

# STRANGE MESONS

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

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

**$K^\pm$**

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

Mass  $m = 493.677 \pm 0.016$  MeV [<sup>u</sup>] ( $S = 2.8$ )

Mean life  $\tau = (1.2384 \pm 0.0024) \times 10^{-8}$  s ( $S = 2.0$ )

$c\tau = 3.713$  m

**Slope parameter  $g$**  [<sup>v</sup>]

(See Particle Listings for quadratic coefficients)

$$K^+ \rightarrow \pi^+ \pi^+ \pi^- = -0.2154 \pm 0.0035 \quad (S = 1.4)$$

$$K^- \rightarrow \pi^- \pi^- \pi^+ = -0.217 \pm 0.007 \quad (S = 2.5)$$

$$K^\pm \rightarrow \pi^\pm \pi^0 \pi^0 = 0.652 \pm 0.031 \quad (S = 2.7)$$

**$K^\pm$  decay form factors** [<sup>a,w</sup>]

Assuming  $\mu$ - $e$  universality

$$\lambda_+(K_{\mu 3}^+) = \lambda_+(K_{e 3}^+) = 0.0282 \pm 0.0027 \quad (S = 1.5)$$

$$\lambda_0(K_{\mu 3}^+) = 0.013 \pm 0.005 \quad (S = 1.5)$$

Not assuming  $\mu$ - $e$  universality

$$\lambda_+(K_{e 3}^+) = 0.0278 \pm 0.0019$$

$$\lambda_+(K_{\mu 3}^+) = 0.033 \pm 0.010 \quad (S = 1.8)$$

$$\lambda_0(K_{\mu 3}^+) = 0.004 \pm 0.009 \quad (S = 1.8)$$

$$K_{e 3}^+ \quad |f_S/f_+| = 0.045 \pm 0.033 \quad (S = 1.8)$$

$$K_{e 3}^+ \quad |f_T/f_+| = 0.31 \pm 0.25 \quad (S = 2.4)$$

$$K_{\mu 3}^+ \quad |f_T/f_+| = 0.02 \pm 0.12$$

$$K^+ \rightarrow e^+ \nu_e \gamma \quad |F_A + F_V| = 0.148 \pm 0.010$$

$$K^+ \rightarrow \mu^+ \nu_\mu \gamma \quad |F_A + F_V| = 0.165 \pm 0.013$$

$$K^+ \rightarrow e^+ \nu_e \gamma \quad |F_A - F_V| < 0.49$$

$$K^+ \rightarrow \mu^+ \nu_\mu \gamma \quad |F_A - F_V|$$

$K^-$  modes are charge conjugates of the modes below.

