

# Heavy Flavor Averaging Group

## April 2008

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

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

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

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	New Avg.
240	$K^{*+}\gamma$	$40.3 \pm 2.6$	$38.7 \pm 2.8 \pm 2.6$	$42.5 \pm 3.1 \pm 2.4$	$37.6^{+8.9}_{-8.3} \pm 2.8$		$40.3 \pm 2.6$
241	$K_1^+(1270)\gamma$	$43 \pm 9 \pm 9$		$43 \pm 9 \pm 9$			$43 \pm 12$
242	$K^+\eta\gamma$	$8.4^{+1.5}_{-1.2} \pm 0.9$	<span style="color: red;"><math>10.0 \pm 1.3 \pm 0.5</math></span>	$8.4^{+1.5}_{-1.2} \pm 0.9$			$9.4 \pm 1.1$
–	$K^+\eta'\gamma$	New	<span style="color: red;"><math>&lt; 4.2</math></span>				$< 4.2$
243	$K^+\phi\gamma$	$3.4 \pm 0.9 \pm 0.4$	<span style="color: red;"><math>3.5 \pm 0.6 \pm 0.4</math></span>	$3.4 \pm 0.9 \pm 0.4$			$3.5 \pm 0.6$
244	$K^+\pi^-\pi^+\gamma$	$25.0 \pm 1.8 \pm 2.2$	<span style="color: red;"><math>29.5 \pm 1.3 \pm 2.0</math></span> †	$25.0 \pm 1.8 \pm 2.2$ ‡			$27.6 \pm 1.8$
–	$K^0\pi^+\pi^0\gamma$	New	<span style="color: red;"><math>45.6 \pm 4.2 \pm 3.1</math></span> †				$45.6 \pm 5.2$
245	$K^{*0}\pi^+\gamma$ §	$20^{+7}_{-6}$		$20^{+7}_{-6} \pm 2$			$20^{+7}_{-6}$
246	$K^+\rho^0\gamma$ §	$< 20$		$< 20$			$< 20$
247	$K^+\pi^-\pi^+\gamma$ (N.R.) §	$< 9.2$		$< 9.2$			$< 9.2$
248	$K_1^+(1400)\gamma$	$< 50$		$< 15$			$< 15$
249	$K_2^{*+}(1430)\gamma$	$14.5 \pm 4.0 \pm 1.5$	$14.5 \pm 4.0 \pm 1.5$				$14.5 \pm 4.3$
251	$K_3^{*+}(1780)\gamma$	$< 39$		$< 39$			$< 39$
253	$\rho^+\gamma$	$< 1.8$	<span style="color: red;"><math>1.10^{+0.37}_{-0.33} \pm 0.09</math></span>	<span style="color: blue;"><math>0.86^{+0.30+0.07}_{-0.28-0.08}</math></span>	$< 13$		$0.96^{+0.24}_{-0.22}$
296	$p\bar{\Lambda}\gamma$	$2.16^{+0.58}_{-0.53} \pm 0.20$		<span style="color: red;"><math>2.45^{+0.44}_{-0.38} \pm 0.22</math></span>			$2.45^{+0.49}_{-0.44}$
297	$p\bar{\Sigma}^0\gamma$	$< 4.6$		$< 4.6$			$< 4.6$
315	$\pi^+e^+e^-$	$< 3900$	<span style="color: red;"><math>&lt; 0.18</math></span>	<span style="color: blue;"><math>&lt; 0.055</math></span>			$< 0.055$
316	$\pi^+\mu^+\mu^-$	$< 9100$	<span style="color: red;"><math>&lt; 0.28</math></span>	<span style="color: blue;"><math>&lt; 0.051</math></span>			$< 0.051$
–	$\pi^+\ell^+\ell^-$	New	<span style="color: red;"><math>&lt; 0.12</math></span>	<span style="color: blue;"><math>&lt; 0.037</math></span>			$< 0.037$
