

Heavy Flavor Averaging group (HFLAV) - May 2018
B⁺ Branching Fractions (decays with strange mesons part 1) ($\times 10^{-6}$) - UL at 90% CL
 Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
327	$K^0 \pi^+$	23.7 ± 0.8	$23.9 \pm 1.1 \pm 1.0$	[1]	$18.8^{+3.7+2.1}_{-3.3-1.8}$	[3]	23.79 ± 0.75	
328	$K^+ \pi^0$	12.9 ± 0.5	$13.6 \pm 0.6 \pm 0.7$	[4]	$12.62 \pm 0.31 \pm 0.56$	[2]	$12.94^{+0.52}_{-0.51}$	
329	$\eta' K^+$	70.6 ± 2.5	$71.5 \pm 1.3 \pm 3.2$	[5]	$69.2 \pm 2.2 \pm 3.7$	[6]	70.6 ± 2.7	
330	$\eta' K^{*+}$	$4.8^{+1.8}_{-1.6}$	$4.8^{+1.6 \pm 0.8}_{-1.4}$	[7]	< 2.9	[8]	$4.8^{+1.8}_{-1.6}$	
331	$\eta' K^*(1430)^+$	5.2 ± 2.1	$5.2 \pm 1.9 \pm 1.0$	[7]			5.2 ± 2.1	
332	$\eta' K^*_2(1430)^+$	28 ± 5	$28.0^{+4.6 \pm 2.6}_{-4.3}$	[7]			$28.0^{+5.3}_{-5.0}$	
333	ηK^+	2.4 ± 0.4	$2.94^{+0.39 \pm 0.21}_{-0.34}$	[5]	$2.12 \pm 0.23 \pm 0.11$	[9]	$2.36^{+0.22}_{-0.21}$	
334	ηK^{*+}	19.3 ± 1.6	$18.9 \pm 1.8 \pm 1.3$	[11]	$19.3^{+2.0}_{-1.9}$	[12]	19.3 ± 1.6	
335	$\eta K^*(1430)^+$	18 ± 4	$18.2 \pm 2.6 \pm 2.6$	[11]			18.2 ± 3.7	
336	$\eta K^*_2(1430)^+$	9.1 ± 3.0	$9.1 \pm 2.7 \pm 1.4$	[11]			9.1 ± 3.0	
337	$\eta(1295)K^+ \dagger$	$2.9^{+0.8}_{-0.7}$	$2.9^{+0.8 \pm 0.2 \ddagger}_{-0.7}$	[13]			$2.9^{+0.8}_{-0.7}$	
339	$\eta(1405)K^+ \dagger$	< 1.2	< 1.2	[13]			< 1.2	
340	$\eta(1475)K^+ \dagger$	$13.8^{+2.1}_{-1.8}$	$13.8^{+1.8+1.0}_{-1.7-0.6}$	[13]			$13.8^{+2.1}_{-1.8}$	
341	$f_1(1285)K^+ \dagger$	< 2.0	< 2.0	[13]			< 2.0	
342	$f_1(1420)K^+ \dagger$	< 2.9	< 2.9	[13]			< 2.9	
344	$\phi(1680)K^+ \dagger$	< 3.4	< 3.4	[13]			< 3.4	
345	$f_0(1500)K^+ \dagger$	3.7 ± 2.2	$3.7 \pm 2.2 \S$	[14, 15]			3.7 ± 2.2	
346	ωK^+	6.5 ± 0.4	$6.3 \pm 0.5 \pm 0.3$	[16]	$6.8 \pm 0.4 \pm 0.4$	[17]	6.5 ± 0.4	
347	ωK^{*+}	< 7.4	< 7.4	[19]			< 7.4	
348	$\omega(K\pi)^{*+}$	28 ± 4	$27.5^{+3.0}_{-2.6}$	[19]			$27.5^{+3.0}_{-2.6}$	
349	$\omega K^*(1430)^+$	24 ± 5	$24.0 \pm 2.6 \pm 4.4$	[19]			24.0 ± 5.1	
350	$\omega K^*_2(1430)^+$	21 ± 4	$21.5 \pm 3.6 \pm 2.4$	[19]			21.5 ± 4.3	
351	$\alpha_0(980)^+ K^0 \dagger$	< 3.9	< 3.9	[20]			< 3.9	
352	$\alpha_0(980)^0 K^+ \dagger$	< 2.5	< 2.5	[20]			< 2.5	
353	$K^{*0} \pi^+$	10.1 ± 0.9	$10.8 \pm 0.6^{+1.2}_{-1.4}$	[14]	$9.7 \pm 0.6^{+0.8}_{-0.9}$	[21]	$10.1^{+0.8}_{-0.9}$	
354	$K^{*+} \pi^0$	8.2 ± 1.9	$8.2 \pm 1.5 \pm 1.1$	[22]		$7.1^{+11.4}_{-7.1} \pm 1.0$ [18]	8.2 ± 1.8	
355	$K^+ \pi^+ \pi^-$	51 ± 2.9	$54.4 \pm 1.1 \pm 4.6$	[14]	$48.8 \pm 1.1 \pm 3.6$	[21]	51.0 ± 3.0	
356	$K^+ \pi^+ \pi^- (NR)$	$16.3^{+2.1}_{-1.5}$	$9.3 \pm 1.0^{+6.9}_{-1.7}$	[14]	$16.9 \pm 1.3^{+1.7}_{-1.6}$	[21]	16.3 ± 2.0	
357	$\omega(782)K^+ (K^+ \pi^+ \pi^-)$	6 ± 9	$5.9^{+8.8+0.5}_{-9.0-0.4}$	[14]			$5.9^{+8.8}_{-9.0}$	
358	$f_0(980)K^+ (K^+ \pi^+ \pi^-) \dagger$	$9.4^{+1.0}_{-1.2}$	$10.3 \pm 0.5^{+2.0}_{-1.4}$	[14]	$8.8 \pm 0.8^{+0.9}_{-1.8}$	[21]	$9.4^{+0.9}_{-1.0}$	
359	$f_2(1270)^0 K^+ (K^+ \pi^+ \pi^-)$	1.07 ± 0.27	$0.88^{+0.38+0.01}_{-0.33-0.03}$	[14]	$1.33 \pm 0.30^{+0.23}_{-0.34}$	[21]	1.07 ± 0.29	
360	$f_0(1370)^0 K^+ (K^+ \pi^+ \pi^-) \dagger$	< 10.7	< 10.7	[23]			< 10.7	
361	$\rho(1450)^0 K^+ (K^+ \pi^+ \pi^-)$	< 11.7	< 11.7	[23]			< 11.7	
362	$f'_2(1525)K^+ (K^+ \pi^+ \pi^-)$	< 3.4	< 3.4	[23]			< 3.4	
363	$\rho^0 K^+ (K^+ \pi^+ \pi^-)$	3.7 ± 0.5	$3.56 \pm 0.45^{+0.57}_{-0.46}$	[14]	$3.89 \pm 0.47^{+0.43}_{-0.41}$	[21]	$3.74^{+0.49}_{-0.45}$	

Results for LHCb are relative BFs converted to absolute BFs.

CLEO upper limits that have been greatly superseded are not shown.

\dagger In this product of BFs, all daughter BFs not shown are set to 100%.

\ddagger The value quoted is $\mathcal{B}(B^+ \rightarrow \eta(1295)K^+) \times \mathcal{B}(\eta(1295) \rightarrow \eta\pi\pi)$.

\S Average of results in $K_S^0 K^+ K^-$, $K_S^0 K_S^0 K^+$ [15] and $K^+ \pi^+ \pi^-$ [14]. Includes an f_X resonance with parameters that are compatible with $f_0(1500)$.

