The superkinetic and interacting terms of Chiralsuperfields

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In this paper, we achieve some interesting results in the way to make sense how superparticles interact together and to ordinary particles by means of putting aside the dimensional constraints. This is the first step in the process of constructing an effective model taking binding possibilities of superparticles into account.

I. In brief

In hadron models, we see that quarks and antiquarks combine together and form bound-states as baryons and mesons. Logically, it is possible that their superpartners combine in somehow and form something by the name of superbaryons and supermesons. As we know, squarks and anti-squarks are scalars. Hence, superbaryons and supermesons are scalars too. For the time being, this topic has not been mentioned, because general supersymmetric gauge field theories have not been completely constructed yet. Because of complicated calculations, physicists usually put constraints into superfields in order to get some interacting initial terms of interacting Lagrangian when constructing supersymmetric gauge field theories. Unfortunately, several interacting possibilities between particles and sparticles are missed due to these constraints. So that, we can not predict some new particles which may pay important roles in effective models. In the framework of this paper, we put some constraints on supersymmetric Lagrangian aside with a hope of finding more interacting possibilities between particles and sparticles. From these results, we expect to contribute to construct a better phenomenological theory for mesons and nucleons.

II. Superkinetic of a chiral superfield and interacting terms

2.1 Superkinetic terms

In Supersymmetric field theories, supersymmetric Lagrangians are usually constructed by using supersymmetric utilities. It is seemingly undoubted. By more strictly considering, however, we realize that these Lagrangians are constructed from the parts whose have potential characteristic. The parts consist of two members f and K. Here, f is called superpotential, K is Kahler
potential. Moreover, whether the super derivatives are defined for supersymmetric transformations? These are the motivation for us to live no stone unturned to obtain new contributions by which are produced using these superderivatives

2.1.1 Fundamental blocks

\[
D_\alpha (\Phi (x, \theta)) = - \left( \frac{\partial}{\partial \theta_\alpha} + (\gamma^\mu)_\alpha \partial_\mu \right) (\Phi (x, \theta))
\]

\[
= \sqrt{2} (\psi_L)_\alpha - (\gamma^\mu)_\alpha \partial_\mu \varphi - \theta_\alpha H - (\gamma_5 \gamma^\mu)_\alpha \partial_\mu \varphi +
\]

\[
+ \sqrt{2} (\gamma^\mu)_\alpha (\bar{\theta} \partial_\mu \psi_L) + \sqrt{2} (\gamma_5)_\alpha (\bar{\theta} \gamma^\mu \partial_\mu \psi_L) + \frac{1}{\sqrt{2}} (\bar{\theta} \gamma_5 \theta) (\gamma^\mu \partial_\mu \psi_L)_\alpha -
\]

\[- \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \theta) \partial_\mu H - \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) \partial_\mu H - \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \gamma^\nu \theta) \partial_\mu \varphi +
\]

\[
+ \frac{1}{2} (\gamma_5)_\alpha (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi + \frac{\sqrt{2}}{2} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) (\bar{\theta} \gamma^\nu \partial_\nu \psi_L)
\]

\[
DD (\Phi (x, \theta)) = -4H + 2\sqrt{2} \bar{\theta} \gamma^\mu \partial_\mu \psi_L + 2\sqrt{2} \bar{\theta} \gamma^\mu \gamma_5 \partial_\mu \psi_L +
\]

\[
+ 2 (\bar{\theta} \gamma_5 \gamma^\mu \theta) \partial_\mu H - 2 (\bar{\theta} \theta) \partial^\mu \partial_\mu \varphi +
\]

\[
2 (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi + \sqrt{2} (\bar{\theta} \theta) \partial^\mu \partial_\mu \psi_L -
\]

\[- \sqrt{2} (\bar{\theta} \gamma_5 \theta) (\bar{\theta} \partial^\mu \partial_\mu \psi_L) + \frac{1}{2} (\bar{\theta} \gamma_5 \theta)^2 \partial^\mu \partial_\mu H - \frac{1}{2} (\bar{\theta} \theta) (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu H
\]

\[
D_\alpha (\Phi^* (x, \theta)) = \sqrt{2} (\psi_R)_\alpha - (\gamma^\mu)_\alpha \partial_\mu \varphi^* - \theta_\alpha H^* + (\gamma_5)_\alpha H^* +
\]

