Heavy FLavor AVeraging group (HFLAV) - April 2019

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]	$23.97 \pm 0.53 \pm 0.71$	[2]	$18.8^{+3.7+2.1}_{-3.3-1.8}$	[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]	$12.9^{+2.4+1.2}_{-2.2-1.1}$	[3]			$12.94^{+0.52}_{-0.51}$
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	$\eta' K^{*+}$	$4.8^{+1.8}_{-1.6}$	$4.8^{+1.6}_{-1.4} \pm 0.8$	[7]	< 2.9	[8]					$4.8^{+1.8}_{-1.6}$
331	$\eta' K_0^*(1430)^+$	5.2 ± 2.1	$5.2 \pm 1.9 \pm 1.0$	[7]							5.2 ± 2.1
332	$\eta' K_2^*(1430)^+$	28 ± 5	$28.0^{+4.6}_{-4.3} \pm 2.6$	[7]							$28.0^{+5.3}_{-5.0}$
333	ηK^+	2.4 ± 0.4	$2.94^{+0.39}_{-0.34} \pm 0.21$	[5]	$2.12 \pm 0.23 \pm 0.11$	[9]	$2.2^{+2.8}_{-2.2}$	[10]			$2.36^{+0.22}_{-0.21}$
334	ηK^{*+}	19.3 ± 1.6	$18.9 \pm 1.8 \pm 1.3$	[11]	$19.3^{+2.0}_{-1.9} \pm 1.5$	[12]	$26.4^{+9.6}_{-8.2} \pm 3.3$	[10]			19.3 ± 1.6
335	$\eta K_0^*(1430)^+$	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	$\eta(1295) K^+$ †	$2.9^{+0.8}_{-0.7}$	$2.9^{+0.8}_{-0.7} \pm 0.2$ ‡	[13]							$2.9^{+0.8}_{-0.7}$
339	$\eta(1405) K^+$ †	< 1.2	< 1.2	[13]							< 1.2
340	$\eta(1475) K^+$ †	$13.8^{+2.1}_{-1.8}$	$13.8^{+1.8+1.0}_{-1.7-0.6}$	[13]							$13.8^{+2.1}_{-1.8}$
341	$f_1(1285) K^+$	< 2.0	< 2.0	[13]							< 2.0
342	$f_1(1420) K^+$ †	< 2.9	< 2.9	[13]							< 2.9
344	$\phi(1680) K^+$ †	< 3.4	< 3.4	[13]							< 3.4
345	$f_0(1500) K^+$	3.7 ± 2.2	3.7 ± 2.2 §	[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]	$3.2^{+2.4}_{-1.9} \pm 0.8$	[18]			6.5 ± 0.4
347	ωK^{*+}	< 7.4	< 7.4	[19]							< 7.4
348	$\omega (K\pi)_0^{*+}$	28 ± 4	$27.5^{+3.0}_{-2.6}$	[19]							$27.5^{+3.0}_{-2.6}$
349	$\omega K_0^*(1430)^+$	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	$a_0(980)^+ K^0$ †	< 3.9	< 3.9	[20]							< 3.9
352	$a_0(980)^0 K^+$ †	< 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	$f_0(980) K^+$ $(K^+\pi^+\pi^-)$ †	$9.4^{+1.0}_{-1.2}$	$10.3 \pm 0.5^{+2.0}_{-1.4}$	[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	$f_0(1370)^0 K^+$ $(K^+\pi^+\pi^-)$ †	< 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.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ The value quoted is $\mathcal{B}(B^+ \to \eta(1295)K^+) \times \mathcal{B}(\eta(1295) \to \eta\pi\pi)$.
§ 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) - April 2019

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}_{-7}	$32.0 \pm 1.2^{+10.8}_{-6.0}$	[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			< 45	[24]					< 45
367	$K^*(1680)^0\pi^+$ $(K^+\pi^+\pi^-)$	< 12	< 15	[23]	< 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]			< 0.046	[27]	< 0.046
371	$K^-\pi^+\pi^+$ (NR)	< 56					< 56 [28]				< 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	ρ^+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	$f_0(980)K^{*+}$ †	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	$b_1^+K^0$ †	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]	$8.9 \pm 1.7 \pm 1.2$	[37]					9.2 ± 1.5
382	$K_1(1400)^+\rho^0$	< 780	< 780 ¶	[38]							< 780 ¶
383	$K_2(1430)^+\rho^0$	< 1500	< 1500 ¶	[38]							< 1500 ¶
384	$b_1^0K^+$ †	9.1 ± 2.0	$9.1 \pm 1.7 \pm 1.0$	[39]							9.1 ± 2.0
385	$b_1^+K^{*0}$ †	< 5.9	< 5.9	[40]							< 5.9
386	$b_1^0K^{*+}$ †	< 6.7	< 6.7	[40]							< 6.7
387	$K^+\overline{K}^0$	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	$\overline{K}^0K^+\pi^0$	< 24					< 24 [30]				< 24
389	$K^+K_SK_S$	10.8 ± 0.6	$10.6 \pm 0.5 \pm 0.3$	[15]	$10.42 \pm 0.43 \pm 0.22$	[42]					10.49 ± 0.37
390	$f_0(980)K^+$ $(K^+K_SK_S)$	14.7 ± 3.3	$14.7 \pm 2.8 \pm 1.8$	[15]							14.7 ± 3.3
391	$f_0(1710)K^+$ $(K^+K_SK_S)$	$0.48^{+0.40}_{-0.26}$	$0.48^{+0.40}_{-0.24} \pm 0.11$	[15]							$0.48^{+0.41}_{-0.26}$
392	$K^+K_SK_S$ (NR)	20 ± 4	$19.8 \pm 3.7 \pm 2.5$	[15]							19.8 ± 4.5
393	$K_SK_S\pi^+$	< 0.51	< 0.51	[43]	< 0.87	[42]					< 0.51
394	$K^+K^-\pi^+$	5.0 ± 0.7	$5.0 \pm 0.5 \pm 0.5$	[44]	$5.38 \pm 0.40 \pm 0.35$	[45]					5.24 ± 0.42
395	$K^+K^-\pi^+$ (NR)	< 75					< 75 [28]				< 75
396	$\overline{K}^{*0}K^+$ $(K^+K^-\pi^+)$	< 1.1	< 1.1	[46]							< 1.1
397	$\overline{K}_0^*(1430)^0K^+$ $(K^+K^-\pi^+)$	< 2.2	< 2.2	[46]							< 2.2
398	$K^+K^+\pi^-$	< 0.011	< 0.16	[25]	< 2.4	[26]			< 0.011	[27]	< 0.011
399	$K^+K^+\pi^-$ (NR)	< 87.9									< 87.9