Heavy Flavor Averaging group (HFLAV) - May 2018
 B^+ Branching Fractions (decays with strange mesons part 2) ($\times 10^{-6}$) - UL at 90% CL
Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	BaBar	Belle	CLEO	CDF	LHCb	Our Avg.
364	$K_0^*(1430)^0 \pi^+$ ($K^+ \pi^+ \pi^-$)	45^{+9}	$32.0 \pm 1.2^{+10.8}_{-6.0}$ [14]	$51.6 \pm 1.7^{+7.0}_{-7.5}$ [21]				45.1 ± 6.3
365	$K_2^*(1430)^0 \pi^+$ ($K^+ \pi^+ \pi^-$)	$5.6^{+2.2}_{-1.5}$	$5.6 \pm 1.2^{+1.8}_{-0.8}$ [14]	< 6.9 [24]				$5.6^{+2.2}_{-1.4}$
366	$K^*(1410)^0 \pi^+$ ($K^+ \pi^+ \pi^-$)	< 45	< 15 [23]	< 45 [24]				< 45
367	$K^*(1680)^0 \pi^+$ ($K^+ \pi^+ \pi^-$)	< 12		< 12 [24]				< 12
368	$K^+ \pi^0 \pi^0$	16.2 ± 1.9	$16.2 \pm 1.2 \pm 1.5$ [22]					16.2 ± 1.9
369	$f_0(980)K^+$ ($K^+ \pi^0 \pi^0$)	2.8 ± 0.8	$2.8 \pm 0.6 \pm 0.5$ [22]					2.8 ± 0.8
370	$K^- \pi^+ \pi^+$	< 0.046	< 0.95 [25]	< 4.5 [26]	< 56 [28]		< 0.046 [27]	< 0.046
371	$K^- \pi^+ \pi^+$ (NR)	< 56						< 56
372	$K_1(1270)^0 \pi^+$	< 40	< 40 [29]					< 40
373	$K_1(1400)^0 \pi^+$	< 39	< 39 [29]					< 39
374	$K^0 \pi^+ \pi^0$	< 66			< 66 [30]			< 66
375	$\rho^+ K^0 (K^0 \pi^+ \pi^0)$	8.0 ± 1.5	$8.0^{+1.4}_{-1.3} \pm 0.6$ [31]					$8.0^{+1.5}_{-1.4}$
376	$K^{*+} \pi^+ \pi^-$	75 ± 10	$75.3 \pm 6.0 \pm 8.1$ [32]					75.3 ± 10.1
377	$K^{*+} \rho^0$	4.6 ± 1.1	$4.6 \pm 1.0 \pm 0.4$ [33]					4.6 ± 1.1
378	$f_0(980)K^{*+} \dagger$	4.2 ± 0.7	$4.2 \pm 0.6 \pm 0.3$ [33]					4.2 ± 0.7
379	$a_1^+ K^0$	35 ± 7	$34.9 \pm 5.0 \pm 4.4$ [34]					34.9 ± 6.7
380	$b_1^+ K^0 \dagger$	9.6 ± 1.9	$9.6 \pm 1.7 \pm 0.9$ [35]					9.6 ± 1.9
381	$K^{*0} \rho^+$	9.2 ± 1.5	$9.6 \pm 1.7 \pm 1.5$ [36]					9.2 ± 1.5
382	$K_1(1400)^+ \rho^0$	< 780	< 780 [38]					< 780 [37]
383	$K_2(1430)^+ \rho^0$	< 1500	< 1500 [38]					< 1500 [37]
384	$b_1^0 K^+ \dagger$	9.1 ± 2.0	$9.1 \pm 1.7 \pm 1.0$ [39]					9.1 ± 2.0
385	$b_1^+ K^{*0} \dagger$	< 5.9	< 5.9 [40]					< 5.9
386	$b_1^0 K^{*+} \dagger$	< 6.7	< 6.7 [40]					< 6.7
387	$K^+ \bar{K}^0$	1.31 ± 0.17	$1.61 \pm 0.44 \pm 0.09$ [1]			$1.11 \pm 0.19 \pm 0.05$ [2]	$1.52 \pm 0.21 \pm 0.05$ [41]	1.32 ± 0.14
388	$\bar{K}^0 K^+ \pi^0$	< 24			< 24 [30]			< 24
389	$K^+ K_S K_S$	10.8 ± 0.6	$10.6 \pm 0.5 \pm 0.3$ [15]					10.8 ± 0.6
390	$f_0(980)K^+$ ($K^+ K_S K_S$)	14.7 ± 3.3	$14.7 \pm 2.8 \pm 1.8$ [15]					14.7 ± 3.3
391	$f_0(1710)K^+$ ($K^+ K_S K_S$)	$0.48^{+0.40}_{-0.26}$	$0.48^{+0.40}_{-0.24} \pm 0.11$ [15]					$0.48^{+0.41}_{-0.26}$
392	$K^+ K_S K_S$ (NR)	20 ± 4	$19.8 \pm 3.7 \pm 2.5$ [15]					19.8 ± 4.5
393	$K_S K_S \pi^+$	< 0.51	< 0.51 [42]					< 0.51
394	$K^+ K^- \pi^+$	5.0 ± 0.7	$5.0 \pm 0.5 \pm 0.5$ [43]					5.24 ± 0.42
395	$K^+ K^- \pi^+$ (NR)	< 75			< 75 [28]			< 75
396	$\bar{K}^{*0} K^+$ ($K^+ K^- \pi^+$)	< 1.1	< 1.1 [45]					< 1.1
397	$\bar{K}^{*0}(1430)^0 K^+$ ($K^+ K^- \pi^+$)	< 2.2	< 2.2 [45]					< 2.2
398	$K^+ K^+ \pi^-$	< 0.011	< 0.16 [25]				< 0.011 [26]	< 0.011
399	$K^+ K^+ \pi^-$ (NR)	< 87.9						< 87.9

Results for CDF and LHCb are relative BF's converted to absolute BF's.

CLEO upper limits that have been greatly superseded are not shown.

\dagger In this product of BF's, all daughter BF's not shown are set to 100%.

\blacklozenge Result from ARGUS. Cited in the BaBar column to avoid adding a column to the table.

Heavy Flavor Averaging group (HF/LAV) - May 2018
 B⁺ Branching Fractions (decays with strange mesons part 3) ($\times 10^{-6}$) - UL at 90% CL
 Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
400	$f_2(1525)K^+$	1.8 ± 0.5	1.8 ± 0.5 †	[15]				1.8 ± 0.5
401	$f_J(2220)K^+$	< 1.2				[24]		< 1.2
402	$K^{*+}\pi^+K^-$	< 11.8	< 11.8	[32]		[46]		< 11.8
403	$K^{*+}\overline{K}^{*0}$	0.91 ± 0.29	$1.2 \pm 0.5 \pm 0.1$ [47]	[47]		$0.77^{+0.35}_{-0.30} \pm 0.12$ [48]		$0.91^{+0.31}_{-0.28}$
404	$K^{*+}K^+\pi^-$	< 6.1	< 6.1	[32]				< 6.1
405	$K^+K^-K^+$	34.0 ± 1.4	$34.6 \pm 0.6 \pm 0.9$ [15]	[15]		$30.6 \pm 1.2 \pm 2.3$ [24]		34.0 ± 1.0
406	$\phi K^+ (K^+K^-K^+)$	$8.8^{+0.7}_{-0.6}$	$9.2 \pm 0.4^{+0.7}_{-0.5}$ [15]	[15]		$9.6 \pm 0.9^{+1.1}_{-0.8}$ [24]		8.8 ± 0.5
407	$f_0(980)K^+ (K^+K^-K^+)$	9.4 ± 3.2	$9.4^{+1.6}_{-2.8}$ [15]	[15]		$5.5^{+2.1}_{-1.8} \pm 0.6$ [49]	$7.6 \pm 1.3 \pm 0.6$ [50]	$9.4^{+1.6}_{-2.8}$
408	$a_2(1320)K^+ (K^+K^-K^+)$ †	< 1.1	$4.3 \pm 0.60 \pm 0.30$ [51]	[51]				< 1.1
409	$X_0(1550)K^+ (K^+K^-K^+)$	4.3 ± 0.7						4.30 ± 0.67
410	$\phi(1680)K^+ (K^+K^-K^+)$ †	< 0.8						< 0.8
411	$f_0(1710)K^+ (K^+K^-K^+)$ †	1.1 ± 0.6	$1.12 \pm 0.25 \pm 0.50$ [15]	[15]				1.12 ± 0.56
412	$K^+K^-K^+ (NR)$	$23.8^{+2.8}_{-5.0}$	$22.8 \pm 2.7 \pm 7.6$ [15]	[15]		$24.0 \pm 1.5^{+2.6}_{-6.0}$ [24]		$23.8^{+2.9}_{-5.1}$
413	$K^{*+}K^+K^-$	36 ± 5	$36.2 \pm 3.3 \pm 3.6$ [32]	[32]				36.2 ± 4.9
414	ϕK^{*+}	10.0 ± 2.0	$11.2 \pm 1.0 \pm 0.9$ [52]	[52]		$6.7^{+2.1+0.7}_{-1.9-1.0}$ [53]		10.0 ± 1.1
415	$\phi(K\pi)^{*+}$	8.3 ± 1.6	$8.3^{+1.4}_{-0.8}$ [54]	[54]				$8.3^{+1.4}_{-0.8}$
416	$\phi K_1(1270)^+$	6.1 ± 1.9	$6.1 \pm 1.6 \pm 1.1$ [54]	[54]				6.1 ± 1.9
417	$\phi K_1(1400)^+$	< 3.2	< 3.2	[54]				< 3.2
418	$\phi K^*(1410)^+$	< 4.3	< 4.3	[54]				< 4.3
419	$\phi K_0^*(1430)^+$	7.0 ± 1.6	$7.0 \pm 1.3 \pm 0.9$ [54]	[54]				7.0 ± 1.6
420	$\phi K_2^*(1430)^+$	8.4 ± 2.1	$8.4 \pm 1.8 \pm 1.0$ [54]	[54]				8.4 ± 2.1
421	$\phi K_2(1770)^+$	< 15	< 15	[54]				< 15
422	$\phi K_2(1820)^+$	< 16.3	< 16.3 [54]	[54]				< 16.3
423	$a_1^+K^{*0}$	< 3.6	< 3.6	[55]				< 3.6
424	$\phi\phi K^+ \S$	5.0 ± 1.2	$5.6 \pm 0.5 \pm 0.3$ [56]	[56]		$2.6^{+1.1}_{-0.9} \pm 0.3$ [46]		5.0 ± 0.5
425	$\eta' n' K^+$	< 25	< 25	[57]				< 25
426	$K^+\omega\phi$	< 1.9						< 1.9
427	$K^+X(1812)^+$ †	< 0.32						< 0.32

Results for CDF and LHCb are relative BFs converted to absolute BFs.

