Quantum Mechanics's new Energy-momentum equation

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Abstract: Special Relativity Theory can be derived out from quantum mechanics. Special Relativity Theory is not a independent theory. Special Relativity Theory is included in the quantum mechanics.Start from the new thinking,we derive out a new energy-momentum equation.In low energy region,the new energy-momentum equation can transition to Special Relativity Theory. Special Relativity Theory is only approximate of new energy-momentum equation.The new energy-momentum equation will take great change to physics.Energy have maximum value.Momentum have maximum value. The scattering problems in quantum filed theory will be solved. Renormalization is no longer needed.Lightspeed is no longer maximum speed value.

1. Derive out Special Relativity Theory from Quantum Mechanics

In the quantum mechanics,the group velocity V_g is equal with particle velocity V.That is V_g=V

The phase velocity $V_p = \frac{c^2}{V}$

So we get, $V_g V_p = V \cdot \frac{c^2}{V} = c^2$

So we get a equation, $V_g V_p = c^2$ (1.1)

The equation (1.1) is derived.But we think from the other side.We suppose this equation is exist at first,not be derived out.Why this equation is exist, we don't know.This equation is

discovered by our instinct.

To quantum wave,there exist a equation,

$$V_g = \frac{d\varpi}{d\kappa} = \frac{d(\hbar\varpi)}{d(\hbar\kappa)} = \frac{dE}{dP} \quad (1.2)$$

Please pay attention to the equation, $V_g = \frac{dE}{dP}$.

From De.Broglie equation,we can derive out,the phase velocity,

$$V_p = \lambda\nu = \frac{h}{P}\frac{E}{h} = \frac{E}{P} \quad (1.3)$$

Take (1.3) and (1.2) into (1.1),we get,

$$V_g V_p = \frac{E}{P}\frac{dE}{dP} = \frac{dE^2}{dP^2} = c^2$$

So we get a equation,

$$\frac{dE^2}{dP^2} = c^2 \quad (1.4)$$

So we get, $dE^2 = dP^2 \cdot c^2$ .So,

$$E^2 = P^2c^2 + cons\tan t \quad (1.5)$$

This equation is so familiar.It's more like energy-momentum equation.The constant is wait solving.Now we solve the constant's value.

The group velocity V_g is equal with particle velocity V.That is V_g =V.

Exist equation,P=mV (1.6)

So,V=V_g =P/m (1.7)

Take (1.3) and (1.7) into (1.1),get, $V_g V_p = \frac{E}{P}\cdot\frac{P}{m} = \frac{E}{m} = c^2$

So get, $E = mc^2$ (1.8)

Equation (1.8) is the energy-mass equation in Special Relativity Theory.

Take (1.8) into (1.5),get,

$$m^2c^4 = P^2c^2 + cons\tan t$$

So we can set the constant is value when P=0.

We set $m^2c^2 = m_o^2c^2$ when P=0.So,

$$E^2 = m^2c^4 = P^2c^2 + m_o^2c^4 \quad (1.9)$$

This is the energy-mass equation in Special Relativity Theory.

Discover equation (1.9),so we can derive out Special Relativity Theory.Include the completion,the lightspeedis the max speed,can be derived out from equation (1.9).

Summarize above derived process.We suppose exist the equation $V_gV_p = c^2$ at first.Then use the equation P=mV.Then use De.Broglie equation.So we can derive out equation (1.9),and can derive out Special Relativity Theory.

We can discover,the equation, $V_gV_p = c^2$ ($\frac{dE^2}{dP^2} = c^2$),is so much important.

In fact,the equation,P=mV. It's usage is that take mass concept into quantum mechanics .

From above derived process,we can see this.Before use equation P=mV,from(1.1) to (1.5),process don't have relationship with mass concept.

Use equation (1.6),we take mass concept into quantum mechanics.Then we can derive out equation (1.9).And can derive out Special Relativity Theory.

If we only suppose that equation (1.1) is exist,so we can derive out Special Relativity Theory from De.Broglie equation.So Special Relativity Theory is not a independent theory,to quantum mechanics.The quantum mechanics have include Special Relativity Theory.

