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Supersymmetric contribution to the CP asymmetry of $B \to J/\psi\phi$ in the light of recent $B_s - \bar{B}_s$ measurements

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We derive new model independent constraints on the supersymmetric extensions of the standard model from the new experimental measurements of $B_s - \bar{B}_s$ mass difference. We point out that supersymmetry can still give a significant contribution to the CP asymmetry of $B_s \to J/\psi\phi$ that can be measured at the LHCb experiment. These new constraints on the LL and RR squark mixing severely restricted their possible contributions to the CP asymmetries of $B \to \phi K$ and $B \to \eta' K$. Therefore, SUSY models with dominant LR flavor mixing is the only way to accommodate the apparent deviation of CP asymmetries from those expected in the standard model. Finally we present an example of SUSY nonminimal flavor model that can accommodate the new ΔM_{B_s} results and also induces significant CP asymmetries in $B_s \to J/\psi\phi$, $B \to \phi K$, and $B \to \eta' K$ processes.

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Recently, the D0 [1] and CDF [2] Collaborations have reported new results for the $B_s - \bar{B}_s$ mass difference:

$$17 ps^{-1} < \Delta M_{B_s} < 21 ps^{-1} \quad 90\%\text{C.L.} \quad (\text{D0}),$$
$$\Delta M_{B_s} = 17.33^{+0.42}_{-0.21} \pm 0.07 ps^{-1} \quad (\text{CDF}), \tag{1}$$

which seems consistent with the standard model (SM) predictions. In fact, the estimation of the SM value for ΔM_{B_s} contains large hadronic uncertainties. The $B_s^0 - \bar{B}_s^0$ mass difference is defined as $\Delta M_{B_s} = 2\mathcal{M}_{12}(B_s) = 2|\langle B_s^0 | H_{\text{eff}}^{\Delta B=2} | \bar{B}_s^0 \rangle|$, where $H_{\text{eff}}^{\Delta B=2}$ is the effective Hamiltonian responsible for the $\Delta B = 2$ transition. In the SM, $H_{\text{eff}}^{\Delta B=2}$ is generated by the box diagrams with W exchange. The best determination for $\Delta M_{B_s}^{\text{SM}}$ can be obtained from a ratio to the $\Delta M_{B_d}^{\text{SM}}$ in which some QCD corrections as well as t quark mass dependence are cancelled out

$$\frac{\Delta M_{B_s}^{\text{SM}}}{\Delta M_{B_d}^{\text{SM}}} = \frac{M_{B_s}}{M_{B_d}} \frac{B_{B_s} f_{B_s}^2}{B_{B_d} f_{B_d}^2} \frac{|V_{ts}|^2}{|V_{td}|^2}, \tag{2}$$

where $M_{B_d} = 5.28$ GeV and $M_{B_s} = 5.37$ GeV and the lattice calculations lead to $B_{B_s} f_{B_s}^2 / (B_{B_d} f_{B_d}^2) = (1.15 \pm 0.06^{+0.07}_{-0.00})^2$ [3]. Since the $B_d^0 - \bar{B}_d^0$ oscillation is mostly saturated by the SM contributions [4], we can assume that $\Delta M_{B_d}^{\text{SM}} = \Delta M_{B_d}^{\text{exp}} = (0.502 \pm 0.007)\ \text{ps}^{-1}$. Finally, $|V_{ts}|^2/|V_{td}|^2$ can be given as a function of the angle γ of the unitary triangle of Cabibbo-Kobayashi-Maskawa (CKM) mixing matrix. In Fig. 1, we present the allowed range of $\Delta M_{B_s}^{\text{SM}}$ in terms of the angle γ (measured from a pure SM process). Here we assume that $|V_{cb}|$ and $|V_{ub}|$ are free of new physics and can be determined by the SM contribution to the semileptonic decay. Also, it is assumed that the angle β is given by β^{SM}, measured from $B_d \to J/\psi K_s$. As can be seen from this figure, the new bounds on ΔM_{B_s} impose stringent constraints on the values of γ^{SM}. The lower bound of D0 result excludes values of $\gamma^{\text{SM}} > 70°$. It is worth mentioning that the best fit for γ^{SM} and $\Delta M_{B_s}^{\text{SM}}$, according to UTfit group is given by [5]:

