Generalization of equivalence principle (GEP)

Einstein looked with half closed eyes to reality

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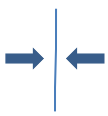
Abstract:

We generalized equivalence principle to connect between the field and its conjugate to find one single equation governed many equations in physics like Maxwell equations, Newton law, special and general relativity, schrodinger equation Klien Gordan equation, Dirac equation, mass energy equivalence,De Brogly relation and photo electric effect. It can be tested in many fields.

Principle of equivalence:

The rotation of conjugate field (antifield) in space time generates an entangled space time field and we cannot distinguish between the field that created by the rotation of antifield and the origin field, and vice versa.

Suppose two isolated frame works, Alice frame work and Bob frame work. If these two frame works are separated by brain, where the brain represents the O of the two frame works. If Alice measured particle A and send the measuring information to Bob ,where Bob find that A is identical to his particle B.



But if we construct third reference frame with Cindy, she says A and B are in anti-orientation, or $A = -B$.

If we let A and B entangled together. Now when we rotate A in space-time clockwise $\nabla \times A$, also B rotates, but in counterclockwise $-\nabla \times B$. Now the rotation of A generates anti A in Bob frame work and the rotation of B generates anti B in Alice frame work. But in Cindy frame work, anti B is equal to A and anti A is equal to B.

We can see that, rotation of A in Cindy frame work causes three processes,

1. - Rotation of B
2. Creation of A
3. Creation of B

If ψ the initial state of Alice particle and ϕ for Bob particle, and Θ for final state of Alice particle and Ξ for Bob particle. Now Alice write $\langle\Theta|\psi\rangle = \langle\psi|\psi\rangle$. And Bob write

$\langle\Xi|\phi\rangle = \langle\phi|\phi\rangle$ .In Cindy framework the situation is different, the physical predictions on the system follow from the two-particle probability amplitudes $\langle\Theta,\Xi|\psi,\phi\rangle = \langle-\phi,-\psi|\psi,\phi\rangle$ .therefore the physical probability amplitude of Alice particle is $\langle\Theta|\psi\rangle = \langle-\phi|\psi\rangle$, for Bob $\langle\Xi|\phi\rangle = \langle-\psi|\phi\rangle$.

Rosario and Giuseppe[(Quantum entanglement of identical particles by standard information-theoretic notions) Rosario Lo Franco, and Giuseppe Compagno. arXiv:1511.03445v4 [quant-ph] 6 Mar 2016], show as a natural creation of maximally entangled states is possible just by moving two identical particles with opposite pseudospin into the same site, as recently confirmed in a recent experiment with ultracold atoms [A. M. Kaufman, B. J. Lester, M. Foss-Feig, M. L. Wall, A. M. Rey, and C. A. Regal, Nature (2015), doi:10.1038/nature16073.]

If we denote Alice frame work by the field and Bob, by antifield, then the relation between the field and its antifield is:

$$\left(\vec{\nabla}\times\ \right)_F = -\left(\hat{\hat{F}}\vec{\nabla}\cdot\ + \frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\ \right)_{AF} \qquad (1)$$

Where $\left(\vec{\nabla}\times\ \right)_F$ transforms like pseudovector.

$$\left(\vec{\nabla}\times\ \right)_{AF} = \left(\hat{F}\vec{\nabla}\cdot\ + \frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\ \right)_F \qquad (2)$$

And $\left(\vec{\nabla}\times\ \right)_{AF}$ transforms like a polar vector**.**

$\hat{F}$ and $\hat{\hat{F}}$ are unit vectors of the field and antifield respectively.

Where the subscription F refers to field and AF refers to antifield.

Compare with Helmholtz decomposition theorem, $\vec{F} = -\vec{\nabla}\varphi + \vec{\nabla}\times\vec{A}$

We find F and φ in the same field and A in antifield.

Where the longitudinal field is $\vec{F_l} = -\vec{\nabla}\varphi$ and the transverse field is $\vec{F_t} = \vec{\nabla}\times\vec{A}$, the above equations satisfy Helmholtz decomposition theory if we compose the field and its antifield.

This means if the field is longitudinal field its antifield becomes transverse field and vice versa.

Equivalence principle from Quaternion:

The multiplication rule for the two quaternions, $\overleftrightarrow{A} = (a_0, \vec{A})$ and $\overleftrightarrow{B} = (b_0, \vec{B})$ is given by

$$\overleftrightarrow{A}\,\overleftrightarrow{B} = \left(a_0 b_0 - \vec{A}\cdot\vec{B}, a_0\vec{B} + \vec{A}b_0 + \vec{A}\times\vec{B}\right) \qquad \text{a}$$

Therefore, the ordinary continuity equation can be written in a quaternionic continuity equation by defining the operator $\overleftrightarrow{\nabla} = (\widetilde{\nabla}, \vec{\nabla})$ and current $\overleftrightarrow{J} = (\tilde{J}, \vec{J})$,

$$\overleftrightarrow{\nabla}\overleftrightarrow{J} = (\widetilde{\nabla}\tilde{J} - \nabla\cdot\vec{J}\ ,\ \widetilde{\nabla}\vec{J} + \vec{\nabla}\tilde{J} + \vec{\nabla}\times\vec{J}) \qquad \text{b}$$

