Addendum to "Constraint on $\bar{\rho}$, $\bar{\eta}$ from $B \to K^*\pi$"

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A 1σ range, $20° < \Phi_{3/2} < 115°$, defining the slope of a linear Cabibbo-Kobayashi-Maskawa relation, $\bar{\eta} = \tan\Phi_{3/2}(\bar{\rho} - 0.24 \pm 0.03)$, was obtained from $B^0 \to K^*\pi$ amplitudes measured in two Dalitz plot analyses of $B^0 \to K\pi\pi$. A correction reported recently by the *BABAR* Collaboration in results for $B^0 \to K^+\pi^-\pi^0$ is shown to imply a somewhat narrower 1σ range for the slope parameter, $39° < \Phi_{3/2} < 112°$.

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A Dalitz analysis of $B^0 \to K^+\pi^-\pi^0$ by the *BABAR* collaboration reported in Ref. [1] has been very recently corrected [2]. We had used the earlier uncorrected version of this analysis to obtain a Cabibbo-Kobayashi-Maskawa (CKM) constraint [3]. In this Addendum we recalculate the constraint using the corrected experimental results.

The following linear constraint between the Wolfenstein parameters [4] $\bar{\rho}$ and $\bar{\eta}$ was first derived in Ref. [5]:

$$\bar{\eta} = \tan\Phi_{3/2}(\bar{\rho} - 0.24 \pm 0.03). \tag{1}$$

$2\Phi_{3/2} \equiv \arg(A_{3/2}/\bar{A}_{3/2})$ is the relative phase between the amplitude for $B^0 \to (K^*\pi)_{I=3/2}$ and its charge conjugate. This phase can be measured in Dalitz analyses of $B^0 \to K^+\pi^-\pi^0$ and $B^0(t) \to K_S\pi^+\pi^-$. Two corresponding analyses, performed by the *BABAR* collaboration in Refs. [1,6], measured the magnitudes of amplitudes for $B^0 \to K^{*+}\pi^-$, $B^0 \to K^{*0}\pi^0$, their charge conjugates, and three relative phases,

$$\begin{aligned} \phi &\equiv \arg\left(\frac{A(B^0 \to K^{*0}\pi^0)}{A(B^0 \to K^{*+}\pi^-)}\right), \\ \bar{\phi} &\equiv \arg\left(\frac{A(\bar{B}^0 \to \bar{K}^{*0}\pi^0)}{A(\bar{B}^0 \to K^{*-}\pi^+)}\right), \\ \Delta\phi &\equiv \arg\left(\frac{A(B^0 \to K^{*+}\pi^-)}{A(\bar{B}^0 \to K^{*-}\pi^+)}\right). \end{aligned} \tag{2}$$

In Ref. [3] we have used these measurements, including negative log-likelihood values for ϕ and $\bar{\phi}$ [1], to calculate a χ^2 dependence on $\Phi_{3/2}$. The log-likelihood values for ϕ and $\bar{\phi}$ have been recently corrected for a missing factor of 2 [2]. This affects the χ^2 dependence on $\Phi_{3/2}$. The corrected dependence is plotted in Fig. 1. The broken purple curve corresponds to an unconstrained $|\bar{A}_{3/2}/A_{3/2}|$, while the solid blue curve is obtained by imposing the bounds $0.8 < |\bar{A}_{3/2}/A_{3/2}| < 1.2$, expected to hold in the standard model [3]. The latter curve defines a 1σ range,

$$39° < \Phi_{3/2} < 112°. \tag{3}$$

Figure 2 shows the linear constraint (1) with the large range of slopes (3) overlaid on CKMfitter results following from [7,8] $|V_{ub}|/|V_{cb}| = 0.086 \pm 0.009$, obtained in semileptonic B decays, and values $\beta = (21.5 \pm 1.0)°$, $\alpha = (88 \pm 6)°$, and $\gamma = (53^{+15}_{-18} \pm 3 \pm 9)°$ [9], obtained in $B \to J/\psi K_S$, $B \to \pi\pi$, $\rho\rho$, $\rho\pi$, and $B^+ \to D^{(*)}K^{(*)+}$, respectively. The small theoretical error in the $B \to K^*\pi$ constraint [± 0.03 in Eq. (1)] is described by the difference between dark and light shaded regions in Fig. 2.

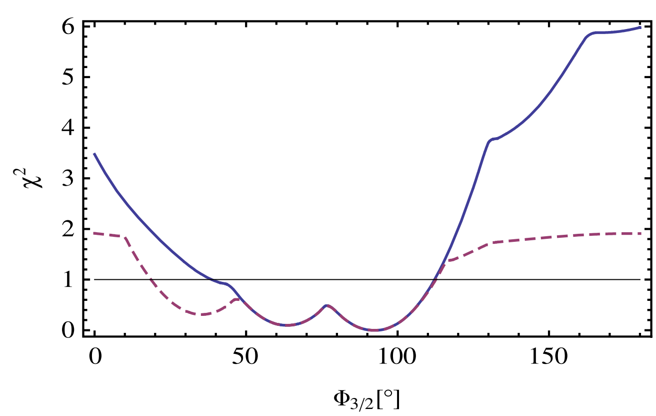

FIG. 1 (color online). χ^2 dependence on $\Phi_{3/2}$ for unconstrained $|R_{3/2}|$ (broken purple line) and for $0.8 < |R_{3/2}| < 1.2$ (solid blue line). A black horizontal line at $\chi^2 = 1$ defines 1σ ranges for $\Phi_{3/2}$.

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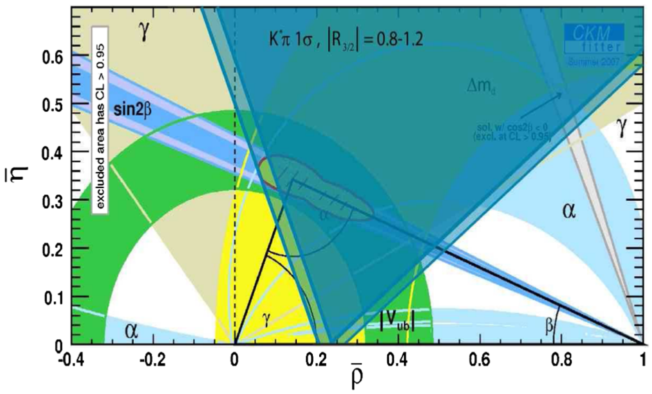

FIG. 2 (color online). Constraint in the $\bar{\rho} - \bar{\eta}$ plane following from Eqs. (1) and (3). The dark shaded region marked $K^*\pi 1\sigma$ corresponds to the experimental error on $\Phi_{3/2}$ given by the 1σ range (3), while the light shaded region includes also the error ± 0.03 in (1). Also shown are CKMfitter constraints obtained using $|V_{ub}|/|V_{cb}|$, β, α, γ, and Δm_d [8].

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