$$\gamma^{\text{SM}} = 61.3 \pm 4.5, \qquad \Delta M_{B_s}^{\text{SM}} = (17.45 \pm 0.25) ps^{-1}, \tag{3}$$

and according to CKMfitter group is given by [6]

$$\gamma^{\text{SM}} = 59.8^{+4.9}_{-4.1}, \qquad \Delta M_{B_s}^{\text{SM}} = 17.3^{+0.49}_{-0.20}. \tag{4}$$

Therefore, it is expected that the experimental measurements in Eq. (1) provide important constraints on any new physics beyond the SM [7]. In this paper, we study the constraints imposed on the supersymmetric (SUSY) model due to these experimental limits. We derive model independent bounds on the relevant SUSY mass insertions. Then we analyze the implications of these constraints on the supersymmetric contribution to the CP asymmetry in $B_s \to J/\psi\phi$ process. Finally, we consider the SUSY non-

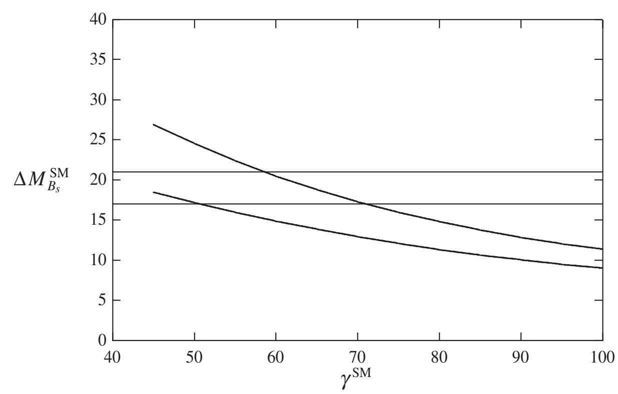

FIG. 1. Allowed region of ΔM_{B_s}, in the SM, as a function of the angle γ.

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minimal flavor model studied in Ref. [8], as an example for the SUSY model, that can accommodate the new ΔM_{B_s} results and also induces significant CP asymmetry in $B \to J/\psi\phi$ which can be measured at the LHCb experiment.

In supersymmetric theories, the effective Hamiltonian $H_{\rm eff}^{\Delta B=2}$ receives new contributions through the box diagrams mediated by gluino, chargino, neutralino, and charged Higgs. It turns out that gluino exchanges give the dominant contributions [9]. The most general effective Hamiltonian for $\Delta B = 2$ processes, induced by gluino exchange through $\Delta B = 2$ box diagrams, can be expressed as

$$H_{\rm eff}^{\Delta B=2} = \sum_{i=1}^{5} C_i(\mu)Q_i(\mu) + \sum_{i=1}^{3} \tilde{C}_i(\mu)\tilde{Q}_i(\mu) + \text{H.c.}, \quad (5)$$

where $C_i(\mu)$, $\tilde{C}_i(\mu)$ and $Q_i(\mu)$, $\tilde{Q}_i(\mu)$ are the Wilson coefficients and the local operators normalized at the scale m_b, respectively, which can be found in Ref. [9]. As in the B_d system, the effect of SUSY can be parametrized by a dimensionless parameter r_s and a phase $2\theta_s$ defined as follows:

$$r_s e^{i\theta_s} = \sqrt{\frac{\mathcal{M}_{12}(B_s)}{\mathcal{M}_{12}^{\rm SM}(B_s)}}, \quad (6)$$