If we write (2) in one equation

$$\overleftrightarrow{\nabla}\overleftrightarrow{J} = \widetilde{\nabla}\tilde{J} - \nabla\cdot\vec{J} + \ \widetilde{\nabla}\vec{J} + \vec{\nabla}\tilde{J} + \vec{\nabla}\times\vec{J} \qquad \text{c}$$

If we apply the transformation $\widetilde{\nabla}\tilde{J} \to \nabla\cdot\vec{J}$ and $\widetilde{\nabla}\vec{J} \to -\vec{\nabla}\tilde{J}$ to equation (c),we find

$$\overleftrightarrow{\nabla}\overleftrightarrow{J} = \vec{\nabla}\times\vec{J} \qquad \text{d}$$

But $\overleftrightarrow{\nabla}\overleftrightarrow{J}$ is Lorentz invariant. That means $\overleftrightarrow{\nabla}\overleftrightarrow{J} = 0$.which implies the rotation $\vec{\nabla}\times\vec{J} = 0$.but we stated in GEP the rotation of the field caused rotation of its conjugate, as $\widetilde{\nabla}\times\tilde{J}$.

Therefore, we find the quaternion bracket missed this term. So, equation (d) becomes, $\overleftrightarrow{\nabla}\overleftrightarrow{J} = \vec{\nabla}\times\vec{J} + \widetilde{\nabla}\times\tilde{J} = \vec{\nabla}\times\vec{J} - \vec{\nabla}\times\vec{J} = 0$

Therefore , the quaternion bracket should contain this additional term,

$$\overleftrightarrow{\nabla}\overleftrightarrow{J} = (\widetilde{\nabla}\tilde{J} - \nabla\cdot\vec{J}\ + \widetilde{\nabla}\times\tilde{J}\,, \widetilde{\nabla}\vec{J} + \vec{\nabla}\tilde{J} + \vec{\nabla}\times\vec{J}) \qquad \text{e}$$

Arbab,in (A quaternionic unification of electromagnetism and

hydrodynamics)[arXiv:1003.0070v2 [physics.gen-ph] 6 Apr 2010] found a quaternionic continuity equation as

$$\overleftrightarrow{\nabla}\overleftrightarrow{J} = \left[-\left(\nabla\cdot\vec{J} + \frac{\partial\rho}{\partial t}\right), \frac{i}{c}\left(\frac{\partial\vec{J}}{\partial t} + \vec{\nabla}\rho c^2\right) + \vec{\nabla}\times\vec{J}\right] \qquad \text{f}$$

Where, $\overleftrightarrow{\nabla} = \left(\frac{i}{c}\frac{\partial}{\partial t}, \vec{\nabla}\right)$ and $\overleftrightarrow{J} = (i\rho c, \vec{J})$

We can notice the complex second term $\frac{i}{c}\left(\frac{\partial\vec{J}}{\partial t} + \vec{\nabla}\rho c^2\right) + \vec{\nabla}\times\vec{J} = 0$,represents the rotation of the field to generate antifield as we stated in GEP. Now if we add the rotation of the antifield to the quaternion, we find the second rotation,

$-\hat{F}\left(\nabla\cdot\vec{J}+\frac{\partial\rho}{\partial t}\right)+\tilde{\nabla}\times\tilde{J}=0$. We multiply the scalar with unit vector to compatible the terms. The quaternionic continuity equation becomes,

$$\tilde{\vec{\nabla}}\tilde{\vec{J}}=\left[-\hat{F}\left(\nabla\cdot\vec{J}+\frac{\partial\rho}{\partial t}\right)+i\left(\vec{\nabla}\times\vec{J}\right),\frac{i}{c}\left(\frac{\partial\vec{J}}{\partial t}+\vec{\nabla}\rho c^2\right)+\vec{\nabla}\times\vec{J}\right]=[0,0] \qquad \text{g}$$

Where $\tilde{\nabla}\times\tilde{J}\equiv i\left(\vec{\nabla}\times\vec{J}\right)$

So, we can recognize that, the quaternion product plus anti-rotation represents the complete description of field/antifield rotation and proofs GEP.

Maxwell equations:

If we define a charge with $q=(q,\tilde{q})$, where q is the real charge and $\tilde{q}$ is anticharge , therefore we have four types of charges positive,antipositive,negative and antinegative.

The effective charge is a complete set of charge and anticharge, positive charge is $(+,\tilde{+})$ and negative charge is $(-,\tilde{-})$. This generates electric field with $\left(\vec{E}_e,\tilde{E}\right)$ where $\vec{E}_e$ the electric field vector and $\tilde{E}$ the antielectric field vector. Also they are entangled.

