$f_0(1500)$

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

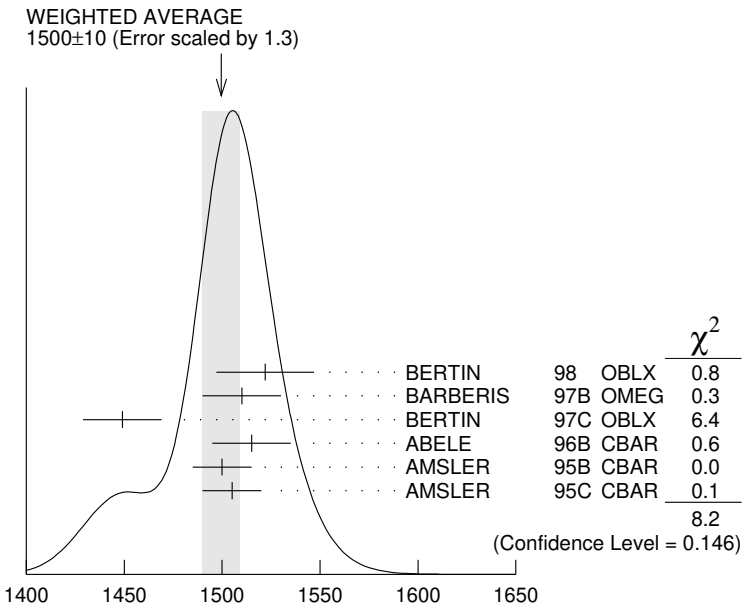
See also the mini-reviews on scalar mesons under $f_0(1370)$ and on non-$q\overline{q}$ candidates. (See the index for the page number.)

$f_0(1500)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1500±10 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
1522±25		BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \rightarrow \pi^+\pi^+\pi^-$
1510±20		[1] BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
1449±20		[1] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
1515±20		ABELE	96B	CBAR	0.0 $\overline{p}p \rightarrow \pi^0 K^0_L K^0_L$
1500±15		[2] AMSLER	95B	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0$
1505±15		[3] AMSLER	95C	CBAR	0.0 $\overline{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1497±10		[4] BARBERIS	99	OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
1502±10		[4] BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
1502±12±10		[5] BARBERIS	99D	OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
1530±45		[4] BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
1505±18		[4] FRENCH	99		300 $pp \rightarrow p_f(K^+K^-)p_s$
1580±80		[4] ALDE	98	GAM4	100 $\pi^- p \rightarrow \pi^0\pi^0 n$
1499± 8		[1] ANISOVICH	98B	RVUE	Compilation
~ 1520		REYES	98	SPEC	800 $pp \rightarrow p_s p_f K^0_S K^0_S$
~ 1475		FRABETTI	97D	E687	$D^\pm_s \rightarrow \pi^\mp\pi^\pm\pi^\pm$
~ 1505		ABELE	96	CBAR	0.0 $\overline{p}p \rightarrow 5\pi^0$
1500± 8		[1] ABELE	96C	RVUE	Compilation
1460±20	120	[4] AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
1500± 8		BUGG	96	RVUE	
1500±10		[6] AMSLER	95D	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1445± 5		[7] ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
1497±30		[4] ANTINORI	95	OMEG	300,450 $pp \rightarrow pp\pi^+\pi^-$
~ 1505		BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1446± 5		[4] ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$

1545 ± 25		[4]	AMSLER	94E	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\eta\eta'$
1520 ± 25		[1,8]	ANISOVICH	94	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
1505 ± 20		[1,9]	BUGG	94	RVUE	$\overline{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
1560 ± 25		[4]	AMSLER	92	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\eta\eta$
1550 ± 45 ± 30		[4]	BELADIDZE	92C	VES	36 π^- Be $\rightarrow \pi^-\eta'\eta$ Be
1449 ± 4		[4]	ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
1610 ± 20		[4]	ALDE	88	GAM4	300 $\pi^- N \rightarrow \pi^- N2\eta$
~ 1525			ASTON	88D	LASS	11 $K^- p \rightarrow K^0_S K^0_S \Lambda$
1570 ± 20	600	[4]	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
1575 ± 45		[10]	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
1568 ± 33		[4]	BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta\eta' n$
1592 ± 25		[4]	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
1525 ± 5		[4]	GRAY	83	DBC	0.0 $\overline{p}N \rightarrow 3\pi$

[1] T-matrix pole.
[2] T-matrix pole, supersedes ANISOVICH 94.
[3] T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
[4] Breit-Wigner mass.
[5] Supersedes BARBERIS 99 and BARBERIS 99B.
[6] T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[7] Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
[8] From a simultaneous analysis of the annihilations $\overline{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.
[9] Reanalysis of ANISOVICH 94 data.
[10] From central value and spread of two solutions. Breit-Wigner mass.