where $\mathcal{M}_{12}(B_s) = \langle B_s^0 | H_{\rm eff}^{\Delta B=2} | \bar{B}_s^0 \rangle \equiv \mathcal{M}_{12}^{\rm SM} + \mathcal{M}_{12}^{\rm SUSY}$. Thus, the total $B_s - \bar{B}_s$ mass difference is given by $\Delta M_{B_s} = 2|\mathcal{M}_{12}^{\rm SM}(B_s)| r_s^2 = \Delta M_{B_s}^{\rm SM} r_s^2$. In the mass insertion approximation, the gluino contribution to the amplitude of B_s oscillation is given in terms of the ratio of the gluino mass to the average squark mass, $x = m_{\tilde{g}}^2/m_{\tilde{q}}^2$, and the down squark mass insertions between second and third generations, $(\delta_{AB}^d)_{23}$, where A and B stand for left-handed (L) or right-handed (R) mixing. A general expression for $R_s = \mathcal{M}_{12}^{\tilde{g}}/\mathcal{M}_{12}^{\rm SM}$ has been given in Ref. [9] as follows:

$$\begin{aligned} R_s = {} & a_1(m_{\tilde{q}}, x)[(\delta_{LL}^d)_{23}^2 + (\delta_{RR}^d)_{23}^2] + a_2(m_{\tilde{q}}, x)[(\delta_{LR}^d)_{23}^2 \\ & + (\delta_{RL}^d)_{23}^2] + a_3(m_{\tilde{q}}, x)[(\delta_{LR}^d)_{23}(\delta_{RL}^d)_{23}] \\ & + a_4(m_{\tilde{q}}, x)[(\delta_{LL}^d)_{23}(\delta_{RR}^d)_{23}], \end{aligned} \quad (7)$$

where the coefficients $|a_1| \simeq \mathcal{O}(1)$, $|a_2| < |a_3| < |a_4| \simeq \mathcal{O}(100)$. For instance, with $m_{\tilde{q}} = 300$ and $x = 1$, one finds

$$\begin{aligned} R_s = {} & 7.2[(\delta_{LL}^d)_{23}^2 + (\delta_{RR}^d)_{23}^2] + 129.8[(\delta_{LR}^d)_{23}^2 + (\delta_{RL}^d)_{23}^2] \\ & - 205.7[(\delta_{LR}^d)_{23}(\delta_{RL}^d)_{23}] - 803.8[(\delta_{LL}^d)_{23}(\delta_{RR}^d)_{23}]. \end{aligned} \quad (8)$$

Note that $r_s^2 = |1 + R_s|$. From the experimental upper bound on ΔM_{B_s} in Eq. (1), one can derive an upper bound on the mass insertions involved in Eq. (7). In order to find conservative upper bounds, we set the SM contribution to its best fit value, namely $\Delta M_{B_s}^{\rm SM} = 17.5\ \text{ps}^{-1}$. In this case, the $|R_s|$ should satisfy the following bound:

$$|R_s| = \left| \frac{(\Delta M_{B_s})_{\rm exp}}{(\Delta M_{B_s})_{\rm SM}} - 1 \right| \lesssim 4/17. \quad (9)$$

It is worth mentioning that if one assumes that $\Delta M_{B_s}^{\rm SM} \simeq 21\ \text{ps}^{-1}$, the above bound remains valid. In Table I we present our results for the upper bounds on $|(\delta_{AB}^d)_{23}|$ mass insertions from their individual contributions to $B_s - \bar{B}_s$ mixing for $m_{\tilde{q}} = 300$ GeV and x varies from 0.25 to 2. As can be seen from Eq. (7) the constraints imposed on the mass insertions are symmetric under changing $L \leftrightarrow R$. Therefore, we present in Table I the upper bounds on one combination of the mass insertions.

