Infinite color energy in the SUSY

Imre Czövek

In the article I examined the infinite color potential of the color charge breaking, and the supersymmetrical space-time quantum shift of spin transformations. The discrete supersymmetry breaks the energy and the color. The supersymmetrical Lagrangian allowed me to introduce the followings:
1. the supersymmetry generators appear in the vertex, so the interactions contain spinor charges in supergauge transformations,
2. discrete space-time translation appears in the propagator, the non continuous particle path is available,
3. dangerous color breaking.

I declare, if a lone color charge disappears, the whole universe would become a non color singlet QGP again, like 10^{10} years ago in the Big Bang. The baryon and lepton number remain invariant in the inverse electroweak phase transition and in the ordinary electroweak phase transition in my theory, because the baryon genesis simulations can't prove the baryon number breaking, with the possible Higgs mass.

The not color singlet QGP state in the Big Bang gives an easy explanation to the near infinite energy of the Big Bang. This explanation hides the lightest SUSY particle, and hides this trace of Big Bang as a not observable dark matter. The dangerous cause of Big Bang will be reproducible by next year in the LHC experiment. This is one more reason for searching of this theory. The gluino mass is crucial, and this energy will be reached at the CERN.

The color antiscreening forbids the escape of quarks and gluons from the hadrons, and forbids the existence of free quarks. The equal definitions of **quark confinement**:
1. the not color singlet state has got infinite energy,
2. at infinite distance the singlet quark- antiquark potential becomes infinite,
3. the gluon spectrum has mass-gap on low energy,
4. the color charge rises with the distance.

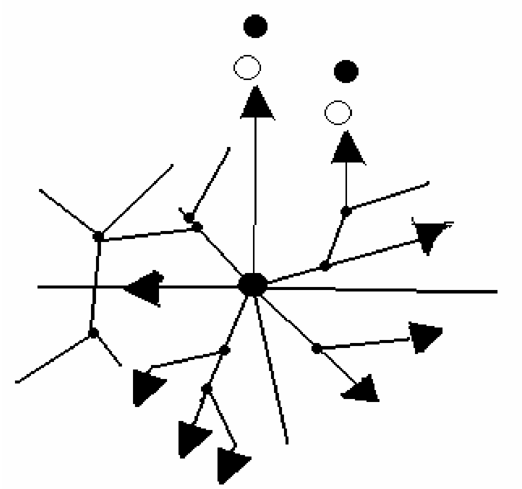

Fig. 1.
The central extra color charge creates gluons →, charges ● ○ and with the gluons attracts other hadrons

The static quark potential is linear on large distance and on low energy:

$$V\ (r) = -k(\alpha_S)r \tag{1}$$

The "k" constant depends on the $\alpha_S(\Delta q)$ strong coupling constant, and $\alpha_S(\Delta q)$ depends on the impulse difference. This potential bound the quarks like to the spring, and this potential order the gluons in narrow flux tubes.

If we create (or disappear) an extra lone quark color, the non singlet potential energy in (1) would be around infinity, it is the first definition of quark confinement. The "spring" potential connects **all** quarks. This extra color charge polarizes all other hadrons and attracts them until $k(\alpha_S(q^2)) \to 0$. The k=0 means the QGP state. So we get again a very dense, hot and charged QGP universe. k=0 is a compulsion, because k>0 rises the energy. For example if an anti red quark disappears, the color charge rises with the distance. The lone red quark color seems infinite red from large distance. This red attracts the blue and green quarks of any nucleon and repulses the red quark of the nucleons. But the color charge of the quark is random in the hadron, so this potential attracts with 2/3-1/3 force the hadrons. The white hadrons can't neutralize this extra red color. The red quark accelerate the hadrons until the impulse difference became q, where $k(\alpha_S(q))=0$. The apparition of the missing anti red charge dissolve the k=0 compulsion and the potential became zero $V_{r=\infty}=0$. The globally white QGP can expand and cool.

The physicists don't break the Energy and charge, but the infinite E is in the QCD, and if SUSY would be today, it should break the "T_{ij}" SU(3) color charge immediately, because the spinor and color charge don't commutate with each other.

Quantum shift[7] is the name of the space shift: any fluctuation of the Grassmann space generates a space shift for the particles. I used discrete Grassmann (spin) shifts instead of fluctuations, because the new SUSY vertex allows that for me.

