Review of Particle Physics: C. Caso *et al.* (Particle Data Group), European Physical Journal **C3**, 1 (1998)

$\Sigma(2250)$

$I(J^P) = 1(?^?)$ Status: $*\!*\!*$

Results from partial-wave analyses are too weak to warrant separating them from the production and cross-section experiments. LASINSKI 71 in $\overline{K}N$ using a Pomeron + resonances model, and DEBELLEFON 76, DEBELLEFON 77, and DEBELLEFON 78 in energy-dependent partial-wave analyses of $\overline{K}N \rightarrow \Lambda\pi$, $\Sigma\pi$, and $N\overline{K}$, respectively, suggest two resonances around this mass.

$\Sigma(2250)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2210 to 2280 (≈ 2250) OUR ESTIMATE				
2270 ± 50	DEBELLEFON	78	DPWA	D_5 wave
2210 ± 30	DEBELLEFON	78	DPWA	G_9 wave
2275 ± 20	DEBELLEFON	77	DPWA	D_5 wave
2215 ± 20	DEBELLEFON	77	DPWA	G_9 wave
2300 ± 30	[1] DEBELLEFON	75B	HBC	$K^- p \rightarrow \Xi^{*0} K^0$
2251^{+30}_{-20}	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$, F_5 wave
2280 ± 14	AGUILAR-...	70B	HBC	$K^- p$ 3.9, 4.6 GeV/c
2237 ± 11	BRICMAN	70	CNTR	Total, charge exchange
2255 ± 10	COOL	70	CNTR	$K^- p$, $K^- d$ total
2250 ± 7	BUGG	68	CNTR	$K^- p$, $K^- d$ total
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2260	DEBELLEFON	76	IPWA	D_5 wave
2215	DEBELLEFON	76	IPWA	G_9 wave
2250 ± 20	LU	70	CNTR	$\gamma p \rightarrow K^+ Y^*$
2245	BLANPIED	65	CNTR	$\gamma p \rightarrow K^+ Y^*$
2299 ± 6	BOCK	65	HBC	$\overline{p} p$ 5.7 GeV/c

$\Sigma(2250)$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
60 to 150 (≈ 100) OUR ESTIMATE				
120 ± 40	DEBELLEFON	78	DPWA	D_5 wave
80 ± 20	DEBELLEFON	78	DPWA	G_9 wave
70 ± 20	DEBELLEFON	77	DPWA	D_5 wave
60 ± 20	DEBELLEFON	77	DPWA	G_9 wave
130 ± 20	[1] DEBELLEFON	75B	HBC	$K^- p \rightarrow \Xi^{*0} K^0$
192 ± 30	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$, F_5 wave
100 ± 20	AGUILAR-...	70B	HBC	$K^- p$ 3.9, 4.6 GeV/c
164 ± 50	BRICMAN	70	CNTR	Total, charge exchange
230 ± 20	BUGG	68	CNTR	$K^- p$, $K^- d$ total

• • • We do not use the following data for averages, fits, limits, etc. • • •

100	DEBELLEFON	76	IPWA	D_5 wave
140	DEBELLEFON	76	IPWA	G_9 wave
170	COOL	70	CNTR	$K^- p$, $K^- d$ total
125	LU	70	CNTR	$\gamma p \rightarrow K^+ Y^*$
150	BLANPIED	65	CNTR	$\gamma p \rightarrow K^+ Y^*$
21^{+17}_{-21}	BOCK	65	HBC	$\overline{p} p$ 5.7 GeV/c

$\Sigma(2250)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\overline{K}$	<10 %
Γ_2	$\Lambda\pi$	seen
Γ_3	$\Sigma\pi$	seen
Γ_4	$N\overline{K}\pi$	
Γ_5	$\Xi(1530)K$	

The above branching fractions are our estimates, not fits or averages.