$f_0(1500)$ mass (MeV)

$f_0(1500)$ WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
112± 10 OUR AVERAGE					
108± 33		BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \rightarrow \pi^+\pi^+\pi^-$
120± 35		[11] BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
114± 30		[11] BERTIN	97C	OBLX	0.0 $\overline{p}p \rightarrow \pi^+\pi^-\pi^0$
105± 15		ABELE	96B	CBAR	0.0 $\overline{p}p \rightarrow \pi^0 K^0_L K^0_L$
120± 25		[12] AMSLER	95B	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0$
120± 30		[13] AMSLER	95C	CBAR	0.0 $\overline{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
104± 25		[14] BARBERIS	99	OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
131± 15		[14] BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
98± 18±16		[15] BARBERIS	99D	OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
160± 50		[14] BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
100± 33		[14] FRENCH	99		300 $pp \rightarrow p_f(K^+K^-)p_s$
280±100		[16] ALDE	98	GAM4	100 $\pi^- p \rightarrow \pi^0\pi^0 n$
130± 20		[11] ANISOVICH	98B	RVUE	Compilation
~ 100		FRABETTI	97D	E687	$D_s^\pm \rightarrow \pi^\mp\pi^\pm\pi^\pm$
~ 169		ABELE	96	CBAR	0.0 $\overline{p}p \rightarrow 5\pi^0$
100± 30	120	[14] AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
132± 15		BUGG	96	RVUE	
154± 30		[17] AMSLER	95D	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
65± 10		[18] ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
199± 30		[14] ANTINORI	95	OMEG	300,450 $pp \rightarrow pp\pi^+\pi^-$
56± 12		[14] ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
100± 40		[14] AMSLER	94E	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\eta\eta'$
$148^{+\ 20}_{-\ 25}$		[11,19] ANISOVICH	94	CBAR	0.0 $\overline{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
150± 20		[11,20] BUGG	94	RVUE	$\overline{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
245± 50		[14] AMSLER	92	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\eta\eta$
153± 67±50		[14] BELADIDZE	92C	VES	36 π^- Be $\rightarrow \pi^-\eta'\eta$ Be
78± 18		[14] ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
170± 40		[14] ALDE	88	GAM4	300 $\pi^- N \rightarrow \pi^- N2\eta$
150± 20	600	[14] ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
265± 65		[21] ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
260± 60		[14] BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta\eta' n$
210± 40		[14] BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
101± 13		[14] GRAY	83	DBC	0.0 $\overline{p}N \rightarrow 3\pi$

[11] T-matrix pole.
[12] T-matrix pole, supersedes ANISOVICH 94.
[13] T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
[14] Breit-Wigner mass.
[15] Supersedes BARBERIS 99 and BARBERIS 99B.
[16] Breit-Wigner width.
[17] T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
[18] Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
[19] From a simultaneous analysis of the annihilations $\overline{p}p \to 3\pi^0, \pi^0\eta\eta$.
[20] Reanalysis of ANISOVICH 94 data.
[21] From central value and spread of two solutions. Breit-Wigner mass.

