frac{3}{2}}{k_H}\right)\left(\sqrt{k_H/r'}\frac{d}{dr'}-\left(1-\frac{r'-k_H\varepsilon}{k_H}\right)\frac{j-\frac{1}{2}}{k_H}\right)F=0$$

$$\frac{E^2-m^2}{(\hbar c)^2}\text{-}\left((1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}\right)F+\sqrt{k_H/r'}\frac{J-1/2}{k_H^2}+(1+\varepsilon)\frac{(J+3/2)}{k_H}\sqrt{\frac{k_H}{r'}}\frac{d}{dr'}+$$

$$\left(\frac{k_H}{r'}\frac{d^2}{dr^2}-\frac{1}{2}\frac{k_H}{r^{4/2}}\frac{d}{dr'}\right)F=0.$$ Multiplying both sides by r'^2 we obtain:

$$\left(\left[\frac{E^2-m^2}{(\hbar c)^2}r'^2\right]-(1+2\varepsilon)(J+3/2)(J-1/2)\frac{r'^2}{k_H^2}\right)F+(1+\varepsilon)\frac{(J+3/2)}{\sqrt{k_H}}r^{3/2}\frac{d}{dr'}+$$

$$\left[\left(r'k_H\frac{d^2}{dr'^2}\right)-\frac{1}{2}k_H\frac{d}{dr'}-\frac{\sqrt{k_H}r'^{3/2}}{k_H^2}(J-1/2)\right]F=$$

Defining $r'\equiv r^2$ and doing the derivatives in the new variable:

$$\frac{dF}{dr^2}=\frac{dF}{dr}\frac{dr}{dr^2}=\frac{1}{2r}\frac{dF}{dr}$$ and

$$\frac{d^2F}{dr^2}=\frac{1}{2r}\frac{d}{dr}\left(\frac{1}{2r}\frac{dF}{dr}\right)=\frac{1}{2r}\left(-\frac{1}{2r^2}\frac{dF}{dr}\right)+\frac{1}{2r}\frac{1}{2r}\frac{d^2F}{dr^2}=$$

$$-\frac{1}{4r^3}\frac{dF}{dr}+\frac{1}{4r^2}\frac{d^2F}{dr^2}$$ Substituting these expressions for the derivatives in:

$$\left[\frac{E^2-m^2}{(\hbar c)^2}r^4-(1+\varepsilon)(J+3/2)(J-1/2)\frac{r^4}{k_H^2}\right]F+$$

$$\left[\frac{k_H}{4}\frac{d^2}{dr'^2}-\frac{1}{4r}k_H\frac{d}{dr'}\right]F\text{-}\frac{\sqrt{k_H}r'^3(J-1/2)}{k_H^2}F+\frac{r^3(1+\varepsilon)(J+3/2)}{k_H}\frac{\sqrt{k_H}}{2r}\frac{d}{dr'}F+$$

$$-\frac{k_H}{4r}\frac{d}{dr}F=$$

$$\left[\left(\frac{E^2-m^2}{(\hbar c)^2}\right)-(1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}\right]\sum a_n r^{n+4}+\frac{k_H}{4}\sum(n-1)na_n r^{n-2}\text{-}$$

$$\frac{k_H}{4}\sum na_n r^{n-2}\text{-}\frac{\sqrt{k_H}}{k_H^2}\left(J-\frac{1}{2}\right)\sum a_n r^{n+3}+(1+\varepsilon)\frac{(J+3/2)}{2\sqrt{k_H}}\sum na_n r^{n+1}\text{-}\frac{k_H}{4}\sum na_n r^{n-2}=$$

$$\left(\frac{E^2-m^2}{(\hbar c)^2}-(1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}\right)\sum a_{n-4}r^n+\frac{k_H}{4}\sum(n+1)(n+2)a_{n+2}r^n\text{-}$$

$$\frac{k_H}{4}\sum\ (n+2)a_{n+2}r^n\text{-}\ \frac{\sqrt{k_H}}{k_H^2}\left(J-\frac{1}{2}\right)\sum a_{n-3}r^n\quad +(1+\varepsilon)\frac{(J+3/2)}{2\sqrt{k_H}}\sum(n+1)a_{n-2}r^n\text{-}$$

$$\frac{k_H}{4}\sum(n+2)a_{n+2}r^n\text{=0.}$$

Combining terms noting simplification due to combining the a_{n+2} terms

$$\left(\frac{E^2-m^2}{(\hbar c)^2}-(1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}\right)\sum a_{n-4}r^n+\frac{k_H}{4}\sum(n-1)(n+1)a_{n+2}r^n+$$

$$\frac{\sqrt{k_n}}{k_H^3}(J-1/2)\sum\ a_{n-3}r^n+(1+\varepsilon)\frac{J+3/2}{2\sqrt{k_H}}\sum(n-1)a_{n-1}r^n=0$$

Next we write the individual eigenfunctions as:

$$\left(\frac{E^2-m^2}{(\hbar c)^2}-(1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}\right)\sum a_{n-4}r^n=0.$$

Thus since these series terms add to zero:

$$E=\sqrt{m^2+(\hbar c)^2(1+2\varepsilon)\frac{(J+3/2)(J-1/2)}{k_H^2}}\tag{9.24}$$

$(1+\varepsilon)\dfrac{J+3/2}{2\sqrt{k_H}}\sum(n-1)a_{n-2}r^n=0.$ Here $r'=r^2$ so $r^{-2/2}=r'^{-1}=\sqrt{r}^{-2}$

$$\frac{k_H}{4}\sum(n^2-1)a_{n+2}r^n=0\tag{9.25}$$

$$-\frac{\sqrt{k_H}}{k_H^2}(J-1/2)\sum a_{n-3}r^n=0\tag{9.26}$$

J=1/2 with N=1 solves the indicial equation implied by 9.24-9.26. Recall from 9.4 that m=proton in this case (case 2). The energy in 9.24 is then that of a neutral particle (q=0) with the mass of the neutron so E $=E_q$ =m=m_N. See equation 9.23b for neutron lifetime and 2P3/2 for neutron spherical harmonic state, section 10.3) But in case 2 and equation 9.23 then the previously derived charged spin ½ hadrons m_Σ, m_Ξ can also be put back into the Dirac equations for 'm'(instead of the proton). Thus the charged, m_Σ, m_Ξ from equation 9.14 can be put into the "m" in 9.24 which gives the **neutral** E=m=m_N, m_Ξ.. m_Σ has a N=1/2 and so does not satisfy the above equations and so does not exhibit a stable neutral Σ. Recall the Ω^- (which is J=3/2) is not J= ½ so doesn't have a neutral counterpart as does the proton and these other J= ½ hyperons.
Recall the iterated Dirac equation is the Klein Gordon (in χ with J=0) equation eigenstate transitions.

J=0, q=0 Case 2

Recall J=0 is allowed in every case.
m=1 proton, j=0 in equation 9.24 means K Long. Equation 9.23 gives K long mass eigenvalue: 1+(0+3/2)(0-1/2)/1=1/4. Thus √.25 =.5. Thus .5X938X1.06=497 MeV=K_{long}. Note case 2 is zero charge and note also from section 9.8 that the Strangeness=2|√.5|=2*.707 ≈1 as in strangeness equation 9.34 below.
m≈1 for Neutron then in 9.24 we have K short, if m=m_Ξ and J=0 then D^o Long.

If m=m$_\Xi$ j=0, and neutral then 9.24 gives D^o Short.

9.8 CASE 3 m=0, so ψ_L, f state, charge=0 (lower case of equation 9.5).

In case 3 there is no central force therefore N=0 and j=½ in f. This is the m=0 left handed doublet case of Chapter 3. Let R=k$_H$-r, r<<R for stability we can write:

$$\sqrt{g_{rr}} = 1/\sqrt{1+k_H/R+\varepsilon} \approx \frac{\sqrt{R}}{\sqrt{R+k_H+R\varepsilon}} =$$

$$\frac{\sqrt{k_H-r}}{\sqrt{k_H-r+k_H+(k_H-r)\varepsilon}} = \frac{\sqrt{k_H-r}}{\sqrt{k_H(2+\varepsilon)-r(1+\varepsilon)}} = \frac{(1-\varepsilon/2)}{\sqrt{2}}\left(\frac{1-\frac{r}{2k_H}+\frac{r^2}{8k_H^2}+..}{1-\frac{r}{4k_H}+\frac{r^2}{16k_H^2}+..}\right) =$$

$$((1-\varepsilon/2)/\sqrt{2})\ (1-\frac{r}{4k_H}+\frac{3r^2}{32k_H^2}-..) \approx \frac{1-\frac{r}{4k_H}}{\sqrt{2}}$$

Therefore equation 9.1 reads:

$$[E+m_p]F-\hbar c\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}+\frac{j+\frac{3}{2}}{k_H-r}\right)f=0$$

$$[E+m_p]F-\hbar c\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)(j+\frac{3}{2})/k_H\right)f=0;$$

$$[E-m_p]f+\hbar c\left(\sqrt{g_{rr}}\frac{d}{dr}-\frac{j-\frac{1}{2}}{r}\right)F=0 \qquad (9.27)$$

From the above equation 9.27 if (and j= ½) m$_p$=0 then

$$[E-m_p]f+\hbar c\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}-(1+r/k_H)\left(j-\frac{1}{2}\right)/k_H\right)F=0$$

Therefore (with j= ½) from equation 9.27 for small r. In any case:

$$F=\hbar c\frac{\hbar c}{[E+m_p]}\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)\left(j+\frac{3}{2}\right)/k_H\right)f$$

$$[E+m_p]F-\hbar c\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}+\frac{j+\frac{3}{2}}{k_H-r}\right)f=0$$

Solving for *f* and substituting back in 9.27

$$\left[E-m_p\right]f+\hbar c\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}-(1+r/k_H)(j-.5)/k_H\right)\bullet$$

$$\frac{\hbar c}{E+m_p}\left((1-r/k_H 4)\frac{d}{\sqrt{2}dr}+(1+r/k_H)(j+\frac{3}{2})/k_H\right)F=\left\lfloor E-m_p\right\rfloor f+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(-(1-r/4k_H)\frac{d}{k_H 4\sqrt{2}dr}+(1-r/4k_H)^2\frac{d^2}{\sqrt{2}dr^2}+(1-r/4k_H)(j+\frac{3}{2})/k_H^2\right)f$$

$$+\frac{(\hbar c)^2}{E+m_p}\left(-(1+3r/k_H 4)(j-.5)\frac{d}{\sqrt{2}k_H dr}-(1+r/k_H)^2(j+1.5)(j-\frac{1}{2})/k_H^2\right)f=$$

$$\left(\left[E-m_p\right]+\left[\frac{(\hbar c)^2}{(E+m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2+(j+\frac{3}{2})/\sqrt{2}k_H^2\right)\right]\right)f+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(2\sqrt{2}\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^3-(j+\frac{3}{2})/4k_H^3\right)rf+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(-\frac{1}{k_H 4\sqrt{2}}+\left(j-\frac{1}{2}\right)\frac{1}{k_H}\right)\frac{df}{dr}+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}-\left(j-\frac{1}{2}\right)\frac{3}{4k_H^2}\right)r\frac{df}{dr}+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{1}{\sqrt{2}}\right)\frac{d^2 f}{dr^2}+$$

$$\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{-1}{2\sqrt{2}k_H}\right)r\frac{d^2 f}{dr^2}$$