317	$\pi^+\nu\bar{\nu}$	$< 100$	$< 100$	<span style="color: red;"><math>&lt; 170</math></span>			$< 100$
318	$K^+e^+e^-$	$0.80^{+0.22}_{-0.19}$	<span style="color: red;"><math>0.42^{+0.12}_{-0.11} \pm 0.02</math></span>	$0.63^{+0.19}_{-0.17} \pm 0.03$	$< 2.4$		$0.49 \pm 0.10$
319	$K^+\mu^+\mu^-$	$0.34^{+0.19}_{-0.14}$	<span style="color: red;"><math>0.31^{+0.15}_{-0.12} \pm 0.03</math></span>	$0.45^{+0.14}_{-0.12} \pm 0.03$	$< 3.68$	<span style="color: blue;"><math>0.60 \pm 0.15 \pm 0.04</math></span>	$0.45^{+0.09}_{-0.08}$
320	$K^+\ell^+\ell^-$	$0.53^{+0.11}_{-0.10} \pm 0.3$	<span style="color: red;"><math>0.38^{+0.09}_{-0.08} \pm 0.02</math></span>				$0.38^{+0.09}_{-0.08}$
321	$K^+\nu\bar{\nu}$	$< 52$	$< 52$	<span style="color: red;"><math>&lt; 14</math></span>	$< 240$		$< 14$
–	$\rho^+\nu\bar{\nu}$	New		<span style="color: red;"><math>&lt; 150</math></span>			$< 150$
322	$K^{*+}e^+e^-$	$< 4.6$	<span style="color: red;"><math>0.75^{+0.76}_{-0.65} \pm 0.38</math></span>	$2.02^{+1.27+0.23}_{-1.01-0.24}$			$1.23^{+0.69}_{-0.62}$
323	$K^{*+}\mu^+\mu^-$	$< 2.2$	<span style="color: red;"><math>0.97^{+0.94}_{-0.69} \pm 0.14</math></span>	$0.65^{+0.69+0.14}_{-0.53-0.15}$			$0.78^{+0.56}_{-0.44}$
324	$K^{*+}\ell^+\ell^-$	$< 2.2$	<span style="color: red;"><math>0.73^{+0.50}_{-0.42} \pm 0.21</math></span>				$0.73^{+0.54}_{-0.47}$
–	$K^{*+}\nu\bar{\nu}$	New		<span style="color: red;"><math>&lt; 140</math></span>			$< 140$
327	$K^+e^+\mu^-$	$< 0.8$	<span style="color: red;"><math>&lt; 0.09</math></span>				$< 0.09$
328	$K^+e^-\mu^+$	$< 6400$	<span style="color: red;"><math>&lt; 0.13</math></span>				$< 0.13$
–	$K^+\tau^\pm\mu^\mp$	New	<span style="color: red;"><math>&lt; 77</math></span>				$< 77$
329	$K^{*+}e^\pm\mu^\mp$	$< 7.9$	<span style="color: red;"><math>&lt; 1.4</math></span>				$< 1.4$
330	$\pi^-e^+e^+$	$< 1.6$			$< 1.6$		$< 1.6$
331	$\pi^-\mu^+\mu^+$	$< 1.4$			$< 1.4$		$< 1.4$
332	$\pi^-e^+\mu^+$	$< 1.3$			$< 1.3$		$< 1.3$
333	$\rho^-e^+e^+$	$< 2.6$			$< 2.6$		$< 2.6$
334	$\rho^-\mu^+\mu^+$	$< 5.0$			$< 5.0$		$< 5.0$
335	$\rho^-e^+\mu^+$	$< 3.3$			$< 3.3$		$< 3.3$
336	$K^-e^+e^+$	$< 1.0$			$< 1.0$		$< 1.0$
337	$K^-\mu^+\mu^+$	$< 1.8$			$< 1.8$		$< 1.8$
338	$K^-e^+\mu^+$	$< 2.0$			$< 2.0$		$< 2.0$
339	$K^{*-}e^+e^+$	$< 2.8$			$< 2.8$		$< 2.8$
340	$K^{*-}\mu^+\mu^+$	$< 8.3$			$< 8.3$		$< 8.3$
341	$K^{*-}e^+\mu^+$	$< 4.4$			$< 4.4$		$< 4.4$
–	$\pi^+e^\pm\mu^\mp$	New	<span style="color: red;"><math>&lt; 0.17</math></span>				$< 0.17$