The superparticle disappearance with the SUSY transformation

Only the product of two conjugated super transformations is Hermitian and measurable. The $\{Q_\alpha,\overline{Q}_\beta\}_+ \sim 2\sigma_{\alpha\beta}{}^\mu p_\mu$ anticommutator is always Hermitian, so this two Q operators act at once in time. I inserted these measurable $\{Q,\overline{Q}\}_+$ spinor charges in the SUSY vertices as coupling constants (charges) are in SM vertices -> $g_{susy}e^{i\varepsilon\overline{Q}+i\overline{\varepsilon}Q}$. The product in the group:

$$e^{i\varepsilon\overline{Q}+i\overline{\varepsilon}Q}e^{i(\Theta\overline{Q}+\overline{\Theta}Q+x^\mu p_\mu)} = e^{i[(x^\mu+\overline{\varepsilon}2i\sigma^\mu\varepsilon)p_\mu+(\Theta+\varepsilon)\overline{Q}+(\overline{\Theta}+\overline{\varepsilon})Q]}$$

The definition of two infinitesimal SUSY transformations is:

$$[\delta_1,\delta_2]\Psi = \left[\varepsilon_1\overline{Q},\overline{\varepsilon_2 Q}\right]_-\Psi = \overline{\varepsilon}_2 2i\sigma^\mu\varepsilon_1\partial_\mu\Psi = \delta_a\Psi \qquad (2)$$

The space-time translation of the fermions and bosons is the same:

$$a^\mu = \overline{\varepsilon}_2 2i\sigma^\mu\varepsilon_1 \qquad (7.a)$$

$a^\mu = \overline{\varepsilon}2i\sigma^\mu\varepsilon \geq 0$ is positive and causal if $\varepsilon_2 = \varepsilon_1$.

On the supersymmetric coordinates ($\mathbf{x}^{0,1,,2,3}$, $\Theta^{1,2}$, $\overline{\Theta_{1,2}}$) the supersymmetric action gives the same translation:

$$\left[\varepsilon_1\overline{Q},\overline{\varepsilon_2 Q}\right]_- : (x,\Theta,\overline{\Theta}) = (x+\overline{\varepsilon}2i\sigma\varepsilon, \Theta+\varepsilon_1, \overline{\Theta}+\overline{\varepsilon}_2) \qquad (7.b)$$

This quantum shift was written in many text books, but they assumed that it is infinitesimal small. BUT ε is a finite constant, eq 6. isn't a continuous translation, is not dissolvable to the sum of measureable infinitesimal parts.

$$\delta a = \left[\sum_{i=1}^{\infty} \varepsilon_i \overline{Q}, \sum_{j=1}^{\infty} \overline{\varepsilon}_j Q \right]_- = \sum_{i,j=1}^{\infty} \left[\varepsilon_i \overline{Q}, \overline{\varepsilon}_j Q \right]_- \neq \sum_{i=1}^{\infty} \left[\varepsilon_i \overline{Q}, \overline{\varepsilon}_i Q \right]_- = \sum_{i=1}^{\infty} \delta a_i$$

The anticommutator of these sums is different from the sum of anticommutators. The decomposition is not measureable. The measurable SUSY should be *discrete symmetry and breaks the invariance laws.*

Spontaneous Symmetry Breaking:

As SUSY and SU(2) $_{weak}$ *spontaneous sym. breaking theorem we can choose the* ε *constant to the goldstone fermion field* $\boldsymbol{\varepsilon = \lambda}$. Then a^{μ} is a large non dissolvable, constant amount of time (and space).

The Wess Zumino Lagrange is invariant under SUSY transformation.

$$L = (\frac{1}{2}\phi T \phi - \frac{m}{2}\phi\phi - \frac{g}{3}\phi\phi\phi)_F = (\frac{1}{2}\phi' T \phi' - \frac{m}{2}\phi'\phi' - \frac{g}{3}\phi'\phi'\phi_2)_F$$

$$\phi' = e^{i\varepsilon\overline{Q} + i\overline{\varepsilon}Q}\phi \qquad (8)$$

The ϕ derivates of eq 8. give the new vertex and the new propagator. The general and the gluon-gluino vertex:

$$\Gamma_{super} = \frac{\partial^3 L_{\text{int}}}{\partial\phi\partial\phi\partial\phi} = \frac{\partial^3 L'_{\text{int}}}{\partial\phi\partial\phi\partial\phi} = \frac{\partial^3 (g\phi'\phi'\phi)}{\partial\phi\partial\phi\partial\phi} \Big|_{components}$$

$$\Gamma_{g,gino} = g_s f^{abc} \gamma_\mu \rightarrow g_{susy} f^{abc} \gamma_\mu e^{i\varepsilon\overline{Q} + i\overline{\varepsilon}Q} \qquad (9)$$

The $e^{i\varepsilon\overline{Q} + i\overline{\varepsilon}Q}$ positive time shift creates the gluino field later, the disappeared fields stay disappeared later, too.