Above process seems only formal changes,no substantive changes.But,if we consider that Special Relativity Theory is not a independent theory.Our thinking is no longer been limited by Special Relativity Theory.Then we can get new thinking.

Next,change the equation (1.1), $V_gV_p = c^2$,we discover that new theory can be break through.

2. New energy-momentum equation

Above,we take into the equation, $V_gV_p = c^2$

And derive out equation (1.4), $\frac{dE^2}{dP^2} = c^2$

This equation is our suppose.Now we change this equation's form.What will happen?

Change equation's form,take into a new equation.

$$\frac{dE^2}{dP^2} = \frac{c^2}{\sqrt{1-\frac{P^2}{P_m^2}}} \quad (2.1)$$

There, P_m is constant.It's value is the maximum momentum.

The source of inspiration is a quation in Special Relativity Theory.

$$m = \frac{m_o}{\sqrt{1-\frac{V^2}{c^2}}}$$

From this equation,we take a maximum speed.That is Lightspeed c.

Why we take into the maximum momentum, P_m ?Because the scattering problems in quantum filed theory.In Special Relativity Theory,exist a maximum speed,the Lightspeed c.Analogously,if exist a maximum momentum, the scattering problems will be solved.So no longer need Renormalization.This is the inspiration that we take into equation (2.1).

Will discover,take into equation (2.1),miracles happen.

From (2.1),get

$$dE^2 = \frac{c^2}{\sqrt{1-\frac{P^2}{P_m^2}}} \cdot dP^2,$$

$$d(\frac{E^2}{P_m^2}) = \frac{c^2}{\sqrt{1-\frac{P^2}{P_m^2}}} \cdot d(\frac{P^2}{P_m^2})$$

set $\frac{P^2}{P_m^2} = x, \frac{E^2}{P_m^2} = y$,get

$$dy = \frac{c^2}{\sqrt{1-x}} \cdot dx = -\frac{c^2}{\sqrt{1-x}} \cdot d(1-x) = -2c^2 d(\sqrt{1-x})$$

So get, $y = -2c^2\sqrt{1-x} + B$,B is a constant waiting solving.

So get, $\frac{E^2}{P_m^2} = B - 2c^2\sqrt{1-\frac{P^2}{P_m^2}}$,then get

$$E^2 = BP_m^2 - 2P_m^2 c^2\sqrt{1-\frac{P^2}{P_m^2}} \quad (2.2)$$

In this equation, we find,momentum have maximum momentum, P_m .And energy have maximum energy.We represent the maximum energy by E_m . $E_m = BP_m^2$.

E ans P satisfies De.Broglie equation also.

$$E = h\nu = \hbar\varpi$$

$$P = \frac{h}{\lambda} = \hbar\kappa$$

In equation (2.2), momentum have maximum momentum P_m ,and energy have maximum energy E_m . The scattering problems will be solved.So no longer need Renormalization.

In equation (2.2),when P=0,it will transition to energy-mass equation (1.9) in Special Relativity Theory.So

$$E^2 = BP_m^2 - 2P_m^2 c^2 = m_o^2 c^4$$

$$BP_m^2 = 2P_m^2 c^2 + m_o^2 c^4 \quad (2.3)$$

$$B = 2c^2 + \frac{m_o^2 c^4}{P_m^2} \quad (2.4)$$

From (2.4),diffent particle have different rest mass,so diffent particle have diffent B value. Diffent particles have diffent P_m value also.To diffent particle,it's P_m value need to be measure by physics experiments.

Take (2.3) into (2.2),so get

$$E^2 = m_o^2 c^4 + 2P_m^2 c^2 - 2P_m^2 c^2 \sqrt{1 - \frac{P^2}{P_m^2}} \quad (2.5)$$

We can find.Energy E,it's value be limited, $m_o^2 c^4 \le E^2 \le 2P_m^2 c^2 + m_o^2 c^4$.