Next substitute in F= $\sum_n a_n r^n$

$$\sum_M^N\left(\left[E-m_p\right]+\left[\frac{(\hbar c)^2}{(E+m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2+(j+\frac{3}{2})/\sqrt{2}k_H^2\right)\right]\right)a_n r^n+$$

$$\sum_M^N\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(2\sqrt{2}\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^3-(j+\frac{3}{2})/4k_H^3\right)a_{n-1}r^n+\qquad(9.28)$$

$$\sum_M^N\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(-\frac{1}{k_H 4\sqrt{2}}+\left(j-\frac{1}{2}\right)\frac{1}{k_H}\right)(n+1)a_{n+1}r^n+\qquad(9.29)$$

$$\sum_M^N\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}-\left(j-\frac{1}{2}\right)\frac{3}{4k_H^2}\right)na_n r^n+\qquad(9.30)$$

$$\sum_M^N\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{1}{\sqrt{2}}\right)(n+2)(n+1)a_{n+2}r^n+\qquad(9.31)$$

$$\sum_{M}^{N}\frac{(\hbar c)^2}{(E+m_p)\sqrt{2}}\left(\frac{-1}{2\sqrt{2}k_H}\right)(n+1)na_{n+1}r^n = 0 \qquad (9.32)$$

We now take 9.27 and 9.30 together and 9.29 and 9.32 together (since they have the same a_n). Thus there are 4 independent series (with 9.28 and 10.31) here. The equation 9.27 and 9.30 nth terms give:

$$\left([E+m_p]+\left[\frac{(\hbar c)^2}{(E-m_p)}\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2+(j+\frac{3}{2})/\sqrt{2}k_H^2\right)\right]\right)+$$

$$\frac{(\hbar c)^2}{(E-m_p)\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}-\left(j-\frac{1}{2}\right)\frac{3}{4k_H^2}\right)n,$$

At some value of n=N we have for a solution

$$(E^2-m_p^2)+\left(\left[\left[\left(-\left(j+\frac{3}{2}\right)(j-\frac{1}{2})/k_H^2+(j+\frac{3}{2})/\sqrt{2}k_H^2\right)\right]\right]\right)+\frac{1}{\sqrt{2}}\left(\frac{1}{k_H^2 16\sqrt{2}}-\left(j-\frac{1}{2}\right)\frac{3}{4k_H^2}\right)N=0$$

therefore rearranging:

$$E=\sqrt{m_p^2+\frac{1}{k_H^2}((j+3/2)(j-1/2)+.7071j+1.0607+(.0156-(j-.5).5303)N)} \qquad (9.33)$$

Recall from the equation 9.4 ‘f’ case that we have m_p=m=0, and zero charge therefore no central force thus N=0 in $f\propto r^o$ in equation 8.1. Therefore since there is small r and $dr^0/dt=d1/dt=0$ in the equations just above equation 9.27 along with 9.33 then the 9.27-9.32 equations add to zero and thus are solved. Also the j=3/2 (so L=1) case is not allowed since that requires a central force to give L≠0, j= ½ and of course j=0 is allowed here. Thus
N= **0**, j= ½, m=0 then from 9.33 we have E=1115.8 Mev Λ_o

N=0, j=0, η mass and also gives m=.56 (with m=0) in 9.33 used in gyromagnetic ratio calculation for f. Recall ε=.08 (with m=0) for F in 9.14. This is the nontrivial f state zero point energy for r<k since Ψ=ψ+χ from our observability definition. Note Kaons then give no strange bound states because this mass is real (in contrast to the imaginary pion mass in 9.22).

9.9 Strangeness

Recall that in 9.14 (which applies to Case 1 and Case 2) the energy is $E^2=m_o^2+(j^2+1.7071j-1.10355-(j(.53033))+.7642))N)/k_H^2$. Now m_o^2 and E is conserved (m_o is a constant) here and thus it appears that energy conservation implies that the square root of j^2+1.7071j-1.10355)-(j.5303+.7642)N ≡S must be conserved. Therefore $E^2=m^2+S^2$ then and “S” is conserved for the charged core states and thus for the neutrals given that in section 9.8 that $E_q\to m$ then (for f state m=0 we also have S≈E for Λ). We could also write $E^2=m^2+C^2$ for the next 2P state eigenstates (call C charm if you want) which would also have their own associated production (since <|> not zero). Thus, as an example, normalizing to a factor of 2X:

2XSQR[(.5(.5303)+.7642)(0)]=0=$S_{nucleon}$, 2XSQR|[(.5(.5303)+.7642)(-1)|≈2=S_Ξ,
2XSQR|[.5(.5303+.7642)(-½)]| ≈1=S_Σ, 2X SQR|[(1.5²+1.7071(1.5)-1.10355-
(1.5(.5303+.7642)))(-1)]|≈3=S_Ω. (9.34)

Strangeness is only an approximate conservation law in the examples in 9.34 but there is enough conservation at least for the "associated production" and we have not yet included the weak interaction here. This is a **direct derivation of strangeness**, instead of just having postulated it as it is in the standard model and QCD. Strangeness isn't strange anymore.

Charm, bottom, top: In chapter 9 equation assuming hard spherical shell. We obtain other (less stable, resonances) particle groups using equation 9.5 by taking the quadratic approximation of g_{rr} (i.e., include the $(3/32)(r/k_H)^2$ term in 9.5) Using 10.8 instead of just the linear approximation we used above. Recall that the perturbative $(3/32)(r/k_H)^2$ term had to be included since it gave a ≈20Mev correction to the hyperon masses.

```
C Meson Mass Derivation From Potential Of Chapter 10 And The New Pde eq.9
C Spherically Symmetric Wave Function Required
      PROGRAMFracsN
      DOUBLE PRECISION A,B,C,D,E,F,H,I,I1,J,KK
      DOUBLE PRECISION K1,K2,K3,K4,N1,N2,N3,N4,R,W,X,Y,Z
      DOUBLE PRECISION Y1,E1,E2,MM1,MM2,MM3,EE,JJ
      integer N,M,M1
      DIMENSION EE(400)
C     Variational principle on E with respect to I and Y1,
C     RungeKutte on D equation 8.1. Y=2 width Deuteron
C     pion oscillation resonance modeled between 0 and Y=2.
      H=0.001
      mH=2 !harmonic number for oscillation inside Y=2.
C     mN=1 gives pion 0 and K+-,mN=2 gives pi+- and Ko resonance
      ep=0.08*mH   !pion 1st and 2nd harmonic resonance added to Y1
      W=1.0+ep !pion mass added to nucleon.
      J=0.0  !spin 0 mesons
      X=0.0001   !mass energy increments
      I1=100000000.0
      A=0.0
      B=0.0
      C=0.0
      E=0.0
      KK=78.8   !gives MeV energy units
      JJ=J*1.
      Y1=2.0+ep  !pion  increases Y1.
50    D=.0000001
      I1=0.0
      F=.0000001
      Y=Y1
60    R=Y
       V=1.0/(1.0+ep-R) !chapter 14 potential for spin 0
       E1=E
       K1=((W-E-V)*F)+(((J-0.5)/R)*D)
       N1=((E+W+V)*D)-(((J+1.5)/R)*F)
```

```
      R=R+(0.5*H)
      V=1.0/(1.0+ep-R)
      K2=((W-E-V)*(F+(0.5*H*N1)))+(((J-0.5)/R)*(D+(0.5*H*K1)))
      N2=((E+W+V)*(D+(0.5*H*K1)))-(((J+1.5)/R)*(F+(0.5*H*N1)))
      K3=((W-E-V)*(F+(0.5*H*N2)))+(((J-0.5)/R)*(F+(0.5*H*K2)))
      N3=((E+W+V)*(D+(0.5*H*K2)))-(((J+1.5)/R)*(F+(0.5*H*N2)))
      R=R+(.5*H)
      V=1.0/(1.0+ep-R)
      K4=((W-E-V)*(F+(H*N3)))+(((J-0.5)/R)*(D+(H*K3)))
      N4=((E+W+V)*(D+(H*K3)))-(((J+1.5)/R)*(F+(H*N3)))
      E=E1
      F=F+((H/6.0)*(N1+(2.0*N2)+(2.0*N3)+N4))
      D=D+((H/6.0)*(K1+(2.0*K2)+(2.0*K3)+K4))
       I=(F*F)+(D*D)
100   I1=I1+(I*(R+(0.5*H))*(R+(0.5*H)))
      IF((abs(R-1.0-ep)).LT.(0.9*H))THEN
      Y=Y-(2.0*H)
      GOTO 60
      ENDIF
     Y=Y-H
     IF(Y.LT.0.0)THEN
      GOTO 200
      ENDIF
      GOTO 60
200   E=E+X
      C=I1
      IF(B.LT.A)THEN

      GOTO 310
      ENDIF
      GOTO 312
310   IF(C.GT.B)THEN
      ENDIF
312   IF(B.GT.A)THEN
      GOTO 315
      ENDIF
      GOTO 320
315   IF(C.LT.B)THEN
      print *,'  '
      print *,'E=',(E-X)*KK,' J=',J,' max I'
      ENDIF
320   IF(E.GT.8.0)THEN
      GOTO 349
      ENDIF
      A=B
      B=C
```

```
 330   GOTO 50
 349   print*,'program finished'
 350   stop
       End
```

C **Results for** spin 0,L=0 are

C For mN=1 get 135MeV π^o and 493$K^\pm$ for resonance with 1 meson.

C For mN=2 get 139Mev $\pi^\pm$ and 497Mev K^o for resonance with two mesons in ordinary nuclear matter nucleus would split before K energy created. In a neutron star however K s could be created.

This fortran computer program only requires a few seconds to run on a PC. On the other hand lattice gauge theory programs (assuming a SU(3) lattice) require massive computing power and really do not duplicate high energy liquid state strong interactions anyway

Chapter 10

$r \approx r_H$ Application: $2P_{3/2}$ Half Integer Spherical Harmonics Solutions. This is a continuation of Chapter 9

10.2 Overview of $2P_{3/2}$ Solutions to Equation 9 (the New Dirac equation) at $r \approx r_H$ in the Context of the Equivalence Principle (single charge e) Implication

Allowing this *single* charge '*e'* to move near and inside that stable singularity radius $r \approx 2q^2/mc^2$ in the $\sqrt{g_{ij}}$ in this new Dirac equation (equation 2) as we see below makes the motion relativistic but stable requiring all the Dirac equation spherical harmonic solutions, not just the ones allowed by the Schrodinger equation. Also the next order of approximation above the hard shell for our g_{oo} horizon $r_H = 2e^2/m_ec^2$ is the harmonic oscillator $V \alpha r^{+1}$ giving the *SU(3) SYMMETRY* of the three dimensional harmonic oscillator. The *+1* in the exponent of V (instead of the inverse square law-1) also reverses the sign on the exchange integral $\pm\int \psi^*_{111}(r')\psi^*_{lmn}(r'')V(r',r'')\psi_{lmn}(r')\psi_{111}(r'')d\tau = J$ designating the symmetric and antisymmetric states), making here then the *J=3/2* state *m=-3/2* and 3/2 (i.e., $\psi = \mathcal{Y}^{3/2}{}_{3/2}(\theta,\phi) + \mathcal{Y}^{-3/2}{}_{3/2}(\theta,\phi) = 2P_{3/2}$ eigenspinor) the first ground state that varies with azimuthal angle(baryons) above the already filled 1S (in analogy with helium) on the energy ladder instead of the expected ½ and –½ (these ½ s by the way give $2P_{1/2}$ in the $\psi^*\psi$ of the next higher P orbital slots) that vary with azimuthal angle (baryons).