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%.
¶ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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]	< 8	[24]				1.8 ± 0.5
401	$f_J(2220)K^+$	< 1.2			< 1.2	[47]				< 1.2
402	$K^{*+}\pi^+K^-$	< 11.8	< 11.8	[32]						< 11.8
403	$K^{*+}\overline{K}^{*0}$	0.91 ± 0.29	$1.2 \pm 0.5 \pm 0.1$	[48]	$0.77^{+0.35}_{-0.30} \pm 0.12$	[49]				$0.91^{+0.31}_{-0.28}$
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]	$30.6 \pm 1.2 \pm 2.3$	[24]				34.0 ± 1.0
406	ϕK^+ $(K^+K^-K^+)$	$8.8^{+0.7}_{-0.6}$	$9.2 \pm 0.4^{+0.7}_{-0.5}$	[15]	$9.6 \pm 0.9^{+1.1}_{-0.8}$	[24]	$5.5^{+2.1}_{-1.8} \pm 0.6$	$7.6 \pm 1.3 \pm 0.6$ [51]		8.8 ± 0.5
407	$f_0(980)K^+$ $(K^+K^-K^+)$	9.4 ± 3.2	$9.4^{+1.6}_{-2.8}$	[15]						$9.4^{+1.6}_{-2.8}$
408	$a_2(1320)K^+$ $(K^+K^-K^+)$ †	< 1.1			< 1.1	[24]				< 1.1
409	$X_0(1550)K^+$ $(K^+K^-K^+)$	4.3 ± 0.7	$4.3 \pm 0.60 \pm 0.30$	[52]						4.30 ± 0.67
410	$\phi(1680)K^+$ $(K^+K^-K^+)$ †	< 0.8			< 0.8	[24]				< 0.8
411	$f_0(1710)K^+$ $(K^+K^-K^+)$ †	1.1 ± 0.6	$1.12 \pm 0.25 \pm 0.50$	[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]	$24.0 \pm 1.5^{+2.6}_{-6.0}$	[24]				$23.8^{+2.9}_{-5.1}$
413	$K^{*+}K^+K^-$	36 ± 5	$36.2 \pm 3.3 \pm 3.6$	[32]						36.2 ± 4.9
414	ϕK^{*+}	10.0 ± 2.0	$11.2 \pm 1.0 \pm 0.9$	[53]	$6.7^{+2.1+0.7}_{-1.9-1.0}$	[54]	$10.6^{+6.4+1.8}_{-4.9-1.6}$	[50]		10.0 ± 1.1
415	$\phi(K\pi)_0^{*+}$	8.3 ± 1.6	$8.3^{+1.4}_{-0.8}$	[55]						$8.3^{+1.4}_{-0.8}$
416	$\phi K_1(1270)^+$	6.1 ± 1.9	$6.1 \pm 1.6 \pm 1.1$	[55]						6.1 ± 1.9
417	$\phi K_1(1400)^+$	< 3.2	< 3.2	[55]						< 3.2
418	$\phi K^*(1410)^+$	< 4.3	< 4.3	[55]						< 4.3
419	$\phi K_0^*(1430)^+$	7.0 ± 1.6	$7.0 \pm 1.3 \pm 0.9$	[55]						7.0 ± 1.6
420	$\phi K_2^*(1430)^+$	8.4 ± 2.1	$8.4 \pm 1.8 \pm 1.0$	[55]						8.4 ± 2.1
421	$\phi K_2(1770)^+$	< 15	< 15	[55]						< 15
422	$\phi K_2(1820)^+$	< 16.3	< 16.3	[55]						< 16.3
423	$a_1^+K^{*0}$	< 3.6	< 3.6	[56]						< 3.6
424	$\phi\phi K^+$ §	5.0 ± 1.2	$5.6 \pm 0.5 \pm 0.3$	[57]	$2.6^{+1.1}_{-0.9} \pm 0.3$	[47]				5.0 ± 0.5
425	$\eta'\eta'K^+$	< 25	< 25	[58]						< 25
426	$K^+\omega\phi$	< 1.9			< 1.9	[59]				< 1.9
427	$K^+X(1812)$ †	< 0.32			< 0.32	[59]				< 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 $K_S^0K^+K^-$, $K_S^0K_S^0K^+$ [15].
§ $M_{\phi\phi} < 2.85$ GeV/c^2.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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

