$a_0(980)$

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

See our minireview on scalar mesons under $f_0(600)$. (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

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
987.4 ± 1.0 ±3.0		[1,2] BUGG	08A	RVUE	0	$\overline{p}p \to \pi^0\pi^0\eta$
989.1 ± 1.0 ±3.0		[2,3] BUGG	08A	RVUE	0	$\overline{p}p \to \pi^0\pi^0\eta$
985 ± 4 ±6	318	ACHARD	02B	L3		183–209 $e^+e^- \to e^+e^-\eta\pi^+\pi^-$
995 $^{+52}_{-10}$	36	[4] ACHASOV	00F	SND		$e^+e^- \to \eta\pi^0\gamma$
994 $^{+33}_{-\ 8}$	36	[5] ACHASOV	00F	SND		$e^+e^- \to \eta\pi^0\gamma$
975 ± 7		BARBERIS	00H			450 $pp \to p_f\eta\pi^0 p_s$
988 ± 8		BARBERIS	00H			450 $pp \to \Delta_f^{++}\eta\pi^- p_s$
∼ 1055		[6] OLLER	99	RVUE		$\eta\pi$, $K\overline{K}$
∼ 1009.2		[6] OLLER	99B	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
993.1 ± 2.1		[7] TEIGE	99	B852		18.3 $\pi^- p \to \eta\pi^+\pi^- n$
988 ± 6		[6] ANISOVICH	98B	RVUE		Compilation
987		TORNQVIST	96	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
991		JANSSEN	95	RVUE		$\eta\pi \to \eta\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
984.45± 1.23±0.34		AMSLER	94C	CBAR		0.0 $\overline{p}p \to \omega\eta\pi^0$
982 ± 2		[8] AMSLER	92	CBAR		0.0 $\overline{p}p \to \eta\eta\pi^0$
984 ± 4	1040	[8] ARMSTRONG	91B	OMEG	±	300 $pp \to pp\eta\pi^+\pi^-$
976 ± 6		ATKINSON	84E	OMEG	±	25–55 $\gamma p \to \eta\pi n$
986 ± 3	500	[9] EVANGELIS...	81	OMEG	±	12 $\pi^- p \to \eta\pi^+\pi^-\pi^- p$
990 ± 7	145	[9] GURTU	79	HBC	±	4.2 $K^- p \to \Lambda\eta 2\pi$
980 ±11	47	CONFORTO	78	OSPK	−	4.5 $\pi^- p \to pX^-$
978 ±16	50	CORDEN	78	OMEG	±	12–15 $\pi^- p \to n\eta 2\pi$
977 ± 7		GRASSLER	77	HBC	−	16 $\pi^\mp p \to p\eta 3\pi$
989 ± 4	70	WELLS	75	HBC	−	3.1–6 $K^- p \to \Lambda\eta 2\pi$
972 ±10	150	DEFOIX	72	HBC	±	0.7 $\overline{p}p \to 7\pi$
970 ±15	20	BARNES	69C	HBC	−	4–5 $K^- p \to \Lambda\eta 2\pi$
980 ±10		CAMPBELL	69	DBC	±	2.7 $\pi^+ d$
980 ±10	15	MILLER	69B	HBC	−	4.5 $K^- N \to \eta\pi\Lambda$
980 ±10	30	AMMAR	68	HBC	±	5.5 $K^- p \to \Lambda\eta 2\pi$

[1] Parameterizes couplings to $\overline{K}K$, $\pi\eta$, and $\pi\eta'$.
[2] Using AMSLER 94D and ABELE 98.
[3] From the T-matrix pole on sheet II.
[4] Using the model of ACHASOV 89. Supersedes ACHASOV 98B.
[5] Using the model of JAFFE 77. Supersedes ACHASOV 98B.
[6] T-matrix pole.
[7] Breit-Wigner fit, average between $a_0^{\pm}$ and a_0^0. The fit favors a slightly heavier $a_0^{\pm}$.
[8] From a single Breit-Wigner fit.
[9] From $f_1(1285)$ decay.

