$\Xi(1820)$ $3/2^-$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$ Status: ∗∗∗

The clearest evidence is an 8-standard-deviation peak in ΛK^- seen by GAY 76C. TEODORO 78 favors $J = 3/2$, but cannot make a parity discrimination. BIAGI 87C is consistent with $J = 3/2$ and favors negative parity for this J value.

$\Xi(1820)$ MASS

We only average the measurements that appear to us to be most significant and best determined.

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
1823 ± 5 OUR ESTIMATE						
1823.5± 1.4 OUR AVERAGE						
1825.5± 4.7±4.7	288	ABLIKIM	20C	BES3	−	$e^+ e^- \to \Xi(1820)^- \overline{\Xi}^+$
1819.4± 3.1±2.0	280	[1] BIAGI	87	SPEC	0	Ξ^- Be → (ΛK^-) X
1826 ± 3 ±1	54	BIAGI	87C	SPEC	0	Ξ^- Be → $(\Lambda \overline{K}^0)$ X
1822 ± 6		JENKINS	83	MPS	−	$K^- p \to K^+$ (MM)
1830 ± 6	300	BIAGI	81	SPEC	−	SPS hyperon beam
1823 ± 2	130	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1817 ± 3		ADAMOVICH	99B	WA89		Σ^- nucleus, 345 GeV
1797 ±19	74	BRIEFEL	77	HBC	0	$K^- p$ 2.87 GeV/c
1829 ± 9	68	BRIEFEL	77	HBC	−0	$\Xi(1530)\pi$
1860 ±14	39	BRIEFEL	77	HBC	−	$\Sigma^- \overline{K}^0$
1870 ± 9	44	BRIEFEL	77	HBC	0	$\Lambda \overline{K}^0$
1813 ± 4	57	BRIEFEL	77	HBC	−	ΛK^-
1807 ±27		DIBIANCA	75	DBC	−0	$\Xi\pi\pi$, $\Xi^*\pi$
1762 ± 8	28	[2] BADIER	72	HBC	−0	$\Xi\pi$, $\Xi\pi\pi$, YK
1838 ± 5	38	[2] BADIER	72	HBC	−0	$\Xi\pi$, $\Xi\pi\pi$, YK
1830 ±10	25	[3] CRENNELL	70B	DBC	−0	3.6, 3.9 GeV/c
1826 ±12		[4] CRENNELL	70B	DBC	−0	3.6, 3.9 GeV/c
1830 ±10	40	ALITTI	69	HBC	−	Λ, $\Sigma\overline{K}$
1814 ± 4	30	BADIER	65	HBC	0	$\Lambda \overline{K}^0$
1817 ± 7	29	SMITH	65C	HBC	−0	$\Lambda \overline{K}^0$, ΛK^-
1770		HALSTEINSLID	63	FBC	−0	K^- freon 3.5 GeV/c

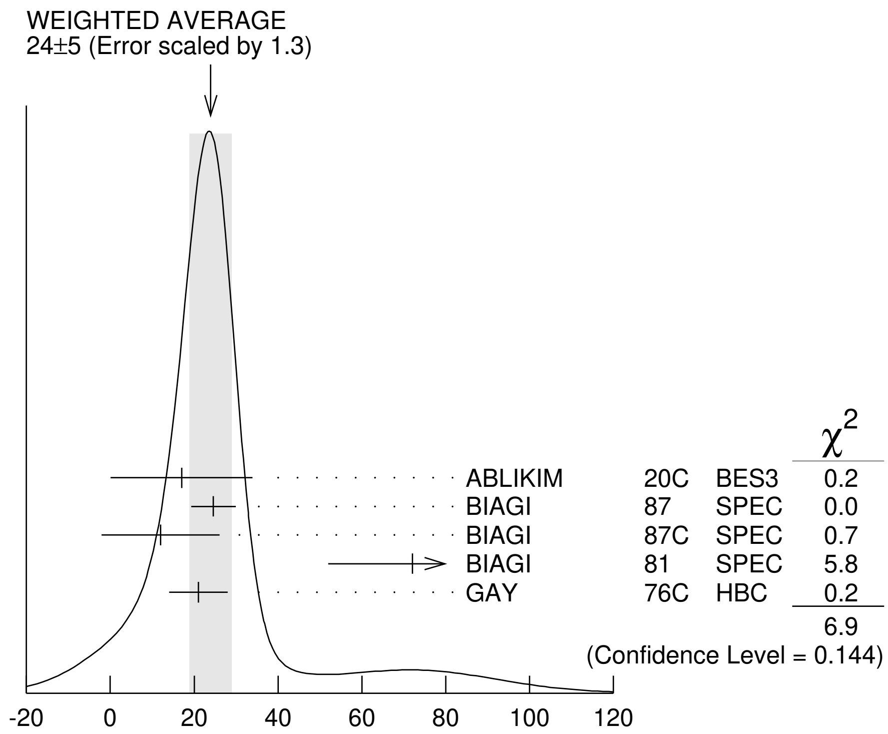
$\Xi(1820)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
24 $^{+15}_{-10}$ OUR ESTIMATE						
24 ± 5 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.					
17.0±15.0±7.9	288	ABLIKIM	20C	BES3	−	$e^+ e^- \to \Xi(1820)^- \overline{\Xi}^+$
24.6± 5.3	280	[1] BIAGI	87	SPEC	0	Ξ^- Be → (ΛK^-) X
12 ±14 ±1.7	54	BIAGI	87C	SPEC	0	Ξ^- Be → $(\Lambda \overline{K}^0)$ X