\[
+ (\gamma_5 \gamma^\mu)_\alpha \partial_\mu \varphi^* + \sqrt{2} (\gamma^\mu)_\alpha (\bar{\theta} \partial_\mu \psi_R) - \sqrt{2} (\gamma_5)_\alpha (\bar{\theta} \gamma^\mu \partial_\mu \psi_R) -
\]

\[- \frac{1}{\sqrt{2}} (\bar{\theta} \gamma_5 \theta) (\gamma^\mu \partial_\mu \psi_R)_\alpha - \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \theta) \partial_\mu H^* + \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) \partial_\mu H^* +
\]

\[
+ \frac{1}{2} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \gamma^\mu \theta) \partial_\mu \varphi^* + \frac{1}{2} (\gamma_5)_\alpha (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi^* - \frac{1}{\sqrt{2}} (\gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) (\bar{\theta} \gamma^\nu \partial_\nu \psi_R)
\]

\[
DD (\Phi^* (x, \theta)) = -4H^* + 2\sqrt{2} \bar{\theta} \gamma^\mu \partial_\mu \psi_R + 2\sqrt{2} \bar{\theta} \gamma^\mu \gamma_5 \partial_\mu \psi_R -
\]

\[- 2 (\bar{\theta} \gamma_5 \gamma^\mu \theta) \partial_\mu H^* - 2 (\bar{\theta} \theta) \partial^\mu \partial_\mu \varphi^* - 2 (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi^* + \sqrt{2} (\bar{\theta} \theta) (\bar{\theta} \partial^\mu \partial_\mu \psi_R)
\]

\[- \sqrt{2} (\bar{\theta} \gamma_5 \theta) (\bar{\theta} \partial^\mu \partial_\mu \psi_R) + \frac{1}{2} (\bar{\theta} \gamma_5 \theta)^2 \partial^\mu \partial_\mu H^* - \frac{1}{2} (\bar{\theta} \theta) (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu H^*
\]

\[
\bar{D}_\alpha (\Phi (x, \theta)) = \sqrt{2} (\bar{\psi}_L)_\alpha + (\bar{\theta} \gamma^\mu)_\alpha \partial_\mu \varphi - \bar{\theta}_\alpha H - (\bar{\theta} \gamma_5)_\alpha H -
\]

\[- (\bar{\theta} \gamma_5 \gamma^\mu)_\alpha \partial_\mu \varphi^* - \sqrt{2} (\bar{\theta} \gamma^\mu)_\alpha (\partial_\mu \bar{\psi}_L) - \sqrt{2} (\bar{\theta} \gamma_5)_\alpha (\partial_\mu \bar{\psi}_L \gamma^\mu \theta) -
\]

\[- \frac{1}{\sqrt{2}} (\bar{\theta} \gamma_5 \theta) (\partial_\mu \bar{\psi}_L \gamma^\mu)_\alpha + \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \theta) \partial_\mu H + \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) \partial_\mu H +
\]

\[2\]
\[ + \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \gamma^\nu \theta) \partial_\mu \partial_\nu \varphi + \frac{1}{2} (\bar{\theta} \gamma_5)_\alpha (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi + \frac{\sqrt{2}}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) (\partial_\mu \partial_\nu \bar{\psi}_L \gamma^\nu \theta) \]

\[ \bar{D}_\alpha (\Phi^* (x, \theta)) = \sqrt{2} (\bar{\psi}_R)_\alpha + (\bar{\theta} \gamma^\mu)_\alpha \partial_\mu \varphi^* - \bar{\theta}_\alpha H^* + (\bar{\theta} \gamma_5)_\alpha H^* + \]

\[ + (\bar{\theta} \gamma_5 \gamma^\mu)_\alpha \partial_\mu \varphi^* - \sqrt{2} (\bar{\theta} \gamma^\mu)_\alpha (\partial_\mu \bar{\psi}_R \theta) - \sqrt{2} (\bar{\theta} \gamma_5)_\alpha (\partial_\mu \bar{\psi}_R \gamma^\mu \theta) + \]

\[ + \frac{1}{\sqrt{2}} (\bar{\theta} \gamma_5 \theta) (\bar{\theta} \gamma_5 \gamma^\mu)_\alpha + \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) \partial_\mu H^* - \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) \partial_\mu H^* - \]

\[ - \frac{1}{2} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \gamma^\mu \theta) \partial_\mu \partial_\nu \varphi^* + \frac{1}{2} (\bar{\theta} \gamma_5)_\alpha (\bar{\theta} \gamma_5 \theta) \partial^\mu \partial_\mu \varphi^* + \frac{1}{\sqrt{2}} (\bar{\theta} \gamma^\mu)_\alpha (\bar{\theta} \gamma_5 \theta) (\partial_\mu \partial_\nu \bar{\psi}_R \gamma^\nu \theta) \]

