Heavy Flavor Averaging Group
May 2013

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

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	CLEO	CDF	LHCb	New Avg.
337	$K^{*+}\gamma$	42.1 ± 1.8	$42.2 \pm 1.4 \pm 1.6$	$42.5 \pm 3.1 \pm 2.4$	$37.6^{+8.9}_{-8.3} \pm 2.8$			42.1 ± 1.8
338	$K_1^+(1270)\gamma$	43 ± 13		$43 \pm 9 \pm 9$				43 ± 12
339	$K^+\eta\gamma$	7.9 ± 0.9	$7.7 \pm 1.0 \pm 0.4$	$8.4^{+1.5}_{-1.2} \pm 0.9$				7.9 ± 0.9
340	$K^+\eta'\gamma$	$2.9^{+1.0}_{-0.9}$	$1.9^{+1.5}_{-1.2} \pm 0.1$	$3.6 \pm 1.2 \pm 0.4$				$2.9^{+1.0}_{-0.9}$
341	$K^+\phi\gamma$	2.7 ± 0.4	$3.5 \pm 0.6 \pm 0.4$	$2.48 \pm 0.30 \pm 0.24$				2.71 ± 0.34
342	$K^+\pi^-\pi^+\gamma$	27.6 ± 2.2	$29.5 \pm 1.3 \pm 2.0$ †	$25.0 \pm 1.8 \pm 2.2$ ‡				27.6 ± 1.8
343	$K^{*0}\pi^+\gamma$ §	20^{+7}_{-6}		$20^{+7}_{-6} \pm 2$				20^{+7}_{-6}
344	$K^+\rho^0\gamma$ §	< 20		< 20				< 20
345	$K^+\pi^-\pi^+\gamma$(N.R.)§	< 9.2		< 9.2				< 9.2
346	$K^0\pi^+\pi^0\gamma$	46 ± 5	$45.6 \pm 4.2 \pm 3.1$ †					45.6 ± 5.2
347	$K_1^+(1400)\gamma$	< 15		< 15				< 15
348	$K_2^*(1430)^+\gamma$	14 ± 4	$14.5 \pm 4.0 \pm 1.5$					14.5 ± 4.3
350	$K_3^*(1780)^+\gamma$	< 39		< 39				< 39
352	$\rho^+\gamma$	0.98 ± 0.25	$1.20^{+0.42}_{-0.37} \pm 0.20$	$0.87^{+0.29+0.09}_{-0.27-0.11}$	< 13			$0.98^{+0.25}_{-0.24}$
402	$p\overline{\Lambda}\gamma$	$2.4^{+0.5}_{-0.4}$		$2.45^{+0.44}_{-0.38} \pm 0.22$				$2.45^{+0.49}_{-0.44}$
406	$p\overline{\Sigma^0}\gamma$	< 4.6		< 4.6				< 4.6
437	$\pi^+\ell^+\ell^-$	< 0.049	< 0.066	< 0.049				< 0.049
438	$\pi^+e^+e^-$	< 0.080	< 0.125	< 0.080				< 0.080
439	$\pi^+\mu^+\mu^-$	< 0.069	< 0.055	< 0.069			$0.023 \pm 0.006 \pm 0.001$	0.023 ± 0.006
440	$\pi^+\nu\overline{\nu}$	< 100	< 100	< 98				< 98
441	$K^+\ell^+\ell^-$	0.51 ± 0.05	$0.47 \pm 0.06 \pm 0.02$	$0.53^{+0.06}_{-0.05} \pm 0.03$				0.50 ± 0.04
442	$K^+e^+e^-$	0.55 ± 0.07	$0.51^{+0.12}_{-0.11} \pm 0.02$	$0.57^{+0.09}_{-0.08} \pm 0.03$	< 2.4			0.55 ± 0.07
443	$K^+\mu^+\mu^-$	0.48 ± 0.04	$0.41^{+0.16}_{-0.15} \pm 0.02$	$0.53 \pm 0.08^{+0.07}_{-0.03}$	< 3.68	$0.45 \pm 0.03 \pm 0.02$	$0.436 \pm 0.015 \pm 0.018$	0.444 ± 0.019
444	$K^+\nu\overline{\nu}$	< 13	< 13	< 55	< 240			< 13
445	$\rho^+\nu\overline{\nu}$	< 150		< 213				< 213
446	$K^{*+}\ell^+\ell^-$	1.29 ± 0.21	$1.40^{+0.40}_{-0.37} \pm 0.09$	$1.24^{+0.23}_{-0.21} \pm 0.13$				$1.29^{+0.22}_{-0.21}$
447	$K^{*+}e^+e^-$	$1.55^{+0.40}_{-0.31}$	$1.38^{+0.47}_{-0.42} \pm 0.08$	$1.73^{+0.50}_{-0.42} \pm 0.20$				$1.55^{+0.35}_{-0.32}$
448	$K^{*+}\mu^+\mu^-$	1.07 ± 0.22	$1.46^{+0.79}_{-0.75} \pm 0.12$	$1.11^{+0.32}_{-0.27} \pm 0.10$		$0.89 \pm 0.25 \pm 0.09$	1.16 ± 0.19	$1.09^{+0.14}_{-0.13}$
449	$K^{*+}\nu\overline{\nu}$	< 80	< 80	< 40				< 40
452	$\pi^+e^\pm\mu^\mp$	< 0.17	< 0.17					< 0.17
–	$\pi^+e^+\tau^-$	New	< 74					< 74
–	$\pi^+e^-\tau^+$	New	< 20					< 20
–	$\pi^+e^\pm\tau^\mp$	New	< 75					< 75
–	$\pi^+\mu^+\tau^-$	New	< 62					< 62
–	$\pi^+\mu^-\tau^+$	New	< 45					< 45
–	$\pi^+\mu^\pm\tau^\mp$	New	< 72					< 72
453	$K^+e^+\mu^-$	< 0.091	< 0.091					< 0.091
454	$K^+e^-\mu^+$	< 0.13	< 0.13					< 0.13
455	$K^+e^\pm\mu^\mp$	< 0.091	< 0.091					< 0.091
–	$K^+e^+\tau^-$	New	< 43					< 43
–	$K^+e^-\tau^+$	New	< 15					< 15
–	$K^+e^\pm\tau^\mp$	New	< 30					< 30
–	$K^+\mu^+\tau^-$	New	< 45					< 45
–	$K^+\mu^-\tau^+$	New	< 28					< 28
456	$K^+\mu^\pm\tau^\mp$	< 77	< 48					< 48
457	$K^{*+}e^+\mu^-$	< 1.3	< 1.3					< 1.3
458	$K^{*+}e^-\mu^+$	< 0.99	< 0.99					< 0.99
459	$K^{*+}e^\pm\mu^\mp$	< 1.4	< 1.4					< 1.4
460	$\pi^-e^+e^+$	< 1.6	< 0.023		< 1.6			< 0.023
461	$\pi^-\mu^+\mu^+$	< 0.04	< 0.107		< 1.4		< 0.044	< 0.044
462	$\pi^-e^+\mu^+$	< 1.3			< 1.3			< 1.3
463	$\rho^-e^+e^+$	< 2.6			< 2.6			< 2.6
464	$\rho^-\mu^+\mu^+$	< 5.0			< 5.0			< 5.0
465	$\rho^-e^+\mu^+$	< 3.3			< 3.3			< 3.3
466	$K^-e^+e^+$	< 1.0	< 0.03		< 1.0			< 0.03
467	$K^-\mu^+\mu^+$	< 0.04	< 0.067		< 1.8		< 0.041	< 0.041
468	$K^-e^+\mu^+$	< 2.0			< 2.0			< 2.0
469	$K^{*-}e^+e^+$	< 2.8			< 2.8			< 2.8
470	$K^{*-}\mu^+\mu^+$	< 8.3			< 8.3			< 8.3
471	$K^{*-}e^+\mu^+$	< 4.4			< 4.4			< 4.4