CLEO upper limits that have been greatly superseded are not shown.

† In this product of BFs, all daughter BFs not shown are set to 100%.

‡ Average of results in $K_S^0 K^+ K^-$, $K_S^0 K_S^0 K^+$ [15].

§ $M_{\phi\phi} < 2.85 \text{ GeV}/c^2$.

Heavy Flavor Averaging group (HFLAV) - May 2018
 B^+ Branching Fractions (decays without strange mesons) ($\times 10^{-6}$) - UL at 90% CL
Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RFP#	Mode	PDG2017 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
446	$\pi^+\pi^0$	5.5 ± 0.4	$5.02 \pm 0.46 \pm 0.29$ [4]	$5.86 \pm 0.26 \pm 0.38$ [2]	$4.6^{+1.8+0.6}_{-1.6-0.7}$ [3]			$5.48^{+0.35}_{-0.34}$
447	$\pi^+\pi^+\pi^-$	15.2 ± 1.4	$15.2 \pm 0.6 \pm 1.3$ [59]					15.2 ± 1.4
448	$\rho^0\pi^+$	8.3 ± 1.2	$8.1 \pm 0.7^{+1.3}_{-1.6}$ [59]	$8.0^{+2.3}_{-2.0} \pm 0.7$ [60]	$10.4^{+3.3}_{-3.4} \pm 2.1$ [18]			$8.3^{+1.2}_{-1.3}$
449	$f_0(980)\pi^+\dagger$	< 1.5	< 1.5 [59]					< 1.5
450	$f_2(1270)\pi^+$	$1.6^{+0.7}_{-0.4}$	$1.57 \pm 0.42^{+0.55}_{-0.25}$ [59]					$1.57^{+0.69}_{-0.49}$
451	$\rho(1450)^0\pi^+\dagger$	1.4 ± 0.6	$1.4 \pm 0.4^{+0.5}_{-0.8}$ [59]					$1.4^{+0.6}_{-0.9}$
452	$f_0(1370)\pi^+\dagger$	< 4.0	< 4.0 [59]					< 4.0
454	$\pi^+\pi^-\pi^+(NR)$	$5.3^{+1.5}_{-1.1}$	$5.3 \pm 0.7^{+1.3}_{-0.8}$ [59]					$5.3^{+1.5}_{-1.1}$
455	$\pi^+\pi^0\pi^0$	< 890	< 890 † [61]					< 890 †
456	$\rho^+\pi^0$	10.9 ± 1.4	$10.2 \pm 1.4 \pm 0.9$ [62]	$13.2 \pm 2.3^{+1.4}_{-1.9}$ [63]	$10.9^{+1.4}_{-1.5}$			$10.9^{+1.4}_{-1.5}$
458	$\rho^+\rho^0$	24.0 ± 1.9	$23.7 \pm 1.4 \pm 1.4$ [64]	$31.7 \pm 7.1^{+3.8}_{-6.7}$ [65]				$24.0^{+1.9}_{-2.0}$
459	$f_0(980)\rho^+\dagger$	< 2.0	< 2.0 [64]					< 2.0
460	$a_1^+\pi^0$	26 ± 7	$26.4 \pm 5.4 \pm 4.1$ [66]					26.4 ± 6.8
461	$a_1^0\pi^+$	20 ± 6	$20.4 \pm 4.7 \pm 3.4$ [66]					20.4 ± 5.8
462	$\omega\pi^+$	6.9 ± 0.5	$6.7 \pm 0.5 \pm 0.4$ [16]	$6.9 \pm 0.6 \pm 0.5$ [67]	$11.3^{+3.3}_{-2.9} \pm 1.4$ [18]			6.9 ± 0.5
463	$\omega\rho^+$	15.9 ± 2.1	$15.9 \pm 1.6 \pm 1.4$ [19]					15.9 ± 2.1
464	$\eta\pi^+$	4.02 ± 0.27	$4.00 \pm 0.40 \pm 0.24$ [5]	$4.07 \pm 0.26 \pm 0.21$ [9]	$1.2^{+2.8}_{-1.2}$ [10]			4.02 ± 0.27
465	$\eta\rho^+$	7.0 ± 2.9	$9.9 \pm 1.2 \pm 0.8$ [68]					6.9 ± 1.0
466	$\eta'\pi^+$	2.7 ± 0.9	$3.5 \pm 0.6 \pm 0.2$ [5]	$4.1^{+1.4}_{-1.3} \pm 0.4$ [12]	$4.8^{+5.2}_{-3.8}$ [10]			$2.7^{+0.5}_{-0.4}$
467	$\eta'\rho^+$	9.7 ± 2.2	$9.7^{+1.9}_{-1.8} \pm 1.1$ [7]	$1.8^{+0.7}_{-0.6} \pm 0.1$ [6]	$1.0^{+5.8}_{-1.0}$ [10]			$9.7^{+2.2}_{-2.1}$
468	$\phi\pi^+$	< 0.15	< 0.24 [69]	< 0.33 [70]			< 0.15 [71]	< 0.15
469	$\phi\rho^+$	< 3.0	< 3.0 [72]					< 3.0
470	$a_0(980)^0\pi^+\dagger$	< 5.8	< 5.8 [20]					< 5.8
471	$a_0(980)^+\pi^0\dagger$	< 1.4	< 1.4 [73]					< 1.4
472	$\pi^+\pi^+\pi^+\pi^-\pi^-$	< 860	< 860 † [61]					< 860 †
473	$\rho^0 a_1(1260)^+$	< 620						< 620
474	$\rho^0 a_2(1320)^+$	< 720						< 720
475	$b_1^0\pi^+\dagger$	6.7 ± 2.0	$6.7 \pm 1.7 \pm 1.0$ [39]					6.7 ± 2.0
476	$b_1^+\pi^0\dagger$	< 3.3	< 3.3 [35]					< 3.3
477	$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	< 6300	< 6300 † [61]					< 6300 †
478	$b_1^+\rho^0\dagger$	< 5.2	< 5.2 [40]					< 5.2
480	$b_1^0\rho^+\dagger$	< 3.3	< 3.3 [40]					< 3.3

Results for LHCb are relative BF's converted to absolute BF's.

CLEO upper limits that have been greatly superseded are not shown.

† In this product of BF's, all daughter BF's not shown are set to 100%.

‡ Result from ARGUS. Cited in the BABAR column to avoid adding a column to the table.