$\Sigma(2250)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

$\Gamma(N\overline{K})/\Gamma_{\text{total}}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
<0.1 OUR ESTIMATE				
0.08±0.02	DEBELLEFON	78	DPWA	D_5 wave
0.02±0.01	DEBELLEFON	78	DPWA	G_9 wave

$(J+\frac{1}{2})\times\Gamma(N\overline{K})/\Gamma_{\text{total}}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.16±0.12	BRICMAN	70	CNTR	Total, charge exchange
0.42	COOL	70	CNTR	$K^- p$, $K^- d$ total
0.47	BUGG	68	CNTR	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\overline{K} \rightarrow \Sigma(2250) \rightarrow \Lambda\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.16±0.03	VANHORN	75	DPWA	$K^- p \rightarrow \Lambda\pi^0$, F_5 wave
• • • We do not use the following data for averages, fits, limits, etc. • • •				
+0.11	DEBELLEFON	76	IPWA	D_5 wave
−0.10	DEBELLEFON	76	IPWA	G_9 wave
−0.18	BARBARO-...	70	DPWA	$K^- p \rightarrow \Lambda\pi^0$, G_9 wave

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2250) \rightarrow \Sigma\pi$ — $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.06\pm0.02$	DEBELLEFON	77	DPWA	D_5 wave
-0.03 ± 0.02	DEBELLEFON	77	DPWA	G_9 wave
$+0.07$	BARBARO-...	70	DPWA	$K^- p \rightarrow \Sigma\pi$, G_9 wave

$\Gamma(N\overline{K})/\Gamma(\Sigma\pi)$ — Γ_1/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.18	BARNES	69	HBC	1 standard dev. limit

$\Gamma(\Lambda\pi)/\Gamma(\Sigma\pi)$ — Γ_2/Γ_3

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.18	BARNES	69	HBC	1 standard dev. limit

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2250) \rightarrow \Xi(1530)K$ — $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.18 ± 0.04	[1] DEBELLEFON	75B	HBC	$K^- p \rightarrow \Xi^{*0} K^0$

$\Sigma(2250)$ FOOTNOTES

[1] Seen in the (initial and final state) D_5 wave. Isospin not determined.

$\Sigma(2250)$ REFERENCES

DEBELLEFON	78	NC 42A 403	De Bellefon, Berthon, Billoir+	(CDEF, SACL) IJP
DEBELLEFON	77	NC 37A 175	De Bellefon, Berthon, Billoir+	(CDEF, SACL) IJP
DEBELLEFON	76	NP B109 129	De Bellefon, Berthon	(CDEF) IJP
Also	75	NP B90 1	De Bellefon, Berthon, Brunet+	(CDEF, SACL) IJP
DEBELLEFON	75B	NC 28A 289	De Bellefon, Berthon, Billoir+	(CDEF, SACL)
VANHORN	75	NP B87 145		(LBL) IJP
Also	75B	NP B87 157	VanHorn	(LBL) IJP
LASINSKI	71	NP B29 125		(EFI) IJP
AGUILAR-...	70B	PRL 25 58	Aguilar-Benitez, Barnes, Bassano+	(BNL, SYRA)
BARBARO-...	70	Duke Conf. 173	Barbaro-Galtieri	(LRL) IJP
BRICMAN	70	PL 31B 152	+Ferro-Luzzi, Perreau+	(CERN, CAEN, SACL)
COOL	70	PR D1 1887	+Giacomelli, Kycia, Leontic, Li+	(BNL) I
Also	66	PRL 16 1228	Cool, Giacomelli, Kycia, Leontic, Lundby+	(BNL) I
LU	70	PR D2 1846	+Greenberg, Hughes, Minehart, Mori+	(YALE)
BARNES	69	PRL 22 479	+Flaminio, Montanet, Samios+	(BNL, SYRA)
BUGG	68	PR 168 1466	+Gilmore, Knight+	(RHEL, BIRM, CAVE) I
BLANPIED	65	PRL 14 741	+Greenberg, Hughes, Kitching, Lu+	(YALE, CEA)
BOCK	65	PL 17 166	+Cooper, French, Kinson+	(CERN, SACL)