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

Heavy Flavor Averaging Group
May 2013

Compilation of B^0 Semi-leptonic and Radiative Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	CLEO	CDF	LHCb	New Avg.
310	$K^0\eta\gamma$	7.6 ± 1.8	$7.1^{+2.1}_{-2.0} \pm 0.4$	$8.7^{+3.1+1.9}_{-2.7-1.6}$				$7.6^{+1.8}_{-1.7}$
311	$K^0\eta'\gamma$	< 6.4	< 6.6	< 6.4				< 6.4
312	$K^0\phi\gamma$	2.7 ± 0.7	< 2.7	$2.74 \pm 0.60 \pm 0.32$				2.74 ± 0.68
313	$K^+\pi^-\gamma$ §	4.6 ± 1.4		$4.6^{+1.3+0.5}_{-1.2-0.7}$				4.6 ± 1.4
314	$K^{*0}\gamma$	43.3 ± 1.5	$44.7 \pm 1.0 \pm 1.6$	$40.1 \pm 2.1 \pm 1.7$	$45.5^{+7.2}_{-6.8} \pm 3.4$			43.3 ± 1.5
315	$K^*(1410)^0\gamma$	< 130		< 130				< 130
316	$K^+\pi^-\gamma$ (N.R.) §	< 2.6		< 2.6				< 2.6
318	$K^0\pi^+\pi^-\gamma$	19.5 ± 2.2	$18.5 \pm 2.1 \pm 1.2$ †	$24 \pm 4 \pm 3$ ‡				19.5 ± 2.2
319	$K^+\pi^-\pi^0\gamma$	41 ± 4	$40.7 \pm 2.2 \pm 3.1$ †					40.7 ± 3.8
320	$K_1^0(1270)\gamma$	< 58		< 58				< 58
321	$K_1^0(1400)\gamma$	< 12		< 15				< 15
322	$K_2^*(1430)^0\gamma$	12.4 ± 2.4	$12.2 \pm 2.5 \pm 1.0$	$13 \pm 5 \pm 1$				12.4 ± 2.4
324	$K_3^*(1780)^0\gamma$	< 83		< 83				< 83
326	$\rho^0\gamma$	0.86 ± 0.15	$0.97^{+0.24}_{-0.22} \pm 0.06$	$0.78^{+0.17+0.09}_{-0.16-0.10}$	< 17			$0.86^{+0.15}_{-0.14}$
328	$\omega\gamma$	$0.44^{+0.18}_{-0.16}$	$0.50^{+0.27}_{-0.23} \pm 0.09$	$0.40^{+0.19}_{-0.17} \pm 0.13$	< 9.2			$0.44^{+0.18}_{-0.16}$
329	$\phi\gamma$	< 0.85	< 0.85		< 3.3			< 0.85
435	$\pi^0\ell^+\ell^-$	< 0.12	< 0.053	< 0.154				< 0.053
436	$\pi^0 e^+ e^-$	< 0.14	< 0.084	< 0.227				< 0.084
437	$\pi^0\mu^+\mu^-$	< 0.18	< 0.069	< 0.184				< 0.069
–	$\eta\ell^+\ell^-$	New	< 0.064					< 0.064
–	$\eta e^+ e^-$	New	< 0.108					< 0.108
–	$\eta\mu^+\mu^-$	New	< 0.112					< 0.112
438	$\pi^0\nu\bar{\nu}$	< 220		< 69				< 69
439	$K^0\ell^+\ell^-$	$0.31^{+0.08}_{-0.07}$	$0.21^{+0.15}_{-0.13} \pm 0.02$	$0.34^{+0.09}_{-0.08} \pm 0.02$				$0.31^{+0.08}_{-0.07}$
440	$K^0 e^+ e^-$	$0.16^{+0.10}_{-0.08}$	$0.08^{+0.15}_{-0.12} \pm 0.01$	$0.20^{+0.14}_{-0.10} \pm 0.01$	< 8.45			$0.16^{+0.10}_{-0.08}$
441	$K^0\mu^+\mu^-$	0.38 ± 0.08	$0.49^{+0.29}_{-0.25} \pm 0.03$	$0.44^{+0.13}_{-0.10} \pm 0.03$	< 6.64	$0.33 \pm 0.08 \pm 0.03$	$0.31^{+0.07}_{-0.06}$	$0.35^{+0.05}_{-0.04}$
442	$K^0\nu\bar{\nu}$	< 56	< 56	< 97				< 56
443	$\rho^0\nu\bar{\nu}$	< 440		< 208				< 208
444	$K^{*0}\ell^+\ell^-$	$0.99^{+0.12}_{-0.11}$	$1.03^{+0.22}_{-0.21} \pm 0.07$	$0.97^{+0.13}_{-0.11} \pm 0.07$				$0.99^{+0.13}_{-0.11}$
445	$K^{*0}e^+e^-$	$1.03^{+0.19}_{-0.17}$	$0.86^{+0.26}_{-0.24} \pm 0.05$	$1.18^{+0.27}_{-0.22} \pm 0.09$				$1.03^{+0.19}_{-0.17}$
446	$K^{*0}\mu^+\mu^-$	1.06 ± 0.10	$1.35^{+0.40}_{-0.37} \pm 0.10$	$1.06^{+0.19}_{-0.14} \pm 0.07$		$1.14 \pm 0.09 \pm 0.06$		$1.13^{+0.10}_{-0.09}$
447	$K^{*0}\nu\bar{\nu}$	< 120	< 93	< 55				< 55
448	$\phi\nu\bar{\nu}$	< 58		< 127				< 127
450	$\pi^0 e^\pm\mu^\mp$	< 0.14	< 0.14					< 0.14
451	$K^0 e^\pm\mu^\mp$	< 0.27	< 0.27					< 0.27
452	$K^{*0} e^\pm\mu^\mp$	< 0.53	< 0.58					< 0.58