Heavy Flavor Averaging group (HFLAV) - May 2018
 B^0 Branching Fractions (decays with strange mesons part 1) ($\times 10^{-6}$) - UL at 90% CL
Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	BABAR	Belle	CDF	LHCb	Our Avg.
257	$K^+\pi^-$	19.6 ± 0.5	$19.1 \pm 0.6 \pm 0.6$ [75]	$20.0 \pm 0.34 \pm 0.60$ [2]	$18.0^{+2.3+1.2}_{-2.1-0.9}$ [3]		$19.57^{+0.53}_{-0.52}$
258	$K^0\pi^0$	9.9 ± 0.5	$10.1 \pm 0.6 \pm 0.4$ [76]	$9.68 \pm 0.46 \pm 0.50$ [2]	$12.8^{+4.0+1.7}_{-3.3-1.4}$ [3]		9.93 ± 0.49
259	$\eta' K^0$	66 ± 4	$68.5 \pm 2.2 \pm 3.1$ [5]	$58.9^{+3.6}_{-3.5} \pm 4.3$ [6]	$89^{+18}_{-16} \pm 9$ [10]		66.1 ± 3.1
260	$\eta' K^{*0}$	2.8 ± 0.6	$3.1^{+0.9}_{-0.8} \pm 0.3$ [7]	$2.6 \pm 0.7 \pm 0.2$ [77]	$7.8^{+7.7}_{-5.7}$ [10]		$2.8^{+0.6}_{-0.5}$
261	$\eta' K_0^*(1430)^0$	6.3 ± 1.6	$6.3 \pm 1.3 \pm 0.9$ [7]				6.3 ± 1.6
262	$\eta' K_2^*(1430)^0$	13.7 ± 3.2	$13.7^{+3.0}_{-1.9} \pm 1.2$ [7]				$13.7^{+3.2}_{-2.2}$
263	ηK^0	$1.23^{+0.27}_{-0.24}$	$1.15^{+0.43}_{-0.38} \pm 0.09$ [5]	$1.27^{+0.33}_{-0.29} \pm 0.08$ [9]	$0.0^{+3.0}_{-0.0}$ [10]		$1.23^{+0.27}_{-0.24}$
264	ηK^{*0}	15.9 ± 1.0	$16.5 \pm 1.1 \pm 0.8$ [11]	$15.2 \pm 1.2 \pm 1.0$ [12]	$13.8^{+5.5}_{-4.6} \pm 1.6$ [10]		15.9 ± 1.0
265	$\eta K_0^*(1430)^0$	11.0 ± 2.2	$11.0 \pm 1.6 \pm 1.5$ [11]				11.0 ± 2.2
266	$\eta K_2^*(1430)^0$	9.6 ± 2.1	$9.6 \pm 1.8 \pm 1.1$ [11]				9.6 ± 2.1
267	ωK^0	4.8 ± 0.4	$5.4 \pm 0.8 \pm 0.3$ [16]	$4.5 \pm 0.4 \pm 0.3$ [17]	$10.0^{+5.4}_{-4.2} \pm 1.4$ [18]		4.8 ± 0.4
268	$a_0(980)^0 K^0 \dagger$	< 7.8	< 7.8 [20]				< 7.8
269	$b_1^0 K^0 \dagger$	< 7.8	< 7.8 [35]				< 7.8
270	$a_0(980)^- K^+ \dagger$	< 1.9	< 1.9 [78]				< 1.9
271	$b_1^- K^+ \dagger$	7.4 ± 1.4	$7.4 \pm 1.0 \pm 1.0$ [39]				7.4 ± 1.4
272	$b_1^0 K^{*0} \dagger$	< 8.0	< 8.0 [40]				< 8.0
273	$b_1^- K^{*+} \dagger$	< 5.0	< 5.0 [40]				< 5.0
274	$a_0(1450)^- K^+ \dagger$	< 3.1	< 3.1 [78]				< 3.1
275	$K_S X^0$ (Familon) \dagger	< 53					< 53
276	ωK^{*0}	2.0 ± 0.5	$2.2 \pm 0.6 \pm 0.2$ [19]	$1.8 \pm 0.7^{+0.3}_{-0.2}$ [80]			2.0 ± 0.5
277	$\omega(K\pi)_0^{*0}$	18.4 ± 2.5	$18.4^{+1.8}_{-1.7}$ [19]				$18.4^{+1.8}_{-1.7}$
278	$\omega K_0^*(1430)^0$	16.0 ± 3.4	$16.0 \pm 1.6 \pm 3.0$ [19]				16.0 ± 3.4
279	$\omega K_2^*(1430)^0$	10.1 ± 2.3	$10.1 \pm 2.0 \pm 1.1$ [19]				10.1 ± 2.3
280	$\omega K^+\pi^-$ (NR) \dagger	5.1 ± 1.0					5.1 ± 1.0
281	$K^+\pi^-\pi^0$	37.8 ± 3.2	$38.5 \pm 1.0 \pm 3.9$ [81]	$5.1 \pm 0.7 \pm 0.7$ [80]	$36.6^{+4.2}_{-4.3} \pm 3.0$ [82]		37.8 ± 3.2
282	$\rho^- K^+$	7.0 ± 0.9	$6.6 \pm 0.5 \pm 0.8$ [81]	$15.1^{+3.4+2.4}_{-3.3-2.6}$ [82]			7.0 ± 0.9
283	$\rho(1450)^- K^+$	2.4 ± 1.2	$2.4 \pm 1.0 \pm 0.6$ [81]				2.4 ± 1.2
284	$\rho(1700)^- K^+$	0.6 ± 0.7	$0.6 \pm 0.6 \pm 0.4$ [81]				0.6 ± 0.7
285	$K^+\pi^-\pi^0$ (NR)	2.8 ± 0.6	$2.8 \pm 0.5 \pm 0.4$ [81]	< 9.4 [82]			2.8 ± 0.6
286	$(K\pi)_0^{*+}\pi^-$	34 ± 5	$34.2 \pm 2.4 \pm 4.1$ [81]				34.2 ± 4.8
287	$(K\pi)_0^{*+}\pi^0$	8.6 ± 1.7	$8.6^{+1.1}_{-1.3}$ [81]				$8.6^{+1.1}_{-1.3}$

Results for LHCb are relative BFs converted to absolute BFs.

CLEO upper limits that have been greatly superseded are not shown.

\dagger In this product of BFs, all daughter BFs not shown are set to 100%.

\dagger $0.755 < M(K\pi) < 1.250$ GeV/ c^2 .

Heavy Flavor Averaging group (HF/LAV) - May 2018

B^0 Branching Fractions (decays with strange mesons part 2) ($\times 10^{-6}$) - UL at 90% CL

Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RFP#	Mode	PDG2017 Avg.	BaBar	Belle	CLEO	CDF	LHCb	Our Avg.
288	$K_2^*(1430)^0 \pi^0$	< 4.0	< 4.0	[83]				< 4.0
289	$K^*(1680)^0 \pi^0$	< 7.5	< 7.5	[83]				< 7.5
290	$K_x^{*0} \pi^0$	6.1 ± 1.6						$6.1^{+1.7}_{-1.6}$
291	$K^0 \pi^+ \pi^-$	52.0 ± 2.4						
292	$K^0 \pi^+ \pi^- (NR)$	$14.7^{+4.0}_{-2.6}$	$50.2 \pm 1.5 \pm 1.8$	[84]	$6.1^{+1.6+0.5}_{-1.5-0.6}$			
293	$\rho^0 K^0$	4.7 ± 0.6	$11.1^{+2.5 \pm 0.9}$	[84]	$47.5 \pm 2.4 \pm 3.7$	[85]	$48.8^{+3.2}_{-2.8}$	49.4 ± 1.7
294	$K^{*+} \pi^-$	8.4 ± 0.8	$4.4 \pm 0.7 \pm 0.3$	[84]	$19.9 \pm 2.5^{+1.7}_{-2.0}$	[85]		14.7 ± 2.0
295	$K_0^*(1430)^+ \pi^-$	33 ± 7	8.2 ± 0.9	[81,84]	$6.1 \pm 1.0^{+1.5}_{-1.2}$	[85]		4.7 ± 0.7
296	$K_x^{*+} \pi^-$	5.1 ± 1.6	$29.9^{+2.3}_{-1.7} \pm 3.6$	[84]	$8.4 \pm 1.1^{+1.0}_{-0.9}$	[85]		8.4 ± 0.8
297	$K^*(1410)^+ \pi^- \dagger$	< 3.8			$49.7 \pm 3.8^{+6.8}_{-8.2}$	[85]		$33.5^{+3.9}_{-3.8}$
298	$f_0(980)K^0 \dagger$	7.0 ± 0.9	$6.9 \pm 0.8 \pm 0.6$	[84]	$5.1^{+1.5+0.6}_{-1.5-0.7}$	[82]		$5.1^{+1.6}_{-1.7}$
299	$f_2(1270)^0 K^0$	$2.7^{+1.3}_{-1.2}$	$2.7^{+1.0 \pm 0.9}$	[84]	< 2.5 \dagger	[85]		7.0 ± 0.9
300	$f_x(1300)^0 K^0$	1.8 ± 0.7	$1.81^{+0.55 \pm 0.48}$	[84]	< 3.5	[82]		$2.7^{+1.3}_{-1.2}$
301	$K^{*0} \pi^0$	3.3 ± 0.6	$3.3 \pm 0.5 \pm 0.4$	[81]	< 6.3	[85]		$1.81^{+0.73}_{-0.66}$
302	$K^*(1430)^+ \pi^-$	< 6	< 16.2	[81]	< 10.1	[85]		3.3 ± 0.6
303	$K_2^*(1680)^+ \pi^-$	< 10	< 25	[83]				< 3.8
304	$K^+ \pi^- \pi^+ \pi^-$	< 230	< 230	[83]				< 10.1
305	$\rho^0 K^+ \pi^-$	2.8 ± 0.7		[87]				< 230
306	$f_0(980)K^+ \pi^-$	$1.4^{+0.5}_{-0.6}$	$2.8 \pm 0.5 \pm 0.5$	[88]	$2.1^{+0.8+0.9}_{-0.6-0.5}$	[88]		2.8 ± 0.7
307	$K^+ \pi^- \pi^+ \pi^- (NR)$	< 2.1			$1.4 \pm 0.4^{+0.3}_{-0.4}$	[88]		$1.4^{+0.5}_{-0.6}$
308	$K^{*0} \rho^0$	55 ± 5	$54.5 \pm 2.9 \pm 4.3$	[89]				< 2.1
309	$K^0 \rho^0$	3.9 ± 1.3	$5.1 \pm 0.6^{+0.6}_{-0.8}$	[90]				54.5 ± 5.2
310	$f_0(980)K^{*0} \dagger$	$3.9^{+2.1}_{-1.8}$	$5.7 \pm 0.6 \pm 0.4$	[90]				3.9 ± 0.8
311	$K_1(1270)^+ \pi^-$	< 30	17^{+6}_{-25}	[29]				3.9 ± 0.5
312	$K_1(1400)^+ \pi^-$	< 27	16^{+8}_{-24}	[29]				17^{+6}_{-25}
313	$a_1^- K^+$	16 ± 4	$16.3 \pm 2.9 \pm 2.3$	[34]				16^{+8}_{-24}
314	$K^{*+} \rho^-$	10.3 ± 2.6	$10.3 \pm 2.3 \pm 1.3$	[90]				16.3 ± 3.7
315	$K_0(1430)^+ \rho^-$	28 ± 12	$28 \pm 10 \pm 6$	[90]				10.3 ± 2.6
316	$K_1^+(1400)^0 \rho^0$	< 3000	$28 \pm 10 \pm 6$	[38]				28 ± 11
317	$K_0^+(1430)^0 \rho^0$	27 ± 6	$27 \pm 4 \pm 4$	[90]				28 ± 11
318	$K^*(1430)^0 f_0(980)$	2.7 ± 0.9	$2.7 \pm 0.7 \pm 0.6$	[90]				27 ± 5
319	$K_2^*(1430)^0 f_0(980)$	8.6 ± 2.0	$8.6 \pm 1.7 \pm 1.0$	[90]				2.7 ± 0.9
320	$K^+ K^-$	0.078 ± 0.015	< 0.5	[75]				8.6 ± 2.0
321	$K^0 \bar{K}^0$	1.21 ± 0.16	$1.08 \pm 0.28 \pm 0.11$	[1]	$0.10 \pm 0.08 \pm 0.04$	[2]	$0.0780 \pm 0.0127 \pm 0.0084$	0.0803 ± 0.0147
322	$K^{*0} K^- \pi^+$	6.5 ± 0.8	$6.4 \pm 1.0 \pm 0.6$	[93]	$1.26 \pm 0.19 \pm 0.05$	[2]		1.21 ± 0.16
323	$K^{*+} K^{\pm}$				< 18	[26]	6.07 ± 0.84	6.18 ± 0.68
324	$K^{*0} \bar{K}^0 \dagger$						< 0.4	< 0.4
325	$K^+ K^- \pi^0$	< 0.96	< 1.9	[95]	$2.17 \pm 0.60 \pm 0.24$	[97]	< 0.96	< 0.96
326	$K_S^0 K_S^0 \pi^0$	< 0.9	< 0.9	[98]				< 0.9
327	$K_S^0 K_S^0 \eta$	< 1.0	< 1.0	[98]				< 1.0
328	$K_S^0 K_S^0 \eta'$	< 2.0	< 2.0	[98]				< 2.0
329	$K^+ K^- K^0$	24.9 ± 3.1	$26.5 \pm 0.9 \pm 0.8$	[15]	$28.3 \pm 3.3 \pm 4.0$	[26]		26.8 ± 1.0
330	ϕK^0	7.3 ± 0.7	$7.1 \pm 0.6^{+0.4}_{-0.3}$	[15]	$9.0^{+2.2}_{-1.8} \pm 0.7$	[53]	27.3 ± 1.9	$7.3^{+0.7}_{-0.6}$
331	$f_0(980)K^0 \dagger$	$7.0^{+3.5}_{-3.0}$	$7.0^{+2.6}_{-1.8} \pm 2.4$	[15]	$5.4^{+3.7}_{-2.7} \pm 0.7$	[49]		$7.0^{+3.5}_{-3.0}$

