$a_1(1260)$

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

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$a_1(1260)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
1230±40 OUR ESTIMATE						
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1203± 3		[1] GOMEZ-DUMM	04	RVUE		$\tau^+ \to \pi^+\pi^+\pi^-\nu_\tau$
1331±10± 3	37k	[2] ASNER	00	CLE2		10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$
1255± 7± 6	5904	[3] ABREU	98G	DLPH		e^+e^-
1207± 5± 8	5904	[4] ABREU	98G	DLPH		e^+e^-
1196± 4± 5	5904	[5,6] ABREU	98G	DLPH		e^+e^-
1240±10		BARBERIS	98B			450 $pp \to p_f\pi^+\pi^-\pi^0 p_s$
1262± 9± 7		[3,7] ACKERSTAFF	97R	OPAL		E^{ee}_{cm}= 88–94, $\tau \to 3\pi\nu$
1210± 7± 2		[4,7] ACKERSTAFF	97R	OPAL		E^{ee}_{cm}= 88–94, $\tau \to 3\pi\nu$
1211± 7^{+50}_{-0}		[4] ALBRECHT	93C	ARG		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1121± 8		[8] ANDO	92	SPEC		8 $\pi^-p \to \pi^+\pi^-\pi^0 n$
1242±37		[9] IVANOV	91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
1260±14		[10] IVANOV	91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
1250± 9		[11] IVANOV	91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
1208±15		ARMSTRONG	90	OMEG	0	300.0$pp \to pp\pi^+\pi^-\pi^0$
1220±15		[12] ISGUR	89	RVUE		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1260±25		[13] BOWLER	88	RVUE		
1166±18±11		BAND	87	MAC		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1164±41±23		BAND	87	MAC		$\tau^+ \to \pi^+\pi^0\pi^0\nu$
1250±40		[12] TORNQVIST	87	RVUE		
1046±11		ALBRECHT	86B	ARG		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1056±20±15		RUCKSTUHL	86	DLCO		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1194±14±10		SCHMIDKE	86	MRK2		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
1255±23		BELLINI	85	SPEC		40 $\pi^-A \to \pi^-\pi^+\pi^-A$
1240±80		[14] DANKOWY...	81	SPEC	0	8.45 $\pi^-p \to n3\pi$
1280±30		[14] DAUM	81B	CNTR		63,94 $\pi^-p \to p3\pi$
1041±13		[15] GAVILLET	77	HBC	+	4.2 $K^-p \to \Sigma 3\pi$

[1] Using the data of BARATE 98R.
[2] From a fit to the 3π mass spectrum including the $K\overline{K}^*(892)$ threshold.
[3] Uses the model of KUHN 90.
[4] Uses the model of ISGUR 89.
[5] Includes the effect of a possible a_1' state.
[6] Uses the model of FEINDT 90.

[7] Supersedes AKERS 95P.
[8] Average and spread of values using 2 variants of the model of BOWLER 75.
[9] Reanalysis of RUCKSTUHL 86.
[10] Reanalysis of SCHMIDKE 86.
[11] Reanalysis of ALBRECHT 86B.
[12] From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
[13] From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
[14] Uses the model of BOWLER 75.
[15] Produced in K^- backward scattering.

