

# LIGHT UNFLAVORED MESONS

## ( $S = C = B = 0$ )

For  $I = 1$  ( $\pi, b, \rho, a$ ):  $u\bar{d}, (u\bar{u}-d\bar{d})/\sqrt{2}, d\bar{u}$ ;  
for  $I = 0$  ( $\eta, \eta', h, h', \omega, \phi, f, f'$ ):  $c_1(u\bar{u} + d\bar{d}) + c_2(s\bar{s})$

NODE=MXXX005

 **$f_0(500)$** 

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M014

also known as  $\sigma$ ; was  $f_0(600)$ 

See the review on "Scalar Mesons below 1 GeV."

Mass (T-Matrix Pole  $\sqrt{s}$ ) = (400–550)– $i$ (200–350) MeV

Mass (Breit-Wigner) = 400 to 800 MeV

Full width (Breit-Wigner) = 100 to 800 MeV

NODE=M014PP;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M014M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M014W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

<b><math>f_0(500)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\pi$	seen	–
$\gamma\gamma$	seen	–

NODE=M014215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=5;OUR EST;→ UNCHECKED ←

 **$\rho(770)$** 

$$I^G(J^{PC}) = 1^+(1^{--})$$

NODE=M009

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole  $\sqrt{s} = (761-765) - i(71-74)$  MeVMass (Breit-Wigner) =  $775.26 \pm 0.23$  MeVFull width (Breit-Wigner) =  $149.1 \pm 0.8$  MeV

NODE=M009PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M009M0;DTYPE=M  
NODE=M009W5;DTYPE=G

<b><math>\rho(770)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$\pi\pi$	~ 100	%	363
<b><math>\rho(770)^\pm</math> decays</b>			
$\pi^\pm\gamma$	( $4.5 \pm 0.5$ )	$\times 10^{-4}$	S=2.2 375
$\pi^\pm\eta$	< 6	$\times 10^{-3}$	CL=84% 152
$\pi^\pm\pi^+\pi^-\pi^0$	< 2.0	$\times 10^{-3}$	CL=84% 254
<b><math>\rho(770)^0</math> decays</b>			
$\pi^+\pi^-\gamma$	( $9.9 \pm 1.6$ )	$\times 10^{-3}$	362
$\pi^0\gamma$	( $4.7 \pm 0.8$ )	$\times 10^{-4}$	S=1.7 376
$\eta\gamma$	( $3.00 \pm 0.21$ )	$\times 10^{-4}$	194
$\pi^0\pi^0\gamma$	( $4.5 \pm 0.8$ )	$\times 10^{-5}$	363
$\mu^+\mu^-$	[a] ( $4.55 \pm 0.28$ )	$\times 10^{-5}$	373
$e^+e^-$	[a] ( $4.72 \pm 0.05$ )	$\times 10^{-5}$	388
$\pi^+\pi^-\pi^0$	( $1.01^{+0.54}_{-0.36} \pm 0.34$ )	$\times 10^{-4}$	323
$\pi^+\pi^-\pi^+\pi^-$	( $1.8 \pm 0.9$ )	$\times 10^{-5}$	251
$\pi^+\pi^-\pi^0\pi^0$	( $1.6 \pm 0.8$ )	$\times 10^{-5}$	257
$\pi^0e^+e^-$	< 1.2	$\times 10^{-5}$	CL=90% 376

NODE=M009225;DESIG=1;OUR EVAL;  
→ UNCHECKED ←

NODE=M009;CLUMP=A  
DESIG=3  
DESIG=5  
DESIG=21

NODE=M009;CLUMP=B

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=22

DESIG=30

DESIG=9

 **$\omega(782)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M001

Mass  $m = 782.66 \pm 0.13$  MeV ( $S = 2.0$ )Full width  $\Gamma = 8.68 \pm 0.13$  MeV

NODE=M001M;DTYPE=M

NODE=M001W;DTYPE=G

$\omega(782)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$\pi^+\pi^-\pi^0$	(89.2 $\pm$ 0.7 ) %		327	NODE=M001215;DESIG=1
$\pi^0\gamma$	( 8.35 $\pm$ 0.27) %	S=2.2	380	DESIG=3
$\pi^+\pi^-$	( 1.53 $^{+0.11}_{-0.13}$ ) %	S=1.2	366	DESIG=2
neutrals (excluding $\pi^0\gamma$ )	( 7 $^{+8}_{-4}$ ) $\times 10^{-3}$	S=1.1	–	DESIG=13
$\eta\gamma$	( 4.5 $\pm$ 0.4 ) $\times 10^{-4}$	S=1.1	200	DESIG=6
$\pi^0e^+e^-$	( 7.7 $\pm$ 0.6 ) $\times 10^{-4}$		380	DESIG=14
$\pi^0\mu^+\mu^-$	( 1.34 $\pm$ 0.18) $\times 10^{-4}$	S=1.5	349	DESIG=11
$e^+e^-$	( 7.38 $\pm$ 0.22) $\times 10^{-5}$	S=1.9	391	DESIG=7
$\pi^+\pi^-\pi^0\pi^0$	< 2 $\times 10^{-4}$	CL=90%	262	DESIG=12
$\pi^+\pi^-\gamma$	< 3.6 $\times 10^{-3}$	CL=95%	366	DESIG=4
$\pi^+\pi^-\pi^+\pi^-$	< 1 $\times 10^{-3}$	CL=90%	256	DESIG=15
$\pi^0\pi^0\gamma$	( 6.7 $\pm$ 1.1 ) $\times 10^{-5}$		367	DESIG=5
$\eta\pi^0\gamma$	< 3.3 $\times 10^{-5}$	CL=90%	162	DESIG=17
$\mu^+\mu^-$	( 7.4 $\pm$ 1.8 ) $\times 10^{-5}$		377	DESIG=8
$3\gamma$	< 1.9 $\times 10^{-4}$	CL=95%	391	DESIG=10
<b>Charge conjugation (C) violating modes</b>				
$\eta\pi^0$	C < 2.1 $\times 10^{-4}$	CL=90%	162	NODE=M001;CLUMP=A
$2\pi^0$	C < 2.2 $\times 10^{-4}$	CL=90%	367	DESIG=9
$3\pi^0$	C < 2.3 $\times 10^{-4}$	CL=90%	330	DESIG=193
invisible	< 7 $\times 10^{-5}$	CL=90%	–	DESIG=16
				DESIG=194

 **$\eta'(958)$** 

$$I^G(J^{PC}) = 0^+(0^-+)$$

Mass  $m = 957.78 \pm 0.06$  MeVFull width  $\Gamma = 0.188 \pm 0.006$  MeV

NODE=M002

NODE=M002M;DTYPE=M

NODE=M002W;DTYPE=G

$\eta'(958)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$\pi^+\pi^-\eta$	(42.5 $\pm$ 0.5 ) %		232	NODE=M002215;DESIG=1
$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$ )	(29.5 $\pm$ 0.4 ) %		165	DESIG=9
$\pi^0\pi^0\eta$	(22.4 $\pm$ 0.5 ) %		239	DESIG=2
$\omega\gamma$	( 2.52 $\pm$ 0.07 ) %		159	DESIG=7
$\omega e^+e^-$	( 2.0 $\pm$ 0.4 ) $\times 10^{-4}$		159	DESIG=205
$\gamma\gamma$	( 2.307 $\pm$ 0.033) %		479	DESIG=6
$3\pi^0$	( 2.50 $\pm$ 0.17 ) $\times 10^{-3}$		430	DESIG=8
$\mu^+\mu^-\gamma$	( 1.13 $\pm$ 0.28 ) $\times 10^{-4}$		467	DESIG=20
$\pi^+\pi^-\mu^+\mu^-$	( 2.0 $\pm$ 0.4 ) $\times 10^{-5}$		401	DESIG=201
$\pi^+\pi^-\pi^0$	( 3.61 $\pm$ 0.17 ) $\times 10^{-3}$		428	DESIG=121
( $\pi^+\pi^-\pi^0$ ) S-wave	( 3.8 $\pm$ 0.5 ) $\times 10^{-3}$		428	DESIG=211
$\pi^\mp\rho^\pm$	( 7.4 $\pm$ 2.3 ) $\times 10^{-4}$		106	DESIG=210
$2(\pi^+\pi^-)$	( 8.4 $\pm$ 0.9 ) $\times 10^{-5}$		372	DESIG=131
$\pi^+\pi^-2\pi^0$	( 1.8 $\pm$ 0.4 ) $\times 10^{-4}$		376	DESIG=202
$2(\pi^+\pi^-)$ neutrals	< 1 %	95%	–	DESIG=132
$2(\pi^+\pi^-)\pi^0$	< 1.8 $\times 10^{-3}$	90%	298	DESIG=141
$2(\pi^+\pi^-)2\pi^0$	< 1 %	95%	197	DESIG=15
$3(\pi^+\pi^-)$	< 3.1 $\times 10^{-5}$	90%	189	DESIG=203
$K^\pm\pi^\mp$	< 4 $\times 10^{-5}$	90%	334	DESIG=207
$\pi^+\pi^-e^+e^-$	( 2.42 $\pm$ 0.10 ) $\times 10^{-3}$		458	DESIG=10
$\pi^+e^-\nu_e + \text{c.c.}$	< 2.1 $\times 10^{-4}$	90%	469	DESIG=204
$\gamma e^+e^-$	( 4.91 $\pm$ 0.27 ) $\times 10^{-4}$		479	DESIG=28
$\pi^0\gamma\gamma$	( 3.20 $\pm$ 0.24 ) $\times 10^{-3}$		469	DESIG=24
$\pi^0\gamma\gamma$ (non resonant)	( 6.2 $\pm$ 0.9 ) $\times 10^{-4}$		–	DESIG=212
$\eta\gamma\gamma$	< 1.33 $\times 10^{-4}$	90%	322	DESIG=214
$4\pi^0$	< 4.94 $\times 10^{-5}$	90%	380	DESIG=26
$e^+e^-$	< 5.6 $\times 10^{-9}$	90%	479	DESIG=150
$e^+e^-e^+e^-$	( 4.5 $\pm$ 1.1 ) $\times 10^{-6}$		479	DESIG=215
invisible	< 6 $\times 10^{-4}$	90%	–	DESIG=200

**Charge conjugation (C), Parity (P),  
Lepton family number (LF) violating modes**

$\pi^+ \pi^-$	$P, CP$	$< 1.8$	$\times 10^{-5}$	90%	458
$\pi^0 \pi^0$	$P, CP$	$< 4$	$\times 10^{-4}$	90%	459
$\pi^0 e^+ e^-$	$C$	$[b] < 1.4$	$\times 10^{-3}$	90%	469
$\pi^0 \rho^0$	$C$	$< 4$	%	90%	111
$\eta e^+ e^-$	$C$	$[b] < 2.4$	$\times 10^{-3}$	90%	322
$3\gamma$	$C$	$< 1.0$	$\times 10^{-4}$	90%	479
$\mu^+ \mu^- \pi^0$	$C$	$[b] < 6.0$	$\times 10^{-5}$	90%	445
$\mu^+ \mu^- \eta$	$C$	$[b] < 1.5$	$\times 10^{-5}$	90%	273
$e\mu$	$LF$	$< 4.7$	$\times 10^{-4}$	90%	473

NODE=M002;CLUMP=B

DESIG=111

DESIG=25

DESIG=16

DESIG=18

DESIG=17

DESIG=23

DESIG=22

DESIG=21

DESIG=27

 **$f_0(980)$** 

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M003

See the review on "Scalar Mesons below 1 GeV."

T-matrix pole  $\sqrt{s} = (980-1010) - i(20-35)$  MeV [c]Mass (Breit-Wigner) =  $990 \pm 20$  MeV [c]

Full width (Breit-Wigner) = 10 to 100 MeV [c]

NODE=M003PP;DTYPE=p;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=M003M1;DTYPE=M;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=M003W1;DTYPE=G;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$

<b><math>f_0(980)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\pi$	seen	476
$K\bar{K}$	seen	36
$\gamma\gamma$	seen	495

NODE=M003215;DESIG=2;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 DESIG=1;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
 DESIG=5;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

 **$a_0(980)$** 

$$I^G(J^{PC}) = 1^-(0^{++})$$

NODE=M036

See the review on "Scalar Mesons below 1 GeV."

T-matrix pole  $\sqrt{s} = (960-1030) - i(20-70)$  MeV [c]Mass  $m = 980 \pm 20$  MeV [c]Full width  $\Gamma = 50$  to 100 MeV [c]

NODE=M036PP;DTYPE=p;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=M036M1;DTYPE=M;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=M036W1;DTYPE=G;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$

<b><math>a_0(980)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\eta\pi$	seen	319
$K\bar{K}$	seen	†
$\eta'\pi$	seen	†
$\rho\pi$	not seen	137
$\gamma\gamma$	seen	490

NODE=M036215;DESIG=1;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 DESIG=3;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
 DESIG=8  
 DESIG=2;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
 DESIG=5;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$

 **$\phi(1020)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M004

Mass  $m = 1019.461 \pm 0.016$  MeVFull width  $\Gamma = 4.249 \pm 0.013$  MeV ( $S = 1.1$ )

NODE=M004M;DTYPE=M

NODE=M004W;DTYPE=G

$\phi(1020)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$K^+ K^-$	(49.1 $\pm$ 0.5 )%	S=1.3	127	NODE=M004215;DESIG=1
$K_L^0 K_S^0$	(33.9 $\pm$ 0.4 )%	S=1.2	110	DESIG=2
$\rho\pi + \pi^+\pi^-\pi^0$	(15.4 $\pm$ 0.4 )%	S=1.2	–	DESIG=24
$\eta\gamma$	( 1.301 $\pm$ 0.025 )%	S=1.2	363	DESIG=4
$\pi^0\gamma$	( 1.32 $\pm$ 0.05 ) $\times 10^{-3}$		501	DESIG=7
$\ell^+\ell^-$	–		510	DESIG=256;OUR EVAL;→ UNCHECKED ←
$e^+e^-$	( 2.979 $\pm$ 0.033 ) $\times 10^{-4}$	S=1.3	510	DESIG=5
$\mu^+\mu^-$	( 2.85 $\pm$ 0.19 ) $\times 10^{-4}$		499	DESIG=6
$\eta e^+e^-$	( 1.08 $\pm$ 0.04 ) $\times 10^{-4}$		363	DESIG=17
$\pi^+\pi^-$	( 7.3 $\pm$ 1.3 ) $\times 10^{-5}$		490	DESIG=8
$\omega\pi^0$	( 4.7 $\pm$ 0.5 ) $\times 10^{-5}$		171	DESIG=25
$\omega\gamma$	< 5 %	CL=84%	209	DESIG=10
$\rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%	215	DESIG=12
$\pi^+\pi^-\gamma$	( 4.1 $\pm$ 1.3 ) $\times 10^{-5}$		490	DESIG=9
$f_0(980)\gamma$	( 3.22 $\pm$ 0.19 ) $\times 10^{-4}$	S=1.1	29	DESIG=20
$\pi^0\pi^0\gamma$	( 1.12 $\pm$ 0.06 ) $\times 10^{-4}$		492	DESIG=19
$\pi^+\pi^-\pi^+\pi^-$	( 3.9 $\pm$ 2.8 ) $\times 10^{-6}$		410	DESIG=15
$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6 $\times 10^{-6}$	CL=90%	342	DESIG=14
$\pi^0 e^+ e^-$	( 1.33 $\pm$ 0.07 ) $\times 10^{-5}$		501	DESIG=21
$\pi^0\eta\gamma$	( 7.27 $\pm$ 0.30 ) $\times 10^{-5}$	S=1.5	346	DESIG=22
$a_0(980)\gamma$	( 7.6 $\pm$ 0.6 ) $\times 10^{-5}$		39	DESIG=23
$K^0\bar{K}^0\gamma$	< 1.9 $\times 10^{-8}$	CL=90%	110	DESIG=257
$\eta'(958)\gamma$	( 6.21 $\pm$ 0.21 ) $\times 10^{-5}$		60	DESIG=194
$\eta\pi^0\pi^0\gamma$	< 2 $\times 10^{-5}$	CL=90%	293	DESIG=195
$\mu^+\mu^-\gamma$	( 1.4 $\pm$ 0.5 ) $\times 10^{-5}$		499	DESIG=196
$\rho\gamma\gamma$	< 1.2 $\times 10^{-4}$	CL=90%	215	DESIG=250
$\eta\pi^+\pi^-$	< 1.8 $\times 10^{-5}$	CL=90%	288	DESIG=255
$\eta\mu^+\mu^-$	< 9.4 $\times 10^{-6}$	CL=90%	321	DESIG=26
$\eta U \rightarrow \eta e^+ e^-$	< 1 $\times 10^{-6}$	CL=90%	–	DESIG=259
invisible	< 1.7 $\times 10^{-4}$	CL=90%	–	DESIG=260
<b>Lepton Family number (LF) violating modes</b>				
$e^\pm\mu^\mp$	LF < 2	$\times 10^{-6}$ CL=90%	504	NODE=M004;CLUMP=A DESIG=258

 **$h_1(1170)$** 

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Mass  $m = 1166 \pm 6$  MeVFull width  $\Gamma = 375 \pm 35$  MeV

NODE=M030

NODE=M030M;DTYPE=M

NODE=M030W;DTYPE=G

 **$h_1(1170)$  DECAY MODES**

	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\rho\pi$	seen	305

NODE=M030215;DESIG=1;OUR EST;  
→ UNCHECKED ← **$b_1(1235)$** 

$$I^G(J^{PC}) = 1^+(1^{+-})$$

Mass  $m = 1229.5 \pm 3.2$  MeV ( $S = 1.6$ )Full width  $\Gamma = 142 \pm 9$  MeV ( $S = 1.2$ )

NODE=M011

NODE=M011M;DTYPE=M

NODE=M011W;DTYPE=G

<b><math>b_1(1235)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\omega\pi$ [D/S amplitude ratio = $0.277 \pm 0.027$ ]	seen		348
$\pi^\pm\gamma$	$(1.6 \pm 0.4) \times 10^{-3}$		607
$\eta\rho$	seen		†
$\pi^+\pi^+\pi^-\pi^0$	< 50 %	84%	535
$K^*(892)^\pm K^\mp$	seen		†
$(K\bar{K})^\pm\pi^0$	< 8 %	90%	248
$K_S^0 K_S^0 \pi^\pm$	< 6 %	90%	235
$K_S^0 K_S^0 \pi^\pm$	< 2 %	90%	235
$\phi\pi$	< 1.5 %	84%	147

NODE=M011215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=9  
DESIG=8;OUR EST;→ UNCHECKED ←  
DESIG=2;OUR EST;→ UNCHECKED ←  
DESIG=74  
DESIG=71;OUR EST;→ UNCHECKED ←  
DESIG=73;OUR EST;→ UNCHECKED ←  
DESIG=72;OUR EST;→ UNCHECKED ←  
DESIG=5;OUR EST;→ UNCHECKED ←

 **$a_1(1260)$  [d]**

$$I^G(J^{PC}) = 1^-(1^{++})$$

T-Matrix Pole  $\sqrt{s} = (1209 \pm 4_{-9}^{+12}) - i(288 \pm 6_{-10}^{+45})$  MeV  
Mass (Breit-Wigner) =  $1230 \pm 40$  MeV [c]  
Full width (Breit-Wigner) = 250 to 600 MeV [c]

NODE=M010

NODE=M010PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M010M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M010W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

<b><math>a_1(1260)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$3\pi$	seen	577
$(\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen	353
$(\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen	353
$(\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen	†
$(\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen	†
$f_0(500)\pi, f_0 \rightarrow \pi\pi$	seen	—
$f_0(980)\pi, f_0 \rightarrow \pi\pi$	seen	179
$f_0(1370)\pi, f_0 \rightarrow \pi\pi$	seen	†
$f_2(1270)\pi, f_2 \rightarrow \pi\pi$	seen	†
$\pi^+\pi^-\pi^0$	seen	576
$\pi^0\pi^0\pi^0$	not seen	577
$KK\pi$	seen	250
$K^*(892)K$	seen	†
$\pi\gamma$	seen	608

NODE=M010215;DESIG=17;OUR EST;  
→ UNCHECKED ←  
DESIG=7;OUR EST;→ UNCHECKED ←  
DESIG=8;OUR EST;→ UNCHECKED ←  
DESIG=9;OUR EST;→ UNCHECKED ←  
DESIG=10;OUR EST;→ UNCHECKED ←  
DESIG=16;OUR EST;→ UNCHECKED ←  
DESIG=11  
DESIG=12;OUR EST;→ UNCHECKED ←  
DESIG=13;OUR EST;→ UNCHECKED ←  
DESIG=22  
DESIG=23;OUR EST;→ UNCHECKED ←  
DESIG=18;OUR EST;→ UNCHECKED ←  
DESIG=14;OUR EST;→ UNCHECKED ←  
DESIG=4;OUR EST;→ UNCHECKED ←

 **$f_2(1270)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

T-Matrix Pole  $\sqrt{s} = (1260-1283) - i(90-110)$  MeV  
Mass (Breit-Wigner) =  $1275.4 \pm 0.8$  MeV ( $S = 1.1$ )  
Full width (Breit-Wigner) =  $186.6 \pm 2.3$  MeV ( $S = 1.5$ )

NODE=M005

NODE=M005PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M005M;DTYPE=M  
NODE=M005W;DTYPE=G

<b><math>f_2(1270)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$\pi\pi$	$(84.3 \pm 2.9_{-0.9})\%$	$S=1.2$	623
$\pi^+\pi^-\pi^0$	$(7.7 \pm 1.1_{-3.2})\%$	$S=1.2$	563
$K\bar{K}$	$(4.6 \pm 0.4)\%$	$S=2.7$	404
$2\pi^+2\pi^-$	$(2.8 \pm 0.4)\%$	$S=1.2$	559
$\eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	$S=2.1$	326
$4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$		565
$\gamma\gamma$	$(1.42 \pm 0.24) \times 10^{-5}$	$S=1.4$	638
$\eta\pi\pi$	< 8 $\times 10^{-3}$	CL=95%	478
$K^0 K^- \pi^+ + \text{c.c.}$	< 3.4 $\times 10^{-3}$	CL=95%	293
$e^+e^-$	< 6 $\times 10^{-10}$	CL=90%	638

NODE=M005215;DESIG=1

DESIG=3

DESIG=4

DESIG=2

DESIG=7

DESIG=9

DESIG=8

DESIG=6

DESIG=5

DESIG=10

 **$f_1(1285)$** 

$$I^G(J^{PC}) = 0^+(1^{++})$$

Mass  $m = 1281.9 \pm 0.5$  MeV ( $S = 1.8$ )  
Full width  $\Gamma = 22.7 \pm 1.1$  MeV ( $S = 1.5$ )

NODE=M008

NODE=M008M;DTYPE=M

NODE=M008W;DTYPE=G

$f_1(1285)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$4\pi$	(32.7 ± 1.9) %	S=1.2	568	NODE=M008215;DESIG=21
$\pi^0\pi^0\pi^+\pi^-$	(21.8 ± 1.3) %	S=1.2	566	DESIG=22
$2\pi^+2\pi^-$	(10.9 ± 0.6) %	S=1.2	563	DESIG=20
$\rho^0\pi^+\pi^-$	(10.9 ± 0.6) %	S=1.2	336	DESIG=191
$\rho^0\rho^0$	seen		†	DESIG=23
$4\pi^0$	< 7 × 10 <sup>-4</sup>	CL=90%	568	DESIG=7
$\eta\pi^+\pi^-$	(35 ± 15) %		479	DESIG=198
$\eta\pi\pi$	(52.2 ± 2.0) %	S=1.2	482	DESIG=3
$a_0(980)\pi$ [ignoring $a_0(980) \rightarrow K\bar{K}$ ]	(38 ± 4) %		238	DESIG=4
$\eta\pi\pi$ [excluding $a_0(980)\pi$ ]	(14 ± 4) %		482	DESIG=5
$K\bar{K}\pi$	(9.0 ± 0.4) %	S=1.1	308	DESIG=1
$K\bar{K}^*(892)$	not seen		†	DESIG=6
$\pi^+\pi^-\pi^0$	(3.0 ± 0.9) × 10 <sup>-3</sup>		603	DESIG=197
$\rho^\pm\pi^\mp$	< 3.1 × 10 <sup>-3</sup>	CL=95%	390	DESIG=199
$\gamma\rho^0$	(6.1 ± 1.0) %	S=1.7	406	DESIG=13
$\phi\gamma$	(7.4 ± 2.6) × 10 <sup>-4</sup>		236	DESIG=10
$e^+e^-$	< 9.4 × 10 <sup>-9</sup>	CL=90%	641	DESIG=200

 **$\eta(1295)$** 

$$I^G(J^{PC}) = 0^+(0^-+)$$

NODE=M037

See the review on "Spectroscopy of Light Meson Resonances."

Mass  $m = 1294 \pm 4$  MeV (S = 1.6)Full width  $\Gamma = 55 \pm 5$  MeV

NODE=M037M;DTYPE=M

NODE=M037W;DTYPE=G

$\eta(1295)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\eta\pi^+\pi^-$	seen	487	NODE=M037215;DESIG=2;OUR EST;
$a_0(980)\pi$	seen	248	→ UNCHECKED ← DESIG=1;OUR EST;→ UNCHECKED ←
$\eta\pi^0\pi^0$	seen	490	DESIG=4;OUR EST;→ UNCHECKED ←
$\eta(\pi\pi)$ S-wave	seen	—	DESIG=5;OUR EST;→ UNCHECKED ←
$\sigma\eta$	seen	—	DESIG=6;OUR EST;→ UNCHECKED ←
$K\bar{K}\pi$	seen	320	DESIG=7;OUR EST;→ UNCHECKED ←

 **$\pi(1300)$** 

$$I^G(J^{PC}) = 1^-(0^-+)$$

NODE=M058

Mass  $m = 1300 \pm 100$  MeV [c]Full width  $\Gamma = 200$  to 600 MeV [c]

NODE=M058M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=M058W;DTYPE=G;OUR EST;

→ UNCHECKED ←

$\pi(1300)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\rho\pi$	seen	404	NODE=M058215;DESIG=1;OUR EST;
$\pi(\pi\pi)$ S-wave	seen	—	→ UNCHECKED ← DESIG=3;OUR EST;→ UNCHECKED ←

 **$a_2(1320)$** 

$$I^G(J^{PC}) = 1^-(2^++)$$

NODE=M012

T-Matrix Pole  $\sqrt{s} = (1305-1321)-i(52-58)$  MeV

Mass (Breit-Wigner) = 1318.2 ± 0.6 MeV (S = 1.2)

Full width (Breit-Wigner) = 107 ± 5 MeV [c]

NODE=M012PP;DTYPE=p;OUR EST;

→ UNCHECKED ←

NODE=M012M0;DTYPE=M

NODE=M012W0;DTYPE=G;OUR EST;

→ UNCHECKED ←

$a_2(1320)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$3\pi$	(70.1 $\pm$ 2.7 ) %	S=1.2	624
$\eta\pi$	(14.5 $\pm$ 1.2 ) %		535
$\omega\pi\pi$	(10.6 $\pm$ 3.2 ) %	S=1.3	366
$K\bar{K}$	( 4.9 $\pm$ 0.8 ) %		437
$\eta'(958)\pi$	( 5.5 $\pm$ 0.9 ) $\times 10^{-3}$		288
$\pi^\pm\gamma$	( 2.91 $\pm$ 0.27) $\times 10^{-3}$		652
$\gamma\gamma$	( 9.4 $\pm$ 0.7 ) $\times 10^{-6}$		659
$e^+e^-$	< 5 $\times 10^{-9}$	CL=90%	659

NODE=M012215;DESIG=1  
DESIG=3  
DESIG=4  
DESIG=2  
DESIG=8  
DESIG=7  
DESIG=9  
DESIG=10

 **$f_0(1370)$** 

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M147

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole  $\sqrt{s} = (1250-1440) - i (60-300)$  MeV

Mass (Breit-Wigner) = 1200 to 1500 MeV

Full width (Breit-Wigner) = 200 to 500 MeV

NODE=M147PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M147M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M147W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

$f_0(1370)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\pi$	seen	672
$4\pi$	seen	617
$4\pi^0$	seen	617
$2\pi^+2\pi^-$	seen	612
$\pi^+\pi^-2\pi^0$	seen	615
$\rho\rho$	seen	†
$2(\pi\pi)_S$ -wave	seen	-
$\pi(1300)\pi$	seen	†
$a_1(1260)\pi$	seen	35
$\eta\eta$	seen	411
$K\bar{K}$	seen	475
$K\bar{K}n\pi$	not seen	†
$6\pi$	not seen	508
$\omega\omega$	not seen	†
$\gamma\gamma$	seen	685
$e^+e^-$	not seen	685

NODE=M147215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=10;OUR EST;→ UNCHECKED ←  
DESIG=4;OUR EST;→ UNCHECKED ←  
DESIG=5;OUR EST;→ UNCHECKED ←  
DESIG=6;OUR EST;→ UNCHECKED ←  
DESIG=14;OUR EST;→ UNCHECKED ←  
DESIG=15;OUR EST;→ UNCHECKED ←  
DESIG=16;OUR EVAL;→ UNCHECKED ←  
DESIG=17;OUR EVAL;→ UNCHECKED ←  
DESIG=2;OUR EST;→ UNCHECKED ←  
DESIG=11;OUR EST;→ UNCHECKED ←  
DESIG=18;OUR EVAL;→ UNCHECKED ←  
DESIG=19;OUR EVAL;→ UNCHECKED ←  
DESIG=20;OUR EVAL;→ UNCHECKED ←  
DESIG=12;OUR EST;→ UNCHECKED ←  
DESIG=13;OUR EST;→ UNCHECKED ←

 **$\pi_1(1400)$** 

$$I^G(J^{PC}) = 1^-(1^{-+})$$

NODE=M111

Coupled channel analyses favor the existence of only one broad  $1^{-+}$

isovector state consistent with  $\pi_1(1600)$  in the 1400-1600 MeV

region. See the review on "Spectroscopy of Light Meson

Resonances." See also  $\pi_1(1600)$ .

T-Matrix Pole  $\sqrt{s} = (1405 \pm 4_{-18}^{+15}) - i (314 \pm 14_{-69}^{+18})$  MeV

Mass (Breit-Wigner) =  $1354 \pm 25$  MeV (S = 1.8)

Full width (Breit-Wigner) =  $330 \pm 35$  MeV

NODE=M111PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M111M;DTYPE=M  
NODE=M111W;DTYPE=G

$\pi_1(1400)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\eta\pi^0$	seen	557
$\eta\pi^-$	seen	556
$\rho(770)\pi$	not seen	442

NODE=M111215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=4;OUR EST;→ UNCHECKED ←  
DESIG=5

 **$\eta(1405)$** 

$$I^G(J^{PC}) = 0^+(0^{-+})$$

NODE=M027

See the review on "Spectroscopy of Light Meson Resonances." See also  $\eta(1475)$ .

Mass  $m = 1408.8 \pm 2.0$  MeV (S = 2.2)

Full width  $\Gamma = 50.1 \pm 2.6$  MeV (S = 1.7)

NODE=M027MX;DTYPE=M  
NODE=M027WX;DTYPE=G

$\eta(1405)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$K\bar{K}\pi$	seen		424	NODE=M027215;DESIG=2;OUR EST; → UNCHECKED ←
$\eta\pi\pi$	seen		562	DESIG=5;OUR EST;→ UNCHECKED ←
$a_0(980)\pi$	seen		345	DESIG=4;OUR EST;→ UNCHECKED ←
$\eta(\pi\pi)$ S-wave	seen		—	DESIG=9;OUR EST;→ UNCHECKED ←
$f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0$	not seen		—	DESIG=15
$f_0(980)\eta$	seen		†	DESIG=10;OUR EST;→ UNCHECKED ←
$4\pi$	seen		639	DESIG=6;OUR EST;→ UNCHECKED ←
$\rho\rho$	<58 %	99.85%	†	DESIG=12
$\rho^0\gamma$	seen		491	DESIG=8;OUR EST;→ UNCHECKED ←
$K^*(892)K$	seen		123	DESIG=11;OUR EST;→ UNCHECKED ←

 **$h_1(1415)$** 

$$I^G(J^{PC}) = 0^-(1^{+-})$$

was  $h_1(1380)$ 

$$\text{Mass } m = 1409^{+9}_{-8} \text{ MeV } (S = 1.9)$$

$$\text{Full width } \Gamma = 78 \pm 11 \text{ MeV}$$

NODE=M109

NODE=M109M;DTYPE=M  
NODE=M109W;DTYPE=G **$f_1(1420)$** 

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

$$\text{Mass } m = 1426.3 \pm 0.9 \text{ MeV } (S = 1.1)$$

$$\text{Full width } \Gamma = 54.5 \pm 2.6 \text{ MeV}$$

NODE=M006

NODE=M006M2;DTYPE=M  
NODE=M006W;DTYPE=G

$f_1(1420)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$K\bar{K}\pi$	seen	438	NODE=M006215;DESIG=2;OUR EST; → UNCHECKED ←
$K\bar{K}^*(892) + \text{c.c.}$	seen	163	DESIG=1;OUR EST;→ UNCHECKED ←
$\eta\pi\pi$	possibly seen	573	DESIG=5;OUR EST;→ UNCHECKED ←
$\phi\gamma$	seen	349	DESIG=9;OUR EST;→ UNCHECKED ←

 **$\omega(1420)$  [e]**

$$I^G(J^{PC}) = 0^-(1^{--})$$

$$\text{Mass } m = 1410 \pm 60 \text{ MeV } [c]$$

$$\text{Full width } \Gamma = 290 \pm 190 \text{ MeV } [c]$$

NODE=M125

NODE=M125M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M125W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

$\omega(1420)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\rho\pi$	seen	480	NODE=M125215;DESIG=1;OUR EST; → UNCHECKED ←
$\omega\pi\pi$	seen	437	DESIG=4;OUR EST;→ UNCHECKED ←
$b_1(1235)\pi$	seen	112	DESIG=5;OUR EST;→ UNCHECKED ←
$e^+e^-$	seen	705	DESIG=3;OUR EST;→ UNCHECKED ←

 **$a_0(1450)$** 

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

$$\text{T-Matrix Pole } \sqrt{s} = (1290-1500) - i(30-140) \text{ MeV}$$

$$\text{Mass (Breit-Wigner)} = 1439 \pm 34 \text{ MeV } (S = 1.8)$$

$$\text{Full width (Breit-Wigner)} = 258 \pm 14 \text{ MeV}$$

NODE=M149

NODE=M149PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M149M;DTYPE=M  
NODE=M149W;DTYPE=G



Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M149215;NODE=M149

$a_0(1450)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\eta$	$0.093 \pm 0.020$	607
$\pi\eta'(958)$	$0.033 \pm 0.017$	384
$K\bar{K}$	$0.082 \pm 0.028$	523
$\omega\pi\pi$	<b>DEFINED AS 1</b>	458
$a_0(980)\pi\pi$	seen	310
$\gamma\gamma$	seen	719

DESIG=1  
DESIG=2  
DESIG=3  
DESIG=4  
DESIG=5  
DESIG=6

**$\rho(1450)$**

$$I^G(J^{PC}) = 1^+(1^{--})$$

NODE=M105

See the review on "Spectroscopy of Light Meson Resonances."

$$\text{Mass } m = 1465 \pm 25 \text{ MeV [c]}$$

$$\text{Full width } \Gamma = 400 \pm 60 \text{ MeV [c]}$$

NODE=M105M0;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M105W0;DTYPE=G;OUR EST;  
→ UNCHECKED ←

$\rho(1450)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\pi$	seen	720
$\pi^+\pi^-$	seen	719
$4\pi$	seen	669
$e^+e^-$	seen	732
$\eta\rho$	seen	311
$a_2(1320)\pi$	not seen	55
$K\bar{K}$	seen	541
$K^+K^-$	seen	541
$K\bar{K}^*(892) + \text{c.c.}$	possibly seen	229
$\pi^0\gamma$	seen	726
$\eta\gamma$	seen	630
$f_0(500)\gamma$	not seen	—
$f_0(980)\gamma$	not seen	398
$f_0(1370)\gamma$	not seen	92
$f_2(1270)\gamma$	not seen	177

NODE=M105215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=20;OUR EVAL;→ UNCHECKED ←  
DESIG=2;OUR EST;→ UNCHECKED ←  
DESIG=4;OUR EST;→ UNCHECKED ←  
DESIG=3  
DESIG=8;OUR EST;→ UNCHECKED ←  
DESIG=7;OUR EVAL;→ UNCHECKED ←  
DESIG=21;OUR EVAL;→ UNCHECKED ←  
DESIG=15;OUR EST;→ UNCHECKED ←  
DESIG=23;OUR EST;→ UNCHECKED ←  
DESIG=9  
DESIG=16;OUR EST;→ UNCHECKED ←  
DESIG=17;OUR EST;→ UNCHECKED ←  
DESIG=18;OUR EST;→ UNCHECKED ←  
DESIG=19;OUR EST;→ UNCHECKED ←

**$\eta(1475)$**

$$I^G(J^{PC}) = 0^+(0^{-+})$$

NODE=M175

See the review on "Spectroscopy of Light Meson Resonances." See also  $\eta(1405)$ .

$$\text{Mass } m = 1475 \pm 4 \text{ MeV } (S = 1.4)$$

$$\text{Full width } \Gamma = 90 \pm 9 \text{ MeV } (S = 1.6)$$

NODE=M175M5;DTYPE=M  
NODE=M175W5;DTYPE=G

$\eta(1475)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\bar{K}\pi$	seen	477
$K\bar{K}^*(892) + \text{c.c.}$	seen	244
$a_0(980)\pi$	seen	396
$\gamma\gamma$	seen	738
$K_S^0 K_S^0 \eta$	possibly seen	†
$\gamma\phi(1020)$	possibly seen	385

NODE=M175215;DESIG=2;OUR EST;  
→ UNCHECKED ←  
DESIG=1;OUR EST;→ UNCHECKED ←  
DESIG=4;OUR EST;→ UNCHECKED ←  
DESIG=7;OUR EST;→ UNCHECKED ←  
DESIG=8;OUR EVAL;→ UNCHECKED ←  
DESIG=9

**$f_0(1500)$**

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M152

See the review on "Spectroscopy of Light Meson Resonances."

$$\text{T-Matrix Pole } \sqrt{s} = (1430-1530) - i(40-90) \text{ MeV}$$

$$\text{Mass (Breit-Wigner)} = 1522 \pm 25 \text{ MeV}$$

$$\text{Full width (Breit-Wigner)} = 108 \pm 33 \text{ MeV}$$

NODE=M152PP;DTYPE=p;OUR EST;  
→ UNCHECKED ←  
NODE=M152M;DTYPE=M  
NODE=M152W;DTYPE=G

<b><math>f_0(1500)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor	$p$ (MeV/c)	
$\pi\pi$	(34.5±2.2) %	1.2	749	NODE=M152215;DESIG=8
$\pi^+\pi^-$	seen		748	DESIG=9
$2\pi^0$	seen		749	DESIG=3;OUR EST;→ UNCHECKED ←
$4\pi$	(48.9±3.3) %	1.2	700	DESIG=7
$4\pi^0$	seen		700	DESIG=5;OUR EST;→ UNCHECKED ←
$2\pi^+2\pi^-$	seen		696	DESIG=6;OUR EST;→ UNCHECKED ←
$2(\pi\pi)_{S\text{-wave}}$	seen		—	DESIG=11;OUR EST;→ UNCHECKED ←
$\rho\rho$	seen		†	DESIG=12;OUR EST;→ UNCHECKED ←
$\pi(1300)\pi$	seen		163	DESIG=13;OUR EST;→ UNCHECKED ←
$a_1(1260)\pi$	seen		234	DESIG=14;OUR EST;→ UNCHECKED ←
$\eta\eta$	( 6.0±0.9) %	1.1	528	DESIG=1
$\eta\eta'(958)$	( 2.2±0.8) %	1.4	107	DESIG=2
$K\bar{K}$	( 8.5±1.0) %	1.1	579	DESIG=4
$\gamma\gamma$	not seen		761	DESIG=10;OUR EST;→ UNCHECKED ←

 **$f'_2(1525)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass  $m = 1517.4 \pm 2.5$  MeV ( $S = 2.8$ )  
 Full width  $\Gamma = 86 \pm 5$  MeV ( $S = 2.2$ )

NODE=M013  
 NODE=M013MX;DTYPE=M  
 NODE=M013WX;DTYPE=G

<b><math>f'_2(1525)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor	$p$ (MeV/c)	
$K\bar{K}$	(87.6±2.2) %	1.1	576	NODE=M013215;DESIG=2
$\eta\eta$	(11.6±2.2) %	1.1	525	DESIG=4
$\pi\pi$	( 8.3±1.6) × 10 <sup>-3</sup>		747	DESIG=1
$\gamma\gamma$	( 9.5±1.1) × 10 <sup>-7</sup>	1.1	759	DESIG=8

 **$\pi_1(1600)$** 

$$I^G(J^{PC}) = 1^-(1^{-+})$$

See the review on "Spectroscopy of Light Meson Resonances" and a note in PDG 06, Journal of Physics **G33** 1 (2006). See also  $\pi_1(1400)$ .