Three comments on the results of Table I are in order: (1) the constraints obtained on $|(\delta_{LL(RR)}^d)_{23}|$ are the strongest known constraints on these mass insertions, since other processes based on $b \to s$ transition, like $B \to X_s\gamma$, leave them unconstrained [10]. In fact with these constraints, one can verify that the $LL(RR)$ contributions to $B \to \phi K$, $B \to \eta' K$, and $B \to \pi K$ are diminished and become insignificant. Therefore, LR contribution remains as the only candidate for saturating any deviation from the SM results in the CP asymmetries or branching ratios of these processes [8]. (2) The upper bounds on $LR(RL)$ mass insertions from the $B_s - \bar{B}_s$ are less stringent than those derived from the experimental limits of the branching ratio of $B \to X_s\gamma$ [10]. (3) The combined effect of $(\delta_{LL}^d)_{23}$ and $(\delta_{RR}^d)_{23}$ is severely constrained by ΔM_{B_s}. However, the lowest value of $(\delta_{LL}^d)_{23}$, that can be obtained in the minimal SUSY model with universal soft SUSY breaking terms, is of order $\lambda^2 \sim \mathcal{O}(10^{-2})$. Therefore, it is clear that models with large RR mixing would be disfavored by the ΔM_{B_s} constraints, consistently with the previous conclusions reached by using the mercury electric dipole moment (EDM) constraints [11]. Indeed, with a large $(\delta_{RR}^d)_{23}$ one may induce a large imaginary part of the mass insertion $(\delta_{LR}^d)_{22}$ which overproduces the mercury EDM. This also implies strong constraints on the right squark mixings.

The $B_s \to J/\psi\phi$ decay is accessible at hadron colliders where plenty of B_s will be produced. It is, therefore, considered as one of the benchmark channels to be studied at the LHCb experiment. The final state of $B_s \to J/\psi\phi$ is not a CP eigenstate, but a superposition of CP odd and even states which can, however, be disentangled through an angular analysis of their products [12]. This angular dis-

TABLE I. Upper bounds on $|(\delta_{AB}^d)_{23}|$, $\{A, B\} = \{L, R\}$ from $\Delta M_{B_s} < 21\text{ps}^{-1}$ for $m_{\tilde{q}} = 300$ GeV.

x	$\lvert(\delta_{LL}^d)_{23}\rvert$	$\lvert(\delta_{LR}^d)_{23}\rvert$	$\sqrt{\lvert(\delta_{LR}^d)_{23}(\delta_{RL}^d)_{23}\rvert}$	$\sqrt{\lvert(\delta_{LL}^d)_{23}(\delta_{RR}^d)_{23}\rvert}$
0.25	0.074	0.035	0.018	0.014
0.5	0.11	0.037	0.024	0.015
1	0.17	0.04	0.032	0.016
1.5	0.27	0.43	0.039	0.017
2	0.46	0.046	0.046	0.018

tribution yields to a tiny direct *CP* violation. Thus, the *CP* asymmetry of the B_s and $\bar{B}_s$ meson decay to $J/\psi\phi$ is given by

$$a_{J/\psi\phi}(t) = \frac{\Gamma(\bar{B}_s^0(t) \to J/\psi\phi) - \Gamma(B_s^0(t) \to J/\psi\phi)}{\Gamma(\bar{B}_s^0(t) \to J/\psi\phi) + \Gamma(B_s^0(t) \to J/\psi\phi)} = S_{J/\psi\phi} \sin(\Delta M_{B_s} t), \quad (10)$$

where $S_{J/\psi\phi}$ is the mixing-induced *CP* asymmetry. In the SM, the mixing *CP* asymmetry $S_{J/\psi\phi}$ is given by [9]

$$S_{J/\psi\phi} = \sin 2\beta_s^{\rm SM} = \sin[2\arg(V_{tb}V_{ts}^*)] \simeq -2\lambda^2\eta \simeq \mathcal{O}(10^{-2}). \quad (11)$$

Such small *CP* asymmetry in the SM gives the hope that if a sizable value of $S_{J/\psi\phi}$ is found in future experiments (in particular at the LHCb experiment), then it would be an immediate signal for a new physics effect.