a_1(1260) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
250 to 600 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
480±20		[16] GOMEZ-DUMM 04	RVUE		$\tau^+ \to \pi^+\pi^+\pi^-\nu_\tau$
460±85	205	[17] DRUTSKOY 02	BELL		$B \to D^{(*)} K^- K^{*0}$
814±36±13	37k	[18] ASNER 00	CLE2		10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$
450±50	22k	[19] AKHMETSHIN 99E	CMD2		1.05–1.38 $e^+e^- \to \pi^+\pi^-\pi^0\pi^0$
570±10		[20] BONDAR 99	RVUE		$e^+e^- \to 4\pi$, $\tau \to 3\pi\nu_\tau$
587±27±21	5904	[21] ABREU 98G	DLPH		e^+e^-
478±3±15	5904	[22] ABREU 98G	DLPH		e^+e^-
425±14±8	5904	[23,24] ABREU 98G	DLPH		e^+e^-
400±35		BARBERIS 98B			450 $pp \to p_f\pi^+\pi^-\pi^0 p_s$
621±32±58		[21,25] ACKERSTAFF 97R	OPAL		E^{ee}_{cm}= 88–94, $\tau \to 3\pi\nu$
457±15±17		[22,25] ACKERSTAFF 97R	OPAL		E^{ee}_{cm}= 88–94, $\tau \to 3\pi\nu$
$446\pm21^{+140}_{-0}$		[22] ALBRECHT 93C	ARG		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
239±11		ANDO 92	SPEC		8 $\pi^-p \to \pi^+\pi^-\pi^0 n$
266±13±4		[26] ANDO 92	SPEC		8 $\pi^-p \to \pi^+\pi^-\pi^0 n$
465^{+228}_{-143}		[27] IVANOV 91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
298^{+40}_{-34}		[28] IVANOV 91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
488±32		[29] IVANOV 91	RVUE		$\tau \to \pi^+\pi^+\pi^-\nu$
430±50		ARMSTRONG 90	OMEG	0	300.0$pp \to pp\pi^+\pi^-\pi^0$
420±40		[30] ISGUR 89	RVUE		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
396±43		[31] BOWLER 88	RVUE		
405±75±25		BAND 87	MAC		$\tau^+ \to \pi^+\pi^+\pi^-\nu$
419±108±57		BAND 87	MAC		$\tau^+ \to \pi^+\pi^0\pi^0\nu$
521±27		ALBRECHT 86B	ARG		$\tau^+ \to \pi^+\pi^+\pi^-\nu$

$476^{+132}_{-120}\pm 54$		RUCKSTUHL	86	DLCO		$\tau^+ \rightarrow \pi^+\pi^+\pi^-\nu$
$462\pm 56\pm 30$		SCHMIDKE	86	MRK2		$\tau^+ \rightarrow \pi^+\pi^+\pi^-\nu$
292 ± 40		BELLINI	85	SPEC		$40\ \pi^- A \rightarrow \pi^-\pi^+\pi^- A$
380 ± 100	[32]	DANKOWY...	81	SPEC	0	$8.45\ \pi^- p \rightarrow n 3\pi$
300 ± 50	[32]	DAUM	81B	CNTR		$63,94\ \pi^- p \rightarrow p 3\pi$
230 ± 50	[33]	GAVILLET	77	HBC	+	$4.2\ K^- p \rightarrow \Sigma 3\pi$

[16] Using the data of BARATE 98R.
[17] From a fit of the $K^- K^{*0}$ distribution assuming m_{a_1}= 1230 MeV and purely resonant production of the $K^- K^{*0}$ system.
[18] From a fit to the 3π mass spectrum including the $K\overline{K}^*(892)$ threshold.
[19] Using the $a_1(1260)$ mass of 1230 MeV.
[20] From AKHMETSHIN 99E and ASNER 00 data using the $a_1(1260)$ mass of 1230 MeV.
[21] Uses the model of KUHN 90.
[22] Uses the model of ISGUR 89.
[23] Includes the effect of a possible a_1' state.
[24] Uses the model of FEINDT 90.
[25] Supersedes AKERS 95P.
[26] Average and spread of values using 2 variants of the model of BOWLER 75.
[27] Reanalysis of RUCKSTUHL 86.
[28] Reanalysis of SCHMIDKE 86.
[29] Reanalysis of ALBRECHT 86B.
[30] From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
[31] From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
[32] Uses the model of BOWLER 75.
[33] Produced in K^- backward scattering.

$a_1(1260)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\pi^+\pi^-\pi^0$	
Γ_2	$\pi^0\pi^0\pi^0$	
Γ_3	$(\rho\pi)_{S-\text{wave}}$	seen
Γ_4	$(\rho\pi)_{D-\text{wave}}$	seen
Γ_5	$(\rho(1450)\pi)_{S-\text{wave}}$	seen
Γ_6	$(\rho(1450)\pi)_{D-\text{wave}}$	seen
Γ_7	$\sigma\pi$	seen
Γ_8	$f_0(980)\pi$	not seen
Γ_9	$f_0(1370)\pi$	seen
Γ_{10}	$f_2(1270)\pi$	seen
Γ_{11}	$K\overline{K}^*(892)$+ c.c.	seen
Γ_{12}	$\pi\gamma$	seen

$a_1(1260)$ PARTIAL WIDTHS

$\Gamma(\pi\gamma)$ — Γ_{12}

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
640±246	ZIELINSKI	84C	SPEC	$200\ \pi^+ Z \to Z 3\pi$

