

Heavy Flavor Averaging Group - B^+ Polarization Measurements - May 2013

Measurements of the longitudinal polarization fraction f_L
 In PDG2012 [New since PDG2012 \(preliminary\)](#) [New since PDG2012 \(published\)](#)

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	New Avg.
258	ωK^{*+}	$0.41 \pm 0.18 \pm 0.05$	$0.41 \pm 0.18 \pm 0.05$		0.41 ± 0.19
261	$\omega K_2^*(1430)^+$	$0.56 \pm 0.10 \pm 0.04$	$0.56 \pm 0.10 \pm 0.04$		0.56 ± 0.11
289	$K^{*+} \rho^0$	$0.78 \pm 0.12 \pm 0.03$	$0.78 \pm 0.12 \pm 0.03$		0.78 ± 0.12
293	$K^{*0} \rho^+$	0.48 ± 0.08	$0.52 \pm 0.10 \pm 0.04$	$0.43 \pm 0.11^{+0.05}_{-0.02}$	0.48 ± 0.08
311	$K^{*+} \bar{K}^{*0}$	$0.75^{+0.16}_{-0.26} \pm 0.03$	$0.75^{+0.16}_{-0.26} \pm 0.03$		$0.75^{+0.16}_{-0.26}$
323	ϕK^{*+}	0.50 ± 0.05	$0.49 \pm 0.05 \pm 0.03$	$0.52 \pm 0.08 \pm 0.03$	0.50 ± 0.05
325	$\phi K_1(1270)^+$	$0.46^{+0.12+0.06}_{-0.13-0.07}$	$0.46^{+0.12+0.06}_{-0.13-0.07}$		$0.46^{+0.13}_{-0.15}$
329	$\phi K_2^*(1430)^+$	$0.80^{+0.09}_{-0.10} \pm 0.03$	$0.80^{+0.09}_{-0.10} \pm 0.03$		0.80 ± 0.10
365	$\rho^+ \rho^0$	0.950 ± 0.016	$0.950 \pm 0.015 \pm 0.006$	$0.95 \pm 0.11 \pm 0.02$	0.950 ± 0.016
370	$\omega \rho^+$	$0.90 \pm 0.05 \pm 0.03$	$0.90 \pm 0.05 \pm 0.03$		0.90 ± 0.06

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 Full angular analysis of $B^+ \rightarrow \phi K^{*+}$

In PDG2012 [New since PDG2012 \(preliminary\)](#) [New since PDG2012 \(published\)](#)

Parameter	PDG2012 Avg.	BABAR	Belle	New Avg.
$f_{\perp} = \Lambda_{\perp\perp}$	0.20 ± 0.05	$0.21 \pm 0.05 \pm 0.02$	$0.19 \pm 0.08 \pm 0.02$	0.20 ± 0.05
ϕ_{\parallel}	2.34 ± 0.18	$2.47 \pm 0.20 \pm 0.07$	$2.10 \pm 0.28 \pm 0.04$	2.34 ± 0.17
ϕ_{\perp}	2.58 ± 0.17	$2.69 \pm 0.20 \pm 0.03$	$2.31 \pm 0.30 \pm 0.07$	2.58 ± 0.17
δ_0	$3.07 \pm 0.18 \pm 0.06$	$3.07 \pm 0.18 \pm 0.06$		3.07 ± 0.19
A_{CP}^0	$0.17 \pm 0.11 \pm 0.02$	$0.17 \pm 0.11 \pm 0.02$		0.17 ± 0.11
A_{CP}^{\perp}	$0.22 \pm 0.24 \pm 0.08$	$0.22 \pm 0.24 \pm 0.08$		0.22 ± 0.25
$\Delta\phi_{\parallel}$	$0.07 \pm 0.20 \pm 0.05$	$0.07 \pm 0.20 \pm 0.05$		0.07 ± 0.21
$\Delta\phi_{\perp}$	$0.19 \pm 0.20 \pm 0.07$	$0.19 \pm 0.20 \pm 0.07$		0.19 ± 0.21
$\Delta\delta_0$	$0.20 \pm 0.18 \pm 0.03$	$0.20 \pm 0.18 \pm 0.03$		0.20 ± 0.18

BR, f_L and A_{CP} are tabulated separately.