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

Heavy Flavor Averaging Group
May 2013

Compilation of B Semi-leptonic and Radiative Branching Fractions

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

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	CLEO	New Avg.
65	$K\eta\gamma$	$8.5^{+1.8}_{-1.6}$		$8.5^{+1.3}_{-1.2} \pm 0.9$		$8.5^{+1.6}_{-1.5}$
67	$K_2^*(1430)\gamma$	$1.7^{+0.6}_{-0.5}$			$1.7 \pm 0.6 \pm 0.1$	1.7 ± 0.6
69	$K_3^*(1780)\gamma$	< 37		< 2.8		< 2.8
76	$s\gamma$	360 ± 23	$300 \pm 14 \pm 20$	$345 \pm 15 \pm 40$	$321 \pm 43^{+32}_{-29}$	$343 \pm 21 \pm 7$
77	$d\gamma$	9.2 ± 3.0	$9.2 \pm 2.0 \pm 2.3$			9.2 ± 3.0
83	$\rho\gamma$	1.39 ± 0.25	$1.73^{+0.34}_{-0.32} \pm 0.17$	$1.21^{+0.24}_{-0.22} \pm 0.12$	< 14	$1.39^{+0.22}_{-0.21}$
84	$\rho/\omega\gamma$	1.30 ± 0.23	$1.63^{+0.30}_{-0.28} \pm 0.16$	$1.14 \pm 0.20^{+0.10}_{-0.12}$	< 14	$1.30^{+0.18}_{-0.19}$
116	se^+e^- ‡	4.7 ± 1.3	$6.0 \pm 1.7 \pm 1.3$	$4.56 \pm 1.15^{+0.33}_{-0.40}$	< 57	$4.91^{+1.04}_{-1.06}$
117	$s\mu^+\mu^-$	4.3 ± 1.2	$5.0 \pm 2.8 \pm 1.2$	$1.91 \pm 1.02^{+0.16}_{-0.18}$	< 58	$2.23^{+0.97}_{-0.98}$
118	$s\ell^+\ell^-$ ‡	4.5 ± 1.0	$5.6 \pm 1.5 \pm 1.3$	$3.33 \pm 0.80^{+0.19}_{-0.24}$	< 42	$3.66^{+0.76}_{-0.77}$
119	$\pi\ell^+\ell^-$	< 0.062	< 0.059	< 0.062		< 0.059
–	πe^+e^-	New	< 0.110			< 0.110
–	$\pi\mu^+\mu^-$	New	< 0.050			< 0.050
120	Ke^+e^-	0.44 ± 0.06	$0.39^{+0.09}_{-0.08} \pm 0.02$	$0.48^{+0.08}_{-0.07} \pm 0.03$		0.44 ± 0.06
121	$K^*e^+e^-$	1.19 ± 0.20	$0.99^{+0.23}_{-0.21} \pm 0.06$	$1.39^{+0.23}_{-0.20} \pm 0.12$		$1.19^{+0.17}_{-0.16}$
122	$K\mu^+\mu^-$	0.44 ± 0.04	$0.41^{+0.13}_{-0.12} \pm 0.02$	$0.50 \pm 0.06 \pm 0.03$		0.48 ± 0.06
123	$K^*\mu^+\mu^-$	1.06 ± 0.09	$1.35^{+0.35}_{-0.33} \pm 0.10$	$1.10^{+0.16}_{-0.14} \pm 0.08$		$1.15^{+0.16}_{-0.15}$
124	$K\ell^+\ell^-$	0.45 ± 0.04	$0.47 \pm 0.06 \pm 0.02$	$0.48^{+0.05}_{-0.04} \pm 0.03$	< 1.7	0.48 ± 0.04
125	$K^*\ell^+\ell^-$	1.08 ± 0.11	$1.02^{+0.14}_{-0.13} \pm 0.05$	$1.07^{+0.11}_{-0.10} \pm 0.09$	< 3.3	1.05 ± 0.10
126	$K\nu\overline{\nu}$	< 14	< 14			< 14
127	$K^*\nu\overline{\nu}$	< 80	< 79			< 79
129	$\pi e^\pm\mu^\mp$	< 0.092	< 0.092		< 1.6	< 0.092
130	$\rho e^\pm\mu^\mp$	< 3.2			< 3.2	< 3.2
131	$Ke^\pm\mu^\mp$	< 0.038	< 0.038		< 1.6	< 0.038
132	$K^*e^\pm\mu^\mp$	< 0.51	< 0.51		< 6.2	< 0.51
–	$s\gamma$ with baryons	New			< 38 †	< 38 †