Mass (T-Matrix Pole  $\sqrt{s}$ ) = (1480–1680) –  $i$  (150–300) MeV  
 Mass (Breit-Wigner) =  $1661^{+15}_{-11}$  MeV ( $S = 1.2$ )  
 Full width (Breit-Wigner) =  $240 \pm 50$  MeV ( $S = 1.7$ )

NODE=M164TMP;DTYPE=M;OUR EST;  
 → UNCHECKED ←  
 NODE=M164M;DTYPE=M  
 NODE=M164W;DTYPE=G

<b><math>\pi_1(1600)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\pi\pi\pi$	seen	803	NODE=M164215;DESIG=1;OUR EST; → UNCHECKED ←
$\rho^0\pi^-$	seen	641	DESIG=2
$f_2(1270)\pi^-$	not seen	318	DESIG=4
$b_1(1235)\pi$	seen	357	DESIG=5
$\eta'(958)\pi^-$	seen	543	DESIG=3
$\eta\pi$	seen	734	DESIG=7;OUR EST;→ UNCHECKED ←
$f_1(1285)\pi$	seen	314	DESIG=6;OUR EST;→ UNCHECKED ←

 **$a_1(1640)$** 

$$I^G(J^{PC}) = 1^-(1^{++})$$

Mass  $m = 1655 \pm 16$  MeV ( $S = 1.2$ )  
 Full width  $\Gamma = 254 \pm 40$  MeV ( $S = 1.8$ )

NODE=M161  
 NODE=M161M;DTYPE=M  
 NODE=M161W;DTYPE=G

$a_1(1640)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi\pi\pi$	seen	800
$f_2(1270)\pi$	seen	314
$\sigma\pi$	seen	—
$\rho\pi$ <i>S-wave</i>	seen	638
$\rho\pi$ <i>D-wave</i>	seen	638
$\omega\pi\pi$	seen	607
$f_1(1285)\pi$	seen	309
$a_1(1260)\eta$	not seen	†

NODE=M161215;DESIG=3;OUR EST;  
 → UNCHECKED ←  
 DESIG=1;OUR EST;→ UNCHECKED ←  
 DESIG=2;OUR EST;→ UNCHECKED ←  
 DESIG=7;OUR EST;→ UNCHECKED ←  
 DESIG=4;OUR EST;→ UNCHECKED ←  
 DESIG=5;OUR EST;→ UNCHECKED ←  
 DESIG=6;OUR EST;→ UNCHECKED ←  
 DESIG=8

 **$\eta_2(1645)$** 

$$I^G(J^{PC}) = 0^+(2^-+)$$

Mass  $m = 1617 \pm 5$  MeV  
 Full width  $\Gamma = 181 \pm 11$  MeV

NODE=M154  
 NODE=M154M;DTYPE=M  
 NODE=M154W;DTYPE=G

$\eta_2(1645)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$a_2(1320)\pi$	seen	242
$K\bar{K}\pi$	seen	580
$K^*\bar{K}$	seen	404
$\eta\pi^+\pi^-$	seen	685
$a_0(980)\pi$	seen	499
$f_2(1270)\eta$	not seen	†

NODE=M154215;DESIG=1;OUR EST;  
 → UNCHECKED ←  
 DESIG=2;OUR EST;→ UNCHECKED ←  
 DESIG=3;OUR EST;→ UNCHECKED ←  
 DESIG=4;OUR EST;→ UNCHECKED ←  
 DESIG=5;OUR EST;→ UNCHECKED ←  
 DESIG=6;OUR EST;→ UNCHECKED ←

 **$\omega(1650)$  <sup>[f]</sup>**

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 1670 \pm 30$  MeV [c]  
 Full width  $\Gamma = 315 \pm 35$  MeV [c]

NODE=M126  
 NODE=M126M;DTYPE=M;OUR EST;  
 → UNCHECKED ←  
 NODE=M126W;DTYPE=G;OUR EST;  
 → UNCHECKED ←

$\omega(1650)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\rho\pi$	seen	647
$\rho(1450)\pi$	seen	145
$\omega\pi\pi$	seen	617
$\omega\eta$	seen	500
$e^+e^-$	seen	835
$\pi^0\gamma$	not seen	830

NODE=M126215;DESIG=1;OUR EST;  
 → UNCHECKED ←  
 DESIG=6  
 DESIG=2;OUR EST;→ UNCHECKED ←  
 DESIG=4;OUR EST;→ UNCHECKED ←  
 DESIG=3;OUR EST;→ UNCHECKED ←  
 DESIG=5

 **$\omega_3(1670)$** 

$$I^G(J^{PC}) = 0^-(3^{--})$$

Mass  $m = 1667 \pm 4$  MeV  
 Full width  $\Gamma = 168 \pm 10$  MeV

NODE=M045  
 NODE=M045M;DTYPE=M  
 NODE=M045W;DTYPE=G

$\omega_3(1670)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\rho\pi$	seen	645
$\omega\pi\pi$	seen	615
$b_1(1235)\pi$	possibly seen	361

NODE=M045215;DESIG=1;OUR EST;  
 → UNCHECKED ←  
 DESIG=2;OUR EST;→ UNCHECKED ←  
 DESIG=3;OUR EST;→ UNCHECKED ←

 **$\pi_2(1670)$** 

$$I^G(J^{PC}) = 1^-(2^-+)$$

Mass  $m = 1670.6^{+2.9}_{-1.2}$  MeV ( $S = 1.3$ )  
 Full width  $\Gamma = 258^{+8}_{-9}$  MeV ( $S = 1.2$ )

NODE=M034  
 NODE=M034M;DTYPE=M  
 NODE=M034W;DTYPE=G

$\pi_2(1670)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$3\pi$	(95.8±1.4) %		808	NODE=M034215;DESIG=20
$f_2(1270)\pi$	(56.3±3.2) %		327	DESIG=8
$\rho\pi$	(31 ±4 ) %		647	DESIG=2
$\sigma\pi$	(10 ±4 ) %		—	DESIG=13
$\pi(\pi\pi)$ S-wave	( 8.7±3.4) %		—	DESIG=11
$\pi^\pm\pi^+\pi^-$	(53 ±4 ) %		806	DESIG=10
$K\bar{K}^*(892) + \text{c.c.}$	( 4.2±1.4) %		453	DESIG=5
$\omega\rho$	( 2.7±1.1) %		302	DESIG=14
$\pi^\pm\gamma$	( 7.0±1.2) × 10 <sup>-4</sup>		829	DESIG=27
$\gamma\gamma$	< 2.8 × 10 <sup>-7</sup>	90%	835	DESIG=12
$\eta\pi$	< 5 %		739	DESIG=3
$\pi^\pm 2\pi^+ 2\pi^-$	< 5 %		735	DESIG=4
$\rho(1450)\pi$	< 3.6 × 10 <sup>-3</sup>	97.7%	145	DESIG=15
$b_1(1235)\pi$	< 1.9 × 10 <sup>-3</sup>	97.7%	364	DESIG=16
$f_1(1285)\pi$	possibly seen		322	DESIG=25
$a_2(1320)\pi$	not seen		291	DESIG=26

 **$\phi(1680)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 1680 \pm 20$  MeV [c]  
 Full width  $\Gamma = 150 \pm 50$  MeV [c]

NODE=M067

NODE=M067M1;DTYPE=M;OUR EST;  
 → UNCHECKED ←  
 NODE=M067W1;DTYPE=G;OUR EST;  
 → UNCHECKED ←

$\phi(1680)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\bar{K}^*(892) + \text{c.c.}$	seen	462
$K_S^0 K\pi$	seen	621
$K\bar{K}$	seen	680
$e^+e^-$	seen	840
$\omega\pi\pi$	not seen	623
$K^+K^-\pi^+\pi^-$	seen	544
$\eta\phi$	seen	290
$\eta\gamma$	seen	751
$f_2'(1525)\gamma$	not seen	155

NODE=M067215;DESIG=4;OUR EST;  
 → UNCHECKED ←  
 DESIG=5;OUR EST;→ UNCHECKED ←  
 DESIG=3;OUR EST;→ UNCHECKED ←  
 DESIG=6;OUR EST;→ UNCHECKED ←  
 DESIG=1;OUR EST;→ UNCHECKED ←  
 DESIG=12;OUR EVAL;→ UNCHECKED ←  
 DESIG=10  
 DESIG=13  
 DESIG=15

 **$\rho_3(1690)$** 

$$I^G(J^{PC}) = 1^+(3^{--})$$

Mass  $m = 1688.8 \pm 2.1$  MeV  
 Full width  $\Gamma = 161 \pm 10$  MeV (S = 1.5)

NODE=M015

NODE=M015M;DTYPE=M

NODE=M015W;DTYPE=G

$\rho_3(1690)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor	$p$ (MeV/c)
$4\pi$	(71.1 ± 1.9 ) %		790
$\pi^\pm\pi^+\pi^-\pi^0$	(67 ±22 ) %		787
$\omega\pi$	(16 ± 6 ) %		655
$\pi\pi$	(23.6 ± 1.3 ) %		834
$K\bar{K}\pi$	( 3.8 ± 1.2 ) %		629
$K\bar{K}$	( 1.58± 0.26) %	1.2	685
$\eta\pi^+\pi^-$	seen		727
$\rho(770)\eta$	seen		520
$\pi\pi\rho$	seen		633
$a_2(1320)\pi$	seen		307
$\rho\rho$	seen		335

NODE=M015215;DESIG=2

DESIG=11

DESIG=7

DESIG=1

DESIG=3

DESIG=4

DESIG=13

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

 **$\rho(1700)$** 

$$I^G(J^{PC}) = 1^+(1^{--})$$

See the review on "Spectroscopy of Light Meson Resonances."

Mass  $m = 1720 \pm 20$  MeV [c] ( $\eta\rho^0$  and  $\pi^+\pi^-$  modes)  
 Full width  $\Gamma = 250 \pm 100$  MeV [c] ( $\eta\rho^0$  and  $\pi^+\pi^-$  modes)

NODE=M065

NODE=M065M0;DTYPE=M;OUR EST;  
 → UNCHECKED ←  
 NODE=M065W0;DTYPE=G;OUR EST;  
 → UNCHECKED ←

$\rho(1700)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$2(\pi^+\pi^-)$	seen	803	NODE=M065215;DESIG=2;OUR EST;
$\rho\pi\pi$	seen	653	→ UNCHECKED ←
$\rho^0\pi^+\pi^-$	seen	651	DESIG=1;OUR EST;→ UNCHECKED ←
$\rho^\pm\pi^\mp\pi^0$	seen	652	DESIG=9;OUR EST;→ UNCHECKED ←
$a_1(1260)\pi$	seen	404	DESIG=15;OUR EST;→ UNCHECKED ←
$h_1(1170)\pi$	seen	450	DESIG=16;OUR EST;→ UNCHECKED ←
$\pi(1300)\pi$	seen	349	DESIG=17;OUR EST;→ UNCHECKED ←
$\rho\rho$	seen	372	DESIG=18;OUR EST;→ UNCHECKED ←
$\pi^+\pi^-$	seen	849	DESIG=4;OUR EST;→ UNCHECKED ←
$\pi\pi$	seen	849	DESIG=13;OUR EST;→ UNCHECKED ←
$K\bar{K}^*(892) + \text{c.c.}$	seen	496	DESIG=10;OUR EST;→ UNCHECKED ←
$\eta\rho$	seen	545	DESIG=11;OUR EST;→ UNCHECKED ←
$a_2(1320)\pi$	not seen	334	DESIG=14;OUR EST;→ UNCHECKED ←
$K\bar{K}$	seen	704	DESIG=5;OUR EST;→ UNCHECKED ←
$e^+e^-$	seen	860	DESIG=8;OUR EST;→ UNCHECKED ←
$\pi^0\omega$	seen	674	DESIG=6;OUR EST;→ UNCHECKED ←
$\pi^0\gamma$	not seen	855	DESIG=194
$f_0(1500)\gamma$	not seen	187	DESIG=195

 **$a_2(1700)$** 

$$I^G(J^{PC}) = 1^-(2^{++})$$

Mass  $m = 1698 \pm 40$  MeV  
 Full width  $\Gamma = 265 \pm 60$  MeV

NODE=M162  
 NODE=M162M;DTYPE=M  
 NODE=M162W;DTYPE=G

$a_2(1700)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\eta\pi$	$(3.6 \pm 1.1) \%$	754	NODE=M162215;DESIG=4
$\eta'\pi$	seen	568	DESIG=8;OUR EVAL;→ UNCHECKED ←
$\gamma\gamma$	$(1.13 \pm 0.30) \times 10^{-6}$	849	DESIG=1
$\rho\pi$	seen	664	DESIG=2;OUR EVAL;→ UNCHECKED ←
$f_2(1270)\pi$	seen	350	DESIG=3;OUR EVAL;→ UNCHECKED ←
$K\bar{K}$	$(1.9 \pm 1.2) \%$	691	DESIG=5
$\omega\pi^-\pi^0$	seen	634	DESIG=6;OUR EVAL;→ UNCHECKED ←
$\omega\rho$	seen	338	DESIG=7;OUR EVAL;→ UNCHECKED ←

 **$f_0(1710)$** 

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

T-matrix pole  $\sqrt{s} = (1680-1820) - i(50-180)$  MeV  
 Mass (Breit-Wigner) =  $1733^{+8}_{-7}$  MeV ( $S = 1.5$ )  
 Full width (Breit-Wigner) =  $150^{+12}_{-10}$  MeV ( $S = 1.3$ )

NODE=M068  
 NODE=M068PP;DTYPE=p;OUR EST;  
 → UNCHECKED ←  
 NODE=M068M;DTYPE=M  
 NODE=M068W;DTYPE=G

$f_0(1710)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$K\bar{K}$	seen	712	NODE=M068215;DESIG=2;OUR EST;
$\eta\eta$	seen	671	→ UNCHECKED ←
$\pi\pi$	seen	856	DESIG=5;OUR EST;→ UNCHECKED ←
$\gamma\gamma$	seen	866	DESIG=6;OUR EST;→ UNCHECKED ←
$\omega\omega$	seen	372	DESIG=4

 **$\pi(1800)$** 

$$I^G(J^{PC}) = 1^-(0^{-+})$$

Mass  $m = 1810^{+9}_{-11}$  MeV ( $S = 2.2$ )  
 Full width  $\Gamma = 215^{+7}_{-8}$  MeV

NODE=M075  
 NODE=M075M;DTYPE=M  
 NODE=M075W;DTYPE=G

$\pi(1800)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi^+\pi^-\pi^-$	seen	878
$f_0(500)\pi^-$	seen	—
$f_0(980)\pi^-$	seen	624
$f_0(1370)\pi^-$	seen	366
$f_0(1500)\pi^-$	not seen	232
$\rho\pi^-$	not seen	731
$\eta\eta\pi^-$	seen	660
$a_0(980)\eta$	seen	471
$a_2(1320)\eta$	not seen	†
$f_2(1270)\pi$	not seen	441
$f_0(1370)\pi^-$	not seen	366
$f_0(1500)\pi^-$	seen	232
$\eta\eta'(958)\pi^-$	seen	373
$K_0^*(1430)K^-$	seen	†
$K^*(892)K^-$	not seen	568

NODE=M075215;DESIG=10;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=11;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=3;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=1  
DESIG=12  
DESIG=2  
DESIG=7;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=5;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=13  
DESIG=14  
DESIG=15  
DESIG=6;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=8;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=4  
DESIG=9

 **$\phi_3(1850)$** 

$$I^G(J^{PC}) = 0^-(3^{--})$$

Mass  $m = 1854 \pm 7$  MeV  
Full width  $\Gamma = 87^{+28}_{-23}$  MeV ( $S = 1.2$ )

NODE=M054  
NODE=M054M;DTYPE=M  
NODE=M054W;DTYPE=G

$\phi_3(1850)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\bar{K}$	seen	785
$K\bar{K}^*(892) + \text{c.c.}$	seen	602

NODE=M054215;DESIG=1;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EST; $\rightarrow$  UNCHECKED  $\leftarrow$

 **$\eta_2(1870)$** 

$$I^G(J^{PC}) = 0^+(2^{-+})$$

Mass  $m = 1842 \pm 8$  MeV  
Full width  $\Gamma = 225 \pm 14$  MeV

NODE=M101  
NODE=M101M;DTYPE=M  
NODE=M101W;DTYPE=G

$\eta_2(1870)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\eta\pi\pi$	seen	816
$a_2(1320)\pi$	seen	434
$f_2(1270)\eta$	seen	119
$a_0(980)\pi$	seen	651
$\gamma\gamma$	seen	921

NODE=M101225;DESIG=1;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=4;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=8;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=9

 **$\pi_2(1880)$** 

$$I^G(J^{PC}) = 1^-(2^{-+})$$

Mass  $m = 1874^{+26}_{-5}$  MeV ( $S = 1.6$ )  
Full width  $\Gamma = 237^{+33}_{-30}$  MeV ( $S = 1.2$ )

NODE=M185  
NODE=M185M;DTYPE=M  
NODE=M185W;DTYPE=G

$\pi_2(1880)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\eta\eta\pi^-$	seen	702
$a_0(980)\eta$	seen	528
$a_2(1320)\eta$	seen	76
$f_0(1500)\pi$	seen	294
$f_1(1285)\pi$	seen	485
$\omega\pi^-\pi^0$	seen	744

NODE=M185215;DESIG=1;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=3;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=4;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=5;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=6;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

 **$f_2(1950)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

T-Matrix Pole  $\sqrt{s} = (1830-2020) - i(110-220)$  MeV  
Mass (Breit-Wigner) =  $1936 \pm 12$  MeV ( $S = 1.3$ )  
Full width (Breit-Wigner) =  $464 \pm 24$  MeV

NODE=M135  
NODE=M135PP;DTYPE=p;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
NODE=M135M;DTYPE=M  
NODE=M135W;DTYPE=G

<b><math>f_2(1950)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K^*(892)\bar{K}^*(892)$	seen	377
$\pi^+\pi^-$	seen	958
$\pi^0\pi^0$	seen	959
$4\pi$	seen	921
$\eta\eta$	seen	798
$K\bar{K}$	seen	833
$\gamma\gamma$	seen	968
$p\bar{p}$	seen	238

NODE=M135215;DESIG=1  
DESIG=2;OUR EST;→ UNCHECKED ←  
DESIG=10;OUR EST;→ UNCHECKED ←  
DESIG=7;OUR EST;→ UNCHECKED ←  
DESIG=6;OUR EST;→ UNCHECKED ←  
DESIG=8;OUR EST;→ UNCHECKED ←  
DESIG=9;OUR EST;→ UNCHECKED ←  
DESIG=12

 **$a_4(1970)$** 

$$I^G(J^{PC}) = 1^-(4^{++})$$

NODE=M017

was  $a_4(2040)$ Mass  $m = 1967 \pm 16$  MeV ( $S = 2.1$ )Full width  $\Gamma = 324_{-18}^{+15}$  MeV

NODE=M017M;DTYPE=M

NODE=M017W;DTYPE=G

<b><math>a_4(1970)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\bar{K}$	seen	851
$\pi^+\pi^-\pi^0$	seen	959
$\rho\pi$	seen	825
$f_2(1270)\pi$	seen	559
$\omega\pi^-\pi^0$	seen	801
$\omega\rho$	seen	601
$\eta\pi$	seen	902
$\eta'(958)\pi$	seen	743

NODE=M017215;DESIG=1  
DESIG=2  
DESIG=5;OUR EST;→ UNCHECKED ←  
DESIG=6;OUR EST;→ UNCHECKED ←  
DESIG=7;OUR EST;→ UNCHECKED ←  
DESIG=8  
DESIG=3  
DESIG=4;OUR EST;→ UNCHECKED ←

 **$f_2(2010)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M106

Mass  $m = 2011_{-80}^{+60}$  MeVFull width  $\Gamma = 202 \pm 60$  MeVNODE=M106M;DTYPE=M  
NODE=M106W;DTYPE=G

<b><math>f_2(2010)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\phi\phi$	seen	†
$K\bar{K}$	seen	876

NODE=M106215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=2

 **$f_4(2050)$** 

$$I^G(J^{PC}) = 0^+(4^{++})$$

NODE=M016

Mass  $m = 2018 \pm 11$  MeV ( $S = 2.1$ )Full width  $\Gamma = 237 \pm 18$  MeV ( $S = 1.9$ )NODE=M016M;DTYPE=M  
NODE=M016W;DTYPE=G

<b><math>f_4(2050)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\omega\omega$	seen	637
$\pi\pi$	$(17.0 \pm 1.5)\%$	1000
$K\bar{K}$	$(6.8_{-1.8}^{+3.4}) \times 10^{-3}$	880
$\eta\eta$	$(2.1 \pm 0.8) \times 10^{-3}$	848
$4\pi^0$	$< 1.2\%$	964
$\gamma\gamma$	seen	1009
$a_2(1320)\pi$	seen	567

NODE=M016215;DESIG=6  
DESIG=1  
DESIG=2  
DESIG=3  
DESIG=5  
DESIG=4;OUR EVAL;→ UNCHECKED ←  
DESIG=7

 **$\phi(2170)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M103

Mass  $m = 2163 \pm 7$  MeV [c] ( $S = 1.1$ )Full width  $\Gamma = 103_{-21}^{+28}$  MeV [c] ( $S = 2.2$ )NODE=M103M;DTYPE=M  
NODE=M103W;DTYPE=G

$\phi(2170)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$e^+ e^-$	seen	1082
$\phi\eta$	seen	727
$\omega\eta$	seen	848
$\phi\eta'$	seen	438
$\phi f_0(980)$	seen	400
$K^+ K^- f_0(980) \rightarrow$	seen	—
$K^+ K^- \pi^+ \pi^-$	seen	—
$K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen	—
$K^{*0} K^\pm \pi^\mp$	not seen	762
$K^*(892)^0 \bar{K}^*(892)^0$	not seen	612

NODE=M103215;DESIG=1;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=5;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=16;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=11;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=6  
DESIG=7  
DESIG=8  
DESIG=10

 **$f_2(2300)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass  $m = 2297 \pm 28$  MeV  
Full width  $\Gamma = 149 \pm 40$  MeV

NODE=M107  
NODE=M107M;DTYPE=M  
NODE=M107W;DTYPE=G

$f_2(2300)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\phi\phi$	seen	529
$K\bar{K}$	seen	1037
$\gamma\gamma$	seen	1149
$\Lambda\bar{\Lambda}$	seen	273

NODE=M107215;DESIG=1  
DESIG=2  
DESIG=3  
DESIG=4

 **$f_2(2340)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass  $m = 2346_{-10}^{+21}$  MeV  
Full width  $\Gamma = 331_{-18}^{+27}$  MeV

NODE=M108  
NODE=M108M;DTYPE=M  
NODE=M108W;DTYPE=G

$f_2(2340)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\phi\phi$	seen	580
$\eta\eta$	seen	1037
$\eta'\eta'$	seen	677

NODE=M108215;DESIG=1;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2  
DESIG=3

## STRANGE MESONS ( $S = \pm 1, C = B = 0$ )

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s$ , similarly for  $K^{*}$ 's

NODE=MXXX020

 **$K_0^*(700)$** 

$$I(J^P) = \frac{1}{2}(0^+)$$

also known as  $\kappa$ ; was  $K_0^*(800)$

See the review on "Scalar Mesons below 1 GeV."

Mass (T-Matrix Pole  $\sqrt{s}$ ) = (630–730) –  $i$  (260–340) MeV  
Mass (Breit-Wigner) =  $845 \pm 17$  MeV  
Full width (Breit-Wigner) =  $468 \pm 30$  MeV

NODE=M174

NODE=M174TMP;DTYPE=M;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
NODE=M174M;DTYPE=M  
NODE=M174W;DTYPE=G



<b><math>K_0^*(700)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	100 %	256

NODE=M174215;DESIG=1;OUR EVAL;  
→ UNCHECKED ←

 **$K^*(892)$** 

$$I(J^P) = \frac{1}{2}(1^-)$$

Mass (T-Matrix Pole  $\sqrt{s}$ ) =  $(890 \pm 14) - i(26 \pm 6)$  MeV  
 $K^*(892)^\pm$  hadroproduced mass  $m = 891.67 \pm 0.26$  MeV  
 $K^*(892)^\pm$  in  $\tau$  decays mass  $m = 895.5 \pm 0.8$  MeV  
 $K^*(892)^0$  mass  $m = 895.55 \pm 0.20$  MeV ( $S = 1.7$ )  
 $K^*(892)^\pm$  hadroproduced full width  $\Gamma = 51.4 \pm 0.8$  MeV  
 $K^*(892)^\pm$  in  $\tau$  decays full width  $\Gamma = 46.2 \pm 1.3$  MeV  
 $K^*(892)^0$  full width  $\Gamma = 47.3 \pm 0.5$  MeV ( $S = 1.9$ )

NODE=M018

NODE=M018TMP;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M018M1;DTYPE=M  
NODE=M018MCT;DTYPE=M  
NODE=M018M2;DTYPE=M  
NODE=M018W1;DTYPE=G  
NODE=M018W5;DTYPE=G  
NODE=M018W2;DTYPE=G

<b><math>K^*(892)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$K\pi$	$\sim 100$ %		289
$K^0\gamma$	$(2.46 \pm 0.21) \times 10^{-3}$		307
$K^\pm\gamma$	$(9.8 \pm 0.9) \times 10^{-4}$		309
$K\pi\pi$	$< 7 \times 10^{-4}$	95%	223

NODE=M018220;DESIG=1;OUR EVAL;  
→ UNCHECKED ←  
DESIG=4  
DESIG=3  
DESIG=2

 **$K_1(1270)$** 

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass  $m = 1253 \pm 7$  MeV ( $S = 2.2$ )  
Full width  $\Gamma = 90 \pm 20$  MeV [c]

NODE=M028

NODE=M028MX;DTYPE=M  
NODE=M028WX;DTYPE=G;OUR EST;  
→ UNCHECKED ←

<b><math>K_1(1270)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor	$p$ (MeV/c)
$K\rho$	$(38 \pm 13)$ %	2.2	†
$K_0^*(1430)\pi$	$(28 \pm 4)$ %		†
$K^*(892)\pi$	$(21 \pm 10)$ %	2.2	286
$K\omega$	$(11.0 \pm 2.0)$ %		†
$Kf_0(1370)$	$(3.0 \pm 2.0)$ %		†
$\gamma K^0$	seen		528

NODE=M028215;DESIG=2  
DESIG=7  
DESIG=1  
DESIG=5  
DESIG=8  
DESIG=9;OUR EST;→ UNCHECKED ←

 **$K_1(1400)$** 

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass  $m = 1403 \pm 7$  MeV  
Full width  $\Gamma = 174 \pm 13$  MeV ( $S = 1.6$ )

NODE=M064

NODE=M064M;DTYPE=M  
NODE=M064W;DTYPE=G

<b><math>K_1(1400)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K^*(892)\pi$	$(94 \pm 6)$ %	402
$K\rho$	$(3.0 \pm 3.0)$ %	293
$Kf_0(1370)$	$(2.0 \pm 2.0)$ %	†
$K\omega$	$(1.0 \pm 1.0)$ %	284
$K_0^*(1430)\pi$	not seen	†
$\gamma K^0$	seen	613
$K\phi$	seen	†

NODE=M064215;DESIG=1  
DESIG=2  
DESIG=8  
DESIG=5  
DESIG=7;OUR EST;→ UNCHECKED ←  
DESIG=9;OUR EST;→ UNCHECKED ←  
DESIG=10

 **$K^*(1410)$** 

$$I(J^P) = \frac{1}{2}(1^-)$$

Mass  $m = 1414 \pm 15$  MeV ( $S = 1.3$ )  
Full width  $\Gamma = 232 \pm 21$  MeV ( $S = 1.1$ )

NODE=M094

NODE=M094M;DTYPE=M  
NODE=M094W;DTYPE=G

<b>K*(1410) DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$K^*(892)\pi$	> 40 %	95%	410
$K\pi$	( $6.6 \pm 1.3$ ) %		612
$K\rho$	< 7 %	95%	305
$\gamma K^0$	< 2.3 $\times 10^{-4}$	90%	619
$K\phi$	seen		†

NODE=M094215;DESIG=2  
DESIG=1  
DESIG=3;OUR EST;→ UNCHECKED ←  
DESIG=4  
DESIG=5

 **$K_0^*(1430)$** 

$$I(J^P) = \frac{1}{2}(0^+)$$

Mass  $m = 1425 \pm 50$  MeV [c]  
Full width  $\Gamma = 270 \pm 80$  MeV [c]

NODE=M019  
NODE=M019M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M019W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

<b><math>K_0^*(1430)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	( $93 \pm 10$ ) %	619
$K\eta$	( $8.6^{+2.7}_{-3.4}$ ) %	486
$K\eta'(958)$	seen	†

NODE=M019215;DESIG=1  
DESIG=2  
DESIG=3

 **$K_2^*(1430)$** 

$$I(J^P) = \frac{1}{2}(2^+)$$

$K_2^*(1430)^\pm$  mass  $m = 1427.3 \pm 1.5$  MeV ( $S = 1.3$ )  
 $K_2^*(1430)^0$  mass  $m = 1432.4 \pm 1.3$  MeV  
 $K_2^*(1430)^\pm$  full width  $\Gamma = 100.0 \pm 2.1$  MeV  
 $K_2^*(1430)^0$  full width  $\Gamma = 109 \pm 5$  MeV ( $S = 1.9$ )

NODE=M022  
NODE=M022M1;DTYPE=M  
NODE=M022M4;DTYPE=M  
NODE=M022W1;DTYPE=G  
NODE=M022W4;DTYPE=G

<b><math>K_2^*(1430)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$K\pi$	( $49.9 \pm 1.2$ ) %		620
$K^*(892)\pi$	( $24.7 \pm 1.5$ ) %		420
$K^*(892)\pi\pi$	( $13.4 \pm 2.2$ ) %		373
$K\rho$	( $8.7 \pm 0.8$ ) %	S=1.2	320
$K\omega$	( $2.9 \pm 0.8$ ) %		313
$K^+\gamma$	( $2.4 \pm 0.5$ ) $\times 10^{-3}$	S=1.1	628
$K\eta$	( $1.5^{+3.4}_{-1.0}$ ) $\times 10^{-3}$	S=1.3	488
$K\omega\pi$	< 7.2 $\times 10^{-4}$	CL=95%	106
$K^0\gamma$	< 9 $\times 10^{-4}$	CL=90%	627

NODE=M022215;DESIG=1  
DESIG=2  
DESIG=6  
DESIG=3  
DESIG=4  
DESIG=8  
DESIG=5  
DESIG=7  
DESIG=10;OUR EVAL;→ UNCHECKED ←

 **$K(1460)$** 

$$I(J^P) = \frac{1}{2}(0^-)$$

<b><math>K(1460)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K^*(892)\pi$	seen	—
$K\rho$	seen	—
$K_0^*(1430)\pi$	seen	—
$K\phi$	seen	—

NODE=M021

NODE=M021215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=2;OUR EST;→ UNCHECKED ←  
DESIG=3;OUR EST;→ UNCHECKED ←  
DESIG=4

 **$K_1(1650)$** 

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass  $m = 1650 \pm 50$  MeV  
Full width  $\Gamma = 150 \pm 50$  MeV

NODE=M099  
NODE=M099M;DTYPE=M  
NODE=M099W;DTYPE=G

**$K^*(1680)$** 

$$I(J^P) = \frac{1}{2}(1^-)$$

Mass  $m = 1718 \pm 18$  MeV  
 Full width  $\Gamma = 322 \pm 110$  MeV ( $S = 4.2$ )

NODE=M095  
 NODE=M095M;DTYPE=M  
 NODE=M095W;DTYPE=G

<b><math>K^*(1680)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	(38.7±2.5) %	782
$K\rho$	(31.4 <sup>+5.0</sup> <sub>-2.1</sub> ) %	571
$K^*(892)\pi$	(29.9 <sup>+2.2</sup> <sub>-5.0</sub> ) %	618
$K\phi$	seen	387
$K\eta$	( 1.4 <sup>+1.0</sup> <sub>-0.8</sub> ) %	683

NODE=M095215;DESIG=1  
 DESIG=3  
 DESIG=2  
 DESIG=4  
 DESIG=6

 **$K_2(1770)$  [g]**

$$I(J^P) = \frac{1}{2}(2^-)$$

Mass  $m = 1773 \pm 8$  MeV  
 Full width  $\Gamma = 186 \pm 14$  MeV

NODE=M023  
 NODE=M023M;DTYPE=M  
 NODE=M023W;DTYPE=G

<b><math>K_2(1770)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi\pi$		794
$K_2^*(1430)\pi$	seen	287
$K^*(892)\pi$	seen	654
$Kf_2(1270)$	seen	53
$K\phi$	seen	441
$K\omega$	seen	607

NODE=M023215;DESIG=1;OUR EST;  
 DESIG=2;OUR EST;→ UNCHECKED ←  
 DESIG=4;OUR EST;→ UNCHECKED ←  
 DESIG=9;OUR EST;→ UNCHECKED ←  
 DESIG=10  
 DESIG=8

 **$K_3^*(1780)$** 

$$I(J^P) = \frac{1}{2}(3^-)$$

Mass  $m = 1779 \pm 8$  MeV ( $S = 1.2$ )  
 Full width  $\Gamma = 161 \pm 17$  MeV ( $S = 1.1$ )

NODE=M060  
 NODE=M060M;DTYPE=M  
 NODE=M060W;DTYPE=G

<b><math>K_3^*(1780)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$K\rho$	(31 ± 9) %		616
$K^*(892)\pi$	(20 ± 5) %		657
$K\pi$	(18.8± 1.0) %		815
$K\eta$	(30 ± 13) %		721
$K_2^*(1430)\pi$	< 16 %	95%	292

NODE=M060215;DESIG=3  
 DESIG=2  
 DESIG=1  
 DESIG=6  
 DESIG=4

 **$K_2(1820)$  [g]**

$$I(J^P) = \frac{1}{2}(2^-)$$

Mass  $m = 1819 \pm 12$  MeV  
 Full width  $\Gamma = 264 \pm 34$  MeV

NODE=M146  
 NODE=M146M;DTYPE=M  
 NODE=M146W;DTYPE=G

<b><math>K_2(1820)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi\pi$	seen	819
$K_2^*(1430)\pi$	seen	328
$K^*(892)\pi$	seen	683
$Kf_2(1270)$	seen	191
$K\omega$	seen	640
$K\phi$	seen	483

NODE=M146215;DESIG=5;OUR EVAL;  
 DESIG=1;OUR EVAL;→ UNCHECKED ←  
 DESIG=2;OUR EVAL;→ UNCHECKED ←  
 DESIG=3;OUR EVAL;→ UNCHECKED ←  
 DESIG=6;OUR EVAL;→ UNCHECKED ←  
 DESIG=7

 **$K_2^*(1980)$** 

$$I(J^P) = \frac{1}{2}(2^+)$$

Mass  $m = 1994<sup>+60</sup><sub>-50</sub>$  MeV ( $S = 2.8$ )  
 Full width  $\Gamma = 348<sup>+50</sup><sub>-30</sub>$  MeV ( $S = 1.3$ )

NODE=M104  
 NODE=M104M;DTYPE=M  
 NODE=M104W;DTYPE=G

<b><math>K_2^*(1980)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K^*(892)\pi$	possibly seen	791
$K\rho$	possibly seen	762
$Kf_2(1270)$	possibly seen	424
$K\phi$	seen	627
$K\eta$	seen	850

NODE=M104215;DESIG=2  
DESIG=3  
DESIG=4  
DESIG=5  
DESIG=6

 **$K_4^*(2045)$** 

$$I(J^P) = \frac{1}{2}(4^+)$$

$$\text{Mass } m = 2048_{-9}^{+8} \text{ MeV } (S = 1.1)$$

$$\text{Full width } \Gamma = 199_{-19}^{+27} \text{ MeV}$$

NODE=M035  
NODE=M035M;DTYPE=M  
NODE=M035W;DTYPE=G

<b><math>K_4^*(2045)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	(9.9±1.2) %	960
$K^*(892)\pi\pi$	(9 ±5 ) %	804
$K^*(892)\pi\pi\pi$	(7 ±5 ) %	770
$\rho K\pi$	(5.7±3.2) %	744
$\omega K\pi$	(5.0±3.0) %	740
$\phi K\pi$	(2.8±1.4) %	597
$\phi K^*(892)$	(1.4±0.7) %	368

NODE=M035215;DESIG=1  
DESIG=2  
DESIG=5  
DESIG=3  
DESIG=4  
DESIG=6  
DESIG=7

## CHARMED MESONS ( $C = \pm 1$ )

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}\text{'s}$$

NODE=MXXX035

 **$D^*(2007)^0$** 

$$I(J^P) = \frac{1}{2}(1^-)$$

$I, J, P$  need confirmation.

$$\text{Mass } m = 2006.85 \pm 0.05 \text{ MeV } (S = 1.1)$$

$$m_{D^{*0}} - m_{D^0} = 142.014 \pm 0.030 \text{ MeV } (S = 1.5)$$

$$\text{Full width } \Gamma < 2.1 \text{ MeV, CL} = 90\%$$

$\bar{D}^*(2007)^0$  modes are charge conjugates of modes below.

