

# a<sub>1</sub>(1260)

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

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## a<sub>1</sub>(1260) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
<b>1230±40 OUR ESTIMATE</b>					
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1203 ± 3		<sup>1</sup> GOMEZ DUMM04	RVUE		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
1331 ± 10 ± 3	37k	<sup>2</sup> ASNER	00	CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
1255 ± 7 ± 6	5904	<sup>3</sup> ABREU	98G	DLPH	$e^+ e^-$
1207 ± 5 ± 8	5904	<sup>4</sup> ABREU	98G	DLPH	$e^+ e^-$
1196 ± 4 ± 5	5904	<sup>5,6</sup> ABREU	98G	DLPH	$e^+ e^-$
1240 ± 10		BARBERIS	98B		450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1262 ± 9 ± 7		<sup>3,7</sup> ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1210 ± 7 ± 2		<sup>4,7</sup> ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1211 ± 7 <sup>+50</sup> <sub>-0</sub>		<sup>4</sup> ALBRECHT	93C	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1121 ± 8		<sup>8</sup> ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1242 ± 37		<sup>9</sup> IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 14		<sup>10</sup> IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1250 ± 9		<sup>11</sup> IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1208 ± 15		ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
1220 ± 15		<sup>12</sup> ISGUR	89	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 25		<sup>13</sup> BOWLER	88	RVUE	
1166 ± 18 ± 11		BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1164 ± 41 ± 23		BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
1250 ± 40		<sup>12</sup> TORNQVIST	87	RVUE	
1046 ± 11		ALBRECHT	86B	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1056 ± 20 ± 15		RUCKSTUHL	86	DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1194 ± 14 ± 10		SCHMIDKE	86	MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1255 ± 23		BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1240 ± 80		<sup>14</sup> DANKOWY...	81	SPEC 0	8.45 $\pi^- p \rightarrow n 3\pi$
1280 ± 30		<sup>14</sup> DAUM	81B	CNTR	63,94 $\pi^- p \rightarrow p 3\pi$
1041 ± 13		<sup>15</sup> GAVILLET	77	HBC +	4.2 $K^- p \rightarrow \Sigma 3\pi$

<sup>1</sup> Using the data of BARATE 98R.

<sup>2</sup> From a fit to the  $3\pi$  mass spectrum including the  $K\bar{K}^*$ (892) threshold.

<sup>3</sup> Uses the model of KUHN 90.

<sup>4</sup> Uses the model of ISGUR 89.

<sup>5</sup> Includes the effect of a possible  $a_1'$  state.

<sup>6</sup> Uses the model of FEINDT 90.

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

### $a_1(1260)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
<b>250 to 600 OUR ESTIMATE</b>					
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
480 ± 20		<sup>16</sup> GOMEZ DUMM04	RVUE		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
460 ± 85	205	<sup>17</sup> DRUTSKOY 02	BELL		$B \rightarrow D^{(*)} K^- K^{*0}$
814 ± 36 ± 13	37k	<sup>18</sup> ASNER 00	CLE2		10.6 $e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
450 ± 50	22k	<sup>19</sup> AKHMETSHIN 99E	CMD2		1.05–1.38 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
570 ± 10		<sup>20</sup> BONDAR 99	RVUE		$e^+ e^- \rightarrow 4\pi, \tau \rightarrow 3\pi \nu_\tau$
587 ± 27 ± 21	5904	<sup>21</sup> ABREU 98G	DLPH		$e^+ e^-$
478 ± 3 ± 15	5904	<sup>22</sup> ABREU 98G	DLPH		$e^+ e^-$
425 ± 14 ± 8	5904	<sup>23,24</sup> ABREU 98G	DLPH		$e^+ e^-$
400 ± 35		BARBERIS 98B			450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
621 ± 32 ± 58		<sup>21,25</sup> ACKERSTAFF 97R	OPAL		$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
457 ± 15 ± 17		<sup>22,25</sup> ACKERSTAFF 97R	OPAL		$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
446 ± 21 <sup>+140</sup> / <sub>-0</sub>		<sup>22</sup> ALBRECHT 93C	ARG		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
239 ± 11		ANDO 92	SPEC		8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
266 ± 13 ± 4		<sup>26</sup> ANDO 92	SPEC		8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
465 <sup>+228</sup> / <sub>-143</sub>		<sup>27</sup> IVANOV 91	RVUE		$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
298 <sup>+40</sup> / <sub>-34</sub>		<sup>28</sup> IVANOV 91	RVUE		$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
488 ± 32		<sup>29</sup> IVANOV 91	RVUE		$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
430 ± 50		ARMSTRONG 90	OMEG 0		300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
420 ± 40		<sup>30</sup> ISGUR 89	RVUE		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
396 ± 43		<sup>31</sup> BOWLER 88	RVUE		
405 ± 75 ± 25		BAND 87	MAC		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
419 ± 108 ± 57		BAND 87	MAC		$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
521 ± 27		ALBRECHT 86B	ARG		$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