We can check the relation to write Maxwell equations,

$$\left(\vec{\nabla}\times\ \vec{E}_e\right)_R=-\left(\hat{\tilde{F}}\,\vec{\nabla}\cdot\tilde{E}+\frac{1}{c}\frac{\partial\tilde{E}}{\partial t}\right)_I=-\frac{\partial\vec{B}}{\partial t} \qquad (3)$$

$$\left(\vec{\nabla}\times\ \tilde{E}\right)_I=\left(\hat{F}\,\vec{\nabla}\cdot\vec{E}_e+\frac{1}{c}\frac{\partial\vec{E}_e}{\partial t}\right)_R=\frac{\vec{\rho}}{\epsilon_0}+\frac{1}{c}\frac{\partial\vec{E}_e}{\partial t} \qquad (4)$$

The left side of (4) is $c\left(\vec{\nabla}\times\vec{B}\right)$,we find

$$\vec{\nabla}\times\ \vec{B}=\mu_0\vec{J}+\frac{1}{c^2}\frac{\partial\vec{E}_e}{\partial t} \qquad (5)$$

Where $c^2=\frac{1}{\mu_0\epsilon_0}$ and $\left|\vec{V}\right|=c$.

Can we define the electric and magnetic field with one vector and its antivector?

When we define the electric and magnetic field with one vector $\vec{A}$ and it's antivector $\tilde{A}$ as:

$\vec{E}=-\vec{\nabla}\times\tilde{A}$ and the antielectric field with $\tilde{E}=\vec{\nabla}\times\vec{A}$,the magnetic field can be defined as $\vec{B}=\frac{\tilde{E}}{|\vec{V}|}$.

By getting the rotation and divergence of the electric field and the antielectric field, we find,

$$\vec{E} = -\vec{\nabla} \times \tilde{A} = -\left(\hat{F}\,\vec{\nabla} \cdot \vec{A} \,+\, \frac{1}{|\vec{V}|}\frac{\partial \vec{A}}{\partial t}\right) \qquad (6)$$

$$\vec{B} = \frac{\tilde{E}}{|\vec{V}|} = \frac{1}{|\vec{V}|}\left(\vec{\nabla} \times \vec{A}\right) = \frac{-1}{|\vec{V}|}\left(\hat{\hat{F}}\,\vec{\nabla} \cdot \tilde{A} \,+\, \frac{1}{|\vec{V}|}\frac{\partial \tilde{A}}{\partial t}\right) \qquad (7)$$

Equations (6) and (7) agree with the electric and magnetic fields that defined by Jackson(Jackson J.D.Classical electrodynamics.John Wiley and sons,1967)

If we put $\hat{F}\,\vec{\nabla} \cdot \vec{A} = \nabla\emptyset$; and $\frac{\vec{A}}{|\vec{V}|} = \vec{C}$.

As we proposed the electric and magnetic field are defined in two regions, field and antifield.

In the region of field we write,

$$\vec{E}_F = -\left(\hat{F}\,\vec{\nabla} \cdot \vec{A} \,+\, \frac{1}{|\vec{V}|}\frac{\partial \vec{A}}{\partial t}\right) \;;\; \vec{B}_F = \frac{1}{|\vec{V}|}\left(\vec{\nabla} \times \vec{A}\right)$$

In the region of antifield we define,

$$\vec{E}_{AF} = -\vec{\nabla} \times \tilde{A} \;;\vec{B}_{AF} = \frac{-1}{|\vec{V}|}\left(\hat{\hat{F}}\vec{\nabla} \cdot \tilde{A} \,+\, \frac{1}{|\vec{V}|}\frac{\partial \tilde{A}}{\partial t}\right)$$

Therefore, we write

$$\vec{E} = \vec{E}_F + \vec{E}_{AF} \;\;;\; \vec{B} = \vec{B}_F + \vec{B}_{AF} \qquad (8)$$

By getting the rotation and divergence of the electric field and the antielectric field, we find,

First at field region:

The electric field rotation is

$$\vec{\nabla} \times \vec{E}_F = -\vec{\nabla} \times \left(\Lambda\hat{F}\right) - \frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\left(\vec{\nabla} \times \vec{A}\right) = -\vec{J}_m - \frac{\partial \vec{B}}{\partial t} \qquad (9)$$

The magnetic field rotation is

$$\vec{\nabla} \times \vec{B}_F = \frac{1}{|\vec{V}|}\vec{\nabla} \times \left(\vec{\nabla} \times \vec{A}\right) = \vec{\nabla}\left(\vec{\nabla}.\vec{A}\right) - \vec{\nabla}^2\vec{A} = \vec{\nabla}\Lambda - \vec{\nabla}^2\vec{A} \qquad (10)$$

The magnetic current can be defined as

$$\vec{J}_m = \vec{\nabla} \times \left(\Lambda\hat{F}\right) \qquad (11)$$

where the scalar field Λ is

$$\Lambda = \vec{\nabla} \cdot \vec{A} \qquad (12)$$

And electric field divergence is

$$\vec{\nabla} \cdot \vec{E}_F = -\vec{\nabla} \cdot \left(\Lambda \hat{F}\right) - \frac{1}{|\vec{V}|}\frac{\partial \Lambda}{\partial t} = \frac{\rho}{\epsilon_0} - \frac{1}{|\vec{V}|}\frac{\partial \Lambda}{\partial t} \tag{13}$$