RPP#	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	$15.2 \pm 0.6 \pm 1.3$ [60]					15.2 ± 1.4
448	$\rho^0\pi^+$	8.3 ± 1.2	$8.1 \pm 0.7^{+1.3}_{-1.6}$ [60]	$8.0^{+2.3}_{-2.0} \pm 0.7$ [61]	$10.4^{+3.3}_{-3.4} \pm 2.1$[18]			$8.3^{+1.2}_{-1.3}$
449	$f_0(980)\pi^+$ †	< 1.5	< 1.5 [60]					< 1.5
450	$f_2(1270)\pi^+$	$1.6^{+0.7}_{-0.4}$	$1.57 \pm 0.42^{+0.55}_{-0.25}$ [60]					$1.57^{+0.69}_{-0.49}$
451	$\rho(1450)^0\pi^+$ †	$1.4^{+0.6}_{-0.9}$	$1.4 \pm 0.4^{+0.5}_{-0.8}$ [60]					$1.4^{+0.6}_{-0.9}$
452	$f_0(1370)\pi^+$ †	< 4.0	< 4.0 [60]					< 4.0
454	$\pi^+\pi^-\pi^+(NR)$	$5.3^{+1.5}_{-1.1}$	$5.3 \pm 0.7^{+1.3}_{-0.8}$ [60]					$5.3^{+1.5}_{-1.1}$
455	$\pi^+\pi^0\pi^0$	< 890	< 890 ‡ [62]					< 890 ‡
456	$\rho^+\pi^0$	10.9 ± 1.4	$10.2 \pm 1.4 \pm 0.9$ [63]	$13.2 \pm 2.3^{+1.4}_{-1.9}$ [64]				$10.9^{+1.4}_{-1.5}$
458	$\rho^+\rho^0$	24.0 ± 1.9	$23.7 \pm 1.4 \pm 1.4$ [65]	$31.7 \pm 7.1^{+3.8}_{-6.7}$ [66]				$24.0^{+1.9}_{-2.0}$
459	$f_0(980)\rho^+$ †	< 2.0	< 2.0 [65]					< 2.0
460	$a_1^+\pi^0$	26 ± 7	$26.4 \pm 5.4 \pm 4.1$ [67]					26.4 ± 6.8
461	$a_1^0\pi^+$	20 ± 6	$20.4 \pm 4.7 \pm 3.4$ [67]					20.4 ± 5.8
462	$\omega\pi^+$	6.9 ± 0.5	$6.7 \pm 0.5 \pm 0.4$ [16]	$6.9 \pm 0.6 \pm 0.5$ [68]	$11.3^{+3.3}_{-2.9} \pm 1.4$[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	$9.9 \pm 1.2 \pm 0.8$ [69]	$4.1^{+1.4}_{-1.3} \pm 0.4$ [12]	$4.8^{+5.2}_{-3.8}$ [10]			6.9 ± 1.0
466	$\eta'\pi^+$	2.7 ± 0.9	$3.5 \pm 0.6 \pm 0.2$ [5]	$1.8^{+0.7}_{-0.6} \pm 0.1$ [6]	$1.0^{+5.8}_{-1.0}$ [10]			$2.7^{+0.5}_{-0.4}$
467	$\eta'\rho^+$	9.7 ± 2.2	$9.7^{+1.9}_{-1.8} \pm 1.1$ [7]	< 5.8 [8]				$9.7^{+2.2}_{-2.1}$
468	$\phi\pi^+$	< 0.15	< 0.24 [70]	< 0.33 [71]			< 0.15[72]	< 0.15
469	$\phi\rho^+$	< 3.0	< 3.0 [73]					< 3.0
470	$a_0(980)^0\pi^+$ †	< 5.8	< 5.8 [20]					< 5.8
471	$a_0(980)^+\pi^0$ †	< 1.4	< 1.4 [74]					< 1.4
472	$\pi^+\pi^+\pi^+\pi^-\pi^-$	< 860	< 860 ‡ [62]					< 860 ‡
473	$\rho^0 a_1(1260)^+$	< 620			< 620 [75]			< 620
474	$\rho^0 a_2(1320)^+$	< 720			< 720 [75]			< 720
475	$b_1^0\pi^+$ †	6.7 ± 2.0	$6.7 \pm 1.7 \pm 1.0$ [39]					6.7 ± 2.0
476	$b_1^+\pi^0$ †	< 3.3	< 3.3 [35]					< 3.3
477	$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	< 6300	< 6300 ‡ [62]					< 6300 ‡
478	$b_1^+\rho^0$ †	< 5.2	< 5.2 [40]					< 5.2
480	$b_1^0\rho^+$ †	< 3.3	< 3.3 [40]					< 3.3

Results for LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
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‡ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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	CLEO	CDF	LHCb	Our Avg.
257	$K^+\pi^-$	19.6 ± 0.5	$19.1 \pm 0.6 \pm 0.6$ [76]	$20.0 \pm 0.34 \pm 0.60$ [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	$10.1 \pm 0.6 \pm 0.4$ [77]	$9.68 \pm 0.46 \pm 0.50$ [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]	$2.6 \pm 0.7 \pm 0.2$ [78]	$7.8^{+7.7}_{-5.7}$ [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	$a_0(980)^0 K^0$ †	< 7.8	< 7.8 [20]					< 7.8
269	$b_1^0 K^0$ †	< 7.8	< 7.8 [35]					< 7.8
270	$a_0(980)^- K^+$ †	< 1.9	< 1.9 [79]					< 1.9
271	$b_1^- K^+$ †	7.4 ± 1.4	$7.4 \pm 1.0 \pm 1.0$ [39]					7.4 ± 1.4
272	$b_1^0 K^{*0}$ †	< 8.0	< 8.0 [40]					< 8.0
273	$b_1^- K^{*+}$ †	< 5.0	< 5.0 [40]					< 5.0
274	$a_0(1450)^- K^+$ †	< 3.1	< 3.1 [79]					< 3.1
275	$K_S X^0(\text{Familon})$ †	< 53			< 53 [80]			< 53
276	ωK^{*0}	2.0 ± 0.5	$2.2 \pm 0.6 \pm 0.2$ [19]	$1.8 \pm 0.7^{+0.3}_{-0.2}$ [81]				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) [1]	5.1 ± 1.0		$5.1 \pm 0.7 \pm 0.7$ [81]				5.1 ± 1.0
281	$K^+\pi^-\pi^0$	37.8 ± 3.2	$38.5 \pm 1.0 \pm 3.9$ [82]	$36.6^{+4.2}_{-4.3} \pm 3.0$ [83]				37.8 ± 3.2
282	$\rho^- K^+$	7.0 ± 0.9	$6.6 \pm 0.5 \pm 0.8$ [82]	$15.1^{+3.4+2.4}_{-3.3-2.6}$ [83]				7.0 ± 0.9
283	$\rho(1450)^- K^+$	2.4 ± 1.2	$2.4 \pm 1.0 \pm 0.6$ [82]					2.4 ± 1.2
284	$\rho(1700)^- K^+$	0.6 ± 0.7	$0.6 \pm 0.6 \pm 0.4$ [82]					0.6 ± 0.7
285	$K^+\pi^-\pi^0$ (NR)	2.8 ± 0.6	$2.8 \pm 0.5 \pm 0.4$ [82]	< 9.4 [83]				2.8 ± 0.6
286	$(K\pi)_0^{*+}\pi^-$	34 ± 5	$34.2 \pm 2.4 \pm 4.1$ [82]					34.2 ± 4.8
287	$(K\pi)_0^{*+}\pi^0$	8.6 ± 1.7	$8.6^{+1.1}_{-1.3}$ [82]					$8.6^{+1.1}_{-1.3}$

Results for LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
[1] $0.755 < M(K\pi) < 1.250$ GeV/c^2.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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