<b><math>K^+</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
<b>Leptonic and semileptonic modes</b>			
$e^+ \nu_e$	( 1.55 $\pm$ 0.07 ) $\times 10^{-5}$		247
$\mu^+ \nu_\mu$	(63.43 $\pm$ 0.17 ) %	S=1.2	236
$\pi^0 e^+ \nu_e$	( 4.87 $\pm$ 0.06 ) %	S=1.2	228
Called $K_{e3}^+$ .			
$\pi^0 \mu^+ \nu_\mu$	( 3.27 $\pm$ 0.06 ) %	S=1.2	215
Called $K_{\mu3}^+$ .			
$\pi^0 \pi^0 e^+ \nu_e$	( 2.1 $\pm$ 0.4 ) $\times 10^{-5}$		206
$\pi^+ \pi^- e^+ \nu_e$	( 4.08 $\pm$ 0.09 ) $\times 10^{-5}$		203
$\pi^+ \pi^- \mu^+ \nu_\mu$	( 1.4 $\pm$ 0.9 ) $\times 10^{-5}$		151
$\pi^0 \pi^0 \pi^0 e^+ \nu_e$	< 3.5 $\times 10^{-6}$	CL=90%	135
<b>Hadronic modes</b>			
$\pi^+ \pi^0$	(21.13 $\pm$ 0.14 ) %	S=1.1	205
$\pi^+ \pi^0 \pi^0$	( 1.73 $\pm$ 0.04 ) %	S=1.2	133
$\pi^+ \pi^+ \pi^-$	( 5.576 $\pm$ 0.031 ) %	S=1.1	125
<b>Leptonic and semileptonic modes with photons</b>			
$\mu^+ \nu_\mu \gamma$	[x,y] ( 5.50 $\pm$ 0.28 ) $\times 10^{-3}$		236
$\pi^0 e^+ \nu_e \gamma$	[x,y] ( 2.65 $\pm$ 0.20 ) $\times 10^{-4}$		228
$\pi^0 e^+ \nu_e \gamma$ (SD)	[z] < 5.3 $\times 10^{-5}$	CL=90%	228
$\pi^0 \mu^+ \nu_\mu \gamma$	[x,y] < 6.1 $\times 10^{-5}$	CL=90%	215
$\pi^0 \pi^0 e^+ \nu_e \gamma$	< 5 $\times 10^{-6}$	CL=90%	206
<b>Hadronic modes with photons</b>			
$\pi^+ \pi^0 \gamma$	[x,y] ( 2.75 $\pm$ 0.15 ) $\times 10^{-4}$		205
$\pi^+ \pi^0 \gamma$ (DE)	[y,aa] ( 4.7 $\pm$ 0.9 ) $\times 10^{-6}$		205
$\pi^+ \pi^0 \pi^0 \gamma$	[x,y] ( 7.4 $^{+5.5}_{-2.9}$ ) $\times 10^{-6}$		133
$\pi^+ \pi^+ \pi^- \gamma$	[x,y] ( 1.04 $\pm$ 0.31 ) $\times 10^{-4}$		125
$\pi^+ \gamma \gamma$	[y] ( 1.10 $\pm$ 0.32 ) $\times 10^{-6}$		227
$\pi^+ 3\gamma$	[y] < 1.0 $\times 10^{-4}$	CL=90%	227
<b>Leptonic modes with <math>\ell\bar{\ell}</math> pairs</b>			
$e^+ \nu_e \nu\bar{\nu}$	< 6 $\times 10^{-5}$	CL=90%	247
$\mu^+ \nu_\mu \nu\bar{\nu}$	< 6.0 $\times 10^{-6}$	CL=90%	236
$e^+ \nu_e e^+ e^-$	( 3.1 $^{+3.1}_{-1.6}$ ) $\times 10^{-8}$		247
$\mu^+ \nu_\mu e^+ e^-$	( 1.3 $\pm$ 0.4 ) $\times 10^{-7}$		236
$e^+ \nu_e \mu^+ \mu^-$	< 5 $\times 10^{-7}$	CL=90%	—
$\mu^+ \nu_\mu \mu^+ \mu^-$	< 4.1 $\times 10^{-7}$	CL=90%	185

**Lepton Family number (LF), Lepton number (L),  $\Delta S = \Delta Q$  (SQ) violating modes, or  $\Delta S = 1$  weak neutral current (S1) modes**