$K\overline{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 1053		[10] OLLER	99C	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
982 ± 3		[11] ABELE	98	CBAR		0.0 $\overline{p}p \to K_L^0 K^{\pm}\pi^{\mp}$
975 ± 15		BERTIN	98B	OBLX	±	0.0 $\overline{p}p \to K^{\pm}K_S\pi^{\mp}$
976 ± 6	316	DEBILLY	80	HBC	±	1.2–2 $\overline{p}p \to f_1(1285)\omega$
1016 ± 10	100	[12] ASTIER	67	HBC	±	0.0 $\overline{p}p$
1003.3 ± 7.0	143	[13] ROSENFELD	65	RVUE	±	

[10] T-matrix pole.
[11] T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
[12] ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
[13] 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. • • •						
80.2 ± 3.8 ± 5.4		[14] BUGG	08A	RVUE	0	$\overline{p}p \to \pi^0\pi^0\eta$
50 ± 13 ± 4	318	ACHARD	02B	L3		183–209 $e^+e^- \to e^+e^-\eta\pi^+\pi^-$
72 ± 16		BARBERIS	00H			450 $pp \to p_f\eta\pi^0 p_s$
61 ± 19		BARBERIS	00H			450 $pp \to \Delta_f^{++}\eta\pi^- p_s$
~ 42		[15] OLLER	99	RVUE		$\eta\pi$, $K\overline{K}$
~ 112		[15] OLLER	99B	RVUE		$\pi\pi \to \eta\pi$, $K\overline{K}$
71 ± 7		TEIGE	99	B852		18.3 $\pi^- p \to \eta\pi^+\pi^- n$
92 ± 20		[15] ANISOVICH	98B	RVUE		Compilation
65 ± 10		[16] BERTIN	98B	OBLX	±	0.0 $\overline{p}p \to K^{\pm}K_S\pi^{\mp}$
~ 100		TORNQVIST	96	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
202		JANSSEN	95	RVUE		$\eta\pi \to \eta\pi$, $K\overline{K}$, $K\pi$, $\eta\pi$
54.12 ± 0.34 ± 0.12		AMSLER	94C	CBAR		0.0 $\overline{p}p \to \omega\eta\pi^0$
54 ± 10		[17] AMSLER	92	CBAR		0.0 $\overline{p}p \to \eta\eta\pi^0$

95	±14	1040	[17] ARMSTRONG	91B	OMEG	±	300 $pp \to pp\eta\pi^+\pi^-$
62	±15	500	[18] EVANGELIS...	81	OMEG	±	12 $\pi^- p \to \eta\pi^+\pi^-\pi^- p$
60	±20	145	[18] GURTU	79	HBC	±	4.2 $K^- p \to \Lambda\eta 2\pi$
60	$^{+50}_{-30}$	47	CONFORTO	78	OSPK	−	4.5 $\pi^- p \to pX^-$
86.0	$^{+60.0}_{-50.0}$	50	CORDEN	78	OMEG	±	12–15 $\pi^- p \to n\eta 2\pi$
44	±22		GRASSLER	77	HBC	−	16 $\pi^\mp p \to p\eta 3\pi$
80	to 300		[19] FLATTE	76	RVUE	−	4.2 $K^- p \to \Lambda\eta 2\pi$
16.0	$^{+25.0}_{-16.0}$	70	WELLS	75	HBC	−	3.1–6 $K^- p \to \Lambda\eta 2\pi$
30	± 5	150	DEFOIX	72	HBC	±	0.7 $\overline{p}p \to 7\pi$
40	±15		CAMPBELL	69	DBC	±	2.7 $\pi^+ d$
60	±30	15	MILLER	69B	HBC	−	4.5 $K^- N \to \eta\pi\Lambda$
80	±30	30	AMMAR	68	HBC	±	5.5 $K^- p \to \Lambda\eta 2\pi$

[14] From the T-matrix pole on sheet II, using AMSLER 94D and ABELE 98.
[15] T-matrix pole.
[16] The $\eta\pi$ width.
[17] From a single Breit-Wigner fit.
[18] From $f_1(1285)$ decay.
[19] Using a two-channel resonance parametrization of GAY 76B data.