RPP#	Mode	PDG2017 Avg.	*BABAR*		Belle	CLEO	CDF	LHCb		Our Avg.
288	$K_2^*(1430)^0\pi^0$	< 4.0	< 4.0	[84]						< 4.0
289	$K^*(1680)^0\pi^0$	< 7.5	< 7.5	[84]						< 7.5
290	$K_x^{*0}\pi^0$ [2]	6.1 ± 1.6			$6.1^{+1.6+0.5}_{-1.5-0.6}$	[83]				$6.1^{+1.7}_{-1.6}$
291	$K^0\pi^+\pi^-$	52.0 ± 2.4	$50.2 \pm 1.5 \pm 1.8$	[85]	$47.5 \pm 2.4 \pm 3.7$	[86]	$50^{+10}_{-9} \pm 7$ [30]		$48.8^{+3.2}_{-2.8}$ §	[87]	49.4 ± 1.7
292	$K^0\pi^+\pi^-$ (NR)	$14.7^{+4.0}_{-2.6}$	$11.1^{+2.5}_{-1.0} \pm 0.9$	[85]	$19.9 \pm 2.5^{+1.7}_{-2.0}$	[86]				14.7 ± 2.0
293	$\rho^0 K^0$	4.7 ± 0.6	$4.4 \pm 0.7 \pm 0.3$	[85]	$6.1 \pm 1.0^{+1.1}_{-1.2}$	[86]				4.7 ± 0.7
294	$K^{*+}\pi^-$	8.4 ± 0.8	8.2 ± 0.9 [3]	[82, 85]	$8.4 \pm 1.1^{+1.0}_{-0.9}$	[86]	$16^{+6}_{-5} \pm 2$ [30]			8.4 ± 0.8
295	$K_0^*(1430)^+\pi^-$	33 ± 7	$29.9^{+2.3}_{-1.7} \pm 3.6$	[85]	$49.7 \pm 3.8^{+6.8}_{-8.2}$	[86]				$33.5^{+3.9}_{-3.8}$
296	$K_x^{*+}\pi^-$ [2]	5.1 ± 1.6			$5.1^{+1.5+0.6}_{-1.5-0.7}$	[83]				$5.1^{+1.6}_{-1.7}$
297	$K^*(1410)^+\pi^-$ †	< 3.8			< 3.8	[86]				< 3.8
298	$f_0(980)K^0$ †	7.0 ± 0.9	$6.9 \pm 0.8 \pm 0.6$	[85]	$7.6 \pm 1.7^{+0.9}_{-1.3}$	[86]				7.0 ± 0.9
299	$f_2(1270)^0K^0$	$2.7^{+1.3}_{-1.2}$	$2.7^{+1.0}_{-0.8} \pm 0.9$	[85]	< 2.5 †	[86]				$2.7^{+1.3}_{-1.2}$
300	$f_x(1300)^0K^0$	1.8 ± 0.7	$1.81^{+0.55}_{-0.45} \pm 0.48$	[85]						$1.81^{+0.73}_{-0.66}$
301	$K^{*0}\pi^0$	3.3 ± 0.6	$3.3 \pm 0.5 \pm 0.4$	[82]	< 3.5	[83]				3.3 ± 0.6
302	$K_2^*(1430)^+\pi^-$	< 6	< 16.2	[84]	< 6.3	[86]				< 6.3
303	$K^*(1680)^+\pi^-$	< 10	< 25	[84]	< 10.1	[86]				< 10.1
304	$K^+\pi^-\pi^+\pi^-$	< 230	< 230 [4]	[88]						< 230 [4]
305	$\rho^0 K^+\pi^-$	2.8 ± 0.7			$2.8 \pm 0.5 \pm 0.5$ [2]	[89]				2.8 ± 0.7
306	$f_0(980)K^+\pi^-$	$1.4^{+0.5}_{-0.6}$			$1.4 \pm 0.4^{+0.3}_{-0.4}$ [2]	[89]				$1.4^{+0.5}_{-0.6}$
307	$K^+\pi^-\pi^+\pi^-$ (NR)	< 2.1					< 2.1 [89]			< 2.1
308	$K^{*0}\pi^+\pi^-$	55 ± 5	$54.5 \pm 2.9 \pm 4.3$	[90]						54.5 ± 5.2
309	$K^{*0}\rho^0$	3.9 ± 1.3	$5.1 \pm 0.6^{+0.6}_{-0.8}$	[91]	$2.1^{+0.8+0.9}_{-0.7-0.5}$	[89]				3.9 ± 0.8
310	$f_0(980)K^{*0}$ †	$3.9^{+2.1}_{-1.8}$	$5.7 \pm 0.6 \pm 0.4$	[91]	$1.4^{+0.6+0.6}_{-0.5-0.4}$	[89]				3.9 ± 0.5
311	$K_1(1270)^+\pi^-$	< 30	17^{+6}_{-25}	[29]						17^{+6}_{-25}
312	$K_1(1400)^+\pi^-$	< 27	16^{+8}_{-24}	[29]						16^{+8}_{-24}
313	$a_1^-K^+$	16 ± 4	$16.3 \pm 2.9 \pm 2.3$	[34]						16.3 ± 3.7
314	$K^{*+}\rho^-$	10.3 ± 2.6	$10.3 \pm 2.3 \pm 1.3$	[91]						10.3 ± 2.6
315	$K_0(1430)^+\rho^-$	28 ± 12	$28 \pm 10 \pm 6$	[91]						28 ± 11
316	$K_1(1400)^0\rho^0$	< 3000	$28 \pm 10 \pm 6$ [5]	[38]						28 ± 11
317	$K_0^*(1430)^0\rho^0$	27 ± 6	$27 \pm 4 \pm 4$	[91]						27 ± 5
318	$K_0^*(1430)^0 f_0(980)$	2.7 ± 0.9	$2.7 \pm 0.7 \pm 0.6$	[91]						2.7 ± 0.9
319	$K_2^*(1430)^0 f_0(980)$	8.6 ± 2.0	$8.6 \pm 1.7 \pm 1.0$	[91]						8.6 ± 2.0
320	K^+K^-	0.078 ± 0.015	< 0.5	[76]	$0.10 \pm 0.08 \pm 0.04$ [2]		$0.23 \pm 0.10 \pm 0.10$[92]	$0.0780 \pm 0.0127 \pm 0.0084$	[93]	0.0803 ± 0.0147
321	$K^0\overline{K}^0$	1.21 ± 0.16	$1.08 \pm 0.28 \pm 0.11$	[1]	$1.26 \pm 0.19 \pm 0.05$ [2]					1.21 ± 0.16
322	$K^0K^-\pi^+$	6.5 ± 0.8	$6.4 \pm 1.0 \pm 0.6$	[94]	7.20 ± 0.72	[95]		6.07 ± 0.84 [1]	[87]	6.66 ± 0.50
323	$K^{*\mp}K^{\pm}$							< 0.4	[96]	< 0.4
324	$K^{*0}\overline{K}^0$ ‡	< 0.96	< 1.9	[97]				< 0.96	[98]	< 0.96
325	$K^+K^-\pi^0$	2.2 ± 0.6			$2.17 \pm 0.60 \pm 0.24$[99]					2.17 ± 0.65
326	$K_SK_S\pi^0$	< 0.9	< 0.9	[100]						< 0.9
327	$K_SK_S\eta$	< 1.0	< 1.0	[100]						< 1.0
328	$K_SK_S\eta'$	< 2.0	< 2.0	[100]						< 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]		27.3 ± 1.9 [1]	[87]	26.8 ± 1.0
330	ϕK^0	7.3 ± 0.7	$7.1 \pm 0.6^{+0.4}_{-0.3}$	[15]	$9.0^{+2.2}_{-1.8} \pm 0.7$	[54]	$5.4^{+3.7}_{-2.7} \pm 0.7$[50]			$7.3^{+0.7}_{-0.6}$
331	$f_0(980)K^0$ †	$7.0^{+3.5}_{-3.0}$	$7.0^{+2.6}_{-1.8} \pm 2.4$	[15]						$7.0^{+3.5}_{-3.0}$