The $e^{i\varepsilon\overline{Q} + i\overline{\varepsilon}Q}$ phase of SUSY space-time shift appears in the propagator and vertex, because I can put this phase in the supersymmetric Lagrange density and $\delta_\varepsilon L = 0$. The vertex was obtained from L_{int} and the propagator was obtained from L_0.

The $\Phi\Phi^+$ superfield propagator allows $\Theta \neq \Theta'$ and allows translations, small distances where the SUSY particle doesn't "propagate" classically. The new Feynman propagator contains space-time translation:

$$\langle 0 | T\{\Phi(x_1, \Theta_1, \overline{\Theta_1})\Phi^+(x_2, \Theta_2, \overline{\Theta_2})\} | 0 \rangle = -i \exp[i(\Theta_1 \sigma^m \overline{\Theta}_1 + \Theta_2 \sigma^m \overline{\Theta}_2 - 2\Theta_1 \sigma^m \overline{\Theta_2})\partial_m] \Delta_F (x_1 - x_2)$$

(10)

A SUSY interaction shifts the Grassman space with ε. The propagator gets a space shift phase after the vertex point. (In the $(x, \Theta, \overline{\Theta})$ interaction point the field disappear, the vertex shifts the Grassman space, and the new field appear in ($x + \overline{\varepsilon} 2i\sigma\varepsilon$, $\Theta + \varepsilon, \overline{\Theta} + \overline{\varepsilon}$).)

Between the points: $(x, \Theta, \overline{\Theta})$ and ($x + \overline{\varepsilon} 2i\sigma\varepsilon$, $\Theta + \varepsilon, \overline{\Theta} + \overline{\varepsilon}$) the propagator contains a space-time jump phase:

$$\langle 0 | T\{(1+[\varepsilon_1 \overline{Q}, \overline{\varepsilon_2} Q])\Phi(x,\Theta,\overline{\Theta})\Phi^+(x,\Theta,\overline{\Theta})\} | 0\rangle = -i\exp[i(\varepsilon\sigma^m\overline{\varepsilon} + \Theta\sigma^m\overline{\varepsilon} - \varepsilon\sigma^m\overline{\Theta})\partial_m]\Delta_F(\overline{\varepsilon}2i\sigma\varepsilon) =$$

$$=> -i\exp[ia^m\partial_m]\Delta_F(x, x+a)$$

We get similar discrete space-time translation, like in the definition of SUSY. It's another proof of the discrete space translation among spin transformations.

With Hermitian Q the charge breaking would be too easy. The spinor charge and the color charge are not commutate, are not invariant. We get different eigen charges if we first measure T then Q, or first Q then T:

$$[Q_{ai}, T_j] = (b_j)_i^k Q_{ak}; \quad [\bar{Q}_{\dot{a}i}, T_j] = -(b_j)_i^k \bar{Q}_{\dot{a}k} \qquad (14)$$

Lack of observations

-If a vertex contains a superparticle, then there are quantum shifted outgoing legs.

- SUSY particles can disappear forever in any $g_{susy} e^{i\varepsilon\overline{Q} + i\overline{\varepsilon}Q}$ interaction in the flat-space. LSP (as dark matter) will *vanish forever,* because with self interactions we can add infinite amount of time shifts $\Psi(t + \sum a_0)$. In each loop we get $2a_\mu$ quantum shift. The Grassmann coordinate of LSP change always. It propagate only in Grassmann space.
- Virtual (small) shift is favourable to quantum vagueness.
- In the nature there is not supersymmetric QGP.

In the near of the black holes the curved space $[x_1, x_2] \neq 0$ change the double SUSY transformations:

$$(\delta_\eta\delta_\varepsilon - \delta_\varepsilon\delta_\eta)V^A = V^D\varepsilon^C\eta^B R^A_{BCD} - \varepsilon^C\eta^B T^D_{BC} D_D V^A \qquad (17)$$

These equations are more complicated because new gravitational fields appear in eq. 17. Curved SUSY isn't measureable. In curved space the super particle can not vanish, so black holes eat the LSP.

- Fermions and bosons have equal mass m=0 during the disappeared translation, this is the same mass multiplet of unbroken SUSY. Fermions and bosons have equal occupation of states because T=0, but before and after the disappearance this particles have high temperature.

re-Big Bang:

I find very interesting that a little charge breaking can cause infinite universe contraction and explosion. The disappearance of a lot of color particles gave a white noise color and could gave a quasi stable state. After the restoration of broken SUSY the Goldstone fermion vanishes. The discrete space-time shifts became a random parameter independently from Goldstino. The contraction continue until all baryon bacame QGP state, because on the border of SU(2) restored space spontan broken SUSY particles have discrete shifts. Until $k_{source} > 0$ the hadrons move in the direction of the source. This takes for long time (billions of years) if we collect all baryons. But it's not a long time for the time shifted super particles.

Ref.:

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