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

# Heavy Flavor Averaging Group

April 2008

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

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

In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	New Avg.
213	$K^{*0}\gamma$	$40.1 \pm 2.0$	$39.2 \pm 2.0 \pm 2.4$	$40.1 \pm 2.1 \pm 1.7$	$45.5^{+7.2}_{-6.8} \pm 3.4$		$40.1 \pm 2.0$
214	$K^0\eta\gamma$	$8.7^{+3.1+1.9}_{-2.7-1.6}$	$11.3^{+2.8}_{-2.6} \pm 0.6$	$8.7^{+3.1+1.9}_{-2.7-1.6}$			$10.3^{+2.3}_{-2.1}$
–	$K^0\eta'\gamma$	New	$< 6.6$				$< 6.6$
215	$K^0\phi\gamma$	$< 8.3$	$< 2.7$	$< 8.3$			$< 2.7$
216	$K^+\pi^-\gamma$ §	$4.6 \pm 1.4$		$4.6^{+1.3+0.5}_{-1.2-0.7}$			$4.6 \pm 1.4$
217	$K^{*0}(1410)\gamma$	$< 130$		$< 130$			$< 130$
218	$K^+\pi^-\gamma$ (N.R.) §	$< 2.6$		$< 2.6$			$< 2.6$
219	$K^0\pi^+\pi^-\gamma$	$24 \pm 4 \pm 3$	$18.5 \pm 2.1 \pm 1.2$ †	$24 \pm 4 \pm 3$ ‡			$19.5 \pm 2.2$
–	$K^+\pi^-\pi^0\gamma$	New	$40.7 \pm 2.2 \pm 3.1$ †				$40.7 \pm 3.8$
220	$K_1^0(1270)\gamma$	$< 58$		$< 58$			$< 58$
221	$K_1^0(1400)\gamma$	$< 15$		$< 15$			$< 15$
222	$K_2^{*0}(1430)\gamma$	$12.4 \pm 2.4$	$12.2 \pm 2.5 \pm 1.0$	$13 \pm 5 \pm 1$			$12.4 \pm 2.4$
224	$K_3^{*0}(1780)\gamma$	$< 83$		$< 83$			$< 83$
226	$\rho^0\gamma$	$< 0.4$	$0.79^{+0.22}_{-0.20} \pm 0.06$	$0.76 \pm 0.17 \pm 0.06$	$< 17$		$0.77 \pm 0.14$
227	$\omega\gamma$	$< 0.8$	$0.40^{+0.24}_{-0.20} \pm 0.05$	$0.42^{+0.20}_{-0.18} \pm 0.04$	$< 9.2$		$0.41^{+0.16}_{-0.14}$
228	$\phi\gamma$	$< 0.85$	$< 0.85$		$< 3.3$		$< 0.85$
–	$\pi^0e^+e^-$	New	$< 0.14$	$< 0.143$			$< 0.14$
–	$\pi^0\mu^+\mu^-$	New	$< 0.51$	$< 0.154$			$< 0.154$
–	$\pi^0\ell^+\ell^-$	New	$< 0.12$	$< 0.133$			$< 0.12$
–	$\pi^0\nu\bar{\nu}$	New		$< 220$			$< 220$
293	$K^0e^+e^-$	$< 0.54$	$0.13^{+0.16}_{-0.11} \pm 0.02$	$0.00^{+0.20+0.02}_{-0.12-0.05}$	$< 8.45$		$0.09^{+0.12}_{-0.09}$
294	$K^0\mu^+\mu^-$	$0.20^{+0.13}_{-0.10}$	$0.59^{+0.33}_{-0.26} \pm 0.07$	$0.56^{+0.29}_{-0.23} \pm 0.05$	$< 6.64$		$0.57^{+0.22}_{-0.18}$
295	$K^0\ell^+\ell^-$	$< 0.68$	$0.29^{+0.16}_{-0.13} \pm 0.03$				$0.29^{+0.16}_{-0.13}$
–	$K^0\nu\bar{\nu}$	New		$< 160$			$< 160$
–	$\rho^0\nu\bar{\nu}$	New		$< 440$			$< 440$
296	$K^{*0}e^+e^-$	$< 2.4$	$1.04^{+0.33}_{-0.29} \pm 0.11$	$1.29^{+0.57+0.13}_{-0.49-0.10}$			$1.11^{+0.30}_{-0.26}$
297	$K^{*0}\mu^+\mu^-$	$1.22^{+0.38}_{-0.32}$	$0.87^{+0.38}_{-0.33} \pm 0.12$	$1.33^{+0.42}_{-0.37} \pm 0.11$		$0.82 \pm 0.31 \pm 0.10$	$0.98^{+0.22}_{-0.21}$
298	$K^{*0}\nu\bar{\nu}$	$< 1000$		$< 340$			$< 340$
299	$K^{*0}\ell^+\ell^-$	$1.17 \pm 0.30$	$0.81^{+0.21}_{-0.19} \pm 0.09$				$0.81^{+0.23}_{-0.21}$
–	$\phi\nu\bar{\nu}$	New		$< 58$			$< 58$
–	$\pi^0e^\pm\mu^\mp$	New	$< 0.14$				$< 0.14$
301	$K^0e^\pm\mu^\pm$	$< 4.0$	$< 0.27$				$< 0.27$
302	$K^{*0}e^\pm\mu^\pm$	$< 3.4$	$< 0.58$				$< 0.58$