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

Heavy Flavor Averaging Group
May 2013
Isospin Asymmetry

In PDG2012 | New since PDG2012 (preliminary) | New since PDG2012 (published)

RPP#	Parameter	PDG2012 Avg.	BABAR	Belle	New Avg.
64	$\Delta_{0-}(K^*\gamma)$	0.052 ± 0.026	$0.066 \pm 0.021 \pm 0.022$	$0.012 \pm 0.044 \pm 0.026$	0.052 ± 0.026
76	$\Delta_{0-}(X_s\gamma)$	-0.01 ± 0.06	-0.01 ± 0.06		-0.01 ± 0.06
83	$\Delta_{\rho\gamma}$	-0.46 ± 0.17	$-0.43^{+0.25}_{-0.22} \pm 0.10$	$-0.48^{+0.21+0.08}_{-0.19-0.09}$	$-0.46^{+0.17}_{-0.16}$
124	$\Delta_{0-}(K\ell\ell)$†	$-0.40^{+0.34}_{-0.30}$	$-1.43^{+0.56}_{-0.85} \pm 0.05$	$-0.31^{+0.17}_{-0.14} \pm 0.08$	$-0.40^{+0.16}_{-0.15}$
125	$\Delta_{0-}(K^*\ell\ell)$†	-0.44 ± 0.13	$-0.56^{+0.17}_{-0.15} \pm 0.03$	$-0.29 \pm 0.16 \pm 0.09$	$-0.44^{+0.13}_{-0.12}$
	$\Delta_{0-}(K^{(*)}\ell\ell)$†	-0.45 ± 0.17	$-0.64^{+0.15}_{-0.14} \pm 0.03$	$-0.30^{+0.12}_{-0.11} \pm 0.08$	-0.45 ± 0.10

†$m_{\ell\ell} < m_{J/\psi}$

Heavy Flavor Averaging Group
May 2013
Isospin Asymmetry ($A_{\rm I}$)

In PDG2010 | New since PDG2010 (preliminary) | New since PDG2010 (published)

RPP#	Mode	q^2 [(GeV/c^2)^2] †	PDG2012 Avg.	BABAR	Belle	CDF ‡	LHCb ‡	New Avg.
124	$K\ell^+\ell^-$	< 2.0	New	$-0.51^{+0.49}_{-0.95}$	$-0.33^{+0.34}_{-0.26}$	$0.19 \pm 0.34 \pm 0.05$	$-0.55^{+0.40}_{-0.56}$	$-0.24^{+0.18}_{-0.19}$
	$K\ell^+\ell^-$	$[2.0, 4.3]$	New	$-0.73^{+0.48}_{-0.55}$	$-0.47^{+0.50}_{-0.39}$	$-0.07 \pm 0.34 \pm 0.07$	$-0.76^{+0.45}_{-0.79}$	$-0.42^{+0.20}_{-0.22}$
	$K\ell^+\ell^-$	$[4.3, 8.68]$	New	$-0.32^{+0.27}_{-0.30}$	$-0.19^{+0.26}_{-0.22}$	$-0.20 \pm 0.26 \pm 0.08$	$0.00^{+0.14}_{-0.15}$	-0.11 ± 0.11
	$K\ell^+\ell^-$	$[10.09, 12.86]$	New	$-0.05^{+0.25}_{-0.29}$	$-0.29^{+0.37}_{-0.29}$	$-0.27 \pm 0.37 \pm 0.08$	$-0.15^{+0.19}_{-0.22}$	$-0.16^{+0.14}_{-0.15}$
	$K\ell^+\ell^-$	$[14.18, 16.00]$	New	$0.05^{+0.32}_{-0.43}$	$-0.40^{+0.61}_{-0.69}$	$0.04 \pm 0.23 \pm 0.05$	-0.40 ± 0.22	$-0.17^{+0.14}_{-0.15}$
	$K\ell^+\ell^-$	> 16.00	New	$-0.93^{+0.83}_{-4.99}$	$0.11^{+0.25}_{-0.22}$	$-0.29 \pm 0.28 \pm 0.06$	$-0.52^{+0.18}_{-0.22}$	$-0.28^{+0.12}_{-0.13}$
	$K\ell^+\ell^-$	$[1.00, 6.00]$	New	$-0.41^{+0.25}_{-0.01}$	$-0.41^{+0.26}_{-0.21}$	$-0.06 \pm 0.24 \pm 0.07$	$-0.35^{+0.23}_{-0.27}$	-0.30 ± 0.12
125	$K^*\ell^+\ell^-$	< 2.0	New	$-0.17^{+0.29}_{-0.24}$	$-0.67^{+0.19}_{-0.17}$	$0.15 \pm 0.32 \pm 0.06$	$0.05^{+0.27}_{-0.21}$	$-0.25^{+0.12}_{-0.11}$
	$K^*\ell^+\ell^-$	$[2.0, 4.3]$	New	$-0.06^{+0.56}_{-0.36}$	$1.45^{+1.04}_{-1.15}$	$0.00 \pm 0.39 \pm 0.07$	$-0.27^{+0.29}_{-0.18}$	$-0.12^{+0.23}_{-0.17}$
	$K^*\ell^+\ell^-$	$[4.3, 8.68]$	New	$0.03^{+0.43}_{-0.32}$	$-0.34^{+0.32}_{-0.30}$	$0.29 \pm 0.41 \pm 0.13$	$-0.06^{+0.19}_{-0.14}$	$-0.06^{+0.14}_{-0.11}$
	$K^*\ell^+\ell^-$	$[10.09, 12.86]$	New	$-0.48^{+0.23}_{-0.19}$	$0.00^{+0.22}_{-0.23}$	$0.43 \pm 0.35 \pm 0.10$	$-0.16^{+0.17}_{-0.16}$	-0.14 ± 0.11
	$K^*\ell^+\ell^-$	$[14.18, 16.00]$	New	$0.24^{+0.61}_{-0.39}$	$0.16^{+0.31}_{-0.36}$	$0.17 \pm 0.29 \pm 0.07$	$0.02^{+0.23}_{-0.21}$	$0.11^{+0.15}_{-0.14}$
	$K^*\ell^+\ell^-$	> 16.00	New	$1.07^{+4.28}_{-1.01}$	$-0.02^{+0.22}_{-0.23}$	$-0.23 \pm 0.23 \pm 0.06$	$0.02^{+0.21}_{-0.20}$	-0.05 ± 0.13
	$K^*\ell^+\ell^-$	$[1.00, 6.00]$	New	$-0.20^{+0.30}_{-0.23}$	$0.33^{+0.38}_{-0.44}$	$-0.26 \pm 0.21 \pm 0.07$	-0.15 ± 0.16	$-0.16^{+0.12}_{-0.11}$

