

Erratum

Radiative corrections to the K_{e3}^{\pm} decay revised

V. Bytev¹, E. Kuraev¹, A. Baratt², J. Thompson²

¹ Bogoliubov Laboratory of Theoretical Physics, JINR, Dubna, Moscow region, 141980, Russia

² Department of Physics and Astronomy, University of Pittsburgh, PA, USA

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1 Typos

1. p. 62 ‘contribution to RC we estimate to be at the level of 0.0005’ should read ‘contribution to RC we estimate to be at the level of -0.00045’.
2. caption to Fig. 3: ‘see (39)’ should read ‘see (38)’.
3. caption to Fig. 5: ‘see (39)’ should read ‘see (41)’.
4. caption to Fig. 6: ‘see (40)’ should read ‘see (42)’.
5. In (28) and (69) the last term instead of

$$\int_0^{b(z)-y} dx \mathcal{J} \quad \text{should be} \quad \int_0^N dx \mathcal{J},$$

where

$$N = \frac{b_-(z)(b(z) - y)}{b(z)}.$$

6. on page 67 in App. C (84) should read:

$$\delta_{SD}^{hard} = \frac{\alpha}{2\pi a_0(y, z)} \int_0^N dx J^{SD}(x, y, z).$$

7. (88) should read:

$$\delta^{SD} = -0.00045.$$

8. in (98) last term in first instead of

$$\int_{b_-(z)-y}^{b(z)-y} dx \mathcal{J}(x, y, z) \quad \text{should be} \quad \int_{b_-(z)-y}^N dx \mathcal{J}(x, y, z).$$

9. In (114) for quantities G_2 and G_4 should read:

$$G_2 = \frac{R(z)}{(x+y)} + \frac{x^2}{2} + \frac{1}{2}x(z+2y)$$

$$+ \frac{1}{4}(2z + 3y(y+z)) - 1,$$

$$G_4 = \frac{1}{8}x(4+y) + \frac{1}{2}y - 1.$$

10. in (71) the left hand side should consist of only one term: $R_{phot_{2D}}(y, z)$.

2 Wrong pion’s mass

Erroneously in our calculations we used $m_{\pi^{\pm}}$ instead of m_{π^0} . This affected the Dalitz plot in the Born approximation (the new one is Table 1), corrections to the Dalitz plot (the new one is Table 2), and the result of integration in (99): -0.035 should be corrected to -0.037 . Figures 3 and 4 are affected very slightly; the impact of this error on the plots in Figs. 5 and 6 is not visible by eye.

3 Evaluation of the uncertainty

The correction to the full width has the following uncertainties:

1. uncertainty of the short distance enhancement factor: $S_{EW} = 1.0232 \pm 0.0003$ (the values are taken from Cirigliano et al, hep-ph/0110153).
2. uncertainty in the terms $O(p^4)$ and $O(p^6)$ calculated in the framework of ChPT is $5 \cdot 10^{-4}$ of the width calculated in the Born approximation.
3. uncertainty of the QED calculations is of the order $(\alpha/\pi)^2$.

Altogether, within the framework of our calculation, the uncertainty of the correction to the full width is 0.1% of the width calculated in the Born approximation. So $\delta = (1.995 \pm 0.1)\%$, and this value replaces the one stated

Table 1. Dalitz plot distribution in the Born approximation $a_0(y, z)$

z/y	0.07	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
1.025	0.014	0.074	0.132	0.169	0.187	0.184	0.162	0.119	0.057
0.975		0.032	0.094	0.137	0.159	0.162	0.144	0.107	0.049
0.925			0.057	0.104	0.132	0.139	0.127	0.094	0.042
0.875			0.019	0.072	0.104	0.117	0.109	0.082	0.034
0.825				0.039	0.077	0.094	0.092	0.069	0.027
0.775					0.049	0.072	0.074	0.057	0.019
0.725					0.022	0.049	0.057	0.044	0.012
0.675						0.027	0.039	0.032	
0.625							0.022	0.019	
0.580								0.008	

Table 2. Correction to Dalitz plot distribution $\Delta(y, z) = a_0(y, z)\delta(y, z) \times 10^3$

z/y	0.07	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85
1.025	3.80	4.67	3.96	2.16	-0.16	-2.53	-4.45	-5.32	-4.12
0.975		4.01	3.70	2.19	0.09	-2.13	-3.96	-4.82	-3.66
0.925			3.44	2.23	0.34	-1.72	-3.48	-4.31	-3.20
0.875			3.20	2.28	0.60	-1.32	-2.98	-3.79	-2.72
0.825				2.32	0.86	-0.91	-2.49	-3.28	-2.22
0.775					1.13	-0.50	-1.99	-2.75	-1.71
0.725					1.40	-0.08	-1.49	-2.22	-1.15
0.675						0.34	-0.98	-1.67	
0.625							-0.46	-1.10	
0.580								-0.54	

in the abstract: $\delta = 0.020 \pm 0.0002$. The uncertainty of the corrections to the Dalitz plot is dominated by the higher order terms that contain logarithms with m_e (they are not important for the uncertainty of the full width since they cancel when integrated). This uncertainty is of the order $\alpha L_e/\pi$ and makes up 3% of the calculated corrections shown in the table.

Also, in the abstract ‘We estimate the accuracy of our results to be at the level of 1%’ should read ‘We estimate the accuracy of our results, within the framework of our calculation, to be at the level of 0.1% of the values calculated in the Born approximation’. On the page 62 ‘All together we believe the accuracy of the results to be at the level of 0.01’ should read ‘All together we believe the accuracy of the results to be at the level of 0.1% of the values calculated in the Born approximation’. Equation (51) should be replaced by

$$\frac{\Gamma}{\Gamma_0} = 1 + \delta(1 \pm 0.1),$$

and (52) should be the same:

$$\frac{\Gamma}{\Gamma_0} = 1 + \delta = 1.020.$$

For that δ we obtain $|V_{us}f_+(0)| = 0.221 \pm 0.002$. This value should be in formula (53). By using new value of the form factor $f_+(0) = 0.9874 \pm 0.0084$ we obtain for $V_{us} = 0.224 \pm 0.003$. This value should be in abstract and (54).