$\pi^+ \pi^+ e^- \bar{\nu}_e$	SQ	< 1.2	$\times 10^{-8}$	CL=90%	203
$\pi^+ \pi^+ \mu^- \bar{\nu}_\mu$	SQ	< 3.0	$\times 10^{-6}$	CL=95%	151
$\pi^+ e^+ e^-$	S1	( 2.88 $\pm$ 0.13 )	$\times 10^{-7}$		227
$\pi^+ \mu^+ \mu^-$	S1	( 7.6 $\pm$ 2.1 )	$\times 10^{-8}$	S=3.4	172
$\pi^+ \nu \bar{\nu}$	S1	( 1.6 $\begin{smallmatrix} +1.8 \\ -0.8 \end{smallmatrix}$ )	$\times 10^{-10}$		227
$\pi^+ \pi^0 \nu \bar{\nu}$	S1	< 4.3	$\times 10^{-5}$	CL=90%	—
$\mu^- \nu e^+ e^+$	LF	< 2.0	$\times 10^{-8}$	CL=90%	236
$\mu^+ \nu_e$	LF	[d] < 4	$\times 10^{-3}$	CL=90%	236
$\pi^+ \mu^+ e^-$	LF	< 2.8	$\times 10^{-11}$	CL=90%	214
$\pi^+ \mu^- e^+$	LF	< 5.2	$\times 10^{-10}$	CL=90%	214
$\pi^- \mu^+ e^+$	L	< 5.0	$\times 10^{-10}$	CL=90%	214
$\pi^- e^+ e^+$	L	< 6.4	$\times 10^{-10}$	CL=90%	227
$\pi^- \mu^+ \mu^+$	L	[d] < 3.0	$\times 10^{-9}$	CL=90%	172
$\mu^+ \bar{\nu}_e$	L	[d] < 3.3	$\times 10^{-3}$	CL=90%	236
$\pi^0 e^+ \bar{\nu}_e$	L	< 3	$\times 10^{-3}$	CL=90%	228
$\pi^+ \gamma$	[bb]	< 3.6	$\times 10^{-7}$	CL=90%	—

**$K^0$**

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

50%  $K_S$ , 50%  $K_L$

Mass  $m = 497.672 \pm 0.031$  MeV

$m_{K^0} - m_{K^\pm} = 3.995 \pm 0.034$  MeV (S = 1.1)

$|m_{K^0} - m_{\bar{K}^0}| / m_{\text{average}} < 10^{-18}$ , CL = 90% [cc]

**T-violation parameters in  $K^0$ - $\bar{K}^0$  mixing** [w]

Asymmetry  $A_T$  in  $K^0$ - $\bar{K}^0$  mixing =  $(6.6 \pm 1.6) \times 10^{-3}$

**CPT-violation parameters in  $K^0$ - $\bar{K}^0$  mixing** [w]

Re  $\delta = (2.9 \pm 2.7) \times 10^{-4}$

Im  $\delta = (-0.8 \pm 3.1) \times 10^{-3}$



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

Mean life  $\tau = (0.8935 \pm 0.0008) \times 10^{-10}$  s    Assuming *CPT*  
 Mean life  $\tau = (0.8937 \pm 0.0012) \times 10^{-10}$  s    Not assuming *CPT*  
 $c\tau = 2.6786$  cm    Assuming *CPT*

**CP-violation parameters** [*dd*]

$\text{Im}(\eta_{+-0}) = -0.002 \pm 0.009$   
 $\text{Im}(\eta_{000}) = -0.05 \pm 0.13$

<b><math>K_S^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	<i>p</i> (MeV/c)
<b>Hadronic modes</b>			
$\pi^0 \pi^0$	$(31.40 \pm 0.27) \%$	S=1.2	209
$\pi^+ \pi^-$	$(68.60 \pm 0.27) \%$	S=1.2	206
$\pi^+ \pi^- \pi^0$	$(3.2 \begin{smallmatrix} +1.2 \\ -1.0 \end{smallmatrix}) \times 10^{-7}$		133
<b>Modes with photons or <math>l\bar{l}</math> pairs</b>			
$\pi^+ \pi^- \gamma$	[ <i>x, ee</i> ] $(1.78 \pm 0.05) \times 10^{-3}$		206
$\pi^+ \pi^- e^+ e^-$	$(4.5 \pm 0.8) \times 10^{-5}$		—
$\gamma\gamma$	$(2.5 \pm 0.4) \times 10^{-6}$		249
<b>Semileptonic modes</b>			
$\pi^\pm e^\mp \nu_e$	[ <i>ff</i> ] $(7.2 \pm 1.4) \times 10^{-4}$		229
<b>CP violating (CP) and <math>\Delta S = 1</math> weak neutral current (S1) modes</b>			
$3\pi^0$	<i>CP</i> < 1.4	$\times 10^{-5}$	CL=90% 139
$\mu^+ \mu^-$	<i>S1</i> < 3.2	$\times 10^{-7}$	CL=90% 225
$e^+ e^-$	<i>S1</i> < 1.4	$\times 10^{-7}$	CL=90% 249
$\pi^0 e^+ e^-$	<i>S1</i> < 1.4	$\times 10^{-7}$	CL=90% 231



