

Heavy Flavor Averaging Group

Aug. 2007

Compilation of B^+ Semi-leptonic and Radiative Branching Fractions

All branching fractions are in units of 10^{-6}

In PDG2006 New since PDG2006 (preliminary) New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	New Avg.
240	$K^{*+}\gamma$	40.3 ± 2.6	$38.7 \pm 2.8 \pm 2.6$	$42.5 \pm 3.1 \pm 2.4$	$37.6^{+8.9}_{-8.3} \pm 2.8$		40.3 ± 2.6
241	$K_1^+(1270)\gamma$	$43 \pm 9 \pm 9$		$43 \pm 9 \pm 9$			43 ± 12
242	$K^+\eta\gamma$	$8.4^{+1.5}_{-1.2} \pm 0.9$	$10.0 \pm 1.3 \pm 0.5$	$8.4^{+1.5}_{-1.2} \pm 0.9$			9.4 ± 1.1
–	$K^+\eta'\gamma$	New	< 4.2				< 4.2
243	$K^+\phi\gamma$	$3.4 \pm 0.9 \pm 0.4$	$3.5 \pm 0.6 \pm 0.4$	$3.4 \pm 0.9 \pm 0.4$			3.5 ± 0.6
244	$K^+\pi^-\pi^+\gamma$	$25.0 \pm 1.8 \pm 2.2$	$29.5 \pm 1.3 \pm 1.9$ †	$25.0 \pm 1.8 \pm 2.2$ ‡			27.7 ± 1.8
–	$K^0\pi^+\pi^0\gamma$	New	$45.6 \pm 4.2 \pm 3.0$ †				45.6 ± 5.2
245	$K^{*0}\pi^+\gamma$ §	20^{+7}_{-6}		$20^{+7}_{-6} \pm 2$			20^{+7}_{-6}
246	$K^+\rho^0\gamma$ §	< 20		< 20			< 20
247	$K^+\pi^-\pi^+\gamma$ (N.R.) §	< 9.2		< 9.2			< 9.2
248	$K_1^+(1400)\gamma$	< 50		< 15			< 15
249	$K_2^{*+}(1430)\gamma$	$14.5 \pm 4.0 \pm 1.5$	$14.5 \pm 4.0 \pm 1.5$				14.5 ± 4.3
251	$K_3^{*+}(1780)\gamma$	< 39		< 39			< 39
253	$\rho^+\gamma$	< 1.8	$1.10^{+0.37}_{-0.33} \pm 0.09$	$0.86^{+0.30+0.07}_{-0.28-0.08}$	< 13		$0.88^{+0.28}_{-0.26}$
296	$p\bar{\Lambda}\gamma$	$2.16^{+0.58}_{-0.53} \pm 0.20$		$2.45^{+0.44}_{-0.38} \pm 0.22$			$2.45^{+0.49}_{-0.44}$
297	$p\bar{\Sigma}^0\gamma$	< 4.6		< 4.6			< 4.6
315	$\pi^+e^+e^-$	< 3900	< 0.18	< 0.055			< 0.055
316	$\pi^+\mu^+\mu^-$	< 9100	< 0.28	< 0.051			< 0.051
