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# Accurate Production Process of Higgs Supersymmetric Particles on High Energy Linear Collider

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Looking for the standard Higgs particle model and the measurement has been the main task of high energy collider experiments. Its measurement and research for understanding the interactions of elementary particles and the sources of their quality is extremely important. Exciting is the LHC found the Higgs particle, although not completely sure, but its measurements and particle properties of the standard model Higgs boson is very close to the available data. The natural properties of this newly discovered particle measurement and research and ultimately determine, if it is a Higgs boson of the standard model of particle physics is the main task. This paper focuses on the task, in the framework of standard model of high-energy process, collider Higgs boson accompanied generated by in-depth discussion.

## 1. Introduction

In order to explore the most basic constituents of matter, the fundamental role of law, modern particle physics gives the history of mankind's deepest and most successful attempt (Fujii et al., 2015). Although the matter is made of elementary particles discrete unit idea has reached thousands of years, with the discovery of atomic nuclei and the development of special relativity and quantum mechanics (Baer et al., 2013). From the early twentieth century, we have deeper laws of nature understanding and new understanding (Borzumati et al., 2014; Baldi et al., 2014). In experiments delve into the internal structure of atom, the greatest experimental physicist Ernest Rutherford. One of the experimental method is designed behavior of the particles in the subatomic scale (Cao et al., 2014). On the subatomic scale, special relativity and quantum mechanics provides a description of the theoretical basis of particle behavior (Choi et al., 2015).

Force interaction has not been included, in addition to theoretical difficulties, but also because the experiments cannot reach the device can be measured to scale large enough gravitational need (Djouadi et al., 2015). In the standard model, the spin 1/2 fermions were the most basic units of matter particles compared with three generations of quarks and leptons three generations (Djouadi et al., 2013). Interaction between fermions is through the exchange of spin-1 bosons completed. Specifically, the electromagnetic interaction photon exchange, the exchange of the weak interaction W or Z bosons and strong interaction exchange gluons (Buchmueller et al., 2015; Klute et al., 2013).

Although the standard model has achieved great success, but as a model theory, there is reason to believe that the standard model is not a fundamental theory (Baglio et al., 2013). There are some shortcomings and deficiencies. Its shortcomings mainly in three aspects: First, the standard model contains a large number of free parameters, cannot explain the sources and quantum predictions fermion algebra charge, cannot give quality and theoretical predictions of particle mixing angle, cannot explain the damage CP the physical origin of CKM matrix; secondly, the standard model of quantum electrodynamics (QED) will become a strong interaction at some energy scale, which indicates that the standard model is a more fundamental theory of effective low-energy approximation. Third, Higgs quality problems due to radiation correction contribution to the quality of Higgs particles, fermions such as ring integral diverging term, this will lead to mass correction term Higgs particle δm2 ~Λ2, which is a low-energy physics no longer applyΛ2energy standard, which is within the scope of the standard model cannot be explained.

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## 2. Standard model higgs boson and related theories

### 2.1 Standard model higgs particle

For the material field, it is spin 1/2 Fermi field, including three generations of left-, right-handed quarks and leptons, namely (Gröber et al., 2013):

$$f_{L,R} = P_{L,R} f = \frac{1}{2}(1 \mp \gamma_5)\, f \tag{1}$$

Which left fermions is weak isospin doublet and the right-hand fermions is weak isospin singlet:

$$L = \{L^i\} = \left\{ \begin{pmatrix} \nu_e^i \\ e^i \end{pmatrix}_L \right\} = \left\{ \begin{pmatrix} \nu_e \\ e \end{pmatrix}_L \begin{pmatrix} \nu_\mu \\ \mu \end{pmatrix}_L \begin{pmatrix} \nu_\tau \\ \tau \end{pmatrix}_L \right\} \tag{2}$$

$$Q = \{Q^i\} = \left\{ \begin{pmatrix} u^i \\ d^i \end{pmatrix}_L \right\} = \left\{ \begin{pmatrix} u \\ d \end{pmatrix}_L \begin{pmatrix} c \\ s \end{pmatrix}_L \begin{pmatrix} t \\ b \end{pmatrix}_L \right\} \tag{3}$$

Here we believe that neutrinos are massless and only the left hand. Quark or about the same time the color group SU (3) c of the triplet, that they should come with color indicators, there is not marked (Ellis et al., 2015). A fermion is supercharged:

$$\Upsilon_{Li} = -1, \Upsilon_{Qi} = 1/3, \Upsilon_{Ei} = -2, \Upsilon_{Ui} = 4/3, \Upsilon_{Di} = -2/3 \tag{4}$$