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

$m_{K_L} - m_{K_S}$   
 $= (0.5303 \pm 0.0009) \times 10^{10} \hbar s^{-1}$     Assuming *CPT*  
 $= (3.490 \pm 0.006) \times 10^{-12}$  MeV    Assuming *CPT*  
 $= (0.5301 \pm 0.0016) \times 10^{10} \hbar s^{-1}$     Not assuming *CPT*  
 Mean life  $\tau = (5.17 \pm 0.04) \times 10^{-8}$  s    (S = 1.1)  
 $c\tau = 15.51$  m

**Slope parameter *g*** [*v*]

(See Particle Listings for quadratic coefficients)

$$K_L^0 \rightarrow \pi^+ \pi^- \pi^0 = 0.678 \pm 0.008 \quad (S = 1.5)$$

### $K_L$ decay form factors [w]

Assuming  $\mu$ - $e$  universality

$$\lambda_+(K_{\mu 3}^0) = \lambda_+(K_{e 3}^0) = 0.0300 \pm 0.0020 \quad (S = 2.0)$$

$$\lambda_0(K_{\mu 3}^0) = 0.030 \pm 0.005 \quad (S = 2.0)$$

Not assuming  $\mu$ - $e$  universality

$$\lambda_+(K_{e 3}^0) = 0.0291 \pm 0.0018 \quad (S = 1.5)$$

$$\lambda_+(K_{\mu 3}^0) = 0.033 \pm 0.005 \quad (S = 2.3)$$

$$\lambda_0(K_{\mu 3}^0) = 0.027 \pm 0.006 \quad (S = 2.3)$$

$$K_{e 3}^0 \quad |f_S/f_+| < 0.04, \text{ CL} = 68\%$$

$$K_{e 3}^0 \quad |f_T/f_+| < 0.23, \text{ CL} = 68\%$$

$$K_{\mu 3}^0 \quad |f_T/f_+| = 0.12 \pm 0.12$$

$$K_L \rightarrow e^+ e^- \gamma: \quad \alpha_{K^*} = -0.33 \pm 0.05$$

$$\alpha_{K^*} = -0.158 \pm 0.027$$

$$\alpha_{K^*}^{\text{eff}} = -0.14 \pm 0.22$$

$$a_V = -0.72 \pm 0.07$$

### $CP$ -violation parameters [dd]

$$\delta_L = (0.327 \pm 0.012)\%$$

$$|\eta_{00}| = (2.274 \pm 0.017) \times 10^{-3}$$

$$|\eta_{+-}| = (2.286 \pm 0.017) \times 10^{-3}$$

$$|\eta_{00}/\eta_{+-}| = 0.9946 \pm 0.0013 \text{ [gg]} \quad (S = 2.3)$$

$$\text{Re}(\epsilon'/\epsilon) = (1.8 \pm 0.4) \times 10^{-3} \text{ [gg]} \quad (S = 2.3)$$

Assuming  $CPT$

$$\phi_{+-} = \phi_{00} = (43.51 \pm 0.06)^\circ$$

Not assuming *CPT*

$$\phi_{+-} = (43.4 \pm 0.7)^\circ$$

$$\phi_{00} = (43.2 \pm 1.0)^\circ$$

$$\phi_{00} - \phi_{+-} = (-0.1 \pm 0.8)^\circ$$

$$CP \text{ asymmetry } A \text{ in } K_L^0 \rightarrow \pi^+ \pi^- e^+ e^- = (13.6 \pm 2.8)\%$$