† see the original paper for the exact q^2 selection. ‡ muon mode only ($\ell = \mu$).

Heavy Flavor Averaging Group

May 2013

Compilation of B Inclusive Branching Fractions

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

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	CLEO	New Avg.
79	$s\eta$	261^{+53}_{-79}		$261 \pm 30^{+44}_{-74}$ §	< 440	261^{+53}_{-79}
80	$s\eta'$	420 ± 90	$390 \pm 80 \pm 90$‡		$460 \pm 110 \pm 60$‡	423 ± 86
81	K^+X	< 187	< 187†			< 187†
82	K^0X	195^{+71}_{-67}	$195^{+51}_{-45} \pm 50$†			195^{+71}_{-67}
93	π^+X	370 ± 80	$372^{+50}_{-47} \pm 59$†			372^{+77}_{-75}

† $p^* > 2.34$ GeV; § $0.4 < M_{X_s} < 2.6$ GeV; ‡ $2.0 < p^* < 2.7$ GeV

Heavy Flavor Averaging Group

May 2013

Compilation of B Leptonic Branching Fractions

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

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	CLEO	CDF	LHCb	CMS	New Avg.
25	$e^+\nu$	< 0.98	< 1.9	< 1.0	< 15				< 1.0
26	$\mu^+\nu$	< 1.0	< 1.0	< 1.7	< 21				< 1.0
27	$\tau^+\nu$	165 ± 34	179 ± 48	96 ± 26†	< 840				114 ± 22
28	$\ell^+\nu_\ell\gamma$	< 15.6	< 15.6						< 15.6
29	$e^+\nu_e\gamma$	< 17	< 17		< 200				< 17
30	$\mu^+\nu_\mu\gamma$	< 24	< 26		< 52				< 26
429	$\gamma\gamma$	< 0.32	< 0.32	< 0.62					< 0.32
430	e^+e^-	< 0.083	< 0.113	< 0.19	< 0.83	< 0.083			< 0.083
431	$e^+e^-\gamma$	< 0.12	< 0.12						< 0.12
432	$\mu^+\mu^-$	< 0.0014	< 0.052	< 0.16	< 0.61	< 0.0038	< 0.00080	< 0.0014	< 0.00080
433	$\mu^+\mu^-\gamma$	< 0.16	< 0.16						< 0.16
–	$\mu^+\mu^-\mu^+\mu^-$	New					< 0.0051		< 0.0051
434	$\tau^+\tau^-$	< 4100	< 4100						< 4100
449	$e^\pm\mu^\mp$	< 0.064	< 0.092	< 0.17	< 1.5	< 0.064			< 0.064
455	$e^\pm\tau^\mp$	< 28	< 28		< 110				< 28
456	$\mu^\pm\tau^\mp$	< 22	< 22		< 38				< 22
457	$\nu\bar{\nu}$	< 220	< 24	< 130					< 24
458	$\nu\bar{\nu}\gamma$	< 47	< 17						< 17

†The authors average this result with the earlier PRD 82, 071101 (2006).

