RECEIVED: May 21, 2020

ACCEPTED: May 21, 2020

PUBLISHED: June 16, 2020

Erratum: Angular analysis of the rare decay $\Lambda_b \rightarrow \Lambda(1520)(\rightarrow N \bar{K})\ell^+\ell^-$

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ERRATUM TO: [JHEP06\(2019\)136](#)

ABSTRACT: We provide corrections to section 2, section 4 and appendix A of ref. [1]. We update the numerical results of ref. [1] with the latest results from ref. [2]

ARXIV EPRINT: [1903.00448](#)

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1 Corrections to section 2 of ref. [1]

The paragraph after eq. (2.5) of ref. [1] should read “We can introduce the same kinematics as for semileptonic four-body B -meson decays, leading to four independent variables chosen as the dilepton invariant mass q^2 , the angles θ_{Λ^*} and θ_ℓ with respect to the z axis and the angle between the hadronic and leptonic planes ϕ , following the same LHCb conventions as for $\Lambda_b \rightarrow \Lambda(\rightarrow N\pi)\ell^+\ell^-$ [35–37] (up to the identifications $\theta_{\Lambda^*} = \theta_b$ and $\phi = \chi$) recalled in figure 1.”

Eq. (2.16) of ref. [1] should read

$$\begin{aligned}
 \langle \Lambda^* \ell^+ \ell^- | O_\mu^H O^{L;\mu} | \Lambda_b \rangle &= \langle \Lambda^* | O_\mu^H | \Lambda_b \rangle g^{\mu\nu} \langle \ell^+ \ell^- | O_\nu^L | 0 \rangle \\
 &= \sum_{\lambda=t,0,+,-} g_{\lambda\lambda'} (\varepsilon^{*\mu}(\lambda) \langle \Lambda^* | O_\mu^H | \Lambda_b \rangle) (\varepsilon^\nu(\lambda) \langle \ell^+ \ell^- | O_\nu^L | 0 \rangle) \\
 &= \sum_{\lambda=t,0,+,-} g_{\lambda\lambda'} \sum_i f_\lambda^i (\bar{u}_{\Lambda^*}^\alpha \varepsilon^{*\mu}(\lambda) \Gamma_{\mu\alpha}^{Hi} u_{\Lambda_b}) (\bar{u}_{\ell^-} \varepsilon^\nu(\lambda) \Gamma_\nu^L v_{\ell^-}),
 \end{aligned} \tag{1.1}$$

Eq. (2.24) of ref. [1] should read

$$\mathcal{L}_2 = g \varepsilon^{\mu\nu\alpha\beta} (\partial_\mu \bar{\psi}_\nu) \gamma_\alpha \Psi \partial_\beta \phi + h.c. \tag{1.2}$$

2 Corrections to section 4 of ref. [1]

Figures 2–5 of ref. [1] were based on the MCN quark model of the arXiv version 2 of ref. [2]. These figures are superseded by figures 1–4 of this Erratum, which are based on the same quark model of the published version of ref. [2] in Int. J. Mod. Phys.

3 Corrections to appendix A of ref. [1]

Eq. (A.4) of ref. [1] should read

$$k_1^\mu = \begin{pmatrix} \frac{m_{\Lambda^*}^2 + m_N^2 - m_K^2}{2m_{\Lambda^*}} \\ \frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \sin \theta_{\Lambda^*} \cos \phi \\ \frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \sin \theta_{\Lambda^*} \sin \phi \\ \frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \cos \theta_{\Lambda^*} \end{pmatrix}, \quad k_2^\mu = \begin{pmatrix} \frac{m_{\Lambda^*}^2 + m_K^2 - m_N^2}{2m_{\Lambda^*}} \\ -\frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \sin \theta_{\Lambda^*} \cos \phi \\ -\frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \sin \theta_{\Lambda^*} \sin \phi \\ -\frac{m_{\Lambda^*}}{2} \beta_{N\bar{K}} \cos \theta_{\Lambda^*} \end{pmatrix}, \tag{3.1}$$

Figure 1. Top: Differential decay rate (normalised to the total Λ_b decay width) in the SM case and three NP scenarios. Only short-distance contributions from charm loops are include. Bottom: For illustration only, we also show the effect of a model for charmonium resonances in the SM case [2].

The comment after eq. (A.5) of ref. [1] should read: “These definitions agree with the LHCb convention for $\Lambda_b \rightarrow \Lambda(\rightarrow N\pi)\ell^+\ell^-$ [35–37] (up to the identifications $\theta_{\Lambda^*} = \theta_b$ and $\phi = \chi$) and they also agree with the LHCb convention for $B \rightarrow K^*(\rightarrow K\pi)\ell^+\ell^-$ decays [2,53] up to the identification $\{B^0, K^{*0}, K^+, \pi^-\} \rightarrow \{\Lambda_b, \Lambda^*, p, K^-\}$.”

The last line of eq. (A.7) of ref. [1] should read

$$u_{\Lambda^*}(+3/2) = \frac{1}{2\sqrt{m_{\Lambda_b}}} \begin{pmatrix} 0 & 0 & 0 & 0 \\ -\sqrt{s_+} & 0 & -\sqrt{s_-} & 0 \\ -i\sqrt{s_+} & 0 & -i\sqrt{s_-} & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad (3.2)$$

Figure 2. Top: A_{FB}^ℓ in the SM case and three NP scenarios. Only short-distance contributions from charm loops are include. Bottom: For illustration only, we also show the effect of a model for charmonium resonances in the SM case [2].

The last line of eq. (A.8) of ref. [1] concerns $u_{\Lambda^*}(+3/2)$ rather than $u_{\Lambda^*}(-3/2)$.

Eq. (A.9) of ref. [1] should read

$$u_{N(+1/2)} = \frac{1}{\sqrt{2m_{\Lambda^*}}} \begin{pmatrix} \sqrt{r_+} \cos \frac{\theta_{\Lambda^*}}{2} \\ \sqrt{r_+} \sin \frac{\theta_{\Lambda^*}}{2} e^{i\phi} \\ \sqrt{r_-} \cos \frac{\theta_{\Lambda^*}}{2} \\ \sqrt{r_-} \sin \frac{\theta_{\Lambda^*}}{2} e^{i\phi} \end{pmatrix}, \quad u_{N(-1/2)} = \frac{1}{\sqrt{2m_{\Lambda^*}}} \begin{pmatrix} -\sqrt{r_+} \sin \frac{\theta_{\Lambda^*}}{2} e^{-i\phi} \\ \sqrt{r_+} \cos \frac{\theta_{\Lambda^*}}{2} \\ \sqrt{r_-} \sin \frac{\theta_{\Lambda^*}}{2} e^{-i\phi} \\ -\sqrt{r_-} \cos \frac{\theta_{\Lambda^*}}{2} \end{pmatrix}. \quad (3.3)$$

Figure 3. Variation of S_{1c} (top) and $S_{2cc} - S_{1cc}/4$ (bottom) with respect to the dilepton invariant mass, in the case of the SM and three NP scenarios.

Figure 4. Variation of S_{3ss} (top) and S_{5sc} (bottom) with respect to the dilepton invariant mass, in the case of the SM and three NP models.

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References

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- [2] L. Mott and W. Roberts, *Rare dileptonic decays of Λ_b in a quark model*, *Int. J. Mod. Phys. A* **27** (2012) 1250016 [[arXiv:1108.6129](https://arxiv.org/abs/1108.6129)] [[INSPIRE](#)].