$f_0(1500)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\eta\eta'(958)$	seen
Γ_2	$\eta\eta$	seen
Γ_3	4π	seen
Γ_4	$4\pi^0$	seen
Γ_5	$2\pi^+2\pi^-$	seen
Γ_6	$\pi\pi$	seen
Γ_7	$\pi^+\pi^-$	seen
Γ_8	$2\pi^0$	seen
Γ_9	$K\overline{K}$	seen
Γ_{10}	$\gamma\gamma$	

$f_0(1500)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(total)$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_6\Gamma_{10}/\Gamma$

VALUE (keV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.46	95	BARATE	00E	ALEP	$\gamma\gamma \to \pi^+\pi^-$

$f_0(1500)$ BRANCHING RATIOS

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$ Γ_1/Γ_2

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.29±0.10	[22] AMSLER	95C	CBAR	0.0 $\overline{p}p \to \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.84±0.23	ABELE	96C	RVUE	Compilation
2.7 ±0.8	BINON	84C	GAM2	38 $\pi^- p \to \eta\eta' n$

[22] Using AMSLER 94E ($\eta\eta'\pi^0$).

$\Gamma(\eta\eta)/\Gamma_{total}$ Γ_2/Γ

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
large	ALDE	88	GAM4	300 $\pi^- N \to \eta\eta\pi^- N$
large	BINON	83	GAM2	38 $\pi^- p \to 2\eta n$

$\Gamma(4\pi^0)/\Gamma(\eta\eta)$ Γ_4/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.8 ± 0.3	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(2\pi^0)/\Gamma(\eta\eta)$ Γ_8/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
1.45 ± 0.61	[23] AMSLER	95C	CBAR	0.0 $\overline{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.29 ± 0.72	[24] ABELE	96C	RVUE	Compilation
2.12 ± 0.81	[25] AMSLER	95D	CBAR	0.0 $\overline{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$
<0.3	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$

[23] Using AMSLER 95B ($3\pi^0$).
[24] 2π width determined to be 60 $\pm$ 12 MeV.
[25] Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

$\Gamma(K\overline{K})/\Gamma(\eta\eta)$ Γ_9/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.6		[26] BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.4	90	[27] PROKOSHKIN	91	GAM4	300 $\pi^- p \rightarrow \pi^- p\eta\eta$

[26] Using ETKIN 82B and COHEN 80.
[27] Combining results of GAM4 with those of WA76 on $K\overline{K}$ central production.

$\Gamma(K\overline{K})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.044 ± 0.021	BUGG	96	RVUE

$\Gamma(K\overline{K})/\Gamma(\pi\pi)$ Γ_9/Γ_6

VALUE	DOCUMENT ID		TECN	COMMENT
0.19 ± 0.07	[28] ABELE	98	CBAR	0.0 $\overline{p}p \rightarrow K^0_L K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.33\pm0.03\pm0.07$	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+K^-$, $\pi^+\pi^-$
0.20 ± 0.08	[29] ABELE	96B	CBAR	0.0 $\overline{p}p \rightarrow \pi^0 K^0_L K^0_L$

[28] Using $\pi^0\pi^0$ from AMSLER 95B.
[29] Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0\eta$) and SU(3).

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.454 ± 0.104	BUGG	96	RVUE

$\Gamma(4\pi)/\Gamma(\pi\pi)$ Γ_3/Γ_6

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.4 ± 0.8	[30] ABELE	96	CBAR	0.0 $\overline{p}p \rightarrow 5\pi^0$

[30] Excluding $\rho\rho$ contribution to 4π.

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	BERTIN	98	OBLX	0.05–0.405 $\overline{n}p \rightarrow$
possibly seen	FRABETTI	97D	E687	$D_s^{\pm} \rightarrow \pi^{\mp}\pi^{\pm}\pi^{\pm}$ $\pi^+\pi^+\pi^-$