Also recall the identity $(exp(i\phi)+exp(-i\phi))/2 = cos\phi$. The $\mathcal{Y}^{3/2}{}_{3/2}$ orbital is a $exp(i3/2\phi)$ and $Y^{-3/2}{}_{3/2}$ orbital is $exp(-i3/2\phi)$ and thus from the identity the summed state is $cos(3/2\phi)$ with probability density $\psi^*\psi = cos^2(3/2\phi)$, the trifolium three lobed shape. Thus there are TWO +e s giving a net charge of +2/3e in each lobe because the +electron charge 'e' is in each orbital lobe on the average only *1/3 the time* (*FRACTIONAL CHARGE*) giving the many scattering properties (such as jets) associated with the angular distribution of multiple fractional charges interior to this horizon. The lobe 'structure' *can't leave (ASSYMPTOTIC FREEDOM)* as in the Schrodinger equation case or move so is *NONRELATIVISTIC* in contrast to its rapidly moving m_e constituent.

Finally we solve the problem with the new pde using a computer program, set the boundary conditions as if the Deuteron was a square well. See end of chapter 9 for the fortran program. In any case we can build the hyperons and mesons with integer charges e, don't need the fractional charges.

10.3 Trifolium Diagram

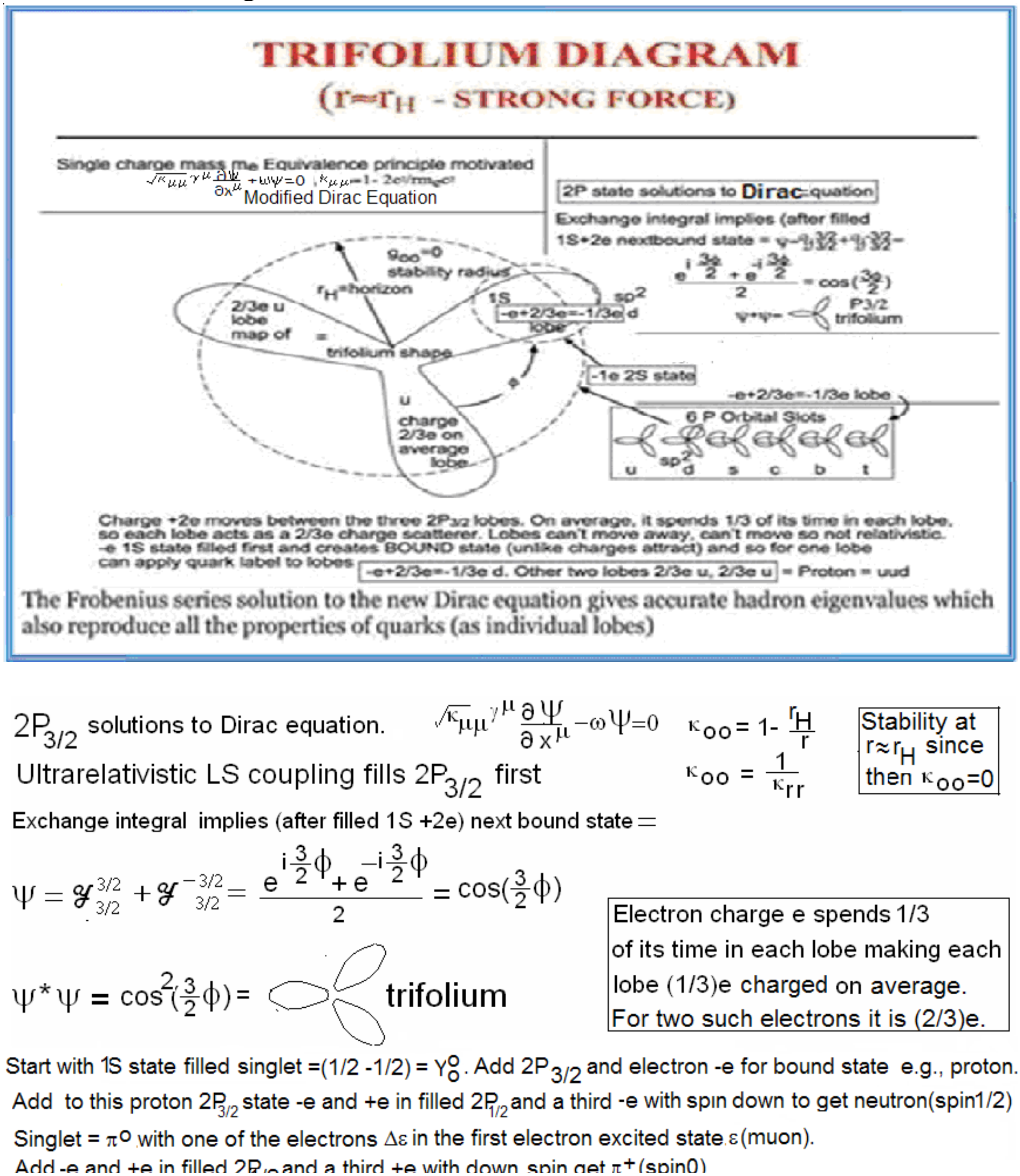


Figure 10-1 Trifolium diagram

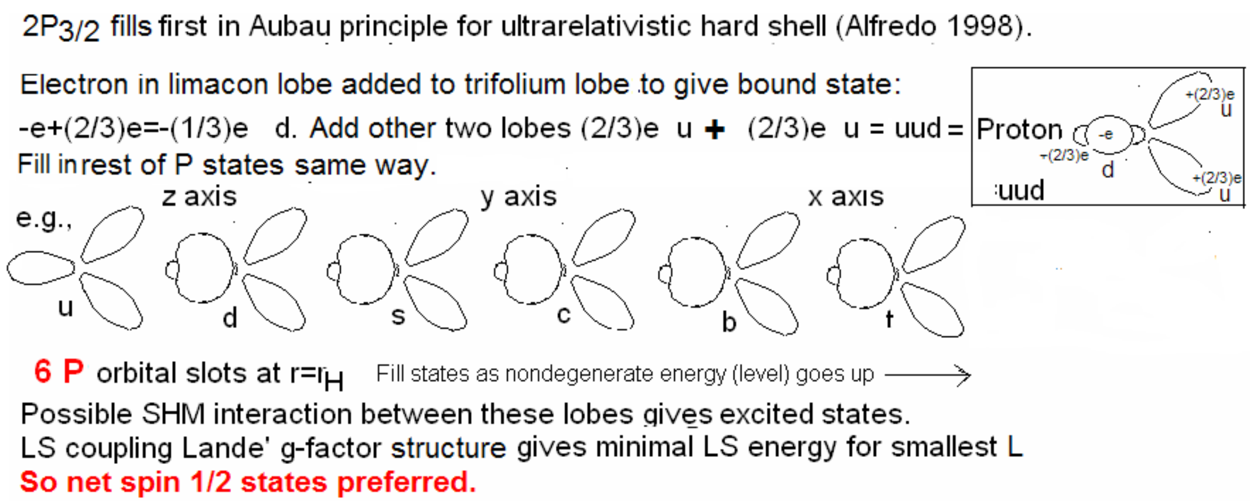


Fig2 Note we get a similar shape to the trifolium with lattice QCD theory.

.

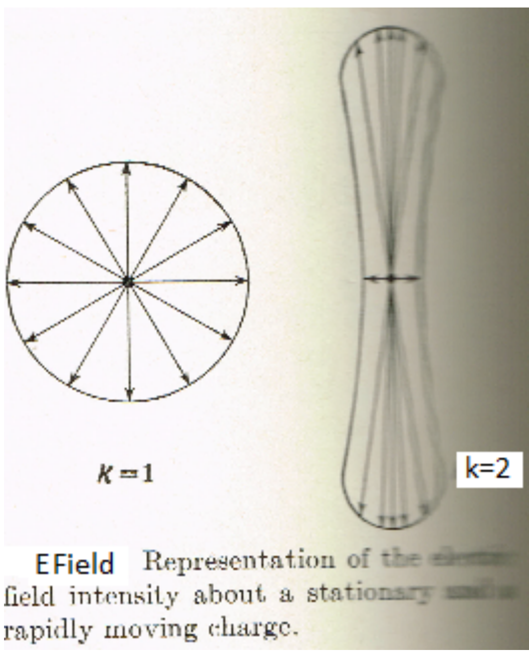


Fig.3 Second diagram is the E field of a ultrarelativistic charged particle (“Electronic Motion”, McGraw Hill, Harman)

Thus the neutron charge configuration allows for the creation of both the W and the H_v and the proton charge configuration does not allow this.

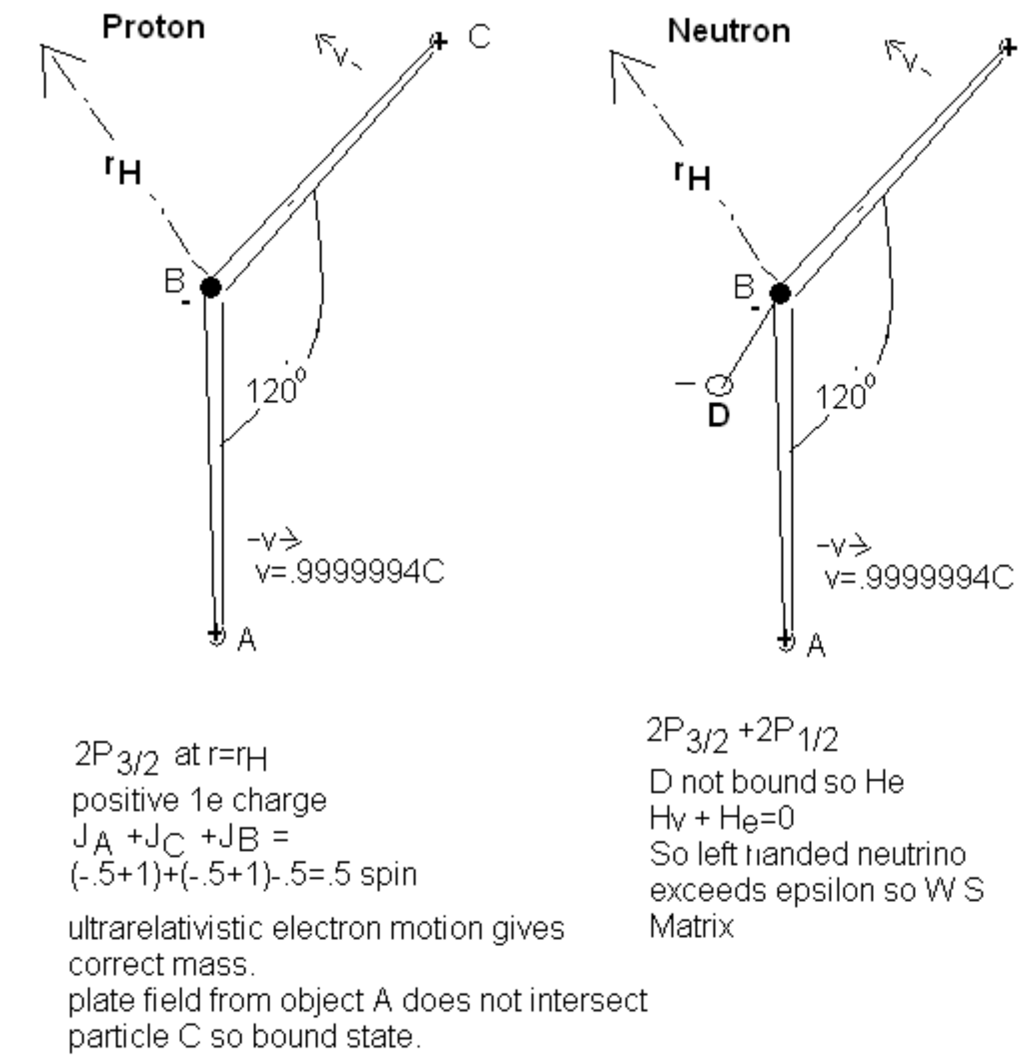


Fig.4

10.5 Two (e+e+e at $r \approx r_H$) Objects: The Deuteron

The only stable lepton state in this theory so far are 2 (eq.2 in 4D) and e+e+e at $r=r_H$ with the latter being internally unstable but regenerative through that particle (re)creation step above (fig6). Also if a second e+e+e object is nearby a $2P_{1/2}$ state (sect.1.6, eq.2) the second proton picks up the electron making this state also regenerative and stable (Deuteron). According to sec.7.3 the neutron in deuteron decays but its electron is then transferred to the other proton and it then days creating a net oscillation.