–	$\pi^+\ell^+\ell^-$	New	< 0.12	< 0.037			< 0.037
317	$\pi^+\nu\bar{\nu}$	< 100	< 100	< 170			< 100
318	$K^+e^+e^-$	$0.80^{+0.22}_{-0.19}$	$0.42^{+0.12}_{-0.11} \pm 0.02$	$0.63^{+0.19}_{-0.17} \pm 0.03$	< 2.4		0.49 ± 0.10
319	$K^+\mu^+\mu^-$	$0.34^{+0.19}_{-0.14}$	$0.31^{+0.15}_{-0.12} \pm 0.03$	$0.45^{+0.14}_{-0.12} \pm 0.03$	< 3.68	$0.60 \pm 0.15 \pm 0.04$	$0.45^{+0.09}_{-0.08}$
320	$K^+\ell^+\ell^-$	$0.53^{+0.11}_{-0.10} \pm 0.3$	$0.38^{+0.09}_{-0.08} \pm 0.02$				$0.38^{+0.09}_{-0.08}$
321	$K^+\nu\bar{\nu}$	< 52	< 52	< 14	< 240		< 14
–	$\rho^+\nu\bar{\nu}$	New		< 150			< 150
322	$K^{*+}e^+e^-$	< 4.6	$0.75^{+0.76}_{-0.65} \pm 0.38$	$2.02^{+1.27+0.23}_{-1.01-0.24}$			$1.23^{+0.69}_{-0.62}$
323	$K^{*+}\mu^+\mu^-$	< 2.2	$0.97^{+0.94}_{-0.69} \pm 0.14$	$0.65^{+0.69+0.14}_{-0.53-0.15}$			$0.78^{+0.56}_{-0.44}$
324	$K^{*+}\ell^+\ell^-$	< 2.2	$0.73^{+0.50}_{-0.42} \pm 0.21$				$0.73^{+0.54}_{-0.47}$
–	$K^{*+}\nu\bar{\nu}$	New		< 140			< 140
327	$K^+e^+\mu^-$	< 0.8	< 0.09				< 0.09
328	$K^+e^-\mu^+$	< 6400	< 0.13				< 0.13
–	$K^+\tau^\pm\mu^\mp$	New	< 77				< 77
329	$K^{*+}e^\pm\mu^\mp$	< 7.9	< 1.4				< 1.4
330	$\pi^-e^+e^+$	< 1.6			< 1.6		< 1.6
331	$\pi^-\mu^+\mu^+$	< 1.4			< 1.4		< 1.4
332	$\pi^-e^+\mu^+$	< 1.3			< 1.3		< 1.3
333	$\rho^-e^+e^+$	< 2.6			< 2.6		< 2.6
334	$\rho^-\mu^+\mu^+$	< 5.0			< 5.0		< 5.0
335	$\rho^-e^+\mu^+$	< 3.3			< 3.3		< 3.3
336	$K^-e^+e^+$	< 1.0			< 1.0		< 1.0
337	$K^-\mu^+\mu^+$	< 1.8			< 1.8		< 1.8
338	$K^-e^+\mu^+$	< 2.0			< 2.0		< 2.0
339	$K^{*-}e^+e^+$	< 2.8			< 2.8		< 2.8
340	$K^{*-}\mu^+\mu^+$	< 8.3			< 8.3		< 8.3
341	$K^{*-}e^+\mu^+$	< 4.4			< 4.4		< 4.4
–	$\pi^+e^\pm\mu^\mp$	New	< 0.17				< 0.17

