The relation of colour charge to electric charge

Dirac has shown how the Klein-Gordon equation can be factored into two linear parts using 4x4 Dirac gamma matrices. [Dirac, P.A.M., The Principles of Quantum Mechanics, 4th edition (Oxford University Press) ISBN 0-19-852011-5]

\[
(\partial^2 - m^2) I = (-i[sy^0\partial_t + r y^1\partial_x + gy^2\partial_y + by^3\partial_z] - w m I) [i[sy^0\partial_t + r y^1\partial_x + gy^2\partial_y + by^3\partial_z] - w m I]
\]

where \(r, g, b\) and \(s, w\) equal +1 or -1.

For leptons \(r, g, b\) all equal -1 and for quarks two of \(r, g, b\) are equal to +1 and the third equals -1. The signs are all negated for anti-particles as in the equation above.

When \(s = +1\), count the number of plus signs (say) for \(r, g, b\) which is 0 for leptons and 2 for quarks.

When \(s = -1\), count the number of minus signs (say) for \(r, g, b\) which is 3 for leptons and 1 for quarks.

For material particles \(r, g, b\) all equal -1 which is always true for leptons and true for three distinct quarks with \(r, g, b\) equal to -1 separately or a quark and an appropriate anti-quark.

Let \(\hat{y} = iy_0, y_0, y_1, y_2, y_3, y_4\) where \(y_0, y_1, y_2, y_3, y_4\) are vectors which anti-commute and where:

\[
y_i^2 = y_i^2 = -I \quad y_0^2 = y_0^2 = I
\]

Then: 
\[
y_0\hat{y} = \hat{y}y_0 \quad y_1\hat{y} = \hat{y}y_1 \quad y_2\hat{y} = \hat{y}y_2 \quad y_3\hat{y} = \hat{y}y_3 \quad y_4\hat{y} = \hat{y}y_4 \quad \hat{y}^2 = I
\]

Let:
\[
\hat{s} = \frac{1}{2}(1 + s \hat{y}) \quad \hat{r} = \frac{1}{2}(1 + r \hat{y}) \quad \hat{g} = \frac{1}{2}(1 + g \hat{y}) \quad \hat{b} = \frac{1}{2}(1 + b \hat{y}) \quad \hat{w} = \frac{1}{2}(1 + w \hat{y})
\]

Then:
\[
\hat{s}\hat{y} = \hat{y}\hat{s} \quad \hat{r}\hat{y} = \hat{y}\hat{r} \quad \hat{g}\hat{y} = \hat{y}\hat{g} \quad \hat{b}\hat{y} = \hat{y}\hat{b} \quad \hat{w}\hat{y} = \hat{y}\hat{w}
\]

A charged particle moving in an electro-colour-weak field will have its partial derivatives \(\partial_t, \partial_x, \partial_y, \partial_z\) modified by minimal coupling to become covariant derivatives \(\nabla_t, \nabla_x, \nabla_y, \nabla_z\). Thus:

\[
(\hat{s}y_0\nabla_t + \hat{r}y_1\nabla_x + \hat{g}y_2\nabla_y + \hat{b}y_3\nabla_z + \hat{w}y_4\nabla_w) \left(\hat{s}y_0\nabla_t + \hat{r}y_1\nabla_x + \hat{g}y_2\nabla_y + \hat{b}y_3\nabla_z + \hat{w}y_4\nabla_w\right)
\]

\[
= \hat{s}\nabla_t^2 - \hat{r}\nabla_x^2 - \hat{g}\nabla_y^2 - \hat{b}\nabla_z^2 + \hat{w}\nabla_w^2
\]

\[
+ \hat{s}\hat{w}y_0y_0(\nabla_t\nabla_w - \nabla_w\nabla_t)
\]

\[
+ \hat{s}y_0[\hat{r}y_1(\nabla_x\nabla_z - \nabla_z\nabla_x) + \hat{g}y_2(\nabla_y\nabla_z - \nabla_z\nabla_y) + \hat{b}y_3(\nabla_z\nabla_z - \nabla_z\nabla_z)]
\quad (= 0 \text{ for a neutrino })
\]

\[
+ \hat{w}y_4[\hat{r}y_1(\nabla_w\nabla_x - \nabla_x\nabla_w) + \hat{g}y_2(\nabla_w\nabla_y - \nabla_y\nabla_w) + \hat{b}y_3(\nabla_w\nabla_z - \nabla_z\nabla_w)]
\]

\[
+ \hat{r}\hat{g}y_1y_2\nabla_x\nabla_y + \hat{g}\hat{b}y_2y_3\nabla_y\nabla_z + \hat{b}\hat{r}y_3y_4\nabla_z\nabla_x + \hat{w}\hat{r}y_1y_4\nabla_t\nabla_w
\]

\[
= \hat{s}\nabla_t^2 - \hat{r}\nabla_x^2 - \hat{g}\nabla_y^2 - \hat{b}\nabla_z^2 + \hat{w}\nabla_w^2
\]

\[
+ \hat{s}\hat{w}y_0y_0R(\partial_t, \partial_w)
\]

\[
+ \hat{s}y_0[\hat{r}y_1R(\partial_x, \partial_z) + \hat{g}y_2R(\partial_y, \partial_z) + \hat{b}y_3R(\partial_z, \partial_z)]
\quad (= 0 \text{ for a neutrino })
\]

\[
+ \hat{w}y_4[\hat{r}y_1R(\partial_w, \partial_x) + \hat{g}y_2R(\partial_w, \partial_y) + \hat{b}y_3R(\partial_w, \partial_z)]
\]

\[
- \hat{r}\hat{g}y_1y_2R(\partial_x, \partial_y) - \hat{g}\hat{b}y_2y_3R(\partial_y, \partial_z) - \hat{b}\hat{r}y_3y_4R(\partial_z, \partial_x)
\]

where \(R(\partial\partial)\) is the Riemann Curvature Tensor in the \(\partial_x, \partial_y\) directions.

Gravity as curvature emerges from the interaction of the 5 bit electro-colour-weak charge with the electro-colour-weak field.