In the presence of the SUSY contribution, the *CP* asymmetry $S_{J/\psi\phi}$ is given by [9]

$$S_{J/\psi\phi} = \sin 2\beta_s^{\rm eff} = \sin(2\beta_s^{\rm SM} + 2\theta_s), \quad (12)$$

where θ_s is given in Eq. (6) as $2\theta_s = \arg(1 + R_s)$. Therefore, the value of $S_{J/\psi\phi}$ depends on the magnitude of R_s which, as emphasized above, is constrained from ΔM_{B_s} to be less than or equal to $4/17$. In this respect, it is easy to show that the maximum value of $S_{J/\psi\phi}$ that one may obtain from SUSY contributions to the $B_s - \bar{B}_s$ mixing is given by

$$S_{J/\psi\phi} \simeq 0.24. \quad (13)$$

It is important to note that due to the stringent constraints on $(\delta^d_{LR})_{23}$ from $b \to s\gamma$: $|(\delta^d_{LR})_{23}| \lesssim 0.016$, the *LR* (*RL*) supersymmetric contribution to $S_{J/\psi\phi}$ is very restricted. It implies that $S_{J/\psi\phi} < 0.02$, which is too small to be observed at the Tevatron or the LHC. Therefore, the *LR* and *RL* contributions cannot provide a significant contribution to the B_s mixing or to the mixing *CP* asymmetry of $B_s \to J/\psi\phi$.

On the other hand, the *LL* and *RR* mass insertions can generate sizable and measurable values of $S_{J/\psi\phi}$. For instance, $(\delta^d_{LL(RR)})_{23} \simeq 0.17 e^{i\pi/4}$ yields to $R \simeq 0.24 e^{i\pi/2}$ which implies that $\sin 2\beta_s \simeq 0.24$. However, as mentioned above, it is important to note that since the minimum value of the mass insertion $(\delta^d_{LL})_{23}$ is of order 10^{-2}, thus, in case of SUSY models with large right-handed squark mixings, i.e., $(\delta^d_{RR})_{23} \sim 0.17$, one finds that $\sqrt{(\delta^d_{LL})_{23}(\delta^d_{RR})_{23}} \sim \mathcal{O}(10^{-1})$ which may exceed its upper bound presented in Table I. Therefore, in this scenario, contributions from both $(\delta^d_{RR})^2_{23}$ and $(\delta^d_{LL})_{23}(\delta^d_{RR})_{23}$ should be considered simultaneously in determining the ΔM_{B_s} and $\sin 2\beta_s$.

We now consider the impact of the ΔM_{B_s} constraints derived above on the mixed *CP* asymmetries in $B_d \to \phi K$ and $B_d \to \eta' K$ processes, which at the quark level are also based on the $b \to s$ transition. The *BABAR* and Belle results for these asymmetries lead to the following averages:

$$S_{\phi K} = 0.47 \pm 0.19, \qquad S_{\eta' K} = 0.48 \pm 0.09, \quad (14)$$

which display about 1σ and 2.5σ deviation from the SM predictions, respectively.

The SUSY contributions to the decay amplitudes of $B_d \to \phi K$ and $B_d \to \eta' K$ are given by [13]

$$A_{\phi K} = -i\frac{G_F}{\sqrt{2}} m^2_{B_d} F_+^{B_d \to K} f_\phi \sum_{i=1}^{12} H_i(\phi)(C_i + \tilde{C}_i),$$
$$A_{\eta' K} = -i\frac{G_F}{\sqrt{2}} m^2_{B_d} F_+^{B_d \to K} f^s_{\eta'} \sum_{i=1}^{12} H_i(\eta')(C_i - \tilde{C}_i), \quad (15)$$

