

$a_0(980)$

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

See our minireview on scalar mesons under $f_0(500)$. (See the index for the page number.)

$a_0(980)$ MASS

VALUE (MeV) DOCUMENT ID
980±20 OUR ESTIMATE Mass determination very model dependent

$\eta\pi$ FINAL STATE ONLY

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
982.5 ± 1.6 ± 1.1	16.9k	¹ AMBROSINO	09F	KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
986 ± 4		ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
982.3 ^{+0.6} _{-0.7} ^{+3.1} _{-4.7}		² UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
987.4 ± 1.0 ± 3.0		^{3,4} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
989.1 ± 1.0 ± 3.0		^{4,5} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
985 ± 4 ± 6	318	ACHARD	02B	L3	183–209 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
995 ⁺⁵² ₋₁₀	36	⁶ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
994 ⁺³³ ₋₈	36	⁷ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
975 ± 7		BARBERIS	00H		450 $pp \rightarrow p_f\eta\pi^0 p_s$
988 ± 8		BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++}\eta\pi^- p_s$
~ 1055		⁸ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 1009.2		⁸ OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
993.1 ± 2.1		⁹ TEIGE	99	B852	18.3 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
988 ± 6		⁸ ANISOVICH	98B	RVUE	Compilation
987		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
991		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
984.45 ± 1.23 ± 0.34		AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
982 ± 2		¹⁰ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
984 ± 4	1040	¹⁰ ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow p p \eta \pi^+ \pi^-$
976 ± 6		ATKINSON	84E	OMEG ±	25–55 $\gamma p \rightarrow \eta\pi n$
986 ± 3	500	¹¹ EVANGELIS...	81	OMEG ±	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
990 ± 7	145	¹¹ GURTU	79	HBC ±	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
980 ± 11	47	CONFORTO	78	OSPK –	4.5 $\pi^- p \rightarrow pX^-$
978 ± 16	50	CORDEN	78	OMEG ±	12–15 $\pi^- p \rightarrow n\eta 2\pi$
977 ± 7		GRASSLER	77	HBC –	16 $\pi^\mp p \rightarrow p\eta 3\pi$
989 ± 4	70	WELLS	75	HBC –	3.1–6 $K^- p \rightarrow \Lambda\eta 2\pi$

972	± 10	150	DEFOIX	72	HBC	\pm	$0.7 \bar{p}p \rightarrow 7\pi$
970	± 15	20	BARNES	69C	HBC	$-$	$4-5 K^- p \rightarrow \Lambda\eta 2\pi$
980	± 10		CAMPBELL	69	DBC	\pm	$2.7 \pi^+ d$
980	± 10	15	MILLER	69B	HBC	$-$	$4.5 K^- N \rightarrow \eta\pi\Lambda$
980	± 10	30	AMMAR	68	HBC	\pm	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

- ¹ Using the model of ACHASOV 89 and ACHASOV 03B.
- ² From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.
- ³ Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$.
- ⁴ Using AMSLER 94D and ABELE 98.
- ⁵ From the T-matrix pole on sheet II.
- ⁶ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.
- ⁷ Using the model of JAFFE 77. Supersedes ACHASOV 98B.
- ⁸ T-matrix pole.
- ⁹ Breit-Wigner fit, average between a_0^\pm and a_0^0 . The fit favors a slightly heavier a_0^\pm .
- ¹⁰ From a single Breit-Wigner fit.
- ¹¹ From $f_1(1285)$ decay.

$K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
925 \pm 5 \pm 8	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 1053		² OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
982 \pm 3		³ ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
975 \pm 15		BERTIN	98B	OBLX	\pm $0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
976 \pm 6	316	DEBILLY	80	HBC	\pm $1.2-2 \bar{p}p \rightarrow f_1(1285)\omega$
1016 \pm 10	100	⁴ ASTIER	67	HBC	\pm $0.0 \bar{p}p$
1003.3 \pm 7.0	143	⁵ ROSENFELD	65	RVUE	\pm

- ¹ Using a two-channel resonance parametrization with couplings fixed to ABELE 98.
- ² T-matrix pole.
- ³ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
- ⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
- ⁵ Plus systematic errors.

$a_0(980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50 to 100 OUR ESTIMATE		Width determination very model dependent. Peak width in $\eta\pi$ is about 60 MeV, but decay width can be much larger.			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
75.6 \pm 1.6	$\begin{smallmatrix} +17.4 \\ -10.0 \end{smallmatrix}$	¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
80.2 \pm 3.8	\pm 5.4	² BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
50 \pm 13	\pm 4	318 ACHARD	02B	L3	$183-209 e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
72 \pm 16		BARBERIS	00H		$450 pp \rightarrow p_f\eta\pi^0 p_s$
61 \pm 19		BARBERIS	00H		$450 pp \rightarrow \Delta_f^{++}\eta\pi^- p_s$
~ 42		³ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 112		³ OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$