And magnetic field divergence is

$$\vec{\nabla} \cdot \vec{B}_F = \frac{1}{|\vec{V}|}\vec{\nabla} \cdot \left(\vec{\nabla} \times \vec{A}\right) = 0 \tag{14}$$

The charge density is

$$\frac{\rho}{\epsilon_0} = -\vec{\nabla} \cdot \left(\Lambda \hat{F}\right) \tag{15}$$

Second at antifield region:

The antielectric field rotation is

$$\vec{\nabla} \times \vec{E}_{AF} = -\vec{\nabla} \times \left(\vec{\nabla} \times \tilde{A}\right) = \vec{\nabla}^2 \tilde{A} - \vec{\nabla}\widetilde{\Lambda} \tag{16}$$

The antimagnetic field rotation is

$$\vec{\nabla} \times \vec{B}_{AF} = \frac{-1}{|\vec{V}|}\left(\vec{\nabla} \times \left(\widetilde{\Lambda}\hat{\tilde{F}}\right) - \frac{1}{|\vec{V}|}\frac{\partial E}{\partial t}\right) = \frac{\tilde{J}_m}{|\vec{V}|} + \frac{1}{|\vec{V}|^2}\frac{\partial E}{\partial t} \tag{17}$$

The antimagnetic current density is

$$\tilde{J}_m = -\vec{\nabla} \times \left(\widetilde{\Lambda}\hat{\tilde{F}}\right) \tag{18}$$

the antiscalar is,

$$\widetilde{\Lambda} = \vec{\nabla} \cdot \tilde{A} \tag{19}$$

And antielectric field divergence is

$$\vec{\nabla} \cdot \vec{E}_{AF} = -\vec{\nabla} \cdot \left(\vec{\nabla} \times \tilde{A}\right) = 0 \tag{20}$$

And the magnetic field divergence is

$$\vec{\nabla} \cdot \vec{B}_{AF} = \frac{-1}{|\vec{V}|}\left\{\vec{\nabla} \cdot \left(\hat{\tilde{F}}\,\vec{\nabla} \cdot \tilde{A} + \frac{1}{|\vec{V}|}\frac{\partial \tilde{A}}{\partial t}\right)\right\} = \frac{-\vec{\nabla} \cdot \left(\widetilde{\Lambda}\hat{\tilde{F}}\right)}{|\vec{V}|} - \frac{1}{|\vec{V}|^2}\frac{\partial \widetilde{\Lambda}}{\partial t} = \frac{\tilde{\rho}}{|\vec{V}|\epsilon_0} - \frac{1}{|\vec{V}|^2}\frac{\partial \widetilde{\Lambda}}{\partial t} \tag{21}$$

Where the anticharge density is

$$\frac{\tilde{\rho}}{\epsilon_0} = -\vec{\nabla} \cdot \left(\widetilde{\Lambda}\hat{\tilde{F}}\right) \tag{22}$$

Finally we find the total description of the rotation and divergence of the electric and magnetic field as:

$$\vec{\nabla} \times \vec{E} = \vec{\nabla} \times \vec{E}_F + \vec{\nabla} \times \vec{E}_{AF} = -\vec{J}_m - \frac{\partial \vec{B}}{\partial t} + \vec{\nabla}^2 \tilde{A} - \vec{\nabla}\widetilde{\Lambda} \tag{23}$$

$$\vec{\nabla}\cdot\vec{E}=\vec{\nabla}\cdot\vec{E}_F=\frac{\rho}{\epsilon_0}-\frac{1}{|\vec{V}|}\frac{\partial\Lambda}{\partial t} \qquad (24)$$

$$\vec{\nabla}\times\vec{B}=\vec{\nabla}\times\vec{B}_F+\vec{\nabla}\times\vec{B}_{AF}=\vec{\nabla}\Lambda-\vec{\nabla}^2\vec{A}+\frac{\tilde{J}_m}{|\vec{V}|}+\frac{1}{|\vec{V}|^2}\frac{\partial E}{\partial t} \qquad (25)$$

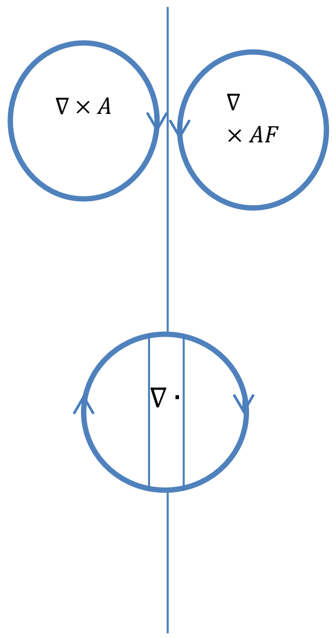
$$\vec{\nabla}\cdot\vec{B}=\vec{\nabla}\cdot\vec{B}_{AF}=\frac{\tilde{\rho}}{|\vec{V}|\epsilon_0}-\frac{1}{|\vec{V}|^2}\frac{\partial\tilde{\Lambda}}{\partial t} \qquad (26)$$

Equations (23) and (25) are identical under the transformation $F\rightarrow -AF$.also they do not contain any information about the medium.