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

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Compilation of  $B$  Semi-leptonic and Radiative Branching Fractions  
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RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	New Avg.
61	$K_2^*(1430)\gamma$	$1.7 \pm 0.6 \pm 0.1$			$1.7 \pm 0.6 \pm 0.1$	$1.7 \pm 0.6$
63	$K_3^*(1780)\gamma$	$< 37$		$< 2.8$		$< 2.8$
70	$s\gamma$	$343 \pm 29$	$327 \pm 18_{-41}^{+55}$	$325 \pm 16 \pm 24$	$321 \pm 43_{-29}^{+32}$	$352 \pm 23 \pm 9$
–	$s\gamma$ with baryons	New			$< 38 \uparrow$	$< 38 \uparrow$
74	$\rho\gamma$	$< 1.9$	$1.36_{-0.27}^{+0.29} \pm 0.10$	$1.19 \pm 0.24 \pm 0.12$	$< 14$	$1.27_{-0.19}^{+0.20}$
75	$\rho/\omega\gamma$	$< 1.2$	$1.25 \pm 0.25 \pm 0.09$	$1.13 \pm 0.20 \pm 0.11$	$< 14$	$1.18 \pm 0.17$
–	$K\eta\gamma$	New		$8.5_{-1.2}^{+1.3} \pm 0.9$		$8.5_{-1.5}^{+1.6}$
105	$se^+e^- \ddagger$	$4.7 \pm 1.3$	$6.0 \pm 1.7 \pm 1.3$	$4.0 \pm 1.3_{-0.8}^{+0.9}$	$< 57$	$4.7 \pm 1.3$
106	$s\mu^+\mu^-$	$4.3 \pm 1.2$	$5.0 \pm 2.8 \pm 1.2$	$4.1 \pm 1.1_{-0.8}^{+0.9}$	$< 58$	$4.3_{-1.2}^{+1.3}$
107	$sl^+\ell^- \ddagger$	$4.5 \pm 1.0$	$5.6 \pm 1.5 \pm 1.3$	$4.11 \pm 0.83_{-0.81}^{+0.85}$	$< 42$	$4.50_{-1.01}^{+1.03}$
–	$\pi\ell^+\ell^-$	New	$< 0.091$	$< 0.051$		$< 0.051$
108	$Ke^+e^-$	$0.60_{-0.12}^{+0.14}$	$0.33_{-0.08}^{+0.09} \pm 0.02$	$0.48_{-0.13}^{+0.15} \pm 0.03$		$0.38_{-0.07}^{+0.08}$
109	$K^*e^+e^-$	$1.24_{-0.32}^{+0.37}$	$0.97_{-0.27}^{+0.30} \pm 0.14$	$1.49_{-0.46-0.13}^{+0.52+0.11}$		$1.13_{-0.26}^{+0.28}$
110	$K\mu^+\mu^-$	$0.47_{-0.10}^{+0.11}$	$0.35_{-0.11}^{+0.13} \pm 0.03$	$0.48_{-0.11}^{+0.13} \pm 0.04$		$0.42_{-0.08}^{+0.09}$
111	$K^*\mu^+\mu^-$	$1.19_{-0.29}^{+0.34}$	$0.88_{-0.30}^{+0.35} \pm 0.12$	$1.17_{-0.31}^{+0.36} \pm 0.10$		$1.03_{-0.23}^{+0.26}$
112	$K\ell^+\ell^-$	$0.54 \pm 0.08$	$0.34 \pm 0.07 \pm 0.02$	$0.48_{-0.09}^{+0.10} \pm 0.03$	$< 1.7$	$0.39 \pm 0.06$
113	$K^*\ell^+\ell^-$	$1.05 \pm 0.20$	$0.78_{-0.17}^{+0.19} \pm 0.11$	$1.15_{-0.24}^{+0.26} \pm 0.08$	$< 3.3$	$0.94_{-0.16}^{+0.17}$
115	$\pi e^\pm\mu^\mp$	$< 1.6$	$< 0.092$		$< 1.6$	$< 0.092$
116	$\rho e^\pm\mu^\mp$	$< 3.2$			$< 3.2$	$< 3.2$
117	$Ke^\pm\mu^\mp$	$< 1.6$	$< 0.038$		$< 1.6$	$< 0.038$
118	$K^*e^\pm\mu^\mp$	$< 6.2$	$< 0.51$		$< 6.2$	$< 0.51$