$K\overline{K}$ ONLY

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*CHG*	*COMMENT*
92± 8		[20] ABELE	98	CBAR		0.0 $\overline{p}p \to K^0_L K^\pm\pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
∼ 24		[21] OLLER	99C	RVUE		$\pi\pi \to \pi\pi$, $K\overline{K}$
∼ 25	100	[22] ASTIER	67	HBC	±	
57±13	143	[23] ROSENFELD	65	RVUE	±	

[20] T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
[21] T-matrix pole.
[22] ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
[23] Plus systematic errors.

a_0(980) DECAY MODES

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

$a_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_4

VALUE (keV)	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30±0.10	[24] AMSLER	98	RVUE

[24] Using $\Gamma_{\gamma\gamma}$B($a0(980) \rightarrow \eta\pi$) =0.24 ± 0.08 keV.

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

$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_1\Gamma_4/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
$0.24^{+0.08}_{-0.07}$ OUR AVERAGE					
0.28±0.04±0.10	44	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$0.19\pm0.07^{+0.10}_{-0.07}$		ANTREASYAN	86	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\eta$

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_1\Gamma_5/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<1.5	90	VOROBYEV	88	ND	$e^+e^- \rightarrow \pi^0\eta$

$a_0(980)$ BRANCHING RATIOS

$\Gamma(K\overline{K})/\Gamma(\eta\pi)$ — Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.183±0.024 OUR AVERAGE Error includes scale factor of 1.2.					
0.57 ±0.16	[25] BARGIOTTI	03	OBLX		$\overline{p}p$
0.23 ±0.05	[26] ABELE	98	CBAR		0.0 $\overline{p}p \rightarrow K^0_L K^{\pm}\pi^{\mp}$
0.166±0.01 ±0.02	[27] BARBERIS	98C	OMEG		450 $pp \rightarrow p_f f_1(1285) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.05 ±0.07 ±0.05	[28] BUGG	08A	RVUE	0	$\overline{p}p \rightarrow \pi^0\pi^0\eta$
∼ 0.60	OLLER	99B	RVUE		$\pi\pi \rightarrow \eta\pi$, $K\overline{K}$
0.7 ±0.3	[27] CORDEN	78	OMEG		12–15 $\pi^- p \rightarrow n\eta 2\pi$
0.25 ±0.08	[27] DEFOIX	72	HBC	±	0.7 $\overline{p} \rightarrow 7\pi$

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$ — Γ_3/Γ_1

$\rho\pi$ forbidden.

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.25	70	AMMAR	70	HBC	±	4.1,5.5 $K^- p \rightarrow \Lambda\eta 2\pi$

[25] Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^{\pm}K^0_S\pi^{\mp}$.

[26] Using $\pi^0\pi^0\eta$ from AMSLER 94D.

[27] From the decay of $f_1(1285)$.

[28] A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94.

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ACHARD	02B	PL B526 269	P. Achard *et al.*	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis *et al.*	(WA 102 Collab.)
OLLER	99	PR D60 099906 (erratum)	J.A. Oller *et al.*	
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OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige *et al.*	(BNL E852 Collab.)
ABELE	98	PR D57 3860	A. Abele *et al.*	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)
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BARBERIS	98C	PL B440 225	D. Barberis *et al.*	(WA 102 Collab.)
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TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSEN	95	PR D52 2690	G. Janssen *et al.*	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler *et al.*	(Crystal Barrel Collab.)
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BUGG	94	PR D50 4412	D.V. Bugg *et al.*	(LOQM)
AMSLER	92	PL B291 347	C. Amsler *et al.*	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest *et al.*	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
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