NODE=M061  
NODE=M061M;DTYPE=M  
NODE=M061DM;DTYPE=D  
NODE=M061W;DTYPE=G  
NODE=M061220;NODE=M061

<b><math>D^*(2007)^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^0\pi^0$	(64.7 ±0.9 ) %	43
$D^0\gamma$	(35.3 ±0.9 ) %	137
$D^0e^+e^-$	( 3.91±0.33) × 10 <sup>-3</sup>	137

DESIG=1  
DESIG=2  
DESIG=3

 **$D^*(2010)^\pm$** 

$$I(J^P) = \frac{1}{2}(1^-)$$

$I, J, P$  need confirmation.

$$\text{Mass } m = 2010.26 \pm 0.05 \text{ MeV}$$

$$m_{D^*(2010)^+} - m_{D^+} = 140.603 \pm 0.015 \text{ MeV}$$

$$m_{D^*(2010)^+} - m_{D^0} = 145.4258 \pm 0.0017 \text{ MeV}$$

$$\text{Full width } \Gamma = 83.4 \pm 1.8 \text{ keV}$$

NODE=M062  
NODE=M062M;DTYPE=M  
NODE=M062MD;DTYPE=D  
NODE=M062DM;DTYPE=D  
NODE=M062W;DTYPE=G

$D^*(2010)^-$  modes are charge conjugates of the modes below.

NODE=M062225;NODE=M062

$D^*(2010)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^0\pi^+$	(67.7±0.5) %	39
$D^+\pi^0$	(30.7±0.5) %	38
$D^+\gamma$	(1.6±0.4) %	136

DESIG=1  
DESIG=3  
DESIG=2

**$D_0^*(2300)$**

$$I(J^P) = \frac{1}{2}(0^+)$$

was  $D_0^*(2400)$

Mass  $m = 2343 \pm 10$  MeV ( $S = 1.5$ )  
Full width  $\Gamma = 229 \pm 16$  MeV

NODE=M252

NODE=M252M;DTYPE=M  
NODE=M252W;DTYPE=G

$D_0^*(2300)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D\pi^\pm$	seen	411

NODE=M252215;DESIG=1

**$D_1(2420)$**

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass  $m = 2422.1 \pm 0.6$  MeV ( $S = 1.7$ )  
 $m_{D_1(2420)^0} - m_{D^{*+}} = 411.8 \pm 0.6$  MeV ( $S = 1.7$ )  
 $m_{D_1(2420)^\pm} - m_{D_1(2420)^0} = 4 \pm 4$  MeV  
Full width  $\Gamma = 31.3 \pm 1.9$  MeV ( $S = 2.8$ )

$\bar{D}_1(2420)$  modes are charge conjugates of modes below.

NODE=M253

NODE=M253M;DTYPE=M

NODE=M253DM;DTYPE=D

NODE=M253DMC;DTYPE=D

NODE=M253W;DTYPE=G

NODE=M253215;NODE=M253

$D_1(2420)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^*(2007)^0\pi$	seen	359

DESIG=1

**$D_1(2430)^0$**

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass  $m = 2412 \pm 9$  MeV  
Full width  $\Gamma = 314 \pm 29$  MeV

NODE=M180

NODE=M180M;DTYPE=M

NODE=M180W;DTYPE=G

$D_1(2430)^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^*(2010)^+\pi^-$	seen	345

NODE=M180215;DESIG=1;OUR EVAL;  
→ UNCHECKED ←

**$D_2^*(2460)$**

$$I(J^P) = \frac{1}{2}(2^+)$$

Mass  $m = 2461.1^{+0.7}_{-0.8}$  MeV ( $S = 6.2$ )  
 $m_{D_2^*(2460)^0} - m_{D^+} = 591.5^{+0.7}_{-0.8}$  MeV ( $S = 5.9$ )  
 $m_{D_2^*(2460)^0} - m_{D^{*+}} = 450.9^{+0.7}_{-0.8}$  MeV ( $S = 5.9$ )  
 $m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0} = 2.4 \pm 1.7$  MeV  
Full width  $\Gamma = 47.3 \pm 0.8$  MeV ( $S = 1.5$ )

$\bar{D}_2^*(2460)$  modes are charge conjugates of modes below.

NODE=M254

NODE=M254M;DTYPE=M

NODE=M254DM;DTYPE=D

NODE=M254DM2;DTYPE=D

NODE=M254DMC;DTYPE=D

NODE=M254W;DTYPE=G

NODE=M254215;NODE=M254

$D_2^*(2460)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D\pi^-$	seen	509
$D^*(2010)\pi^-$	seen	389

DESIG=1

DESIG=2

**$D_3^*(2750)$**

$$I(J^P) = \frac{1}{2}(3^-)$$

Mass  $m = 2763.1 \pm 3.2$  MeV ( $S = 2.1$ )  
Full width  $\Gamma = 66 \pm 5$  MeV

NODE=M203

NODE=M203M;DTYPE=M

NODE=M203W;DTYPE=G

$D_3^*(2750)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D\pi$	seen	743
$D^+\pi^-$	seen	739
$D^0\pi^\pm$	seen	743
$D^*\pi$	seen	639
$D^{*+}\pi^-$	seen	639

NODE=M203215;DESIG=1;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=3;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=4;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=5;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

## CHARMED, STRANGE MESONS (C = $\pm 1$ , S = $\pm 1$ ) (including possibly non- $q\bar{q}$ states)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{*+}s$$

NODE=MXXX040

$D_s^{*\pm}$

$$I(J^P) = 0(?^?)$$

NODE=S074

$J^P$  is natural, width and decay modes consistent with  $1^-$ .

$$\text{Mass } m = 2112.2 \pm 0.4 \text{ MeV}$$

NODE=S074M;DTYPE=M

$$m_{D_s^{*\pm}} - m_{D_s^\pm} = 143.8 \pm 0.4 \text{ MeV}$$

NODE=S074DM;DTYPE=D  
NODE=S074W;DTYPE=G

$$\text{Full width } \Gamma < 1.9 \text{ MeV, CL} = 90\%$$

$D_s^{*-}$  modes are charge conjugates of the modes below.

NODE=S074215;NODE=S074

$D_s^{*+}$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D_s^+\gamma$	(93.5 $\pm$ 0.7) %	139
$D_s^+\pi^0$	( 5.8 $\pm$ 0.7) %	48
$D_s^+e^+e^-$	( 6.7 $\pm$ 1.6) $\times 10^{-3}$	139

DESIG=1  
DESIG=2  
DESIG=3

$D_{s0}^*(2317)^\pm$

$$I(J^P) = 0(0^+)$$

$J, P$  need confirmation.

NODE=M172

$J^P$  is natural, low mass consistent with  $0^+$ .

See the review on "Heavy Non- $q\bar{q}$  Mesons."

$$\text{Mass } m = 2317.8 \pm 0.5 \text{ MeV}$$

NODE=M172M;DTYPE=M

$$m_{D_{s0}^*(2317)^\pm} - m_{D_s^\pm} = 349.4 \pm 0.5 \text{ MeV}$$

NODE=M172DM;DTYPE=D  
NODE=M172W;DTYPE=G

$$\text{Full width } \Gamma < 3.8 \text{ MeV, CL} = 95\%$$

$D_{s0}^*(2317)^-$  modes are charge conjugates of modes below.

NODE=M172215;NODE=M172

$D_{s0}^*(2317)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$D_s^+ \pi^0$	$(100^{+0}_{-20})\%$		298
$D_s^+ \gamma$	$< 5\%$	90%	323
$D_s^*(2112)^+ \gamma$	$< 6\%$	90%	—
$D_s^+ \gamma \gamma$	$< 18\%$	95%	323
$D_s^*(2112)^+ \pi^0$	$< 11\%$	90%	—
$D_s^+ \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	194
$D_s^+ \pi^0 \pi^0$	not seen		205

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7;OUR EVAL;→ UNCHECKED ←

### $D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

NODE=M173

See the review on "Heavy Non- $q\bar{q}$  Mesons."

$$\text{Mass } m = 2459.5 \pm 0.6 \text{ MeV} \quad (S = 1.1)$$

$$m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}} = 347.3 \pm 0.7 \text{ MeV} \quad (S = 1.2)$$

$$m_{D_{s1}(2460)^\pm} - m_{D_s^\pm} = 491.1 \pm 0.6 \text{ MeV} \quad (S = 1.1)$$

$$\text{Full width } \Gamma < 3.5 \text{ MeV, CL} = 95\%$$

NODE=M173M;DTYPE=M

NODE=M173MD;DTYPE=D

NODE=M173DM;DTYPE=D

NODE=M173W;DTYPE=G

$D_{s1}(2460)^-$  modes are charge conjugates of the modes below.

NODE=M173215;NODE=M173

$D_{s1}(2460)^+$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$D_s^{*+} \pi^0$	$(48 \pm 11)\%$		297
$D_s^+ \gamma$	$(18 \pm 4)\%$		442
$D_s^+ \pi^+ \pi^-$	$(4.3 \pm 1.3)\%$	S=1.1	363
$D_s^{*+} \gamma$	$< 8\%$	CL=90%	323
$D_{s0}^*(2317)^+ \gamma$	$(3.7^{+5.0}_{-2.4})\%$		138

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

### $D_{s1}(2536)^\pm$

$$I(J^P) = 0(1^+)$$

$J, P$  need confirmation.

NODE=M121

$$\text{Mass } m = 2535.11 \pm 0.06 \text{ MeV}$$

NODE=M121M;DTYPE=M

$$m_{D_{s1}(2536)^\pm} - m_{D_s^*(2111)} = 422.9 \pm 0.4 \text{ MeV}$$

NODE=M121DM;DTYPE=D

$$m_{D_{s1}(2536)^\pm} - m_{D^*(2010)^\pm} = 524.85 \pm 0.04 \text{ MeV}$$

NODE=M121DN;DTYPE=D

$$m_{D_{s1}(2536)^\pm} - m_{D^*(2007)^0} = 528.26 \pm 0.05 \text{ MeV} \quad (S = 1.2)$$

NODE=M121DP;DTYPE=D

$$\text{Full width } \Gamma = 0.92 \pm 0.05 \text{ MeV}$$

NODE=M121W;DTYPE=G

Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M121215;NODE=M121

$D_{s1}(2536)^-$  modes are charge conjugates of the modes below.

$D_{s1}(2536)^+$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$D^*(2010)^+ K^0$	$0.85 \pm 0.12$		149
$(D^*(2010)^+ K^0)_{S\text{-wave}}$	$0.61 \pm 0.09$		149
$D^+ \pi^- K^+$	$0.028 \pm 0.005$		176
$D^*(2007)^0 K^+$	<b>DEFINED AS 1</b>		167
$D^+ K^0$	$< 0.34$	90%	381
$D^0 K^+$	$< 0.12$	90%	391
$D_s^{*+} \gamma$	possibly seen		388
$D_s^+ \pi^+ \pi^-$	seen		437

DESIG=1

DESIG=7

DESIG=8

DESIG=4

DESIG=2

DESIG=5

DESIG=3

DESIG=6

### $D_{s2}^*(2573)$

$$I(J^P) = 0(2^+)$$

NODE=M148

$$\text{Mass } m = 2569.1 \pm 0.8 \text{ MeV} \quad (S = 2.4)$$

NODE=M148M;DTYPE=M

$$m_{D_{s2}^*(2573)} - m_{D^0} = 704 \pm 3.2 \text{ MeV}$$

NODE=M148DM;DTYPE=D

$$\text{Full width } \Gamma = 16.9 \pm 0.7 \text{ MeV}$$

NODE=M148W;DTYPE=G

$D_{s2}^*(2573)^-$  modes are charge conjugates of the modes below.

NODE=M148215;NODE=M148

$D_{s2}^*(2573)^+$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^0 K^+$	seen	431
$D^*(2007)^0 K^+$	not seen	238
$D^+ K_S^0$	seen	422
$D^{*+} K_S^0$	seen	225

DESIG=1  
DESIG=2;OUR EVAL;→ UNCHECKED ←  
DESIG=4;OUR EVAL;→ UNCHECKED ←  
DESIG=5;OUR EVAL;→ UNCHECKED ←

**$D_{s1}^*(2700)^\pm$**

$$I(J^P) = 0(1^-)$$

Mass  $m = 2714 \pm 5$  MeV ( $S = 1.5$ )

Full width  $\Gamma = 122 \pm 10$  MeV

NODE=M182

NODE=M182M;DTYPE=M  
NODE=M182W;DTYPE=G

$D_{s1}^*(2700)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^0 K^+$	seen	579
$D^+ K_S^0$	seen	573
$D^{*0} K^+$	seen	438
$D^{*+} K_S^0$	seen	431

NODE=M182215;DESIG=1;OUR EVAL;  
→ UNCHECKED ←  
DESIG=3;OUR EVAL;→ UNCHECKED ←  
DESIG=5;OUR EVAL;→ UNCHECKED ←  
DESIG=6;OUR EVAL;→ UNCHECKED ←

**$D_{s3}^*(2860)^\pm$**

$$I(J^P) = 0(3^-)$$

Mass  $m = 2860 \pm 7$  MeV

Full width  $\Gamma = 53 \pm 10$  MeV

NODE=M226

NODE=M226M;DTYPE=M  
NODE=M226W;DTYPE=G

$D_{s3}^*(2860)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^0 K^+$	seen	710
$D^+ K_S^0$	seen	704
$D^{*0} K^+$	seen	589
$D^{*+} K_S^0$	seen	584

NODE=M226215;DESIG=2;OUR EVAL;  
→ UNCHECKED ←  
DESIG=3;OUR EVAL;→ UNCHECKED ←  
DESIG=5;OUR EVAL;→ UNCHECKED ←  
DESIG=6;OUR EVAL;→ UNCHECKED ←

## BOTTOM MESONS ( $B = \pm 1$ )

$B^+ = u\bar{b}$ ,  $B^0 = d\bar{b}$ ,  $\bar{B}^0 = \bar{d}b$ ,  $B^- = \bar{u}b$ , similarly for  $B^{*}$ 's

NODE=MXXX045

**$B_1(5721)$**

$$I(J^P) = \frac{1}{2}(1^+)$$

$I, J, P$  need confirmation.

NODE=M244

$B_1(5721)^+$  mass =  $5725.9^{+2.5}_{-2.7}$  MeV

$m_{B_1^+} - m_{B^{*0}}$  =  $401.2^{+2.4}_{-2.7}$  MeV

$B_1(5721)^0$  mass =  $5726.1 \pm 1.3$  MeV ( $S = 1.2$ )

$m_{B_1^0} - m_{B^+}$  =  $446.7 \pm 1.3$  MeV ( $S = 1.2$ )

$m_{B_1^0} - m_{B^{*+}}$  =  $401.4 \pm 1.2$  MeV ( $S = 1.2$ )

Full width  $\Gamma(B_1(5721)^+) = 31 \pm 6$  MeV ( $S = 1.1$ )

Full width  $\Gamma(B_1(5721)^0) = 27.5 \pm 3.4$  MeV ( $S = 1.1$ )

NODE=M244M+;DTYPE=M  
NODE=M244DM+;DTYPE=D  
NODE=M244M0;DTYPE=M  
NODE=M244DM0;DTYPE=D  
NODE=M244DM1;DTYPE=D  
NODE=M244W+;DTYPE=G  
NODE=M244W0;DTYPE=G



$B_1(5721)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B^* \pi$	seen	365

NODE=M244215;DESIG=1

 **$B_2^*(5747)$** 

$$I(J^P) = \frac{1}{2}(2^+)$$

$I, J, P$  need confirmation.

NODE=M245

$$B_2^*(5747)^+ \text{ mass} = 5737.2 \pm 0.7 \text{ MeV}$$

NODE=M245M+;DTYPE=M

$$m_{B_2^{*+}} - m_{B^0} = 457.5 \pm 0.7 \text{ MeV}$$

NODE=M245DM+;DTYPE=D

$$B_2^*(5747)^0 \text{ mass} = 5739.5 \pm 0.7 \text{ MeV} \quad (S = 1.4)$$

NODE=M245M0;DTYPE=M

$$m_{B_2^{*0}} - m_{B_1^0} = 13.4 \pm 1.4 \text{ MeV} \quad (S = 1.3)$$

NODE=M245DM0;DTYPE=D

$$m_{B_2^{*0}} - m_{B^+} = 460.2 \pm 0.6 \text{ MeV} \quad (S = 1.4)$$

NODE=M245DM2;DTYPE=D

$$\text{Full width } \Gamma(B_2^*(5747)^+) = 20 \pm 5 \text{ MeV} \quad (S = 2.2)$$

NODE=M245W+;DTYPE=G

$$\text{Full width } \Gamma(B_2^*(5747)^0) = 24.2 \pm 1.7 \text{ MeV}$$

NODE=M245W0;DTYPE=G

$B_2^*(5747)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B \pi$	seen	420
$B^* \pi$	seen	376

NODE=M245215;DESIG=1

DESIG=2

 **$B_J(5970)$** 

$$I(J^P) = \frac{1}{2}(?^?)$$

$I, J, P$  need confirmation.

NODE=M248

$$B_J(5970)^+ \text{ mass } m = 5964 \pm 5 \text{ MeV}$$

NODE=M248M+;DTYPE=M

$$m_{B_J(5970)^+} - m_{B^0} = 685 \pm 5 \text{ MeV}$$

NODE=M248DM+;DTYPE=D

$$B_J(5970)^0 \text{ mass } m = 5971 \pm 5 \text{ MeV}$$

NODE=M248M0;DTYPE=M

$$m_{B_J(5970)^0} - m_{B^+} = 691 \pm 5 \text{ MeV}$$

NODE=M248DM0;DTYPE=D

$$B_J(5970)^+ \text{ full width } \Gamma = 62 \pm 20 \text{ MeV}$$

NODE=M248W+;DTYPE=G

$$B_J(5970)^0 \text{ full width } \Gamma = 81 \pm 12 \text{ MeV}$$

NODE=M248W0;DTYPE=G

$B_J(5970)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B \pi$	possibly seen	633
$B^* \pi$	seen	592

NODE=M248215;DESIG=1

DESIG=2

## BOTTOM, STRANGE MESONS

### ( $B = \pm 1, S = \mp 1$ )

$$B_S^0 = s\bar{b}, \bar{B}_S^0 = \bar{s}b, \quad \text{similarly for } B_S^{*'}\text{'s}$$

NODE=MXXX046

 **$B_{s1}(5830)^0$** 

$$I(J^P) = 0(1^+)$$

$I, J, P$  need confirmation.

NODE=M187

$$\text{Mass } m = 5828.70 \pm 0.20 \text{ MeV}$$

NODE=M187M;DTYPE=M

$$m_{B_{s1}^0} - m_{B^{*+}} = 503.99 \pm 0.17 \text{ MeV}$$

NODE=M187DM;DTYPE=D

$$\text{Full width } \Gamma = 0.5 \pm 0.4 \text{ MeV}$$

NODE=M187W;DTYPE=G

$B_{s1}(5830)^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B^{*+} K^-$	seen	97

NODE=M187215;DESIG=1

 **$B_{s2}^*(5840)^0$** 

$$I(J^P) = 0(2^+)$$

$I, J, P$  need confirmation.

NODE=M186

$$\text{Mass } m = 5839.86 \pm 0.12 \text{ MeV}$$

NODE=M186M;DTYPE=M

$$m_{B_{s2}^{*0}} - m_{B^+} = 560.52 \pm 0.14 \text{ MeV}$$

NODE=M186DM2;DTYPE=D

$$\text{Full width } \Gamma = 1.49 \pm 0.27 \text{ MeV}$$

NODE=M186W;DTYPE=G

Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M186215;NODE=M186

$B_{s2}^*$ (5840) <sup>0</sup> DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B^+ K^-$	<b>DEFINED AS 1</b>	252
$B^{*+} K^-$	$0.093 \pm 0.018$	141
$B^0 K_S^0$	$0.43 \pm 0.11$	245
$B^{*0} K_S^0$	$0.04 \pm 0.04$	–

DESIG=1  
DESIG=2  
DESIG=4  
DESIG=3

## BOTTOM, CHARMED MESONS ( $B = C = \pm 1$ )

$$B_c^+ = c\bar{b}, B_c^- = \bar{c}b, \text{ similarly for } B_c^{*'}\text{'s}$$

NODE=MXXX049

 $B_c(2S)^\pm$ 

$$I(J^P) = 0(0^-)$$

Mass  $m = 6871.2 \pm 1.0$  MeV

NODE=M217

NODE=M217M;DTYPE=M

$B_c(2S)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B_c^+ \pi^+ \pi^-$	seen	504

NODE=M217215;DESIG=1

## $c\bar{c}$ MESONS (including possibly non- $q\bar{q}$ states)

NODE=MXXX025

 $\eta_c(1S)$ 

$$I^G(J^{PC}) = 0^+(0^-+)$$

Mass  $m = 2983.9 \pm 0.4$  MeV ( $S = 1.2$ )Full width  $\Gamma = 32.0 \pm 0.7$  MeV

NODE=M026

NODE=M026M;DTYPE=M

NODE=M026W;DTYPE=G

$\eta_c(1S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
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### Decays involving hadronic resonances

$\eta'(958) \pi \pi$	( $1.87 \pm 0.26$ ) %		1323
$\eta'(958) K \bar{K}$	( $1.61 \pm 0.25$ ) %		1131
$\rho \rho$	( $1.5 \pm 0.4$ ) %		1275
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	( $1.5 \pm 0.5$ ) %		1278
$K^*(892) \bar{K}^*(892)$	( $6.3 \pm 1.2$ ) $\times 10^{-3}$		1196
$K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	( $1.1 \pm 0.5$ ) %		1073
$\phi K^+ K^-$	( $2.9 \pm 1.4$ ) $\times 10^{-3}$		1104
$\phi \phi$	( $1.58 \pm 0.19$ ) $\times 10^{-3}$		1089
$\phi 2(\pi^+ \pi^-)$	< 4 $\times 10^{-3}$	90%	1251
$a_0(980) \pi$	seen		1327
$K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	90%	1310
$f_2(1270) \eta$	seen		1145
$f_2(1270) \eta'$	seen		984
$\omega \omega$	( $2.1 \pm 0.5$ ) $\times 10^{-3}$		1270
$\omega \phi$	< 2.5 $\times 10^{-4}$	90%	1185
$f_2(1270) f_2(1270)$	( $9.7 \pm 2.5$ ) $\times 10^{-3}$		774
$f_2(1270) f_2'(1525)$	( $9.1 \pm 3.0$ ) $\times 10^{-3}$		524
$f_0(500) \eta$	seen		–
$f_0(500) \eta'$	seen		–

NODE=M026215;NODE=M026;CLUMP=A

DESIG=24

DESIG=85

DESIG=19

DESIG=26

DESIG=18

DESIG=57

DESIG=28

DESIG=17

DESIG=58

DESIG=21

DESIG=40

DESIG=23

DESIG=92

DESIG=20

DESIG=47

DESIG=46

DESIG=59

DESIG=86

DESIG=87

$f_0(980)\eta$	seen	1264	DESIG=70
$f_0(980)\eta'$	seen	1130	DESIG=88
$f_0(1500)\eta$	seen	1016	DESIG=71
$f_0(1710)\eta'$	seen	623	DESIG=90
$f_0(2100)\eta'$	seen	†	DESIG=91
$f_0(2200)\eta$	seen	498	DESIG=72
$a_0(1320)\pi$	seen	–	DESIG=74
$a_0(1450)\pi$	seen	1123	DESIG=75
$a_0(1700)\pi$	seen	–	DESIG=89
$a_0(1950)\pi$	seen	860	DESIG=79
$K_0^*(1430)\bar{K}$	seen	–	DESIG=76
$K_2^*(1430)\bar{K}$	seen	–	DESIG=77
$K_0^*(1950)\bar{K}$	seen	–	DESIG=78

**Decays into stable hadrons**

$K\bar{K}\pi$	( 7.0 ± 0.4 ) %	1381	NODE=M026;CLUMP=B DESIG=14
$K\bar{K}\eta$	( 1.32±0.15 ) %	1265	DESIG=25
$\eta\pi^+\pi^-$	( 1.7 ± 0.5 ) %	1428	DESIG=16
$\eta 2(\pi^+\pi^-)$	( 4.6 ± 1.4 ) %	1386	DESIG=61
$K^+K^-\pi^+\pi^-$	( 6.5 ± 1.0 ) × 10 <sup>-3</sup>	1345	DESIG=15
$K^+K^-\pi^+\pi^-\pi^0$	( 3.4 ± 0.5 ) %	1304	DESIG=60
$K^0K^-\pi^+\pi^-\pi^+ + c.c.$	( 5.7 ± 1.6 ) %	–	DESIG=62
$K^+K^- 2(\pi^+\pi^-)$	( 7.6 ± 2.4 ) × 10 <sup>-3</sup>	1254	DESIG=55
$2(K^+K^-)$	( 1.38±0.29 ) × 10 <sup>-3</sup>	1056	DESIG=27
$\pi^+\pi^-\pi^0$	< 5 × 10 <sup>-4</sup>	90% 1476	DESIG=81
$\pi^+\pi^-\pi^0\pi^0$	( 4.8 ± 1.1 ) %	1460	DESIG=63
$2(\pi^+\pi^-)$	( 8.7 ± 1.1 ) × 10 <sup>-3</sup>	1459	DESIG=11
$2(\pi^+\pi^-\pi^0)$	(16.2 ± 2.1 ) %	1409	DESIG=64
$3(\pi^+\pi^-)$	( 1.8 ± 0.4 ) %	1407	DESIG=56
$p\bar{p}$	( 1.35±0.13 ) × 10 <sup>-3</sup>	1160	DESIG=12
$p\bar{p}\pi^0$	( 3.6 ± 1.4 ) × 10 <sup>-3</sup>	1101	DESIG=65
$\Lambda\bar{\Lambda}$	( 1.02±0.23 ) × 10 <sup>-3</sup>	991	DESIG=45
$K^+\bar{p}\Lambda + c.c.$	( 2.5 ± 0.4 ) × 10 <sup>-3</sup>	772	DESIG=82
$\bar{\Lambda}(1520)\Lambda + c.c.$	( 3.1 ± 1.3 ) × 10 <sup>-3</sup>	694	DESIG=83
$\Sigma^+\bar{\Sigma}^-$	( 2.1 ± 0.6 ) × 10 <sup>-3</sup>	901	DESIG=66
$\Xi^-\bar{\Xi}^+$	( 9.0 ± 2.6 ) × 10 <sup>-4</sup>	692	DESIG=67
$\pi^+\pi^-p\bar{p}$	( 5.5 ± 1.9 ) × 10 <sup>-3</sup>	1027	DESIG=13

**Radiative decays**

$\gamma\gamma$	( 1.68±0.12 ) × 10 <sup>-4</sup>	1492	NODE=M026;CLUMP=C DESIG=31
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**Charge conjugation (C), Parity (P),  
Lepton Family number (LF) violating modes**

$\pi^+\pi^-$	$P,CP < 1.1$	× 10 <sup>-4</sup>	90%	1485	DESIG=51	NODE=M026;CLUMP=D
$\pi^0\pi^0$	$P,CP < 4$	× 10 <sup>-5</sup>	90%	1486	DESIG=52	
$K^+K^-$	$P,CP < 6$	× 10 <sup>-4</sup>	90%	1408	DESIG=53	
$K_S^0K_S^0$	$P,CP < 3.1$	× 10 <sup>-4</sup>	90%	1407	DESIG=54	

**J/ψ(1S)**

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 3096.900 \pm 0.006$  MeV  
 Full width  $\Gamma = 92.6 \pm 1.7$  keV (S = 1.1)

NODE=M070  
 NODE=M070M;DTYPE=M  
 NODE=M070W;DTYPE=G

<b>J/ψ(1S) DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level (MeV/c)	$\rho$	
hadrons	(87.7 ± 0.5) %	—	—	NODE=M070215;DESIG=3
virtual $\gamma \rightarrow$ hadrons	(13.50 ± 0.30) %	—	—	DESIG=4
$ggg$	(64.1 ± 1.0) %	—	—	DESIG=249
$\gamma g g$	(8.8 ± 1.1) %	—	—	DESIG=250
$e^+e^-$	(5.971 ± 0.032) %	1548	—	DESIG=1
$e^+e^-\gamma$	[h] (8.8 ± 1.4) × 10 <sup>-3</sup>	1548	—	DESIG=5
$\mu^+\mu^-$	(5.961 ± 0.033) %	1545	—	DESIG=2
<b>Decays involving hadronic resonances</b>				NODE=M070;CLUMP=A
$\rho\pi$	(1.69 ± 0.15) %	S=2.4	1448	DESIG=20
$\rho^0\pi^0$	(5.6 ± 0.7) × 10 <sup>-3</sup>	—	1448	DESIG=21
$a_2(1320)^0\pi^+\pi^- \rightarrow$ $2(\pi^+\pi^-)\pi^0$	(2.8 ± 0.6) × 10 <sup>-3</sup>	—	—	DESIG=442
$a_2(1320)^+\pi^-\pi^0 + c.c. \rightarrow$ $2(\pi^+\pi^-)\pi^0$	(3.7 ± 0.7) × 10 <sup>-3</sup>	—	—	DESIG=443
$a_2(1320)\rho$	(1.09 ± 0.22) %	—	1123	DESIG=43
$\eta\pi^+\pi^-$	(3.8 ± 0.7) × 10 <sup>-4</sup>	—	1487	DESIG=239
$\eta\pi^+\pi^-\pi^0$	(1.17 ± 0.20) %	—	1470	DESIG=420
$\eta\pi^+\pi^-3\pi^0$	(4.9 ± 1.0) × 10 <sup>-3</sup>	—	1419	DESIG=422
$\eta\rho$	(1.93 ± 0.23) × 10 <sup>-4</sup>	—	1396	DESIG=22
$\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow$ $\eta\phi\pi^+\pi^-$	(1.2 ± 0.4) × 10 <sup>-4</sup>	—	628	DESIG=287
$\eta\phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 <sup>-4</sup>	CL=90%	—	DESIG=253
$\eta K^\pm K_S^0 \pi^\mp$	[l] (2.2 ± 0.4) × 10 <sup>-3</sup>	—	1278	DESIG=230
$\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 <sup>-3</sup>	—	1003	DESIG=252
$\rho\eta'(958)$	(8.1 ± 0.8) × 10 <sup>-5</sup>	S=1.6	1281	DESIG=23
$\rho^\pm\pi^\mp\pi^+\pi^-2\pi^0$	(2.8 ± 0.8) %	—	1364	DESIG=415
$\rho^+\rho^-\pi^+\pi^-\pi^0$	(6 ± 4) × 10 <sup>-3</sup>	—	1186	DESIG=416
$\rho^+K^+K^-\pi^- + c.c. \rightarrow$ $K^+K^-\pi^+\pi^-\pi^0$	(3.5 ± 0.8) × 10 <sup>-3</sup>	—	—	DESIG=444
$\rho^\mp K^\pm K_S^0$	(1.9 ± 0.4) × 10 <sup>-3</sup>	—	1269	DESIG=342
$\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.3 ± 0.7) × 10 <sup>-3</sup>	—	—	DESIG=328
$\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp$	(3.5 ± 0.6) × 10 <sup>-4</sup>	—	—	DESIG=329
$\rho(1450)^0\pi^0 \rightarrow K^+K^-\pi^0$	(2.7 ± 0.6) × 10 <sup>-4</sup>	—	—	DESIG=312
$\rho(1450)\eta'(958) \rightarrow$ $\pi^+\pi^-\eta'(958)$	(3.3 ± 0.7) × 10 <sup>-6</sup>	—	—	DESIG=345
$\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0$	(1.7 ± 1.1) × 10 <sup>-4</sup>	—	—	DESIG=313
$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	(8 ± 40) × 10 <sup>-6</sup>	—	—	DESIG=314
$\omega\pi^0$	(4.5 ± 0.5) × 10 <sup>-4</sup>	S=1.4	1446	DESIG=32
$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0$	(1.7 ± 0.8) × 10 <sup>-5</sup>	—	—	DESIG=327
$\omega\pi^+\pi^-$	(8.5 ± 1.0) × 10 <sup>-3</sup>	S=1.3	1435	DESIG=24
$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 <sup>-3</sup>	—	1436	DESIG=140
$\omega 3\pi^0$	(1.9 ± 0.6) × 10 <sup>-3</sup>	—	1419	DESIG=421
$\omega f_2(1270)$	(4.3 ± 0.6) × 10 <sup>-3</sup>	—	1142	DESIG=28
$\omega\eta$	(1.74 ± 0.20) × 10 <sup>-3</sup>	S=1.6	1394	DESIG=30
$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 <sup>-3</sup>	—	1418	DESIG=211
$\omega\pi^0\eta$	(3.4 ± 1.7) × 10 <sup>-4</sup>	—	1363	DESIG=360
$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 <sup>-3</sup>	—	1392	DESIG=26
$\omega\pi^+\pi^-2\pi^0$	(3.3 ± 0.5) %	—	1394	DESIG=412
$\omega\eta'\pi^+\pi^-$	(1.12 ± 0.13) × 10 <sup>-3</sup>	—	1173	DESIG=385
$\omega\eta'(958)$	(1.89 ± 0.18) × 10 <sup>-4</sup>	—	1279	DESIG=31
$\omega f_0(980)$	(1.4 ± 0.5) × 10 <sup>-4</sup>	—	1267	DESIG=150
$\omega f_0(1710) \rightarrow \omega K \bar{K}$	(4.8 ± 1.1) × 10 <sup>-4</sup>	—	878	DESIG=130
$\omega f_1(1420)$	(6.8 ± 2.4) × 10 <sup>-4</sup>	—	1062	DESIG=105
$\omega f_2'(1525)$	< 2.2 × 10 <sup>-4</sup>	CL=90%	1007	DESIG=29
$\omega X(1835) \rightarrow \omega p \bar{p}$	< 3.9 × 10 <sup>-6</sup>	CL=95%	—	DESIG=263
$\omega X(1835), X \rightarrow \eta'\pi^+\pi^-$	< 6.2 × 10 <sup>-5</sup>	—	—	DESIG=386
$\omega K^+K^-$	(1.52 ± 0.31) × 10 <sup>-3</sup>	—	1268	DESIG=441

$\omega K^\pm K_S^0 \pi^\mp$	[i] $( 3.4 \pm 0.5 ) \times 10^{-3}$	1210	DESIG=101
$\omega K \bar{K}$	$( 1.9 \pm 0.4 ) \times 10^{-3}$	1268	DESIG=27
$\omega K^*(892) \bar{K} + \text{c.c.}$	$( 6.1 \pm 0.9 ) \times 10^{-3}$	1097	DESIG=102
$\eta' K^{*\pm} K^\mp$	$( 1.48 \pm 0.13 ) \times 10^{-3}$	–	DESIG=355
$\eta' K^{*0} \bar{K}^0 + \text{c.c.}$	$( 1.66 \pm 0.21 ) \times 10^{-3}$	1000	DESIG=357
$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.}$	$( 2.16 \pm 0.31 ) \times 10^{-4}$	–	DESIG=353
$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	$( 1.51 \pm 0.23 ) \times 10^{-4}$	–	DESIG=354
$\eta' h_1(1415) \rightarrow \gamma \eta' \eta'$	$( 4.7 \pm \frac{1.1}{2.0} ) \times 10^{-7}$	–	DESIG=430
$\bar{K} K^*(892) + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$( 5.0 \pm 0.5 ) \times 10^{-3}$	–	DESIG=332
$K^+ K^*(892)^- + \text{c.c.}$	$( 6.0 \pm \frac{0.8}{1.0} ) \times 10^{-3}$	S=2.9 1373	DESIG=121
$K^+ K^*(892)^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	$( 2.69 \pm \frac{0.13}{0.20} ) \times 10^{-3}$	–	DESIG=231
$K^+ K^*(892)^- + \text{c.c.} \rightarrow$ $K^0 K^\pm \pi^\mp + \text{c.c.}$	$( 3.0 \pm 0.4 ) \times 10^{-3}$	–	DESIG=232
$K^0 \bar{K}^*(892)^0 + \text{c.c.}$	$( 4.2 \pm 0.4 ) \times 10^{-3}$	1373	DESIG=122
$K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow$ $K^0 K^\pm \pi^\mp + \text{c.c.}$	$( 3.2 \pm 0.4 ) \times 10^{-3}$	–	DESIG=233
$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	$( 5.7 \pm 0.8 ) \times 10^{-3}$	1343	DESIG=214
$K^*(892)^\pm K^\mp \pi^0$	$( 4.1 \pm 1.3 ) \times 10^{-3}$	1344	DESIG=343
$K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$( 2.0 \pm 0.5 ) \times 10^{-3}$	1342	DESIG=299
$K^*(892)^+ K_S^0 \pi^- + \text{c.c.} \rightarrow$ $K_S^0 K_S^0 \pi^+ \pi^-$	$( 6.7 \pm 2.2 ) \times 10^{-4}$	–	DESIG=300
$K^*(892)^0 K^- \pi^+ + \text{c.c.} \rightarrow$ $K^+ K^- \pi^+ \pi^-$	$( 3.8 \pm 0.5 ) \times 10^{-3}$	–	DESIG=445
$K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$( 6.3 \pm \frac{0.6}{0.5} ) \times 10^{-6}$	–	DESIG=376
$K^*(892)^0 K_S^0 \pi^0$	$( 7 \pm 4 ) \times 10^{-4}$	1343	DESIG=344
$K^*(892)^\pm K^*(700)^\mp$	$( 1.1 \pm \frac{1.0}{0.6} ) \times 10^{-3}$	–	DESIG=257
$K^*(892)^0 \bar{K}^*(892)^0$	$( 2.3 \pm 0.6 ) \times 10^{-4}$	1266	DESIG=46
$K^*(892)^\pm K^*(892)^\mp$	$( 1.00 \pm \frac{0.22}{0.40} ) \times 10^{-3}$	1266	DESIG=256
$K_1(1400)^\pm K^\mp$	$( 3.8 \pm 1.4 ) \times 10^{-3}$	1170	DESIG=132
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$ $K^\pm K^\mp \pi^0$	$( 7 \pm 4 ) \times 10^{-5}$	–	DESIG=330
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$( 8 \pm 6 ) \times 10^{-5}$	–	DESIG=318
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$ $K^\pm K^\mp \pi^0$	$( 1.0 \pm 0.5 ) \times 10^{-4}$	–	DESIG=321
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$( 4.0 \pm 1.0 ) \times 10^{-4}$	–	DESIG=320
$\bar{K}_2^*(1430) K + \text{c.c.}$	$< 4.0 \times 10^{-3}$	CL=90% 1158	DESIG=45
$K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	$( 2.69 \pm \frac{0.25}{0.19} ) \times 10^{-4}$	–	DESIG=381
$K_2^*(1430)^0 K^- \pi^+ + \text{c.c.} \rightarrow$ $K^+ K^- \pi^+ \pi^-$	$( 2.6 \pm 0.9 ) \times 10^{-3}$	–	DESIG=446
$K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}$	$( 3.6 \pm 1.8 ) \times 10^{-3}$	1116	DESIG=301
$\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}$	$( 4.67 \pm 0.29 ) \times 10^{-3}$	1011	DESIG=48
$K_2^*(1430)^- K^*(892)^+ + \text{c.c.}$	$( 3.4 \pm 2.9 ) \times 10^{-3}$	1011	DESIG=303
$K_2^*(1430)^- K^*(892)^+ +$ $\text{c.c.} \rightarrow$ $K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$( 4 \pm 4 ) \times 10^{-4}$	–	DESIG=304
$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90% 601	DESIG=47
$\bar{K}_2^*(1770)^0 K^*(892)^0 + \text{c.c.} \rightarrow$ $K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$( 6.9 \pm 0.9 ) \times 10^{-4}$	–	DESIG=235
$K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	$( 1.10 \pm \frac{0.60}{0.14} ) \times 10^{-5}$	–	DESIG=382