$\ddagger E_\gamma >$

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Compilation of  $B$  Inclusive Branching Fractions  
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In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

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

$\dagger p^* > 2.34$  GeV

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April 2008

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

In PDG2006

New since PDG2006 (preliminary)

New since PDG2006 (published)

RPP#	Mode	PDG2006 Avg.	BABAR	Belle	CLEO	CDF	DØ	New Avg.
15	$e^+ \nu$	$< 15$	$< 5.2$	$< 1.0$	$< 15$			$< 1.0$
16	$\mu^+ \nu$	$< 6.6$	$< 5.6$	$< 1.7$	$< 21$			$< 1.7$
17	$\tau^+ \nu$	$< 260$	$120 \pm 40 \pm 36$	$179^{+56+46}_{-49-51}$	$< 840$			$141^{+43}_{-42}$
18	$e^+ \nu e \gamma$	$< 200$			$< 200$			$< 200$
19	$\mu^+ \nu \mu \gamma$	$< 52$			$< 52$			$< 52$
290	$\gamma \gamma$	$< 0.62$	$< 1.7$	$< 0.62$				$< 0.62$
291	$e^+ e^-$	$< 0.061$	$< 0.113$	$< 0.19$	$< 0.83$			$< 0.113$
–	$e^+ e^- \gamma$	New	$< 0.12$					$< 0.12$
292	$\mu^+ \mu^-$	$< 0.039$	$< 0.052$	$< 0.16$	$< 0.61$	$< 0.023$		$< 0.023$
–	$\mu^+ \mu^- \gamma$	New	$< 0.16$					$< 0.16$
–	$\tau^+ \tau^-$	New	$< 4100$					$< 4100$
300	$e^\pm \mu^\mp$	$< 0.17$	$< 0.092$	$< 0.17$	$< 1.5$			$< 0.092$
303	$e^\pm \tau^\mp$	$< 110$	$< 28$		$< 110$			$< 28$
304	$\mu^\pm \tau^\mp$	$< 38$	$< 22$		$< 38$			$< 22$
305	$\nu \bar{\nu}$	$< 220$	$< 220$					$< 220$
306	$\nu \bar{\nu} \gamma$	$< 47$	$< 47$					$< 47$

# Radiative and Leptonic Decays:

## *BABAR* References

- [1] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **70**, 112006 (2004).
- [2] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **98**, 151802 (2007).
- [3] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **73**, 092001 (2006).
- [4] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **94**, 101801 (2005).
- [5] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **77**, 032007 (2008).
- [6] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **74**, 031102 (2006).
- [7] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **70**, 091105 (2004).
- [8] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **93**, 081802 (2004).
- [9] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **77**, 011107 (2008).
- [10] *BABAR* Collaboration (B. Aubert *et al.*), arXiv:0801.0697 (2008).
- [11] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **72**, 091103 (2005).
- [12] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **93**, 091802 (2004).
- [13] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **72**, 052004 (2005).
- [14] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **87**, 241803 (2001).
- [15] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **98**, 211804 (2007).
- [16] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **96**, 241802 (2006).
- [17] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **75**, 051102 (2007).
- [18] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **99**, 051801 (2007).
- [19] *BABAR* Collaboration (B. Aubert *et al.*), hep-ex/0607053 (ICHEP06 contributed paper).
- [20] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. D **77**, 011104 (2008).
- [21] *BABAR* Collaboration (B. Aubert *et al.*), Phys. Rev. Lett. **99**, 201801 (2007).
- [22]
- [23]
- [24]
- [25]
- [26]
- [27]
- [28]
- [29]
- [30]