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

<sup>16</sup> Using the data of BARATE 98R.

<sup>17</sup> 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.

<sup>18</sup> From a fit to the  $3\pi$  mass spectrum including the  $K \bar{K}^*(892)$  threshold.

<sup>19</sup> Using the  $a_1(1260)$  mass of 1230 MeV.

<sup>20</sup> From AKHMETSHIN 99E and ASNER 00 data using the  $a_1(1260)$  mass of 1230 MeV.

<sup>21</sup> Uses the model of KUHN 90.

<sup>22</sup> Uses the model of ISGUR 89.

<sup>23</sup> Includes the effect of a possible  $a_1'$  state.

<sup>24</sup> Uses the model of FEINDT 90.

<sup>25</sup> Supersedes AKERS 95P.

<sup>26</sup> Average and spread of values using 2 variants of the model of BOWLER 75.

<sup>27</sup> Reanalysis of RUCKSTUHL 86.

<sup>28</sup> Reanalysis of SCHMIDKE 86.

<sup>29</sup> Reanalysis of ALBRECHT 86B.

<sup>30</sup> From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.

<sup>31</sup> From a combined reanalysis of ALBRECHT 86B and DAUM 81B.

<sup>32</sup> Uses the model of BOWLER 75.

<sup>33</sup> Produced in  $K^-$  backward scattering.

### $a_1(1260)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1 \quad \pi^+ \pi^- \pi^0$	
$\Gamma_2 \quad \pi^0 \pi^0 \pi^0$	
$\Gamma_3 \quad (\rho\pi)_{S\text{-wave}}$	seen
$\Gamma_4 \quad (\rho\pi)_{D\text{-wave}}$	seen
$\Gamma_5 \quad (\rho(1450)\pi)_{S\text{-wave}}$	seen
$\Gamma_6 \quad (\rho(1450)\pi)_{D\text{-wave}}$	seen
$\Gamma_7 \quad \sigma\pi$	seen
$\Gamma_8 \quad f_0(980)\pi$	not seen
$\Gamma_9 \quad f_0(1370)\pi$	seen
$\Gamma_{10} \quad f_2(1270)\pi$	seen
$\Gamma_{11} \quad K \bar{K}^*(892) + \text{c.c.}$	seen
$\Gamma_{12} \quad \pi\gamma$	seen

## $a_1(1260)$ PARTIAL WIDTHS

$\Gamma(\pi\gamma)$				$\Gamma_{12}$
<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<b>640±246</b>	ZIELINSKI	84C SPEC	200 $\pi^+ Z \rightarrow Z 3\pi$	

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<b>-0.108±0.016 OUR AVERAGE</b>				
-0.14 ±0.04 ±0.07	<sup>36</sup> CHUNG	02 E852	18.3 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^- p$	
-0.10 ±0.02 ±0.02	<sup>34,35</sup> ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow$ $3\pi\nu$	
-0.11 ±0.02	<sup>34</sup> ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	

<sup>34</sup> Uses the model of ISGUR 89.