### 2.1.2 Combinations

These are some basic objects. We will imply abilities to combine them in order to contribute new parts into Lagrangian. The general action is added by term as:

\[ I_H = \frac{1}{2} \int d^4 x \left( H_D^2 \right) + \frac{1}{8} \int d^4 x \left( H_D^4 \right) \] (7)

Where:

\[ H_D^2 = \left[ \bar{D} (\Phi^* (x, \theta)) D (\Phi (x, \theta)) + \bar{D} (\Phi^* (x, \theta)) \gamma_5 \gamma_5 D (\Phi (x, \theta)) \right]_{\bar{\theta} \bar{\theta} \bar{\theta} \bar{\theta}} \] (8)

and

\[ H_D^4 = \left[ \bar{D} \bar{D} (\Phi^* (x, \theta)) \bar{D} \bar{D} (\Phi (x, \theta)) \right]_{\bar{\theta} \bar{\theta} \bar{\theta} \bar{\theta}} \] (9)

After meticulous calculations, we achieve some exciting results:

\[ H_D^2 = 0 \] (10)

\[ H_D^4 = 2 \partial^\mu \partial_\mu (H^* H) - 8 \partial^\mu H^* \partial_\mu H + 8 \partial^\mu \partial_\mu \varphi^* \partial^\nu \partial_\nu \varphi \] (11)

In this expression, the first term is a total derivative. Hence, it vanish when is put in the action. While, the third term, the unexpected term, will be canceled by on-shell condition and massless scenario. That means:

\[ \partial^\mu \partial_\mu \varphi^* = 0; \partial^\mu \partial_\mu \varphi = 0 \] (12)

\[ H_D^4 = \partial^\mu H^* \partial_\mu H \] (13)

Hence, we can write new Lagrangian density:

\[ L_H = \partial^\mu H^* \partial_\mu H \] (14)

### 2.2 Interacting terms
we expect to determine the interacting forms between sparticles with ordinary particles. Let consider N superfields $\Phi_n(x, \theta)$ and N complex conjugate superfields $\Phi^*_n(x, \theta)$. They are expressed as:

$$\Phi_n(x, \theta) = \varphi_n(x_+) + \sqrt{2} \theta^T \varepsilon \psi_{Ln} (x_+) + H_n(x_+) \left( \theta^T_L \varepsilon \theta_L \right)$$ (15)

$$\Phi^*_n(x, \theta) = \bar{\varphi}_n(x_-) - \sqrt{2} \theta^T \varepsilon \psi_{Ln} (x_-) + \bar{H}_n(x_-) \left( \theta^T_L \varepsilon \theta_L \right)$$ (16)

While, $x_+$ and $x_-$ are

$$x_\mu^\pm = x^\mu \pm \theta^T \varepsilon \gamma^\mu \theta_L$$ (17)

The interacting function is performed as formula:

$$f(\Phi) = \sum_{i=1}^{N} f_i(\Phi_i) + t \sum_{i \neq j=1}^{N} \Phi_i \Phi_j + d \sum_{i \neq j \neq k=1}^{N} \Phi_i \Phi_j \Phi_k + h.c$$ (18)

Correspondingly, the interacting action is

$$I_{int} = \int dx^4 \left\{ \sum_{i=1}^{N} [f_i(\Phi_i)]_F + t \sum_{i \neq j=1}^{N} [\Phi_i \Phi_j]_F + d \sum_{i \neq j \neq k=1}^{N} [\Phi_i \Phi_j \Phi_k]_F + h.c \right\}$$ (19)