71	± 7		TEIGE	99	B852	18.3 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
92	± 20		³ ANISOVICH	98B	RVUE	Compilation
65	± 10		⁴ BERTIN	98B	OBLX \pm	0.0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
~ 100			TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
202			JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
54.12	$\pm 0.34 \pm 0.12$		AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
54	± 10		⁵ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
95	± 14	1040	⁵ ARMSTRONG	91B	OMEG \pm	300 $pp \rightarrow pp\eta\pi^+\pi^-$
62	± 15	500	⁶ EVANGELIS...	81	OMEG \pm	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
60	± 20	145	⁶ GURTU	79	HBC \pm	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
60	$\begin{smallmatrix} +50 \\ -30 \end{smallmatrix}$	47	CONFORTO	78	OSPK $-$	4.5 $\pi^- p \rightarrow p\chi^-$
86.0	$\begin{smallmatrix} +60.0 \\ -50.0 \end{smallmatrix}$	50	CORDEN	78	OMEG \pm	12-15 $\pi^- p \rightarrow n\eta 2\pi$
44	± 22		GRASSLER	77	HBC $-$	16 $\pi^\mp p \rightarrow p\eta 3\pi$
80	to 300		⁷ FLATTE	76	RVUE $-$	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
16.0	$\begin{smallmatrix} +25.0 \\ -16.0 \end{smallmatrix}$	70	WELLS	75	HBC $-$	3.1-6 $K^- p \rightarrow \Lambda\eta 2\pi$
30	± 5	150	DEFOIX	72	HBC \pm	0.7 $\bar{p}p \rightarrow 7\pi$
40	± 15		CAMPBELL	69	DBC \pm	2.7 $\pi^+ d$
60	± 30	15	MILLER	69B	HBC $-$	4.5 $K^- N \rightarrow \eta\pi\Lambda$
80	± 30	30	AMMAR	68	HBC \pm	5.5 $K^- p \rightarrow \Lambda\eta 2\pi$

¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

² From the T-matrix pole on sheet II, using AMSLER 94D and ABELE 98.

³ T-matrix pole.

⁴ The $\eta\pi$ width.

⁵ From a single Breit-Wigner fit.

⁶ From $f_1(1285)$ decay.

⁷ Using a two-channel resonance parametrization of GAY 76B data.

$K\bar{K}$ ONLY

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
92 \pm 8		¹ ABELE	98	CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

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

~ 24		² OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	³ ASTIER	67	HBC \pm	
57 \pm 13	143	⁴ ROSENFELD	65	RVUE \pm	

¹ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.

² T-matrix pole.

³ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

⁴ Plus systematic errors.

$a_0(980)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi$	dominant
Γ_2 $K\bar{K}$	seen
Γ_3 $\rho\pi$	
Γ_4 $\gamma\gamma$	seen
Γ_5 e^+e^-	

$a_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$	Γ_4
<u>VALUE (keV)</u>	<u>DOCUMENT ID</u> <u>TECN</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.30 ± 0.10	¹ AMSLER 98 RVUE
¹ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.	

$a_0(980)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_4/\Gamma$
<u>VALUE (keV)</u> <u>EVTS</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
0.21 $\begin{smallmatrix} +0.08 \\ -0.04 \end{smallmatrix}$ OUR AVERAGE	
0.128 $\begin{smallmatrix} +0.003 +0.502 \\ -0.002 -0.043 \end{smallmatrix}$	¹ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$
0.28 ± 0.04 ± 0.10 44	OEST 90 JADE $e^+e^- \rightarrow e^+e^-\pi^0\eta$
0.19 ± 0.07 $\begin{smallmatrix} +0.10 \\ -0.07 \end{smallmatrix}$	ANTREASYAN 86 CBAL $e^+e^- \rightarrow e^+e^-\pi^0\eta$

¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_5/\Gamma$
<u>VALUE (eV)</u> <u>CL%</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
<1.5	90 VOROBYEV 88 ND $e^+e^- \rightarrow \pi^0\eta$

$a_0(980)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$	Γ_2/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>CHG</u> <u>COMMENT</u>
0.183 ± 0.024 OUR AVERAGE Error includes scale factor of 1.2.	
0.57 ± 0.16	¹ BARGIOTTI 03 OBLX $\bar{p}p$
0.23 ± 0.05	² ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.166 ± 0.01 ± 0.02	³ BARBERIS 98C OMEG $450 p p \rightarrow p_f f_1(1285) p_s$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
1.20 ± 0.15	⁴ ANISOVICH 09 RVUE $0.0 \bar{p}p, \pi N$
1.05 ± 0.07 ± 0.05	⁵ BUGG 08A RVUE 0 $\bar{p}p \rightarrow \pi^0\pi^0\eta$
~ 0.60	OLLER 99B RVUE $\pi\pi \rightarrow \eta\pi, K\bar{K}$
0.7 ± 0.3	³ CORDEN 78 OMEG $12-15 \pi^- p \rightarrow n\eta 2\pi$
0.25 ± 0.08	³ DEFOIX 72 HBC ± $0.7 \bar{p} \rightarrow 7\pi$

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$
 $\rho\pi$ forbidden. Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.25	70	AMMAR	70	HBC	\pm 4.1,5.5 $K^- p \rightarrow \Lambda\eta 2\pi$
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¹ Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0 \pi^\mp$.² Using $\pi^0\pi^0\eta$ from AMSLER 94D.³ From the decay of $f_1(1285)$.⁴ This is a ratio of couplings.⁵ A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94. **$a_0(980)$ REFERENCES**

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
ACHASOV	03B	PR D68 014006	N.N. Achasov, A.V. Kiselev	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>	
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TNTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)

AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)
Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.				
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIPV)
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)