When P is far less than P_m,equation (2.2) have series expansion,

$$E^2 = BP_m^2 - 2P_m^2 c^2 (1 - \frac{1}{2}\frac{P^2}{P_m^2} - \frac{1}{8}(\frac{P^2}{P_m^2})^2 - \cdots) \quad (2.6)$$

Take first and second items,and reference equation (2.3),we get

$$E^2 = P^2 c^2 + m_o^2 c^4 \quad (2.7)$$

It transition to Special Relativity Theory.But equation (2.7) is approximate only,it is not completely accurate.The equation (2.7) is valid under the conditions that P is far less than P_m.

If take the third item,or take the fouth item,Will bring result that break through GZK cut-off limit.

Because equation (2.7) is approximate only,it is not completely accurate.The equation (2.7) is valid under the conditions that P is far less than P_m.And quantum filed theory is derived out from equation (2.7).So quantum filed theory is valid under the conditions that P is far less than P_m.So,if equation (2.2) is correct, quantum filed theory need rebuild.

From above analysis,we find,Renormalization's essence is that select momentum integration in low energy region only.That is only select low energy region.The low energy region is region that equation $E^2 = P^2 c^2 + m_o^2 c^4$ can be valid.In fact, momentum's whole region is between zero to P_m.But another,in high energy region,the equation $E^2 = P^2 c^2 + m_o^2 c^4$ will be invalid.And quantum filed theory is valid under the conditions that equation $E^2 = P^2 c^2 + m_o^2 c^4$ is invalid.How to solv this problem?So we cut off the momentum integration,only select low momentum integration.This is the Renormalization's essence. Renormalization is valid,It's reason is that.In low energy region(low momentum region),equation (2.2) can transition to equation (2.7).

Momentum's whole region is between zero to P_m.So momentum integration in whole region

is a limited value,not a unlimited value.So we can see, Renormalization cut off high momentum region,only cut off a limited integration value,not cut off a unlimited integration value.This is Renormalization's essence. Renormalization's cut-off,is valid only in low momentum region.In high momentum region,even though we cut off,we computer value is not correct value.The value will deviate out from physics real value.

Because current quantum filed theory is development under equation $E^2 = P^2c^2 + m_o^2c^4$,so current quantum filed theory need to be development under equation (2.2). Current quantum filed theory need to be rebuild.

Because equation (2.7) is approximate only. Equation (2.7) is valid only in low energy region. We know equation $E^2 = P^2c^2 + m_o^2c^4$ is result of Lorentz symmetry.So, Lorentz symmetry will need to be reconsidered.We must build new symmetry about physics space-time.

And the equation, $E = mc^2$,mass-energy equation in Special Relativity Theory,only valid in low energy region.

In equation (2.2),we take into P=mV,we take into mass concept.But we can't derive out equation $E = mc^2$ .So the mass concept change to be fuzzy. The mass concept need to be reconsidered.So, what affect can be take into General Relativity Theory.Because General Relativity Theory,it's basic is mass concept.

To the equation, $V_g = \frac{dE}{dP}$,we know it very shallowly.What is it's physical meaning?

To a particle,what is it's P_m value?It need be measure by physics experiments.

From (2.5),can derive out,

$$E_m^2 = \frac{(E^2 - E_o^2)^2}{2(E^2 - (E_o^2 + P^2c^2))} + E_o^2$$

$E_o^2 = m_o^2c^4$,it is particle's energy of rest mass. $E^2 - (E_o^2 + P^2c^2)$ is the deviation between new energy and Special Relativity Theory energy.Refer to GZK cut-off,we can computer this particle's E_m value roughly.GZK cut-off is appear at 10^{19} eV range.The energy is 10^{20} eV that cosmic rays energy break through GZK cut-off.So we can computer

approximately.It's E_m is around 10^{39} eV approximately.It's P_m is around 10^{12} kg.m/s approximately.

From (2.1) and (2.2),Lightspeed c is no longer the maximum speed.

At last,if equation (2.2) is correct,physics will change greatly.

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