Results for CDF and LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%. ‡ Includes two distinct decay processes: $\mathcal{B}(B^0 \to f) + \mathcal{B}(B^0 \to \bar{f})$.
§ Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [87]) and to the averages of the BFs in their numerators, as measured by other experiments (RPP 322 and 329).
[1] Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [87]) and to the averages of the BFs therein, as measured by other experiments (excluding the present line).
[2] $0.75 < M(K\pi) < 1.20$ GeV/c^2. [3] Average of *BABAR* results from $B^0 \to K^+\pi^-\pi^0$ [82] and $B^0 \to K^0\pi^+\pi^-$ [85].
[4] Result from DELPHI. Cited in the *BABAR*column to avoid adding a column to the table.
[5] Result from ARGUS. Cited in the *BABAR*column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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

RPP#	Mode	PDG2017 Avg.	*BABAR*		Belle		CLEO		CDF	LHCb	Our Avg.
332	$f_0(1500)K^0$ †	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	$f_0(1710)K^0$ †	4.4 ± 0.9	$4.4 \pm 0.7 \pm 0.5$	[15]							4.4 ± 0.9
335	$K^0K^+K^-$ (NR)	33 ± 10	$33 \pm 5 \pm 9$	[15]							33 ± 10
336	$K_SK_SK_S$	6.0 ± 0.5	$6.19 \pm 0.48 \pm 0.19$	[101]	$4.2^{+1.6}_{-1.3} \pm 0.8$	[26]					6.04 ± 0.50
337	$f_0(980)K_S$ †	2.7 ± 1.8	$2.7^{+1.3}_{-1.2} \pm 1.3$ †	[101]							2.7 ± 1.8
338	$f_0(1710)K_S$ †	$0.50^{+0.50}_{-0.26}$	$0.50^{+0.46}_{-0.24} \pm 0.11$ †	[101]							$0.50^{+0.47}_{-0.26}$
339	$f_0(2010)K_S$ †	0.5 ± 0.6	$0.54^{+0.21}_{-0.20} \pm 0.52$ †	[101]							0.54 ± 0.56
340	$K_SK_SK_S$ (NR)	13.3 ± 3.1	$13.3^{+2.2}_{-2.3} \pm 2.2$	[101]							$13.3^{+3.1}_{-3.2}$
341	$K_SK_SK_L$	< 16	< 16 [2]	[102]							< 16 [2]
342	$K^{*0}K^+K^-$	27.5 ± 2.6	$27.5 \pm 1.3 \pm 2.2$	[90]							27.5 ± 2.6
343	ϕK^{*0}	10.0 ± 0.5	$9.7 \pm 0.5 \pm 0.6$	[103]	$10.4 \pm 0.5 \pm 0.6$	[104]	$11.5^{+4.5+1.8}_{-3.7-1.7}$	[50]			$10.1^{+0.6}_{-0.5}$
344	$K^+\pi^-\pi^+K^-$ (NR)	< 71.7			< 71.7 [3]	[105]					< 71.7 [3]
345	$K^{*0}\pi^+K^-$	4.5 ± 1.3	$4.6 \pm 1.1 \pm 0.8$	[90]	< 13.9 [3]	[105]					4.6 ± 1.4
346	$K^{*0}\overline{K}^{*0}$	0.8 ± 0.5	$1.28^{+0.35}_{-0.30} \pm 0.11$	[106]	$0.26^{+0.33+0.10}_{-0.29-0.08}$	[105]					0.81 ± 0.23
347	$K^+\pi^-K^+\pi^-$ (NR)	< 6.0			< 6.0 [3]	[105]					< 6.0 [3]
348	$K^{*0}K^+\pi^-$	< 2.2	< 2.2	[90]	< 7.6 [3]	[105]					< 2.2
349	$K^{*0}K^{*0}$	< 0.2	< 0.41	[106]	< 0.2	[105]					< 0.2
350	$K^{*+}K^{*-}$	< 2.0	< 2.0	[107]							< 2.0
351	$K_1^*(1400)^0\phi$	< 5000	< 5000 ‡	[38]							< 5000 ‡
352	$(K\pi)_0^{*0}\phi$	4.3 ± 0.4	$4.3 \pm 0.4 \pm 0.4$	[103]	$4.3 \pm 0.4 \pm 0.4$	[104]					4.3 ± 0.4
353	$(K\pi)_0^{*0}\phi$	< 1.7	< 1.7 [4]	[108]							< 1.7 [4]
354	$K_0^*(1430)^0\pi^+K^-$	< 31.8			< 31.8 [3]	[105]					< 31.8 [3]
355	$K_0^*(1430)^0\overline{K}^{*0}$	< 3.3			< 3.3	[105]					< 3.3
356	$K_0^*(1430)^0\overline{K}_0^*(1430)^0$	< 8.4			< 8.4	[105]					< 8.4
357	$\phi K_0^*(1430)^0$	3.9 ± 0.8	$3.9 \pm 0.5 \pm 0.6$	[103]	$4.3 \pm 0.4 \pm 0.4$	[104]					4.2 ± 0.5
358	$K_0^*(1430)^0K^{*0}$	< 1.7			< 1.7	[105]					< 1.7
359	$K_0^*(1430)^0K_0^*(1430)^0$	< 4.7			< 4.7	[105]					< 4.7
360	$\phi K^*(1680)^0$	< 3.5	< 3.5	[108]							< 3.5
361	$\phi K_3^*(1780)^0$	< 2.7	< 2.7	[108]							< 2.7
362	$\phi K_4^*(2045)^0$	< 15.3	< 15.3	[108]							< 15.3
363	$\rho^0K_2^*(1430)^0$	< 1100	< 1100 ‡	[38]							< 1100 ‡
364	$\phi K_2^*(1430)^0$	6.8 ± 0.9	$7.5 \pm 0.9 \pm 0.5$	[103]	$5.5^{+0.9}_{-0.7} \pm 1.0$	[104]					6.8 ± 0.8
365	$\phi\phi K^0$ §	4.5 ± 0.9	$4.5 \pm 0.8 \pm 0.3$	[57]							4.5 ± 0.9
366	$\eta'\eta'K^0$	< 31	< 31	[58]							< 31

† In this product of BFs, all daughter BFs not shown are set to 100%. ‡ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.
§ $M_{\phi\phi} < 2.85$ GeV/c^2.
[2] $0.75 < M(K\pi) < 1.20$ GeV/c^2. [3] $0.70 < M(K\pi) < 1.70$ GeV/c^2.
[4] $1.60 < M(K\pi) < 2.15$ GeV/c^2.