Schrodinger Equation For Many Deuterons

Equation 9 iterated for Bosons is the Klein Gordon equation. Here we derive the SHM Schrodinger equation version for the deuteron. From the energy component of polarized representation of equation 8.1, 8.2: and using iterated (as in bosonic, here deuterons)

$E^2=p^2c^2+m^2_oc^4 =$

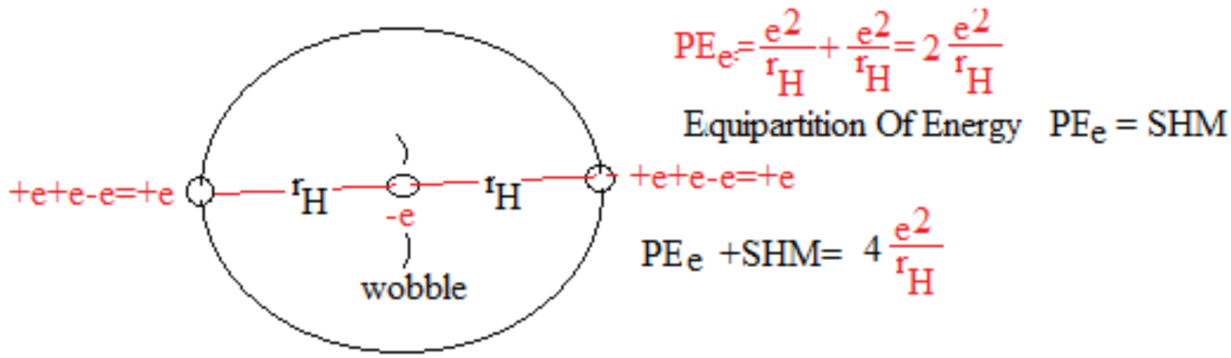
$$E^2 = \left(\frac{1}{\sqrt{\kappa_{oo}}}\right)^2 = \frac{1}{1-\frac{r_H}{r}} = \frac{r}{r-r_H} = \frac{r}{r-r_H} - \frac{r-r_H}{r-r_H} + 1 = \frac{r_H}{r-r_H} + 1 = V+1 \qquad (10.8.1)$$

Note the resemblance of $E^2=p^2c^2+m^2_oc^4$ to the Schrodinger equation if the $E^2 =[r_H/(r-r_H)]+1$, $p^2c^2 \rightarrow k^2$ 2nd derivative of equation 10.8.1. $r'_H=[^3\sqrt{}((6Z/4\pi)]r_H$ in eq.10.8.1. Note for low energy large r $m_ec^2(V) \approx PE$=ordinary E&M potential energy. For high energy small r in contrast then $V+1 \approx 0 = E^2$.
From the new pde model $r=r_H=2.817X10^{-15}$.(DavidMaker.com, partI, eq.2)

Equipartition of Energy
Well, the central electron in the deuteron really is in a vacuum and is also doing 1D simple harmonic motion!
The (1/2)kx^2 SHM PEosc gives the same escape velocity v in (1/2)mv^2 as that 4e^2/r (=1.1Mev) does (2 springs and 2X for ultrarelativistic gas in the 2 protons so 2X2=4). So PEosc=PEe. But PEosc=PErot (rotation) from the *equipartition of energy.*
So PEe=PEosc=PErot =1 Mev (X1.1) in Deuterium. Subtract off the neutron PEe and get [(1+1+1)-1]1.1=2.2Mev binding energy of the Deuteron. The nucleus is made of Deuterons. The odd neutron just adds an excess PEe.

The nucleus is somewhere you would expect the equipartition of energy to hold (recall it holds quite well in a hot gas). So for the electron at r_H between the protons in the deuteron the electric potential energy PEe, given those ultrarelativistic positrons in each proton, provides the highest escape speed in KE =½mv^2 which in turn provides the ½kx^2 potential energy for the spring SHM model since the SHM also provides the same high speeds which you cannot exceed. Recall this same max ½kx^2 gives us $\hbar\omega_o$(½) in the SHM quantum model for the oscillation (model energy). From the equipartition of energy that oscillation energy equals the rotational energy so in the deuteron you have these three sources of binding energy. Since the PEe is about 1.1Mev then you have:
1.1+1.1+1.1= 3.3. We subtract 1.1 to get 2.2Mev binding energy for the deuteron. We subtract the 1.1 since we typically don't count the binding energy in the neutron by itself. If there is a dangling electron we have to add a 1.1 to the PEe.
We can continue this use of the equipartition of energy for larger and large nuclei which makes it just M(1.1+1.1+1.1))=energy for each deuteron in the nucleus.
Note we did not have the absurd assumptions of 1D and motion through a vacuum as in the shell model. The 1D arises from the electron motion between the two protons which also moves in a vacuum between the two protons. So we recreated the shell model without all its silly assumptions and know why it works!
10.6 Recall for J=1 we have $\psi \propto r\sin\theta \propto Y^1_1(\theta,\phi)$ double lobe $\psi^*\psi$ along the z axis: From equation 9.14 we find with these inputs that E=1867Mev (9.23)
The deuteron. The only stable lepton state in this theory so far are 2e and 3e at $r=r_H$ with the latter being internally unstable but regenerative through that particle (re)creation step above (fig6). Also if a second 3e object is nearby a $2P_{1/2}$ state (sect.1.6, eq.1.2.7) the second proton picks up the electron making this state also regenerative and stable (Deuteron).
The two protons are stuck at the line of sight horizon $r_H \approx 2.88X10^{-15}$m. Because of the ultrarelativistic motion in the transverse direction there is that Fitzgerald contraction down to

nearly a point (lepton, $S_{1/2}$ states) allowing Maxwell's equations to again be used and also showing we can use +e+e-e=+e charge for the center of each proton. A Gaussian pillbox can then be defined obtaining the usual ke^2/r potential energy for each central positive e. Define $r=2.88/\sqrt{2}$. So the average distance to the central Deuteron electron from all 3 electrons is $(r\sqrt{2}+r\sqrt{2}+r)/3=(2\sqrt{2}r+r)/3=2.6=r_H$'. Tabulated D charge radius=$2.128\text{X}10^{-15}$ m$\approx r_H$. Note the middle electron is also at $2r_H/2=r_H$ since it has side to side wobble. From the equipartition of energy PE_e=SHM so potential energy is PE=SHM +PE_e so =$2PE_e$ and PE is provided by both protons on the central electron potential energy $e^2/r_H+e^2/r_H$ between the electron and 2 protons is $PE_e=2e^2/r_H$ and so for both protons $PE=2e^2/r_H$ +SHM=$PE_e+PE_e=4e^2/r_H$.



Electron at r_H
The equation used here is the iterated **new pde** eq.2 (2nd derivative with eq.10.8.1) with SHM approximation of bond vibration spring potential energy with $PE=2ke^2/r_H=\frac{1}{2}kx_o^2=p^2/2m=\hbar\omega_o/2$ with 3D spherical harmonics with rotational energy $[\hbar^2/(2I)](L(L+1))=[\hbar^2/(2mr^2)](L(L+1))=[\hbar^2c^2/(2mc^2r^2)](L(L+1))=[\hbar^2c^2/(\hbar\omega r^2)](L(L+1))=[\hbar c^2/((c/r)r^2)](L(L+1))=[\hbar c/r](L(L+1))=\hbar\omega_o(L(L+1))$. Given $\kappa_{00}=1-\Delta\varepsilon-r_H/r$. at $r=r_H$ (where the electron is located here). So from Ch.8 Energy=$1/\sqrt{\kappa_{00}}$ then $m=1/\sqrt{\Delta\varepsilon}$ in that in $[\hbar^2/(2mr^2)](L(L+1))$ then $m=1/\sqrt{\Delta\varepsilon}$. So $[\hbar^2/(2mr^2)]$=1.2Mev $=\hbar\omega_o$.
The 3D components of the SHM tensor $A_{ij}=(1/(2m))(p_ip_j+m^2\omega^2x_ix_j)$ and components of L satisfy Poisson bracket relations SU(3). So by including as a perturbation the rotation, the 3D SHM version gives SU(3) symmetry in the S derived from those A_{ij} (Herbert Goldstein, 'Classical Mechanics' 2nd edition, pp.425) which holds in both the classical and QM case then (So we have just explained the origin of the adhoc QCD gauged alternative to this nuclear physics.)
Bond Potential Energy: Electrostatic&Magnetic
The two ultrarelativistic positrons in each of the two protons $2P_{3/2}$ at $r=r_H$ are behaving like a ultrarelativistic cloud in the ultrarelativistic virial theorem from the perspective of the central electron in the deuteron so their potential energies are multiplied by 2. Alternatively the B field of the proton is 10^{12}T making the spin-orbit interaction potential energy the same at r_H as the electrostatic potential energy $LS=a_o^2(1/r)(\partial V/\partial r)(S\bullet L)=r_Hke^2/r_H^2(s*L)$ with LS_o=1,2,3..,. So for two protons with a electron in between at $r=r_H$, using the conservation of energy, the total smallest Potential Energy (for electron between 2 protons):
$PE=2ke^2/r_H+2ke^2/r_H=2(\frac{1}{2})kx_o^2$ (2 springs)=2.047Mev (of the Deuteron in eq.,10.8.1 counting both electrostatic and LS energy together. But from the conservation of energy the smallest potential energy $PE+KE=E_o$ also equals the largest kinetic energy $\frac{1}{2}kx_o^2=p^2/2m=\hbar\omega_o=1$ with r_H the distance between the electron and the two protons $r_H=2.817\text{X}10^{-15}$m from big C section 4.

So the energy levels fill up like they do in the hydrogen atom. Eg., Spin½ Tritium and He3 fill the N=2, 2P state for example.

Equipartition of Energy

So there are then simple rules to follow for finding nuclear binding energy. They come out of the new pde and use the conservation of energy. Use equipartition of energy.

1) Number of bonds gives number of PE+LS (1PE=1.11Mev). LS=1 for PE=1.

2) LS=PE except if extra electron

3) Mħω(N+D/2) equally distributed among all bonds. N is SHM quantum number, M dimension. Equipartition of energy between Eosc , PE and LS.except (when extra electron).

4) subtract neutron number since binding energy does not include them.

1.11XN= Mev

10.7 Details of Finding Binding Energies:

Deuterium. P-e-P Note PE plus LC. Subtract 1neutron+1p

$E=E_{osc}$ +PE+LS=1+1+1 =3. 3-1 =2, 1.11X2=**2.2** Mev

Neutron is then ½ Deuteron (since we then dropped $2P_{3/2}$).:3/2=1.5Mev

>>

He3. PE=3 so P-e-P

3+3+3=9, 9-2=7, 7X1.11=**7.6** Mev P

Tritium. Extra electron **so** e-P-e-P-e-P

3+4+3=10. 10-2=8, 8X1.11=8.6 Mev

>>

He4 PE=9 so

9+9+9=27. 27-2=25 25X1.11=27.75, 28/4=**7** P-N, magic#

Lithium. Note 2 more bonds so +2PE1. Subtract 3n and 3P

10+10+10=30. 30-3=27, 27X1.11=**30** 30/6=**5**

5 other 4nucleon 2P isotopes and isotones.eg.,

Carbon is 3 He4 -2P so 28+1=29, 3X29=87, 87/12=7.3.

Rest of even #nuclei multiples of He4 and D, odd number add 1.