where the C_i are the corresponding Wilson coefficients to the local operators of $b \to s$ transition. C_i as functions of the mass insertions $(\delta^d_{LL})_{23}$ and $(\delta^d_{LR})_{23}$ and $\tilde{C}_i$ as functions of $(\delta^d_{RR})_{23}$ and $(\delta^d_{RL})_{23}$ can be found in Ref. [13]. Here the QCD factorization mechanism is adopted to determine the hadronic matrix elements and as in Ref. [13] they can be parametrized in terms of the parameters $H_i(\phi)$ and $H_i(\eta')$ which are given in Ref. [13]. In terms of SUSY contributions, the *CP* asymmetry $S_{\phi(\eta')K}$ can be written as [14]

$$S_{\phi(\eta')K} = \sin 2\beta + 2|R_{\phi(\eta')}| \cos\delta_{\phi(\eta')} \sin\theta_{\phi(\eta')} \cos 2\beta, \quad (16)$$

where $R_{\phi(\eta')} = (\frac{A^{\rm SUSY}}{A^{\rm SM}})_{\phi(\eta')K}$, $\theta_{\phi(\eta')} = \arg[(\frac{A^{\rm SUSY}}{A^{\rm SM}})_{\phi(\eta')K}]$ and $\delta_{\phi(\eta')}$ is the strong phase. Thus, in order to derive $S_{\phi(\eta')K}$ toward their central values of the average experimental results in Eq. (14), $|R_{\phi(\eta')}| \gtrsim 0.2$ should be satisfied. For a gluino mass and average squark mass of order $\tilde{m} = m_{\tilde{g}} = 500$ GeV, one finds

$$R_\phi = -0.14 e^{-i0.1}(\delta^d_{LL})_{23} - 127 e^{-i0.08}(\delta^d_{LR})_{23} + L \leftrightarrow R, \quad (17)$$

and

$$R_{\eta'} = -0.07 e^{i0.24}(\delta^d_{LL})_{23} - 64(\delta^d_{LR})_{23} - L \leftrightarrow R. \quad (18)$$

It is now clear that the ΔM_{B_s} constraints play a crucial role in reducing the *LL* and *RR* contributions to the $S_{\phi(\eta')K}$. By implementing the bounds in Table I, one can easily observe that the *LL*(*RR*) contribution leads to $|R_{\phi(\eta')}| \sim \mathcal{O}(10^{-2})$ which yields a negligible effect on $S_{\phi(\eta')}$ and one can safely conclude that the *LL* and *RR* mass insertions cannot provide an explanation to any deviation in $S_{\phi(\eta')}$ results. On the other hand, the contribution of $(\delta^d_{LR})_{32}$ is less constrained by ΔM_{B_s} and large effects in $|R_{\phi(\eta')}|$ that could drive $S_{\phi(\eta')K}$ toward 0.4 can be achieved.

The above results show that $S_{J/\psi\phi}$ and $S_{\phi(\eta')K}$ are dominated by different mass insertions: *LL* and *LR*/*RL*, respectively. As emphasized in Ref. [8], these two mass insertions can be enhanced simultaneously in SUSY models with intermediate/large $\tan\beta$ and a simple nonminimal flavor structure, where the scalar mass of the first two generations is different from the scalar mass of the third generation. In particular, let us consider the following soft SUSY breaking terms are assumed at the grand unification scale

$$M_1 = M_2 = M_3 = M_{1/2}, \qquad A^u = A^d = A_0 e^{i\phi_A},$$
$$M_U^2 = M_D^2 = m_0^2, \qquad m_{H_1}^2 = m_{H_2}^2 = m_0^2,$$
$$M_Q^2 = \begin{pmatrix} m_0^2 & & \\ & m_0^2 & \\ & & a^2 m_0^2 \end{pmatrix}. \tag{19}$$

The parameter a measures the nonuniversality of the squark masses. It is worth mentioning that the EDM constraints on the CP violating phase ϕ_A of the trilinear coupling is less severe than the constraints imposed on the other SUSY CP phases and can be of order $\mathcal{O}(0.1)$ [15].