Heavy FLavor AVeraging group (HFLAV) - April 2019

B^0 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

RPP#	Mode	PDG2017 Avg.	*BABAR*		Belle		CLEO		CDF	LHCb		Our Avg.
387	$\pi^+\pi^-$	5.12 ± 0.19	$5.5 \pm 0.4 \pm 0.3$	[76]	$5.04 \pm 0.21 \pm 0.18$	[2]	$4.5^{+1.4}_{-1.2}{}^{+0.5}_{-0.4}$	[3]	$5.02 \pm 0.33 \pm 0.35$ ‡	[109] $5.08 \pm 0.17 \pm 0.37$	[110]	5.10 ± 0.19
388	$\pi^0\pi^0$	1.91 ± 0.22	$1.83 \pm 0.21 \pm 0.13$	[77]	$1.31 \pm 0.19 \pm 0.18$	[111]						1.59 ± 0.18
389	$\eta\pi^0$	0.41 ± 0.17	< 1.5	[69]	$0.41^{+0.17}_{-0.15}{}^{+0.05}_{-0.07}$	[112]	< 2.9	[10]				$0.41^{+0.18}_{-0.17}$
390	$\eta\eta$	< 1.0	< 1.0	[5]	$0.76^{+0.27}_{-0.23}{}^{+0.14}_{-0.16}$	[113]						$0.76^{+0.30}_{-0.28}$
391	$\eta'\pi^0$	1.2 ± 0.6	$0.9 \pm 0.4 \pm 0.1$	[69]	$2.8 \pm 1.0 \pm 0.3$	[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	[69]	< 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	[79]	< 1.9	[12]						< 1.5
397	$f_0(980)\eta$ †	< 0.4	< 0.4	[79]								< 0.4
398	$\omega\eta$	$0.94^{+0.40}_{-0.31}$	$0.94^{+0.35}_{-0.30} \pm 0.09$	[5]								$0.94^{+0.36}_{-0.31}$
399	$\omega\eta'$	$1.0^{+0.5}_{-0.4}$	$1.01^{+0.46}_{-0.38} \pm 0.09$	[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	$1.2 \pm 0.3^{+0.3}_{-0.2}$	[114]								1.2 ± 0.4
403	$\phi\pi^0$	< 0.15	< 0.28	[70]	< 0.15	[71]						< 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								$0.182 \pm 0.048 \pm 0.014$ §	[115]	0.182 ± 0.050
407	$\phi\rho^0$	< 0.33	< 0.33	[73]								< 0.33
408	$f_0(980)\phi$ †	< 0.38	< 0.38	[73]								< 0.38
409	$\omega\phi$	< 0.7	< 0.7	[114]								< 0.7
410	$\phi\phi$	< 0.028	< 0.2	[73]						< 0.024	[116]	< 0.024
411	$a_0^{\mp}(980)\pi^{\pm}$ †	< 3.1	< 3.1	[79]								< 3.1
412	$a_0^{\mp}(1450)\pi^{\pm}$ †	< 2.3	< 2.3	[79]								< 2.3
413	$\pi^+\pi^-\pi^0$	< 720	< 720 ¶	[62]								< 720 ¶
414	$\rho^0\pi^0$	2.0 ± 0.5	$1.4 \pm 0.6 \pm 0.3$	[117]	$3.0 \pm 0.5 \pm 0.7$	[118]	$1.6^{+2.0}_{-1.4} \pm 0.8$	[18]				2.0 ± 0.5
415	$\rho^{\mp}\pi^{\pm}$	23.0 ± 2.3	$22.6 \pm 1.8 \pm 2.2$	[119]	$22.6 \pm 1.1 \pm 4.4$	[118]	$27.6^{+8.4}_{-7.4} \pm 4.2$	[18]				23.0 ± 2.3
416	$\pi^+\pi^-\pi^+\pi^-$	< 11.2	< 23.1	[120]	< 11.2	[121]						< 11.2
417	$\rho^0\pi^+\pi^-(NR)$	< 8.8	< 8.8	[120]	< 12	[121]						< 8.8
418	$\rho^0\rho^0$	0.96 ± 0.15	$0.92 \pm 0.32 \pm 0.14$	[120]	$1.02 \pm 0.30 \pm 0.15$	[121]				$0.94 \pm 0.17 \pm 0.11$ ‡	[122]	0.95 ± 0.16
419	$f_0(980)\pi^+\pi^-(NR)$ †	< 3.0			< 3.0	[121]						< 3.0
420	$f_0(980)\rho^0$ †	0.78 ± 0.25	< 0.40	[120]	$0.78 \pm 0.22 \pm 0.11$	[121]						0.78 ± 0.25
421	$f_0(980)f_0(980), 4\pi$ †◇	< 0.19	< 0.19	[120]	< 0.2	[121]						< 0.19
422	$f_0(980)f_0(980), 2\pi 2K$ †1	< 0.23	< 0.23	[73]								< 0.23
423	$a_1^{\mp}\pi^{\pm}$	26 ± 5	$33.2 \pm 3.8 \pm 3.0$	[123]	$22.2 \pm 2.0 \pm 2.8$	[124]						25.9 ± 2.8
424	$a_2^{\mp}\pi^{\pm}$	< 6.3			< 6.3	[124]						< 6.3
425	$\pi^+\pi^-\pi^0\pi^0$	< 3100	< 3100 ¶	[62]								< 3100 ¶
426	$\rho^+\rho^-$	27.7 ± 1.9	$25.5 \pm 2.1^{+3.6}_{-3.9}$	[125]	$28.3 \pm 1.5 \pm 1.5$	[126]						27.7 ± 1.9
427	$a_1(1260)^0\pi^0$	< 1100	< 1100 ¶	[62]								< 1100 ¶
428	$\omega\pi^0$	< 0.5	< 0.5	[69]	< 2.0	[68]						< 0.5
429	$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 9000	< 9000 ¶	[62]								< 9000 ¶
430	$a_1^{\pm}\rho^{\mp}$	< 61	< 61	[127]								< 61
431	$a_1^0\rho^0$	< 2400	< 2400 ¶	[62]								< 2400 ¶

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%.
‡ Result given as $0.94 \pm 0.17 \pm 0.09 \pm 0.06$ where last error is from $\mathcal{B}(B^0 \to \phi K^{*0})$.
§ In the mass range $400 < m(\pi^+\pi^-) < 1600$ GeV/c^2.
¶ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.
◇ Both $f_0(980)$ decay into $\pi^+\pi^-$.
1 Using the final state $\pi^+\pi^- K^+ K^-$.