$f_0(1500)$ REFERENCES

BARATE	00E	PL B472 189	R. Barate *et al.*	(ALEPH Collab.)
BARBERIS	99	PL B453 305	D. Barberis *et al.*	(Omega expt.)
BARBERIS	99B	PL B453 316	D. Barberis *et al.*	(Omega expt.)
BARBERIS	99D	PL B462 462	D. Barberis *et al.*	(Omega expt.)
BELLAZZINI	99	PL B467 296	R. Bellazzini *et al.*	
FRENCH	99	PL B214 213	B. French *et al.*	(WA76 Collab.)
ABELE	98	PR D57 3860	A. Abele *et al.*	(Crystal Barrel Collab.)
ALDE	98	EPJ A3 361	D. Alde *et al.*	(GAM4 Collab.)
Also	99	PAN 62 405	D. Alde *et al.*	(GAMS Collab.)
ANISOVICH	98B	UFN 41 419	V.V. Anisovich *et al.*	
BERTIN	98	PR D57 55	A. Bertin *et al.*	(OBELIX Collab.)
REYES	98	PRL 81 4079	M.A. Reyes *et al.*	
BARBERIS	97B	PL B413 217	D. Barberis *et al.*	(WA102 Collab.)
BERTIN	97C	PL B408 476	A. Bertin *et al.*	(OBELIX Collab.)
FRABETTI	97D	PL B407 79	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ABELE	96	PL B380 453	A. Abele *et al.*	(Crystal Barrel Collab.)
ABELE	96B	PL B385 425	A. Abele *et al.*	(Crystal Barrel Collab.)
ABELE	96C	NP A609 562	A. Abele *et al.*	(Crystal Barrel Collab.)
AMELIN	96B	PAN 59 976	D.V. Amelin *et al.*	(SERP, TBIL)
		Translated from YAF 59 1021.		
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)
AMSLER	95B	PL B342 433	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler *et al.*	(Crystal Barrel Collab.)
ANTINORI	95	PL B353 589	F. Antinori *et al.*	(ATHU, BARI, BIRM+)
BUGG	95	PL B353 378	D.V. Bugg *et al.*	(LOQM, PNPI, WASH)
ABATZIS	94	PL B324 509	S. Abatzis *et al.*	(ATHU, BARI, BIRM+)
AMSLER	94C	PL B327 425	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler *et al.*	(Crystal Barrel Collab.)
AMSLER	94E	PL B340 259	C. Amsler *et al.*	(Crystal Barrel Collab.)
ANISOVICH	94	PL B323 233	V.V. Anisovich *et al.*	
BUGG	94	PR D50 4412	D.V. Bugg *et al.*	(LOQM)
AMSLER	92	PL B291 347	C. Amsler *et al.*	(Crystal Barrel Collab.)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)
		Translated from DANS 316 900.		
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE	88	PL B201 160	D.M. Alde *et al.*	(SERP, BELG, LANL, LAPP+)
ASTON	88D	NP B301 525	D. Aston *et al.*	(SLAC, NAGO, CINC, INUS)
ALDE	87	PL B198 286	D.M. Alde *et al.*	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde *et al.*	(BELG, LAPP, SERP, CERN+)
BINON	84C	NC 80A 363	F.G. Binon *et al.*	(BELG, LAPP, SERP+)
BINON	83	NC 78A 313	F.G. Binon *et al.*	(BELG, LAPP, SERP+)
Also	83B	SJNP 38 561	F.G. Binon *et al.*	(BELG, LAPP, SERP+)
		Translated from YAF 38 934.		
GRAY	83	PR D27 307	L. Gray *et al.*	(SYRA)
ETKIN	82B	PR D25 1786	A. Etkin *et al.*	(BNL, CUNY, TUFTS, VAND)
COHEN	80	PR D22 2595	D. Cohen *et al.*	(ANL)

OTHER RELATED PAPERS

ANISOVICH	99H	PL B467 289	A.V. Anisovich, V.V. Anisovich	
AMSLER	98	RMP 70 1293	C. Amsler	
STROHMEIER	98	PL B438 21	M. Strohmeier *et al.*	
ANISOVICH	97	PL B395 123	A.V. Anisovich, A.V. Sarantsev	(PNPI)
ANISOVICH	97B	ZPHY A357 123	A.V. Anisovich *et al.*	(PNPI)
ANISOVICH	97C	PL B413 137		
ANISOVICH	97E	PAN 60 1892	A.V. Anisovich *et al.*	(PNPI)
		Translated from YAF 60 2065.		
PROKOSHKIN	97	SPD 42 117	Y.D. Prokoshkin *et al.*	(SERP)
		Translated from DANS 353 323.		
AMSLER	96	PR D53 295	C. Amsler, F.E. Close	(ZURI, RAL)
AMSLER	95E	PL B353 385	C. Amsler, F.E. Close	(ZURI, RAL)
GASPERO	95	NP A588 861	M. Gaspero	(ROMA)
SLAUGHTER	88	MPL A3 1361	M.D. Slaughter	(LANL)