In detail

$$[f_i(\Phi_i)]_F = H_i \frac{\partial f_i}{\partial \varphi_i} - \frac{1}{2} \frac{\partial^2 f_i}{\partial \varphi_i^2} \bar{\psi}_{Li} \psi_{Li}$$ (20)

$$[\Phi_i \Phi_j]_F = \varphi_i H_j + \varphi_j H_i - \bar{\psi}_{Li} \psi_{Lj}$$ (21)

$$[\Phi_i \Phi_j \Phi_k]_F = \varphi_i \varphi_j H_k + \varphi_j \varphi_k H_i + \varphi_k \varphi_i H_j - \bar{\psi}_{Li} \psi_{Lj} \varphi_k - \bar{\psi}_{Lj} \psi_{Lk} \varphi_i - \bar{\psi}_{Li} \psi_{Lk} \varphi_j$$ (22)

Remember that $\varphi_i, \psi_{Li}, \bar{\psi}_{Li}, H_i$, depend on $x_+ = x^\mu \pm \theta^T \varepsilon \gamma^\mu \theta_L$. However, it is possible to achieve the dependence of them on Minkovskian variables through a transformation in the action. Hence, we have:

$$I_{int} = I_i + I_{ijk}$$ (23)

Where

$$I_i = \int dx^4 \left\{ \sum_{i=1}^{N} \left[ H_i \frac{\partial f_i}{\partial \varphi_i} - \frac{1}{2} \frac{\partial^2 f_i}{\partial \varphi_i^2} \bar{\psi}_{Li} \psi_{Li} \right] \right\}$$ (24)

$$I_{ijk} = \int dx^4 \left\{ \sum_{i \neq j \neq k=1}^{N} \left[ t \left( \varphi_j H_i + \varphi_i H_j - \bar{\psi}_{Li} \psi_{Lj} \right) + d \left( \varphi_i \varphi_j H_k - \bar{\psi}_{Lj} \psi_{Lk} \varphi_i \right) \right] + h.c \right\}$$ (25)
We denoted that
\[ \varphi_i \varphi_j H_k = \varphi_i \varphi_j H_k + \varphi_j \varphi_k H_i + \varphi_k \varphi_i H_j \]  
\[ \overline{\psi}_L \psi_L \varphi_k = \overline{\psi}_L \psi_L \varphi_k + \overline{\psi}_L \psi_L \varphi_i + \overline{\psi}_L \psi_L \varphi_j \]  

III. The three superfield system

We take into account three chiral superfields: quark up superfield \( U \), quark down superfield \( D \), quark strange superfield \( S \). They are expressed as:
\[ \Phi_i (x, \theta) = \varphi_i (x_+) - \sqrt{2} \theta_L \varepsilon \psi_L i (x_+) + H_i (x_+) \theta_L \varepsilon \theta_L \]  
Or:
\[ \Phi_i (x, \theta) = \varphi_i (x) - \sqrt{2} (\bar{\theta} \psi_L i (x)) + \left( \bar{\theta} \left( \frac{1 + \gamma_5}{2} \right) \theta \right) H_i (x) + \]  
\[ + \frac{1}{2} \left( \bar{\theta} \gamma_\mu \gamma_5 \theta \right) \partial_\mu \varphi_i (x) - \frac{1}{\sqrt{2}} \left( \bar{\theta} \gamma_5 \theta \right) \left( \partial_\mu \psi_L i (x) \right) - \frac{1}{8} \left( \bar{\theta} \gamma_5 \theta \right)^2 \partial_\mu \partial_\mu \varphi_i (x) \]  
Here, \( i=1, 2, 3 \). \( \Phi_{1,2,3} = U, D, S \) are chiral superfields; \( \psi_{L1,2,3} = u, d, s \) are quark up, down and strange; \( \varphi_{1,2,3} = \tilde{u}, \tilde{d}, \tilde{s} \) are superpartners of quarks; \( H_i \) are auxiliary fields of superfields \( U, D, S \). The supersymmetric action:
\[ I = I_K + I_H + I_{int} \]  
Where
\[ I_K = \int dx^4 [K]_D \]  
\[ I_H = \frac{h_1}{2} \int d^4x (H_D^2) + \frac{h_2}{8} \int d^4x (H_D^4) \]  
\[ I_{int} = \int dx^4 \left\{ \sum_{i=1}^{3} [f_i (\Phi_i)]_F + \sum_{i \neq j=1}^{3} \eta_{ij} [\Phi_i \Phi_j]_F + \sum_{i \neq j \neq k=1}^{3} \omega_{ijk} [\Phi_i \Phi_j \Phi_k]_F \right\} + \]  
\[ + \int dx^4 \left\{ \sum_{i=1}^{3} [f_i (\Phi_i)]^*_F + \sum_{i \neq j=1}^{3} \eta_{ij}^* [\Phi_i \Phi_j]^*_F + \sum_{i \neq j \neq k=1}^{3} \omega_{ijk}^* [\Phi_i \Phi_j \Phi_k]^*_F \right\} + \]  
\[ +hc \]  
h_1, h_2 are constants with dimensions of -1 and -2, respectively. In this case, we put renormalization aside, so that these minus values are acceptable.
\( \eta_{ij}, \varpi_{ijk} \) are interacting constants.