Heavy FLavor AVeraging group (HFLAV) - April 2019

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.	*BABAR*		Belle	CLEO	CDF	LHCb	Our Avg.
432	$b_1^{\mp}\pi^{\pm}$ †	10.9 ± 1.5	$10.9 \pm 1.2 \pm 0.9$	[39]					10.9 ± 1.5
433	$b_1^0\pi^0$ †	< 1.9	< 1.9	[35]					< 1.9
434	$b_1^{\pm}\rho^{\mp}$ †	< 1.4	< 1.4	[40]					< 1.4
435	$b_1^0\rho^0$ †	< 3.4	< 3.4	[40]					< 3.4
436	$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	< 3000	< 3000 ‡	[62]					< 3000 ‡
437	$a_1^{\pm}a_1^{\mp}$	11.8 ± 2.6	11.8 ± 2.6	[128]					11.8 ± 2.6
438	$\pi+\pi^+\pi^+\pi^-\pi^-\pi^-\pi^0$	< 11000	< 11000 ‡	[62]					< 11000 ‡

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

Heavy FLavor AVeraging group (HFLAV) - April 2019

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	$\mathcal{B}(B^0 \to K^+K^-)/\mathcal{B}(B^0 \to K^+\pi^-)$		$0.012 \pm 0.005 \pm 0.005$ [92]	$0.00398 \pm 0.00065 \pm 0.00042$	[93]	0.00416 ± 0.00099
323	$\mathcal{B}(B^0 \to K^{*\mp}K^{\pm})/\mathcal{B}(B^0 \to K^{*+}\pi^-)$			< 0.05	[96]	< 0.05
324	$\mathcal{B}(B^0 \to K^0_S K^{*0})/\mathcal{B}(B^0 \to K^0_S \pi^+\pi^-)$ †			< 0.020	[98]	< 0.020
387	$\mathcal{B}(B^0 \to \pi^+\pi^-)/\mathcal{B}(B^0 \to K^+\pi^-)$	0.261 ± 0.015	$0.259 \pm 0.017 \pm 0.016$[109]	$0.262 \pm 0.009 \pm 0.017$	[110]	0.261 ± 0.015

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

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] A. B. Kaliyar *et al.*, (Belle collaboration), Phys. Rev. **D99**, no. 3, 031102, (2019), arXiv:1812.10221 [hep-ex].

[43] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051101, (2009), arXiv:0811.1979 [hep-ex].

[44] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 221801, (2007), arXiv:0708.0376 [hep-ex].

[45] C. L. Hsu *et al.*, (Belle collaboration), Phys. Rev. **D96**, no. 3, 031101, (2017), arXiv:1705.02640 [hep-ex].

[46] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071103, (2007), arXiv:0706.1059 [hep-ex].

[47] H. C. Huang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 241802, (2003), arXiv:hep-ex/0305068 [hep-ex].

[48] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051102, (2009), arXiv:0901.1223 [hep-ex].

[49] Y. M. Goh *et al.*, (Belle collaboration), Phys. Rev. **D91**, 071101, (2015), arXiv:1502.00381 [hep-ex].

[50] R. A. Briere *et al.*, (CLEO collaboration), Phys. Rev. Lett. **86**, 3718, (2001), arXiv:hep-ex/0101032 [hep-ex].

[51] D. Acosta *et al.*, (CDF collaboration), Phys. Rev. Lett. **95**, 031801, (2005), arXiv:hep-ex/0502044 [hep-ex].

[52] A. Abulencia *et al.*, (CDF collaboration), Phys. Rev. **D73**, 032003, (2006), arXiv:hep-ex/0510048 [hep-ex].

[53] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 201802, (2007), arXiv:0705.1798 [hep-ex].

[54] K. F. Chen *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 201801, (2003), arXiv:hep-ex/0307014 [hep-ex].

[55] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 161801, (2008), arXiv:0806.4419 [hep-ex].

[56] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 091101, (2010), arXiv:1007.2732 [hep-ex].

[57] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D84**, 012001, (2011), arXiv:1105.5159 [hep-ex].

[58] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 031105, (2006), arXiv:hep-ex/0605008 [hep-ex].

[59] C. Liu *et al.*, (Belle collaboration), Phys. Rev. **D79**, 071102, (2009), arXiv:0902.4757 [hep-ex].

[60] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 072006, (2009), arXiv:0902.2051 [hep-ex].

[61] A. Gordon *et al.*, (Belle collaboration), Phys. Lett. **B542**, 183, (2002), arXiv:hep-ex/0207007 [hep-ex].

[62] H. Albrecht *et al.*, (ARGUS collaboration), Phys. Lett. **B241**, 278, (1990).

[63] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 091103, (2007), arXiv:hep-ex/0701035 [hep-ex].

[64] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **94**, 031801, (2005), arXiv:hep-ex/0406006 [hep-ex].

[65] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **102**, 141802, (2009), arXiv:0901.3522 [hep-ex].

[66] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 221801, (2003), arXiv:hep-ex/0306007 [hep-ex].

[67] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 261801, (2007), arXiv:0708.0050 [hep-ex].

[68] C. M. Jen *et al.*, (Belle collaboration), Phys. Rev. **D74**, 111101, (2006), arXiv:hep-ex/0609022 [hep-ex].

[69] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 011107, (2008), arXiv:0804.2422 [hep-ex].

[70] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 011102, (2006), arXiv:hep-ex/0605037 [hep-ex].

[71] J. H. Kim *et al.*, (Belle collaboration), Phys. Rev. **D86**, 031101, (2012), arXiv:1206.4760 [hep-ex].

[72] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B728**, 85, (2014), arXiv:1309.3742 [hep-ex].

[73] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 201801, (2008), arXiv:0807.3935 [hep-ex].