$K_4^*(2045)^+ K^- + c.c. \rightarrow$ $K^+ K^- \pi^0$	$(6.2 \pm 2.9)$	$\times 10^{-6}$	–	DESIG=383
$K_1(1270)^\pm K^\mp$	$< 3.0$	$\times 10^{-3}$	CL=90%	1240 DESIG=131
$K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5)$	$\times 10^{-7}$	–	DESIG=377
$a_2(1320)^\pm \pi^\mp$	[i] $< 4.3$	$\times 10^{-3}$	CL=90%	1263 DESIG=42
$\phi \pi^0$	$3 \times 10^{-6}$ or $1 \times 10^{-7}$			1377 DESIG=33;OUR EVAL;→ UNCHECKED ←
$\phi \pi^+ \pi^-$	$(9.4 \pm 1.5)$	$\times 10^{-4}$	S=1.7	1365 DESIG=34
$\phi \pi^0 \pi^0$	$(5.0 \pm 1.0)$	$\times 10^{-4}$		1366 DESIG=76
$\phi 2(\pi^+ \pi^-)$	$(1.60 \pm 0.32)$	$\times 10^{-3}$		1318 DESIG=35
$\phi \eta$	$(7.4 \pm 0.6)$	$\times 10^{-4}$	S=1.2	1320 DESIG=37
$\phi \eta'(958)$	$(4.6 \pm 0.5)$	$\times 10^{-4}$	S=2.2	1192 DESIG=38
$\phi \eta \eta'$	$(2.32 \pm 0.17)$	$\times 10^{-4}$		885 DESIG=387
$\phi f_0(980)$	$(3.2 \pm 0.9)$	$\times 10^{-4}$	S=1.9	1178 DESIG=41
$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	$(2.60 \pm 0.34)$	$\times 10^{-4}$	–	DESIG=236
$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$	$(1.8 \pm 0.5)$	$\times 10^{-4}$	–	DESIG=237
$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(4.5 \pm 1.0)$	$\times 10^{-6}$	–	DESIG=278
$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \rho^0 \pi^0$	$(1.7 \pm 0.6)$	$\times 10^{-6}$		1045 DESIG=279
$\phi f_0(980) \eta \rightarrow \eta \phi \pi^+ \pi^-$	$(3.2 \pm 1.0)$	$\times 10^{-4}$	–	DESIG=229
$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$	$(4.4 \pm 1.4)$	$\times 10^{-6}$	–	DESIG=258
$\phi f_2(1270)$	$(3.2 \pm 0.6)$	$\times 10^{-4}$		1036 DESIG=39
$\phi f_1(1285)$	$(2.6 \pm 0.5)$	$\times 10^{-4}$		1032 DESIG=106
$\phi f_1(1285) \rightarrow$ $\phi \pi^0 f_0(980) \rightarrow$ $\phi \pi^0 \pi^+ \pi^-$	$(9.4 \pm 2.8)$	$\times 10^{-7}$		952 DESIG=280
$\phi f_1(1285) \rightarrow$ $\phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0$	$(2.1 \pm 2.2)$	$\times 10^{-7}$		955 DESIG=281
$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	$(2.0 \pm 1.0)$	$\times 10^{-5}$		946 DESIG=128
$\phi f_2'(1525)$	$(8 \pm 4)$	$\times 10^{-4}$	S=2.7	877 DESIG=40
$\phi X(1835) \rightarrow \phi p \bar{p}$	$< 2.1$	$\times 10^{-7}$	CL=90%	– DESIG=291
$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	$< 2.8$	$\times 10^{-4}$	CL=90%	578 DESIG=288
$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	$< 6.13$	$\times 10^{-5}$	CL=90%	– DESIG=289
$\phi K \bar{K}$	$(1.77 \pm 0.16)$	$\times 10^{-3}$	S=1.3	1179 DESIG=36
$\phi f_0(1710) \rightarrow \phi K \bar{K}$	$(3.6 \pm 0.6)$	$\times 10^{-4}$		875 DESIG=129
$\phi K^+ K^-$	$(8.3 \pm 1.1)$	$\times 10^{-4}$		1179 DESIG=295
$\phi K_S^0 K_S^0$	$(5.9 \pm 1.5)$	$\times 10^{-4}$		1176 DESIG=305
$\phi K^\pm K_S^0 \pi^\mp$	[i] $(7.2 \pm 0.8)$	$\times 10^{-4}$		1114 DESIG=103
$\phi K^*(892) \bar{K} + c.c.$	$(2.18 \pm 0.23)$	$\times 10^{-3}$		969 DESIG=104
$b_1(1235)^\pm \pi^\mp$	[i] $(3.0 \pm 0.5)$	$\times 10^{-3}$		1300 DESIG=49
$b_1(1235)^0 \pi^0$	$(2.3 \pm 0.6)$	$\times 10^{-3}$		1300 DESIG=160
$f_2'(1525) K^+ K^-$	$(1.06 \pm 0.35)$	$\times 10^{-3}$		897 DESIG=308
$\Delta(1232)^+ \bar{p}$	$< 1$	$\times 10^{-4}$	CL=90%	1100 DESIG=112
$\Delta(1232)^{++} \bar{p} \pi^-$	$(1.6 \pm 0.5)$	$\times 10^{-3}$		1030 DESIG=70
$\Delta(1232)^{++} \bar{\Delta}(1232)^{--}$	$(1.10 \pm 0.29)$	$\times 10^{-3}$		938 DESIG=66
$\bar{\Sigma}(1385)^0 p K^-$	$(5.1 \pm 3.2)$	$\times 10^{-4}$		646 DESIG=74
$\Sigma(1385)^0 \bar{\Lambda} + c.c.$	$< 8.2$	$\times 10^{-6}$	CL=90%	911 DESIG=111
$\Sigma(1385)^- \bar{\Sigma}^+ (or c.c.)$	[i] $(3.1 \pm 0.5)$	$\times 10^{-4}$		855 DESIG=68
$\Sigma(1385)^- \bar{\Sigma}(1385)^+ (or c.c.)$	[i] $(1.16 \pm 0.05)$	$\times 10^{-3}$		697 DESIG=67
$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(1.07 \pm 0.08)$	$\times 10^{-3}$		697 DESIG=309
$\Lambda(1520) \bar{\Lambda} + c.c. \rightarrow \gamma \Lambda \bar{\Lambda}$	$< 4.1$	$\times 10^{-6}$	CL=90%	– DESIG=260
$\bar{\Lambda}(1520) \Lambda + c.c.$	$< 1.80$	$\times 10^{-3}$	CL=90%	807 DESIG=364
$\Xi^0 \Xi^0$	$(1.17 \pm 0.04)$	$\times 10^{-3}$		818 DESIG=248
$\Xi(1530)^- \Xi^+ + c.c.$	$(3.18 \pm 0.08)$	$\times 10^{-4}$		600 DESIG=107
$\Xi(1530)^0 \Xi^0$	$(3.2 \pm 1.4)$	$\times 10^{-4}$		608 DESIG=108
$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + c.c.$	[i] $< 1.1$	$\times 10^{-5}$	CL=90%	– DESIG=205
$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	[i] $< 2.1$	$\times 10^{-5}$	CL=90%	– DESIG=206
$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	[i] $< 1.6$	$\times 10^{-5}$	CL=90%	– DESIG=207
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	[i] $< 5.6$	$\times 10^{-5}$	CL=90%	– DESIG=208
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	[i] $< 1.1$	$\times 10^{-5}$	CL=90%	– DESIG=209

## Decays into stable hadrons

NODE=M070;CLUMP=B

$2(\pi^+\pi^-)\pi^0$	( 4.2 ± 0.4 ) %	S=2.1	1496	DESIG=9
$3(\pi^+\pi^-)\pi^0$	( 2.9 ± 0.6 ) %		1433	DESIG=11
$\pi^+\pi^-3\pi^0$	( 1.9 ± 0.9 ) %		1497	DESIG=358
$\pi^+\pi^-4\pi^0$	( 6.5 ± 1.3 ) × 10 <sup>-3</sup>		1470	DESIG=419
$\rho^\pm\pi^\mp\pi^0\pi^0$	( 1.41 ± 0.22 ) %		1421	DESIG=362
$\rho^+\rho^-\pi^0$	( 6.0 ± 1.1 ) × 10 <sup>-3</sup>		1298	DESIG=363
$\pi^+\pi^-\pi^0$	( 2.10 ± 0.08 ) %	S=1.6	1533	DESIG=7
$2(\pi^+\pi^-\pi^0)$	( 1.61 ± 0.20 ) %		1468	DESIG=210
$\pi^+\pi^-\pi^0K^+K^-$	( 1.52 ± 0.27 ) %	S=1.4	1368	DESIG=18
$\pi^+\pi^-$	( 1.47 ± 0.14 ) × 10 <sup>-4</sup>		1542	DESIG=6
$2(\pi^+\pi^-)$	( 3.20 ± 0.25 ) × 10 <sup>-3</sup>	S=1.2	1517	DESIG=8
$3(\pi^+\pi^-)$	( 4.3 ± 0.4 ) × 10 <sup>-3</sup>		1466	DESIG=10
$2(\pi^+\pi^-)3\pi^0$	( 6.2 ± 0.9 ) %		1435	DESIG=411
$4(\pi^+\pi^-)\pi^0$	( 9.0 ± 3.0 ) × 10 <sup>-3</sup>		1345	DESIG=12
$2(\pi^+\pi^-)\eta$	( 2.29 ± 0.28 ) × 10 <sup>-3</sup>		1446	DESIG=201
$3(\pi^+\pi^-)\eta$	( 7.2 ± 1.5 ) × 10 <sup>-4</sup>		1379	DESIG=202
$2(\pi^+\pi^-\pi^0)\eta$	( 1.6 ± 0.5 ) × 10 <sup>-3</sup>		1381	DESIG=418
$\pi^+\pi^-\pi^0\pi^0\eta$	( 2.4 ± 0.5 ) × 10 <sup>-3</sup>		1448	DESIG=359
$\rho^\pm\pi^\mp\pi^0\eta$	( 1.9 ± 0.8 ) × 10 <sup>-3</sup>		1326	DESIG=361
$K^+K^-$	( 2.86 ± 0.21 ) × 10 <sup>-4</sup>		1468	DESIG=13
$K_S^0K_L^0$	( 1.95 ± 0.11 ) × 10 <sup>-4</sup>	S=2.4	1466	DESIG=75
$K_S^0K_S^0$	< 1.4 × 10 <sup>-8</sup>	CL=95%	1466	DESIG=14
$K\bar{K}\pi$	( 6.1 ± 1.0 ) × 10 <sup>-3</sup>		1442	DESIG=15
$K^+K^-\pi^0$	( 2.88 ± 0.12 ) × 10 <sup>-3</sup>		1442	DESIG=334
$K_S^0K^\pm\pi^\mp$	( 5.6 ± 0.5 ) × 10 <sup>-3</sup>		1440	DESIG=335
$K_S^0K_L^0\pi^0$	( 2.06 ± 0.26 ) × 10 <sup>-3</sup>		1440	DESIG=336
$K^*(892)^0\bar{K}^0 + c.c. \rightarrow$	( 1.21 ± 0.18 ) × 10 <sup>-3</sup>		-	DESIG=339
$K_S^0K_L^0\pi^0$				
$K_2^*(1430)^0\bar{K}^0 + c.c. \rightarrow$	( 4.3 ± 1.3 ) × 10 <sup>-4</sup>		-	DESIG=338
$K_S^0K_L^0\pi^0$				
$K^+K^-\pi^+\pi^-$	( 7.0 ± 1.0 ) × 10 <sup>-3</sup>		1407	DESIG=16
$K^+K^-\pi^0\pi^0$	( 2.13 ± 0.22 ) × 10 <sup>-3</sup>		1410	DESIG=234
$K_S^0K_L^0\pi^+\pi^-$	( 3.8 ± 0.6 ) × 10 <sup>-3</sup>		1406	DESIG=296
$K_S^0K_L^0\pi^0\pi^0$	( 1.9 ± 0.4 ) × 10 <sup>-3</sup>		1408	DESIG=337
$K_S^0K_L^0\eta$	( 1.45 ± 0.33 ) × 10 <sup>-3</sup>		1328	DESIG=340
$K_S^0K_S^0\pi^+\pi^-$	( 1.68 ± 0.19 ) × 10 <sup>-3</sup>		1406	DESIG=297
$K^\mp K_S^0\pi^\pm\pi^0$	( 5.7 ± 0.5 ) × 10 <sup>-3</sup>		1408	DESIG=341
$K^+K^-2(\pi^+\pi^-)$	( 3.1 ± 1.3 ) × 10 <sup>-3</sup>		1320	DESIG=17
$K^+K^-\pi^+\pi^-\eta$	( 4.7 ± 0.7 ) × 10 <sup>-3</sup>		1221	DESIG=238
$2(K^+K^-)$	( 7.2 ± 0.8 ) × 10 <sup>-4</sup>		1131	DESIG=19
$K^+K^-K_S^0K_S^0$	( 4.2 ± 0.7 ) × 10 <sup>-4</sup>		1127	DESIG=298
$p\bar{p}$	( 2.120 ± 0.029 ) × 10 <sup>-3</sup>		1232	DESIG=50
$p\bar{p}\pi^0$	( 1.19 ± 0.08 ) × 10 <sup>-3</sup>	S=1.1	1176	DESIG=52
$p\bar{p}\pi^+\pi^-$	( 6.0 ± 0.5 ) × 10 <sup>-3</sup>	S=1.3	1107	DESIG=54
$p\bar{p}\pi^+\pi^-\pi^0$	[k] ( 2.3 ± 0.9 ) × 10 <sup>-3</sup>	S=1.9	1033	DESIG=55
$p\bar{p}\eta$	( 2.00 ± 0.12 ) × 10 <sup>-3</sup>		948	DESIG=56
$p\bar{p}\rho$	< 3.1 × 10 <sup>-4</sup>	CL=90%	774	DESIG=57
$p\bar{p}\omega$	( 9.8 ± 1.0 ) × 10 <sup>-4</sup>	S=1.3	768	DESIG=58
$p\bar{p}\eta'(958)$	( 1.29 ± 0.14 ) × 10 <sup>-4</sup>	S=2.0	596	DESIG=59
$p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta$	( 6.8 ± 1.8 ) × 10 <sup>-5</sup>		-	DESIG=276
$p\bar{p}\phi$	( 5.19 ± 0.33 ) × 10 <sup>-5</sup>		527	DESIG=127
$p\bar{n}\pi^-$	( 2.12 ± 0.09 ) × 10 <sup>-3</sup>		1174	DESIG=53
$n\bar{n}$	( 2.09 ± 0.16 ) × 10 <sup>-3</sup>		1231	DESIG=64
$n\bar{n}\pi^+\pi^-$	( 4 ± 4 ) × 10 <sup>-3</sup>		1106	DESIG=65
$nN(1440)$	seen		978	DESIG=215;OUR EST;→ UNCHECKED ←

$nN(1520)$	seen		928	DESIG=216;OUR EST;→ UNCHECKED ←
$nN(1535)$	seen		917	DESIG=217;OUR EST;→ UNCHECKED ←
$\Lambda\bar{\Lambda}$	$(1.89 \pm 0.09) \times 10^{-3}$	S=2.8	1074	DESIG=60
$\Lambda\bar{\Lambda}\pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		998	DESIG=109
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		903	DESIG=261
$\Lambda\bar{\Lambda}\eta$	$(1.62 \pm 0.17) \times 10^{-4}$		672	DESIG=228
$\Lambda\bar{\Sigma}^-\pi^+$ (or c.c.)	[ $(8.3 \pm 0.7) \times 10^{-4}$ ]	S=1.2	950	DESIG=71
$pK^-\bar{\Lambda} + c.c.$	$(8.6 \pm 1.1) \times 10^{-4}$		876	DESIG=72
$pK^-\bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		819	DESIG=73
$\Lambda nK_S^0 + c.c.$	$(6.5 \pm 1.1) \times 10^{-4}$		872	DESIG=225
$\Lambda\bar{\Sigma} + c.c.$	$(2.83 \pm 0.23) \times 10^{-5}$		1034	DESIG=61
$\Sigma^+\bar{\Sigma}^-$	$(1.07 \pm 0.04) \times 10^{-3}$		992	DESIG=247
$\Sigma^0\bar{\Sigma}^0$	$(1.172 \pm 0.032) \times 10^{-3}$	S=1.4	988	DESIG=63
$\Sigma^+\bar{\Sigma}^-\eta$	$(6.3 \pm 0.4) \times 10^{-5}$		498	DESIG=448
$\Xi^-\bar{\Xi}^+$	$(9.7 \pm 0.8) \times 10^{-4}$	S=1.4	807	DESIG=62

## Radiative decays

$\gamma\eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.5	111	NODE=M070;CLUMP=C DESIG=85
$\gamma\eta_c(1S) \rightarrow 3\gamma$	$(3.8 \pm 1.3 \pm 1.0) \times 10^{-6}$	S=1.1	—	DESIG=246
$\gamma\eta_c(1S) \rightarrow \gamma\eta\eta\eta'$	$(4.9 \pm 0.8) \times 10^{-5}$		—	DESIG=391
$3\gamma$	$(1.16 \pm 0.22) \times 10^{-5}$		1548	DESIG=81
$4\gamma$	$< 9 \times 10^{-6}$	CL=90%	1548	DESIG=244
$5\gamma$	$< 1.5 \times 10^{-5}$	CL=90%	1548	DESIG=245
$\gamma\pi^0$	$(3.56 \pm 0.17) \times 10^{-5}$		1546	DESIG=82
$\gamma\pi^0\pi^0$	$(1.15 \pm 0.05) \times 10^{-3}$		1543	DESIG=283
$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517	DESIG=95
$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		878	DESIG=203
$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		—	DESIG=204
$\gamma\pi^+\pi^- 2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		1518	DESIG=99
$\gamma K_S^0 K_S^0$	$(8.1 \pm 0.4) \times 10^{-4}$		1466	DESIG=378
$\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	1442	DESIG=176
$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		1407	DESIG=143
$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		1266	DESIG=145
$\gamma\eta$	$(1.085 \pm 0.018) \times 10^{-3}$		1500	DESIG=83
$\gamma\eta\pi^0$	$(2.14 \pm 0.31) \times 10^{-5}$		1497	DESIG=292
$\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0$	$< 2.5 \times 10^{-6}$	CL=95%	—	DESIG=293
$\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0$	$< 6.6 \times 10^{-6}$	CL=95%	—	DESIG=294
$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1487	DESIG=96
$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		—	DESIG=142
$\gamma\eta'(958)$	$(5.25 \pm 0.07) \times 10^{-3}$	S=1.3	1400	DESIG=84
$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		1340	DESIG=94
$\gamma\rho\omega$	$< 5.4 \times 10^{-4}$	CL=90%	1338	DESIG=226
$\gamma\rho\phi$	$< 8.8 \times 10^{-5}$	CL=90%	1258	DESIG=227
$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		1336	DESIG=97
$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166	DESIG=98
$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223	DESIG=89
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223	DESIG=171
$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		—	DESIG=170
$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223	DESIG=124
$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	$< 8.2 \times 10^{-5}$	CL=95%	—	DESIG=212
$\gamma\eta(1405) \rightarrow \gamma\gamma\gamma$	$< 2.63 \times 10^{-6}$	CL=90%	—	DESIG=348
$\gamma\eta(1475) \rightarrow \gamma\gamma\gamma$	$< 1.86 \times 10^{-6}$	CL=90%	—	DESIG=349
$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048	DESIG=125
$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		—	DESIG=224
$\gamma\eta(1760) \rightarrow \gamma\gamma\gamma$	$< 4.80 \times 10^{-6}$	CL=90%	—	DESIG=347
$\gamma\eta(2225)$	$(3.14 \pm 0.50 \pm 0.19) \times 10^{-4}$		752	DESIG=126
$\gamma f_2(1270)$	$(1.63 \pm 0.12) \times 10^{-3}$	S=1.3	1286	DESIG=86
$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.58 \pm 0.60 \pm 0.22) \times 10^{-5}$		—	DESIG=373



$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$	1283	DESIG=88
$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(4.2 \pm 1.5) \times 10^{-4}$	-	DESIG=284
$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.1 \pm 0.4) \times 10^{-5}$	-	DESIG=368
$\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi$	$(7.9 \pm 1.3) \times 10^{-4}$	1220	DESIG=175
$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	$(1.09 \pm 0.24) \times 10^{-4}$	1183	DESIG=172
$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	$(1.7 \pm_{-1.4}^{0.6}) \times 10^{-5}$	-	DESIG=265
$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \pm_{-0.60}^{0.24}) \times 10^{-5}$	-	DESIG=369
$\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$	-	DESIG=141
$\gamma f_2'(1525)$	$(5.7 \pm_{-0.5}^{0.8}) \times 10^{-4}$	S=1.5 1177	DESIG=87
$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \pm_{-0.5}^{0.7}) \times 10^{-5}$	-	DESIG=374
$\gamma f_2'(1525) \rightarrow \gamma \eta \eta$	$(3.4 \pm 1.4) \times 10^{-5}$	-	DESIG=268
$\gamma f_2(1640) \rightarrow \gamma \omega \omega$	$(2.8 \pm 1.8) \times 10^{-4}$	-	DESIG=222
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.8 \pm 0.5) \times 10^{-4}$	-	DESIG=135
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(9.5 \pm_{-0.5}^{1.0}) \times 10^{-4}$	S=1.5 1075	DESIG=91
$\gamma f_0(1710) \rightarrow \gamma \omega \omega$	$(3.1 \pm 1.0) \times 10^{-4}$	-	DESIG=221
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$(2.4 \pm_{-0.7}^{1.2}) \times 10^{-4}$	-	DESIG=266
$\gamma f_0(1710) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$	-	DESIG=262
$\gamma f_0(1770) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \pm_{-0.33}^{0.20}) \times 10^{-5}$	-	DESIG=370
$\gamma f_2(1810) \rightarrow \gamma \eta \eta$	$(5.4 \pm_{-2.4}^{3.5}) \times 10^{-5}$	-	DESIG=269
$\gamma \eta_1(1855) \rightarrow \gamma \eta \eta'$	$(2.7 \pm_{-0.5}^{0.4}) \times 10^{-6}$	-	DESIG=447
$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$	-	DESIG=223
$\gamma f_2(1950) \rightarrow$	$(7.0 \pm 2.2) \times 10^{-4}$	-	DESIG=144
$\gamma K^*(892) \bar{K}^*(892)$			
$\gamma f_0(2020) \rightarrow \gamma \eta' \eta'$	$(2.63 \pm_{-0.50}^{0.32}) \times 10^{-4}$	-	DESIG=426
$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$	891	DESIG=100
$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \pm_{-0.30}^{0.60}) \times 10^{-4}$	-	DESIG=267
$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$	-	DESIG=286
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$	-	DESIG=285
$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	$(2.72 \pm_{-0.50}^{0.19}) \times 10^{-4}$	-	DESIG=371
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 3.9 \times 10^{-5}$	CL=90%	DESIG=136
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 4.1 \times 10^{-5}$	CL=90%	DESIG=137
$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$	-	DESIG=138
$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	$(4.9 \pm 0.7) \times 10^{-5}$	-	DESIG=372
$\gamma f_0(2330) \rightarrow \gamma \eta' \eta'$	$(6.1 \pm_{-1.8}^{4.0}) \times 10^{-6}$	-	DESIG=427
$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \pm_{-2.2}^{2.4}) \times 10^{-5}$	-	DESIG=270
$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	$(5.5 \pm_{-1.5}^{4.0}) \times 10^{-5}$	-	DESIG=375
$\gamma f_2(2340) \rightarrow \gamma \eta' \eta'$	$(8.7 \pm_{-1.8}^{0.9}) \times 10^{-6}$	-	DESIG=428
$\gamma f_0(2470) \rightarrow \gamma \eta' \eta'$	$(8.2 \pm_{-2.8}^{4.0}) \times 10^{-7}$	-	DESIG=429
$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.7 \pm_{-0.8}^{0.6}) \times 10^{-4}$	S=1.6 1006	DESIG=213
$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \pm_{-0.9}^{1.5}) \times 10^{-5}$	-	DESIG=254
$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \pm_{-1.3}^{2.0}) \times 10^{-5}$	-	DESIG=282
$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	$< 3.56 \times 10^{-6}$	CL=90%	DESIG=350
$\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm_{-0.8}^{0.7}) \times 10^{-5}$	-	DESIG=264
$\gamma X(2370) \rightarrow \gamma K^+ K^- \eta'$	$(1.8 \pm 0.7) \times 10^{-5}$	-	DESIG=388
$\gamma X(2370) \rightarrow \gamma K_S^0 K_S^0 \eta'$	$(1.2 \pm 0.5) \times 10^{-5}$	-	DESIG=389
$\gamma X(2370) \rightarrow \gamma \eta \eta \eta'$	$< 9.2 \times 10^{-6}$	CL=90%	DESIG=390
$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$	1232	DESIG=90
$\gamma p \bar{p} \pi^+ \pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=93
$\gamma \Lambda \bar{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=200
$\gamma A^0 \rightarrow \gamma \text{invisible}$	$[l] < 1.7 \times 10^{-6}$	CL=90%	DESIG=251
$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$[n] < 7.8 \times 10^{-7}$	CL=90%	DESIG=259

<b>Dalitz decays</b>					
$\pi^0 e^+ e^-$	$(7.6 \pm 1.4) \times 10^{-7}$	1546		NODE=M070;CLUMP=G	
$\eta e^+ e^-$	$(1.42 \pm 0.08) \times 10^{-5}$	1500		DESIG=271	
$\eta'(958) e^+ e^-$	$(6.59 \pm 0.18) \times 10^{-5}$	1400		DESIG=272	
$X(1835) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(3.58 \pm 0.25) \times 10^{-6}$	—		DESIG=273	
$X(2120) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(8.2 \pm 1.3) \times 10^{-7}$	—		DESIG=423	
$X(2370) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(1.08 \pm 0.17) \times 10^{-6}$	—		DESIG=425	
$\eta U \rightarrow \eta e^+ e^-$	[o] < 9.11	$\times 10^{-7}$	CL=90%	—	DESIG=424
$\eta'(958) U \rightarrow \eta'(958) e^+ e^-$	[o] < 2.0	$\times 10^{-7}$	CL=90%	—	DESIG=352
$\phi e^+ e^-$	< 1.2	$\times 10^{-7}$	CL=90%	1381	DESIG=366
					DESIG=384

<b>Weak decays</b>					
$D^- e^+ \nu_e + c.c.$	< 7.1	$\times 10^{-8}$	CL=90%	984	NODE=M070;CLUMP=E
$\bar{D}^0 e^+ e^- + c.c.$	< 8.5	$\times 10^{-8}$	CL=90%	987	DESIG=218
$D_s^- e^+ \nu_e + c.c.$	< 1.3	$\times 10^{-6}$	CL=90%	923	DESIG=219
$D_s^{*-} e^+ \nu_e + c.c.$	< 1.8	$\times 10^{-6}$	CL=90%	828	DESIG=220
$D^- \pi^+ + c.c.$	< 7.5	$\times 10^{-5}$	CL=90%	977	DESIG=290
$\bar{D}^0 \bar{K}^0 + c.c.$	< 1.7	$\times 10^{-4}$	CL=90%	898	DESIG=241
$\bar{D}^0 \bar{K}^{*0} + c.c.$	< 2.5	$\times 10^{-6}$	CL=90%	670	DESIG=242
$D_s^- \pi^+ + c.c.$	< 1.3	$\times 10^{-4}$	CL=90%	915	DESIG=275
$D_s^- \rho^+ + c.c.$	< 1.3	$\times 10^{-5}$	CL=90%	663	DESIG=243
					DESIG=274

**Charge conjugation (C), Parity (P),  
Lepton Family number (LF) violating modes**

$\gamma\gamma$	C	< 2.7	$\times 10^{-7}$	CL=90%	1548	NODE=M070;CLUMP=D
$\gamma\phi$	C	< 1.4	$\times 10^{-6}$	CL=90%	1381	DESIG=80
$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90%	1547	DESIG=277
$e^\pm \tau^\mp$	LF	< 7.5	$\times 10^{-8}$	CL=90%	1039	DESIG=177
$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90%	1035	DESIG=178
$\Lambda_c^+ e^- + c.c.$		< 6.9	$\times 10^{-8}$	CL=90%	—	DESIG=179
						DESIG=379

<b>Other decays</b>					
invisible	< 7	$\times 10^{-4}$	CL=90%	—	NODE=M070;CLUMP=F
					DESIG=240

**$\chi_{c0}(1P)$**

$$J^{PC} = 0^+(0^{++})$$

Mass  $m = 3414.71 \pm 0.30$  MeV

Full width  $\Gamma = 10.8 \pm 0.6$  MeV

NODE=M056

NODE=M056M;DTYPE=M

NODE=M056W;DTYPE=G

$\chi_{c0}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
<b>Hadronic decays</b>				NODE=M056215;NODE=M056;CLUMP=A
$2(\pi^+\pi^-)$	$(2.34 \pm 0.18) \%$		1679	DESIG=3
$\rho^0\pi^+\pi^-$	$(9.1 \pm 2.9) \times 10^{-3}$		1607	DESIG=9
$f_0(980)f_0(980)$	$(6.6 \pm 2.1) \times 10^{-4}$		1391	DESIG=20
$\pi^+\pi^-\pi^0\pi^0$	$(3.3 \pm 0.4) \%$		1680	DESIG=61
$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(2.9 \pm 0.4) \%$		1607	DESIG=62
$4\pi^0$	$(3.3 \pm 0.4) \times 10^{-3}$		1681	DESIG=70
$\pi^+\pi^-K^+K^-$	$(1.81 \pm 0.14) \%$		1580	DESIG=5
$K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow$ $\pi^+\pi^-K^+K^-$	$(9.8 \begin{smallmatrix} +4.0 \\ -2.8 \end{smallmatrix}) \times 10^{-4}$		–	DESIG=31
$K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$(8.0 \begin{smallmatrix} +2.0 \\ -2.4 \end{smallmatrix}) \times 10^{-4}$		–	DESIG=32
$K_1(1270)^+K^- + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$(6.3 \pm 1.9) \times 10^{-3}$		–	DESIG=33
$K_1(1400)^+K^- + \text{c.c.} \rightarrow$ $\pi^+\pi^-K^+K^-$	$< 2.7 \times 10^{-3}$	CL=90%	–	DESIG=34
$f_0(980)f_0(980)$	$(1.6 \begin{smallmatrix} +1.0 \\ -0.9 \end{smallmatrix}) \times 10^{-4}$		1391	DESIG=23
$f_0(980)f_0(2200)$	$(7.9 \begin{smallmatrix} +2.0 \\ -2.5 \end{smallmatrix}) \times 10^{-4}$		586	DESIG=24
$f_0(1370)f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	1019	DESIG=25
$f_0(1370)f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	907	DESIG=26
$f_0(1370)f_0(1710)$	$(6.7 \begin{smallmatrix} +3.5 \\ -2.3 \end{smallmatrix}) \times 10^{-4}$		709	DESIG=27
$f_0(1500)f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	907	DESIG=28
$f_0(1500)f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	774	DESIG=29
$f_0(1500)f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	515	DESIG=30
$K^+K^-\pi^+\pi^-\pi^0$	$(8.6 \pm 0.9) \times 10^{-3}$		1545	DESIG=75
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(4.2 \pm 0.4) \times 10^{-3}$		1543	DESIG=87
$K^+K^-\pi^0\pi^0$	$(5.6 \pm 0.9) \times 10^{-3}$		1582	DESIG=63
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.49 \pm 0.33) \%$		1581	DESIG=65
$\rho^+K^-K^0 + \text{c.c.}$	$(1.21 \pm 0.21) \%$		1458	DESIG=66
$K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(4.6 \pm 1.2) \times 10^{-3}$		–	DESIG=67
$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		1579	DESIG=41
$K^+K^-\eta\pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		1468	DESIG=68
$3(\pi^+\pi^-)$	$(1.20 \pm 0.18) \%$		1633	DESIG=4
$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(7.5 \pm 1.6) \times 10^{-3}$		1523	DESIG=10
$K^*(892)^0\bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		1456	DESIG=21
$\pi\pi$	$(8.51 \pm 0.33) \times 10^{-3}$		1702	DESIG=18
$\pi^0\eta$	$< 1.8 \times 10^{-4}$		1661	DESIG=35
$\pi^0\eta'$	$< 1.1 \times 10^{-3}$		1570	DESIG=36
$\pi^0\eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	383	DESIG=86
$\eta\eta$	$(3.01 \pm 0.19) \times 10^{-3}$		1617	DESIG=13
$\eta\eta'$	$(9.1 \pm 1.1) \times 10^{-5}$		1521	DESIG=37
$\eta'\eta'$	$(2.17 \pm 0.12) \times 10^{-3}$		1413	DESIG=46
$\omega\omega$	$(9.7 \pm 1.1) \times 10^{-4}$		1517	DESIG=22
$\omega\phi$	$(1.41 \pm 0.13) \times 10^{-4}$		1447	DESIG=76
$\omega K^+K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		1457	DESIG=88
$K^+K^-$	$(6.05 \pm 0.31) \times 10^{-3}$		1634	DESIG=2
$K_S^0 K_S^0$	$(3.16 \pm 0.17) \times 10^{-3}$		1633	DESIG=15
$\pi^+\pi^-\eta$	$< 2.0 \times 10^{-4}$	CL=90%	1651	DESIG=50
$\pi^+\pi^-\eta'$	$< 4 \times 10^{-4}$	CL=90%	1560	DESIG=53
$\bar{K}^0 K^+\pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	1610	DESIG=17
$K^+K^-\pi^0$	$< 6 \times 10^{-5}$	CL=90%	1611	DESIG=47
$K^+K^-\eta$	$< 2.3 \times 10^{-4}$	CL=90%	1512	DESIG=51
$K^+K^-K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		1331	DESIG=42

$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		1327	DESIG=94
$K^+ K^- K^+ K^-$	$(2.82 \pm 0.29) \times 10^{-3}$		1333	DESIG=14
$K^+ K^- \phi$	$(9.7 \pm 2.5) \times 10^{-4}$		1381	DESIG=44
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		1326	DESIG=91
$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		1329	DESIG=92
$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		1525	DESIG=89
$\phi \phi$	$(8.0 \pm 0.7) \times 10^{-4}$		1370	DESIG=16
$\phi \phi \eta$	$(8.4 \pm 1.0) \times 10^{-4}$		1100	DESIG=96
$p \bar{p}$	$(2.21 \pm 0.08) \times 10^{-4}$		1426	DESIG=11
$p \bar{p} \pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.3	1379	DESIG=48
$p \bar{p} \eta$	$(3.5 \pm 0.4) \times 10^{-4}$		1187	DESIG=52
$p \bar{p} \omega$	$(5.2 \pm 0.6) \times 10^{-4}$		1043	DESIG=69
$p \bar{p} \phi$	$(6.0 \pm 1.4) \times 10^{-5}$		876	DESIG=74
$p \bar{p} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320	DESIG=8
$p \bar{p} \pi^0 \pi^0$	$(1.04 \pm 0.28) \times 10^{-3}$		1324	DESIG=64
$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.22 \pm 0.26) \times 10^{-4}$		890	DESIG=71
$p \bar{p} K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	884	DESIG=40
$p \bar{n} \pi^-$	$(1.27 \pm 0.11) \times 10^{-3}$		1376	DESIG=43
$\bar{p} n \pi^+$	$(1.37 \pm 0.12) \times 10^{-3}$		1376	DESIG=82
$p \bar{n} \pi^- \pi^0$	$(2.34 \pm 0.21) \times 10^{-3}$		1321	DESIG=83
$\bar{p} n \pi^+ \pi^0$	$(2.21 \pm 0.18) \times 10^{-3}$		1321	DESIG=84
$\Lambda \bar{\Lambda}$	$(3.59 \pm 0.15) \times 10^{-4}$		1292	DESIG=19
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.18 \pm 0.13) \times 10^{-3}$		1153	DESIG=38
$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$< 5 \times 10^{-4}$	CL=90%	1153	DESIG=77
$\Lambda \bar{\Lambda} \eta$	$(2.3 \pm 0.4) \times 10^{-4}$		979	DESIG=102
$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	1083	DESIG=78
$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	1083	DESIG=79
$K^+ \bar{p} \Lambda + \text{c.c.}$	$(1.25 \pm 0.12) \times 10^{-3}$	S=1.3	1132	DESIG=49
$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(6.6 \pm 0.5) \times 10^{-4}$		1129	DESIG=101
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.8 \pm 0.9) \times 10^{-4}$		845	DESIG=98
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		859	DESIG=72
$\Lambda(1520) \bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		780	DESIG=73
$\Sigma^0 \bar{\Sigma}^0$	$(4.68 \pm 0.32) \times 10^{-4}$		1222	DESIG=58
$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(3.52 \pm 0.27) \times 10^{-4}$		1089	DESIG=97
$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(3.03 \pm 0.20) \times 10^{-4}$		1090	DESIG=100
$\Sigma^+ \bar{\Sigma}^-$	$(4.6 \pm 0.8) \times 10^{-4}$	S=2.6	1225	DESIG=59
$\Sigma^- \bar{\Sigma}^+$	$(5.1 \pm 0.5) \times 10^{-4}$		1217	DESIG=99
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		1001	DESIG=80
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(2.3 \pm 0.7) \times 10^{-4}$		1001	DESIG=81
$K^- \bar{\Lambda} \Xi^+ + \text{c.c.}$	$(1.94 \pm 0.35) \times 10^{-4}$		873	DESIG=85
$\Xi^0 \bar{\Xi}^0$	$(4.5 \pm 0.5) \times 10^{-4}$	S=1.7	1089	DESIG=60
$\Xi^- \bar{\Xi}^+$	$(4.45 \pm 0.19) \times 10^{-4}$		1081	DESIG=39
$\eta_c \pi^+ \pi^-$	$< 7 \times 10^{-4}$	CL=90%	307	DESIG=90

## Radiative decays

$\gamma J/\psi(1S)$	$(1.40 \pm 0.05) \%$		303	NODE=M056;CLUMP=B DESIG=6
$\gamma \rho^0$	$< 9 \times 10^{-6}$	CL=90%	1619	DESIG=55
$\gamma \omega$	$< 8 \times 10^{-6}$	CL=90%	1618	DESIG=56
$\gamma \phi$	$< 6 \times 10^{-6}$	CL=90%	1555	DESIG=57
$\gamma \gamma$	$(2.04 \pm 0.09) \times 10^{-4}$		1707	DESIG=7
$e^+ e^- J/\psi(1S)$	$(1.33 \pm 0.29) \times 10^{-4}$		303	DESIG=93
$\mu^+ \mu^- J/\psi(1S)$	$< 1.9 \times 10^{-5}$	CL=90%	226	DESIG=95

 $\chi_{c1}(1P)$ 

$$J^{PC} = 0^+(1^+)$$

NODE=M055

Mass  $m = 3510.67 \pm 0.05$  MeV (S = 1.2)Full width  $\Gamma = 0.84 \pm 0.04$  MeV