$$\beta_{CP} \text{ from } K_L \rightarrow e^+ e^- e^+ e^- = -0.23 \pm 0.09$$

$$\gamma_{CP} \text{ from } K_L^0 \rightarrow e^+ e^- e^+ e^- = -0.09 \pm 0.09$$

$$j \text{ for } K_L^0 \rightarrow \pi^+ \pi^- \pi^0 = 0.0011 \pm 0.0008$$

$$f \text{ for } K_L^0 \rightarrow \pi^+ \pi^- \pi^0 = 0.004 \pm 0.006$$

$$|\eta_{+-\gamma}| = (2.35 \pm 0.07) \times 10^{-3}$$

$$\phi_{+-\gamma} = (44 \pm 4)^\circ$$

$$|\epsilon'_{+-\gamma}|/\epsilon < 0.3, \text{ CL} = 90\%$$

### $\Delta S = -\Delta Q$ in $K_{L3}^0$ decay

$$\text{Re } x = -0.002 \pm 0.006$$

$$\text{Im } x = 0.0012 \pm 0.0021$$

$K_L^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
<b>Semileptonic modes</b>			
$\pi^\pm e^\mp \nu_e$ Called $K_{e3}^0$ .	[ff] (38.79 $\pm$ 0.27 ) %	S=1.1	229
$\pi^\pm \mu^\mp \nu_\mu$ Called $K_{\mu3}^0$ .	[ff] (27.18 $\pm$ 0.25 ) %	S=1.1	216
$(\pi \mu \text{ atom}) \nu$	( 1.06 $\pm$ 0.11 ) $\times 10^{-7}$		188
$\pi^0 \pi^\pm e^\mp \nu$	[ff] ( 5.18 $\pm$ 0.29 ) $\times 10^{-5}$		207
<b>Hadronic modes, including Charge conjugation <math>\times</math> Parity Violating (CPV) modes</b>			
$3\pi^0$	(21.08 $\pm$ 0.27 ) %	S=1.1	139
$\pi^+ \pi^- \pi^0$	(12.58 $\pm$ 0.19 ) %	S=1.7	133
$\pi^+ \pi^-$	CPV ( 2.084 $\pm$ 0.032 ) $\times 10^{-3}$	S=1.1	206
$\pi^0 \pi^0$	CPV ( 9.42 $\pm$ 0.19 ) $\times 10^{-4}$	S=1.1	209
<b>Semileptonic modes with photons</b>			
$\pi^\pm e^\mp \nu_e \gamma$	[x,ff,hh] ( 3.53 $\pm$ 0.06 ) $\times 10^{-3}$		229
$\pi^\pm \mu^\mp \nu_\mu \gamma$	( 5.7 $\begin{smallmatrix} +0.6 \\ -0.7 \end{smallmatrix}$ ) $\times 10^{-4}$		—

**Hadronic modes with photons or  $l\bar{l}$  pairs**

$\pi^0\pi^0\gamma$	$< 5.6 \times 10^{-6}$	209
$\pi^+\pi^-\gamma$	$[x, hh] (4.38 \pm 0.13) \times 10^{-5}$	S=1.8 206
$\pi^0 2\gamma$	$[hh] (1.68 \pm 0.10) \times 10^{-6}$	231
$\pi^0\gamma e^+e^-$	$(2.3 \pm 0.4) \times 10^{-8}$	—

**Other modes with photons or  $l\bar{l}$  pairs**

$2\gamma$	$(5.96 \pm 0.15) \times 10^{-4}$	249
$3\gamma$	$< 2.4 \times 10^{-7}$	CL=90% 249
$e^+e^-\gamma$	$(10.0 \pm 0.5) \times 10^{-6}$	S=1.5 249
$\mu^+\mu^-\gamma$	$(3.59 \pm 0.11) \times 10^{-7}$	S=1.3 225
$e^+e^-\gamma\gamma$	$[hh] (5.95 \pm 0.33) \times 10^{-7}$	249
$\mu^+\mu^-\gamma\gamma$	$[hh] (1.0 \pm_{-0.6}^{+0.8}) \times 10^{-8}$	—