Heavy Flavor Averaging Group - B^0 Polarization Measurements - May 2013

Measurements of the longitudinal polarization fraction f_L
 In PDG2012 **New since PDG2012 (preliminary)** **New since PDG2012 (published)**

RPP#	Mode	PDG2012 Avg.	BABAR	Belle	New Avg.
233	ωK^{*0}	0.69 ± 0.13	$0.72 \pm 0.14 \pm 0.02$	$0.56 \pm 0.29^{+0.18}_{-0.08}$	0.70 ± 0.13
236	$\omega K_2^*(1430)^0$	$0.45 \pm 0.12 \pm 0.02$	$0.45 \pm 0.12 \pm 0.02$		0.45 ± 0.12
266	$K^{*0} \rho^0$	$0.57 \pm 0.09 \pm 0.08$	$0.40 \pm 0.08 \pm 0.11$		0.40 ± 0.14
271	$K^{*+} \rho^-$	New	$0.38 \pm 0.13 \pm 0.03$		0.38 ± 0.13
286	ϕK^{*0}	0.480 ± 0.0030	$0.494 \pm 0.034 \pm 0.013$	$0.45 \pm 0.05 \pm 0.02$	0.480 ± 0.030
289	$K^{*0} \bar{K}^{*0}$	$0.80^{+0.10}_{-0.12} \pm 0.06$	$0.80^{+0.10}_{-0.12} \pm 0.06$		$0.80^{+0.12}_{-0.13}$
307	$\phi K_2^*(1430)^0$	$0.901^{+0.046}_{-0.058} \pm 0.037$	$0.901^{+0.046}_{-0.058} \pm 0.037$		$0.901^{+0.059}_{-0.069}$
360	$\rho^0 \rho^0$	$0.75^{+0.11}_{-0.14} \pm 0.04$	$0.75^{+0.11}_{-0.14} \pm 0.04$		$0.75^{+0.12}_{-0.15}$
368	$\rho^+ \rho^-$	$0.977^{+0.028}_{-0.024}$	$0.992 \pm 0.024^{+0.026}_{-0.013}$	$0.941^{+0.034}_{-0.040} \pm 0.030$	$0.978^{+0.025}_{-0.022}$
379	$a_1^\pm a_1^\mp$	$0.31 \pm 0.22 \pm 0.10$	$0.31 \pm 0.22 \pm 0.10$		0.31 ± 0.24

Heavy Flavor Averaging Group - B^0 Polarization Measurements - May 2013

Full angular analysis of $B^0 \rightarrow \phi K^{*0}$

In PDG2012 [New since PDG2012 \(preliminary\)](#) [New since PDG2012 \(published\)](#)

Parameter	PDG2012 Avg.	BABAR	Belle	New Avg.
$f_{\perp} = \Lambda_{\perp\perp}$	0.24 ± 0.05	$0.212 \pm 0.032 \pm 0.013$	$0.31_{-0.05}^{+0.06} \pm 0.02$	0.241 ± 0.029
ϕ_{\parallel}	2.40 ± 0.13	$2.40 \pm 0.13 \pm 0.08$	$2.40_{-0.24}^{+0.28} \pm 0.07$	$2.40_{-0.13}^{+0.14}$
ϕ_{\perp}	2.39 ± 0.13	$2.35 \pm 0.13 \pm 0.09$	$2.51 \pm 0.25 \pm 0.06$	2.39 ± 0.13
δ_0	$2.82 \pm 0.15 \pm 0.09$	$2.82 \pm 0.15 \pm 0.09$		2.82 ± 0.17
A_{CP}^0	0.04 ± 0.06	$0.01 \pm 0.07 \pm 0.02$	$0.13 \pm 0.12 \pm 0.04$	0.04 ± 0.06
A_{CP}^{\perp}	-0.11 ± 0.12	$-0.04 \pm 0.15 \pm 0.06$	$-0.20 \pm 0.18 \pm 0.04$	-0.11 ± 0.12
$\Delta\phi_{\parallel}$	0.11 ± 0.22	$0.22 \pm 0.12 \pm 0.08$	$-0.32 \pm 0.27 \pm 0.07$	0.11 ± 0.13
$\Delta\phi_{\perp}$	0.08 ± 0.22	$0.21 \pm 0.13 \pm 0.08$	$-0.30 \pm 0.25 \pm 0.06$	0.08 ± 0.13
$\Delta\delta_0$	$0.27 \pm 0.14 \pm 0.08$	$0.27 \pm 0.14 \pm 0.08$		0.27 ± 0.16

BR, f_L and A_{CP} are tabulated separately.

Full angular analysis of $B^0 \rightarrow \phi K_2^{*0}(1430)$

In PDG2012 [New since PDG2012 \(preliminary\)](#) [New since PDG2012 \(published\)](#)

Parameter	PDG2012 Avg.	BABAR	Belle	New Avg.
$f_{\perp} = \Lambda_{\perp\perp}$	$0.002_{-0.002}^{+0.018} \pm 0.031$	$0.002_{-0.002}^{+0.018} \pm 0.031$		$0.002_{-0.031}^{+0.036}$
ϕ_{\parallel}	$3.96 \pm 0.38 \pm 0.06$	$3.96 \pm 0.38 \pm 0.06$		3.96 ± 0.39
δ_0	$3.41 \pm 0.13 \pm 0.13$	$3.41 \pm 0.13 \pm 0.13$		3.41 ± 0.18
A_{CP}^0	$-0.05 \pm 0.06 \pm 0.01$	$-0.05 \pm 0.06 \pm 0.01$		-0.05 ± 0.06
$\Delta\phi_{\parallel}$	$-1.00 \pm 0.38 \pm 0.09$	$-1.00 \pm 0.38 \pm 0.09$		-1.00 ± 0.39
$\Delta\delta_0$	$0.11 \pm 0.13 \pm 0.06$	$0.11 \pm 0.13 \pm 0.06$		0.11 ± 0.14

BR, f_L and A_{CP} are tabulated separately.