NODE=M055M;DTYPE=M

NODE=M055W;DTYPE=G

$\chi_{c1}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$e^+ e^-$	$( 1.4 \begin{smallmatrix} +1.5 \\ -1.0 \end{smallmatrix} ) \times 10^{-7}$		1755	NODE=M055215;DESIG=110
<b>Hadronic decays</b>				
$3(\pi^+ \pi^-)$	$( 5.8 \pm 1.4 ) \times 10^{-3}$	S=1.2	1683	NODE=M055;CLUMP=A DESIG=6
$2(\pi^+ \pi^-)$	$( 7.6 \pm 2.6 ) \times 10^{-3}$		1728	DESIG=5
$\pi^+ \pi^- \pi^0 \pi^0$	$( 1.19 \pm 0.15 ) \%$		1729	DESIG=51
$\rho^+ \pi^- \pi^0 + \text{c.c.}$	$( 1.45 \pm 0.24 ) \%$		1658	DESIG=52
$\rho^0 \pi^+ \pi^-$	$( 3.9 \pm 3.5 ) \times 10^{-3}$		1657	DESIG=9
$4\pi^0$	$( 5.4 \pm 0.8 ) \times 10^{-4}$		1729	DESIG=60
$\pi^+ \pi^- K^+ K^-$	$( 4.5 \pm 1.0 ) \times 10^{-3}$		1632	DESIG=7
$K^+ K^- \pi^0 \pi^0$	$( 1.12 \pm 0.27 ) \times 10^{-3}$		1634	DESIG=53
$K^+ K^- \pi^+ \pi^- \pi^0$	$( 1.15 \pm 0.13 ) \%$		1598	DESIG=79
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$( 7.5 \pm 0.8 ) \times 10^{-3}$		1596	DESIG=84
$K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$( 8.6 \pm 1.4 ) \times 10^{-3}$		1632	DESIG=55
$\rho^- K^+ \bar{K}^0 + \text{c.c.}$	$( 5.0 \pm 1.2 ) \times 10^{-3}$		1514	DESIG=56
$K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$( 2.3 \pm 0.6 ) \times 10^{-3}$		-	DESIG=57
$K^+ K^- \eta \pi^0$	$( 1.12 \pm 0.34 ) \times 10^{-3}$		1523	DESIG=58
$\pi^+ \pi^- K_S^0 K_S^0$	$( 6.9 \pm 2.9 ) \times 10^{-4}$		1630	DESIG=28
$K^+ K^- \eta$	$( 3.2 \pm 1.0 ) \times 10^{-4}$		1566	DESIG=42
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$( 7.0 \pm 0.6 ) \times 10^{-3}$		1661	DESIG=17
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$( 10 \pm 4 ) \times 10^{-4}$		1602	DESIG=32
$K^*(892)^+ K^- + \text{c.c.}$	$( 1.4 \pm 0.6 ) \times 10^{-3}$		1602	DESIG=33
$K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%	-	DESIG=34
$K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 2.1 \times 10^{-3}$	CL=90%	-	DESIG=35
$K^+ K^- \pi^0$	$( 1.81 \pm 0.24 ) \times 10^{-3}$		1662	DESIG=38
$\eta \pi^+ \pi^-$	$( 4.62 \pm 0.23 ) \times 10^{-3}$		1701	DESIG=31
$a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$( 3.2 \pm 0.4 ) \times 10^{-3}$	S=2.2	-	DESIG=36
$a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$( 1.76 \pm 0.24 ) \times 10^{-4}$		-	DESIG=93
$a_2(1700)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$( 4.6 \pm 0.7 ) \times 10^{-5}$		-	DESIG=96
$f_2(1270) \eta \rightarrow \eta \pi^+ \pi^-$	$( 3.5 \pm 0.6 ) \times 10^{-4}$		-	DESIG=94
$f_4(2050) \eta \rightarrow \eta \pi^+ \pi^-$	$( 2.5 \pm 0.9 ) \times 10^{-5}$		-	DESIG=95
$\pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 5 \times 10^{-5}$	CL=90%	-	DESIG=97
$\pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 1.5 \times 10^{-5}$	CL=90%	-	DESIG=98
$\pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow$ $\eta \pi^+ \pi^-$	$< 8 \times 10^{-6}$	CL=90%	-	DESIG=99
$f_2(1270) \eta$	$( 6.7 \pm 1.1 ) \times 10^{-4}$		1467	DESIG=37
$\pi^+ \pi^- \eta'$	$( 2.2 \pm 0.4 ) \times 10^{-3}$		1612	DESIG=44
$K^+ K^- \eta'(958)$	$( 8.8 \pm 0.9 ) \times 10^{-4}$		1461	DESIG=85
$K_0^*(1430)^+ K^- + \text{c.c.}$	$( 6.4 \begin{smallmatrix} +2.2 \\ -2.8 \end{smallmatrix} ) \times 10^{-4}$		-	DESIG=86
$f_0(980) \eta'(958)$	$( 1.6 \begin{smallmatrix} +1.4 \\ -0.7 \end{smallmatrix} ) \times 10^{-4}$		1460	DESIG=87
$f_0(1710) \eta'(958)$	$( 7 \begin{smallmatrix} +7 \\ -5 \end{smallmatrix} ) \times 10^{-5}$		1100	DESIG=88
$f_2'(1525) \eta'(958)$	$( 9 \pm 6 ) \times 10^{-5}$		1229	DESIG=89
$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$( 3.5 \pm 0.9 ) \times 10^{-7}$		-	DESIG=61
$K^+ K^*(892)^0 \pi^- + \text{c.c.}$	$( 3.2 \pm 2.1 ) \times 10^{-3}$		1577	DESIG=10
$K^*(892)^0 K^*(892)^0$	$( 1.4 \pm 0.4 ) \times 10^{-3}$		1512	DESIG=21
$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	1390	DESIG=29
$K_S^0 K_S^0 K_S^0 K_S^0$	$( 3.5 \pm 1.0 ) \times 10^{-5}$		1387	DESIG=102
$K^+ K^- K^+ K^-$	$( 5.4 \pm 1.1 ) \times 10^{-4}$		1393	DESIG=14
$K^+ K^- \phi$	$( 4.1 \pm 1.5 ) \times 10^{-4}$		1440	DESIG=30

$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		1387	DESIG=90
$K^+ K^- \pi^0 \phi$	$(1.62 \pm 0.30) \times 10^{-3}$		1390	DESIG=91
$\phi \pi^+ \pi^- \pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		1578	DESIG=82
$\omega \omega$	$(5.7 \pm 0.7) \times 10^{-4}$		1571	DESIG=66
$\omega K^+ K^-$	$(7.8 \pm 0.9) \times 10^{-4}$		1513	DESIG=81
$\omega \phi$	$(2.7 \pm 0.4) \times 10^{-5}$		1503	DESIG=67
$\phi \phi$	$(4.2 \pm 0.5) \times 10^{-4}$		1429	DESIG=68
$\phi \phi \eta$	$(3.0 \pm 0.5) \times 10^{-4}$		1172	DESIG=104
$p \bar{p}$	$(7.60 \pm 0.34) \times 10^{-5}$		1484	DESIG=11
$p \bar{p} \pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$		1438	DESIG=39
$p \bar{p} \eta$	$(1.45 \pm 0.25) \times 10^{-4}$		1254	DESIG=43
$p \bar{p} \omega$	$(2.12 \pm 0.31) \times 10^{-4}$		1117	DESIG=59
$p \bar{p} \phi$	$< 1.7 \times 10^{-5}$	CL=90%	962	DESIG=65
$p \bar{p} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		1381	DESIG=8
$p \bar{p} \pi^0 \pi^0$	$< 5 \times 10^{-4}$	CL=90%	1385	DESIG=54
$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.27 \pm 0.22) \times 10^{-4}$		974	DESIG=62
$p \bar{p} K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	968	DESIG=25
$p \bar{n} \pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		1435	DESIG=74
$p \bar{n} \pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		1435	DESIG=75
$p \bar{n} \pi^- \pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		1383	DESIG=76
$p \bar{n} \pi^+ \pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$		1383	DESIG=77
$\Lambda \bar{\Lambda}$	$(1.27 \pm 0.08) \times 10^{-4}$		1355	DESIG=19
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		1223	DESIG=24
$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(2.5 \pm 0.6) \times 10^{-4}$		1223	DESIG=69
$\Lambda \bar{\Lambda} \eta$	$(5.9 \pm 1.5) \times 10^{-5}$		1059	DESIG=111
$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157	DESIG=70
$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157	DESIG=71
$K^+ \bar{p} \Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2	1203	DESIG=40
$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(1.66 \pm 0.17) \times 10^{-4}$		1200	DESIG=109
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		935	DESIG=106
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		951	DESIG=63
$\Lambda(1520) \bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%	880	DESIG=64
$\Sigma^0 \bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$		1288	DESIG=48
$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(1.53 \pm 0.12) \times 10^{-4}$		1163	DESIG=105
$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(1.46 \pm 0.10) \times 10^{-4}$		1163	DESIG=108
$\Sigma^+ \bar{\Sigma}^-$	$(3.6 \pm 0.7) \times 10^{-5}$		1291	DESIG=49
$\Sigma^- \bar{\Sigma}^+$	$(5.7 \pm 1.5) \times 10^{-5}$		1283	DESIG=107
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%	1081	DESIG=72
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	1081	DESIG=73
$K^- \bar{\Lambda} \Xi^+ + \text{c.c.}$	$(1.35 \pm 0.24) \times 10^{-4}$		963	DESIG=92
$\Xi^0 \bar{\Xi}^0$	$(7.5 \pm 1.3) \times 10^{-5}$		1163	DESIG=50
$\Xi^- \bar{\Xi}^+$	$(6.0 \pm 0.6) \times 10^{-5}$		1155	DESIG=26
$\pi^+ \pi^- + K^+ K^-$	$< 2.1 \times 10^{-3}$		-	DESIG=23
$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	1683	DESIG=27
$\eta_c \pi^+ \pi^-$	$< 3.2 \times 10^{-3}$	CL=90%	413	DESIG=83

## Radiative decays

$\gamma J/\psi(1S)$	$(34.3 \pm 1.0) \%$		389	NODE=M055;CLUMP=B DESIG=1
$\gamma \rho^0$	$(2.16 \pm 0.17) \times 10^{-4}$		1670	DESIG=45
$\gamma \omega$	$(6.8 \pm 0.8) \times 10^{-5}$		1668	DESIG=46
$\gamma \phi$	$(2.4 \pm 0.5) \times 10^{-5}$		1607	DESIG=47
$\gamma \gamma$	$< 6.3 \times 10^{-6}$	CL=90%	1755	DESIG=4
$e^+ e^- J/\psi(1S)$	$(3.46 \pm 0.22) \times 10^{-3}$		389	DESIG=100
$\mu^+ \mu^- J/\psi(1S)$	$(2.33 \pm 0.29) \times 10^{-4}$		335	DESIG=103

 $h_c(1P)$ 

$$I^G(J^{PC}) = 0^-(1^{+-})$$

NODE=M144

Mass  $m = 3525.37 \pm 0.14$  MeV (S = 1.2)  
Full width  $\Gamma = 0.78 \pm 0.28$  MeV

NODE=M144M;DTYPE=M  
NODE=M144W;DTYPE=G

$h_c(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$\rho$ (MeV/c)	
$J/\psi(1S)\pi^0$	$< 5 \times 10^{-4}$	90%	382	NODE=M144215;DESIG=1
$J/\psi(1S)\pi\pi$	not seen		312	DESIG=2;OUR EST;→ UNCHECKED ←
$J/\psi(1S)\pi^+\pi^-$	$< 2.7 \times 10^{-3}$	90%	305	DESIG=10
$p\bar{p}$	$< 1.7 \times 10^{-4}$	90%	1492	DESIG=3
$p\bar{p}\pi^0$	$< 8 \times 10^{-4}$	90%	1447	DESIG=24
$p\bar{p}\pi^+\pi^-$	$(3.3\pm 0.6) \times 10^{-3}$		1390	DESIG=11
$p\bar{p}\pi^0\pi^0$	$< 6 \times 10^{-4}$	90%	1394	DESIG=13
$p\bar{p}\pi^+\pi^-\pi^0$	$(4.4\pm 1.3) \times 10^{-3}$		1331	DESIG=25
$p\bar{p}\eta$	$(7.4\pm 2.2) \times 10^{-4}$		1264	DESIG=23
$\pi^+\pi^-\pi^0$	$(1.9\pm 0.5) \times 10^{-3}$		1749	DESIG=5
$\pi^+\pi^-\pi^0\eta$	$(8.3\pm 2.4) \times 10^{-3}$		1695	DESIG=14
$2\pi^+2\pi^-\pi^0$	$(9.4\pm 1.7) \times 10^{-3}$		1716	DESIG=6
$3\pi^+3\pi^-\pi^0$	$< 1.0$ %	90%	1661	DESIG=7
$K^+K^-\pi^+\pi^-$	$< 7 \times 10^{-4}$	90%	1640	DESIG=12
$K^+K^-\pi^+\pi^-\pi^0$	$(3.8\pm 0.8) \times 10^{-3}$		1606	DESIG=15
$K^+K^-\pi^+\pi^-\eta$	$< 2.7 \times 10^{-3}$	90%	1480	DESIG=16
$K^+K^-\pi^0$	$< 6 \times 10^{-4}$	90%	1670	DESIG=17
$K^+K^-\pi^0\eta$	$< 2.4 \times 10^{-3}$	90%	1532	DESIG=18
$K^+K^-\eta$	$< 1.0 \times 10^{-3}$	90%	1574	DESIG=19
$2K^+2K^-\pi^0$	$< 2.8 \times 10^{-4}$	90%	1339	DESIG=20
$K_S^0 K^\pm \pi^\mp$	$< 6 \times 10^{-4}$	90%	1668	DESIG=21
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(3.2\pm 1.0) \times 10^{-3}$		1604	DESIG=22
<b>Radiative decays</b>				
$\gamma\eta$	$(4.7\pm 2.1) \times 10^{-4}$		1720	NODE=M144;CLUMP=R DESIG=9
$\gamma\eta'(958)$	$(1.5\pm 0.4) \times 10^{-3}$		1633	DESIG=8
$\gamma\eta_c(1S)$	$(57 \pm 5)$ %		500	DESIG=4

 **$\chi_{c2}(1P)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass  $m = 3556.17 \pm 0.07$  MeV  
 Full width  $\Gamma = 1.97 \pm 0.09$  MeV

NODE=M057

NODE=M057M;DTYPE=M

NODE=M057W;DTYPE=G

$\chi_{c2}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)	
<b>Hadronic decays</b>				NODE=M057215;NODE=M057;CLUMP=A
$2(\pi^+\pi^-)$	( 1.02±0.09 ) %		1751	DESIG=3
$\pi^+\pi^-\pi^0\pi^0$	( 1.83±0.23 ) %		1752	DESIG=50
$\rho^+\pi^-\pi^0 + \text{c.c.}$	( 2.19±0.34 ) %		1682	DESIG=51
$4\pi^0$	( 1.11±0.15 ) $\times 10^{-3}$		1752	DESIG=62
$K^+K^-\pi^0\pi^0$	( 2.1 ±0.4 ) $\times 10^{-3}$		1658	DESIG=52
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	( 1.38±0.20 ) %		1657	DESIG=54
$\rho^-K^+\bar{K}^0 + \text{c.c.}$	( 4.1 ±1.2 ) $\times 10^{-3}$		1540	DESIG=55
$K^*(892)^0K^-\pi^+ \rightarrow$	( 2.9 ±0.8 ) $\times 10^{-3}$		–	DESIG=60
$K^-\pi^+K^0\pi^0 + \text{c.c.}$				
$K^*(892)^0\bar{K}^0\pi^0 \rightarrow$	( 3.8 ±0.9 ) $\times 10^{-3}$		–	DESIG=56
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$				
$K^*(892)^-K^+\pi^0 \rightarrow$	( 3.7 ±0.8 ) $\times 10^{-3}$		–	DESIG=57
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$				
$K^*(892)^+\bar{K}^0\pi^- \rightarrow$	( 2.9 ±0.8 ) $\times 10^{-3}$		–	DESIG=58
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$				
$K^+K^-\eta\pi^0$	( 1.3 ±0.4 ) $\times 10^{-3}$		1549	DESIG=59
$K^+K^-\pi^+\pi^-$	( 8.4 ±0.9 ) $\times 10^{-3}$		1656	DESIG=5
$K^+K^-\pi^+\pi^-\pi^0$	( 1.17±0.13 ) %		1623	DESIG=67
$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	( 7.3 ±0.8 ) $\times 10^{-3}$		1621	DESIG=78
$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	( 2.1 ±1.1 ) $\times 10^{-3}$		1602	DESIG=10
$K^*(892)^0\bar{K}^*(892)^0$	( 2.3 ±0.4 ) $\times 10^{-3}$		1538	DESIG=21
$3(\pi^+\pi^-)$	( 8.6 ±1.8 ) $\times 10^{-3}$		1707	DESIG=4
$\phi\phi$	( 1.06±0.09 ) $\times 10^{-3}$		1457	DESIG=16
$\phi\phi\eta$	( 5.3 ±0.6 ) $\times 10^{-4}$		1206	DESIG=99
$\omega\omega$	( 8.4 ±1.0 ) $\times 10^{-4}$		1597	DESIG=25
$\omega K^+K^-$	( 7.3 ±0.9 ) $\times 10^{-4}$		1540	DESIG=79
$\omega\phi$	( 9.6 ±2.7 ) $\times 10^{-6}$		1529	DESIG=68
$\pi\pi$	( 2.23±0.09 ) $\times 10^{-3}$		1773	DESIG=22
$\rho^0\pi^+\pi^-$	( 3.7 ±1.6 ) $\times 10^{-3}$		1682	DESIG=9
$\pi^+\pi^-\pi^0$ (non-resonant)	( 2.0 ±0.4 ) $\times 10^{-5}$		1765	DESIG=95
$\rho(770)^\pm\pi^\mp$	( 6 ±4 ) $\times 10^{-6}$		–	DESIG=96
$\pi^+\pi^-\eta$	( 4.8 ±1.3 ) $\times 10^{-4}$		1724	DESIG=39
$\pi^+\pi^-\eta'$	( 5.0 ±1.8 ) $\times 10^{-4}$		1636	DESIG=42
$\eta\eta$	( 5.4 ±0.4 ) $\times 10^{-4}$		1692	DESIG=14
$K^+K^-$	( 1.01±0.06 ) $\times 10^{-3}$		1708	DESIG=2
$K_S^0K_S^0$	( 5.2 ±0.4 ) $\times 10^{-4}$		1707	DESIG=15
$K^*(892)^\pm K^\mp$	( 1.44±0.21 ) $\times 10^{-4}$		1627	DESIG=87
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	( 1.24±0.27 ) $\times 10^{-4}$		1627	DESIG=88
$K_2^*(1430)^\pm K^\mp$	( 1.48±0.12 ) $\times 10^{-3}$		–	DESIG=89
$K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	( 1.24±0.17 ) $\times 10^{-3}$		1443	DESIG=90
$K_3^*(1780)^\pm K^\mp$	( 5.2 ±0.8 ) $\times 10^{-4}$		–	DESIG=91
$K_3^*(1780)^0\bar{K}^0 + \text{c.c.}$	( 5.6 ±2.1 ) $\times 10^{-4}$		1274	DESIG=92
$a_2(1320)^0\pi^0$	( 1.29±0.34 ) $\times 10^{-3}$		–	DESIG=93
$a_2(1320)^\pm\pi^\mp$	( 1.8 ±0.6 ) $\times 10^{-3}$		1530	DESIG=94
$\bar{K}^0K^+\pi^- + \text{c.c.}$	( 1.28±0.18 ) $\times 10^{-3}$		1685	DESIG=17
$K^+K^-\pi^0$	( 3.0 ±0.8 ) $\times 10^{-4}$		1686	DESIG=36
$K^+K^-\eta$	< 3.2 $\times 10^{-4}$	90%	1592	DESIG=40
$K^+K^-\eta'(958)$	( 1.94±0.34 ) $\times 10^{-4}$		1488	DESIG=82
$\eta\eta'$	( 2.2 ±0.5 ) $\times 10^{-5}$		1600	DESIG=34
$\eta'\eta'$	( 4.6 ±0.6 ) $\times 10^{-5}$		1498	DESIG=35
$\pi^+\pi^-K_S^0K_S^0$	( 2.2 ±0.5 ) $\times 10^{-3}$		1655	DESIG=29
$K^+K^-K_S^0K_S^0$	< 4 $\times 10^{-4}$	90%	1418	DESIG=30
$K_S^0K_S^0K_S^0K_S^0$	( 1.13±0.18 ) $\times 10^{-4}$		1415	DESIG=97
$K^+K^-K^+K^-$	( 1.65±0.20 ) $\times 10^{-3}$		1421	DESIG=24
$K^+K^-\phi$	( 1.42±0.29 ) $\times 10^{-3}$		1468	DESIG=32



$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		1416	DESIG=83
$K^+ K^- \pi^0 \phi$	$(2.7 \pm 0.5) \times 10^{-3}$		1419	DESIG=84
$\phi \pi^+ \pi^- \pi^0$	$(9.3 \pm 1.2) \times 10^{-4}$		1603	DESIG=80
$p \bar{p}$	$(7.33 \pm 0.33) \times 10^{-5}$		1510	DESIG=11
$p \bar{p} \pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$		1465	DESIG=37
$p \bar{p} \eta$	$(1.74 \pm 0.25) \times 10^{-4}$		1285	DESIG=41
$p \bar{p} \omega$	$(3.6 \pm 0.4) \times 10^{-4}$		1152	DESIG=61
$p \bar{p} \phi$	$(2.8 \pm 0.9) \times 10^{-5}$		1002	DESIG=66
$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		1410	DESIG=8
$p \bar{p} \pi^0 \pi^0$	$(7.8 \pm 2.3) \times 10^{-4}$		1414	DESIG=53
$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.91 \pm 0.32) \times 10^{-4}$		1013	DESIG=63
$p \bar{p} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	1007	DESIG=28
$p \bar{n} \pi^-$	$(8.5 \pm 0.9) \times 10^{-4}$		1463	DESIG=31
$\bar{p} n \pi^+$	$(8.9 \pm 0.8) \times 10^{-4}$		1463	DESIG=75
$p \bar{n} \pi^- \pi^0$	$(2.17 \pm 0.18) \times 10^{-3}$		1411	DESIG=76
$\bar{p} n \pi^+ \pi^0$	$(2.11 \pm 0.18) \times 10^{-3}$		1411	DESIG=77
$\Lambda \bar{\Lambda}$	$(1.83 \pm 0.16) \times 10^{-4}$		1384	DESIG=19
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.25 \pm 0.15) \times 10^{-3}$		1255	DESIG=27
$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(6.6 \pm 1.5) \times 10^{-4}$		1255	DESIG=70
$\Lambda \bar{\Lambda} \eta$	$(1.05 \pm 0.26) \times 10^{-4}$		1096	DESIG=105
$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	90%	1192	DESIG=71
$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	90%	1192	DESIG=72
$K^+ \bar{p} \Lambda + \text{c.c.}$	$(7.8 \pm 0.5) \times 10^{-4}$		1236	DESIG=38
$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(3.58 \pm 0.28) \times 10^{-4}$		1233	DESIG=104
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(8.2 \pm 1.1) \times 10^{-4}$		976	DESIG=101
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.8 \pm 0.7) \times 10^{-4}$		992	DESIG=64
$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.6 \pm 1.5) \times 10^{-4}$		924	DESIG=65
$\Sigma^0 \bar{\Sigma}^0$	$(3.7 \pm 0.6) \times 10^{-5}$		1319	DESIG=47
$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(8.2 \pm 0.9) \times 10^{-5}$		1197	DESIG=100
$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(9.1 \pm 0.8) \times 10^{-5}$		1197	DESIG=103
$\Sigma^+ \bar{\Sigma}^-$	$(3.4 \pm 0.7) \times 10^{-5}$		1322	DESIG=48
$\Sigma^- \bar{\Sigma}^+$	$(4.4 \pm 1.8) \times 10^{-5}$		1314	DESIG=102
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	90%	1118	DESIG=73
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	90%	1118	DESIG=74
$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.76 \pm 0.32) \times 10^{-4}$		1004	DESIG=85
$\Xi^0 \bar{\Xi}^0$	$(1.83 \pm 0.22) \times 10^{-4}$		1197	DESIG=49
$\Xi^- \bar{\Xi}^+$	$(1.44 \pm 0.12) \times 10^{-4}$		1189	DESIG=26
$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	90%	185	DESIG=12
$\pi^0 \eta_c$	$< 3.2 \times 10^{-3}$	90%	511	DESIG=81
$\eta_c(1S) \pi^+ \pi^-$	$< 5.4 \times 10^{-3}$	90%	459	DESIG=69
<b>Radiative decays</b>				
$\gamma J/\psi(1S)$	$(19.0 \pm 0.5) \%$		430	NODE=M057;CLUMP=B DESIG=6
$\gamma \rho^0$	$< 1.9 \times 10^{-5}$	90%	1694	DESIG=44
$\gamma \omega$	$< 6 \times 10^{-6}$	90%	1692	DESIG=45
$\gamma \phi$	$< 7 \times 10^{-6}$	90%	1632	DESIG=46
$\gamma \gamma$	$(2.85 \pm 0.10) \times 10^{-4}$		1778	DESIG=7
$e^+ e^- J/\psi(1S)$	$(2.15 \pm 0.14) \times 10^{-3}$		430	DESIG=86
$\mu^+ \mu^- J/\psi(1S)$	$(2.02 \pm 0.33) \times 10^{-4}$		381	DESIG=98

 **$\eta_c(2S)$** 

$$I^G(J^{PC}) = 0^+(0^{-+})$$

NODE=M059

Quantum numbers are quark model predictions.

Mass  $m = 3637.7 \pm 1.1$  MeV ( $S = 1.2$ )Full width  $\Gamma = 13.9 \pm 2.6$  MeV

NODE=M059M;DTYPE=M

NODE=M059W;DTYPE=G

$\eta_c(2S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
hadrons	not seen		—	NODE=M059215;DESIG=1
$K\bar{K}\pi$	( 1.9±1.2 ) %		1729	DESIG=4
$K\bar{K}\eta$	( 5 ±4 ) × 10 <sup>-3</sup>		1637	DESIG=20
$2\pi^+2\pi^-$	< 2.1 %	90%	1792	DESIG=5
$\rho^0\rho^0$	< 1.9 × 10 <sup>-3</sup>	90%	1645	DESIG=16
$3\pi^+3\pi^-$	( 1.3±0.9 ) %		1749	DESIG=8
$K^+K^-\pi^+\pi^-$	< 1.4 %	90%	1700	DESIG=6
$K^{*0}\bar{K}^{*0}$	< 2.9 × 10 <sup>-3</sup>	90%	1585	DESIG=17
$K^+K^-\pi^+\pi^-\pi^0$	( 1.4±1.0 ) %		1668	DESIG=9
$K^+K^-2\pi^+2\pi^-$	< 1.4 %	90%	1627	DESIG=10
$K_S^0K^-2\pi^+\pi^- + c.c.$	( 1.0±0.8 ) %		1666	DESIG=11
$2K^+2K^-$	< 1.3 × 10 <sup>-3</sup>	90%	1470	DESIG=7
$\phi\phi$	< 1.1 × 10 <sup>-3</sup>	90%	1506	DESIG=18
$p\bar{p}$	< 2.0 × 10 <sup>-3</sup>	90%	1558	DESIG=3
$p\bar{p}\pi^+\pi^-$	seen		1461	DESIG=22
$\gamma\gamma$	( 1.6±1.0 ) × 10 <sup>-4</sup>		1819	DESIG=2
$\gamma J/\psi(1S)$	< 1.4 %	90%	501	DESIG=21
$\pi^+\pi^-\eta$	< 6 × 10 <sup>-3</sup>	90%	1766	DESIG=12
$\pi^+\pi^-\eta'$	( 2.6±1.9 ) × 10 <sup>-3</sup>		1680	DESIG=13
$\pi^+\pi^-\eta_c(1S)$	< 25 %	90%	538	DESIG=15

 **$\psi(2S)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M071

Mass  $m = 3686.10 \pm 0.06$  MeV (S = 5.9)Full width  $\Gamma = 294 \pm 8$  keV

NODE=M071M;DTYPE=M

NODE=M071W;DTYPE=G

$\psi(2S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
hadrons	(97.85 ± 0.13 ) %		—	NODE=M071220;DESIG=3
virtual $\gamma \rightarrow$ hadrons	( 1.73 ± 0.14 ) %	S=1.5	—	DESIG=4
$ggg$	(10.6 ± 1.6 ) %		—	DESIG=255
$\gamma gg$	( 1.03 ± 0.29 ) %		—	DESIG=256
light hadrons	(15.4 ± 1.5 ) %		—	DESIG=226
$K_S^0$ anything	(16.0 ± 1.1 ) %		—	DESIG=325
$e^+e^-$	( 7.93 ± 0.17 ) × 10 <sup>-3</sup>		1843	DESIG=1
$\mu^+\mu^-$	( 8.0 ± 0.6 ) × 10 <sup>-3</sup>		1840	DESIG=2
$\tau^+\tau^-$	( 3.1 ± 0.4 ) × 10 <sup>-3</sup>		489	DESIG=68
<b>Decays into <math>J/\psi(1S)</math> and anything</b>				
$J/\psi(1S)$ anything	(61.4 ± 0.6 ) %		—	NODE=M071;CLUMP=A DESIG=11
$J/\psi(1S)$ neutrals	(25.38 ± 0.32 ) %		—	DESIG=12
$J/\psi(1S)\pi^+\pi^-$	(34.68 ± 0.30 ) %		477	DESIG=13
$J/\psi(1S)\pi^0\pi^0$	(18.24 ± 0.31 ) %		481	DESIG=14
$J/\psi(1S)\eta$	( 3.37 ± 0.05 ) %		199	DESIG=15
$J/\psi(1S)\pi^0$	( 1.268±0.032 ) × 10 <sup>-3</sup>		528	DESIG=18
<b>Hadronic decays</b>				
$\pi^+\pi^-$	( 7.8 ± 2.6 ) × 10 <sup>-6</sup>		1838	NODE=M071;CLUMP=B DESIG=21
$\pi^+\pi^-\pi^0$	( 2.01 ± 0.17 ) × 10 <sup>-4</sup>	S=1.7	1830	DESIG=36
$\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0$	( 3.2 ± 1.2 ) × 10 <sup>-5</sup>	S=1.8	—	DESIG=22
$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	( 1.9 <sup>+1.2</sup> <sub>-0.4</sub> ) × 10 <sup>-4</sup>		—	DESIG=201
$2(\pi^+\pi^-)$	( 2.4 ± 0.6 ) × 10 <sup>-4</sup>	S=2.2	1817	DESIG=24
$\rho^0\pi^+\pi^-$	( 2.2 ± 0.6 ) × 10 <sup>-4</sup>	S=1.4	1750	DESIG=33
$2(\pi^+\pi^-)\pi^0$	( 2.9 ± 1.0 ) × 10 <sup>-3</sup>	S=4.7	1799	DESIG=25
$\rho a_2(1320)$	( 2.6 ± 0.9 ) × 10 <sup>-4</sup>		1500	DESIG=65
$\pi^+\pi^-\pi^0\pi^0\pi^0$	( 5.3 ± 0.9 ) × 10 <sup>-3</sup>		1800	DESIG=312
$\pi^+\pi^-4\pi^0$	( 1.4 ± 1.0 ) × 10 <sup>-3</sup>		1778	DESIG=332
$\rho^\pm\pi^\mp\pi^0\pi^0$	< 2.7 × 10 <sup>-3</sup>	CL=90%	1737	DESIG=315
$3(\pi^+\pi^-)$	( 3.5 ± 2.0 ) × 10 <sup>-4</sup>	S=2.8	1774	DESIG=32

$2(\pi^+\pi^-\pi^0)$	$(4.8 \pm 1.5) \times 10^{-3}$		1776	DESIG=221
$3(\pi^+\pi^-\pi^0)$	$(3.5 \pm 1.6) \times 10^{-3}$		1746	DESIG=37
$2(\pi^+\pi^-)3\pi^0$	$(1.42 \pm 0.31) \%$		1748	DESIG=329
$\eta\pi^+\pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	1791	DESIG=202
$\eta\pi^+\pi^-\pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		1778	DESIG=203
$\eta 2(\pi^+\pi^-)$	$(1.2 \pm 0.6) \times 10^{-3}$		1758	DESIG=251
$\eta\pi^+\pi^-\pi^0\pi^0$	$< 4 \times 10^{-4}$	CL=90%	1760	DESIG=313
$\eta\pi^+\pi^-3\pi^0$	$< 2.1 \times 10^{-3}$	CL=90%	1736	DESIG=334
$\eta 2(\pi^+\pi^-\pi^0)$	$< 2.1 \times 10^{-3}$	CL=90%	1705	DESIG=328
$\rho\eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	1717	DESIG=94
$\eta'\pi^+\pi^-\pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		1692	DESIG=204
$\eta'\rho$	$(1.9 \pm 1.7) \times 10^{-5}$		1625	DESIG=93
$\omega\pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		1757	DESIG=92
$\omega\pi^+\pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	1748	DESIG=75
$\omega\pi^+\pi^-2\pi^0$	$(8.7 \pm 2.4) \times 10^{-3}$		1715	DESIG=327
$b_1^\pm\pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	1635	DESIG=40
$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		1515	DESIG=64
$\omega\pi^0\pi^0$	$(1.11 \pm 0.35) \times 10^{-3}$		1749	DESIG=314
$\omega 3\pi^0$	$< 8 \times 10^{-4}$	CL=90%	1736	DESIG=333
$b_1^0\pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		-	DESIG=193
$\omega\eta$	$< 1.1 \times 10^{-5}$	CL=90%	1715	DESIG=95
$\omega\eta'$	$(3.2 \pm 2.5) \times 10^{-5}$		1623	DESIG=91
$\phi\pi^0$	$< 4 \times 10^{-7}$	CL=90%	1699	DESIG=96
$\phi\pi^+\pi^-$	$(1.18 \pm 0.26) \times 10^{-4}$	S=1.5	1690	DESIG=78
$\phi f_0(980) \rightarrow \pi^+\pi^-$	$(7.5 \pm 3.3) \times 10^{-5}$	S=1.6	-	DESIG=81
$\phi\eta$	$(3.10 \pm 0.31) \times 10^{-5}$		1654	DESIG=89
$\eta\phi(2170), \phi(2170) \rightarrow$ $\phi f_0(980), f_0 \rightarrow \pi^+\pi^-$	$< 2.2 \times 10^{-6}$	CL=90%	-	DESIG=316
$\phi\eta'$	$(1.54 \pm 0.20) \times 10^{-5}$		1555	DESIG=90
$\phi f_1(1285)$	$(3.0 \pm 1.3) \times 10^{-5}$		1436	DESIG=319
$\phi\eta(1405) \rightarrow \phi\pi^+\pi^-\eta$	$(8.5 \pm 1.7) \times 10^{-6}$		-	DESIG=320
$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		1325	DESIG=67
$K^+K^-$	$(7.5 \pm 0.5) \times 10^{-5}$		1776	DESIG=23
$K^+K^-\pi^+$	$(7.3 \pm 0.5) \times 10^{-4}$		1754	DESIG=26
$K^+K^-\pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		1754	DESIG=38
$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		1775	DESIG=86
$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		1775	DESIG=85
$K_S^0 K_L^0\pi^0$	$< 3.0 \times 10^{-4}$	CL=90%	1753	DESIG=303
$K^+K^-\pi^0\pi^0$	$(2.6 \pm 1.3) \times 10^{-4}$		1728	DESIG=298
$K^+K^-\pi^+\pi^-\pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		1694	DESIG=206
$\omega f_0(1710) \rightarrow \omega K^+K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		-	DESIG=216
$K^*(892)^0 K^-\pi^+\pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		-	DESIG=217
$K^*(892)^+ K^-\pi^+\pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		-	DESIG=218
$K^*(892)^+ K^-\rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		-	DESIG=219
$K^*(892)^0 K^-\rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		-	DESIG=220
$K_S^0 K_S^0\pi^+\pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1724	DESIG=225
$K_S^0 K_L^0\pi^0\pi^0$	$(1.3 \pm 0.6) \times 10^{-3}$		1726	DESIG=304
$K_S^0 K_L^0\eta$	$(1.3 \pm 0.5) \times 10^{-3}$		1661	DESIG=305
$K^+K^-\rho^0$	$(2.2 \pm 0.4) \times 10^{-4}$		1616	DESIG=205
$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		1417	DESIG=66
$K^+K^-\pi^+\pi^-\eta$	$(1.3 \pm 0.7) \times 10^{-3}$		1574	DESIG=252
$K^+K^-2(\pi^+\pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		1654	DESIG=222
$K^+K^-2(\pi^+\pi^-)\pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		1611	DESIG=240
$K^+K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	1698	DESIG=39
$2(K^+K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$		1499	DESIG=208
$2(K^+K^-)\pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		1440	DESIG=209
$K^+K^-\phi$	$(7.0 \pm 1.6) \times 10^{-5}$		1546	DESIG=79
$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		1588	DESIG=41