<sup>35</sup> Supersedes AKERS 95P.

<sup>36</sup> Deck-type background not subtracted.

## $a_1(1260)$ BRANCHING RATIOS

$\Gamma((\rho\pi)_S\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_3/\Gamma$
<u>VALUE (units 10<sup>-2</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
60.19	37k	<sup>37</sup> ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

$\Gamma((\rho\pi)_D\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma$
<u>VALUE (units 10<sup>-2</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.30±0.60±0.22	37k	<sup>37</sup> ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

$\Gamma((\rho(1450)\pi)_S\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_5/\Gamma$
<u>VALUE (units 10<sup>-2</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.56±0.84±0.32	37k	<sup>37,38</sup> ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

$\Gamma((\rho(1450)\pi)_D\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_6/\Gamma$
<u>VALUE (units 10<sup>-2</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.04±1.20±0.28	37k	<sup>37,38</sup> ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

**$\Gamma(\sigma\pi)/\Gamma_{\text{total}}$**   **$\Gamma_7/\Gamma$**

VALUE (units  $10^{-2}$ )    EVTS    DOCUMENT ID    TECN    COMMENT

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

seen		CHUNG	02	E852	18.3 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^- p$
$18.76 \pm 4.29 \pm 1.48$	37k 37,39	ASNER	00	CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

**$\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$**   **$\Gamma_8/\Gamma$**

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 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
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**$\Gamma(f_0(1370)\pi)/\Gamma_{\text{total}}$**   **$\Gamma_9/\Gamma$**

VALUE (units  $10^{-2}$ )    EVTS    DOCUMENT ID    TECN    COMMENT

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

$7.40 \pm 2.71 \pm 1.26$	37k 37,40	ASNER	00	CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
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**$\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$**   **$\Gamma_{10}/\Gamma$**

VALUE (units  $10^{-2}$ )    EVTS    DOCUMENT ID    TECN    COMMENT

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

$1.19 \pm 0.49 \pm 0.17$	37k 37,41	ASNER	00	CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
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**$\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$**   **$\Gamma_{11}/\Gamma$**

VALUE (units  $10^{-2}$ )    EVTS    DOCUMENT ID    TECN    COMMENT

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

8 to 15	205	42 DRUTSKOY	02	BELL	$B \rightarrow D^{(*)} K^- K^* 0$
$3.3 \pm 0.5 \pm 0.1$	37k	43 ASNER	00	CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$ , $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

**$\Gamma(\sigma\pi)/\Gamma((\rho\pi)_{S\text{-wave}})$**   **$\Gamma_7/\Gamma_3$**

VALUE    EVTS    DOCUMENT ID    TECN    COMMENT

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

$\sim 0.3$	28k	AKHMETSHIN 99E	CMD2	1.05–1.38	$e^+ e^- \rightarrow$ $\pi^+ \pi^- \pi^+ \pi^-$
$0.003 \pm 0.003$		44 LONGACRE	82	RVUE	

**$\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$**   **$\Gamma_2/\Gamma_1$**

VALUE    CL%    DOCUMENT ID    COMMENT

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

$< 0.008$	90	45 BARBERIS	01	450	$p p \rightarrow p_f 3\pi^0 p_s$
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- 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  $\sigma$  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 From a comparison to ALAM 94 assuming purely resonant production of the  $K^- K^{*0}$  system.  
 43 From a fit to the  $3\pi$  mass spectrum including the  $K\bar{K}^*(892)$  threshold.  
 44 Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVILLET 77, DAUM 80, and DANKOWYCH 81.  
 45 Inconsistent with observations of  $\sigma\pi$ ,  $f_0(1370)\pi$ , and  $f_2(1270)\pi$  decay modes.

## $a_1(1260)$ REFERENCES

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