**Charge conjugation  $\times$  Parity ( $CP$ ) or Lepton Family number ( $LF$ ) violating modes, or  $\Delta S = 1$  weak neutral current ( $S1$ ) modes**

$\mu^+\mu^-$	$S1 (7.25 \pm 0.16) \times 10^{-9}$	225
$e^+e^-$	$S1 (9 \pm_{-4}^{+6}) \times 10^{-12}$	249
$\pi^+\pi^-e^+e^-$	$S1 [hh] (3.5 \pm 0.6) \times 10^{-7}$	206
$\mu^+\mu^-e^+e^-$	$S1 (2.6 \pm 0.4) \times 10^{-9}$	225
$e^+e^-e^+e^-$	$S1 (3.75 \pm 0.27) \times 10^{-8}$	249
$\pi^0\mu^+\mu^-$	$CP, S1 [ii] < 3.8 \times 10^{-10}$	CL=90% 177
$\pi^0e^+e^-$	$CP, S1 [ii] < 5.1 \times 10^{-10}$	CL=90% 231
$\pi^0\nu\bar{\nu}$	$CP, S1 [jj] < 5.9 \times 10^{-7}$	CL=90% 231
$e^\pm\mu^\mp$	$LF [ff] < 4.7 \times 10^{-12}$	CL=90% 238
$e^\pm e^\pm\mu^\mp\mu^\mp$	$LF [ff] < 1.23 \times 10^{-10}$	CL=90% —
$\pi^0\mu^\pm e^\mp$	$LF [ff] < 6.2 \times 10^{-9}$	CL=90% —

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

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

$K^*(892)^\pm$  mass  $m = 891.66 \pm 0.26$  MeV

$K^*(892)^0$  mass  $m = 896.10 \pm 0.27$  MeV (S = 1.4)

$K^*(892)^\pm$  full width  $\Gamma = 50.8 \pm 0.9$  MeV

$K^*(892)^0$  full width  $\Gamma = 50.7 \pm 0.6$  MeV (S = 1.1)

<b><math>K^*(892)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$\frac{p}{\text{MeV/c}}$
$K\pi$	$\sim 100$	%	291
$K^0\gamma$	$(2.30 \pm 0.20) \times 10^{-3}$		310
$K^\pm\gamma$	$(9.9 \pm 0.9) \times 10^{-4}$		309
$K\pi\pi$	$< 7 \times 10^{-4}$	95%	224

## **$K_1(1270)$**

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

Mass  $m = 1273 \pm 7$  MeV [ $m$ ]

Full width  $\Gamma = 90 \pm 20$  MeV [ $m$ ]

<b><math>K_1(1270)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\rho$	(42 $\pm$ 6 ) %	76
$K_0^*(1430)\pi$	(28 $\pm$ 4 ) %	—
$K^*(892)\pi$	(16 $\pm$ 5 ) %	301
$K\omega$	(11.0 $\pm$ 2.0) %	—
$Kf_0(1370)$	( 3.0 $\pm$ 2.0) %	—

## **$K_1(1400)$**

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

Mass  $m = 1402 \pm 7$  MeV

Full width  $\Gamma = 174 \pm 13$  MeV ( $S = 1.6$ )

<b><math>K_1(1400)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K^*(892)\pi$	(94 $\pm$ 6 ) %	401
$K\rho$	( 3.0 $\pm$ 3.0) %	298
$Kf_0(1370)$	( 2.0 $\pm$ 2.0) %	—
$K\omega$	( 1.0 $\pm$ 1.0) %	285
$K_0^*(1430)\pi$	not seen	—

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

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

Mass  $m = 1414 \pm 15$  MeV ( $S = 1.3$ )

Full width  $\Gamma = 232 \pm 21$  MeV ( $S = 1.1$ )

<b><math>K^*(1410)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$K^*(892)\pi$	> 40 %	95%	408
$K\pi$	( 6.6 $\pm$ 1.3) %		611
$K\rho$	< 7 %	95%	309