$K^+ \bar{K}^*(892)^0 \pi^- + c.c.$	$(6.7 \pm 2.5) \times 10^{-4}$	1674	DESIG=34
$\eta K^+ K^-$ , no $\eta \phi$	$(3.49 \pm 0.17) \times 10^{-5}$	1664	DESIG=207
$X(1750) \eta \rightarrow K^+ K^- \eta$	$(4.8 \pm 2.8) \times 10^{-6}$	–	DESIG=324
$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	1532	DESIG=42
			CL=90%
$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm_{-0.9}^{+1.3}) \times 10^{-5}$	–	DESIG=265
$K^*(892)^0 \bar{K}^0 + c.c.$	$(1.09 \pm 0.20) \times 10^{-4}$	1697	DESIG=194
$\omega K^+ K^-$	$(1.62 \pm 0.11) \times 10^{-4}$	1614	DESIG=76
			S=1.1
$\omega K_S^0 K_S^0$	$(7.0 \pm 0.5) \times 10^{-5}$	1612	DESIG=330
$\omega K^*(892)^+ K^- + c.c.$	$(2.07 \pm 0.26) \times 10^{-4}$	1482	DESIG=276
$\omega K_2^*(1430)^+ K^- + c.c.$	$(6.1 \pm 1.2) \times 10^{-5}$	1252	DESIG=277
$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$	1481	DESIG=278
$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$	1250	DESIG=279
$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + c.c.$	$(1.6 \pm 0.4) \times 10^{-5}$	–	DESIG=282
$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$	–	DESIG=283
$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + c.c.$	$(3.0 \pm 1.0) \times 10^{-6}$	–	DESIG=284
$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$	–	DESIG=285
$\rho \bar{p}$	$(2.94 \pm 0.08) \times 10^{-4}$	1586	DESIG=27
$n \bar{n}$	$(3.06 \pm 0.15) \times 10^{-4}$	1586	DESIG=309
$\rho \bar{p} \pi^0$	$(1.53 \pm 0.07) \times 10^{-4}$	1543	DESIG=35
$N(940) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(6.4 \pm_{-1.3}^{+1.8}) \times 10^{-5}$	–	DESIG=267
$N(1440) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(7.3 \pm_{-1.5}^{+1.7}) \times 10^{-5}$	–	DESIG=261
			S=2.5
$N(1520) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(6.4 \pm_{-1.8}^{+2.3}) \times 10^{-6}$	–	DESIG=268
$N(1535) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(2.5 \pm 1.0) \times 10^{-5}$	–	DESIG=269
$N(1650) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(3.8 \pm_{-1.7}^{+1.4}) \times 10^{-5}$	–	DESIG=270
$N(1720) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(1.79 \pm_{-0.70}^{+0.26}) \times 10^{-5}$	–	DESIG=271
$N(2300) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(2.6 \pm_{-0.7}^{+1.2}) \times 10^{-5}$	–	DESIG=272
$N(2570) \bar{p} + c.c. \rightarrow \rho \bar{p} \pi^0$	$(2.13 \pm_{-0.31}^{+0.40}) \times 10^{-5}$	–	DESIG=273
$\rho \bar{p} \pi^+ \pi^-$	$(6.0 \pm 0.4) \times 10^{-4}$	1491	DESIG=31
$\rho \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$	1118	DESIG=212
$\rho \bar{p} \eta$	$(6.0 \pm 0.4) \times 10^{-5}$	1373	DESIG=200
$N(1535) \bar{p} + c.c. \rightarrow \rho \bar{p} \eta$	$(4.5 \pm_{-0.6}^{+0.7}) \times 10^{-5}$	–	DESIG=264
$\rho \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$	1435	DESIG=211
$\rho \bar{p} \rho^0$	$(5.0 \pm 2.2) \times 10^{-5}$	1252	DESIG=210
$\rho \bar{p} \omega$	$(6.9 \pm 2.1) \times 10^{-5}$	1247	DESIG=77
$\rho \bar{p} \eta'$	$(1.10 \pm 0.13) \times 10^{-5}$	1141	DESIG=317
$\rho \bar{p} \phi$	$(6.1 \pm 0.6) \times 10^{-6}$	1109	DESIG=80
$\phi X(1835) \rightarrow \rho \bar{p} \phi$	$< 1.82 \times 10^{-7}$	–	DESIG=318
			CL=90%
$\rho \bar{n} \pi^-$ or c.c.	$(2.48 \pm 0.17) \times 10^{-4}$	–	DESIG=227
$\rho \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$	1492	DESIG=228
$\Lambda \bar{\Lambda}$	$(3.81 \pm 0.13) \times 10^{-4}$	1467	DESIG=28
			S=1.4
$\Lambda \bar{\Lambda} \pi^0$	$(1.4 \pm 0.7) \times 10^{-6}$	1412	DESIG=238
$\Lambda \bar{\Lambda} \eta$	$(2.43 \pm 0.32) \times 10^{-5}$	1197	DESIG=239
$\Lambda \bar{\Lambda} \omega(782)$	$(3.3 \pm 0.4) \times 10^{-5}$	1037	DESIG=340
$\Lambda(1670) \bar{\Lambda} \rightarrow \Lambda \bar{\Lambda} \eta$	$(1.3 \pm 0.7) \times 10^{-5}$	–	DESIG=336
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$	1346	DESIG=213
$\Lambda \bar{p} K^+$	$(1.00 \pm 0.14) \times 10^{-4}$	1327	DESIG=214
$\Lambda \bar{p} K^*(892)^+ + c.c.$	$(6.3 \pm 0.7) \times 10^{-5}$	1087	DESIG=321
$\Lambda \bar{p} K^+ \pi^+ \pi^-$	$(1.8 \pm 0.4) \times 10^{-4}$	1167	DESIG=215
$\bar{\Lambda} n K_S^0 + c.c.$	$(8.1 \pm 1.8) \times 10^{-5}$	1324	DESIG=237
$\Delta^{++} \bar{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$	1371	DESIG=70
$\Lambda \bar{\Sigma}^+ \pi^- + c.c.$	$(1.40 \pm 0.13) \times 10^{-4}$	1376	DESIG=280

$\Lambda \bar{\Sigma}^- \pi^+ + \text{c.c.}$	$(1.54 \pm 0.14) \times 10^{-4}$		1379	DESIG=281
$\Lambda \bar{\Sigma}^0 + \text{c.c.}$	$(1.6 \pm 0.7) \times 10^{-6}$		1437	DESIG=326
$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(1.67 \pm 0.18) \times 10^{-5}$		1291	DESIG=274
$\Sigma^+ \bar{\Sigma}^-$	$(2.43 \pm 0.10) \times 10^{-4}$	S=1.4	1408	DESIG=223
$\Sigma^0 \bar{\Sigma}^0$	$(2.35 \pm 0.09) \times 10^{-4}$	S=1.1	1405	DESIG=71
$\Sigma^- \bar{\Sigma}^+$	$(2.82 \pm 0.09) \times 10^{-4}$		1401	DESIG=335
$\Sigma^+ \bar{\Sigma}^- \eta$	$(9.6 \pm 2.4) \times 10^{-6}$		1108	DESIG=339
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(8.5 \pm 0.7) \times 10^{-5}$		1218	DESIG=72
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(8.5 \pm 0.8) \times 10^{-5}$		1218	DESIG=297
$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(6.9 \pm 0.7) \times 10^{-5}$		1218	DESIG=299
$\Xi^- \bar{\Xi}^+$	$(2.87 \pm 0.11) \times 10^{-4}$	S=1.1	1284	DESIG=29
$\Xi^0 \bar{\Xi}^0$	$(2.3 \pm 0.4) \times 10^{-4}$	S=4.2	1291	DESIG=224
$\Xi(1530)^0 \bar{\Xi}(1530)^0$	$(6.8 \pm 0.4) \times 10^{-5}$		1025	DESIG=73
$\Lambda \bar{\Xi}^+ K^- + \text{c.c.}$	$(3.9 \pm 0.4) \times 10^{-5}$		1114	DESIG=293
$\Xi(1530)^- \bar{\Xi}(1530)^+$	$(1.15 \pm 0.07) \times 10^{-4}$		1025	DESIG=322
$\Xi(1530)^- \bar{\Xi}^+$	$(7.0 \pm 1.2) \times 10^{-6}$		1165	DESIG=323
$\Xi(1530)^0 \bar{\Xi}^0$	$(5.3 \pm 0.5) \times 10^{-6}$		1169	DESIG=331
$\Xi(1690)^- \bar{\Xi}^+ \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(5.2 \pm 1.6) \times 10^{-6}$		-	DESIG=294
$\Xi(1820)^- \bar{\Xi}^+ \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.20 \pm 0.32) \times 10^{-5}$		-	DESIG=295
$\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		1060	DESIG=296
$\Omega^- \bar{\Omega}^+$	$(5.66 \pm 0.30) \times 10^{-5}$	S=1.3	774	DESIG=74
$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	512	DESIG=229
$h_c(1P) \pi^0$	$(7.4 \pm 0.5) \times 10^{-4}$		85	DESIG=254
$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	$< 1.7 \times 10^{-6}$	CL=90%	830	DESIG=310
$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$[j] < 8.8 \times 10^{-6}$	CL=90%	-	DESIG=195
$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$[j] < 1.0 \times 10^{-5}$	CL=90%	-	DESIG=196
$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$[j] < 7.0 \times 10^{-6}$	CL=90%	-	DESIG=197
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$[j] < 2.6 \times 10^{-5}$	CL=90%	-	DESIG=198
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$[j] < 6.0 \times 10^{-6}$	CL=90%	-	DESIG=199

**Radiative decays**

NODE=M071;CLUMP=C

$\gamma \chi_{c0}(1P)$	$(9.79 \pm 0.20) \%$		261	DESIG=56
$\gamma \chi_{c1}(1P)$	$(9.75 \pm 0.24) \%$		171	DESIG=58
$\gamma \chi_{c2}(1P)$	$(9.52 \pm 0.20) \%$		128	DESIG=59
$\gamma \eta_c(1S)$	$(3.4 \pm 0.5) \times 10^{-3}$	S=1.3	635	DESIG=61
$\gamma \eta_c(2S)$	$(7 \pm 5) \times 10^{-4}$		48	DESIG=63
$\gamma \pi^0$	$(1.04 \pm 0.22) \times 10^{-6}$	S=1.4	1841	DESIG=52
$\gamma 2(\pi^+ \pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		1817	DESIG=241
$\gamma 3(\pi^+ \pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%	1774	DESIG=249
$\gamma \eta'(958)$	$(1.24 \pm 0.04) \times 10^{-4}$		1719	DESIG=54
$\gamma f_2(1270)$	$(2.73 \pm 0.29) \times 10^{-4}$	S=1.8	1622	DESIG=82
$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(3.1 \pm 1.7) \times 10^{-5}$		1588	DESIG=286
$\gamma f_0(1500)$	$(9.3 \pm 1.9) \times 10^{-5}$		1529	DESIG=287
$\gamma f_2'(1525)$	$(3.3 \pm 0.8) \times 10^{-5}$		1531	DESIG=288
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.5 \pm 0.6) \times 10^{-5}$		-	DESIG=83
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(6.6 \pm 0.7) \times 10^{-5}$		-	DESIG=84
$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(4.8 \pm 1.0) \times 10^{-6}$		1244	DESIG=289
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(3.2 \pm 1.0) \times 10^{-6}$		1193	DESIG=290
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 5.8 \times 10^{-6}$	CL=90%	1168	DESIG=291
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 9.5 \times 10^{-6}$	CL=90%	1168	DESIG=292
$\gamma \eta$	$(9.2 \pm 1.8) \times 10^{-7}$		1802	DESIG=53
$\gamma \eta \pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		1791	DESIG=230
$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	$< 9 \times 10^{-5}$	CL=90%	1569	DESIG=62
$\gamma \eta(1405) \rightarrow \gamma \eta \pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		-	DESIG=232

$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0$	< 5.0	$\times 10^{-7}$	CL=90%	—	DESIG=308
$\gamma\eta(1475) \rightarrow \gamma K\bar{K}\pi$	< 1.4	$\times 10^{-4}$	CL=90%	—	DESIG=234
$\gamma\eta(1475) \rightarrow \gamma\eta\pi^+\pi^-$	< 8.8	$\times 10^{-5}$	CL=90%	—	DESIG=235
$\gamma K^{*0}K^+\pi^- + \text{c.c.}$	( 3.7 $\pm$ 0.9 )	$\times 10^{-4}$		1674	DESIG=242
$\gamma K^{*0}\bar{K}^{*0}$	( 2.4 $\pm$ 0.7 )	$\times 10^{-4}$		1613	DESIG=243
$\gamma K_S^0K^+\pi^- + \text{c.c.}$	( 2.6 $\pm$ 0.5 )	$\times 10^{-4}$		1753	DESIG=244
$\gamma K^+K^-\pi^+\pi^-$	( 1.9 $\pm$ 0.5 )	$\times 10^{-4}$		1726	DESIG=245
$\gamma K^+K^-2(\pi^+\pi^-)$	< 2.2	$\times 10^{-4}$	CL=90%	1654	DESIG=248
$\gamma 2(K^+K^-)$	< 4	$\times 10^{-5}$	CL=90%	1499	DESIG=250
$\gamma p\bar{p}$	( 3.9 $\pm$ 0.5 )	$\times 10^{-5}$	S=2.0	1586	DESIG=246
$\gamma f_2(1950) \rightarrow \gamma p\bar{p}$	( 1.20 $\pm$ 0.22 )	$\times 10^{-5}$		—	DESIG=257
$\gamma f_2(2150) \rightarrow \gamma p\bar{p}$	( 7.2 $\pm$ 1.8 )	$\times 10^{-6}$		—	DESIG=258
$\gamma X(1835) \rightarrow \gamma p\bar{p}$	( 4.6 $\pm$ 1.8 -4.0 )	$\times 10^{-6}$		—	DESIG=259
$\gamma X \rightarrow \gamma p\bar{p}$	[ $\rho$ ] < 2	$\times 10^{-6}$	CL=90%	—	DESIG=260
$\gamma p\bar{p}\pi^+\pi^-$	( 2.8 $\pm$ 1.4 )	$\times 10^{-5}$		1491	DESIG=247
$\gamma\gamma$	< 1.5	$\times 10^{-4}$	CL=90%	1843	DESIG=51
$\gamma\gamma J/\psi$	( 3.1 $\pm$ 1.0 -1.2 )	$\times 10^{-4}$		542	DESIG=266
$e^+e^-\eta'$	( 1.90 $\pm$ 0.26 )	$\times 10^{-6}$		1719	DESIG=311
$e^+e^-\eta_c(1S)$	( 3.8 $\pm$ 0.4 )	$\times 10^{-5}$		635	DESIG=338
$e^+e^-\chi_{c0}(1P)$	( 1.06 $\pm$ 0.24 )	$\times 10^{-3}$		261	DESIG=300
$e^+e^-\chi_{c1}(1P)$	( 8.5 $\pm$ 0.6 )	$\times 10^{-4}$		171	DESIG=301
$e^+e^-\chi_{c2}(1P)$	( 7.0 $\pm$ 0.8 )	$\times 10^{-4}$		128	DESIG=302
<b>Weak decays</b>					
$D^0 e^+e^- + \text{c.c.}$	< 1.4	$\times 10^{-7}$	CL=90%	1371	NODE=M071;CLUMP=E DESIG=306
$\Lambda_c^+ \bar{\Sigma}^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%	586	DESIG=337
<b>Other decays</b>					
invisible	< 1.6	%	CL=90%	—	NODE=M071;CLUMP=D DESIG=275

 **$\psi(3770)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 3773.7 \pm 0.4$  MeV ( $S = 1.4$ )Full width  $\Gamma = 27.2 \pm 1.0$  MeV

NODE=M053

NODE=M053M;DTYPE=M

NODE=M053W;DTYPE=G

$\psi(3770)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$\rho$ (MeV/c)	
$D\bar{D}$	(93 $^{+8}_{-9}$ ) %	S=2.0	287	NODE=M053220;DESIG=2
$D^0\bar{D}^0$	(52 $^{+4}_{-5}$ ) %	S=2.0	287	DESIG=5
$D^+D^-$	(41 $\pm 4$ ) %	S=2.0	254	DESIG=6
$J/\psi X$	( 5.0 $\pm 2.2$ ) $\times 10^{-3}$		–	DESIG=235
$J/\psi\pi^+\pi^-$	( 1.93 $\pm 0.28$ ) $\times 10^{-3}$		561	DESIG=4
$J/\psi\pi^0\pi^0$	( 8.0 $\pm 3.0$ ) $\times 10^{-4}$		565	DESIG=46
$J/\psi\eta$	( 9 $\pm 4$ ) $\times 10^{-4}$		361	DESIG=47
$J/\psi\pi^0$	< 2.8 $\times 10^{-4}$	CL=90%	604	DESIG=48
$e^+e^-$	( 9.6 $\pm 0.7$ ) $\times 10^{-6}$	S=1.3	1887	DESIG=1
<b>Decays to light hadrons</b>				NODE=M053;CLUMP=H
$b_1(1235)\pi$	< 1.4 $\times 10^{-5}$	CL=90%	1684	DESIG=20
$\phi\eta'$	< 7 $\times 10^{-4}$	CL=90%	1607	DESIG=17
$\omega\eta'$	< 4 $\times 10^{-4}$	CL=90%	1672	DESIG=16
$\rho^0\eta'$	< 6 $\times 10^{-4}$	CL=90%	1674	DESIG=15
$\phi\eta$	( 3.1 $\pm 0.7$ ) $\times 10^{-4}$		1703	DESIG=8
$\omega\eta$	< 1.4 $\times 10^{-5}$	CL=90%	1762	DESIG=14
$\rho^0\eta$	< 5 $\times 10^{-4}$	CL=90%	1764	DESIG=13
$\phi\pi^0$	< 3 $\times 10^{-5}$	CL=90%	1746	DESIG=12
$\omega\pi^0$	< 6 $\times 10^{-4}$	CL=90%	1803	DESIG=11
$\pi^+\pi^-\pi^0$	< 5 $\times 10^{-6}$	CL=90%	1874	DESIG=9
$\rho\pi$	< 5 $\times 10^{-6}$	CL=90%	1805	DESIG=10
$K^*(892)^+K^- + c.c.$	< 1.4 $\times 10^{-5}$	CL=90%	1745	DESIG=19
$K^*(892)^0\bar{K}^0 + c.c.$	< 1.2 $\times 10^{-3}$	CL=90%	1745	DESIG=18
$K_S^0 K_L^0$	< 1.2 $\times 10^{-5}$	CL=90%	1820	DESIG=3
$2(\pi^+\pi^-)$	< 1.12 $\times 10^{-3}$	CL=90%	1861	DESIG=21
$2(\pi^+\pi^-)\pi^0$	< 1.06 $\times 10^{-3}$	CL=90%	1844	DESIG=22
$2(\pi^+\pi^-\pi^0)$	< 5.85 %	CL=90%	1821	DESIG=208
$\omega\pi^+\pi^-$	< 6.0 $\times 10^{-4}$	CL=90%	1794	DESIG=24
$3(\pi^+\pi^-)$	< 9.1 $\times 10^{-3}$	CL=90%	1820	DESIG=52
$3(\pi^+\pi^-)\pi^0$	< 1.37 %	CL=90%	1792	DESIG=55
$3(\pi^+\pi^-)2\pi^0$	< 11.74 %	CL=90%	1760	DESIG=210
$\eta\pi^+\pi^-$	< 1.24 $\times 10^{-3}$	CL=90%	1836	DESIG=23
$\pi^+\pi^-2\pi^0$	< 8.9 $\times 10^{-3}$	CL=90%	1862	DESIG=206
$\rho^0\pi^+\pi^-$	< 6.9 $\times 10^{-3}$	CL=90%	1796	DESIG=64
$\eta 3\pi$	< 1.34 $\times 10^{-3}$	CL=90%	1824	DESIG=25
$\eta 2(\pi^+\pi^-)$	< 2.43 %	CL=90%	1804	DESIG=53
$\eta\rho^0\pi^+\pi^-$	< 1.45 %	CL=90%	1708	DESIG=221
$\eta' 3\pi$	< 2.44 $\times 10^{-3}$	CL=90%	1741	DESIG=26
$K^+K^-\pi^+\pi^-$	< 9.0 $\times 10^{-4}$	CL=90%	1773	DESIG=27
$\phi\pi^+\pi^-$	< 4.1 $\times 10^{-4}$	CL=90%	1737	DESIG=28
$K^+K^-2\pi^0$	< 4.2 $\times 10^{-3}$	CL=90%	1774	DESIG=207
$4(\pi^+\pi^-)$	< 1.67 %	CL=90%	1757	DESIG=62
$4(\pi^+\pi^-)\pi^0$	< 3.06 %	CL=90%	1720	DESIG=63
$\phi f_0(980)$	< 4.5 $\times 10^{-4}$	CL=90%	1597	DESIG=29
$K^+K^-\pi^+\pi^-\pi^0$	< 2.36 $\times 10^{-3}$	CL=90%	1741	DESIG=30
$K^+K^-\rho^0\pi^0$	< 8 $\times 10^{-4}$	CL=90%	1624	DESIG=67
$K^+K^-\rho^+\pi^-$	< 1.46 %	CL=90%	1623	DESIG=68
$\omega K^+K^-$	< 3.4 $\times 10^{-4}$	CL=90%	1664	DESIG=32
$\phi\pi^+\pi^-\pi^0$	< 3.8 $\times 10^{-3}$	CL=90%	1723	DESIG=69
$K^{*0}K^-\pi^+\pi^0 + c.c.$	< 1.62 %	CL=90%	1694	DESIG=70
$K^{*+}K^-\pi^+\pi^- + c.c.$	< 3.23 %	CL=90%	1693	DESIG=71
$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67 %	CL=90%	1705	DESIG=209
$K^+K^-2(\pi^+\pi^-)$	< 1.03 %	CL=90%	1702	DESIG=57
$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60 %	CL=90%	1661	DESIG=58
$\eta K^+K^-$	< 4.1 $\times 10^{-4}$	CL=90%	1712	DESIG=31

$\eta K^+ K^- \pi^+ \pi^-$	< 1.24	%	CL=90%	1624	DESIG=222
$\rho^0 K^+ K^-$	< 5.0	$\times 10^{-3}$	CL=90%	1666	DESIG=65
$2(K^+ K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	1552	DESIG=33
$\phi K^+ K^-$	< 7.5	$\times 10^{-4}$	CL=90%	1598	DESIG=34
$2(K^+ K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	1494	DESIG=35
$2(K^+ K^-)\pi^+ \pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	1426	DESIG=59
$K_S^0 K^- \pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	1799	DESIG=200
$K_S^0 K^- \pi^+ \pi^0$	< 1.33	%	CL=90%	1773	DESIG=201
$K_S^0 K^- \rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	1665	DESIG=214
$K_S^0 K^- 2\pi^+ \pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	1740	DESIG=202
$K_S^0 K^- \pi^+ \rho^0$	< 1.6	%	CL=90%	1621	DESIG=215
$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	1670	DESIG=216
$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	1703	DESIG=203
$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	1570	DESIG=217
$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	1658	DESIG=204
$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	1742	DESIG=205
$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	1491	DESIG=218
$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	1427	DESIG=219
$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	1214	DESIG=220
$K^{*0} K^- \pi^+ + c.c.$	< 9.7	$\times 10^{-3}$	CL=90%	1722	DESIG=60
$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	1595	DESIG=54
$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	1544	DESIG=36
$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	1522	DESIG=42
$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	1490	DESIG=37
$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	1310	DESIG=39
$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	1469	DESIG=72
$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	1426	DESIG=61
$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	1431	DESIG=38
$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	1284	DESIG=223
$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	1314	DESIG=66
$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	1186	DESIG=40
$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	737	DESIG=224
$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	1094	DESIG=225
$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1178	DESIG=41
$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	1405	DESIG=43
$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	1387	DESIG=44
$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	1234	DESIG=45
$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	1263	DESIG=226
$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	1465	DESIG=227
$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	1462	DESIG=228
$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	1347	DESIG=229
$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	1353	DESIG=230

**Radiative decays**

$\gamma\chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	211	NODE=M053;CLUMP=R DESIG=51
$\gamma\chi_{c1}$	( 2.49±0.23 )	$\times 10^{-3}$		254	DESIG=50
$\gamma\chi_{c0}$	( 6.9 ±0.6 )	$\times 10^{-3}$		342	DESIG=49
$\gamma\eta_c$	< 7	$\times 10^{-4}$	CL=90%	707	DESIG=231
$\gamma\eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	134	DESIG=232
$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	1765	DESIG=213
$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	1847	DESIG=212
$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%	1884	DESIG=211

 **$\psi_2(3823)$** was  $\psi(3823)$ ,  $X(3823)$ 

$$I^G(J^{PC}) = 0^-(2^{--})$$

$I, J, P$  need confirmation.

NODE=M212

Mass  $m = 3823.5 \pm 0.5$  MeV ( $S = 1.4$ )  
 Full width  $\Gamma < 2.9$  MeV, CL = 90%

NODE=M212M;DTYPE=M  
 NODE=M212W;DTYPE=G



Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M212215;NODE=M212

$\psi_2(3823)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$J/\psi(1S)\pi^+\pi^-$	<0.06	90%	607
$J/\psi(1S)\pi^0\pi^0$	<0.11	90%	610
$J/\psi(1S)\pi^0$	<0.030	90%	646
$J/\psi(1S)\eta$	<0.14	90%	431
$\chi_{c0}\gamma$	<0.24	90%	387
$\chi_{c1}\gamma$	<b>DEFINED AS 1</b>		300
$\chi_{c2}\gamma$	0.28 $^{+0.14}_{-0.11}$		258

DESIG=3  
DESIG=5  
DESIG=6  
DESIG=7  
DESIG=4  
DESIG=1  
DESIG=2

 **$\psi_3(3842)$** 

$$I^G(J^{PC}) = 0^-(3^{--})$$

$J, P$  need confirmation.

NODE=M241

Seen by a single experiment only.

Mass  $m = 3842.71 \pm 0.20$  MeV

Full width  $\Gamma = 2.8 \pm 0.6$  MeV

NODE=M241M;DTYPE=M  
NODE=M241W;DTYPE=G

$\psi_3(3842)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$D^+D^-$	seen	443
$D^0\bar{D}^0$	seen	463

NODE=M241215;DESIG=1  
DESIG=2

 **$\chi_{c1}(3872)$** 

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M176

also known as X(3872)

Mass  $m = 3871.65 \pm 0.06$  MeV

$m_{\chi_{c1}(3872)} - m_{J/\psi} = 775 \pm 4$  MeV

Full width  $\Gamma = 1.19 \pm 0.21$  MeV ( $S = 1.1$ )

NODE=M176M;DTYPE=M  
NODE=M176DM;DTYPE=B  
NODE=M176W;DTYPE=G

$\chi_{c1}(3872)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$e^+e^-$	< 2.8 $\times 10^{-6}$	90%	1936
$\pi^+\pi^-\pi^0$	< 9 $\times 10^{-3}$	90%	1924
$\pi^+\pi^-J/\psi(1S)$	( 3.8 $\pm$ 1.2 ) %		650
$\pi^+\pi^-\pi^0J/\psi(1S)$	not seen		588
$\omega\eta_c(1S)$	< 33 %	90%	368
$\omega J/\psi(1S)$	( 4.3 $\pm$ 2.1 ) %		†
$\phi\phi$	not seen		1646
$D^0\bar{D}^0\pi^0$	(49 $^{+18}_{-20}$ ) %		116
$\bar{D}^{*0}D^0$	(37 $\pm$ 9 ) %		†
$\gamma\gamma$	< 11 %	90%	1936
$D^0\bar{D}^0$	< 29 %	90%	519
$D^+D^-$	< 19 %	90%	502
$\pi^0\chi_{c2}$	< 4 %	90%	273
$\pi^0\chi_{c1}$	( 3.4 $\pm$ 1.6 ) %		319
$\pi^0\chi_{c0}$	< 14 %	90%	—
$\pi^+\pi^-\eta_c(1S)$	< 14 %	90%	745
$\pi^0\pi^0\chi_{c0}$	< 7 %	90%	347
$\pi^+\pi^-\chi_{c0}$	< 2.1 %	90%	340
$\pi^+\pi^-\chi_{c1}$	< 7 $\times 10^{-3}$	90%	218
$p\bar{p}$	< 2.4 $\times 10^{-5}$	95%	1693

NODE=M176215;DESIG=1  
DESIG=29  
DESIG=2  
DESIG=25  
DESIG=24  
DESIG=13  
DESIG=26  
DESIG=8  
DESIG=12  
DESIG=5  
DESIG=6  
DESIG=7  
DESIG=20  
DESIG=18  
DESIG=19  
DESIG=14  
DESIG=28  
DESIG=27  
DESIG=17  
DESIG=16

**Radiative decays**

$\gamma D^+D^-$	< 4 %	90%	502
$\gamma \bar{D}^0D^0$	< 6 %	90%	519
$\gamma J/\psi$	( 8 $\pm$ 4 ) $\times 10^{-3}$		697
$\gamma\chi_{c1}$	< 9 $\times 10^{-3}$	90%	344
$\gamma\chi_{c2}$	< 3.2 %	90%	303
$\gamma\psi(2S)$	( 4.5 $\pm$ 2.0 ) %		181

NODE=M176;CLUMP=B  
DESIG=21  
DESIG=23  
DESIG=9  
DESIG=3  
DESIG=15  
DESIG=11

**C-violating decays** $\eta J/\psi$  < 1.8 % 90% 491NODE=M176;CLUMP=A  
DESIG=4 **$\chi_{c0}(3915)$** 

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M159

was X(3915)

Mass  $m = 3921.7 \pm 1.8$  MeV (S = 1.5)Full width  $\Gamma = 18.8 \pm 3.5$  MeVNODE=M159M;DTYPE=M  
NODE=M159W;DTYPE=G

$\chi_{c0}(3915)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\omega J/\psi$	seen	231
$\bar{D}^{*0} D^0$	not seen	312
$D^+ D^-$	seen	591
$\pi^+ \pi^- \eta_c(1S)$	not seen	788
$\eta_c \eta$	not seen	668
$\eta_c \pi^0$	not seen	817
$K \bar{K}$	not seen	1898
$\gamma \gamma$	seen	1961
$\pi^0 \chi_{c1}$	not seen	368

NODE=M159215;DESIG=1;OUR EST;  
→ UNCHECKED ←  
DESIG=3;OUR EVAL;→ UNCHECKED ←  
DESIG=9  
DESIG=4;OUR EVAL;→ UNCHECKED ←  
DESIG=6  
DESIG=7  
DESIG=5;OUR EVAL;→ UNCHECKED ←  
DESIG=2  
DESIG=8 **$\chi_{c2}(3930)$** 

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M050

Mass  $m = 3922.5 \pm 1.0$  MeV (S = 1.7)Full width  $\Gamma = 35.2 \pm 2.2$  MeV (S = 1.2)NODE=M050M;DTYPE=M  
NODE=M050W;DTYPE=G

$\chi_{c2}(3930)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\gamma \gamma$	seen	1961
$D \bar{D}$	seen	607
$D^+ D^-$	seen	592
$D^0 \bar{D}^0$	seen	607
$\pi^+ \pi^- \eta_c(1S)$	not seen	788
$K \bar{K}$	not seen	1898

NODE=M050215;DESIG=1;OUR EVAL;  
→ UNCHECKED ←  
DESIG=2;OUR EVAL;→ UNCHECKED ←  
DESIG=3;OUR EVAL;→ UNCHECKED ←  
DESIG=4;OUR EVAL;→ UNCHECKED ←  
DESIG=7;OUR EVAL;→ UNCHECKED ←  
DESIG=8;OUR EVAL;→ UNCHECKED ← **$\psi(4040)$  [q]**

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M072

Mass  $m = 4039 \pm 1$  MeVFull width  $\Gamma = 80 \pm 10$  MeVNODE=M072M;DTYPE=M;OUR EST;  
→ UNCHECKED ←  
NODE=M072W;DTYPE=G;OUR EST;  
→ UNCHECKED ←

Due to the complexity of the  $c\bar{c}$  threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective  $\sqrt{s}$  near this particle’s central mass value, more (less) than  $2\sigma$  above zero, without regard to any peaking behavior in  $\sqrt{s}$  or absence thereof. See mode listing(s) for details and references.

NODE=M072215;NODE=M072

$\psi(4040)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$e^+e^-$	$(1.07 \pm 0.16) \times 10^{-5}$		2019	DESIG=5
$D\bar{D}$	seen		775	DESIG=17;OUR EST;→ UNCHECKED ←
$D^0\bar{D}^0$	seen		775	DESIG=1
$D^+D^-$	seen		763	DESIG=18
$D^*\bar{D} + c.c.$	seen		569	DESIG=19;OUR EST;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^0 + c.c.$	seen		575	DESIG=2
$D^*(2010)^+D^- + c.c.$	seen		561	DESIG=20
$D^*\bar{D}^*$	seen		193	DESIG=21;OUR EST;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^*(2007)^0$	seen		226	DESIG=3
$D^*(2010)^+D^*(2010)^-$	seen		193	DESIG=22
$D^0D^-\pi^+ + c.c. (excl. D^*(2007)^0\bar{D}^0 + c.c., D^*(2010)^+D^- + c.c.)$	not seen		–	DESIG=24
$D\bar{D}^*\pi (excl. D^*\bar{D}^*)$	not seen		–	DESIG=25
$D^0\bar{D}^{*-}\pi^+ + c.c. (excl. D^*(2010)^+D^*(2010)^-)$	seen		–	DESIG=26
$D_s^+D_s^-$	seen		452	DESIG=27
$J/\psi\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%	794	DESIG=7
$J/\psi\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%	797	DESIG=8
$J/\psi\eta$	$(5.2 \pm 0.7) \times 10^{-3}$		675	DESIG=9
$J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	90%	823	DESIG=10
$J/\psi\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%	746	DESIG=11
$\chi_{c1}\gamma$	$< 3.4 \times 10^{-3}$	90%	494	DESIG=12
$\chi_{c2}\gamma$	$< 5 \times 10^{-3}$	90%	454	DESIG=13
$\chi_{c1}\pi^+\pi^-\pi^0$	$< 1.1 \%$	90%	306	DESIG=14
$\chi_{c2}\pi^+\pi^-\pi^0$	$< 3.2 \%$	90%	233	DESIG=15
$h_c(1P)\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	403	DESIG=28
$\phi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	1880	DESIG=16
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 2.9 \times 10^{-4}$	90%	1578	DESIG=29
$\Lambda\bar{\Lambda}\pi^0$	$< 9 \times 10^{-5}$	90%	1636	DESIG=30
$\Lambda\bar{\Lambda}\eta$	$< 3.0 \times 10^{-4}$	90%	1452	DESIG=31
$\Lambda\bar{\Lambda}$	$< 6 \times 10^{-6}$	90%	1683	DESIG=36
$\Sigma^+\bar{\Sigma}^-$	$< 1.3 \times 10^{-4}$	90%	1632	DESIG=32
$\Sigma^0\bar{\Sigma}^0$	$< 7 \times 10^{-5}$	90%	1630	DESIG=33
$\Xi^+\bar{\Xi}^-$	$< 1.6 \times 10^{-4}$	90%	1527	DESIG=34
$\Xi^0\bar{\Xi}^0$	$< 1.8 \times 10^{-4}$	90%	1533	DESIG=35
$\mu^+\mu^-$	$(9 \pm 6) \times 10^{-6}$		2017	DESIG=6

 **$\chi_{c1}(4140)$** 

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M193

was X(4140)

$$\text{Mass } m = 4146.5 \pm 3.0 \text{ MeV} \quad (S = 1.3)$$

$$\text{Full width } \Gamma = 19^{+7}_{-5} \text{ MeV}$$

NODE=M193M;DTYPE=M

NODE=M193W;DTYPE=G

 **$\chi_{c1}(4140)$  DECAY MODES**

	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$J/\psi\phi$	seen	216
$\gamma\gamma$	not seen	2073

NODE=M193215;DESIG=1

DESIG=2

 **$\psi(4160)$  [q]**

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M025

$$\text{Mass } m = 4191 \pm 5 \text{ MeV}$$

$$\text{Full width } \Gamma = 70 \pm 10 \text{ MeV}$$

NODE=M025M;DTYPE=M

NODE=M025W;DTYPE=G

Due to the complexity of the  $c\bar{c}$  threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective  $\sqrt{s}$  near this particle’s central mass value, more (less) than  $2\sigma$  above zero, without regard to any peaking behavior in  $\sqrt{s}$  or absence thereof. See mode listing(s) for details and references.