Instead of N in ħω(N+½) going up as in the shell model the N in Nħω(1+½) and Nħω(2+2/2) goes up (as well as PE and L). So we still have the same spherical harmonics (S,P,D,F,G,..) states and the binding energy per nucleon is approximately constant from carbon onward.

Neutron

If the deuteron broke up most of the energy is be in the single proton 1.3MeVand the remaining 1/3 would be in the $2P_{½}$ state .78MeV. Add .511 for the electron and get 1.3Mev, the excess mass of a neutron above a proton.

Radius Of Proton: Average both the $\cos^2$ edge ((1/2)r) and axial width (near zero) (2.81713/2+0)/√2=.98F=r_p. But the spectroscopic and scattering methods that are used to measure r_p do not assume a singularity physics at 2.8F/2=r_{Hp}/2 so allow for the slightly larger radius in practice proton radius= r_p = 1.1F. The shell model sect.6.12 also requires this average radius and so has that inner and outer metric (sect.6.11, 3.1) as in sect 3.1 just like all solutions of eq. 2AI.

1,1,1 deuteron

3,3,3 He3

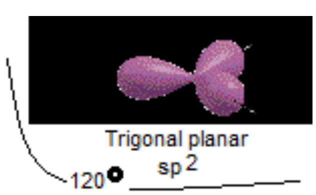
3,4,3 Tritium. (extra e)

9,9,9 He4

10,10,10 Lithium
30,30,30 C
We actually understand the nucleus of the atom from first principles this way.
For history of the alternative Shell model, also see study by A.E.S. Green in 1956).

10.8 High (>100Gev) Energy Solutions
Note at high energy the electrons in the $2P_{3/2}$ lobes (e.g., udd) would appear stationary, not averaged blob (density distributions). We are back to having single 'e' (not fractional "e") scatterers again. Thus at very high energies (>100GeV) single *e* (not fractional charge) should once again dominate scattering and we should no longer see these "jets" (which in the above context is mere P wave scattering) caused by higher probability emission in these trifolium lobe directions. Also note that r_H in κ_{oo} is a hard shell and therefore Van der Waals type liquid equation of state at >100Gev energies. Note by the way that the 6^{th} 2P resonance is observable at these energies.
Let <A'| represent the outgoing scattering wave immediately after a incident plane wave scatters off V. Let |A> be the $2P_{3/2}$ hyperon state for $r=r_H$ having the V. Thus at $r=r_H$ V itself will have the $2P_{3/2}$*$2P_{3/2}$ $=\psi^*\psi$ trifolium shape and thus commute with |A> since they constitute the same structure ($2P_{3/2}$ commutes with itself). So since V commutes with |A> **then <A' also is a $2P_{3/2}$ state** or we have <A'|V|A>=0 and so no scattering into such states. Thus a type of 'P wave scattering' results from an incident plane wave. Thus we explain the origin of the 'jets' that are otherwise ascribed to scattering off quarks.
Note that when the mean free path d during the interaction time is very short ($d<<(1/3)\ 2\pi r_H$) there is no more smearing between the $2P_{3/2}$ lobes and we have scattering off of independent point particles and the $2P_{3/2}$ state ceases to be relevant in the scattering and so the jets disappear. (jet quenching). Thus at extremely high energy the scattering is from charge e (not 1/3e) again and there are no more jets above top energy. LEP actually observed this effect just before it was shut down.

10.9 Charge Independence Of The Strong Interaction
It is well known that the strong interaction is approximately the same magnitude between Neutron-Proton, Neutron-Neutron and Proton-Proton pairs and thus is 'charge independent'. Also note our theory deals with electrons only which only has charge dependence if certain QM effects are ignored. But recall the orthogonality of S and P states as in <S|P>=0, <S|S>=1, <P|P>=1 given all the superscript and subscript substates (e.g.,S and m) are the same as well in the bra and kets. The ordinary nuclear interaction here is due to a covalent bond (sharing electrons) which is also a very strong interaction (bond) at $r=r_H$ and is dependent on the spin S and m state and not so much on the sign of the charge. Thus these QM (valence, spin) effects are very strong at $r=r_H$. Thus the charge independence of the strong interaction is really an S state *in*dependence and $2P_{3/2}$ state dependence at $r=r_H$ of a $2P_{3/2}$ structure interacting with an S state.



.
Fig.5

There are no gauges required in this theory and the QCD SU(3) is such a gauge. We have found that hadrons are excited states composed of these half integer spherical harmonic lobes.

Chapter 11 Scattering Cross-Sections

From the energy component of polarized representation of equation 8.1, 8.2: and using iterated (as in bosonic) section 9.13 $E^2=p^2c^2+m^2_oc^4$ =

$$E^2=\left(\frac{1}{\sqrt{\kappa_{oo}}}\right)^2=\frac{1}{1-\frac{r_H}{r}}=\frac{r}{r-r_H}=\frac{r}{r-r_H}-\frac{r-r_H}{r-r_H}+1=\frac{r_H}{r-r_H}+1=V+k \qquad (10.8.1)$$

Note the resemblance of $E^2=p^2c^2+m^2_oc^4$ to the Schrodinger equation if the $E^2=k^2+1/(r-r_H)+1$ of equation 10.8.1 is substituted into it. We interpret this equation as representing a bounded volume with energy E=V+k therefore allowing us to use that V in the usual Gauge theory method and so substitute it into the ordinary Dirac equation as gauge force. term. So we use $1/(r-r_H)$ instead of 1/r. in the Dirac equation S matrix.

We use the equation 4.1 source and proceed in the usual way of Bjorken and Drell (here $1/r\rightarrow 1/(r-r_H/2)$ to construct the one vertex S matrix for the new Dirac equation 9. Recall the ½ came from the square root in equation 4.1. Thus the k in the integrand denominator is found from the result of our $V=-1/(r-r_H/2)$ potential in equation 10.8.1 instead of the usual Coulomb potential 1/r in the large r limit (so a free electron otherwise):

$$S_{if}\equiv iZ\frac{1}{V}\sqrt{\frac{m^2}{E_fE_i}}\bar{u}(p_f,s_f)\gamma^o u(p_i,s_i)\int_0^\infty\frac{e^{i(p_f-p_i)x}}{r-r_H}dx^4\equiv if(u)\int_o^\infty\frac{e^{i(p_f-p_i)x}}{r-r_H}dx^4 \qquad (16.5)$$

rescaling $r\rightarrow r'+r_H=r$ and $t\rightarrow t'+(r_H/c)\equiv t$ to minimize the resonance energy in p_f-p_i. We then obtain:

$$S_{if}\equiv iZ\frac{1}{V}\sqrt{\frac{m^2}{E_fE_i}}\bar{u}(p_f,s_f)\gamma^o u(p_i,s_i)e^{ir_Hq}\int_0^\infty\frac{e^{i(p_f-p_i)x}}{r}dx^4\equiv if(u)e^{iqr_H}\int_o^\infty\frac{e^{i(p_f-p_i)x}}{r}dx^4$$ For so:

$$S_{if}\equiv if(u)\left[\int_0^\infty\frac{e^{i(p_f-p_i)(x'-r_H/2)}}{|x'|}dx^4-\int_0^\infty\frac{e^{i(p_f-p_i)(x'+r_H/2)}}{|x'|}dx^4\right]\approx if(u)e^{i(r_H/2)q}\left(\int_0^\infty\frac{e^{i(p_f-p_i)(x')}}{|x'|}dx'^4-2\pi(r_H)^3\right)$$

(10.8.6)

Note that $\bar{u}(p_f,s_f)\gamma^o u(p_i,s_i)=(1-\beta\sin^2\frac{\theta}{2})$=Mott scattering term with the $e^{i(rH/2)q}$ our resonance term. The other left side coefficients and reciprocal |x| part of S_{ij} comprise the well known Rutherford scattering term $d\sigma/d\Omega=[(Z_1Z_2e^2)/(8\pi\varepsilon_o mv_o^2)]^2\csc^4(\phi/2)=1.6\times10^4(\csc(\phi/2)/v_o)^4$. (Note that equation 10.8.6 applies to the $2P_{1/2}$-$2P_{3/2}$ state electron-electron interaction (i.e., neutron) below). Here $p_f-p\equiv q$. Note in equation 10.8.6 the factor $ie^{ikq}=i(\cos kq+i\sin kq)$**.** Here we find the rotational resonances at the $2P_{3/2}$ $r=r_H$ lobes associated with maximizing the imaginary part which is icoskq to obtain absorption scattering (at $kq=\pi$), which here will then be the masses exchanged in inverse beta decay. Also a solution to the Dirac component is always a solution to equation 14.1 (but not vice versa) if we invoke an integer spin in this resonance term. Here also the p part uses the old De Broglie wave length to connect to the $p=h/\lambda$. In that regard recall that $h\nu/c=h/\lambda=p$ and for a

DeBroglie wave fundamental harmonic resonance we have $\lambda_{rot}=2\pi r$ for a stationary particle of **spin 1**=L (ambient E&M field source gives L=1 De Broglie).
Coulomb scattering of electrons, taking account spin-spin scattering

$$.\frac{d\sigma}{d\Omega}=\frac{4Z^2\alpha^2m^2}{2|q|^4}Tr\gamma_o\frac{(p_i+m)}{2m}\gamma_o\frac{(p_i+m)}{2m}$$

.

$$\frac{d\sigma}{d\Omega}=\frac{Z^2\alpha^2}{4p^2\beta^2 sin^4(\theta/2)}\left(1-\beta^2 sin^2\frac{\theta}{2}\right)$$

Mott scattering, relativistic correction to Rutherford scattering
Ultrarelativistic electron scattering: Electron rest mass m neglected.

$$\frac{d\sigma}{d\Omega}=\frac{\alpha^2}{4E^2}\left(\frac{(cos^2(\theta/2))-(q^2/(2M^2))(sin^2(\theta/2))}{(sin^4(\theta/2))(1+(2E/M))sin^2(\theta/2)}\right)$$