72 ±20	300	BIAGI	81	SPEC	−	SPS hyperon beam
21 ± 7	130	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c

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

23 ±13		ADAMOVICH	99B	WA89		Σ^- nucleus, 345 GeV
99 ±57	74	BRIEFEL	77	HBC	0	$K^- p$ 2.87 GeV/c
52 ±34	68	BRIEFEL	77	HBC	−0	$\Xi(1530)\pi$
72 ±17	39	BRIEFEL	77	HBC	−	$\Sigma^- \overline{K}^0$
44 ±11	44	BRIEFEL	77	HBC	0	$\Lambda \overline{K}^0$
26 ±11	57	BRIEFEL	77	HBC	−	ΛK^-
85 ±58		DIBIANCA	75	DBC	−0	$\Xi\pi\pi$, $\Xi^*\pi$
51 ±13		[2] BADIER	72	HBC	−0	Lower mass
58 ±13		[2] BADIER	72	HBC	−0	Higher mass
103 $^{+38}_{-24}$		[3] CRENNELL	70B	DBC	−0	3.6, 3.9 GeV/c
48 $^{+36}_{-19}$		[4] CRENNELL	70B	DBC	−0	3.6, 3.9 GeV/c
55 $^{+40}_{-20}$		ALITTI	69	HBC	−	Λ, $\Sigma \overline{K}$
12 ± 4		BADIER	65	HBC	0	$\Lambda \overline{K}^0$
30 ± 7		SMITH	65B	HBC	−0	$\Lambda \overline{K}$
<80		HALSTEINSLID	63	FBC	−0	K^- freon 3.5 GeV/c



$\Xi(1820)$ width (MeV)

$\Xi(1820)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Lambda\overline{K}$	large
Γ_2	$\Sigma\overline{K}$	small
Γ_3	$\Xi\pi$	small
Γ_4	$\Xi(1530)\pi$	small
Γ_5	$\Xi\pi\pi$ (not $\Xi(1530)\pi$)	

$\Xi(1820)$ BRANCHING RATIOS

The dominant modes seem to be $\Lambda\overline{K}$ and (perhaps) $\Xi(1530)\pi$, but the branching fractions are very poorly determined.

$\Gamma(\Lambda\overline{K})/\Gamma_{total}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.25±0.05 OUR AVERAGE					
0.24±0.05	ANISOVICH	12A	DPWA		Multichannel
0.30±0.15	ALITTI	69	HBC	−	$K^- p$ 3.9–5 GeV/c

$\Gamma(\Xi\pi)/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.10±0.10	ALITTI	69	HBC	−	$K^- p$ 3.9–5 GeV/c

$\Gamma(\Xi\pi)/\Gamma(\Lambda\overline{K})$ — Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<0.36	95	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c
0.20±0.20		BADIER	65	HBC	0	$K^- p$ 3 GeV/c

$\Gamma(\Xi\pi)/\Gamma(\Xi(1530)\pi)$ — Γ_3/Γ_4

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
$\mathbf{1.5^{+0.6}_{-0.4}}$	APSELL	70	HBC	0	$K^- p$ 2.87 GeV/c

$\Gamma(\Sigma\overline{K})/\Gamma_{total}$ — Γ_2/Γ

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.30±0.15	ALITTI	69	HBC	−	$K^- p$ 3.9–5 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.02	TRIPP	67	RVUE		Use SMITH 65C

$\Gamma(\Sigma\overline{K})/\Gamma(\Lambda\overline{K})$ — Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.24±0.10	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c