Results for CDF and LHCb are relative BFs converted to absolute BFs.

CLEO upper limits that have been greatly superseded are not shown.

\dagger In this product of BFs, all daughter BFs not shown are set to 100%.

\ddagger Includes two distinct decay processes: $\mathcal{B}(B^0 \rightarrow f) + \mathcal{B}(B^0 \rightarrow \bar{f})$.

\S Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [86]) and to the averages of the BFs in their numerators, as measured by other experiments (RPP 322 and 329).

\parallel Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [86]) and to the averages of the BFs therein, as measured by other experiments (excluding the present line).

$\#$ $0.75 < M(K\pi) < 1.20 \text{ GeV}/c^2$. $\#$ Average of BaBar results from $B^0 \rightarrow K^+ \pi^- \pi^0$ [81] and $B^0 \rightarrow K^0 \pi^+ \pi^-$ [84].

$\#$ Result from DELPHI. Cited in the BaBar column to avoid adding a column to the table.

$\#$ Result from ARGUS. Cited in the BaBar column to avoid adding a column to the table.

Heavy Flavor Averaging group (HFLAV) - May 2018
 B^0 Branching Fractions (decays with strange mesons part 3) ($\times 10^{-6}$) - UL at 90% CL
 Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RFP#	Mode	PDG2017 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
332	$f_0(1500)K^0 \dagger$	13^{+7}_{-5}	$13.3^{+5.8}_{-4.4} \pm 3.2$	[15]				$13.3^{+6.6}_{-5.4}$
333	$f_2'(1525)K^0$	$0.3^{+0.5}_{-0.4}$	$0.29^{+0.27}_{-0.18} \pm 0.36$	[15]				$0.29^{+0.45}_{-0.40}$
334	$f_0(1710)K^0 \dagger$	4.4 ± 0.9	$4.4 \pm 0.7 \pm 0.5$	[15]				4.4 ± 0.9
335	$K^0 K^+ K^- (NR)$	33 ± 10	$33 \pm 5 \pm 9$	[15]				33 ± 10
336	$K_S K_S K_S$	6.0 ± 0.5	$6.19 \pm 0.48 \pm 0.19$	[99]				6.04 ± 0.50
337	$f_0(980)K_S \dagger$	2.7 ± 1.8	$2.7^{+1.3}_{-1.2} \pm 1.3 \dagger$	[99]				2.7 ± 1.8
338	$f_0(1710)K_S \dagger$	$0.50^{+0.50}_{-0.26}$	$0.50^{+0.46}_{-0.24} \pm 0.11 \dagger$	[99]				$0.50^{+0.47}_{-0.26}$
339	$f_0(2010)K_S \dagger$	0.5 ± 0.6	$0.54^{+0.21}_{-0.20} \pm 0.52 \dagger$	[99]				0.54 ± 0.56
340	$K_S K_S K_S (NR)$	13.3 ± 3.1	$13.3^{+2.2}_{-2.3} \pm 2.2$	[99]				$13.3^{+3.1}_{-3.2}$
341	$K_S K_S K_L$	< 16	$< 16^2$	[100]				$< 16^2$
342	$K^*0 K^+ K^-$	27.5 ± 2.6	$27.5 \pm 1.3 \pm 2.2$	[89]				27.5 ± 2.6
343	ϕK^*0	10.0 ± 0.5	$9.7 \pm 0.5 \pm 0.6$	[101]				$10.1^{+0.6}_{-0.5}$
344	$K^+ \pi^- \pi^+ K^- (NR)$	< 71.7	< 2.2	[89]				$< 71.7^3$
345	$K^*0 \pi^+ K^-$	4.5 ± 1.3	$4.6 \pm 1.1 \pm 0.8$	[89]				4.6 ± 1.4
346	$K^*0 \bar{K}^*0$	0.8 ± 0.5	$1.28^{+0.35}_{-0.30} \pm 0.11$	[104]				0.81 ± 0.23
347	$K^+ \pi^- K^+ \pi^- (NR)$	< 6.0	< 6.0	[103]				$< 6.0^3$
348	$K^*0 K^+ \pi^-$	< 2.2	< 2.2	[89]				< 2.2
349	$K^*0 K^*0$	< 0.2	< 0.41	[104]				< 0.2
350	$K^*+ K^*-$	< 2.0	< 2.0	[105]				< 2.0
351	$K_1^*(1400)^0 \phi$	< 5000	$< 5000 \dagger$	[38]				$< 5000 \dagger$
352	$(K\pi)_0^0 \phi$	4.3 ± 0.4	$4.3 \pm 0.4 \pm 0.4$	[101]				4.3 ± 0.4
353	$(K\pi)_0^0 \phi$	< 1.7	$< 1.7^4$	[106]				$< 1.7^4$
354	$K^*(1430)^0 \pi^+ K^-$	< 31.8	$< 31.8^3$	[103]				$< 31.8^3$
355	$K^*(1430)^0 \bar{K}^*0$	< 3.3	< 3.3	[103]				< 3.3
356	$K^*(1430)^0 \bar{K}^*(1430)^0$	< 8.4	< 8.4	[103]				< 8.4
357	$\phi K^*(1430)^0$	3.9 ± 0.8	$3.9 \pm 0.5 \pm 0.6$	[101]				4.2 ± 0.5
358	$K^*(1430)^0 K^*0$	< 1.7	< 1.7	[103]				< 1.7
359	$K^*(1430)^0 K^*(1430)^0$	< 4.7	< 4.7	[103]				< 4.7
360	$\phi K^*(1680)^0$	< 3.5	< 3.5	[106]				< 3.5
361	$\phi K^*(1780)^0$	< 2.7	< 2.7	[106]				< 2.7
362	$\phi K^*(2045)^0$	< 15.3	< 15.3	[106]				< 15.3
363	$\rho^0 K_2^*(1430)^0$	< 1100	$< 1100 \dagger$	[38]				$< 1100 \dagger$
364	$\phi K_2^*(1430)^0$	6.8 ± 0.9	$7.5 \pm 0.9 \pm 0.5$	[101]				6.8 ± 0.8
365	$\phi \phi K^0 \S$	4.5 ± 0.9	$4.5 \pm 0.8 \pm 0.3$	[56]				4.5 ± 0.9
366	$\eta' \eta' K^0$	< 31	< 31	[57]				< 31

\dagger In this product of BFs, all daughter BFs not shown are set to 100%. \dagger Result from ARGUS. Cited in the BABAR column to avoid adding a column to the table.