Kahler potential, here, is formed as:

\[
K(\Phi^*, \Phi) = \sum_{i,j=1}^{3} g_{ij} \Phi_i^* \Phi_j 
\]

(33)

\[
[K(\Phi^*, \Phi)]_D = \sum_{i,j=1}^{3} g_{ij} \left[ -\partial^\mu \phi_i^* \partial_\mu \phi_j + H_i^* H_j + \frac{1}{2} \left( \partial_\mu \bar{\psi}_i \gamma^\mu \psi_j \right) - \frac{1}{2} \left( \bar{\psi}_i \gamma^\mu \partial_\mu \psi_j \right) \right] 
\]

(34)

In order that the kinetic terms of scalar fields and spinor fields coincide with quantum commutative and anti-commutative rules, then must be positive. Hence, we choice \( g_{ij} = \delta_{ij} \)

\[
[K(\Phi^*, \Phi)]_D = \sum_{i=1}^{3} \left[ -\partial^\mu \phi_i^* \partial_\mu \phi_i + H_i^* H_i + \frac{1}{2} \left( \partial_\mu \bar{\psi}_i \gamma^\mu \psi_i \right) - \frac{1}{2} \left( \bar{\psi}_i \gamma^\mu \partial_\mu \psi_i \right) \right] 
\]

(35)

\[
I_K = \int dx^4 \left\{ \sum_{i=1}^{3} \left[ \frac{1}{2} \left( \partial_\mu \bar{\psi}_i \gamma^\mu \psi_i \right) - \frac{1}{2} \left( \bar{\psi}_i \gamma^\mu \partial_\mu \psi_i \right) - \partial^\mu \phi_i^* \partial_\mu \phi_i + H_i^* H_i \right] \right\} 
\]

(36)

In \( I_{int} \)

\[
f_i (\Phi_i) = a_i \Phi_i^2 + b_i \Phi_i^2 + c_i \Phi_i 
\]

(37)

Here, \( a_i, b_i, c_i \) are constants calculated via Supersymmetry Spontaneously Broken

\[
I_{int} = \int dx^4 \left\{ \sum_{i=1}^{3} \left[ a_i H_i + 2b_i H_i \phi_i - b_i \bar{\psi}_L \psi_L + 3c_i H_i \phi_i^2 - 3c_i \phi_i \bar{\psi}_L \psi_L \right] + \right. 
\]

\[
+ \sum_{i=1}^{3} \left[ a_i H_i^* + 2b_i H_i^* \phi_i - b_i \left( \bar{\psi}_L \psi_L \right)^* + 3c_i H_i^* (\phi_i^2)^* - 3c_i \phi_i^* \left( \bar{\psi}_L \psi_L \right)^* \right] + \right. 
\]

\[
+ \sum_{i \neq j=1}^{3} \left[ \eta_{ij} \left( H_i \phi_j + H_j \phi_i - \bar{\psi}_L \psi_L \right) + \eta_{ij}^* \left( H_i^* \phi_j^* + H_j^* \phi_i^* - \left( \bar{\psi}_L \psi_L \right)^* \right) \right] + \right. 
\]

\[
+ \sum_{i \neq j \neq k=1}^{3} \left[ \varpi_{ijk} \left( \bar{H}_i \phi_j \phi_k - \varphi (\bar{\psi}_L \psi_L \bar{\psi}_L \psi_L) \right) + \varpi_{ijk}^* \left[ (H_i \phi_j \phi_k)^* - \left( \varphi (\bar{\psi}_L \psi_L \bar{\psi}_L \psi_L) \right) \right] \right] \right\} 
\]