These specifications in their respective field of population infinitesimal gauge transformation as follows:

$$B_\mu \to B_\mu + \frac{1}{g'} \partial_\mu \theta_1 \tag{5}$$

$$W_\mu^i \to W_\mu^i + \frac{1}{g} \partial_\mu \theta_2^i + \varepsilon^{ijk} \theta_2^j W_\mu^k \tag{6}$$

$$G_\mu^a \to G_\mu^a + \frac{1}{g_s} \partial_\mu \theta_3^a + f^{abc} \theta_3^b G_\mu^c \tag{7}$$

And their field strength tensor can be expressed as:

$$W_{\mu\nu}^i = \partial_\mu W_\nu^i - \partial_\nu W_\mu^i - g \varepsilon^{ijk} W_\mu^j W_\mu^k \quad i, j, k = 1, 2, 3 \tag{8}$$

$$B_{\mu\nu} = \partial_\mu B_\nu + \partial_\nu B_\mu \tag{9}$$

$$G_{\mu\nu}^a = \partial_\mu G_\nu^a - \partial_\nu G_\mu^a - g_s f^{abc} G_\mu^b G_\mu^c \quad a, bc = 1, \cdots, 8 \tag{10}$$

### 2.2 Higgs mechanism of the standard Model

We add a field in the standard modelΦ, a previous section we introduced the zero mass particles norms, and experiment to find the gauge particle has a non-zero mass, so we have to establish a new mechanism to explain. This theory is explained by the introduction of a SU (2) L of the doublet scalar field, which will lead to SU (2Y) L x U (1)r gauge symmetry spontaneous symmetry breaking, called the Higgs mechanism. SU (2) L doublet scalar complex matrix form as follows:

$$\Phi = \begin{pmatrix} \phi^+ \\ \phi^- \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} \phi_1 + i\phi_2 \\ \phi_3 + i\phi_4 \end{pmatrix} \tag{11}$$

Where Φ1, Φ2, Φ3, Φ4 represents a complex scalar field. We requireΦ meet supercharged Y = 1/2 and see it as a color singlet. Its Lagrangian is:

$$L_{\Phi} = \left(D_{\mu}\Phi\right)^{+}\left(D^{\mu}\Phi\right) - V\left(\Phi\right) + L_{Yakava} \tag{12}$$

The first item here includes dynamics and regulate interaction term, the second term is the potential energy term, and the third includes the Yukawa coupling term scalar field with Fermi subsections molecules. Most typically gauge invariant potential energy items, or scalar potential is:

$$V\left(\Phi\right) = -\mu^{2}\Phi^{+}\Phi + \lambda\left(\Phi^{+}\Phi\right)^{2} \tag{13}$$

Where in Figure 1 depicts the type of potential energy curves.

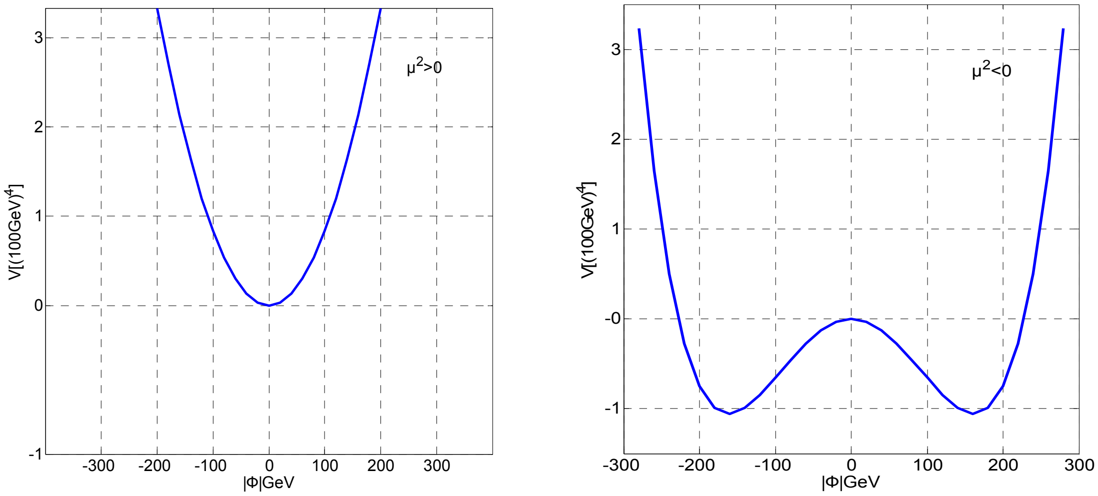


*Figure 1: Coupling coefficient*

In Figure 1, we have

$$\left|\Phi\right| = \sqrt{\Phi^{+}\Phi} \tag{14}$$

The left represents $\mu^2<0$, the right represents $\mu^2>0$, For the standard model parameters using

$$\left|-\mu^{2}\right| \cong \left(88.4GeV\right)^{2} \ \ and \ \ \lambda \cong 0.129 \qquad (15$$