NODE=M025215;NODE=M025

$\psi(4160)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$e^+ e^-$	$(6.9 \pm 3.3) \times 10^{-6}$		2096	DESIG=1
$\mu^+ \mu^-$	seen		2093	DESIG=33
$D\bar{D}$	seen		956	DESIG=15;OUR EVAL;→ UNCHECKED ←
$D^0\bar{D}^0$	seen		956	DESIG=16
$D^+D^-$	seen		947	DESIG=17
$D^*\bar{D}^+ + c.c.$	seen		798	DESIG=18;OUR EVAL;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^0 + c.c.$	seen		802	DESIG=19
$D^*(2010)^+D^- + c.c.$	seen		792	DESIG=20
$D^*\bar{D}^*$	seen		592	DESIG=21;OUR EVAL;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^*(2007)^0$	seen		604	DESIG=22
$D^*(2010)^+D^*(2010)^-$	seen		592	DESIG=23
$D^0D^-\pi^+ + c.c. (excl. D^*(2007)^0\bar{D}^0 + c.c., D^*(2010)^+D^- + c.c.)$	not seen		–	DESIG=24
$D\bar{D}^*\pi + c.c. (excl. D^*\bar{D}^*)$	seen		–	DESIG=25
$D^0D^{*-}\pi^+ + c.c. (excl. D^*(2010)^+D^*(2010)^-)$	not seen		–	DESIG=26
$D_s^+D_s^-$	not seen		719	DESIG=27
$D_s^{*+}D_s^- + c.c.$	seen		385	DESIG=28
$J/\psi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	919	DESIG=2
$J/\psi\pi^0\pi^0$	$< 3 \times 10^{-3}$	90%	922	DESIG=3
$J/\psi K^+K^-$	$< 2 \times 10^{-3}$	90%	407	DESIG=4
$J/\psi\eta$	$< 8 \times 10^{-3}$	90%	822	DESIG=5
$J/\psi\pi^0$	$< 1 \times 10^{-3}$	90%	944	DESIG=6
$J/\psi\eta'$	$< 5 \times 10^{-3}$	90%	457	DESIG=7
$J/\psi\pi^+\pi^-\pi^0$	$< 1 \times 10^{-3}$	90%	879	DESIG=8
$\psi(2S)\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%	396	DESIG=9
$\chi_{c1}\gamma$	$< 5 \times 10^{-3}$	90%	625	DESIG=10
$\chi_{c2}\gamma$	$< 1.3 \%$	90%	587	DESIG=11
$\chi_{c1}\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%	496	DESIG=12
$\chi_{c2}\pi^+\pi^-\pi^0$	$< 8 \times 10^{-3}$	90%	445	DESIG=13
$h_c(1P)\pi^+\pi^-$	$< 5 \times 10^{-3}$	90%	556	DESIG=29
$h_c(1P)\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%	560	DESIG=30
$h_c(1P)\eta$	$< 2 \times 10^{-3}$	90%	348	DESIG=31
$h_c(1P)\pi^0$	$< 4 \times 10^{-4}$	90%	600	DESIG=32
$\phi\pi^+\pi^-$	$< 2 \times 10^{-3}$	90%	1961	DESIG=14
$\gamma\chi_{c1}(3872)$	$< 1.8 \times 10^{-3}$	90%	308	DESIG=44
$\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.36 \times 10^{-4}$	90%	–	DESIG=35
$\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.18 \times 10^{-4}$	90%	–	DESIG=36
$\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.47 \times 10^{-4}$	90%	–	DESIG=37
$\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi$	$< 1.26 \times 10^{-4}$	90%	–	DESIG=39
$\gamma X(3930) \rightarrow \gamma\gamma J/\psi$	$< 8.8 \times 10^{-5}$	90%	–	DESIG=40
$\gamma X(3940) \rightarrow \gamma\gamma J/\psi$	$< 1.79 \times 10^{-4}$	90%	–	DESIG=41
$\omega\pi^0$	not seen		2020	DESIG=47
$\omega\eta$	not seen		1984	DESIG=48
$p\bar{p}p\bar{p}$	not seen		834	DESIG=45
$\Lambda\bar{\Lambda}$	$< 1.5 \times 10^{-6}$	90%	1774	DESIG=46

 **$\psi(4230)$** 

$$J^G(J^{PC}) = 0^-(1^{--})$$

NODE=M074

also known as  $Y(4230)$ ; was  $\psi(4260)$ 

$$\text{Mass } m = 4222.5 \pm 2.4 \text{ MeV } (S = 1.7)$$

$$\text{Full width } \Gamma = 48 \pm 8 \text{ MeV } (S = 3.6)$$

NODE=M074M;DTYPE=M  
NODE=M074W;DTYPE=G

$\psi(4230)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\mu^+\mu^-$	$(3.2\pm 2.9) \times 10^{-5}$	2107	NODE=M074215;DESIG=63
$\eta_c(1S)\pi^+\pi^-$	not seen	1027	DESIG=65
$\eta_c(1S)\pi^+\pi^-\pi^0$	seen	992	DESIG=64
$J/\psi\pi^+\pi^-$	seen	942	DESIG=2
$J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	seen	-	DESIG=41;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$Z_c(3900)^\pm\pi^\mp, Z_c^\pm \rightarrow J/\psi\pi^\pm$	seen	-	DESIG=43;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$J/\psi\pi^0\pi^0$	seen	944	DESIG=4
$J/\psi K^+K^-$	seen	460	DESIG=5;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$J/\psi K_S^0 K_S^0$	not seen	447	DESIG=44
$J/\psi\eta$	seen	848	DESIG=6
$J/\psi\pi^0$	not seen	966	DESIG=7;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$J/\psi\eta'$	seen	504	DESIG=8;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$J/\psi\pi^+\pi^-\pi^0$	not seen	904	DESIG=9;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$J/\psi\eta\pi^0$	not seen	770	DESIG=45
$J/\psi\eta\eta$	not seen	211	DESIG=10;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\psi(2S)\pi^+\pi^-$	seen	426	DESIG=11
$\psi(2S)\eta$	not seen	†	DESIG=12;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\chi_{c0}\omega$	seen	171	DESIG=13
$\chi_{c1}\pi^+\pi^-\pi^0$	not seen	527	DESIG=16;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\chi_{c2}\pi^+\pi^-\pi^0$	not seen	477	DESIG=17;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$h_c(1P)\pi^+\pi^-$	seen	583	DESIG=40
$\phi\pi^+\pi^-$	not seen	1976	DESIG=18;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$	not seen	-	DESIG=22;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$D\bar{D}$	not seen	987	DESIG=19;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$D^0\bar{D}^0$	not seen	987	DESIG=31
$D^+D^-$	not seen	978	DESIG=32
$D^*\bar{D}+c.c.$	not seen	887	DESIG=23;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$D^*(2007)^0\bar{D}^0+c.c.$	not seen	-	DESIG=33
$D^*(2010)^+D^-+c.c.$	not seen	-	DESIG=34
$D^*(2007)^0\bar{D}^*(2007)^0$	not seen	652	DESIG=35
$D^*(2010)^+D^*(2010)^-$	not seen	641	DESIG=36
$D^0D^-\pi^++c.c. (excl. D^*(2007)^0\bar{D}^{*0}+c.c., D^*(2010)^+D^-+c.c.)$	not seen	-	DESIG=38
$D\bar{D}^*\pi+c.c. (excl. D^*\bar{D}^*)$	not seen	723	DESIG=25
$D^0D^{*-}\pi^++c.c. (excl. D^*(2010)^+D^*(2010)^-)$	not seen	-	DESIG=39
$D^0D^*(2010)^-\pi^++c.c.$	seen	716	DESIG=30
$D_1(2420)\bar{D}+c.c.$	not seen	†	DESIG=50
$D^*\bar{D}^*\pi$	not seen	367	DESIG=26
$D^+D^-$	not seen	760	DESIG=27
$D_s^{*+}\bar{D}_s^-+c.c.$	not seen	615	DESIG=28
$D_s^{*+}\bar{D}_s^{*-}$	not seen	†	DESIG=29
$p\bar{p}$	not seen	1890	DESIG=3;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$p\bar{p}\pi^0$	not seen	1854	DESIG=46;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$p\bar{p}\eta$	not seen	1712	DESIG=61
$p\bar{p}\omega$	not seen	1610	DESIG=62
$\Xi^-\bar{\Xi}^+$	not seen	1645	DESIG=51;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\pi^+\pi^+\pi^-\pi^-$	not seen	2087	DESIG=53;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\pi^+\pi^+\pi^-\pi^-\pi^0$	not seen	2071	DESIG=54;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$\omega\pi^0$	not seen	2035	DESIG=68
$\omega\eta$	not seen	1999	DESIG=69
$K_S^0 K^\pm\pi^\mp$	not seen	2032	DESIG=20;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K_S^0 K^\pm\pi^\mp\pi^0$	not seen	2009	DESIG=48;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K_S^0 K^\pm\pi^\mp\eta$	not seen	1917	DESIG=49;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K^+K^-\pi^0$	not seen	2033	DESIG=21;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K^+K^-\pi^+\pi^-$	not seen	2008	DESIG=55;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K^+K^-\pi^+\pi^-\pi^0$	not seen	1981	DESIG=56;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K^+K^+K^-K^-$	not seen	1813	DESIG=57;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$K^+K^+K^-K^-\pi^0$	not seen	1762	DESIG=58;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$p\bar{p}\pi^+\pi^-$	not seen	1810	DESIG=59;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$p\bar{p}\pi^+\pi^-\pi^0$	not seen	1764	DESIG=60;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
$p\bar{p}p\bar{p}$	not seen	864	DESIG=67
$\Lambda\Lambda$	not seen	1791	DESIG=52;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

**Radiative decays**

$\eta_c(1S)\gamma$	possibly seen	1055
$\eta_c(1S)\pi^0\gamma$	not seen	1049
$\chi_{c1}\gamma$	not seen	650
$\chi_{c2}\gamma$	not seen	612
$\chi_{c1}(3872)\gamma$	seen	334

NODE=M074;CLUMP=C  
 DESIG=47  
 DESIG=66  
 DESIG=14;OUR EVAL;→ UNCHECKED ←  
 DESIG=15;OUR EVAL;→ UNCHECKED ←  
 DESIG=42

 **$\chi_{c1}(4274)$** 

$$I^G(J^{PC}) = 0^+(1^{++})$$

was X(4274)

Mass  $m = 4286^{+8}_{-9}$  MeV (S = 1.7)  
 Full width  $\Gamma = 51 \pm 7$  MeV

NODE=M233

NODE=M233M;DTYPE=M  
 NODE=M233W;DTYPE=G

<b><math>\chi_{c1}(4274)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$J/\psi\phi$	seen	522

NODE=M233215;DESIG=1

 **$\psi(4360)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as Y(4360); was X(4360)

$\psi(4360)$  MASS =  $4374 \pm 7$  MeV (S = 2.4)  
 $\psi(4360)$  WIDTH =  $118 \pm 12$  MeV (S = 2.1)

NODE=M181

NODE=M181M;DTYPE=M  
 NODE=M181W;DTYPE=G

<b><math>\psi(4360)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$h_c\pi^+\pi^-$	seen	723
$\psi(2S)\pi^+\pi^-$	seen	579
$\psi(3770)\pi^+\pi^-$	possibly seen	495
$\psi_2(3823)\pi^+\pi^-$	seen	444
$J/\psi\eta$	seen	983
$D^+D^-\pi^+\pi^-$	seen	862
$D_1(2420)\bar{D} + \text{c.c.}$	possibly seen	431
$\omega\pi^0$	not seen	2115
$\omega\eta$	not seen	2080
$p\bar{p}\eta$	not seen	1806
$p\bar{p}\omega$	not seen	1708

NODE=M181215;DESIG=12

DESIG=2

DESIG=11

DESIG=5

DESIG=4

DESIG=17

DESIG=10

DESIG=15

DESIG=16

DESIG=13

DESIG=14

 **$\psi(4415)$  [q]**

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 4421 \pm 4$  MeV  
 Full width  $\Gamma = 62 \pm 20$  MeV

NODE=M073

NODE=M073M;DTYPE=M;OUR EST;  
 → UNCHECKED ←  
 NODE=M073W;DTYPE=G;OUR EST;  
 → UNCHECKED ←

Due to the complexity of the  $c\bar{c}$  threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective  $\sqrt{s}$  near this particle's central mass value, more (less) than  $2\sigma$  above zero, without regard to any peaking behavior in  $\sqrt{s}$  or absence thereof. See mode listing(s) for details and references.

NODE=M073215;NODE=M073

$\psi(4415)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$D\bar{D}$	seen		1187	DESIG=7;OUR EVAL;→ UNCHECKED ←
$D^0\bar{D}^0$	seen		1187	DESIG=8
$D^+D^-$	seen		1179	DESIG=9
$D^*\bar{D} + c.c.$	seen		1063	DESIG=10;OUR EVAL;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^0 + c.c.$	seen		1067	DESIG=11
$D^*(2010)^+D^- + c.c.$	seen		1059	DESIG=12
$D^*\bar{D}^*$	seen		919	DESIG=13;OUR EVAL;→ UNCHECKED ←
$D^*(2007)^0\bar{D}^*(2007)^0 + c.c.$	seen		927	DESIG=14
$D^*(2010)^+D^*(2010)^- + c.c.$	seen		919	DESIG=15
$D^0D^-\pi^+$ (excl. $D^*(2007)^0\bar{D}^0$ +c.c., $D^*(2010)^+D^- + c.c.$ )	< 2.3 %	90%	–	DESIG=4
$D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + c.c.$	(10 ± 4) %		–	DESIG=5
$D^0\bar{D}^{*-}\pi^+ + c.c.$	< 11 %	90%	926	DESIG=6
$D_1(2420)\bar{D} + c.c.$	possibly seen		537	DESIG=25
$D_s^+D_s^-$	not seen		1006	DESIG=16
$\omega\chi_{c2}$	possibly seen		330	DESIG=20
$D_s^{*+}D_s^- + c.c.$	seen		–	DESIG=17
$D_s^{*+}D_s^{*-}$	not seen		652	DESIG=18
$\psi_2(3823)\pi^+\pi^-$	possibly seen		492	DESIG=21
$\psi(3770)\pi^+\pi^-$	possibly seen		541	DESIG=24
$J/\psi\eta$	< 6 × 10 <sup>-3</sup>	90%	1022	DESIG=19
$\chi_{c1}\gamma$	< 8 × 10 <sup>-4</sup>	90%	817	DESIG=22
$\chi_{c2}\gamma$	< 4 × 10 <sup>-3</sup>	90%	780	DESIG=23
$\Lambda\bar{\Lambda}$	< 3.1 × 10 <sup>-6</sup>	90%	1908	DESIG=27
$\omega\pi^0$	not seen		2139	DESIG=28
$\omega\eta$	not seen		2105	DESIG=29
$e^+e^-$	(9.4 ± 3.2) × 10 <sup>-6</sup>		2210	DESIG=1
$\mu^+\mu^-$	(2.0 ± 1.0) × 10 <sup>-5</sup>		2208	DESIG=26

 **$\psi(4660)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M189

also known as Y(4660); was X(4660)

$$\psi(4660) \text{ MASS} = 4630 \pm 6 \text{ MeV} \quad (S = 1.4)$$

$$\psi(4660) \text{ WIDTH} = 72_{-12}^{+14} \text{ MeV} \quad (S = 1.7)$$

NODE=M189M;DTYPE=M

NODE=M189W;DTYPE=G

$\psi(4660)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$e^+e^-$	not seen	2315	NODE=M189215;DESIG=1;OUR EVAL; → UNCHECKED ←
$\psi(2S)\pi^+\pi^-$	seen	809	DESIG=2;OUR EVAL;→ UNCHECKED ←
$J/\psi\eta$	not seen	1192	DESIG=4;OUR EVAL;→ UNCHECKED ←
$D^0D^{*-}\pi^+$	not seen	1153	DESIG=3;OUR EVAL;→ UNCHECKED ←
$\psi_2(3823)\pi^+\pi^-$	seen	691	DESIG=10
$\chi_{c1}\gamma$	not seen	984	DESIG=6;OUR EVAL;→ UNCHECKED ←
$\chi_{c2}\gamma$	not seen	949	DESIG=7;OUR EVAL;→ UNCHECKED ←
$\Lambda_c^+\Lambda_c^-$	seen	363	DESIG=5;OUR EVAL;→ UNCHECKED ←
$D_s^+D_{s1}(2536)^-$	seen	534	DESIG=8;OUR EVAL;→ UNCHECKED ←
$\omega\pi^0$	not seen	2247	DESIG=11
$\omega\eta$	not seen	2215	DESIG=12

# $b\bar{b}$ MESONS (including possibly non- $q\bar{q}$ states)

NODE=MXXX030

 **$\eta_b(1S)$** 

$$I^G(J^{PC}) = 0^+(0^-+)$$

Mass  $m = 9398.7 \pm 2.0$  MeV (S = 1.5)Full width  $\Gamma = 10^{+5}_{-4}$  MeV

NODE=M171

NODE=M171M;DTYPE=M

NODE=M171W;DTYPE=G

$\eta_b(1S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
hadrons	seen		—
$3h^+3h^-$	not seen		4672
$2h^+2h^-$	not seen		4689
$4h^+4h^-$	not seen		4648
$\gamma\gamma$	not seen		4699
$\mu^+\mu^-$	$<9 \times 10^{-3}$	90%	4698
$\tau^+\tau^-$	$<8\%$	90%	4350

NODE=M171225;DESIG=7

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=5

DESIG=6

 **$\Upsilon(1S)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 9460.40 \pm 0.10$  MeVFull width  $\Gamma = 54.02 \pm 1.25$  keV

NODE=M049

NODE=M049M;DTYPE=M

NODE=M049W;DTYPE=G;OUR EVAL;  
→ UNCHECKED ←

$\Upsilon(1S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$\tau^+\tau^-$	( 2.60 ± 0.10 ) %		4384
$e^+e^-$	( 2.39 ± 0.08 ) %		4730
$\mu^+\mu^-$	( 2.48 ± 0.04 ) %		4729

NODE=M049215;DESIG=3

DESIG=2

DESIG=1

**Hadronic decays**

$ggg$	(81.7 ± 0.7 ) %		—	NODE=M049;CLUMP=A
$\gamma gg$	( 2.2 ± 0.6 ) %		—	DESIG=117
$\eta'(958)$ anything	( 2.94 ± 0.24 ) %		—	DESIG=118
$J/\psi(1S)$ anything	( 5.4 ± 0.4 ) × 10 <sup>-4</sup>	S=1.4	4223	DESIG=73
$J/\psi(1S)\eta_c$	< 2.2	× 10 <sup>-6</sup> CL=90%	3623	DESIG=12
$J/\psi(1S)\chi_{c0}$	< 3.4	× 10 <sup>-6</sup> CL=90%	3429	DESIG=146
$J/\psi(1S)\chi_{c1}$	( 3.9 ± 1.2 ) × 10 <sup>-6</sup>		3382	DESIG=147
$J/\psi(1S)\chi_{c2}$	< 1.4	× 10 <sup>-6</sup> CL=90%	3359	DESIG=148
$J/\psi(1S)\eta_c(2S)$	< 2.2	× 10 <sup>-6</sup> CL=90%	3317	DESIG=149
$J/\psi(1S)X(3940)$	< 5.4	× 10 <sup>-6</sup> CL=90%	3148	DESIG=150
$J/\psi(1S)X(4160)$	< 5.4	× 10 <sup>-6</sup> CL=90%	3020	DESIG=151
$X(4350)$ anything, $X \rightarrow$	< 8.1	× 10 <sup>-6</sup> CL=90%	—	DESIG=152
$J/\psi(1S)\phi$				DESIG=167
$Z_c(3900)^\pm$ anything, $Z_c \rightarrow$	< 1.3	× 10 <sup>-5</sup> CL=90%	—	DESIG=168
$J/\psi(1S)\pi^\pm$				
$Z_c(4200)^\pm$ anything, $Z_c \rightarrow$	< 6.0	× 10 <sup>-5</sup> CL=90%	—	DESIG=169
$J/\psi(1S)\pi^\pm$				
$Z_c(4430)^\pm$ anything, $Z_c \rightarrow$	< 4.9	× 10 <sup>-5</sup> CL=90%	—	DESIG=170
$J/\psi(1S)\pi^\pm$				
$X_{cs}^\pm$ anything, $X \rightarrow$	< 5.7	× 10 <sup>-6</sup> CL=90%	—	DESIG=173
$J/\psi K^\pm$				
$\psi(4230)$ anything, $\psi \rightarrow$	< 3.8	× 10 <sup>-5</sup> CL=90%	—	DESIG=161
$J/\psi(1S)\pi^+\pi^-$				
$\psi(4230)$ anything, $\psi \rightarrow$	< 7.5	× 10 <sup>-6</sup> CL=90%	—	DESIG=165
$J/\psi(1S)K^+K^-$				
$\chi_{c1}(4140)$ anything, $\chi_{c1} \rightarrow$	< 5.2	× 10 <sup>-6</sup> CL=90%	—	DESIG=166
$J/\psi(1S)\phi$				
$\chi_{c0}$ anything	< 4	× 10 <sup>-3</sup> CL=90%	—	DESIG=5



$\chi_{c1}$ anything	$( 1.90 \pm 0.35 ) \times 10^{-4}$	—	DESIG=6
$\chi_{c1}(1P)X_{tetra}$	$< 3.78 \times 10^{-5}$	CL=90%	DESIG=175
$\chi_{c2}$ anything	$( 2.8 \pm 0.8 ) \times 10^{-4}$	—	DESIG=7
$\psi(2S)$ anything	$( 1.23 \pm 0.20 ) \times 10^{-4}$	—	DESIG=8
$\psi(2S)\eta_c$	$< 3.6 \times 10^{-6}$	CL=90%	3345 DESIG=153
$\psi(2S)\chi_{c0}$	$< 6.5 \times 10^{-6}$	CL=90%	3124 DESIG=154
$\psi(2S)\chi_{c1}$	$< 4.5 \times 10^{-6}$	CL=90%	3070 DESIG=155
$\psi(2S)\chi_{c2}$	$< 2.1 \times 10^{-6}$	CL=90%	3043 DESIG=156
$\psi(2S)\eta_c(2S)$	$< 3.2 \times 10^{-6}$	CL=90%	2994 DESIG=157
$\psi(2S)X(3940)$	$< 2.9 \times 10^{-6}$	CL=90%	2797 DESIG=158
$\psi(2S)X(4160)$	$< 2.9 \times 10^{-6}$	CL=90%	2645 DESIG=159
$\psi(4230)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	$< 7.9 \times 10^{-5}$	CL=90%	— DESIG=162
$\psi(4360)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	$< 5.2 \times 10^{-5}$	CL=90%	— DESIG=163
$\psi(4660)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	$< 2.2 \times 10^{-5}$	CL=90%	— DESIG=164
$X(4050)^\pm$ anything, $X \rightarrow$ $\psi(2S)\pi^\pm$	$< 8.8 \times 10^{-5}$	CL=90%	— DESIG=171
$Z_c(4430)^\pm$ anything, $Z_c \rightarrow$ $\psi(2S)\pi^\pm$	$< 6.7 \times 10^{-5}$	CL=90%	— DESIG=172
$\chi_{c1}(3872)$ anything	$< 2.5 \times 10^{-4}$	CL=90%	— DESIG=194
$Z_c(4200)^+ Z_c(4200)^-$	$< 2.23 \times 10^{-5}$	CL=90%	— DESIG=178
$Z_c(3900)^\pm Z_c(4200)^\mp$	$< 8.1 \times 10^{-6}$	CL=90%	— DESIG=179
$Z_c(3900)^+ Z_c(3900)^-$	$< 1.8 \times 10^{-6}$	CL=90%	— DESIG=180
$X(4050)^+ X(4050)^-$	$< 1.58 \times 10^{-5}$	CL=90%	— DESIG=181
$X(4250)^+ X(4250)^-$	$< 2.66 \times 10^{-5}$	CL=90%	— DESIG=182
$X(4050)^\pm X(4250)^\mp$	$< 4.42 \times 10^{-5}$	CL=90%	— DESIG=183
$Z_c(4430)^+ Z_c(4430)^-$	$< 2.03 \times 10^{-5}$	CL=90%	— DESIG=184
$X(4055)^\pm X(4055)^\mp$	$< 2.33 \times 10^{-5}$	CL=90%	— DESIG=186
$X(4055)^\pm Z_c(4430)^\mp$	$< 4.55 \times 10^{-5}$	CL=90%	— DESIG=189
$\rho\pi$	$< 3.68 \times 10^{-6}$	CL=90%	4697 DESIG=11
$\omega\pi^0$	$< 3.90 \times 10^{-6}$	CL=90%	4697 DESIG=131
$\pi^+\pi^-$	$< 5 \times 10^{-4}$	CL=90%	4728 DESIG=23
$K^+K^-$	$< 5 \times 10^{-4}$	CL=90%	4704 DESIG=24
$p\bar{p}$	$< 5 \times 10^{-4}$	CL=90%	4636 DESIG=25
$\pi^+\pi^-\pi^0$	$( 2.1 \pm 0.8 ) \times 10^{-6}$		4725 DESIG=72
$\phi K^+K^-$	$( 2.4 \pm 0.5 ) \times 10^{-6}$		4623 DESIG=136
$\omega\pi^+\pi^-$	$( 4.5 \pm 1.0 ) \times 10^{-6}$		4694 DESIG=137
$K^*(892)^0 K^-\pi^+ + c.c.$	$( 4.4 \pm 0.8 ) \times 10^{-6}$		4667 DESIG=138
$\phi f_2'(1525)$	$< 1.63 \times 10^{-6}$	CL=90%	4551 DESIG=139
$\omega f_2(1270)$	$< 1.79 \times 10^{-6}$	CL=90%	4611 DESIG=140
$\rho(770) a_2(1320)$	$< 2.24 \times 10^{-6}$	CL=90%	4605 DESIG=141
$K^*(892)^0 \bar{K}_2^*(1430)^0 + c.c.$	$( 3.0 \pm 0.8 ) \times 10^{-6}$		4579 DESIG=142
$K_1(1270)^\pm K^\mp$	$< 2.41 \times 10^{-6}$	CL=90%	4634 DESIG=143
$K_1(1400)^\pm K^\mp$	$( 1.0 \pm 0.4 ) \times 10^{-6}$		4613 DESIG=144
$b_1(1235)^\pm \pi^\mp$	$< 1.25 \times 10^{-6}$	CL=90%	4649 DESIG=145
$\pi^+\pi^-\pi^0\pi^0$	$( 1.28 \pm 0.30 ) \times 10^{-5}$		4720 DESIG=132
$K_S^0 K^+\pi^- + c.c.$	$( 1.6 \pm 0.4 ) \times 10^{-6}$		4696 DESIG=133
$K^*(892)^0 \bar{K}^0 + c.c.$	$( 2.9 \pm 0.9 ) \times 10^{-6}$		4675 DESIG=134
$K^*(892)^- K^+ + c.c.$	$< 1.11 \times 10^{-6}$	CL=90%	4675 DESIG=135
$f_1(1285)$ anything	$( 4.6 \pm 3.1 ) \times 10^{-3}$		— DESIG=174
$D^*(2010)^\pm$ anything	$( 2.52 \pm 0.20 ) \%$		— DESIG=30
$f_1(1285)X_{tetra}$	$< 6.24 \times 10^{-5}$	CL=90%	— DESIG=176
${}^2H$ anything	$( 2.85 \pm 0.25 ) \times 10^{-5}$		— DESIG=107
Sum of 100 exclusive modes	$( 1.200 \pm 0.017 ) \%$		— DESIG=128

## Radiative decays

					NODE=M049;CLUMP=B
$\gamma\pi^+\pi^-$	( 6.3 ± 1.8 )	$\times 10^{-5}$	4728	DESIG=70	
$\gamma\pi^0\pi^0$	( 1.7 ± 0.7 )	$\times 10^{-5}$	4728	DESIG=71	
$\gamma\pi\pi$ (S-wave)	( 4.6 ± 0.7 )	$\times 10^{-5}$	4728	DESIG=190	
$\gamma\pi^0\eta$	< 2.4	$\times 10^{-6}$	CL=90%	4713	DESIG=111
$\gamma K^+K^-$	[r] ( 1.14 ± 0.13 )	$\times 10^{-5}$	4704	DESIG=102	
$\gamma p\bar{p}$	[s] < 6	$\times 10^{-6}$	CL=90%	4636	DESIG=103
$\gamma 2h^+2h^-$	( 7.0 ± 1.5 )	$\times 10^{-4}$	4720	DESIG=20	
$\gamma 3h^+3h^-$	( 5.4 ± 2.0 )	$\times 10^{-4}$	4703	DESIG=21	
$\gamma 4h^+4h^-$	( 7.4 ± 3.5 )	$\times 10^{-4}$	4679	DESIG=22	
$\gamma\pi^+\pi^-K^+K^-$	( 2.9 ± 0.9 )	$\times 10^{-4}$	4686	DESIG=14	
$\gamma 2\pi^+2\pi^-$	( 2.5 ± 0.9 )	$\times 10^{-4}$	4720	DESIG=13	
$\gamma 3\pi^+3\pi^-$	( 2.5 ± 1.2 )	$\times 10^{-4}$	4703	DESIG=17	
$\gamma 2\pi^+2\pi^-K^+K^-$	( 2.4 ± 1.2 )	$\times 10^{-4}$	4659	DESIG=18	
$\gamma\pi^+\pi^-p\bar{p}$	( 1.5 ± 0.6 )	$\times 10^{-4}$	4604	DESIG=15	
$\gamma 2\pi^+2\pi^-p\bar{p}$	( 4 ± 6 )	$\times 10^{-5}$	4563	DESIG=19	
$\gamma 2K^+2K^-$	( 2.0 ± 2.0 )	$\times 10^{-5}$	4601	DESIG=16	
$\gamma\eta'$ (958)	< 1.9	$\times 10^{-6}$	CL=90%	4682	DESIG=55
$\gamma\eta$	< 1.0	$\times 10^{-6}$	CL=90%	4714	DESIG=54
$\gamma f_0$ (980)	< 3	$\times 10^{-5}$	CL=90%	4678	DESIG=105
$\gamma f_2'$ (1525)	( 2.9 ± 0.6 )	$\times 10^{-5}$	4609	DESIG=52	
$\gamma f_2$ (1270)	( 1.01 ± 0.06 )	$\times 10^{-4}$	4644	DESIG=51	
$\gamma\eta$ (1405)	< 8.2	$\times 10^{-5}$	CL=90%	4625	DESIG=65
$\gamma f_0$ (1500)	< 1.5	$\times 10^{-5}$	CL=90%	4608	DESIG=108
$\gamma f_0(1500) \rightarrow \gamma K^+K^-$	( 1.0 ± 0.4 )	$\times 10^{-5}$	-	DESIG=192	
$\gamma f_0(1710)$	< 2.6	$\times 10^{-4}$	CL=90%	4571	DESIG=53
$\gamma f_0(1710) \rightarrow \gamma K^+K^-$	( 1.01 ± 0.32 )	$\times 10^{-5}$	-	DESIG=112	
$\gamma f_0(1710) \rightarrow \gamma\pi^+\pi^-$	( 5.3 ± 2.0 )	$\times 10^{-6}$	-	DESIG=191	
$\gamma f_0(1710) \rightarrow \gamma\pi^0\pi^0$	< 1.4	$\times 10^{-6}$	CL=90%	-	DESIG=109
$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	< 1.8	$\times 10^{-6}$	CL=90%	-	DESIG=110
$\gamma f_4$ (2050)	< 5.3	$\times 10^{-5}$	CL=90%	4515	DESIG=104
$\gamma f_0(2200) \rightarrow \gamma K^+K^-$	< 2	$\times 10^{-4}$	CL=90%	4475	DESIG=69
$\gamma f_J(2220) \rightarrow \gamma K^+K^-$	< 8	$\times 10^{-7}$	CL=90%	4469	DESIG=60
$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	< 6	$\times 10^{-7}$	CL=90%	-	DESIG=61
$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	< 1.1	$\times 10^{-6}$	CL=90%	-	DESIG=62
$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	< 3	$\times 10^{-3}$	CL=90%	4469	DESIG=68
$\gamma\eta_c(1S)$	< 2.9	$\times 10^{-5}$	CL=90%	4260	DESIG=119
$\gamma\eta_c(2S)$	< 4	$\times 10^{-4}$	CL=90%	4031	DESIG=193
$\gamma\chi_{c0}$	< 6.6	$\times 10^{-5}$	CL=90%	4114	DESIG=120
$\gamma\chi_{c1}$	( 4.7 $\begin{smallmatrix} +2.4 \\ -1.9 \end{smallmatrix}$ )	$\times 10^{-5}$	4079	DESIG=121	
$\gamma\chi_{c2}$	< 7.6	$\times 10^{-6}$	CL=90%	4062	DESIG=122
$\gamma\chi_{c1}$ (3872)	< 4	$\times 10^{-5}$	CL=90%	3938	DESIG=195
$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.8	$\times 10^{-6}$	CL=90%	-	DESIG=124
$\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi$	< 3.0	$\times 10^{-6}$	CL=90%	-	DESIG=125
$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 2.2	$\times 10^{-6}$	CL=90%	-	DESIG=126
$\gamma X\bar{X}(m_X < 3.1 \text{ GeV})$	[t] < 1	$\times 10^{-3}$	CL=90%	-	DESIG=67
$\gamma X\bar{X}(m_X < 4.5 \text{ GeV})$	[u] < 2.4	$\times 10^{-4}$	CL=90%	-	DESIG=127
$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[v] < 1.78	$\times 10^{-4}$	CL=95%	-	DESIG=113
$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	[x] < 9	$\times 10^{-6}$	CL=90%	-	DESIG=114
$\gamma A^0 \rightarrow \gamma\tau^+\tau^-$	[r] < 1.30	$\times 10^{-4}$	CL=90%	-	DESIG=115
$\gamma A^0 \rightarrow \gamma g g$	[y] < 1	%	CL=90%	-	DESIG=129
$\gamma A^0 \rightarrow \gamma s\bar{s}$	[y] < 1	$\times 10^{-3}$	CL=90%	-	DESIG=130

## Lepton Family number (LF) violating modes

					NODE=M049;CLUMP=C
$e^\pm\mu^\mp$	LF	< 3.9	$\times 10^{-7}$	CL=90%	4730
$\mu^\pm\tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%	4563
$e^\pm\tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%	4563
$\gamma e^\pm\mu^\mp$	LF	< 4.2	$\times 10^{-7}$	CL=90%	4730
$\gamma\mu^\pm\tau^\mp$	LF	< 6.1	$\times 10^{-6}$	CL=90%	4563
$\gamma e^\pm\tau^\mp$	LF	< 6.5	$\times 10^{-6}$	CL=90%	4563

**Other decays**

invisible  $< 3.0 \times 10^{-4}$  CL=90% -  
hadrons (96  $\pm 4$  )% -

NODE=M049;CLUMP=D  
DESIG=106  
DESIG=101

 **$\chi_{b0}(1P)$  [z]**

$$I^G(J^{PC}) = 0^+(0^{++})$$

$J$  needs confirmation.

Mass  $m = 9859.44 \pm 0.42 \pm 0.31$  MeV

NODE=M076

NODE=M076M;DTYPE=M;OUR EVAL;  
→ UNCHECKED ←

$\chi_{b0}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)
$\gamma \Upsilon(1S)$	( 1.94 $\pm$ 0.27 ) %		391
$D^0 X$	$< 10.4$ %	90%	-
$\pi^+ \pi^- K^+ K^- \pi^0$	$< 1.6 \times 10^{-4}$	90%	4875
$2\pi^+ \pi^- K^- K_S^0$	$< 5 \times 10^{-5}$	90%	4875
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 5 \times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- 2\pi^0$	$< 2.1 \times 10^{-4}$	90%	4905
$2\pi^+ 2\pi^- K^+ K^-$	( 1.1 $\pm$ 0.6 ) $\times 10^{-4}$		4861
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$< 2.7 \times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$< 5 \times 10^{-4}$	90%	4828
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 1.6 \times 10^{-4}$	90%	4827
$3\pi^+ 3\pi^-$	$< 8 \times 10^{-5}$	90%	4904
$3\pi^+ 3\pi^- 2\pi^0$	$< 6 \times 10^{-4}$	90%	4881
$3\pi^+ 3\pi^- K^+ K^-$	( 2.4 $\pm$ 1.2 ) $\times 10^{-4}$		4827
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$< 1.0 \times 10^{-3}$	90%	4808
$4\pi^+ 4\pi^-$	$< 8 \times 10^{-5}$	90%	4880
$4\pi^+ 4\pi^- 2\pi^0$	$< 2.1 \times 10^{-3}$	90%	4850
$J/\psi J/\psi$	$< 7 \times 10^{-5}$	90%	3836
$J/\psi \psi(2S)$	$< 1.2 \times 10^{-4}$	90%	3571
$\psi(2S) \psi(2S)$	$< 3.1 \times 10^{-5}$	90%	3273
$J/\psi(1S)$ anything	$< 2.3 \times 10^{-3}$	90%	-

NODE=M076215;DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

DESIG=20

 **$\chi_{b1}(1P)$  [z]**

$$I^G(J^{PC}) = 0^+(1^{++})$$

$J$  needs confirmation.

Mass  $m = 9892.78 \pm 0.26 \pm 0.31$  MeV

NODE=M077

NODE=M077M;DTYPE=M;OUR EVAL;  
→ UNCHECKED ←

$\chi_{b1}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)
$\gamma \Upsilon(1S)$	(35.2 $\pm$ 2.0) %		423
$D^0 X$	(12.6 $\pm$ 2.2) %		-
$\pi^+ \pi^- K^+ K^- \pi^0$	( 2.0 $\pm$ 0.6 ) $\times 10^{-4}$		4892
$2\pi^+ \pi^- K^- K_S^0$	( 1.3 $\pm$ 0.5 ) $\times 10^{-4}$		4892
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 6 \times 10^{-4}$	90%	4863
$2\pi^+ 2\pi^- 2\pi^0$	( 8.0 $\pm$ 2.5 ) $\times 10^{-4}$		4921
$2\pi^+ 2\pi^- K^+ K^-$	( 1.5 $\pm$ 0.5 ) $\times 10^{-4}$		4878
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	( 3.5 $\pm$ 1.2 ) $\times 10^{-4}$		4863
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	( 8.6 $\pm$ 3.2 ) $\times 10^{-4}$		4845
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	( 9.3 $\pm$ 3.3 ) $\times 10^{-4}$		4844
$3\pi^+ 3\pi^-$	( 1.9 $\pm$ 0.6 ) $\times 10^{-4}$		4921
$3\pi^+ 3\pi^- 2\pi^0$	( 1.7 $\pm$ 0.5 ) $\times 10^{-3}$		4898
$3\pi^+ 3\pi^- K^+ K^-$	( 2.6 $\pm$ 0.8 ) $\times 10^{-4}$		4844
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	( 7.5 $\pm$ 2.6 ) $\times 10^{-4}$		4825
$4\pi^+ 4\pi^-$	( 2.6 $\pm$ 0.9 ) $\times 10^{-4}$		4897
$4\pi^+ 4\pi^- 2\pi^0$	( 1.4 $\pm$ 0.6 ) $\times 10^{-3}$		4867
$\omega$ anything	( 4.9 $\pm$ 1.4 ) %		-
$\omega X_{tetra}$	$< 4.44 \times 10^{-4}$	90%	-
$J/\psi J/\psi$	$< 2.7 \times 10^{-5}$	90%	3857
$J/\psi \psi(2S)$	$< 1.7 \times 10^{-5}$	90%	3594
$\psi(2S) \psi(2S)$	$< 6 \times 10^{-5}$	90%	3298
$J/\psi(1S)$ anything	$< 1.1 \times 10^{-3}$	90%	-
$J/\psi(1S) X_{tetra}$	$< 2.27 \times 10^{-4}$	90%	-

NODE=M077215;DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=21

DESIG=22

DESIG=17

DESIG=18

DESIG=19

DESIG=20

DESIG=23

 **$h_b(1P)$** 

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Mass  $m = 9899.3 \pm 0.8$  MeV

NODE=M204

NODE=M204M;DTYPE=M

$h_b(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\eta_b(1S)\gamma$	$(52^{+6}_{-5})\%$	488

NODE=M204215;DESIG=1

 **$\chi_{b2}(1P)$  [z]**

$$I^G(J^{PC}) = 0^+(2^{++})$$

$J$  needs confirmation.