On the other hand equations (24) and (26) are identical under the transformation $F\rightarrow AF$ and contain information about the medium in term of the permittivity ϵ_0 .

To illustrate this point we assume there is brain at the boundary between F and AF, the rotation of F and AF at the two sides of the brain are in the same direction to the brain. The rotation dose not cross the brain, therefore there is no interaction between the field/antifield and the brain medium. This demands that, the field/antifield translates all its information to antifield/field.

In divergence process the medium interact with the field/antifield and modifies the process.



Fig(1):shows the rotation and divergence due to the brain

This process illustrated in Feynman diagrams,the brain interaction is the mediator in Feynman.

Schrodinger equation:

If we define the field and its antifield by rotation of a vector ψ , we find

$\vec{\nabla} \times \vec{\psi}$ is antifield,so

$$\vec{\nabla} \times \left(\vec{\nabla} \times \vec{\psi}\right) = \frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\left(\vec{\nabla} \times \tilde{\psi}\right) \qquad (27)$$

Which gives the field rotation,

$$-\vec{\nabla}^2\vec{\psi} + \vec{\nabla}\left(\vec{\nabla} \cdot \vec{\psi}\right) = \frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\left(\vec{\nabla} \times \tilde{\psi}\right) \qquad (28)$$

We use the vector identity $\vec{\nabla} \times \left(\vec{\nabla} \times \vec{\psi}\right) = \vec{\nabla}\left(\vec{\nabla} \cdot \vec{\psi}\right) - \vec{\nabla}^2\vec{\psi}$

And the antifield rotation,

$$-\vec{\nabla}^2\tilde{\psi} + \vec{\nabla}\left(\vec{\nabla} \cdot \tilde{\psi}\right) = -\frac{1}{|\vec{V}|}\frac{\partial}{\partial t}\left(\vec{\nabla} \times \vec{\psi}\right) \qquad (29)$$

In R.H.S of equation (28) and (29) we can see the rotation of antifield/field that caused the energy term. Therefore as the principle we cannot distinguish between the real energy that caused by the field and that one generated by antifield.so in Schrodinger equation there is explicitly rotation for antifield or in other words there is spin.

Apply the transformation $\vec{\psi} \to \tilde{\psi}$ and $\tilde{\psi} \to -\vec{\psi}$ to equation (28) to recover equation (29)

Compare equations (28) and (29) with Schrodinger equation,

$$-\frac{\hbar^2}{2m}\vec{\nabla}^2\vec{\psi} + V(r)\vec{\psi} = i\hbar\frac{\partial}{\partial t}\vec{\psi} \qquad (30)$$

We find

$$\vec{\psi} = \frac{i\hbar}{2p}\vec{\nabla} \times \tilde{\psi} = -\frac{1}{2}\frac{\hat{P}}{p} \times \tilde{\psi} \qquad (31)$$

Where the momentum operator is $\hat{P} = -i\hbar\vec{\nabla}$, $p = m\left|\vec{V}\right|$

Klein-Gordon equation:

We use equations (28) and (29) and substitute $\frac{1}{|\vec{V}|}\frac{\partial\vec{\psi}}{\partial t} = \left(\vec{\nabla} \times \tilde{\psi}\right)$ in (28) and $\frac{1}{|\vec{V}|}\frac{\partial\tilde{\psi}}{\partial t} = -\left(\vec{\nabla} \times \vec{\psi}\right)$ in (29)

We find

$$\frac{1}{|\vec{V}|^2}\frac{\partial^2\vec{\psi}}{\partial t^2} - \vec{\nabla}^2\vec{\psi} = -\vec{\nabla}\left(\vec{\nabla} \cdot \vec{\psi}\right) \qquad (32)$$

And antifield equation as,

$$\frac{1}{|\vec{V}|^2}\frac{\partial^2\tilde{\psi}}{\partial t^2} - \vec{\nabla}^2\tilde{\psi} = -\vec{\nabla}\left(\vec{\nabla}\cdot\tilde{\psi}\right) \qquad (33)$$

These equations are the wave equations in F and AF.

Equations (32) and (33) are in one form of field/antifield ,no mixed terms are in one equation ,this means Klein-Gordon equation has no explicitly rotation ,or the field/antifield is spinless feature.

Now we have new definition of spin as a rotation of field/antifield to generate antifield/field. Therefore the state of the ,say an electron, is defined as a combination of field and its conjugate, or spin up(field) and spin down(antifield),this is Pauli exclusion principle.