D-wave/S-wave AMPLITUDE RATIO IN DECAY OF $a_1(1260) \to \rho\pi$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.108±0.016 OUR AVERAGE				
−0.14 ±0.04 ±0.07	[36] CHUNG	02	B852	$18.3\ \pi^- p \to \pi^+\pi^-\pi^- p$
−0.10 ±0.02 ±0.02	[34,35] ACKERSTAFF	97R	OPAL	E^{ee}_{cm}= 88–94, $\tau \to 3\pi\nu$
−0.11 ±0.02	[34] ALBRECHT	93C	ARG	$\tau^+ \to \pi^+\pi^+\pi^-\nu$

[34] Uses the model of ISGUR 89.
[35] Supersedes AKERS 95P.
[36] Deck-type background not subtracted.

$a_1(1260)$ BRANCHING RATIOS

$\Gamma((\rho\pi)_{S-wave})/\Gamma_{total}$ — Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
60.19	37k	[37] ASNER	00	CLE2	$10.6\ e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma((\rho\pi)_{D-wave})/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.30±0.60±0.22	37k	[37] ASNER	00	CLE2	$10.6\ e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma((\rho(1450)\pi)_{S-wave})/\Gamma_{total}$ — Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.56±0.84±0.32	37k	[37,38] ASNER	00	CLE2	$10.6\ e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma((\rho(1450)\pi)_{D-wave})/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.04±1.20±0.28	37k	[37,38] ASNER	00	CLE2	$10.6\ e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma(\sigma\pi)/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		CHUNG	02	B852	18.3 $\pi^- p \to \pi^+\pi^-\pi^- p$
18.76±4.29±1.48	37k	[37,39] ASNER	00	CLE2	10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma(f_0(980)\pi)/\Gamma_{total}$ — Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen	37k	ASNER	00	CLE2	10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma(f_0(1370)\pi)/\Gamma_{total}$ — Γ_9/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.40±2.71±1.26	37k	[37,40] ASNER	00	CLE2	10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma(f_2(1270)\pi)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.19±0.49±0.17	37k	[37,41] ASNER	00	CLE2	10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.2±0.5	2255	[42] COAN	04	CLEO	$\tau^- \to K^-\pi^-K^+\nu_\tau$
8 to 15	205	[43] DRUTSKOY	02	BELL	$B \to D^{(*)}K^-K^{*0}$
3.3±0.5±0.1	37k	[44] ASNER	00	CLE2	10.6 $e^+e^- \to \tau^+\tau^-$, $\tau^- \to \pi^-\pi^0\pi^0\nu_\tau$
2.6±0.3		[45] BARATE	99R	ALEP	$\tau \to K\overline{K}\pi\nu_\tau$

$\Gamma(\sigma\pi)/\Gamma((\rho\pi)_{S-wave})$ — Γ_7/Γ_3

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 0.3	28k	AKHMETSHIN	99E	CMD2	1.05–1.38 $e^+e^- \to \pi^+\pi^-\pi^+\pi^-$
0.003±0.003		[46] LONGACRE	82	RVUE	

$\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID		COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.008	90	[47] BARBERIS	01	450 $pp \to p_f 3\pi^0 p_s$

[37] From a fit to the Dalitz plot.
[38] Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.
[39] Assuming for σ mass and width of 860 and 880 MeV respectively.
[40] Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively.
[41] Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively.
[42] Using structure functions from KUHN 92 and DECKER 93A and B($\tau^- \to K^-\pi^-K^+\nu_\tau$) = (0.155 ± 0.006 ± 0.009)% from BRIERE 03.
[43] From a comparison to ALAM 94 assuming purely resonant production of the K^-K^{*0} system.
[44] From a fit to the 3π mass spectrum including the $K\overline{K}^*(892)$ threshold.
[45] Assuming $a_1(1260)$ dominance and taking B($\tau \to a_1(1260)\nu_\tau$) from BUSKULIC 96.
[46] Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVILLET 77, DAUM 80, and DANKOWYCH 81.
[47] Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.