[74] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D77**, 011101, (2008), arXiv:0708.0963 [hep-ex].

[75] D. Bortoletto *et al.*, (CLEO collaboration), Phys. Rev. Lett. **62**, 2436, (1989).

[76] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 012008, (2007), arXiv:hep-ex/0608003 [hep-ex].

[77] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D87**, 052009, (2013), arXiv:1206.3525 [hep-ex].

[78] S. Sato *et al.*, (Belle collaboration), Phys. Rev. **D90**, 072009, (2014), arXiv:1408.6343 [hep-ex].

[79] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 111102, (2007), arXiv:hep-ex/0703038 [hep-ex].

[80] R. Ammar *et al.*, (CLEO collaboration), Phys. Rev. Lett. **87**, 271801, (2001), arXiv:hep-ex/0106038 [hep-ex].

[81] P. Goldenzweig *et al.*, (Belle collaboration), Phys. Rev. Lett. **101**, 231801, (2008), arXiv:0807.4271 [hep-ex].

[82] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D83**, 112010, (2011), arXiv:1105.0125 [hep-ex].

[83] P. Chang *et al.*, (Belle collaboration), Phys. Lett. **B599**, 148, (2004), arXiv:hep-ex/0406075 [hep-ex].

[84] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 052005, (2008), arXiv:0711.4417 [hep-ex].

[85] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 112001, (2009), arXiv:0905.3615 [hep-ex].

[86] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D75**, 012006, (2007), arXiv:hep-ex/0610081 [hep-ex].

[87] R. Aaij *et al.*, (LHCb collaboration), JHEP **11**, 027, (2017), arXiv:1707.01665 [hep-ex].

[88] W. Adam *et al.*, (DELPHI collaboration), Z. Phys. **C72**, 207–220, (1996).

[89] S. H. Kyeong *et al.*, (Belle collaboration), Phys. Rev. **D80**, 051103, (2009), arXiv:0905.0763 [hep-ex].

[90] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071104, (2007), arXiv:0708.2543 [hep-ex].

[91] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 072005, (2012), arXiv:1112.3896 [hep-ex].

[92] T. Aaltonen *et al.*, (CDF collaboration), Phys. Rev. Lett. **108**, 211803, (2012), arXiv:1111.0485 [hep-ex].

[93] R. Aaij *et al.*, (LHCb collaboration), Phys. Rev. Lett. **118**, 081801, (2017), arXiv:1610.08288 [hep-ex].

[94] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 031101, (2010), arXiv:1003.0640 [hep-ex].

[95] Y. T. Lai *et al.*, (Belle collaboration), arXiv:1904.06835 [hep-ex], (2019).

[96] R. Aaij *et al.*, (LHCb collaboration), New J. Phys. **16**, 123001, (2014), arXiv:1407.7704 [hep-ex].

[97] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 072008, (2006), arXiv:hep-ex/0606050 [hep-ex].

[98] R. Aaij *et al.*, (LHCb collaboration), JHEP **01**, 012, (2016), arXiv:1506.08634 [hep-ex].

[99] V. Gaur *et al.*, (Belle collaboration), Phys. Rev. **D87**, 091101, (2013), arXiv:1304.5312 [hep-ex].

[100] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 011101, (2009), arXiv:0905.0868 [hep-ex].

[101] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 054023, (2012), arXiv:1111.3636 [hep-ex].

[102] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 032005, (2006), arXiv:hep-ex/0606031 [hep-ex].

[103] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 092008, (2008), arXiv:0808.3586 [hep-ex].

[104] M. Prim *et al.*, (Belle collaboration), Phys. Rev. **D88**, 072004, (2013), arXiv:1308.1830 [hep-ex].

[105] C. C. Chiang *et al.*, (Belle collaboration), Phys. Rev. **D81**, 071101, (2010), arXiv:1001.4595 [hep-ex].

[106] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **100**, 081801, (2008), arXiv:0708.2248 [hep-ex].

[107] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 051103, (2008), arXiv:0806.4467 [hep-ex].

[108] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 051103, (2007), arXiv:0705.0398 [hep-ex].

[109] T. Aaltonen *et al.*, (CDF collaboration), Phys. Rev. Lett. **106**, 181802, (2011), arXiv:1103.5762 [hep-ex].

[110] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 037, (2012), arXiv:1206.2794 [hep-ex].

[111] T. Julius *et al.*, (Belle collaboration), arXiv:1705.02083 [hep-ex], (2017).

[112] B. Pal *et al.*, (Belle collaboration), Phys. Rev. **D92**, 011101, (2015), arXiv:1504.00957 [hep-ex].

[113] A. Abdesselam *et al.*, (Belle collaboration), arXiv:1609.03267 [hep-ex], (2016).

[114] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D89**, 051101, (2014), arXiv:1312.0056 [hep-ex].

[115] R. Aaij *et al.*, (LHCb collaboration), Phys. Rev. **D95**, 012006, (2017), arXiv:1610.05187 [hep-ex].

[116] (LHCb Collaboration collaboration), "Measurement of CP violation in the $B_s^0 \to \phi\phi$ decay and search for the $B^0 \to \phi\phi$ decay", Tech. Rep. LHCb-CONF-2018-001. CERN-LHCb-CONF-2018-001, CERN, Geneva, Apr, 2018, https://cds.cern.ch/record/2314360.

[117] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **93**, 051802, (2004), arXiv:hep-ex/0311049 [hep-ex].

[118] A. Kusaka *et al.*, (Belle collaboration), Phys. Rev. **D77**, 072001, (2008), arXiv:0710.4974 [hep-ex].

[119] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **91**, 201802, (2003), arXiv:hep-ex/0306030 [hep-ex].

[120] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 071104, (2008), arXiv:0807.4977 [hep-ex].

[121] I. Adachi *et al.*, (Belle collaboration), Phys. Rev. **D89**, 072008, (2014), arXiv:1212.4015 [hep-ex], Addendum ibid. **D89**, 119903, (2014).

[122] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B747**, 468, (2015), arXiv:1503.07770 [hep-ex].

[123] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 051802, (2006), arXiv:hep-ex/0603050 [hep-ex].

[124] J. Dalseno *et al.*, (Belle collaboration), Phys. Rev. **D86**, 092012, (2012), arXiv:1205.5957 [hep-ex].

[125] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 052007, (2007), arXiv:0705.2157 [hep-ex].

[126] 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)].

[127] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 031104, (2006), arXiv:hep-ex/0605024 [hep-ex].

[128] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 092007, (2009), arXiv:0907.1776 [hep-ex].