<u>Newton law:</u>

If we put $\vec{P} = m\vec{V}$ and $\tilde{P} = \tilde{m}\vec{V}$. Therefore we find,

$$\left(\vec{\nabla}\times\ \tilde{P}\ \right)_{AF} = \left(\hat{F}\,\vec{\nabla}\cdot\vec{P}\ +\ \frac{1}{|\vec{V}|}\frac{\partial\vec{P}}{\partial t}\ \right)_F \qquad (34)$$

Which gives

$$\tilde{m}\vec{\omega} = m\hat{F}\,\vec{\nabla}\cdot\vec{V} + \frac{m}{|\vec{V}|}\vec{a} \qquad (35)$$

Where $\vec{\omega} = \vec{\nabla}\times\vec{V}$ is the vorticity and the acceleration $\vec{a} = \frac{\partial\vec{V}}{\partial t}$.

Apply the dot product $\vec{V}\cdot$ for both sides and use the unit vector $\frac{\vec{V}}{|\vec{V}|} = \hat{V}$,we get

$$\tilde{m}\left|\vec{V}\right|\hat{V}\cdot\vec{\omega} = m\left|\vec{V}\right|\hat{V}\cdot\hat{F}\,\vec{\nabla}\cdot\vec{V} + m\,\hat{V}\cdot\vec{a} \qquad (36)$$

The L.H.S in (36) represents force $\tilde{F}$ and the R.H.S is a generalized Newton second law of motion .compare (36) with general curvilinear expression

$$f = m\left(\ddot{x}^i + \Gamma^i_{jk}V^jV^k\right) \qquad (37)$$

If $\hat{V}$ and $\hat{F}$ are parallel the equation has sign (+) and (-) sign for anti-parallel,

$$\tilde{F} = \tilde{m}a = \pm mv\left|\hat{F}\right|\vec{\nabla}\cdot\vec{V} + ma \qquad (38)$$

Where $v = \left|\vec{V}\right|$ and $a = \vec{V}\cdot\vec{\omega} = \hat{V}\cdot\vec{a}$

The antimass can be given by,

$$\widetilde{m} = m\left(1 \pm \frac{v\,|\hat{F}|\vec{\nabla}\cdot\vec{V}}{a}\right) = m\left(1 \pm \frac{\vec{\nabla}\cdot\vec{V}}{H}\right) \qquad (39)$$

Where the constant

$$H = \frac{a}{v\,|\hat{F}|} \qquad (40)$$

Has a dimension of reciprocal time and it can be looks like the Hubble constant.

We find $0 \leq \vec{\nabla}\cdot\vec{V} \leq H$,this means the creation of mass due the annihilation of antimass.

At the equilibrium we get $\vec{\nabla}\cdot\vec{V} = 0$, the total annihilation of antimass when $\hat{V}$ and $\hat{F}$ are anti-parallel, occurs when $\vec{\nabla}\cdot\vec{V} = H$.

When the divergence is equal zero we find $\widetilde{m} = m$,this can be shown as the relativistic mass. The difference occurs due the velocity divergence.

Continuity equation:

If we define the field and antifield with gradient of scalar and its antiscalar as:

$\vec{\psi} = -\vec{\nabla}\varphi$ and $\tilde{\psi} = \vec{\nabla}\tilde{\varphi}$, and apply $\left(\vec{\nabla}\times\vec{\nabla}\tilde{\varphi}\ \right)_{AF} = \left(-\hat{F}\,\vec{\nabla}\cdot\vec{\nabla}\varphi - \frac{1}{|\vec{V}|}\frac{\partial\vec{\nabla}\varphi}{\partial t}\ \right)_F$

We find

$$0 = -\hat{F}\,\vec{\nabla}\cdot\vec{\nabla}\varphi - \frac{1}{|\vec{V}|}\frac{\partial\vec{\nabla}\varphi}{\partial t} \qquad (41)$$

And

$$0 = -\hat{\tilde{F}}\,\vec{\nabla}\cdot\vec{\nabla}\tilde{\varphi} - \frac{1}{|\vec{V}|}\frac{\partial\vec{\nabla}\tilde{\varphi}}{\partial t} \qquad (42)$$

First we use dot product by velocity vector $\vec{V}$ in equation (42)

$$0 = -\vec{V}\cdot\hat{F}\,\vec{\nabla}\cdot\vec{\nabla}\varphi - \frac{\vec{V}\cdot}{|\vec{V}|}\frac{\partial\vec{\nabla}\varphi}{\partial t} \qquad (43)$$

$\vec{V}\cdot\hat{F} = v_F$ the component of the velocity parallel to the field.

$\frac{\vec{V}}{|\vec{V}|} = \hat{V}$ the unit vector of the velocity.