† $M_{K\pi\pi} < 1.8 \text{ GeV}/c^2$; ‡ $1.0 < M_{K\pi\pi} < 2.0 \text{ GeV}/c^2$; § $M_{K\pi\pi} < 2.4 \text{ GeV}/c^2$

Heavy Flavor Averaging Group

Aug. 2007

Compilation of B^0 Semi-leptonic and Radiative Branching Fractions

All branching fractions are in units of 10^{-6}

In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	New Avg.
213	$K^{*0}\gamma$	40.1 ± 2.0	$39.2 \pm 2.0 \pm 2.4$	$40.1 \pm 2.1 \pm 1.7$	$45.5^{+7.2}_{-6.8} \pm 3.4$		40.1 ± 2.0
214	$K^0\eta\gamma$	$8.7^{+3.1+1.9}_{-2.7-1.6}$	$11.3^{+2.8}_{-2.6} \pm 0.6$	$8.7^{+3.1+1.9}_{-2.7-1.6}$			$10.3^{+2.3}_{-2.1}$
–	$K^0\eta'\gamma$	New	< 6.6				< 6.6
215	$K^0\phi\gamma$	< 8.3	< 2.7	< 8.3			< 2.7
216	$K^+\pi^-\gamma$ §	4.6 ± 1.4		$4.6^{+1.3+0.5}_{-1.2-0.7}$			4.6 ± 1.4
217	$K^{*0}(1410)\gamma$	< 130		< 130			< 130
218	$K^+\pi^-\gamma$ (N.R.) §	< 2.6		< 2.6			< 2.6
219	$K^0\pi^+\pi^-\gamma$	$24 \pm 4 \pm 3$	$18.5 \pm 2.1 \pm 1.2$ †	$24 \pm 4 \pm 3$ ‡			19.5 ± 2.2
–	$K^+\pi^-\pi^0\gamma$	New	$40.7 \pm 2.2 \pm 3.1$ †				40.7 ± 3.8
220	$K_1^0(1270)\gamma$	< 58		< 58			< 58
221	$K_1^0(1400)\gamma$	< 15		< 15			< 15
222	$K_2^{*0}(1430)\gamma$	12.4 ± 2.4	$12.2 \pm 2.5 \pm 1.0$	$13 \pm 5 \pm 1$			12.4 ± 2.4
224	$K_3^{*0}(1780)\gamma$	< 83		< 83			< 83
226	$\rho^0\gamma$	< 0.4	$0.79^{+0.22}_{-0.20} \pm 0.06$	$0.76 \pm 0.17 \pm 0.06$	< 17		$0.93^{+0.19}_{-0.18}$
227	$\omega\gamma$	< 0.8	$0.40^{+0.24}_{-0.20} \pm 0.05$	$0.42^{+0.20}_{-0.18} \pm 0.04$	< 9.2		$0.46^{+0.20}_{-0.17}$
228	$\phi\gamma$	< 0.85	< 0.85		< 3.3		< 0.85
–	$\pi^0e^+e^-$	New	< 0.14	< 0.143			< 0.14
–	$\pi^0\mu^+\mu^-$	New	< 0.51	< 0.154			< 0.154
–	$\pi^0\ell^+\ell^-$	New	< 0.12	< 0.133			< 0.12
–	$\pi^0\nu\bar{\nu}$	New		< 220			< 220
293	$K^0e^+e^-$	< 0.54	$0.13^{+0.16}_{-0.11} \pm 0.02$	$0.00^{+0.20+0.02}_{-0.12-0.05}$	< 8.45		$0.09^{+0.12}_{-0.09}$
294	$K^0\mu^+\mu^-$	$0.20^{+0.13}_{-0.10}$	$0.59^{+0.33}_{-0.26} \pm 0.07$	$0.56^{+0.29}_{-0.23} \pm 0.05$	< 6.64		$0.57^{+0.22}_{-0.18}$
295	$K^0\ell^+\ell^-$	< 0.68	$0.29^{+0.16}_{-0.13} \pm 0.03$				$0.29^{+0.16}_{-0.13}$
–	$K^0\nu\bar{\nu}$	New		< 160			< 160
–	$\rho^0\nu\bar{\nu}$	New		< 440			< 440
296	$K^{*0}e^+e^-$	< 2.4	$1.04^{+0.33}_{-0.29} \pm 0.11$	$1.29^{+0.57+0.13}_{-0.49-0.10}$			$1.11^{+0.30}_{-0.26}$
297	$K^{*0}\mu^+\mu^-$	$1.22^{+0.38}_{-0.32}$	$0.87^{+0.38}_{-0.33} \pm 0.12$	$1.33^{+0.42}_{-0.37} \pm 0.11$		$0.82 \pm 0.31 \pm 0.10$	$0.98^{+0.22}_{-0.21}$
298	$K^{*0}\nu\bar{\nu}$	< 1000		< 340			< 340
299	$K^{*0}\ell^+\ell^-$	1.17 ± 0.30	$0.81^{+0.21}_{-0.19} \pm 0.09$				$0.81^{+0.23}_{-0.21}$
–	$\phi\nu\bar{\nu}$	New		< 58			< 58
–	$\pi^0e^\pm\mu^\mp$	New	< 0.14				< 0.14
301	$K^0e^\pm\mu^\pm$	< 4.0	< 0.27				< 0.27
302	$K^{*0}e^\pm\mu^\pm$	< 3.4	< 0.58				< 0.58

† $M_{K\pi\pi} < 1.8 \text{ GeV}/c^2$; ‡ $1.0 < M_{K\pi\pi} < 2.0 \text{ GeV}/c^2$; § $1.25 \text{ GeV}/c^2 < M_{K\pi} < 1.6 \text{ GeV}/c^2$