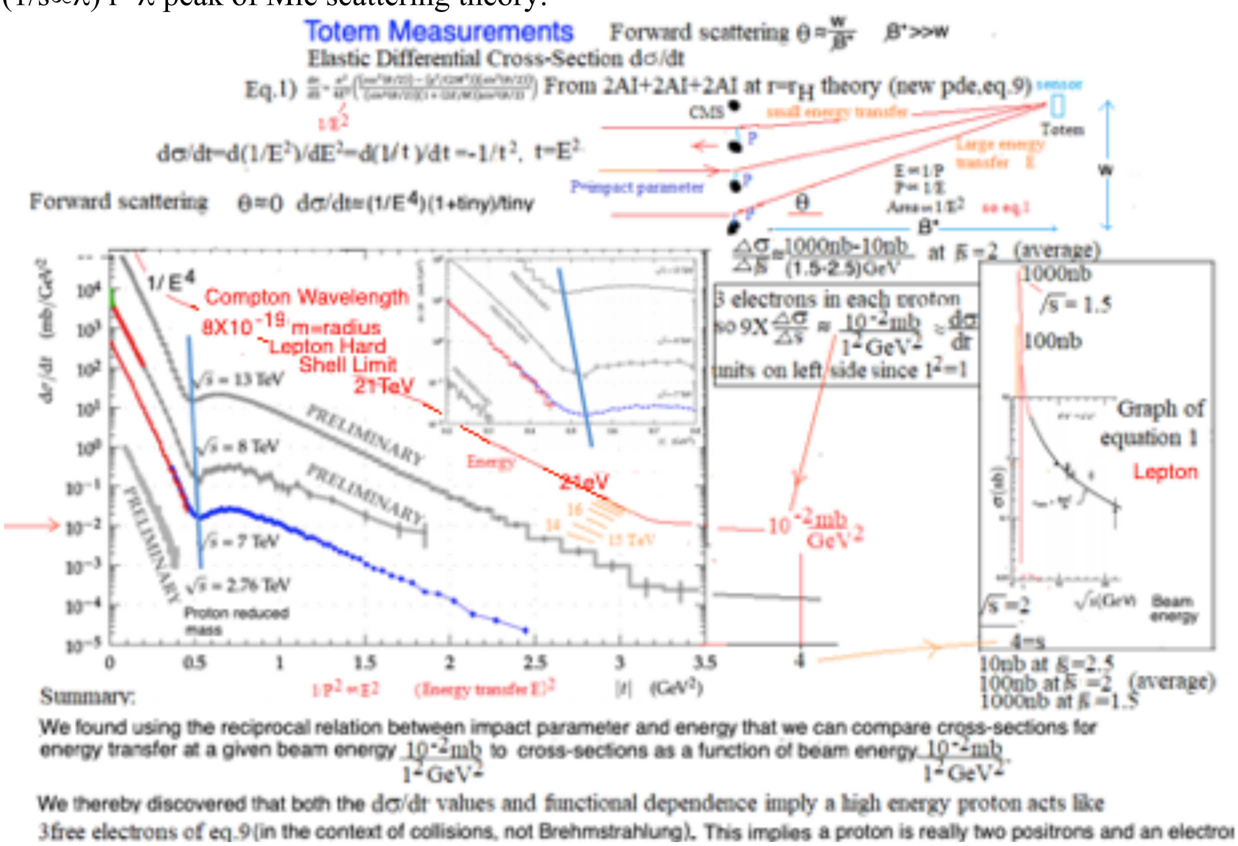
$$\frac{d\sigma}{d\Omega}=\frac{\alpha^2}{4E^2}\left(\frac{(cos^2(\theta/2))-((q^2/(2M^2))sin^2(\theta/2))}{((sin^4(\theta/2)))(1+(2E/M)sin^2(\theta/2))}\right) \quad (10.8.7)$$

$m/E<<1$, $m^2\rightarrow 0$, $q^2=(p_f-p_i)^2=-4EE'sin^2(\theta/2)$. Proton behaves like a heavy electron of mass M. $E\rightarrow 1/\sqrt{\kappa_{00}}=1/\sqrt{(1-\varepsilon-\Delta\varepsilon-r_H/r)}$.
For forward scattering $\theta\approx w/\beta^*\approx 0$ in $sin^2(\theta/2)<<1$ in the below figure 6. So $d\sigma/d\Omega=d(1/E^2)/dE^2(1+tiny)/tiny=((d(1/t)/dt)(1+tiny)/tiny=-(1/t^2)(1+tiny)/tiny$.
$t=E^2$=(energy transfer)^2.
Ultrarelativistic dependence of 10.8.7 new pde electron differential cross-section on $1/E^2$. E=energy. Recall in this theory this should also be the energy dependence of ultrarelativistic proton-proton scattering since protons are made of electrons (in my work) and at very high energies(E>>150GeV) the electron cloud binding energies in the proton don't matter anymore (that Paschen back binding energy starts becoming negligible at TeV energies): we have free electrons hitting free electrons once again.
For energy transfer t on left side graph (fig.6) $d\sigma/dt\propto d(1/E^2)/dE^2=d(1/t)/dt=-1/t^2$. $t=E^2$. Energy transfer $\sqrt{t}$ is proportional to 1/p. But p^2 is proportional to area which is then proportional to $1/\Delta E^2=1/t$. So σ=Area $\propto 1/\Delta E^2=1/t$. $\Delta\sigma/\Delta\sqrt{s}$=(1000nb-10nb)/1GeV. But this is my equation 1 in figure 6 (also eq.10.8.7) for near forward elastic scattering. For 1GeV$\approx 1\sqrt{s}$ then this $\Delta\sigma/(1)$ is a measure of $d\sigma/dt$ on the left side forward scattering elastic energy transfer graph since $1^2=1$. But square root energy transfer $\sqrt{t}$ in a scattering event for a beam at a specific energy (let's say at 13KeV) is also the abscissa of that big graph (on the left of the totem figure 6). So it is possible to get from total cross-section σ of electron scattering verse energy $\sqrt{s}$: $\sigma/\sqrt{s}$) to $d\sigma/dt$ vs t where t=(energy **t**ransferred)^2 at least at (literally) ONE (1GeV) energy transfer.
The fact that LHC totem measures elastic forward scattering thereby made it possible to test this theory (eq.2, 1.11, new pde) at 13TeV (and $\sqrt{s}\approx 2$), the very highest energy particles that mankind can produce. I could estimate from LHC data the asymptotically infinite beam energy transfer (curve) energy (red line) and compare it with my own $\sigma/\sqrt{s}$ at $\sqrt{s}\approx 2$.From the graph of my equation 1 (10.8.7):
1000nb at $\sqrt{s}$=1.5GeV
100nb at $\sqrt{s}$=2GeV

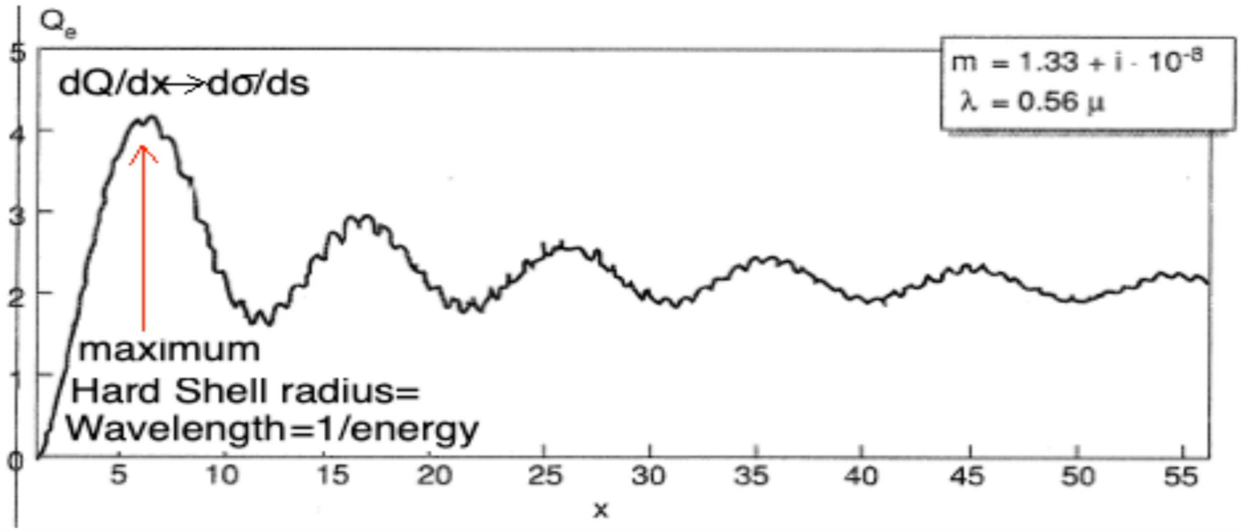
10nb at √s=2.5GeV
But that curve of eq.1 in figure 6 is for one eq.2 electron scattering off of one equation 2 (new pde) electron. Since there are 3 such electrons in each of the two protons you must multiply by 9 to get dσ/dt.
On my QED graph of my eq.1 had σ≈100nb at about 2≈√s. So multiply by 9 and get Δσ/Δs≈ (1000nb-10nb)/((1.5-2.5)√s)=10^{-3}mb/1GeV. But 1^2 =1 and there are 3 electrons per proton so we multiply by 2: 9X10^{-3}mb/1^2GeV^2≈10^{-2}mb/1^2GeV^2 which is sitting in approximately the same t≈2 spot on the left side dσ/dt vs t graph of Fig.6.
So we proved from the data that a ultrarelativistic proton-proton scattering event (~13TeV) is equivalent to 6 free electrons scattering off each other with the electrons obeying (2AI) equation 9, the new pde. Thus the hadron theory that should be used is 2+2+2 at $r=r_H$, not quark theory. Note also the cusp is at the proton reduced mass here. It is where (~.5GeV) binding energy must be added to break the electrons apart in the head on collision which takes away from the elastic scattering energy transfer. So we must apply this theory at much higher energies (eg.,√s≈2). Quark theory (QCD) implies some kind of exponential dependence which is not seen in this scattering data.

Hard Shell Scattering Peak Of dσ/ds Implies Protons Made of Electrons, not Quarks

The electron radius at 2.8X10 $^{-15}$(m_e/m_t)=8.1X10^{-19}m provides the hard shell cross-section limit. For colliding beams we have an additional factor of 2 here. 2($m_\tau+m_\mu$)/m_e)m_p= 6.91347TeV. There 3 are electrons in the proton so the proton energy is 3X6.913Tev=20.74TeV≈21TeV. So the dσ/ds should level off at proton energy 21TeV. This is in analogy with the Q=σ/πr^2∝dσ/ds (1/s∝λ) r=λ peak of Mie scattering theory.



Analogy to Mie scattering



Extinction efficiency (Q_e) as a function of diffraction parameter x (= 2πr/λ).
Analogy of Mie scattering with $Q=\sigma/\pi r^2$. Here the lepton hard shell is at $r=2X10^{-19}$m. Note analogy of leveling off of dσ/ds λ=r (i.e.,x=6) as at x=21TeV for LHC.

Meson Multiples

"tetra quarks" are merely two mesons bound together! They can bind together more deeply if the components of the mesons themselves are bound individually to the components of the other meson giving more mass, section 8.11.

In this theory (DavidMaker.com, Ch.9-10) this is called singlet and doublet states with one bound with more binding energy than the other for those heavy upper 2P Paschen Back states. So these look like heavy and light tetraquark states but they are not, they are merely two types of meson binding states. You could predict the energies from the Paschen Back effect associated with those large plate fields, section 8.11.

References

Pugh, Pugh, *Principles of Electricity and Magnetism*, 2nd Ed. Addison Wesley, pp.270
Bjorken and Drell, *Relativistic Quantum Mechanics,* pp.60
Sokolnikoff, Tensor Analysis, pp.304

11.1. W Compton Wavelength Region

Recall in appendix A m_e Source Term at $r=r_H$ Inside Angle C.
Analogously from **2AC** we get with the eq.3 doublet ε±ε the Proca equ (3*) neutrino and electron Δ ε* at $r=r_H$. As in sect.6.13 in κ_{00} we normalize out the muon ε. So we are left with the electron Δε in $\kappa_{00}=1-[\Delta\varepsilon/(1\pm2\varepsilon)]+[r_H(1+((\varepsilon\pm\varepsilon)/2))/r]$ from the two above rightmost (Proca) diagrams. So Source = $E_{ZW} = \frac{1}{\sqrt{\kappa_{00}}} = \frac{1}{\sqrt{1-\frac{\Delta\varepsilon}{1\pm2\varepsilon}-\frac{r_{He}}{r}(1+(\varepsilon\mp\varepsilon)/2)}} \approx \frac{1}{(1\pm\varepsilon)\sqrt{\Delta\varepsilon}}, at\ r = r_{H_e}$ + is for Z and – is for W. So W (right fig.) is a single electron Δε+ν perturbation at $r=r_H=\lambda$ (since m_e ultra relativistic): So $H=H_o+m_ec^2$ inside V_w. $E_w=2hf=2hc/\lambda$, $(4\pi/3)\lambda^3=V_w$. For the two leptons $\frac{1}{V^{1/2}} = \psi_e = \psi_3, \frac{1}{V^{1/2}} = \psi_\nu = \psi_4$. Fermi 4pt=

$$2G\iiint_0^{r_W}\psi_1\psi_2\psi_3\psi_4\,dV = 2G\iiint_0^{r_W}\psi_1\psi_2\frac{1}{V^{1/2}}\frac{1}{V^{1/2}}V$$

$$= 2\iiint_0^{r_W}\psi_1\psi_2 G \equiv \iiint_0^{V_W}\psi_1\psi_2(2m_ec^2)dV_w = \iiint_0^{V_W}\psi_1(2m_ec^2)\psi_2 dV_w \quad (A3)$$

What is Fermi G? $2m_ec^2(V_W) = .9X10^{-4}Mev\text{-}F^3 = G_F$ **the strength of the weak interaction**.