$a_1(1260)$ REFERENCES

COAN	04	PRL 92 232001	T.E. Coan et al.	(CLEO Collab.)
GOMEZ-DUMM	04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
BRIERE	03	PRL 90 181802	R. A. Briere et al.	(CLEO Collab.)
CHUNG	02	PR D65 072001	S.U. Chung et al.	(BNL E852 Collab.)
DRUTSKOY	02	PL B542 171	A. Drutskoy et al.	(BELLE Collab.)
BARBERIS	01	PL B507 14	D. Barberis et al.	
ASNER	00	PR D61 012002	D.M. Asner et al.	(CLEO Collab.)
AKHMETSHIN	99E	PL B466 392	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)
BARATE	99R	EPJ C11 599	R. Barate et al.	(ALEPH Collab.)
BONDAR	99	PL B466 403	A.E. Bondar et al.	(Novosibirsk CMD-2 Collab.)
ABREU	98G	PL B426 411	P. Abreu et al.	(DELPHI Collab.)
BARATE	98R	EPJ C4 409	R. Barate et al.	(ALEPH Collab.)
BARBERIS	98B	PL B422 399	D. Barberis et al.	(WA 102 Collab.)
ACKERSTAFF	97R	ZPHY C75 593	K. Ackerstaff et al.	(OPAL Collab.)
BUSKULIC	96	ZPHY C70 579	D. Buskulic et al.	(ALEPH Collab.)
AKERS	95P	ZPHY C67 45	R. Akers et al.	(OPAL Collab.)
ALAM	94	PR D50 43	M.S. Alam et al.	(CLEO Collab.)
ALBRECHT	93C	ZPHY C58 61	H. Albrecht et al.	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker et al.	
ANDO	92	PL B291 496	A. Ando et al.	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn et al.	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band et al.	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht et al.	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl et al.	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke et al.	(Mark II Collab.)
BELLINI	85	SJNP 41 781 Translated from YAF 41 1223.	D. Bellini et al.	
ZIELINSKI	84C	PRL 52 1195	M. Zielinski et al.	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 83	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. Dankowych et al.	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum et al.	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum et al.	(AMST, CERN, CRAC, MPIM+) JP
GAVILLET	77	PL 69B 119	P. Gavillet et al.	(AMST, CERN, NIJM+) JP
BOWLER	75	NP B97 227	M.G. Bowler et al.	(OXFTP, DARE)

OTHER RELATED PAPERS

DZIERBA	06	PR D73 072001	A.R. Dzierba *et al.*	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker *et al.*	
CHUNG	02	PR D65 072001	S.U. Chung *et al.*	(BNL E852 Collab.)
FEUILLAT	01	PL B501 37	M. Feuillat, J.L. Lucio, M.J. Pestieau	
MOLCHANOV	01	PL B521 171	V.V. Molchanov *et al.*	(FNAL SELEX Collab.)
BAKER	99	PL B449 114	C.A. Baker *et al.*	
ZAIMIDOROGA	99	PAN 30 1	O.A. Zaimidoroga	
		Translated from SJPN 30 5.		
BARNES	97	PR D55 4157	T. Barnes *et al.*	(ORNL, RAL, MCHS)
AMELIN	95B	PL B356 595	D.V. Amelin *et al.*	(SERP, TBIL)
BOLONKIN	95	PAN 58 1535	B.V. Bolonkin *et al.*	(ITEP)
		Translated from YAF 58 1628.		
WINGATE	95	PRL 74 4596	M. Wingate, T. de Grand	(COLO, FSU)
CONDO	93	PR D48 3045	G.T. Condo *et al.*	(SLAC Hybrid Collab.)
GOUZ	92	Dallas HEP 92, p. 572	Yu.P. Gouz *et al.*	(VES Collab.)
Proceedings XXVI Int. Conf. on High Energy Physics				
IIZUKA	89	PR D39 3357	J. Iizuka, H. Koibuchi, F. Masuda	(NAGO, IBAR+)
BOWLER	86	PL B182 400	M.G. Bowler	(OXF)
BASDEVANT	78	PRL 40 994	J.L. Basdevant, E.L. Berger	(FNAL, ANL) JP
BASDEVANT	77	PR D16 657	J.L. Basdevant, E.L. Berger	(FNAL, ANL) JP
ADERHOLZ	64	PL 10 226	M. Aderholz *et al.*	(AACH3, BERL, BIRM+)
GOLDHABER	64	PRL 12 336	G. Goldhaber *et al.*	(LRL, UCB)
LANDER	64	PRL 13 346A	R.L. Lander *et al.*	(UCSD) JP
BELLINI	63	NC 29 896	G. Bellini *et al.*	(MILA)