This is used to obtain measurementsmh=125GeV and γ=246GeV. When considering the right side of the case, the minimum potential energy

$$\left|\Phi\right| = v/\sqrt{2} = \left(246/\sqrt{2}\right)GeV \tag{16}$$

### 2.3 Quantization and gauge fixing

In quantum field theory, the transition amplitude as the basis of the amount can be written in many forms formulaic. We can of course be quantized later calculated that such a base amount. There are quantized canonical quantization and path integral quantization in two ways, with respect to the former, the latter has many advantages proved in quantum field theory is the most convenient.

We use the path integral quantum computing Yang-Mills Lagrangian field of vacuum to the vacuum transition amplitude. We first look at the path integral Yang-Mills field:

$$\int\prod_{x,k} DA_{\mu}^{k}\left(x\right)e^{iS\left[A_{\mu}^{k}\right]} \tag{17}$$

Here action

$$S[A]=\int d^4xL_{YM} \tag{18}$$

If all of the gauge field Aμ are not independent, then the above path integral may be incorrect, because we may be double-counting of some paths DAμ. In fact because of Yang-Mills gauge field properties involved are required to be bound by the conditions of the specification, all A μ are not completely independent.

A same physical state can be an infinite number of gauge fields can be changed to describe each other, which is why we must consider the reasons for standardized conditions. In this case, we have only one physical state to select a field to describe it. The above mentioned tracks can be understood as the image of a line, the line every point corresponds to a gauge field are described in the same physical state and can be converted into another by a change in specifications. The so-called standardized conditions can be described as one of the tracks intersect with each one of the surfaces, visualize given in Figure 2.

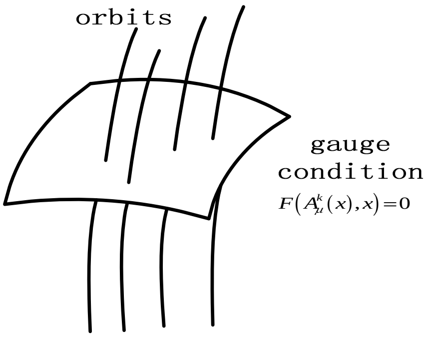
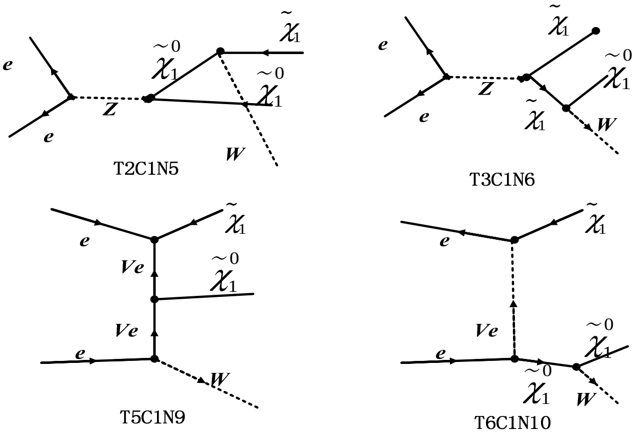


*Figure 2: Figurative description of track conditions and specifications*

## 3. Experiments and results

### 3.1 $e^+e^- \to W^+\tilde{\chi}_1^-\tilde{\chi}_1^0$ Computing and numerical solution

Thesis research process, taking into account $e^+e^- \to W^+\tilde{\chi}_1^-\tilde{\chi}_1^0$, its Feynman diagram form (Figure 3):



T2C1N5 T3C1N6 T5C1N9 T6C1N10

*Figure 3:* $e^+e^- \to W^+\tilde{\chi}_1^-\tilde{\chi}_1^0$ *feynman diagram form*

*We consider this to be the main process of continuous non-resonance region product. Means that our main research* $e^+e^- \to W^+\tilde{\chi}_1^-\tilde{\chi}_1^0$ *process, The product is no longer research process* $\tilde{\chi}_1^+\tilde{\chi}_2^-, \tilde{\chi}_1^0\tilde{\chi}_2^0$, *which is related to the MSSM parameters calculated as follows:*

$$M_A, \tan\beta, m_h, \mu, M_1, A_e, M_L, M_E \tag{19}$$

We chose SM numerical model parameters

$$m_Z = 91.188GeV, m_W = 80.40GeV, \alpha_{EW} = 1/128 \tag{20}$$

Higgs particle mass is selected as$m_h$=125Gev, For SUSY part, we use FormCalc package to solve the quality of supersymmetric particles, andtan$^{\beta}$, ma, Mμ, MAssey and Aeas input parameters.
Wherein, Figure 4 shows the contour plots of the reaction process.