Now equation (43) reads,

$$0 = -\,\vec{\nabla}\cdot\left(v_F\vec{\nabla}\varphi\right) - \frac{\partial}{\partial t}\left(\hat{V}\cdot\vec{\nabla}\varphi\right) \qquad (44)$$

Where the density is

$$\rho = \hat{V} \cdot \vec{\nabla}\varphi \qquad (45)$$

And current is

$$\vec{J} = v_F \vec{\nabla}\varphi \qquad (46)$$

Using equations (44)-(46) we get the continuity equation,

$$\vec{\nabla} \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0 \qquad (47)$$

Second,we use dot product by velocity unit vector $\hat{V}$, in equation (42),

$$0 = -\hat{V} \cdot \hat{F}\, \vec{\nabla} \cdot \vec{\nabla}\varphi - \frac{\hat{V} \cdot}{|\vec{V}|} \frac{\partial \vec{\nabla}\varphi}{\partial t} \qquad (48)$$

$\hat{V} \cdot \hat{F} = |\hat{V}||\hat{F}|$ when the velocity parallel to the field. And $\frac{\hat{V}}{|\vec{V}|} = \vec{V}$ is the velocity vector.

Now we find

$$0 = -\vec{\nabla} \cdot \left(|\hat{V}||\hat{F}|\vec{\nabla}\varphi\right) - \frac{\partial}{\partial t}\left(\vec{V} \cdot \vec{\nabla}\varphi\right) \qquad (49)$$

Where the density vector is

$$|\hat{V}||\hat{F}|\vec{\nabla}\varphi = \vec{\rho} \qquad (50)$$

And current scalar is

$$\vec{V} \cdot \vec{\nabla}\varphi = j \qquad (51)$$

Finally the continuity equation is,

$$\vec{\nabla} \cdot \vec{\rho} + \frac{\partial}{\partial t} j = 0 \qquad (52)$$

These two equations represent the continuity equation for current density and charge density in both cases, scalar and vector.

General relativity and Einstein tensor

in attempt to generalize our principle to tensors and covariant derivatives we define the differential operator in covariant form as,

$$\nabla_l = s\nabla_l + t\nabla_l \qquad (53)$$

where $s\nabla_n$ is spatial derivative and $t\nabla_n$ is temporal derivative.

$$s\nabla_l = \frac{\partial}{\partial x^l} + \Gamma_{ln}^{n} \qquad (54)$$

$$t\nabla_l = \frac{\partial t^l}{\partial x^l} \frac{\partial}{\partial t^l} + \Gamma_{ln}^{n} \qquad (55)$$

And the tensor of rank 2

$$\Upsilon_{mn} = g_{jk}\Gamma^{i} + g_{ki}\Gamma^{j} + g_{ij}\Gamma^{k} \qquad (56)$$

Where

$$\Gamma^{l} = \Gamma^{l}_{ij} + \Gamma^{l}_{ki} + \Gamma^{l}_{jk} \qquad (57)$$

Where the indices m, n, l vary through i, j, k. And Γ^{l}_{ij} christoffel symbols and g_{ij} is the metric tensor. And the differential operator define as

$$\nabla = g_{jk}\nabla_{i} + g_{ki}\nabla_{j} + g_{ij}\nabla_{k} \qquad (58)$$

We change the unit vector with the metric tensor and write

$$(\nabla \times)_{AF} = g_{mn}\nabla_{l} \qquad (59)$$

$$\nabla \times \Upsilon_{mn} = \begin{vmatrix} g_{jk} & g_{ki} & g_{ij} \\ \nabla_{i} & \nabla_{j} & \nabla_{k} \\ \Gamma^{i} & \Gamma^{j} & \Gamma^{k} \end{vmatrix} \qquad (60)$$

$$\nabla \times \Upsilon_{mn} = g_{jk}\left(R_{jk} + \alpha T_{jk}\right) + g_{ki}\left(R_{ki} + \alpha T_{ki}\right) + g_{ij}\left(R_{ij} + \alpha T_{ij}\right) \qquad (64)$$

$$g_{mn}\nabla_{l}\Upsilon_{mn} = g_{mn}\beta\left\{g_{jk}\left(R^{i}_{i} + \alpha T^{i}_{i}\right) + g_{ki}\left(R^{j}_{j} + \alpha T^{j}_{j}\right) + g_{ij}\left(R^{k}_{k} + \alpha T^{k}_{k}\right)\right\} \qquad (65)$$

We find,

$$g_{jk}\left(R_{jk} + \alpha T_{jk}\right) + g_{ki}\left(R_{ki} + \alpha T_{ki}\right) + g_{ij}\left(R_{ij} + \alpha T_{ij}\right) = g_{mn}\beta\left\{g_{jk}\left(R^{i}_{i} + \alpha T^{i}_{i}\right) + \right.$$
$$\left. + g_{ki}\left(R^{j}_{j} + \alpha T^{j}_{j}\right) + g_{ij}\left(R^{k}_{k} + \alpha T^{k}_{k}\right)\right\} \qquad (66)$$

Where α, β are constant.

Equation (66) is rank 4 tensor. Contracting in two indices , ij indices ,where $i \neq j \neq k$

$$\tilde{R}_{ij} + \alpha\tilde{T}_{ij} = \beta g_{ij}R + \alpha\beta g_{ij}T \qquad (67)$$

Where L.H.S represents the antifield and R.H.S of the equation represents the field.

And R, T are curvature scalar and energy density scalar respectively.