## Belle References

- [31] Belle Collaboration (K. Abe *et al.*), Phys. Rev. Lett. **91**, 261601 (2003).
- [32] Belle Collaboration (M. Nakao *et al.*), Phys. Rev. D **69**, 112001 (2004).
- [33] Belle Collaboration (S. Nishida *et al.*), Phys. Rev. Lett. **89**, 231801 (2002).
- [34] Belle Collaboration (K. Ikado *et al.*), Phys. Rev. Lett. **97**, 251802 (2006).
- [35] Belle Collaboration (K. Abe *et al.*), Phys. Lett. B **647**, 67 (2007).
- [36] Belle Collaboration (M.-C. Chang *et al.*), Phys. Rev. D **68**, 111101 (2003).
- [37] Belle Collaboration, talk by A. Limosani at Moriond EW (2008).
- [38] Belle Collaboration (M. Iwasaki *et al.*), Phys. Rev. D **72**, 092005 (2005).
- [39] Belle Collaboration (D. Drutskoy *et al.*), Phys. Rev. Lett. **92**, 051801 (2004).
- [40] Belle Collaboration (K.-F. Chen *et al.*), Phys. Rev. Lett. **99**, 221802 (2007).
- [41] Belle Collaboration (Y.-J. Lee, M.-Z. Wang *et al.*), Phys. Rev. Lett. **95**, 061802 (2005).
- [42] Belle Collaboration (H. Yang *et al.*), Phys. Rev. Lett. **94**, 111802 (2005).
- [43] Belle Collaboration (S. Nishida *et al.*), Phys. Lett. B **610**, 23 (2005).
- [44] Belle Collaboration (K. Abe *et al.*), BELLE-CONF-0738 (2007).
- [45] Belle Collaboration (M.-Z. Wang, Y.-J. Lee *et al.*), Phys. Rev. D **76**, 052004 (2007).
- [46] Belle Collaboration (K. Abe *et al.*), BELLE-CONF-0769 (2007).
- [47]
- [48] Belle Collaboration (S. Villa *et al.*), Phys. Rev. D **73**, 051107 (2006).
- [49]
- [50]

## CLEO References

- [51] CLEO Collaboration (M. Artuso *et al.*), Phys. Rev. Lett. **75**, 785 (1995).
- [52] CLEO Collaboration (T.E. Coan *et al.*), Phys. Rev. Lett. **84**, 5283 (2000).
- [53] CLEO Collaboration (S. Anderson *et al.*), Phys. Rev. Lett. **87**, 181803 (2001).
- [54] CLEO Collaboration (T. Browder *et al.*), Phys. Rev. Lett. **86**, 2950 (2001).
- [55] CLEO Collaboration (K.W. Edwards *et al.*), Phys. Rev. D **65**, 111102R (2002).
- [56] CLEO Collaboration (T. Bergfeld *et al.*), Phys. Rev. D **62**, 091102R (2000).
- [57] CLEO Collaboration (S. Chen *et al.*), Phys. Rev. Lett. **87**, 251807 (2002).
- [58] CLEO Collaboration (S. Glenn *et al.*), Phys. Rev. Lett. **80**, 2289 (1998).
- [59] CLEO Collaboration (K.W. Edwards *et al.*), Phys. Rev. D **65**, 111102 (2002).
- [60] CLEO Collaboration (K.W. Edwards *et al.*), Phys. Rev. D **68**, 011102 (2003).
- [61] CLEO Collaboration (T. Browder *et al.*), Phys. Rev. D **56**, 11 (1997).
- [62] CLEO Collaboration (A. Bornheim *et al.*), Phys. Rev. Lett. **93**, 241802 (2004).
- [63]
- [64]

## Tevatron References

- [65] CDF Collaboration, talk by M. Rescigno at CKM 2006, Nagoya, Japan, Dec. 2006.
- [66] CDF Collaboration (A. Aaltonen *et al.*), Phys. Rev. Lett. **100**, 102001 (2008).