Heavy Flavor Averaging Group
May 2013
Partial Branching Fraction

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

All branching fractions are in units of 10^{-7}

RPP#	Mode	q^2 [(GeV/c^2)^2] †	PDG2012 Avg.	BABAR	Belle	CDF ‡	LHCb ‡	CMS ‡	New Avg.
124	$K\ell^+\ell^-$	< 2.0	0.46 ± 0.22	$0.71^{+0.20}_{-0.18} \pm 0.02$	$0.81^{+0.18}_{-0.16} \pm 0.05$	$0.35 \pm 0.09 \pm 0.02$	$0.56 \pm 0.05 \pm 0.03$ §		0.53 ± 0.04
	$K\ell^+\ell^-$	$[2.0, 4.3]$	0.61 ± 0.15	$0.49^{+0.15}_{-0.13} \pm 0.01$	$0.46^{+0.14}_{-0.12} \pm 0.03$	$0.67 \pm 0.11 \pm 0.04$	$1.00 \pm 0.07 \pm 0.04$ §		0.75 ± 0.05
	$K\ell^+\ell^-$	$[4.3, 8.68]$	1.03 ± 0.13	$0.94^{+0.20}_{-0.19} \pm 0.02$	$1.00^{+0.19}_{-0.18} \pm 0.06$	$1.19 \pm 0.15 \pm 0.07$	$0.57 \pm 0.05 \pm 0.02$ §		0.72 ± 0.05
	$K\ell^+\ell^-$	$[10.09, 12.86]$	0.50 ± 0.09	$0.90^{+0.20}_{-0.19} \pm 0.04$	$0.55^{+0.16}_{-0.14} \pm 0.03$	$0.44 \pm 0.09 \pm 0.03$	$0.57 \pm 0.05 \pm 0.02$ §		0.55 ± 0.04
	$K\ell^+\ell^-$	$[14.18, 16.00]$	$0.49^{+0.08}_{-0.07}$	$0.49^{+0.15}_{-0.14} \pm 0.02$	$0.38^{+0.19}_{-0.12} \pm 0.02$	$0.40 \pm 0.07 \pm 0.02$	$0.38 \pm 0.04 \pm 0.01$ §		0.41 ± 0.03
	$K\ell^+\ell^-$	> 16.00	0.49 ± 0.24	$0.67^{+0.23}_{-0.21} \pm 0.05$	$0.98^{+0.20}_{-0.18} \pm 0.06$	$0.41 \pm 0.08 \pm 0.02$	$0.34 \pm 0.03 \pm 0.01$ §		0.37 ± 0.03
	$K\ell^+\ell^-$	$[1.00, 6.00]$		$1.36^{+0.27}_{-0.24} \pm 0.03$	$1.36^{+0.23}_{-0.21} \pm 0.08$	$1.24 \pm 0.16 \pm 0.07$	$1.21 \pm 0.09 \pm 0.08$ §		$1.26^{+0.09}_{-0.08}$
125	$K^*\ell^+\ell^-$	< 2.0	1.61 ± 0.26	$1.89^{+0.52}_{-0.46} \pm 0.06$	$1.46^{+0.40}_{-0.35} \pm 0.11$	$1.82 \pm 0.35 \pm 0.10$	$1.16^{+0.16}_{-0.18}$	$0.48^{+0.12}_{-0.14} \pm 0.08$	$1.02^{+0.09}_{-0.10}$
	$K^*\ell^+\ell^-$	$[2.0, 4.3]$	0.84 ± 0.20	$0.95^{+0.35}_{-0.30} \pm 0.04$	$0.86^{+0.31}_{-0.27} \pm 0.07$	$1.06 \pm 0.27 \pm 0.06$	$0.71^{+0.11}_{-0.11}$	$0.87 \pm 0.16 \pm 0.14$	0.80 ± 0.08
	$K^*\ell^+\ell^-$	$[4.3, 8.68]$	1.60 ± 0.35	$1.82^{+0.56}_{-0.52} \pm 0.09$	$1.37^{+0.47}_{-0.42} \pm 0.39$	$2.08 \pm 0.41 \pm 0.15$	$2.19^{+0.27}_{-0.30}$	$1.62 \pm 0.31 \pm 0.26$	$1.85^{+0.17}_{-0.16}$
	$K^*\ell^+\ell^-$	$[10.09, 12.86]$	1.95 ± 0.28	$1.86^{+0.52}_{-0.48} \pm 0.10$	$2.24^{+0.44}_{-0.40} \pm 0.19$	$1.85 \pm 0.31 \pm 0.11$	$1.26^{+0.17}_{-0.18}$	$1.50 \pm 0.25 \pm 0.33$	1.58 ± 0.12
	$K^*\ell^+\ell^-$	$[14.18, 16.00]$	1.14 ± 0.19	$1.46^{+0.41}_{-0.36} \pm 0.06$	$1.05^{+0.29}_{-0.26} \pm 0.08$	$1.31 \pm 0.20 \pm 0.07$	$1.02^{+0.14}_{-0.16}$	$0.84^{+0.15}_{-0.16} \pm 0.15$	1.09 ± 0.08
	$K^*\ell^+\ell^-$	> 16.00	1.3 ± 0.6	$1.02^{+0.47}_{-0.42} \pm 0.06$	$2.04^{+0.27}_{-0.24} \pm 0.16$	$1.03 \pm 0.21 \pm 0.06$	$1.23^{+0.18}_{-0.19}$	$1.56 \pm 0.18 \pm 0.24$	1.33 ± 0.11
	$K^*\ell^+\ell^-$	$[1.00, 6.00]$	New	$2.05^{+0.53}_{-0.48} \pm 0.07$	$1.49^{+0.45}_{-0.40} \pm 0.12$	$2.12 \pm 0.46 \pm 0.13$	$1.82^{+0.26}_{-0.29}$	$2.20 \pm 0.30 \pm 0.35$	1.90 ± 0.18
441	$K^0\ell^+\ell^-$	< 2.0	New			$0.49 \pm 0.32 \pm 0.04$	$0.21^{+0.27}_{-0.23}$		$0.32^{+0.21}_{-0.20}$
	$K^0\ell^+\ell^-$	$[2.0, 4.3]$	New			$0.59 \pm 0.39 \pm 0.08$	$0.07^{+0.25}_{-0.21}$		$0.21^{+0.22}_{-0.20}$
	$K^0\ell^+\ell^-$	$[4.3, 8.68]$	New			$0.83 \pm 0.43 \pm 0.12$	1.23 ± 0.31		1.10 ± 0.25
	$K^0\ell^+\ell^-$	$[10.09, 12.86]$	New			$0.28 \pm 0.22 \pm 0.04$	$0.50^{+0.22}_{-0.19}$		$0.40^{+0.15}_{-0.14}$
	$K^0\ell^+\ell^-$	$[14.18, 16.00]$	New			$0.43 \pm 0.18 \pm 0.04$	$0.20^{+0.13}_{-0.09}$		$0.27^{+0.12}_{-0.10}$
	$K^0\ell^+\ell^-$	> 16.00	New			$0.26 \pm 0.15 \pm 0.03$	$0.35^{+0.21}_{-0.14}$		$0.30^{+0.12}_{-0.10}$
	$K^0\ell^+\ell^-$	$[1.00, 6.00]$	New			$1.11 \pm 0.52 \pm 0.14$	$0.65^{+0.45}_{-0.35}$		$0.82^{+0.36}_{-0.32}$
448	$K^{*+}\ell^+\ell^-$	< 2.0	New			$1.50 \pm 0.94 \pm 0.18$	$1.37^{+0.60}_{-0.58}$		$1.41^{+0.51}_{-0.50}$
	$K^{*+}\ell^+\ell^-$	$[2.0, 4.3]$	New			$1.14 \pm 0.82 \pm 0.15$	$1.24^{+0.60}_{-0.55}$		$1.21^{+0.48}_{-0.46}$
	$K^{*+}\ell^+\ell^-$	$[4.3, 8.68]$	New			$1.30 \pm 1.13 \pm 0.37$	$2.50^{+0.88}_{-0.74}$		$2.14^{+0.67}_{-0.61}$
	$K^{*+}\ell^+\ell^-$	$[10.09, 12.86]$	New			$0.89 \pm 0.74 \pm 0.20$	$2.13^{+0.72}_{-0.66}$		$1.60^{+0.51}_{-0.49}$
	$K^{*+}\ell^+\ell^-$	$[14.18, 16.00]$	New			$1.02 \pm 0.58 \pm 0.13$	$1.00^{+0.47}_{-0.38}$		$1.01^{+0.37}_{-0.32}$
	$K^{*+}\ell^+\ell^-$	> 16.00	New			$1.68 \pm 0.74 \pm 0.19$	1.25 ± 0.46		1.36 ± 0.40
	$K^{*+}\ell^+\ell^-$	$[1.00, 6.00]$	New			$3.56 \pm 1.38 \pm 0.43$	$2.90^{+0.90}_{-0.85}$		$3.08^{+0.77}_{-0.74}$