Derivation of the Standard Model But With No Free Parameters

Since we have now derived M_W, M_Z, and their associated Proca equations , m_μ,m_τ,m_e, etc.,Dirac equation figure 2 part.1), G_F, ke^2, Bu, Maxwell's equations, etc. we can now set up a Lagrangian density that implies all these results. In thisFormulation $M_z=M_W/\cos\theta_W$, so you find the Weinberg angle θ_W, $g\sin\theta_W=e$, $g'\cos\theta_W=e$; solve for g and g', etc., We will have thereby derived the standard model from first principles (i.e.,postulate1) and so it no longer contains free parameters!

Thus we have the interaction ε operating in W radius using the doublet of Ch.3.

In general then we have obtained an ortho triplet state here since we are merely writing the Clebsch Gordon coefficients for this addition of two spin ½ angular momentums:

|½,½,0,-1>,.. |½, ½,0,0>,..|½,½,,0,1>,.. or +W Z_o, -W.

Anyway, this small S matrix involves the neutrino and so can allow spin 1/2 neutrino emission jumps instead of just the usual E&M spin 1 jumps. 100km/sec metric quantization translates to a neutrino rest mass of .165eV.

11.2 Excited Z States

Put m_e in Equation 6.4.1

The beautiful thing to be noted here is that for the doublet resonance with the $2P_{3/2}$ lobe at $r=r_H$ that minimizes energy you get the spin 1 W and Z and the value of the Fermi G! We have also shown that this doublet interaction corresponds to the exchange of massive spin 1 particles (recall spin ½ s forbidden by that j-1/2 factor).

11.3 Probability for $2P_{3/2}$ Giving One Decay 1S Product at $r\approx r_H$ In W Region

In equation 4.12 we note that invariance over 2π rotations using $(1+2\varepsilon)d^2\theta$ does not occur anymore thus seemingly violating the conservation of angular momentum. To preserve the conservation of angular momentum the additional angle ε must then include its own angular momentum conservation law here meaning intrinsic spin½ angular momentum in the S state case and/or isospin conservation in the $2P_{3/2}$ case at $r=r_H$. In any event we must also integrate to $C=\varepsilon$. Here we do the E&M component decay given by equation 3.2.

Plug in $S_{½} \propto e^{i\phi/2}$, $½(1\text{-}\gamma^5)\psi=\chi$ into the 4pt. interaction integral. In that regard note that the expectation value of γ^5 is proportional to v $\propto$ Heisenberg equation of motion derivative of $2P_{3/2}\propto e^{i(3/2)\phi}$. We integrate <lepton|baryon> over this W exchange region where we note (~1/100)F for 90Gev particle, so $dV=((1/100)F)^3)$=VolW. Also $ck_o=\varepsilon$=106Mev from section 2.1. From Ch.3 on the vacuum constituents e and ν we note that $\iiint d\tau$=Vol, χ is defined as the vacuum eigenfunction. Vacuum expectation sect.B2: Σ<|va_M>|ε|<vac_{M+1}|>=<| $\iiint\psi^*_\nu\varepsilon\chi_e dV$|>=<|Pot|>= εVolume of W. Recall also that appendix A implies that the W and the Z are composites. This application of eq.2 for example applies to the $2P_{½}$ -$2P_{3/2}$ electron-electron scattering state inside the neutron <Proton$2P_{3/2}$|Pot|Neutron$2P_{½}$ -$2P_{3/2}$>. Plug in $S_{½} \propto e^{i\phi/2}$, $½(1\text{-}\gamma^5)\psi=\chi$ Also we can get a weak, strangeness changing (second term below), decay from a $2P_{½}$-$2P_{3/2}$>m_p to the S state branch equation. eq.2 expectation values in the 4pt..

=Σ<lepton|vac>|ε|<vac|baryon> =Fermi interaction integral =$\int\int\psi_1{}^*\psi_2\psi_3k_oc\chi dV$= $\iiint\psi_1{}^*(\varepsilon\text{VolW})\chi dV$= $\iiint\psi_1{}^*(\varepsilon\text{VolW})\chi dV$. Also $dV=dAd\phi=Kd\phi$.

So the square root of the probability of being in the final state is equal to the Fermi integral= $\int\int\psi_1{}^*(Pot)\chi dV$ =$\int\int\psi_1{}^*\psi_2\psi\varepsilon\Delta V_W\chi dV$=

$$= \int K\left\langle e^{i\phi/2}\,|(\varepsilon\Delta V_W)|\,1-\left(\gamma^5 ie^{i(3/2)\phi}\right)\right\rangle dtcdV = \int K\left[\varepsilon\left(\frac{F}{100}\right)^3\right]\left\langle e^{i\phi/2}-\gamma^5 ie^{i4/2\phi}\right\rangle d\phi$$

$$\varepsilon VolW = \int K\left[\varepsilon\left(\frac{F}{100}\right)^3\right]\left\langle e^{i\phi/2}-\gamma^5 ie^{i4/2\phi}\right\rangle d\phi$$

$$= KG_F\int\left\langle e^{i\phi/2}-\gamma^5 ie^{i4/2\phi}\right\rangle d\phi = KG_F\left(\frac{2e^{i\phi}}{i}\Big|_0^{2\pi+C} - \frac{2\gamma^5 e^{i4\phi}}{i4}\Big|_0^{2\pi+C}\right) \qquad (10.8.7)$$

with <initial|c|final>^{2} ≈ transition probability as in associated production with the separate 2P proton ground state transition being the identity (ΔS=0). Factoring out the 2 and then normalizing 1 to .97 simultaneously normalizes the 1/4 to .24 in section 3.2. With this normalization we can set $\cos\theta_c$=.97 and $\sin\theta_c$ =.24. Thus we can identify θ_c with the *Cabbibo angle and we have derived its value.* We can then write in the weak current sources for hadron decay the **VA structure**: $|\cos\theta_C-\gamma^5\sin\theta_C|$. Thus with the above Cabbibo angle and this CP violation and higher order $(r_H/r)^n$ terms in section 3 we have all the components of the CKM matrix. Note we have also derived the weak interaction constant G_F here.

Given the role ε plays here in decay we find the expectation value of energy ε within the S matrix scattering region in chapter 10.

Recall from section 1.2 the possible mixing of real and imaginary terms in that energy coming out of that first order Taylor expansion. There we found the 1+x and 1-x solutions cancel and we could ignore the 1+1=2 term as it is still a flat metric.

Also there are still extra terms provided by the 'small' higher order r^2 terms in that Taylor expansion so that "higher and lower" than the speed of light mixed condition still can exist (for ΔG≠0. See end of section 4.6 and 10.8.6). In that regard note for the next higher order Taylor term at largest curvature $d^2(1/k_{rr})/dr^2$ is large negative and r^2 is positive implying a net negative term and therefore a neutral charge (see case 2, of section 19.6)! In that case the perturbative squared r term appears to overwhelm the rest since the lower order terms then cancel. Note from the above we put these neutral conditions also into that decay since net charge is zero in the Cabbibo angle derivation. This then appears to be the beta decay condition *where the neutrino (higher than c) and the electron, (lower than c), decay from this neutral particle condition* (bottom of section 10.8). The beginning $2P_{3/2}$ ground state still exists however in the respective Cabbibo angle calculation. Thus those real and imaginary terms coming out of that Taylor expansion provide the explanation for beta decay.

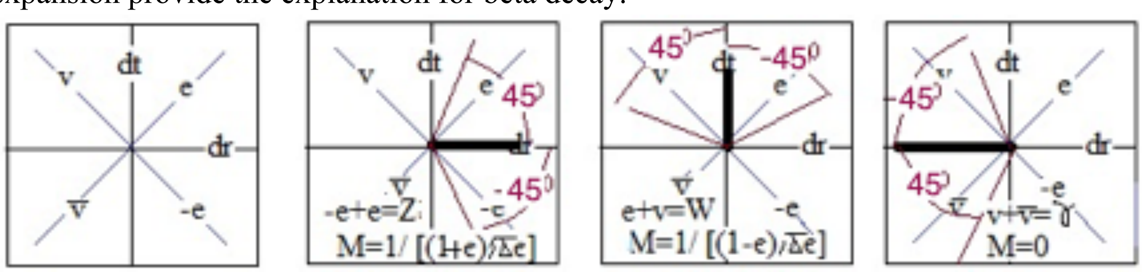


Fig.7

m_e Source Term Inside Angle

.See section 0.2 and B2 So W is a single electron Δε ,ν perturbation at $r=r_H$: $H=H_o+2m_ec^2$ inside V_w. $E_w=2hf=2hc/\lambda$, $(4\pi/3)\lambda^3=V_w$. For the two leptons $\frac{1}{V^{-1/2}}=\psi_e=\psi_3, \frac{1}{V^{-1/2}}=\psi_\nu=\psi_4$.

Fermi 4pt= G$\iiint_0^{V_W} \psi_1\psi_2\psi_3\psi_4\, dV = G\iiint_0^{V_W} \psi_1\psi_2 \frac{1}{V^{1/2}}\frac{1}{V^{1/2}} V$

$= \iiint_0^{V_W} \psi_1\psi_2 G \equiv \iiint_0^{V_W} \psi_1\psi_2 (2m_ec^2) dV_W$ (A3)

What is Fermi G? $2m_ec^2(V_W)/F^3 = .9X10^{-4}$Mev-$F^3 = G_F$ **the strength of the weak interaction**. Next we plug the respective ψs into ψ_1,ψ_2 in sect.B2. In that regard the expectation value of γ^5 is speed and varies with $e^{i3\phi/2}$ in the trifolium. The spin½ decay proton $S_{½} \propto e^{i\phi/2} \equiv \psi_1$, the original $2P_{1/2}$ particle is chiral $\chi=\psi_2\equiv½(1-\gamma^5)\psi=½(1-\gamma^5 e^{i3\phi/2})\psi$. Initial $2P_{1/2}$ electron ψ is constant. Plug these terms into equation B2 $= \iiint_0^{V_W} \psi_1\psi_2 (2m_ec^2) dV_W = \iint \psi_{S1/2}{}^*(2m_ec^2V_w))\chi dV=$

$$K\int \langle e^{\frac{i\phi}{2}}[\Delta\varepsilon V_W]\left(1-\gamma^5 e^{i\phi\frac{3}{2}}\right)\psi\rangle\, d\phi = KG_F\int\left\langle e^{i\phi/2} - \gamma^5 ie^{i4/2\phi}\right\rangle d\phi = KG_F\left(\frac{2e^{i\phi}}{i}\Big|_0^{2\pi+C} - \frac{2\gamma^5 e^{i4\phi}}{i4}\Big|_0^{2\pi+C}\right)$$

with VA <initial|c|final>^{2} ≈ transition probability as in associated production. Factoring out the 2 and then normalizing 1 to .97 simultaneously normalizes the 1/4 to .24 in Ch.3. With this normalization we can set $\cos\theta_c$=.97 and $\sin\theta_c$ =.24. Thus we can identify θ_c with the **Cabbibo angle and we have derived its value.**

$\Gamma=[G^2/(4\pi N)]\, m_i{}^{\alpha_i} P|^{m}|_l(x)|^2$, $x=\Sigma m_j/m_t$ Eg. $1/\tau_\mu=[G^2m_\mu{}^5/(192\pi^3)](1-m_e{}^2/m_\mu{}^2)^6$.