\S $M_{\phi\phi} < 2.85 \text{ GeV}/c^2$.

2 $0.75 < M(K\pi) < 1.20 \text{ GeV}/c^2$. 3 $0.70 < M(K\pi) < 1.70 \text{ GeV}/c^2$.

4 $1.60 < M(K\pi) < 2.15 \text{ GeV}/c^2$.

Heavy Flavor Averaging group (HFLAV) - May 2018

B⁰ Branching Fractions (decays without strange mesons part 1) ($\times 10^{-6}$) - UL at 90% CL

Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RFP#	Mode	PDG2017 Avg.	BaBar	Belle	CLEO	CDF	LHCb	Our Avg.
387	$\pi^+\pi^-$	5.12 ± 0.19	$5.5 \pm 0.4 \pm 0.3$ [75]	$5.04 \pm 0.21 \pm 0.18$ [2]	$4.5^{+1.4+0.5}_{-1.2-0.4}$ [3]	$5.02 \pm 0.33 \pm 0.35$ †[107]	$5.08 \pm 0.17 \pm 0.37$ [108]	5.10 ± 0.19
388	$\pi^0\pi^0$	1.91 ± 0.22	$1.83 \pm 0.21 \pm 0.13$ [76]	$1.31 \pm 0.19 \pm 0.18$ [109]	$1.31 \pm 0.19 \pm 0.18$ [109]			1.59 ± 0.18
389	$\eta\pi^0$	0.41 ± 0.17	< 1.5 [68]	$0.41^{+0.17+0.05}_{-0.15-0.07}$ [110]	< 2.9 [10]			$0.41^{+0.18}_{-0.17}$
390	$\eta\eta$	< 1.0	< 1.0 [5]	$0.76^{+0.27+0.14}_{-0.23-0.16}$ [111]				$0.76^{+0.30}_{-0.28}$
391	$\eta'\pi^0$	1.2 ± 0.6	$0.9 \pm 0.4 \pm 0.1$ [68]	$2.8 \pm 1.0 \pm 0.3$ [6]	$0.0^{+1.8}_{-0.0}$ [10]			1.2 ± 0.4
392	$\eta'\eta'$	< 1.7	< 1.7 [5]	< 6.5 [8]				< 1.7
393	$\eta'\eta$	< 1.2	< 1.2 [68]	< 4.5 [8]				< 1.2
394	$\eta'\rho^0$	< 1.3	< 2.8 [7]	< 1.3 [8]				< 1.3
395	$f_0(980)\eta'$ †	< 0.9	< 0.9 [7]					< 0.9
396	$\eta\rho^0$	< 1.5	< 1.5 [78]	< 1.9 [12]				< 1.5
397	$f_0(980)\eta$ †	< 0.4	< 0.4 [78]					< 0.4
398	$\omega\eta$	$0.94^{+0.40}_{-0.31}$	$0.94^{+0.35 \pm 0.09}$ [5]					$0.94^{+0.36}_{-0.31}$
399	$\omega\eta'$	$1.0^{+0.5}_{-0.4}$	$1.01^{+0.46 \pm 0.09}$ [5]	< 2.2 [8]				$1.01^{+0.47}_{-0.39}$
400	$\omega\rho^0$	< 1.6	< 1.6 [19]					< 1.6
401	$f_0(980)\omega$ †	< 1.5	< 1.5 [19]					< 1.5
402	$\omega\omega$	1.2 ± 0.4	$1.2 \pm 0.3^{+0.3}_{-0.2}$ [112]					1.2 ± 0.4
403	$\phi\pi^0$	< 0.15	< 0.28 [69]	< 0.15 [70]				< 0.15
404	$\phi\eta$	< 0.5	< 0.5 [5]					< 0.5
405	$\phi\eta'$	< 0.5	< 1.1 [5]	< 0.5 [8]				< 0.5
406	$\phi\pi^+\pi^-$	0.18 ± 0.05					0.182 ± 0.014 §[113]	0.182 ± 0.050
407	$\phi\rho^0$	< 0.33	< 0.33 [72]					< 0.33
408	$f_0(980)\phi$ †	< 0.38	< 0.38 [72]					< 0.38
409	$\omega\phi$	< 0.7	< 0.7 [112]					< 0.7
410	$\phi\phi$	< 0.028	< 0.2 [72]				< 0.028 [114]	< 0.028
411	$a_0^\mp(980)\pi^\pm$ †	< 3.1	< 3.1 [78]					< 3.1
412	$a_0^\mp(1450)\pi^\pm$ †	< 2.3	< 2.3 [78]					< 2.3
413	$\pi^+\pi^-\pi^0$	< 720	< 720 ¶ [61]					< 720 ¶
414	$\rho^0\pi^0$	2.0 ± 0.5	$1.4 \pm 0.6 \pm 0.3$ [115]	$3.0 \pm 0.5 \pm 0.7$ [116]	$1.6^{+2.0}_{-1.8}$ ± 0.8 [18]			2.0 ± 0.5
415	$\rho^\mp\pi^\pm$	23.0 ± 2.3	$22.6 \pm 1.8 \pm 2.2$ [117]	$22.6 \pm 1.1 \pm 4.4$ [116]	$27.6^{+8.4}_{-7.4} \pm 4.2$ [18]			23.0 ± 2.3
416	$\pi^+\pi^-\pi^+\pi^-$	< 11.2	< 23.1 [118]	< 11.2 [119]				< 11.2
417	$\rho^0\pi^+\pi^-(NR)$	< 8.8	< 8.8 [118]	< 12 [119]				< 8.8
418	$\rho^0\rho^0$	0.96 ± 0.15	$0.92 \pm 0.32 \pm 0.14$ [118]	$1.02 \pm 0.30 \pm 0.15$ [119]				0.95 ± 0.16
419	$f_0(980)\pi^+\pi^-(NR)$ †	< 3.0	< 3.0 [119]	< 3.0 [119]				< 3.0
420	$f_0(980)\rho^0$ †	0.78 ± 0.25	< 0.40 [118]	$0.78 \pm 0.22 \pm 0.11$ [119]				0.78 ± 0.25
421	$f_0(980)f_0(980), 4\pi$ † \diamond	< 0.19	< 0.19 [118]					< 0.19
422	$f_0(980)f_0(980), 2\pi 2K$ † \dagger	< 0.23	< 0.23 [72]	< 0.2 [119]			$0.94 \pm 0.17 \pm 0.11$ † [120]	< 0.23
423	$a_{1,2}\pi^\pm$	26 ± 5	$33.2 \pm 3.8 \pm 3.0$ [121]	$22.2 \pm 2.0 \pm 2.8$ [122]				25.9 ± 2.8
424	$a_{1,2}\rho^\pm$	< 6.3	< 6.3 [122]					< 6.3
425	$\pi^+\pi^-\pi^0\pi^0$	< 3100	< 3100 ¶ [61]					< 3100 ¶
426	$\rho^+\rho^-$	27.7 ± 1.9	$25.5 \pm 2.1^{+3.6}_{-3.9}$ [123]	$28.3 \pm 1.5 \pm 1.5$ [124]				27.7 ± 1.9
427	$a_1(1260)^0\pi^0$	< 1100	< 1100 ¶ [61]					< 1100 ¶
428	$\omega\pi^0$	< 0.5	< 0.5 [68]					< 0.5
429	$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 9000	< 9000 ¶ [61]	< 2.0 [67]				< 9000 ¶
430	$a_{1,2}\rho^\mp$	< 61	< 61 [125]					< 61
431	$a_{1,2}\rho^0$	< 2400	< 2400 ¶ [61]					< 2400 ¶

Results for CDF and LHCb are relative BF's converted to absolute BF's.

CLEO upper limits that have been greatly superseded are not shown.

† In this product of BF's, all daughter BF's not shown are set to 100%.

‡ Result given as $0.94 \pm 0.17 \pm 0.09 \pm 0.06$ where last error is from $\mathcal{B}(B^0 \rightarrow \phi K^{*0})$.

§ In the mass range $400 < m(\pi^+\pi^-) < 1600$ GeV/c².

¶ Result from ARGUS. Cited in the BaBar column to avoid adding a column to the table.

◇ Both $f_0(980)$ decay into $\pi^+\pi^-$.

† Using the final state $\pi^+\pi^-\pi^+\pi^-K^+K^-$.