NODE=M078

$$\text{Mass } m = 9912.21 \pm 0.26 \pm 0.31 \text{ MeV}$$

NODE=M078M;DTYPE=M;OUR EVAL;  
→ UNCHECKED ←

$\chi_{b2}(1P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\gamma \Upsilon(1S)$	$(18.0 \pm 1.0)\%$		442
$D^0 X$	$< 7.9\%$	90%	–
$\pi^+ \pi^- K^+ K^- \pi^0$	$(8 \pm 5) \times 10^{-5}$		4902
$2\pi^+ \pi^- K^- K_S^0$	$< 1.0 \times 10^{-4}$	90%	4901
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$(5.3 \pm 2.4) \times 10^{-4}$		4873
$2\pi^+ 2\pi^- 2\pi^0$	$(3.5 \pm 1.4) \times 10^{-4}$		4931
$2\pi^+ 2\pi^- K^+ K^-$	$(1.1 \pm 0.4) \times 10^{-4}$		4888
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.1 \pm 0.9) \times 10^{-4}$		4872
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(3.9 \pm 1.8) \times 10^{-4}$		4855
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 5 \times 10^{-4}$	90%	4854
$3\pi^+ 3\pi^-$	$(7.0 \pm 3.1) \times 10^{-5}$		4931
$3\pi^+ 3\pi^- 2\pi^0$	$(1.0 \pm 0.4) \times 10^{-3}$		4908
$3\pi^+ 3\pi^- K^+ K^-$	$< 8 \times 10^{-5}$	90%	4854
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(3.6 \pm 1.5) \times 10^{-4}$		4835
$4\pi^+ 4\pi^-$	$(8 \pm 4) \times 10^{-5}$		4907
$4\pi^+ 4\pi^- 2\pi^0$	$(1.8 \pm 0.7) \times 10^{-3}$		4877
$J/\psi J/\psi$	$< 4 \times 10^{-5}$	90%	3869
$J/\psi \psi(2S)$	$< 5 \times 10^{-5}$	90%	3608
$\psi(2S) \psi(2S)$	$< 1.6 \times 10^{-5}$	90%	3313
$J/\psi(1S)$ anything	$(1.5 \pm 0.4) \times 10^{-3}$		–

NODE=M078215;DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

DESIG=20

 **$\Upsilon(2S)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M052

$$\text{Mass } m = 10023.4 \pm 0.5 \text{ MeV}$$

NODE=M052M;DTYPE=M

$$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13 \text{ MeV}$$

$$\text{Full width } \Gamma = 31.98 \pm 2.63 \text{ keV}$$

NODE=M052DM3;DTYPE=D

NODE=M052W;DTYPE=G;OUR EVAL;  
→ UNCHECKED ←

<b><math>\Upsilon(2S)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$\rho$ (MeV/c)	
$\Upsilon(1S)\pi^+\pi^-$	(17.85 ± 0.26) %		475	NODE=M052215;DESIG=4
$\Upsilon(1S)\pi^0\pi^0$	( 8.6 ± 0.4 ) %		480	DESIG=5
$\tau^+\tau^-$	( 2.00 ± 0.21 ) %		4686	DESIG=3
$\mu^+\mu^-$	( 1.93 ± 0.17 ) %	S=2.2	5011	DESIG=1
$e^+e^-$	( 1.91 ± 0.16 ) %		5012	DESIG=2
$\Upsilon(1S)\pi^0$	< 4	$\times 10^{-5}$ CL=90%	531	DESIG=10
$\Upsilon(1S)\eta$	( 2.9 ± 0.4 )	$\times 10^{-4}$ S=2.0	126	DESIG=6
$J/\psi(1S)$ anything	< 6	$\times 10^{-3}$ CL=90%	4533	DESIG=20
$J/\psi(1S)\eta_c$	< 5.4	$\times 10^{-6}$ CL=90%	3984	DESIG=143
$J/\psi(1S)\chi_{c0}$	< 3.4	$\times 10^{-6}$ CL=90%	3808	DESIG=144
$J/\psi(1S)\chi_{c1}$	< 1.2	$\times 10^{-6}$ CL=90%	3765	DESIG=145
$J/\psi(1S)\chi_{c2}$	< 2.0	$\times 10^{-6}$ CL=90%	3745	DESIG=146
$J/\psi(1S)\eta_c(2S)$	< 2.5	$\times 10^{-6}$ CL=90%	3707	DESIG=147
$J/\psi(1S)X(3940)$	< 2.0	$\times 10^{-6}$ CL=90%	3555	DESIG=148
$J/\psi(1S)X(4160)$	< 2.0	$\times 10^{-6}$ CL=90%	3442	DESIG=149
$\chi_{c1}$ anything	( 2.2 ± 0.5 )	$\times 10^{-4}$	–	DESIG=157
$\chi_{c1}(1P)^0 X_{tetra}$	< 3.67	$\times 10^{-5}$ CL=90%	–	DESIG=160
$\chi_{c2}$ anything	( 2.3 ± 0.8 )	$\times 10^{-4}$	–	DESIG=158
$\psi(2S)\eta_c$	< 5.1	$\times 10^{-6}$ CL=90%	3732	DESIG=150
$\psi(2S)\chi_{c0}$	< 4.7	$\times 10^{-6}$ CL=90%	3536	DESIG=151
$\psi(2S)\chi_{c1}$	< 2.5	$\times 10^{-6}$ CL=90%	3488	DESIG=152
$\psi(2S)\chi_{c2}$	< 1.9	$\times 10^{-6}$ CL=90%	3464	DESIG=153
$\psi(2S)\eta_c(2S)$	< 3.3	$\times 10^{-6}$ CL=90%	3422	DESIG=154
$\psi(2S)X(3940)$	< 3.9	$\times 10^{-6}$ CL=90%	3250	DESIG=155
$\psi(2S)X(4160)$	< 3.9	$\times 10^{-6}$ CL=90%	3120	DESIG=156
$Z_c(3900)^+ Z_c(3900)^-$	< 1.0	$\times 10^{-6}$ CL=90%	–	DESIG=162
$Z_c(4200)^+ Z_c(4200)^-$	< 1.67	$\times 10^{-5}$ CL=90%	–	DESIG=163
$Z_c(3900)^\pm Z_c(4200)^\mp$	< 7.3	$\times 10^{-6}$ CL=90%	–	DESIG=164
$X(4050)^+ X(4050)^-$	< 1.35	$\times 10^{-5}$ CL=90%	–	DESIG=165
$X(4250)^+ X(4250)^-$	< 2.67	$\times 10^{-5}$ CL=90%	–	DESIG=166
$X(4050)^\pm X(4250)^\mp$	< 2.72	$\times 10^{-5}$ CL=90%	–	DESIG=167
$Z_c(4430)^+ Z_c(4430)^-$	< 2.03	$\times 10^{-5}$ CL=90%	–	DESIG=168
$X(4055)^\pm X(4055)^\mp$	< 1.11	$\times 10^{-5}$ CL=90%	–	DESIG=170
$X(4055)^\pm Z_c(4430)^\mp$	< 2.11	$\times 10^{-5}$ CL=90%	–	DESIG=171
${}^2\bar{H}$ anything	( 2.78 <sup>+</sup> <sub>-</sub> 0.30/ 0.26 )	$\times 10^{-5}$ S=1.2	–	DESIG=16
hadrons	(94 ± 11 ) %		–	DESIG=101
$ggg$	(58.8 ± 1.2 ) %		–	DESIG=105
$\gamma g g$	( 1.87 ± 0.28 ) %		–	DESIG=106
$\phi K^+ K^-$	( 1.6 ± 0.4 )	$\times 10^{-6}$	4910	DESIG=133
$\omega\pi^+\pi^-$	< 2.58	$\times 10^{-6}$ CL=90%	4977	DESIG=134
$K^*(892)^0 K^- \pi^+ + c.c.$	( 2.3 ± 0.7 )	$\times 10^{-6}$	4952	DESIG=135
$\phi f_2'(1525)$	< 1.33	$\times 10^{-6}$ CL=90%	4843	DESIG=136
$\omega f_2(1270)$	< 5.7	$\times 10^{-7}$ CL=90%	4899	DESIG=137
$\rho(770) a_2(1320)$	< 8.8	$\times 10^{-7}$ CL=90%	4894	DESIG=138
$K^*(892)^0 \bar{K}_2^*(1430)^0 + c.c.$	( 1.5 ± 0.6 )	$\times 10^{-6}$	4869	DESIG=139
$K_1(1270)^\pm K^\mp$	< 3.22	$\times 10^{-6}$ CL=90%	4921	DESIG=140
$K_1(1400)^\pm K^\mp$	< 8.3	$\times 10^{-7}$ CL=90%	4901	DESIG=141
$b_1(1235)^\pm \pi^\mp$	< 4.0	$\times 10^{-7}$ CL=90%	4935	DESIG=142
$\rho\pi$	< 1.16	$\times 10^{-6}$ CL=90%	4981	DESIG=126
$\pi^+\pi^-\pi^0$	< 8.0	$\times 10^{-7}$ CL=90%	5007	DESIG=127
$\omega\pi^0$	< 1.63	$\times 10^{-6}$ CL=90%	4980	DESIG=128
$\pi^+\pi^-\pi^0\pi^0$	( 1.30 ± 0.28 )	$\times 10^{-5}$	5002	DESIG=129
$K_S^0 K^+ \pi^- + c.c.$	( 1.14 ± 0.33 )	$\times 10^{-6}$	4979	DESIG=130
$K^*(892)^0 \bar{K}^0 + c.c.$	< 4.22	$\times 10^{-6}$ CL=90%	4959	DESIG=131
$K^*(892)^- K^+ + c.c.$	< 1.45	$\times 10^{-6}$ CL=90%	4960	DESIG=132
$f_1(1285)$ anything	( 2.2 ± 1.6 )	$\times 10^{-3}$	–	DESIG=159
$f_1(1285) X_{tetra}$	< 6.47	$\times 10^{-5}$ CL=90%	–	DESIG=161
Sum of 100 exclusive modes	( 2.90 ± 0.30 )	$\times 10^{-3}$	–	DESIG=121

**Radiative decays**

Decay Mode	Value	CL	Count	DESIG	Node
$\gamma\chi_{b1}(1P)$	$(6.9 \pm 0.4) \%$		130	DESIG=8	NODE=M052;CLUMP=A
$\gamma\chi_{b2}(1P)$	$(7.15 \pm 0.35) \%$		111	DESIG=7	
$\gamma\chi_{b0}(1P)$	$(3.8 \pm 0.4) \%$		163	DESIG=9	
$\gamma f_0(1710)$	$< 5.9 \times 10^{-4}$	CL=90%	4862	DESIG=13	
$\gamma f'_2(1525)$	$< 5.3 \times 10^{-4}$	CL=90%	4897	DESIG=12	
$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	CL=90%	4931	DESIG=11	
$\gamma\eta_c(1S)$	$< 2.7 \times 10^{-5}$	CL=90%	4568	DESIG=111	
$\gamma\chi_{c0}$	$< 1.0 \times 10^{-4}$	CL=90%	4430	DESIG=112	
$\gamma\chi_{c1}$	$< 3.6 \times 10^{-6}$	CL=90%	4397	DESIG=113	
$\gamma\chi_{c2}$	$< 1.5 \times 10^{-5}$	CL=90%	4381	DESIG=114	
$\gamma\chi_{c1}(3872)$	$< 2.1 \times 10^{-5}$	CL=90%	4264	DESIG=172	
$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	$< 2.4 \times 10^{-6}$	CL=90%	-	DESIG=116	
$\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%	-	DESIG=117	
$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	$< 1.2 \times 10^{-6}$	CL=90%	-	DESIG=118	
$\gamma X(4350) \rightarrow \phi J/\psi$	$< 1.3 \times 10^{-6}$	CL=90%	-	DESIG=119	
$\gamma\eta_b(1S)$	$(5.5 \pm_{0.9}^{1.1}) \times 10^{-4}$	S=1.2	605	DESIG=102	
$\gamma\eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	$< 3.7 \times 10^{-6}$	CL=90%	-	DESIG=124	
$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	$< 4.9 \times 10^{-6}$	CL=90%	-	DESIG=125	
$\gamma X \rightarrow \gamma + \geq 4$ prongs [aa]	$< 1.95 \times 10^{-4}$	CL=95%	-	DESIG=103	
$\gamma A^0 \rightarrow \gamma$ hadrons	$< 8 \times 10^{-5}$	CL=90%	-	DESIG=108	
$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	$< 8.3 \times 10^{-6}$	CL=90%	-	DESIG=123	

**Lepton Family number (LF) violating modes**

$e^\pm\tau^\mp$	LF	$< 3.2 \times 10^{-6}$	CL=90%	4854	NODE=M052;CLUMP=B
$\mu^\pm\tau^\mp$	LF	$< 3.3 \times 10^{-6}$	CL=90%	4854	DESIG=107
					DESIG=104

 **$\Upsilon_2(1D)$** 

$$J^G(J^{PC}) = 0^-(2^{--})$$

NODE=M177

was  $\Upsilon(1D)$ 

$$\text{Mass } m = 10163.7 \pm 1.4 \text{ MeV } (S = 1.7)$$

NODE=M177M;DTYPE=M

<b><math>\Upsilon_2(1D)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\gamma\gamma \Upsilon(1S)$	seen	679
$\gamma\chi_{bJ}(1P)$	seen	300
$\eta \Upsilon(1S)$	not seen	426
$\pi^+\pi^-\Upsilon(1S)$	$(6.6 \pm 1.6) \times 10^{-3}$	623

NODE=M177215;DESIG=1;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=2;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=3;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$   
DESIG=4

 **$\chi_{b0}(2P)$  [z]**

$$J^G(J^{PC}) = 0^+(0^{++})$$

$J$  needs confirmation.

NODE=M079

$$\text{Mass } m = 10232.5 \pm 0.4 \pm 0.5 \text{ MeV}$$

NODE=M079M;DTYPE=M;OUR EVAL;  
 $\rightarrow$  UNCHECKED  $\leftarrow$

$\chi_{b0}(2P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)	
$\gamma \mathcal{T}(2S)$	$(1.38 \pm 0.30) \%$		207	NODE=M079215;DESIG=2
$\gamma \mathcal{T}(1S)$	$(3.8 \pm 1.7) \times 10^{-3}$		743	DESIG=1
$D^0 X$	$< 8.2$	%	90%	DESIG=3
$\pi^+ \pi^- K^+ K^- \pi^0$	$< 3.4$	$\times 10^{-5}$	90%	DESIG=4
$2\pi^+ \pi^- K^- K_S^0$	$< 5$	$\times 10^{-5}$	90%	DESIG=5
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 2.2$	$\times 10^{-4}$	90%	DESIG=6
$2\pi^+ 2\pi^- 2\pi^0$	$< 2.4$	$\times 10^{-4}$	90%	DESIG=7
$2\pi^+ 2\pi^- K^+ K^-$	$< 1.5$	$\times 10^{-4}$	90%	DESIG=8
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$< 2.2$	$\times 10^{-4}$	90%	DESIG=9
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$< 1.1$	$\times 10^{-3}$	90%	DESIG=10
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 7$	$\times 10^{-4}$	90%	DESIG=11
$3\pi^+ 3\pi^-$	$< 7$	$\times 10^{-5}$	90%	DESIG=12
$3\pi^+ 3\pi^- 2\pi^0$	$< 1.2$	$\times 10^{-3}$	90%	DESIG=13
$3\pi^+ 3\pi^- K^+ K^-$	$< 1.5$	$\times 10^{-4}$	90%	DESIG=14
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$< 7$	$\times 10^{-4}$	90%	DESIG=15
$4\pi^+ 4\pi^-$	$< 1.7$	$\times 10^{-4}$	90%	DESIG=16
$4\pi^+ 4\pi^- 2\pi^0$	$< 6$	$\times 10^{-4}$	90%	DESIG=17

 **$\chi_{b1}(2P)$  [z]**

$$J^G(J^{PC}) = 0^+(1^{++})$$

 $J$  needs confirmation.

NODE=M080

Mass  $m = 10255.46 \pm 0.22 \pm 0.50$  MeV

NODE=M080M;DTYPE=M;OUR EVAL;  
→ UNCHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$  MeV

NODE=M080M2;DTYPE=D

$\chi_{b1}(2P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\omega \mathcal{T}(1S)$	$(1.63^{+0.40}_{-0.34}) \%$	134	NODE=M080215;DESIG=3
$\gamma \mathcal{T}(2S)$	$(18.1 \pm 1.9) \%$	229	DESIG=2
$\gamma \mathcal{T}(1S)$	$(9.9 \pm 1.0) \%$	764	DESIG=1
$\pi \pi \chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$	238	DESIG=4
$D^0 X$	$(8.8 \pm 1.7) \%$	—	DESIG=5
$\pi^+ \pi^- K^+ K^- \pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$	5075	DESIG=6
$2\pi^+ \pi^- K^- K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$	5075	DESIG=7
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$	5047	DESIG=8
$2\pi^+ 2\pi^- 2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$	5104	DESIG=9
$2\pi^+ 2\pi^- K^+ K^-$	$(10 \pm 4) \times 10^{-5}$	5062	DESIG=10
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	5047	DESIG=11
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(10 \pm 4) \times 10^{-4}$	5030	DESIG=12
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	5029	DESIG=13
$3\pi^+ 3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	5103	DESIG=14
$3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	5081	DESIG=15
$3\pi^+ 3\pi^- K^+ K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	5029	DESIG=16
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	5011	DESIG=17
$4\pi^+ 4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	5080	DESIG=18
$4\pi^+ 4\pi^- 2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	5051	DESIG=19

 **$h_b(2P)$** 

$$J^G(J^{PC}) = 0^-(1^{+-})$$

NODE=M205

Mass  $m = 10259.8 \pm 1.2$  MeV

NODE=M205M;DTYPE=M

$h_b(2P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
hadrons	not seen	—
$\eta_b(1S)\gamma$	$(22 \pm 5) \%$	825
$\eta_b(2S)\gamma$	$(48 \pm 13) \%$	257

NODE=M205215;DESIG=1  
DESIG=2  
DESIG=3

$\chi_{b2}(2P)$  [z]

$$I^G(J^{PC}) = 0^+(2^{++})$$

$J$  needs confirmation.

NODE=M081

$$\text{Mass } m = 10268.65 \pm 0.22 \pm 0.50 \text{ MeV}$$

$$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.10 \pm 0.24 \text{ MeV}$$

NODE=M081M;DTYPE=M;OUR EVAL;  
→ UNCHECKED ←  
NODE=M081M2;DTYPE=D

$\chi_{b2}(2P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30}) \%$		194
$\gamma \Upsilon(2S)$	$(8.9 \pm 1.2) \%$		242
$\gamma \Upsilon(1S)$	$(6.6 \pm 0.8) \%$		776
$\pi\pi\chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$		229
$D^0 X$	$< 2.4 \%$	90%	—
$\pi^+\pi^-K^+K^-\pi^0$	$< 1.1 \times 10^{-4}$	90%	5082
$2\pi^+\pi^-K^-K_S^0$	$< 9 \times 10^{-5}$	90%	5082
$2\pi^+\pi^-K^-K_S^0 2\pi^0$	$< 7 \times 10^{-4}$	90%	5054
$2\pi^+2\pi^-2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$		5110
$2\pi^+2\pi^-K^+K^-$	$(9 \pm 4) \times 10^{-5}$		5068
$2\pi^+2\pi^-K^+K^-\pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$		5054
$2\pi^+2\pi^-K^+K^-\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$		5037
$3\pi^+2\pi^-K^-K_S^0\pi^0$	$< 4 \times 10^{-4}$	90%	5036
$3\pi^+3\pi^-$	$(9 \pm 4) \times 10^{-5}$		5110
$3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		5088
$3\pi^+3\pi^-K^+K^-$	$(1.4 \pm 0.7) \times 10^{-4}$		5036
$3\pi^+3\pi^-K^+K^-\pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$		5017
$4\pi^+4\pi^-$	$(9 \pm 5) \times 10^{-5}$		5087
$4\pi^+4\pi^-2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$		5058

NODE=M081215;DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

$\Upsilon(3S)$

$$I^G(J^{PC}) = 0^-(1^{---})$$

NODE=M048

$$\text{Mass } m = 10355.1 \pm 0.5 \text{ MeV}$$

NODE=M048M;DTYPE=M

$$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13 \text{ MeV}$$

$$\text{Full width } \Gamma = 20.32 \pm 1.85 \text{ keV}$$

NODE=M048DM2;DTYPE=D

NODE=M048W;DTYPE=G;OUR EVAL;  
→ UNCHECKED ←



<b><math>\Upsilon(3S)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)	
$\Upsilon(2S)$ anything	(10.6 $\pm$ 0.8 ) %		296	NODE=M048215;DESIG=8
$\Upsilon(2S)\pi^+\pi^-$	( 2.82 $\pm$ 0.18) %	S=1.6	176	DESIG=4
$\Upsilon(2S)\pi^0\pi^0$	( 1.85 $\pm$ 0.14) %		190	DESIG=10
$\Upsilon(2S)\gamma\gamma$	( 5.0 $\pm$ 0.7 ) %		326	DESIG=12
$\Upsilon(2S)\pi^0$	< 5.1 $\times 10^{-4}$	CL=90%	298	DESIG=107
$\Upsilon(1S)\pi^+\pi^-$	( 4.37 $\pm$ 0.08) %		813	DESIG=3
$\Upsilon(1S)\pi^0\pi^0$	( 2.20 $\pm$ 0.13) %		816	DESIG=11
$\Upsilon(1S)\eta$	< 1 $\times 10^{-4}$	CL=90%	677	DESIG=9
$\Upsilon(1S)\pi^0$	< 7 $\times 10^{-5}$	CL=90%	846	DESIG=106
$h_b(1P)\pi^0$	< 1.2 $\times 10^{-3}$	CL=90%	426	DESIG=112
$h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	( 4.3 $\pm$ 1.4 ) $\times 10^{-4}$		–	DESIG=113
$h_b(1P)\pi^+\pi^-$	< 1.2 $\times 10^{-4}$	CL=90%	352	DESIG=114
$\tau^+\tau^-$	( 2.29 $\pm$ 0.30) %		4863	DESIG=16
$\mu^+\mu^-$	( 2.18 $\pm$ 0.21) %	S=2.1	5176	DESIG=1
$e^+e^-$	( 2.18 $\pm$ 0.20) %		5178	DESIG=2
hadrons	(93 $\pm$ 12 ) %		–	DESIG=101
$ggg$	(35.7 $\pm$ 2.6 ) %		–	DESIG=109
$\gamma gg$	( 9.7 $\pm$ 1.8 ) $\times 10^{-3}$		–	DESIG=110
${}^2H$ anything	( 2.33 $\pm$ 0.33) $\times 10^{-5}$		–	DESIG=117

**Radiative decays**

$\gamma\chi_{b2}(2P)$	(13.1 $\pm$ 1.6 ) %	S=3.4	86	NODE=M048;CLUMP=B DESIG=5
$\gamma\chi_{b1}(2P)$	(12.6 $\pm$ 1.2 ) %	S=2.4	99	DESIG=6
$\gamma\chi_{b0}(2P)$	( 5.9 $\pm$ 0.6 ) %	S=1.4	122	DESIG=7
$\gamma\chi_{b2}(1P)$	(10.0 $\pm$ 1.0 ) $\times 10^{-3}$	S=1.7	433	DESIG=103
$\gamma\chi_{b1}(1P)$	( 9 $\pm$ 5 ) $\times 10^{-4}$	S=1.8	452	DESIG=104
$\gamma\chi_{b0}(1P)$	( 2.7 $\pm$ 0.4 ) $\times 10^{-3}$		484	DESIG=13
$\gamma\eta_b(2S)$	< 6.2 $\times 10^{-4}$	CL=90%	350	DESIG=14
$\gamma\eta_b(1S)$	( 5.1 $\pm$ 0.7 ) $\times 10^{-4}$		912	DESIG=15
$\gamma A^0 \rightarrow \gamma$ hadrons	< 8 $\times 10^{-5}$	CL=90%	–	DESIG=115
$\gamma X \rightarrow \gamma + \geq 4$ prongs	[bb] < 2.2 $\times 10^{-4}$	CL=95%	–	DESIG=102
$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	< 5.5 $\times 10^{-6}$	CL=90%	–	DESIG=116
$\gamma A^0 \rightarrow \gamma\tau^+\tau^-$	[cc] < 1.6 $\times 10^{-4}$	CL=90%	–	DESIG=108

**Lepton Family number (LF) violating modes**

$e^\pm\tau^\mp$	LF	< 4.2 $\times 10^{-6}$	CL=90%	5025	NODE=M048;CLUMP=C DESIG=111
$e^\pm\mu^\mp$	LF	< 3.6 $\times 10^{-7}$	CL=90%	5177	DESIG=119
$\mu^\pm\tau^\mp$	LF	< 3.1 $\times 10^{-6}$	CL=90%	5025	DESIG=105

 **$\chi_{b1}(3P)$  [z]**

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M206

 $J$  needs confirmation.

Mass  $m = 10513.4 \pm 0.7$  MeV

NODE=M206M;DTYPE=M

<b><math>\chi_{b1}(3P)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)	
$\Upsilon(1S)\gamma$	seen	1000	NODE=M206215;DESIG=1
$\Upsilon(2S)\gamma$	seen	479	DESIG=2
$\Upsilon(3S)\gamma$	seen	157	DESIG=3

 **$\chi_{b2}(3P)$  [z]**

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M238

 $J$  needs confirmation.

Mass  $m = 10524.0 \pm 0.8$  MeV

NODE=M238M;DTYPE=M

$\chi_{b2}(3P)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Upsilon(3S)\gamma$	seen	168

NODE=M238215;DESIG=1

 **$\Upsilon(4S)$** 

$$J^G(J^{PC}) = 0^-(1^{--})$$

also known as  $\Upsilon(10580)$ Mass  $m = 10579.4 \pm 1.2$  MeVFull width  $\Gamma = 20.5 \pm 2.5$  MeV

NODE=M047

NODE=M047M;DTYPE=M

NODE=M047W;DTYPE=G

$\Upsilon(4S)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$B\bar{B}$	> 96 %	95%	326
$B^+ B^-$	(51.4 ± 0.6) %		331
$D_s^+$ anything + c.c.	(17.8 ± 2.6) %		–
$B^0 \bar{B}^0$	(48.6 ± 0.6) %		326
$J/\psi K_S^0 + (J/\psi, \eta_c) K_S^0$	< 4 × 10 <sup>-7</sup>	90%	–
non- $B\bar{B}$	< 4 %	95%	–
$e^+ e^-$	(1.57 ± 0.08) × 10 <sup>-5</sup>		5290
$\rho^+ \rho^-$	< 5.7 × 10 <sup>-6</sup>	90%	5233
$K^*(892)^0 \bar{K}^0$	< 2.0 × 10 <sup>-6</sup>	90%	5240
$J/\psi(1S)$ anything	< 1.9 × 10 <sup>-4</sup>	95%	–
$D^{*+}$ anything + c.c.	< 7.4 %	90%	5099
$\phi$ anything	(7.1 ± 0.6) %		5240
$\phi\eta$	< 1.8 × 10 <sup>-6</sup>	90%	5226
$\phi\eta'$	< 4.3 × 10 <sup>-6</sup>	90%	5196
$\rho\eta$	< 1.3 × 10 <sup>-6</sup>	90%	5247
$\rho\eta'$	< 2.5 × 10 <sup>-6</sup>	90%	5217
$\Upsilon(1S)$ anything	< 4 × 10 <sup>-3</sup>	90%	1053
$\Upsilon(1S)\pi^+\pi^-$	(8.2 ± 0.4) × 10 <sup>-5</sup>		1026
$\Upsilon(1S)\eta$	(1.81 ± 0.18) × 10 <sup>-4</sup>		924
$\Upsilon(1S)\eta'$	(3.4 ± 0.9) × 10 <sup>-5</sup>		–
$\Upsilon(2S)\pi^+\pi^-$	(8.2 ± 0.8) × 10 <sup>-5</sup>		468
$h_b(1P)\pi^+\pi^-$	not seen		600
$h_b(1P)\eta$	(2.18 ± 0.21) × 10 <sup>-3</sup>		390
$\eta_b(1S)\omega$	< 1.8 × 10 <sup>-4</sup>	90%	–
$^2H$ anything	< 1.3 × 10 <sup>-5</sup>	90%	–
<b>Double Radiative Decays</b>			
$\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S)$	< 2.3 × 10 <sup>-5</sup>	90%	–

NODE=M047215;DESIG=8;OUR EST;  
→ UNCHECKED ←  
DESIG=10

DESIG=12

DESIG=11

DESIG=15

DESIG=6

DESIG=1

DESIG=16

DESIG=22

DESIG=2

DESIG=3

DESIG=4

DESIG=13

DESIG=18

DESIG=19

DESIG=20

DESIG=5

DESIG=7

DESIG=17

DESIG=26

DESIG=9

DESIG=21

DESIG=23

DESIG=27

DESIG=14

NODE=M047;CLUMP=B

DESIG=24

 **$\Upsilon(10860)$** 

$$J^G(J^{PC}) = 0^-(1^{--})$$

Mass  $m = 10885.2^{+2.6}_{-1.6}$  MeVFull width  $\Gamma = 37 \pm 4$  MeV

NODE=M092

NODE=M092M;DTYPE=M

NODE=M092W;DTYPE=G

$\Upsilon(10860)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)	
$B\bar{B}X$	( 76.2 $^{+2.7}_{-4.0}$ ) %		–	NODE=M092215;DESIG=9
$B\bar{B}$	( 5.5 $\pm 1.0$ ) %		1322	DESIG=2
$B\bar{B}^* + \text{c.c.}$	( 13.7 $\pm 1.6$ ) %		–	DESIG=3
$B^*\bar{B}^*$	( 38.1 $\pm 3.4$ ) %		1127	DESIG=4
$B\bar{B}^{(*)}\pi$	< 19.7 %	90%	1015	DESIG=10
$B\bar{B}\pi$	( 0.0 $\pm 1.2$ ) %		1015	DESIG=23
$B^*\bar{B}\pi + B\bar{B}^*\pi$	( 7.3 $\pm 2.3$ ) %		–	DESIG=24
$B^*\bar{B}^*\pi$	( 1.0 $\pm 1.4$ ) %		739	DESIG=25
$B\bar{B}\pi\pi$	< 8.9 %	90%	551	DESIG=11
$B_s^{(*)}\bar{B}_s^{(*)}$	( 20.1 $\pm 3.1$ ) %		905	DESIG=16
$B_s\bar{B}_s$	( 5 $\pm 5$ ) $\times 10^{-3}$		905	DESIG=5
$B_s\bar{B}_s^* + \text{c.c.}$	( 1.35 $\pm 0.32$ ) %		–	DESIG=7
$B_s^*\bar{B}_s^*$	( 17.6 $\pm 2.7$ ) %		543	DESIG=8
no open-bottom	( 3.8 $^{+5.0}_{-0.5}$ ) %		–	DESIG=28
$e^+e^-$	( 8.3 $\pm 2.1$ ) $\times 10^{-6}$		5443	DESIG=1
$K^*(892)^0\bar{K}^0$	< 1.0 $\times 10^{-5}$	90%	5395	DESIG=29
$\Upsilon(1S)\pi^+\pi^-$	( 5.3 $\pm 0.6$ ) $\times 10^{-3}$		1306	DESIG=17
$\Upsilon(1S)\eta$	( 8.5 $\pm 1.7$ ) $\times 10^{-4}$		1229	DESIG=44
$\Upsilon(1S)\eta'$	< 6.9 $\times 10^{-5}$	90%	985	DESIG=45
$\Upsilon(2S)\pi^+\pi^-$	( 7.8 $\pm 1.3$ ) $\times 10^{-3}$		783	DESIG=18
$\Upsilon(2S)\eta$	( 4.1 $\pm 0.6$ ) $\times 10^{-3}$		639	DESIG=46
$\Upsilon(3S)\pi^+\pi^-$	( 4.8 $^{+1.9}_{-1.7}$ ) $\times 10^{-3}$		440	DESIG=19
$\Upsilon(1S)K^+K^-$	( 6.1 $\pm 1.8$ ) $\times 10^{-4}$		959	DESIG=20
$\eta\Upsilon_J(1D)$	( 4.8 $\pm 1.1$ ) $\times 10^{-3}$		–	DESIG=40
$h_b(1P)\pi^+\pi^-$	( 3.5 $^{+1.0}_{-1.3}$ ) $\times 10^{-3}$		903	DESIG=26
$h_b(2P)\pi^+\pi^-$	( 5.7 $^{+1.7}_{-2.1}$ ) $\times 10^{-3}$		544	DESIG=27
$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	( 2.5 $\pm 2.3$ ) $\times 10^{-3}$		894	DESIG=41
$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	< 6.3 $\times 10^{-3}$	90%	894	DESIG=30
$\chi_{b0}(1P)\omega$	< 3.9 $\times 10^{-3}$	90%	631	DESIG=31
$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	< 4.8 $\times 10^{-3}$	90%	–	DESIG=32
$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	( 1.85 $\pm 0.33$ ) $\times 10^{-3}$		861	DESIG=33
$\chi_{b1}(1P)\omega$	( 1.57 $\pm 0.30$ ) $\times 10^{-3}$		582	DESIG=34
$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	( 5.2 $\pm 1.9$ ) $\times 10^{-4}$		–	DESIG=35
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	( 1.17 $\pm 0.30$ ) $\times 10^{-3}$		841	DESIG=36
$\chi_{b2}(1P)\omega$	( 6.0 $\pm 2.7$ ) $\times 10^{-4}$		552	DESIG=37
$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	( 6 $\pm 4$ ) $\times 10^{-4}$		–	DESIG=38
$\gamma X_b \rightarrow \gamma\Upsilon(1S)\omega$	< 3.8 $\times 10^{-5}$	90%	–	DESIG=39
$\eta_b(1S)\omega$	< 1.3 $\times 10^{-3}$	90%	1177	DESIG=42
$\eta_b(2S)\omega$	< 5.6 $\times 10^{-3}$	90%	399	DESIG=43

**Inclusive Decays.**

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

$\phi$ anything	( 13.8 $^{+2.4}_{-1.7}$ ) %	–	DESIG=12
$D^0$ anything + c.c.	(108 $\pm 8$ ) %	–	DESIG=13
$D_s$ anything + c.c.	( 46 $\pm 6$ ) %	–	DESIG=6
$J/\psi$ anything	( 2.06 $\pm 0.21$ ) %	–	DESIG=14
$B^0$ anything + c.c.	( 77 $\pm 8$ ) %	–	DESIG=21
$B^+$ anything + c.c.	( 72 $\pm 6$ ) %	–	DESIG=22

 **$\Upsilon(11020)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M093

Mass  $m = 11000 \pm 4$  MeV

NODE=M093M;DTYPE=M

Full width  $\Gamma = 24^{+8}_{-6}$  MeV

NODE=M093W;DTYPE=G

$\Upsilon(11020)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$e^+ e^-$	$(5.4^{+1.9}_{-2.1}) \times 10^{-6}$	5500
$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(9^{+9}_{-8}) \times 10^{-3}$	1007
$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	seen	975
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	seen	956

NODE=M093215;DESIG=1  
DESIG=2  
DESIG=3  
DESIG=4

## OTHER MESONS

NODE=MXXX050

### $Z_c(3900)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

NODE=M210

was  $X(3900)$

Mass  $m = 3887.1 \pm 2.6$  MeV ( $S = 1.7$ )  
Full width  $\Gamma = 28.4 \pm 2.6$  MeV

NODE=M210M;DTYPE=M  
NODE=M210W;DTYPE=G

$Z_c(3900)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$J/\psi\pi$	seen	699
$h_c\pi^\pm$	not seen	318
$\eta_c\pi^+\pi^-$	not seen	759
$(D\bar{D}^*)^\pm$	seen	—
$D^0 D^{*-} + c.c.$	seen	152
$D^- D^{*0} + c.c.$	seen	143
$\omega\pi^\pm$	not seen	1862
$J/\psi\eta$	not seen	510
$D^+ D^{*-} + c.c.$	seen	—
$D^0 \bar{D}^{*0} + c.c.$	seen	—

NODE=M210215;DESIG=1  
DESIG=2  
DESIG=10  
DESIG=3;OUR EVAL;→ UNCHECKED ←  
DESIG=8  
DESIG=9  
DESIG=4  
DESIG=5  
DESIG=6  
DESIG=7

### $X(4020)^\pm$

$$I^G(J^{PC}) = 1^+(?^{?-})$$

NODE=M213

Mass  $m = 4024.1 \pm 1.9$  MeV  
Full width  $\Gamma = 13 \pm 5$  MeV ( $S = 1.7$ )

NODE=M213M;DTYPE=M  
NODE=M213W;DTYPE=G

$X(4020)^\pm$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$h_c(1P)\pi$	seen	450
$D^* \bar{D}^*$	seen	85
$D\bar{D}^* + c.c.$	not seen	542
$\eta_c\pi^+\pi^-$	not seen	872
$J/\psi(1S)\pi^\pm$	not seen	811

NODE=M213215;DESIG=1  
DESIG=2  
DESIG=4  
DESIG=3  
DESIG=5

### $Z_c(4430)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

$G, C$  need confirmation.

NODE=M195

was  $X(4430)^\pm$

Quantum numbers not established.

Mass  $m = 4478^{+15}_{-18}$  MeV  
Full width  $\Gamma = 181 \pm 31$  MeV

NODE=M195M;DTYPE=M  
NODE=M195W;DTYPE=G

<b>Z<sub>c</sub>(4430) DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\pi^+ \psi(2S)$	seen	711
$\pi^+ J/\psi$	seen	1162

NODE=M195215;DESIG=1  
DESIG=2

**Z<sub>b</sub>(10610)**

$$I^G(J^{PC}) = 1^+(1^{+-})$$

NODE=M207

was X(10610)

Mass  $m = 10607.2 \pm 2.0$  MeV  
Full width  $\Gamma = 18.4 \pm 2.4$  MeV

NODE=M207M;DTYPE=M  
NODE=M207W;DTYPE=G

<b>Z<sub>b</sub>(10610) DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Upsilon(1S)\pi^+$	$(5.4^{+1.9}_{-1.5}) \times 10^{-3}$	1077
$\Upsilon(1S)\pi^0$	not seen	1077
$\Upsilon(2S)\pi^+$	$(3.6^{+1.1}_{-0.8}) \%$	551
$\Upsilon(2S)\pi^0$	seen	552
$\Upsilon(3S)\pi^+$	$(2.1^{+0.8}_{-0.6}) \%$	207
$\Upsilon(3S)\pi^0$	seen	210
$h_b(1P)\pi^+$	$(3.5^{+1.2}_{-0.9}) \%$	671
$h_b(2P)\pi^+$	$(4.7^{+1.7}_{-1.3}) \%$	313
$B^+ \bar{B}^0$	not seen	505
$B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$	$(85.6^{+2.1}_{-2.9}) \%$	—

NODE=M207215;DESIG=1  
DESIG=9  
DESIG=2  
DESIG=10  
DESIG=3  
DESIG=11  
DESIG=4  
DESIG=5  
DESIG=8  
DESIG=6

**Z<sub>b</sub>(10650)**

$$I^G(J^{PC}) = 1^+(1^{+-})$$

$I, G, C$  need confirmation.

NODE=M208

was X(10650)<sup>±</sup>

Mass  $m = 10652.2 \pm 1.5$  MeV  
Full width  $\Gamma = 11.5 \pm 2.2$  MeV

NODE=M208M;DTYPE=M  
NODE=M208W;DTYPE=G

Z<sub>b</sub>(10650)<sup>−</sup> decay modes are charge conjugates of the modes below.

NODE=M208215;NODE=M208

<b>Z<sub>b</sub>(10650)<sup>+</sup> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Upsilon(1S)\pi^+$	$(1.7^{+0.8}_{-0.6}) \times 10^{-3}$	1117
$\Upsilon(2S)\pi^+$	$(1.4^{+0.6}_{-0.4}) \%$	595
$\Upsilon(3S)\pi^+$	$(1.6^{+0.7}_{-0.5}) \%$	259
$h_b(1P)\pi^+$	$(8.4^{+2.9}_{-2.4}) \%$	714
$h_b(2P)\pi^+$	$(15 \pm 4) \%$	360
$B^+ \bar{B}^0$	not seen	703
$B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$	not seen	—
$B^{*+} \bar{B}^{*0}$	$(74 \pm 4 \pm 6) \%$	122

DESIG=1  
DESIG=2  
DESIG=3  
DESIG=4  
DESIG=5  
DESIG=8  
DESIG=6  
DESIG=7

## NOTES

[a] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \rightarrow \mu^+\mu^-) = \Gamma(\rho^0 \rightarrow e^+e^-) \times 0.99785$ .	LINKAGE=MD2
[b] C parity forbids this to occur as a single-photon process.	LINKAGE=CS
[c] Our estimate. See the Particle Listings for details.	LINKAGE=BH
[d] See the "Note on $a_1(1260)$ " in the $a_1(1260)$ Particle Listings in PDG 06, Journal of Physics <b>G33</b> 1 (2006).	LINKAGE=NA1
[e] See also the $\omega(1650)$ .	LINKAGE=MDE
[f] See also the $\omega(1420)$ .	LINKAGE=MDF
[g] See our minireview under the $K_2(1770)$ in the 2004 edition of this <i>Review</i> .	LINKAGE=MBD
[h] For $E_\gamma > 100$ MeV.	LINKAGE=EGM
[i] The value is for the sum of the charge states or particle/antiparticle states indicated.	LINKAGE=SG
[j] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54$ GeV/ $c^2$ mass and a width of less than $25$ MeV/ $c^2$ .	LINKAGE=THT
[k] Includes $\rho\bar{\rho}\pi^+\pi^-\gamma$ and excludes $\rho\bar{\rho}\eta$ , $\rho\bar{\rho}\omega$ , $\rho\bar{\rho}\eta'$ .	LINKAGE=MF
[l] For a narrow state $A$ with mass less than $960$ MeV.	LINKAGE=NSA
[n] For a narrow scalar or pseudoscalar $A^0$ with mass $0.21$ – $3.0$ GeV.	LINKAGE=NA0
[o] For a dark photon $U$ with mass between $100$ and $2100$ MeV.	LINKAGE=DPH
[p] For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.	LINKAGE=NMR
[q] $J^{PC}$ known by production in $e^+e^-$ via single photon annihilation. $I^G$ is not known; interpretation of this state as a single resonance is unclear because of the expectation of substantial threshold effects in this energy region.	LINKAGE=MPD
[r] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV	LINKAGE=E49
[s] $2$ GeV $< m_{K^+K^-} < 3$ GeV	LINKAGE=G49
[t] $X\bar{X}$ = vectors with $m < 3.1$ GeV	LINKAGE=B49
[u] $X$ and $\bar{X}$ = zero spin with $m < 4.5$ GeV	LINKAGE=F49
[v] $1.5$ GeV $< m_X < 5.0$ GeV	LINKAGE=C49
[x] $201$ MeV $< M(\mu^+\mu^-) < 3565$ MeV	LINKAGE=D49
[y] $0.5$ GeV $< m_X < 9.0$ GeV, where $m_X$ is the invariant mass of the hadronic final state.	LINKAGE=I49
[z] Spectroscopic labeling for these states is theoretical, pending experimental information.	LINKAGE=MJ
[aa] $1.5$ GeV $< m_X < 5.0$ GeV	LINKAGE=C52
[bb] $1.5$ GeV $< m_X < 5.0$ GeV	LINKAGE=C48
[cc] For $m_{\tau^+\tau^-}$ in the ranges $4.03$ – $9.52$ and $9.61$ – $10.10$ GeV.	LINKAGE=MRG