† see the original paper for the exact q^2 selection, ‡ muon mode only ($\ell = \mu$), § K^+ channel only.

Heavy Flavor Averaging Group
May 2013
Forward-backward Asymmetry ($A_{\rm FB}$)

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	q^2 [$(\mathrm{GeV}/c^2)^2$] †	PDG2012 Avg.	BABAR	Belle	CDF ‡	LHCb ‡	CMS ‡	ATLAS ‡	New Avg.
124	$K\ell^+\ell^-$	< 2.0	-0.02 ± 0.26		$0.06^{+0.32}_{-0.35} \pm 0.02$	$-0.19^{+0.37}_{-0.45} \pm 0.09$	$0.00^{+0.06+0.03}_{-0.05-0.01}$			$-0.00^{+0.06}_{-0.05}$
	$K\ell^+\ell^-$	$[2.0, 4.3]$	0.2 ± 0.6		$-0.43^{+0.38}_{-0.40} \pm 0.09$	$0.32^{+0.17}_{-0.13} \pm 0.10$	$0.07^{+0.08+0.02}_{-0.05-0.01}$			$0.09^{+0.08}_{-0.06}$
	$K\ell^+\ell^-$	$[4.3, 8.68]$	$-0.20^{+0.10}_{-0.13}$		$-0.20^{+0.12}_{-0.14} \pm 0.03$	$0.08^{+0.08}_{-0.09} \pm 0.01$	$-0.02^{+0.03}_{-0.05} \pm 0.03$			-0.05 ± 0.04
	$K\ell^+\ell^-$	$[10.09, 12.86]$	$-0.15^{+0.13}_{-0.12}$		$-0.21^{+0.17}_{-0.15} \pm 0.06$	$-0.04^{+0.12}_{-0.10} \pm 0.03$	$-0.03 \pm 0.07 \pm 0.01$			-0.07 ± 0.05
	$K\ell^+\ell^-$	$[14.18, 16.00]$	$0.03^{+0.27}_{-0.14}$		$0.04^{+0.32}_{-0.26} \pm 0.05$	$-0.07^{+0.08}_{-0.08} \pm 0.01$	$-0.01^{+0.12}_{-0.06} \pm 0.01$			$-0.03^{+0.06}_{-0.04}$
	$K\ell^+\ell^-$	> 16.00	$0.03^{+0.10}_{-0.08}$		$0.02^{+0.11}_{-0.08} \pm 0.02$	$0.05^{+0.18}_{-0.10} \pm 0.05$	$-0.06^{+0.06+0.02}_{-0.07-0.01}$			-0.01 ± 0.04
	$K\ell^+\ell^-$	$[1.00, 6.00]$			$0.26^{+0.27}_{-0.30} \pm 0.07$	$0.13^{+0.11}_{-0.10} \pm 0.02$	$0.02^{+0.05+0.02}_{-0.03-0.01}$			$0.04^{+0.05}_{-0.04}$
125	$K^*\ell^+\ell^-$	< 2.0	$0.45^{+0.26}_{-0.30}$		$0.47^{+0.26}_{-0.32} \pm 0.03$	$0.05^{+0.28}_{-0.27} \pm 0.10$	$-0.02 \pm 0.12 \pm 0.01$	$0.29^{+0.37}_{-0.00} \pm 0.18$		$0.13^{+0.09}_{-0.08}$
	$K^*\ell^+\ell^-$	$[2.0, 4.3]$	0.14 ± 0.27		$0.11^{+0.31}_{-0.36} \pm 0.07$	$-0.11^{+0.34}_{-0.41} \pm 0.16$	$-0.20 \pm 0.08 \pm 0.01$	$-0.07 \pm 0.20 \pm 0.02$	$0.22 \pm 0.28 \pm 0.14$	-0.13 ± 0.07
	$K^*\ell^+\ell^-$	$[4.3, 8.68]$	0.24 ± 0.24		$0.45^{+0.15}_{-0.21} \pm 0.15$	$0.09^{+0.14}_{-0.14} \pm 0.04$	$0.16^{+0.06}_{-0.05} \pm 0.01$	$-0.01 \pm 0.11 \pm 0.03$	$0.24 \pm 0.13 \pm 0.01$	0.15 ± 0.04
	$K^*\ell^+\ell^-$	$[10.09, 12.86]$	0.53 ± 0.15		$0.43^{+0.18}_{-0.20} \pm 0.03$	$0.44^{+0.12}_{-0.13} \pm 0.08$	$0.28^{+0.07}_{-0.06} \pm 0.02$	$0.40 \pm 0.08 \pm 0.05$	$0.09 \pm 0.09 \pm 0.03$	0.31 ± 0.04
	$K^*\ell^+\ell^-$	$[14.18, 16.00]$	$0.53^{+0.13}_{-0.15}$		$0.70^{+0.16}_{-0.22} \pm 0.10$	$0.53^{+0.09}_{-0.09} \pm 0.07$	$0.51^{+0.07}_{-0.05} \pm 0.02$	$0.29 \pm 0.09 \pm 0.05$	$0.48 \pm 0.19 \pm 0.05$	0.48 ± 0.04
	$K^*\ell^+\ell^-$	> 16.00	$0.67^{+0.10}_{-0.14}$		$0.66^{+0.11}_{-0.16} \pm 0.04$	$0.35^{+0.17}_{-0.19} \pm 0.06$	$0.30 \pm 0.08^{+0.01}_{-0.02}$	$0.41 \pm 0.05 \pm 0.03$	$0.16 \pm 0.10 \pm 0.03$	0.38 ± 0.04
	$K^*\ell^+\ell^-$	$[1.00, 6.00]$			$0.26^{+0.27}_{-0.30} \pm 0.07$	$0.19^{+0.17}_{-0.21} \pm 0.05$	$-0.17 \pm 0.06 \pm 0.01$	$-0.07 \pm 0.12 \pm 0.01$	$0.07 \pm 0.20 \pm 0.07$	-0.11 ± 0.05