Heavy FLavor Averaging group (HF_{LAV}) - May 2018
 B^0 Branching Fractions (decays without strange mesons part 2) ($\times 10^{-6}$) - UL at 90% CL
Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	B _{ABAR}	Belle	CLEO	CDF	LHCb	Our Avg.
432	$b_1^+ \pi^+ \pi^- \pi^+$	10.9 ± 1.5	$10.9 \pm 1.2 \pm 0.9$ [39]					10.9 ± 1.5
433	$b_1^0 \pi^0 \pi^+$	< 1.9	< 1.9 [35]					< 1.9
434	$b_1^+ \rho^+ \pi^-$	< 1.4	< 1.4 [40]					< 1.4
435	$b_1^0 \rho^0 \pi^+$	< 3.4	< 3.4 [40]					< 3.4
436	$\pi^+ \pi^+ \pi^- \pi^- \pi^- \pi^-$	< 3000	< 3000 ‡ [61]					< 3000 ‡
437	$a_1^+ a_1^-$	11.8 ± 2.6	11.8 ± 2.6 [126]					11.8 ± 2.6
438	$\pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- \pi^0$	< 11000	< 11000 ‡ [61]					< 11000 ‡

Results for CDF and LHCb are relative BF's converted to absolute BF's.

CLEO upper limits that have been greatly superseded are not shown.

† In this product of BF's, all daughter BF's not shown are set to 100%.

‡ Result from ARGUS. Cited in the B_{ABAR} column to avoid adding a column to the table.

Heavy Flavor Averaging group (HFLAV) - May 2018

Compilation of B^0 relative Branching Fractions - UL at 90% CL

Preliminary Updated results not included in PDG Live as of Dec. 31, 2017

RPP#	Mode	PDG2017 Avg.	CDF	LHCb	Our Avg.
320	$\mathcal{B}(B^0 \rightarrow K^+ K^-) / \mathcal{B}(B^0 \rightarrow K^+ \pi^-)$		$0.012 \pm 0.005 \pm 0.005$ [91]	$0.00398 \pm 0.00065 \pm 0.00042$ [92]	0.00416 ± 0.00099
323	$\mathcal{B}(B^0 \rightarrow K^{*+} K^\pm) / \mathcal{B}(B^0 \rightarrow K^{*+} \pi^-)$			< 0.05 [94]	< 0.05
324	$\mathcal{B}(B^0 \rightarrow K_S^0 K^{*0}) / \mathcal{B}(B^0 \rightarrow K_S^0 \pi^+ \pi^-)$ †			< 0.020 [96]	< 0.020
387	$\mathcal{B}(B^0 \rightarrow \pi^+ \pi^-) / \mathcal{B}(B^0 \rightarrow K^+ \pi^-)$	0.261 ± 0.015	$0.259 \pm 0.017 \pm 0.016$ [107]	$0.262 \pm 0.009 \pm 0.017$ [108]	0.261 ± 0.015

† Numerator includes two distinct decay processes: $\mathcal{B}(B^0 \rightarrow f) + \mathcal{B}(B^0 \rightarrow \bar{f})$.

References

- [1] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 171805, (2006), [arXiv:hep-ex/0608036](#) [hep-ex].
- [2] Y. T. Duh *et al.*, (Belle collaboration), Phys. Rev. **D87**, 031103, (2013), [arXiv:1210.1348](#) [hep-ex].
- [3] A. Bornheim *et al.*, (CLEO collaboration), Phys. Rev. **D68**, 052002, (2003), [arXiv:hep-ex/0302026](#) [hep-ex], Erratum *ibid.* **D75**, 119907, (2007).
- [4] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 091102, (2007), [arXiv:0707.2798](#) [hep-ex].
- [5] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 112002, (2009), [arXiv:0907.1743](#) [hep-ex].
- [6] J. Schumann *et al.*, (Belle collaboration), Phys. Rev. Lett. **97**, 061802, (2006), [arXiv:hep-ex/0603001](#) [hep-ex].
- [7] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 011502, (2010), [arXiv:1004.0240](#) [hep-ex].
- [8] J. Schumann *et al.*, (Belle collaboration), Phys. Rev. **D75**, 092002, (2007), [arXiv:hep-ex/0701046](#) [hep-ex].
- [9] C. T. Hoi *et al.*, (Belle collaboration), Phys. Rev. Lett. **108**, 031801, (2012), [arXiv:1110.2000](#) [hep-ex].
- [10] S. J. Richichi *et al.*, (CLEO collaboration), Phys. Rev. Lett. **85**, 520, (2000), [arXiv:hep-ex/9912059](#) [hep-ex].
- [11] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 201802, (2006), [arXiv:hep-ex/0608005](#) [hep-ex].
- [12] C. H. Wang *et al.*, (Belle collaboration), Phys. Rev. **D75**, 092005, (2007), [arXiv:hep-ex/0701057](#) [hep-ex].
- [13] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 091801, (2008), [arXiv:0804.0411](#) [hep-ex].
- [14] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 012004, (2008), [arXiv:0803.4451](#) [hep-ex].
- [15] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 112010, (2012), [arXiv:1201.5897](#) [hep-ex].
- [16] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 031103, (2007), [arXiv:0706.3893](#) [hep-ex].
- [17] V. Chobanova *et al.*, (Belle collaboration), Phys. Rev. **D90**, 012002, (2014), [arXiv:1311.6666](#) [hep-ex].
- [18] C. P. Jessop *et al.*, (CLEO collaboration), Phys. Rev. Lett. **85**, 2881, (2000), [arXiv:hep-ex/0006008](#) [hep-ex].

- [19] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 052005, (2009), [arXiv:0901.3703](#) [hep-ex].
- [20] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D70**, 111102, (2004), [arXiv:hep-ex/0407013](#) [hep-ex].
- [21] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. Lett. **96**, 251803, (2006), [arXiv:hep-ex/0512066](#) [hep-ex].
- [22] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D84**, 092007, (2011), [arXiv:1109.0143](#) [hep-ex].
- [23] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D72**, 072003, (2005), [arXiv:hep-ex/0507004](#) [hep-ex], Erratum *ibid.* **D74**, 099903, (2006).
- [24] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D71**, 092003, (2005), [arXiv:hep-ex/0412066](#) [hep-ex].
- [25] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 091102, (2008), [arXiv:0808.0900](#) [hep-ex].
- [26] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D69**, 012001, (2004), [arXiv:hep-ex/0307082](#) [hep-ex].
- [27] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B765**, 307, (2017), [arXiv:1608.01478](#) [hep-ex].
- [28] T. Bergfeld *et al.*, (CLEO collaboration), Phys. Rev. Lett. **77**, 4503, (1996).
- [29] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D81**, 052009, (2010), [arXiv:0909.2171](#) [hep-ex].
- [30] E. Eckhart *et al.*, (CLEO collaboration), Phys. Rev. Lett. **89**, 251801, (2002), [arXiv:hep-ex/0206024](#) [hep-ex].
- [31] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 011103, (2007), [arXiv:hep-ex/0702043](#) [hep-ex].
- [32] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 051104, (2006), [arXiv:hep-ex/0607113](#) [hep-ex].
- [33] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D83**, 051101, (2011), [arXiv:1012.4044](#) [hep-ex].
- [34] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **100**, 051803, (2008), [arXiv:0709.4165](#) [hep-ex].
- [35] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 011104, (2008), [arXiv:0805.1217](#) [hep-ex].
- [36] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 201801, (2006), [arXiv:hep-ex/0607057](#) [hep-ex].
- [37] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **95**, 141801, (2005), [arXiv:hep-ex/0408102](#) [hep-ex].

- [38] H. Albrecht *et al.*, (ARGUS collaboration), Phys. Lett. **B254**, 288, (1991).
- [39] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 241803, (2007), arXiv:0707.4561 [hep-ex].
- [40] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 051101, (2009), arXiv:0907.3485 [hep-ex].
- [41] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B726**, 646, (2013), arXiv:1308.1277 [hep-ex].
- [42] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051101, (2009), arXiv:0811.1979 [hep-ex].
- [43] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 221801, (2007), arXiv:0708.0376 [hep-ex].
- [44] C. L. Hsu *et al.*, (Belle collaboration), Phys. Rev. **D96**, no. 3, 031101, (2017), arXiv:1705.02640 [hep-ex].
- [45] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071103, (2007), arXiv:0706.1059 [hep-ex].
- [46] H. C. Huang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 241802, (2003), arXiv:hep-ex/0305068 [hep-ex].
- [47] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051102, (2009), arXiv:0901.1223 [hep-ex].
- [48] Y. M. Goh *et al.*, (Belle collaboration), Phys. Rev. **D91**, 071101, (2015), arXiv:1502.00381 [hep-ex].
- [49] R. A. Briere *et al.*, (CLEO collaboration), Phys. Rev. Lett. **86**, 3718, (2001), arXiv:hep-ex/0101032 [hep-ex].
- [50] D. Acosta *et al.*, (CDF collaboration), Phys. Rev. Lett. **95**, 031801, (2005), arXiv:hep-ex/0502044 [hep-ex].
- [51] A. Abulencia *et al.*, (CDF collaboration), Phys. Rev. **D73**, 032003, (2006), arXiv:hep-ex/0510048 [hep-ex].
- [52] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 201802, (2007), arXiv:0705.1798 [hep-ex].
- [53] K. F. Chen *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 201801, (2003), arXiv:hep-ex/0307014 [hep-ex].
- [54] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 161801, (2008), arXiv:0806.4419 [hep-ex].
- [55] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 091101, (2010), arXiv:1007.2732 [hep-ex].
- [56] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D84**, 012001, (2011), arXiv:1105.5159 [hep-ex].