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Aug. 2007

Compilation of B Semi-leptonic and Radiative Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2006 New since PDG2006 (preliminary) New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	New Avg.
61	$K_2^*(1430)\gamma$	$1.7 \pm 0.6 \pm 0.1$			$1.7 \pm 0.6 \pm 0.1$	1.7 ± 0.6
63	$K_3^*(1780)\gamma$	< 37		< 2.8		< 2.8
70	$s\gamma$	343 ± 29	$327 \pm 18_{-41}^{+55}$	$355 \pm 32_{-31-7}^{+30+11}$	$321 \pm 43_{-29}^{+32}$	$355 \pm 24_{-10}^{+9} \pm 3$
–	$s\gamma$ with baryons	New			$< 38 \dagger$	$< 38 \dagger$
74	$\rho\gamma$	< 1.9	$1.36_{-0.27}^{+0.29} \pm 0.10$	$1.19 \pm 0.24 \pm 0.12$	< 14	$1.36_{-0.29}^{+0.31}$
75	$\rho/\omega\gamma$	< 1.2	$1.25 \pm 0.25 \pm 0.09$	$1.13 \pm 0.20 \pm 0.11$	< 14	$1.28_{-0.20}^{+0.21}$
–	$K\eta\gamma$	New		$8.5_{-1.2}^{+1.3} \pm 0.9$		$8.5_{-1.5}^{+1.6}$
105	$se^+e^- \ddagger$	4.7 ± 1.3	$6.0 \pm 1.7 \pm 1.3$	$4.0 \pm 1.3_{-0.8}^{+0.9}$	< 57	4.7 ± 1.3
106	$s\mu^+\mu^-$	4.3 ± 1.2	$5.0 \pm 2.8 \pm 1.2$	$4.1 \pm 1.1_{-0.8}^{+0.9}$	< 58	$4.3_{-1.2}^{+1.3}$
107	$s\ell^+\ell^- \ddagger$	4.5 ± 1.0	$5.6 \pm 1.5 \pm 1.3$	$4.11 \pm 0.83_{-0.81}^{+0.85}$	< 42	$4.50_{-1.01}^{+1.03}$
–	$\pi\ell^+\ell^-$	New	< 0.091	< 0.051		< 0.051
108	Ke^+e^-	$0.60_{-0.12}^{+0.14}$	$0.33_{-0.08}^{+0.09} \pm 0.02$	$0.48_{-0.13}^{+0.15} \pm 0.03$		$0.38_{-0.07}^{+0.08}$
109	$K^*e^+e^-$	$1.24_{-0.32}^{+0.37}$	$0.97_{-0.27}^{+0.30} \pm 0.14$	$1.49_{-0.46-0.13}^{+0.52+0.11}$		$1.13_{-0.26}^{+0.28}$
110	$K\mu^+\mu^-$	$0.47_{-0.10}^{+0.11}$	$0.35_{-0.11}^{+0.13} \pm 0.03$	$0.48_{-0.11}^{+0.13} \pm 0.04$		$0.42_{-0.08}^{+0.09}$
111	$K^*\mu^+\mu^-$	$1.19_{-0.29}^{+0.34}$	$0.88_{-0.30}^{+0.35} \pm 0.12$	$1.17_{-0.31}^{+0.36} \pm 0.10$		$1.03_{-0.23}^{+0.26}$
112	$K\ell^+\ell^-$	0.54 ± 0.08	$0.34 \pm 0.07 \pm 0.02$	$0.48_{-0.09}^{+0.10} \pm 0.03$	< 1.7	0.39 ± 0.06
113	$K^*\ell^+\ell^-$	1.05 ± 0.20	$0.78_{-0.17}^{+0.19} \pm 0.11$	$1.15_{-0.24}^{+0.26} \pm 0.08$	< 3.3	$0.94_{-0.16}^{+0.17}$
115	$\pi e^\pm\mu^\mp$	< 1.6	< 0.092		< 1.6	< 0.092
116	$\rho e^\pm\mu^\mp$	< 3.2			< 3.2	< 3.2
117	$Ke^\pm\mu^\mp$	< 1.6	< 0.038		< 1.6	< 0.038
118	$K^*e^\pm\mu^\mp$	< 6.2	< 0.51		< 6.2	< 0.51

$\dagger E_\gamma > 2.0$ GeV; $\ddagger M(\ell^+\ell^-) > 0.2$ GeV/ c^2

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Compilation of B Inclusive Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	New Avg.
–	$K^+ X$	New	$196^{+37+31}_{-34-30} \dagger$			196^{+48}_{-45}
–	$K^0 X$	New	$154^{+55+55}_{-48-41} \dagger$			154^{+77}_{-63}

$\dagger p^* > 2.34$ GeV

Heavy Flavor Averaging Group
Aug. 2007

Compilation of B Leptonic Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	DØ	New Avg.
15	$e^+ \nu$	< 15	< 7.9	< 1.0	< 15			< 1.0
16	$\mu^+ \nu$	< 6.6	< 6.2	< 1.7	< 21			< 1.7
17	$\tau^+ \nu$	< 260	$120 \pm 40 \pm 36$	179^{+56+46}_{-49-51}	< 840			141^{+43}_{-42}
18	$e^+ \nu e \gamma$	< 200			< 200			< 200
19	$\mu^+ \nu \mu \gamma$	< 52			< 52			< 52
290	$\gamma \gamma$	< 0.62	< 1.7	< 0.62				< 0.62
291	$e^+ e^-$	< 0.061	< 0.061	< 0.19	< 0.83			< 0.061
–	$e^+ e^- \gamma$	New	< 0.07					< 0.07
292	$\mu^+ \mu^-$	< 0.039	< 0.083	< 0.16	< 0.61	< 0.015		< 0.015
–	$\mu^+ \mu^- \gamma$	New	< 0.34					< 0.34
–	$\tau^+ \tau^-$	New	< 4100					< 4100
300	$e^\pm \mu^\mp$	< 0.17	< 0.18	< 0.17	< 1.5			< 0.17
303	$e^\pm \tau^\mp$	< 110			< 110			< 110
304	$\mu^\pm \tau^\mp$	< 38			< 38			< 38
305	$\nu \bar{\nu}$	< 220	< 220					< 220
306	$\nu \bar{\nu} \gamma$	< 47	< 47					< 47

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