† see the original paper for the exact q^2 selection. ‡ muon mode only ($\ell = \mu$).

Heavy Flavor Averaging Group
May 2013
Fraction of the Longitudinal Polarization (F_L)

In PDG2012 New since PDG2012 (preliminary) New since PDG2012 (published)

RPP#	Mode	q^2 [(GeV/c^2)^2] †	PDG2012 Avg.	BABAR	Belle	CDF ‡	LHCb ‡	CMS ‡	ATLAS ‡	New Avg.
125	$K^*\ell^+\ell^-$	< 2.0	0.35 ± 0.17		$0.29^{+0.21}_{-0.18} \pm 0.02$	$0.25^{+0.14}_{-0.13} \pm 0.04$	$0.37^{+0.11}_{-0.09}$	$0.60^{+0.00}_{-0.28} \pm 0.19$		$0.34^{+0.07}_{-0.06}$
	$K^*\ell^+\ell^-$	$[2.0, 4.3]$	0.60 ± 0.20		$0.71 \pm 0.24 \pm 0.05$	$0.71^{+0.15}_{-0.17} \pm 0.07$	$0.74^{+0.10}_{-0.09}$	$0.65 \pm 0.17 \pm 0.03$	$0.26 \pm 0.18 \pm 0.06$	0.66 ± 0.06
	$K^*\ell^+\ell^-$	$[4.3, 8.68]$	$0.74^{+0.15}_{-0.17}$		$0.64^{+0.23}_{-0.24} \pm 0.07$	$0.72^{+0.12}_{-0.13} \pm 0.05$	$0.57 \pm 0.07 \pm 0.03$	$0.81^{+0.13}_{-0.12} \pm 0.05$	$0.37 \pm 0.11 \pm 0.02$	0.60 ± 0.05
	$K^*\ell^+\ell^-$	$[10.09, 12.86]$	0.23 ± 0.12		$0.17^{+0.17}_{-0.15} \pm 0.03$	$0.38^{+0.11}_{-0.11} \pm 0.04$	$0.48^{+0.08}_{-0.09} \pm 0.03$	$0.45^{+0.10}_{-0.11} \pm 0.03$	$0.50 \pm 0.09 \pm 0.04$	0.41 ± 0.05
	$K^*\ell^+\ell^-$	$[14.18, 16.00]$	0.34 ± 0.31		$-0.15^{+0.27}_{-0.23} \pm 0.07$	$0.40^{+0.11}_{-0.11} \pm 0.04$	$0.33^{+0.08}_{-0.07} \pm 0.02$	$0.53 \pm 0.12 \pm 0.03$	$0.28 \pm 0.16 \pm 0.03$	0.36 ± 0.05
	$K^*\ell^+\ell^-$	> 16.00	$0.11^{+0.12}_{-0.10}$		$0.12^{+0.15}_{-0.13} \pm 0.02$	$0.19^{+0.12}_{-0.11} \pm 0.07$	$0.38^{+0.09}_{-0.08} \pm 0.03$	$0.44 \pm 0.07 \pm 0.03$	$0.35 \pm 0.08 \pm 0.02$	0.33 ± 0.04
	$K^*\ell^+\ell^-$	$[1.00, 6.00]$			$0.67 \pm 0.23 \pm 0.05$	$0.76^{+0.12}_{-0.14} \pm 0.07$	$0.65^{+0.08}_{-0.07} \pm 0.03$	$0.68 \pm 0.10 \pm 0.02$	$0.18 \pm 0.15 \pm 0.03$	0.62 ± 0.05

† see the original paper for the exact q^2 selection. ‡ muon mode only ($\ell = \mu$).

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