**$K_0^*(1430)$  <sup>[kk]</sup>**

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

Mass  $m = 1412 \pm 6$  MeV

Full width  $\Gamma = 294 \pm 23$  MeV

<b><math>K_0^*(1430)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	(93±10) %	621

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

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

$K_2^*(1430)^\pm$  mass  $m = 1425.6 \pm 1.5$  MeV (S = 1.1)

$K_2^*(1430)^0$  mass  $m = 1432.4 \pm 1.3$  MeV

$K_2^*(1430)^\pm$  full width  $\Gamma = 98.5 \pm 2.7$  MeV (S = 1.1)

$K_2^*(1430)^0$  full width  $\Gamma = 109 \pm 5$  MeV (S = 1.9)

<b><math>K_2^*(1430)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$K\pi$	(49.9±1.2) %		622
$K^*(892)\pi$	(24.7±1.5) %		423
$K^*(892)\pi\pi$	(13.4±2.2) %		375
$K\rho$	( 8.7±0.8) %	S=1.2	331
$K\omega$	( 2.9±0.8) %		319
$K^+\gamma$	( 2.4±0.5) × 10 <sup>-3</sup>	S=1.1	627
$K\eta$	( 1.5 <sup>+3.4</sup> <sub>-1.0</sub> ) × 10 <sup>-3</sup>	S=1.3	492
$K\omega\pi$	< 7.2 × 10 <sup>-4</sup>	CL=95%	110
$K^0\gamma$	< 9 × 10 <sup>-4</sup>	CL=90%	631

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

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

Mass  $m = 1717 \pm 27$  MeV (S = 1.4)

Full width  $\Gamma = 322 \pm 110$  MeV (S = 4.2)

<b><math>K^*(1680)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	(38.7±2.5) %	779
$K\rho$	(31.4 <sup>+4.7</sup> <sub>-2.1</sub> ) %	571
$K^*(892)\pi$	(29.9 <sup>+2.2</sup> <sub>-4.7</sub> ) %	615

**$K_2(1770)$  <sup>[1]</sup>**

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

Mass  $m = 1773 \pm 8$  MeV

Full width  $\Gamma = 186 \pm 14$  MeV

<b><math>K_2(1770)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi\pi$		—
$K_2^*(1430)\pi$	dominant	287
$K^*(892)\pi$	seen	653
$Kf_2(1270)$	seen	—
$K\phi$	seen	441
$K\omega$	seen	608

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

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

Mass  $m = 1776 \pm 7$  MeV ( $S = 1.1$ )

Full width  $\Gamma = 159 \pm 21$  MeV ( $S = 1.3$ )

<b><math>K_3^*(1780)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$K\rho$	(31 ± 9) %		612
$K^*(892)\pi$	(20 ± 5) %		651
$K\pi$	(18.8 ± 1.0) %		810
$K\eta$	(30 ± 13) %		715
$K_2^*(1430)\pi$	< 16 %	95%	284

**$K_2(1820)$  <sup>[mm]</sup>**

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

Mass  $m = 1816 \pm 13$  MeV

Full width  $\Gamma = 276 \pm 35$  MeV

<b><math>K_2(1820)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K_2^*(1430)\pi$	seen	325
$K^*(892)\pi$	seen	680
$Kf_2(1270)$	seen	186
$K\omega$	seen	638

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

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

Mass  $m = 2045 \pm 9$  MeV (S = 1.1)

Full width  $\Gamma = 198 \pm 30$  MeV

<b><math>K_4^*(2045)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$K\pi$	(9.9±1.2) %	958
$K^*(892)\pi\pi$	(9 ±5 ) %	800
$K^*(892)\pi\pi\pi$	(7 ±5 ) %	764
$\rho K\pi$	(5.7±3.2) %	742
$\omega K\pi$	(5.0±3.0) %	736
$\phi K\pi$	(2.8±1.4) %	591
$\phi K^*(892)$	(1.4±0.7) %	363