- [57] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 031105, (2006), arXiv:hep-ex/0605008 [hep-ex].
- [58] C. Liu *et al.*, (Belle collaboration), Phys. Rev. **D79**, 071102, (2009), arXiv:0902.4757 [hep-ex].
- [59] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 072006, (2009), arXiv:0902.2051 [hep-ex].
- [60] A. Gordon *et al.*, (Belle collaboration), Phys. Lett. **B542**, 183, (2002), arXiv:hep-ex/0207007 [hep-ex].
- [61] H. Albrecht *et al.*, (ARGUS collaboration), Phys. Lett. **B241**, 278, (1990).
- [62] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 091103, (2007), arXiv:hep-ex/0701035 [hep-ex].
- [63] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **94**, 031801, (2005), arXiv:hep-ex/0406006 [hep-ex].
- [64] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **102**, 141802, (2009), arXiv:0901.3522 [hep-ex].
- [65] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 221801, (2003), arXiv:hep-ex/0306007 [hep-ex].
- [66] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 261801, (2007), arXiv:0708.0050 [hep-ex].
- [67] C. M. Jen *et al.*, (Belle collaboration), Phys. Rev. **D74**, 111101, (2006), arXiv:hep-ex/0609022 [hep-ex].
- [68] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 011107, (2008), arXiv:0804.2422 [hep-ex].
- [69] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 011102, (2006), arXiv:hep-ex/0605037 [hep-ex].
- [70] J. H. Kim *et al.*, (Belle collaboration), Phys. Rev. **D86**, 031101, (2012), arXiv:1206.4760 [hep-ex].
- [71] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B728**, 85, (2014), arXiv:1309.3742 [hep-ex].
- [72] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 201801, (2008), arXiv:0807.3935 [hep-ex].
- [73] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D77**, 011101, (2008), arXiv:0708.0963 [hep-ex].
- [74] D. Bortoletto *et al.*, (CLEO collaboration), Phys. Rev. Lett. **62**, 2436, (1989).
- [75] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 012008, (2007), arXiv:hep-ex/0608003 [hep-ex].

- [76] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D87**, 052009, (2013), [arXiv:1206.3525 \[hep-ex\]](#).
- [77] S. Sato *et al.*, (*Belle* collaboration), Phys. Rev. **D90**, 072009, (2014), [arXiv:1408.6343 \[hep-ex\]](#).
- [78] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 111102, (2007), [arXiv:hep-ex/0703038 \[hep-ex\]](#).
- [79] R. Ammar *et al.*, (*CLEO* collaboration), Phys. Rev. Lett. **87**, 271801, (2001), [arXiv:hep-ex/0106038 \[hep-ex\]](#).
- [80] P. Goldenzweig *et al.*, (*Belle* collaboration), Phys. Rev. Lett. **101**, 231801, (2008), [arXiv:0807.4271 \[hep-ex\]](#).
- [81] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D83**, 112010, (2011), [arXiv:1105.0125 \[hep-ex\]](#).
- [82] P. Chang *et al.*, (*Belle* collaboration), Phys. Lett. **B599**, 148, (2004), [arXiv:hep-ex/0406075 \[hep-ex\]](#).
- [83] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 052005, (2008), [arXiv:0711.4417 \[hep-ex\]](#).
- [84] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 112001, (2009), [arXiv:0905.3615 \[hep-ex\]](#).
- [85] A. Garmash *et al.*, (*Belle* collaboration), Phys. Rev. **D75**, 012006, (2007), [arXiv:hep-ex/0610081 \[hep-ex\]](#).
- [86] R. Aaij *et al.*, (*LHCb* collaboration), JHEP **11**, 027, (2017), [arXiv:1707.01665 \[hep-ex\]](#).
- [87] W. Adam *et al.*, (*DELPHI* collaboration), Z. Phys. **C72**, 207–220, (1996).
- [88] S. H. Kyeong *et al.*, (*Belle* collaboration), Phys. Rev. **D80**, 051103, (2009), [arXiv:0905.0763 \[hep-ex\]](#).
- [89] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071104, (2007), [arXiv:0708.2543 \[hep-ex\]](#).
- [90] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 072005, (2012), [arXiv:1112.3896 \[hep-ex\]](#).
- [91] T. Aaltonen *et al.*, (*CDF* collaboration), Phys. Rev. Lett. **108**, 211803, (2012), [arXiv:1111.0485 \[hep-ex\]](#).
- [92] R. Aaij *et al.*, (*LHCb* collaboration), Phys. Rev. Lett. **118**, 081801, (2017), [arXiv:1610.08288 \[hep-ex\]](#).
- [93] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 031101, (2010), [arXiv:1003.0640 \[hep-ex\]](#).
- [94] R. Aaij *et al.*, (*LHCb* collaboration), New J. Phys. **16**, 123001, (2014), [arXiv:1407.7704 \[hep-ex\]](#).

- [95] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 072008, (2006), arXiv:hep-ex/0606050 [hep-ex].
- [96] R. Aaij *et al.*, (LHCb collaboration), JHEP **01**, 012, (2016), arXiv:1506.08634 [hep-ex].
- [97] V. Gaur *et al.*, (Belle collaboration), Phys. Rev. **D87**, 091101, (2013), arXiv:1304.5312 [hep-ex].
- [98] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 011101, (2009), arXiv:0905.0868 [hep-ex].
- [99] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 054023, (2012), arXiv:1111.3636 [hep-ex].
- [100] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 032005, (2006), arXiv:hep-ex/0606031 [hep-ex].
- [101] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 092008, (2008), arXiv:0808.3586 [hep-ex].
- [102] M. Prim *et al.*, (Belle collaboration), Phys. Rev. **D88**, 072004, (2013), arXiv:1308.1830 [hep-ex].
- [103] C. C. Chiang *et al.*, (Belle collaboration), Phys. Rev. **D81**, 071101, (2010), arXiv:1001.4595 [hep-ex].
- [104] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **100**, 081801, (2008), arXiv:0708.2248 [hep-ex].
- [105] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 051103, (2008), arXiv:0806.4467 [hep-ex].
- [106] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 051103, (2007), arXiv:0705.0398 [hep-ex].
- [107] T. Aaltonen *et al.*, (CDF collaboration), Phys. Rev. Lett. **106**, 181802, (2011), arXiv:1103.5762 [hep-ex].
- [108] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 037, (2012), arXiv:1206.2794 [hep-ex].
- [109] T. Julius *et al.*, (Belle collaboration), arXiv:1705.02083 [hep-ex], (2017).
- [110] B. Pal *et al.*, (Belle collaboration), Phys. Rev. **D92**, 011101, (2015), arXiv:1504.00957 [hep-ex].
- [111] A. Abdesselam *et al.*, (Belle collaboration), arXiv:1609.03267 [hep-ex], (2016).
- [112] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D89**, 051101, (2014), arXiv:1312.0056 [hep-ex].
- [113] R. Aaij *et al.*, (LHCb collaboration), Phys. Rev. **D95**, 012006, (2017), arXiv:1610.05187 [hep-ex].
- [114] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 053, (2015), arXiv:1508.00788 [hep-ex].
- [115] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **93**, 051802, (2004), arXiv:hep-ex/0311049 [hep-ex].

- [116] A. Kusaka *et al.*, (Belle collaboration), Phys. Rev. **D77**, 072001, (2008), [arXiv:0710.4974](#) [hep-ex].
- [117] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. Lett. **91**, 201802, (2003), [arXiv:hep-ex/0306030](#) [hep-ex].
- [118] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. **D78**, 071104, (2008), [arXiv:0807.4977](#) [hep-ex].
- [119] I. Adachi *et al.*, (Belle collaboration), Phys. Rev. **D89**, 072008, (2014), [arXiv:1212.4015](#) [hep-ex], Addendum *ibid.* **D89**, 119903, (2014).
- [120] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B747**, 468, (2015), [arXiv:1503.07770](#) [hep-ex].
- [121] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. Lett. **97**, 051802, (2006), [arXiv:hep-ex/0603050](#) [hep-ex].
- [122] J. Dalseno *et al.*, (Belle collaboration), Phys. Rev. **D86**, 092012, (2012), [arXiv:1205.5957](#) [hep-ex].
- [123] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. **D76**, 052007, (2007), [arXiv:0705.2157](#) [hep-ex].
- [124] P. Vanhoefer *et al.*, (Belle collaboration), Phys. Rev. **D93**, no. 3, 032010, (2016), [arXiv:1510.01245](#) [hep-ex], [Addendum: Phys. Rev.D94,no.9,099903(2016)].
- [125] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. **D74**, 031104, (2006), [arXiv:hep-ex/0605024](#) [hep-ex].
- [126] B. Aubert *et al.*, (BABAR collaboration), Phys. Rev. **D80**, 092007, (2009), [arXiv:0907.1776](#) [hep-ex].