In general we write equation (67) as

$$\tilde{R}_{\mu\nu} - \beta g_{\mu\nu}R = -\alpha\left(\tilde{T}_{\mu\nu} - \beta g_{\mu\nu}T\right) \qquad (68)$$

Equation (68) is the right form of Einstein equation. We can distinguish between the field and the conjugate and give the right form of vacuum equation without the contradiction caused by assuming that the field is empty and curved.

Also equation (67) can be divided into two equations;

$\tilde{R}_{ij} = -\alpha(\tilde{T}_{ij} - \beta g_{ij} T)$ (68a)

$\tilde{T}_{ij} = \gamma(\tilde{R}_{ij} - \beta g_{ij} R)$ (68b)

These two equations were proposed , in general, in Einstein proposal of general relativity.

The cosmological constant in Einstein field equation is the scalar energy density in (68)

$$\Lambda = \gamma T \quad (69)$$

The vacuum equation is equal to static case (time independent or constant) when the time derivative is vanished.

$$\tilde{R}_{\mu\nu} - \beta g_{\mu\nu} R = 0 \quad (70)$$

If $i = j \neq k$ or $i = k \neq j$ equation (66) gives
$0 = g_{ij} R + \alpha g_{ij} T$ (71)

This equation looks like adiabatic process where $\alpha g_{ij} T$ represents the internal energy and $g_{ij} R$ the work done by the system.

Equation (71) represents closed system with one kind of field and the cosmological constant represents its internal energy. Also (71) gives

$$R_{\mu\nu} = -\alpha T_{\mu\nu} \quad (72)$$

Equation (72) was rejected by Einstein Grossmann, because it describes the internal curvature of the system and cannot be used to describe the gravity caused by curving space time outside massive objects.

Mass energy equivalence:

Now we return to equation (1) and use the angular momentum $\vec{L}$

$$\left(\vec{\nabla} \times \vec{L}\ \right)_F = -\left(\hat{\hat{F}}\,(\vec{\nabla} \cdot \vec{L}) + \frac{1}{|\vec{V}|}\frac{\partial \vec{L}}{\partial t}\ \right)_{AF} \quad (73)$$

$\vec{\nabla} \times \vec{L} = -2\vec{P}$, $\vec{\nabla} \cdot \vec{L} = \vec{P} \cdot (\vec{\nabla} \times \vec{r}) - \vec{r} \cdot (\vec{\nabla} \times \vec{P})$ and $\frac{\partial \vec{L}}{\partial t} = \vec{\tau}$,where $\vec{\tau}$ is the torque. $\vec{\nabla} \times \vec{r} = 0$; $\vec{r} \cdot (\vec{\nabla} \times \vec{P}) = m\vec{r} \cdot \vec{w} = -mv$, where $\vec{w}$ the vorticity. Multiply (73) by velocity $\vec{V}$ and put $\hat{V} = \frac{\vec{V}}{|\vec{V}|}$ the velocity unit vector,

$$(2m - \widetilde{m})v^2 = \hat{V} \cdot \vec{\tau} = \tau\ \cos\theta \quad (74)$$

The torque is $\tau = {}^{E}/_{\theta}$ .for small angle $\cos\theta = \theta$, $m = \widetilde{m}$ and put $v^2 = c^2$ (74) reads,

$E = mc^2$ (75)

Equation (74) can be written as, $2\pi r = \lambda = \frac{E.t}{P}$, where we put $\theta = 2\pi$,one revolution , $\lambda = 2\pi r$, and $P = mv$ .for this conditions $E.t$ represents the unit of rotation energy which equivalent to Planck constant ,which gives Einstein relation $E = h\nu$, where $\nu = \frac{1}{t}$. Putting together we find De-Broglie relation $\lambda = \frac{h}{P}$.

If the brain altered divergence term in (73),then the divergence term acts as the work function .then we find (73) with the conditions above gives photoelectric effect,

$h\omega = \phi + KE$, where $\phi = \frac{1}{2}\left(\vec{V}\cdot\hat{\hat{F}}\right)$ $(\vec{\nabla}\cdot\vec{L})$ and $= \frac{1}{2}E$.

Dirac equation:

Now we rewrite (73) in this form,

$\beta\vec{P} + \hat{F}\sum\alpha P = \frac{\gamma}{c}\frac{\partial\vec{P}}{\partial t}$ (76)

Multiplying by unit vector to obtain scalar form and put $P = mc$,

$\beta mc^2 + c\sum\alpha P = \frac{\partial}{\partial t}P\gamma$ (77)

$\vec{\nabla}\times\tilde{L} = \beta\tilde{P}$, $\vec{\nabla}\cdot\tilde{L} = \sum\alpha P$ and $\frac{1}{|\vec{V}|}\frac{\partial\vec{L}}{\partial t} = -\frac{1}{c}\frac{\partial\gamma\vec{P}}{\partial t}$

R.H.S of equation (77) is energy and the L.H.S is equal to L.H.S of Dirac equation.

As we see there is a combination between the field and antifield, which leads to spin as Schrodinger equation.

Conclusion:

We generalized equivalence principle to find one single equation governed many equations in physics just by using the correct field (vector or tensor).