$r<r_H$ Application: Rotational Selfsimilarity With pde Spin: CP violation

12.1 Fractal selfsimilar spin

The fractal selfsimilarity with the spin in the (new) Dirac equation 2 implies a selfsimilar cosmological ambient metric (Kerr metric) rotation as well as in section 4.1. Thus there will be $2ds_tds_\phi$ rotation metric cross terms with the dt (without the square) implying time T reversal nonconservation and therefore CP *non*conservation since CPT is always conserved. We thereby derive CP nonconservation from first principles: **CP nonconservation is a direct consequence of the fractalness**. This adds another matrix element of magnitude ~1/3800 (sect.6.3) for Kaon decays thus adding off diagonal elements to the CKM matrix.

Or for Kerr rotator use

$$ds^2 = \rho^2\left(\frac{dr^2}{\Delta}+d\theta^2\right)+\left(r^2+a^2\right)\sin^2\theta d\phi^2 - c^2dt^2 + \frac{2mr}{\rho^2}\left(a\sin^2\theta d\theta - cdt\right)^2, \qquad (13.1)$$

$$\rho^2(r,\theta)\equiv r^2+a^2\cos^2\theta; \qquad \Delta(r)\equiv r^2-2mr+a^2$$, or

$ds^2 = dr^2 + dt^2 + 2dtdr + ..$

In a polarized state ($\theta = 0^\circ, 180^\circ$) in 25.3, 25.25 the off diagonal elements are proportional to $\phi=(\phi+c)e^{-C}$. Thus if the charge e is conjugated (C, e changes sign), if dr changes sign (P, parity changes sign) and dt is reversed (t reversal) then the ds quantity on the left side of equation 1.6 is invariant. But if dr (P) changes sign by itself, or even e and P together (CP) change sign then ds is not invariant and this explains, in terms of our fractal picture, why CP and P are not conserved generally. P becomes maximally nonconserved in weak decays as we saw in above. The degree to which this nonconservation occurs depends on the “a” (in eq.3.2.1) transfer <final lal initial> (equation 3.2) which itself depends on the how much momentum and energy is transferred from the S_{M+2} to the S_{M+1} fractal scales as we saw in this section. Recall chapter 5 alternative derivation of that new (dirac) equation pde (eq.2) **linearization of the Klein Gordon equation**(c=1, $\hbar$=1, m=1, eq.2):

$$\left(-\alpha_1 i\frac{\partial}{\partial x_1} - \alpha_2 i\frac{\partial}{\partial x_2} - \alpha_3 i\frac{\partial}{\partial x_3} + \beta\right)\left(-\alpha_1 i\frac{\partial}{\partial x_1} - \alpha_2 i\frac{\partial}{\partial x_2} - \alpha_3 i\frac{\partial}{\partial x_3} + \beta\right) = \qquad (13.2)$$

$$-\alpha_1^2\frac{\partial^2}{\partial x_1^2}-\alpha_2^2\frac{\partial^2}{\partial x_2^2}-\alpha_3^2\frac{\partial^2}{\partial x_3^2}+\beta^2+2\sum_{\mu=1}^{3}\sum_{\nu=1}^{3}\alpha_\mu\alpha_\nu\frac{\partial}{\partial x_\mu}\frac{\partial}{\partial x_\nu}+2\sum_{\mu=1}^{3}\beta i\alpha_\mu=-\frac{\partial^2}{\partial t^2}$$. This equals $=c^2p_1^2+c^2p_2^2+c^2p_3^2+m^2c^4=E^2$ if the off diagonal elements zero which is the condition used in the standard Dirac equation derivation of the α s and β. Note that the off diagonal elements $2\sum_{\mu=1}^{3}\sum_{\nu=1}^{3}\alpha_\mu\alpha_\nu\frac{\partial}{\partial x_\mu}\frac{\partial}{\partial x_\nu}+2\sum_{\mu=1}^{3}\beta i\alpha_\mu$ are equivalent to the off diagonal elements in equation 5.1 (and are corrections to 5.2 in fact) so *are not* zero for parity and CP NONconservation in this context (in a rotating universe). So in the context of the Dirac equation the CP violation term $e_s(dr)dt\rightarrow(dr/ds)(dt/ds)\rightarrow pE\chi$ (after division by ds^2). Thus CP violation goes up as the square (pE) of the energy (so should be larger in bottom factories). The section 13.2 below Cabbibo angle calculation (not rotation related however) is an example of how this method can give the values of the other terms in the CKM matrix. They arise from calculation of <Z> between higher order m harmonics.

This section is important in that we see that CP violation is explainable and calculable in terms of perturbative effects on the ambient metric (and therefore the Dirac equation) of a rotating universe with nearly complete inertial frame dragging (eq. A6 in the E&M form), CP violation doesn't need yet more postulates as is the case with the GSW model. In fact the whole CKM matrix is explainable here as a consequence of this perturbation.

Note the orientation relative to the cosmological spin axis is important in CP violation. Integration of the data over a 3 month time (at time intervals separated by a sidereal day) is going to yield different CP violation parameters than if integration is done over a year.

Miscellaneous

12.2 GIM Derivation

Recall in the GIM (Glashow, Iliopoulos, Maiami) hypothesis that u,d were a pair of left handed Fermion states as in V-A . $d'=d\cos\theta_c+s\sin\theta_c$, $s'=-d\sin\theta_c+s\cos\theta_c$ where θ_c is the Cabbibo angle. Thus u,d are paired, s,c are paired, b,t are paired and we have the V-A transitions.

Here we identify the new pde 2P state for $r=r_H$ has P_x, P_y and P_z states which split in energy due to that Paschen Back effect given those ultrarelativistic plates, into paired spin up and spin down states (P_x,P_x'), (P_y,P_y'),(P_z,P_z') analogous to the GIM (u,d),(s,c),(b,t). Here the spin orbit interaction (LS) coupling energy term is much stronger than the SS coupling term. So we have pairs of states J,M,M'> with P_x and P_y being orthogonal, except for those weak interaction V-A terms. The ds^2 to ds' transition is through the V-A term. Recall equation the 16.7 $|\int\chi_f{}^*G\chi_o\,dV|^2=$ =transitionprobability of a ds^2 to a ds. of eq.B2 ($\chi=.5(1-\gamma^5)\psi$ with ψ in ds^2, χ in ds) for V-A Cabibbo angle transitions (transitions inside P_X separately from P_Y and separately from P_z) where $|1|-|\gamma^5|$ replaces the $\cos\theta_c+\sin\theta_c$. So in analogy for transitions between P_X and P_Y $P_x'\cos\theta c+P_y\sin\theta_c=Px'$, $P_y'=-P_x'\sin\theta_c+P_y'\cos\theta_c$. This is a first principles understanding of GIM thereby allowing us to derive the electroweak cross-sections (WS).

Recall that dz=-1 ,0 solution to eq.2 for C=0 implies dr<0 at least for small C. (low noise). because -1 is on the real r axis.

12.3 Normed Division Algebra, Octonians, E8XE8 and SU(3)XSU(2)XU(1) Basis Change

Note from the above that the new pde fractal theory generated the electron 2AI with mass, the near zero mass left handed neutrino 1.12. Recall also from above the $\kappa_{oo}=\sqrt{(1-\varepsilon-r_H/r)}$. The W was generated from a nonzero ambient metric ε in that S matrix derivation part of the metric coefficient $\kappa_{\mu\nu}$.Interestingly that Normed Division Algebra (NDAR) on the real numbers (as in: $||Z_1||*||Z_2||=||Z|||$) from equation 1 implies that octonians (and thereby the *largest normal Lie group* E8XE8) are also allowed. Recall we have that SU(2) Lie group rotation for the 0° extrema imbedded in a E8XE8 rotation since one of its subgroups being SU(3)XSU(2)XU(1). This is the only subgroup we can use because it is the one that only contains that SU(2).

7.3 Eigenstates

Recall the $m_\tau=1$ was separable at 45° from the rest (of the eq.1.15 diagonal states) since ds is constant there for small rotations. So ds_τ can be normalized.
The B field rotations are here reciprocals of the rotations in the Mandelbulbs since $\kappa_{oo}=1-r_H/r$ and so $r_H/r\rightarrow\xi dr$ for B field motion given smaller radius r means high energy ξdr. So the *ortho* state is the smaller ε Mandelbulb eigenstate and the *para* state is the larger τ limacon Mandelbulb eigenstate.

Meta Theory Of Couplings In SM

From the 1.15 diagonal on the Mandelbrot set: $m=m_L=1+\varepsilon+i\Delta\varepsilon=m_\tau+m_\mu+m_e$.
$\mathbf{mv^2/r_H=qvB}$ (1)
$\mathbf{\pi r_H{}^2B=\Phi o}$ (2)
v=c. Solve Eq.1 and eq.2 for q:
$q=mc\pi r_H/\Phi_o$. (3)
The effect of the *E field lines coming* together by Fitzgerald contraction γ imply a force increase that can be realized by invoking an *effective* charge increase e→q'.or in V/dr'=Electric field with $r=r_H$ in $dr'^2=\kappa_{rr}dr^2=[1/(1-r_H/r)]dr^2$ (The charge e itself really does not change.).
For $\mathbf{m=m_\mu}$ =ε $2P_{3/2}$ state (So ultrarelativistic so E field line contraction.). From equation 3
q'= e, H→e^2 E&M for the Nth fractal scale, Gravity for the N+1th fractal scale.
For $\mathbf{m=m_\tau}$ $+m_\varepsilon$ as meson. $2P_{3/2}$ state (so ultrarelativistic). From equation 3:
q'=46e, H→$(46e)^2$ Strong Force.
For $\mathbf{m=m_e}$$=i\Delta\varepsilon+v$, v small, $2P_{1/2}$, $dr'^2=\kappa_{rr}dr^2=1/(1-r_H/r)dr^2$. So V/dr'=E small. From equation 3:
q'=ie/200, H→iq'V so $\psi(t)=e^{iiq'Vt}\psi(t_o)= e^{-q'Vt}\,\psi(t_o)$.
exponential decay with a force q'^2=40000X *smaller* than the E&M. Weak interaction.
dr' large allowing large uncertainty principle dr' for small nonrelativistic mass m_e in $(dr'\bullet m_ec)\geq\hbar/2)$. This occurs for small externally observed dr and m_ec in the $2P_{1/2}$ state and $1S_{1/2}$ state at $r=r_H$. But these are decay states (PartII Sect.7.3). Given these strength and decay parameters we can alternatively integrate over the r_c volume our W and Z particles to get the Fermi G 4pt coupling of weak interaction theory in the SM. W is then a virtual intermediary here. **So we just derived all 4 forces from that diagonal on the Mandelbrot set.**

Calculations: So for the Kerr mass ortho state (2nd Mandelbulb) $(a/r)^2=\varepsilon+\Delta\varepsilon$ (thus added to 1) at $r=r_H$, for (N+1): $m_\varepsilon v^2/r=qvB$ so $m_\varepsilon v/(qB)=(1-2\varepsilon)m_\mu c/qB=r$. Thus $(1-2\varepsilon)m_\mu c/q=rB=$ $(1-2\varepsilon)(1.883\text{X}10^{-28})(299792458)/(1.6022\text{X}10^{-19})=.3525(1-2\varepsilon)$
$\Phi o/(rB)=\Phi_o/[0.3525(1-2\varepsilon)]=B\pi r^2/(rB)=\pi r$.
$\mathbf{r_H}=1.359\text{X}10^{-15}(2)/[(.3526)\pi(1-2\varepsilon)]=2.805\text{X}10^{-15}\text{m}=\mathbf{e^2/m_ec^2}$ for 2P states (eq.7.1).