Heavy Flavor Averaging Group - B_s Polarization Measurements - May 2013

Measurements of the longitudinal polarization fraction f_L
 In PDG2012 [New since PDG2012 \(preliminary\)](#) [New since PDG2012 \(published\)](#)

RPP#	Mode	PDG2012 Avg.	CDF	LHCb	New Avg.
33	$\phi\phi$	0.348 ± 0.046	$0.348 \pm 0.041 \pm 0.021$	$0.365 \pm 0.022 \pm 0.012$	0.361 ± 0.022
38	$K^{*0}\bar{K}^{*0}$	0.31 ± 0.13		$0.31 \pm 0.12 \pm 0.04$	0.31 ± 0.13
39	$\phi\bar{K}^{*0}$	New		$0.51 \pm 0.15 \pm 0.07$	0.51 ± 0.17

Full angular analysis of $B_s \rightarrow \phi\phi$

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

Parameter	PDG2012 Avg.	CDF	LHCb	New Avg.
$f_{\perp} = \Lambda_{\perp\perp}$	$0.365 \pm 0.044 \pm 0.027$	$0.365 \pm 0.044 \pm 0.027$	$0.291 \pm 0.024 \pm 0.010$	0.306 ± 0.023
ϕ_{\parallel}	$2.71_{-0.36}^{+0.31} \pm 0.22$	$2.71_{-0.36}^{+0.31} \pm 0.22$	$2.57 \pm 0.13 \pm 0.05$	2.58 ± 0.13

BR, f_L and A_{CP} are tabulated separately.

Full angular analysis of $B_s \rightarrow \phi\bar{K}^{*0}$

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

Parameter	PDG2012 Avg.	LHCb	New Avg.
$f_{\perp} = \Lambda_{\perp\perp}$	New	$0.28 \pm 0.11 \pm 0.02$	0.28 ± 0.11
ϕ_{\parallel}	New	$1.75 \pm 0.58 \pm 0.30$	1.75 ± 0.65

BR, f_L and A_{CP} are tabulated separately.

Charmless VV Polarization Measurements:

BABAR References

- [1] *BABAR* Collaboration (P. del Amo Sanchez *et al.*), Phys. Rev. D **83**, 051101 (2010).
- [2] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **78**, 092008 (2008).
- [3] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **76**, 052007 (2007).
- [4] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **78**, 071104 (2008).
- [5] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **79**, 052005 (2009).
- [6] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **97**, 201801 (2006).
- [7] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **102**, 141802 (2009).
- [8] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **99**, 201802 (2007).
- [9] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **100**, 081801 (2008).
- [10] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **101**, 161801 (2008).
- [11] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **79**, 051102 (2009).
- [12] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **80**, 092007 (2009).
- [13] *BABAR* Collaboration, (J. P. Lees *et al.*), Phys. Rev. D **85**, 072005 (2012).
- [14]
- [15]
- [16]
- [17]
- [18]
- [19]
- [20]

Belle References

- [21] Belle Collaboration (J. Zhang, M. Nakao *et al.*), Phys. Rev. Lett. **91**, 221801 (2003).
- [22] Belle Collaboration, (K.-F. Chen *et al.*), Phys. Rev. Lett. **94**, 221804 (2005).
- [23] Belle Collaboration, (J. Zhang *et al.*), Phys. Rev. Lett. **95**, 141801 (2005).
- [24] Belle Collaboration, (A. Somov *et al.*), Phys. Rev. Lett. **96**, 171801 (2006).
- [25] Belle Collaboration, (P. Goldenzweig *et al.*), Phys. Rev. Lett. **101**, 231801 (2008).
- [26]
- [27]
- [28]
- [29]

CDF References

- [30] CDF Collaboration, (A. Aaltonen *et al.*), Phys. Rev. Lett. **107**, 261802 (2011).

LHCb References

- [31] LHCb Collaboration, (R. Aaij *et al.*), Phys. Lett. B **709**, 50 (2012).
- [32] LHCb Collaboration (R. Aaij *et al.*), Phys. Lett. B **713**, 369 (2012).
- [33] LHCb Collaboration (R. Aaij *et al.*), arXiv:1306.2239 (2013).