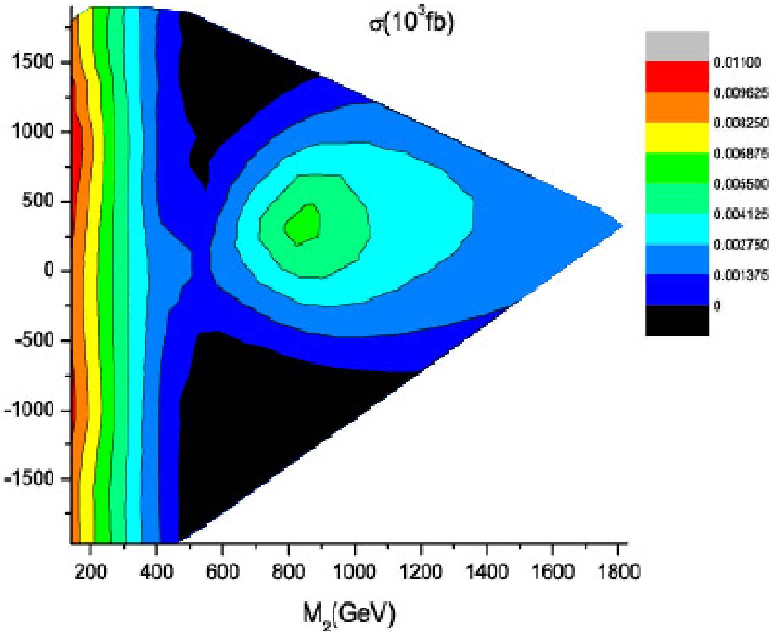


*Figure 4: The contour plots of the reaction process*

### 3.2 Numerical results and discussion

Simulation of the collision energy, respectively s= 14, 33 and 100 TeV hadron collider Ht of the production process. Input parameters are used as follows:

$$\begin{aligned} &G_\mu = 1.1663787\times 10^{-5} GeV^{-2}, \\ &M_W = 80.398GeV, M_Z = 91.1876GeV \\ &M_H = 126GeV, m_t = 173.5GeV \end{aligned} \tag{21}$$

In addition to the top quark, the other five were taken to be zero light quark mass and the CKM matrix is set as a unit matrix. Since we consider the production process is Hfl scattering cross sections NLO EW precision calculations, the corresponding ideal NLO, PDF should contain the results of the EW correction. Unfortunately, PDF with NLOEW amended so far yet.

*Table 1: Hadron generation process of Ht on collision integral scattering cross section LO and NLO*

| $\sqrt{s}TeV$ | $\sigma_{LO}(pb)$ | $\sigma_{NLO}(pb)$ | $\sigma_{g\gamma}(pb)$ | $\delta_{QCD}(\%)$ |
|---|---|---|---|---|
| 14 | 0.49442(7) | 0.5862(23) | 0.00659 | 22.6 |
| 33 | 3.3687(7) | 4.335(23) | 0.02930 | 33.0 |
| 100 | 29.973(7) | 35.65(23) | 0.13475 | 36.8 |

In Table 1, we provide collision energies are s = 14,33 and 100 TeV hadron generation process of Ht on collision integral scattering cross section LO and NLO, and the corresponding relative QCD and EW amendments were also listed in the the last two. By the gj-> Htt subroutine contribution scattering cross sections are also listed. We can see in all Hadron Collider energy collider LO scattering cross sections are amended to enhance NLOQCD but weakened NLO EW, and the absolute value of the relative correction NLO EW than the corresponding NLO QCD relative correction to be much smaller.

## 4. Conclusions

This paper systematically introduces the standard model (SM) Higgs mechanism, expounded produce Higgs particles, their behavior and its interaction with other particles of the school. Introduction of the extended model is the standard model - the minimum supersymmetric model (MSSM). It introduces the model and the particle spectrum MSSM Lagrangian. Focuses on the part of SSM Higgs model, review the nature of Higgs particle mass, coupling, we discussed the MSSM Higgs decay process. This paper focuses on the task, in the framework of the standard model of high-energy process Collider Higgs boson accompanied generated by in-depth discussion.

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