Using the relevant renormalization group equations, one can explore these parameters from the GUT scale to the electroweak scale, where we impose the electroweak symmetry breaking conditions and calculate the squark mass matrices. Then we determine the numerical values of the corresponding mass insertions. For instance, for $a = 5$, $\tan\beta = 15$, and $m_{\tilde{g}} \sim m_{\tilde{q}} \sim 500$ GeV, one finds that $|(\delta_{LL}^d)_{23}| \simeq 0.18$ which leads to $\Delta M_{B_s} \simeq 19\ \mathrm{ps}^{-1}$. Also with a proper choice for the phase ϕ_A, one can get $\arg[(\delta_{LL}^d)_{23}] \simeq 0.7$ which implies that $S_{J/\psi\phi} \simeq 0.1$ which can be measured by the LHCb experiment. Note that in this scenario the phases of the mass insertions are due to a combined effect of the SM phase in the CKM mixing matrix and the SUSY CP phase ϕ_A. However, for the LL mass insertion the main effect is due the CKM phase, see Ref. [8] for more details.

Concerning the mass insertion $(\delta_{LR}^d)_{23}$, it is expected to be negligible due to the universality of the trilinear couplings. However, with intermediate/large $\tan\beta$, the double mass insertion is quite important and it gives the dominant effect as follows [8]

$$(\delta_{LR}^d)_{23_{\rm eff}} = (\delta_{LR}^d)_{23} + (\delta_{LL}^d)_{23}(\delta_{LR}^d)_{33}, \tag{20}$$

where $(\delta_{LR}^d)_{33} \simeq \frac{m_b(A_b - \mu\tan\beta)}{\tilde{m}^2}$. Since $(\delta_{LR}^d)_{23}$ is negligible, $(\delta_{LR}^d)_{23_{\rm eff}}$ is given by

$$(\delta_{LR}^d)_{23_{\rm eff}} \simeq (\delta_{LL}^d)_{23} \frac{m_b}{\tilde{m}} \tan\beta. \tag{21}$$

The parameter μ is determined by the electroweak conditions and it is found to be of order of the squark mass. The phase of μ is set to zero to overcome the EDM constraints. Since $(\delta_{LL}^d)_{23} \simeq 0.18$, the value of $(\delta_{LR}^d)_{23_{\rm eff}}$ is of order 10^{-2} which is sufficient to reduce the CP asymmetries $S_{\phi K}$ and $S_{\eta' K}$ from the SM result $\sin 2\beta \simeq 0.7$ to their central values of average experimental results.

To conclude, We have considered the supersymmetric contributions to the $B_s - \bar{B}_s$ mixing. We derived new model independent constraints on the magnitude of the mass insertions $(\delta_{AB}^d)_{23}$, where $\{A, B\} = \{L, R\}$, from the new experimental measurements of ΔM_{B_s}. We showed that by implementing these constraints, the SUSY contribution, through the LL mixing, can enhance the CP asymmetry of $B_s \to J/\psi\phi$ up to 0.24, which can be observed at the LHCb experiment. We also emphasized that the new constraints exclude the SUSY models with large RR flavor mixing and severely restrict the LL contributions to the CP asymmetries of $B \to \phi K$ and $B \to \eta' K$. Therefore, SUSY models with dominant LR flavor mixing is the only way to accommodate the apparent deviation of CP asymmetries from those expected in the standard model. Finally we studied an example of SUSY nonminimal flavor model and intermediate/large $\tan\beta$. We showed that in this model the new ΔM_{B_s} results and also the CP asymmetries in $B_s \to J/\psi\phi$, $B \to \phi K$, and $B \to \eta' K$ processes can be simultaneously saturated.

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