We achieve the Lagrangian:

\[
L = \sum_{i=1}^{3} \left[ \frac{1}{2} \left( \partial_\mu \bar{\psi}_i \gamma^\mu \psi_i \right) - \frac{1}{2} \left( \bar{\psi}_i \gamma^\mu \partial_\mu \psi_i \right) - \partial^\mu \phi_i^* \partial_\mu \phi_i + h \partial^\mu H_i^* \partial_\mu H_i \right] + 
\]

(39)
\[\begin{align*}
&+ \sum_{i=1}^{3} \left[ a_i H_i + a_i H_i^* + H_i^* H_i + 2b_i \left[ H_i \varphi_i + H_i^* \varphi_i^* - \frac{1}{2} \bar{\psi}_L i \psi_L i - \frac{1}{2} (\bar{\psi}_L i \psi_L i)^* \right] \right]
&+ \sum_{i=1}^{3} 3c_i \left[ H_i \varphi_i^2 - \varphi_i \bar{\psi}_L i \psi_L i + H_i^* (\varphi_i^2) H^* - \varphi_i^* (\bar{\psi}_L i \psi_L i)^* \right] +
&+ \sum_{i \neq j=1}^{3} \left[ \eta_{ij} (H_i \varphi_j + H_j \varphi_i - \bar{\psi}_L i \psi_L j) + \eta_{ij}^* (H_i^* \varphi_j^* + H_j^* \varphi_i^* - (\bar{\psi}_L i \psi_L j)^*) \right] +
&+ \sum_{i \neq j \neq k=1}^{3} \left[ \varpi_{ijk} (H_i \varphi_j \varphi_k - \varphi_i \bar{\psi}_L j \psi_L k) + \varpi_{ijk}^* ((H_i \varphi_j \varphi_k)^* - (\varphi_i \bar{\psi}_L j \psi_L k)^*) \right]
\end{align*}\]

Let consider terms at the last line in detail. We expect to get the reflection of how component fields interact together. We can rewrite these terms:

\[L_{\text{int}} = \omega_{uds} H_u \bar{d} \bar{s} + \omega_{dus} H_d \bar{d} \bar{s} + \omega_{sud} H_s \bar{d} \bar{s} - \omega_{uds} \bar{d} \bar{s} - \omega_{dus} \bar{d} \bar{s} - \omega_{sud} \bar{d} \bar{s} - \text{cc} \quad (40)\]

**IV. Conclusion**

By putting the dimensional constraints aside, we achieve some exciting results, concerning with the existing possibility of \(H\), and how ordinary particles and sparticles and \(H\) interact together.
Bibliography

[1] Bagger. J and Wess .J , *Supersymmetry and Supergravity, Princeton University Press, 2d Ed.*, (1992).
[2] Bilal. A, *Introduction to Supersymmetry, lectures at the summer school ”Gif 2000”, Paris.*
[3] Cahill. K, hep-ph/9907295, (1999).
[4] Mukki. S, Introduction to Symmetry, lectures at the 13th Vietnam School of Physics, Nhatrang
[5] Ryder. L.H, Quantum Field Theory, Cambridge University Press, 2d Ed 1996
[6] Salam. A and Strathdee, *J, Phys. Lett.,51B* (1974) 353
[7] Salam. A and Strathdee, *J, Nucl. Phys.,B76* (1974) 477
[8] Salam. A and Strathdee, *J, Nucl. Phys.,B 97* (1974) 293
[9] Sohnius. M.F, *Phys. Reports*,128, Nos. 223 39-204 (1985)
[10] Weiberg. S, The Quantum Theory of Field, volume III Supersymmetry, Cambridge University Press 2000
[11] Wess. J and Zumino. B, *Nucl. Phys.,B 70* (1974) 39
[12] Wess. J and Zumino. B, *Nucl. Phys.,B 78* (1974) 113
[13] Zumino. B, *Phys. Lett.,78B* (1979) 39
[14] West. P, Introduction to Supersymmetry and Gravity, World Scientific, Singapore 1986