$\Gamma(\Xi(1530)\pi)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.30±0.15	ALITTI	69	HBC	−	$K^- p$ 3.9–5 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	ASTON	85B	LASS		$K^- p$ 11 GeV/c
not seen	[5] HASSALL	81	HBC		$K^- p$ 6.5 GeV/c
<0.25	[6] DAUBER	69	HBC		$K^- p$ 2.7 GeV/c

$\Gamma(\Xi(1530)\pi)/\Gamma(\Lambda\overline{K})$ — Γ_4/Γ_1

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.38±0.27 OUR AVERAGE	Error includes scale factor of 2.3.				
1.0 ±0.3	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c
0.26±0.13	SMITH	65C	HBC	−0	$K^- p$ 2.45–2.7 GeV/c

$\Gamma(\Xi\pi\pi(\text{not }\Xi(1530)\pi))/\Gamma(\Lambda\overline{K})$ — Γ_5/Γ_1

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.30±0.20	BIAGI	87	SPEC	−	Ξ^- Be 116 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.14	[7] BADIER	65	HBC	0	1 st. dev. limit
>0.1	SMITH	65C	HBC	−0	$K^- p$ 2.45–2.7 GeV/c

$\Gamma(\Xi\pi\pi(\text{not }\Xi(1530)\pi))/\Gamma(\Xi(1530)\pi)$ — Γ_5/Γ_4

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
consistent with zero	GAY	76C	HBC	−	$K^- p$ 4.2 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.3±0.5	[8] APSELL	70	HBC	0	$K^- p$ 2.87 GeV/c

$\Xi(1820)$ FOOTNOTES

[1] BIAGI 87 also sees weak signals in the in the $\Xi^-\pi^+\pi^-$ channel at 1782.6 ± 1.4 MeV (Γ = 6.0 ± 1.5 MeV) and 1831.9 ± 2.8 MeV (Γ = 9.6 ± 9.9 MeV).

[2] BADIER 72 adds all channels and divides the peak into lower and higher mass regions. The data can also be fitted with a single Breit-Wigner of mass 1800 MeV and width 150 MeV.

[3] From a fit to inclusive $\Xi\pi$, $\Xi\pi\pi$, and ΛK^- spectra.

[4] From a fit to inclusive $\Xi\pi$ and $\Xi\pi\pi$ spectra only.

[5] Including $\Xi\pi\pi$.

[6] DAUBER 69 uses in part the same data as SMITH 65C.

[7] For the decay mode $\Xi^-\pi^+\pi^0$ only. This limit includes $\Xi(1530)\pi$.

[8] Or less. Upper limit for the 3-body decay.

$\Xi(1820)$ REFERENCES

ABLIKIM	20C	PRL 124 032002	M. Ablikim et al.	(BESIII Collab.)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich et al.	(BONN, PNPI)
ADAMOVICH	99B	EPJ C11 271	M.I. Adamovich et al.	(CERN WA89 Collab.)
BIAGI	87	ZPHY C34 15	S.F. Biagi et al.	(BRIS, CERN, GEVA+)
BIAGI	87C	ZPHY C34 175	S.F. Biagi et al.	(BRIS, CERN, GEVA+) JP
ASTON	85B	PR D32 2270	D. Aston et al.	(SLAC, CARL, CNRC, CINC)
JENKINS	83	PRL 51 951	C.M. Jenkins et al.	(FSU, BRAN, LBL+)
BIAGI	81	ZPHY C9 305	S.F. Biagi et al.	(BRIS, CAVE, GEVA+)
HASSALL	81	NP B189 397	J.K. Hassall et al.	(CAVE, MSU)
TEODORO	78	PL 77B 451	D. Teodoro et al.	(AMST, CERN, NIJM+) JP

BRIEFEL	77	PR D16 2706	E. Briefel *et al.*	(BRAN, UMD, SYRA+)	
Also		PRL 23 884	S.P. Apsell *et al.*	(BRAN, UMD, SYRA+)	
GAY	76C	PL 62B 477	J.B. Gay *et al.*	(AMST, CERN, NIJM)	IJ
DIBIANCA	75	NP B98 137	F.A. Dibianca, R.J. Endorf	(CMU)	
BADIER	72	NP B37 429	J. Badier *et al.*	(EPOL)	
APSELL	70	PRL 24 777	S.P. Apsell *et al.*	(BRAN, UMD, SYRA+)	I
CRENNELL	70B	PR D1 847	D.J. Crennell *et al.*	(BNL)	
ALITTI	69	PRL 22 79	J. Alitti *et al.*	(BNL, SYRA)	I
DAUBER	69	PR 179 1262	P.M. Dauber *et al.*	(LRL)	
TRIPP	67	NP B3 10	R.D. Tripp *et al.*	(LRL, SLAC, CERN+)	
BADIER	65	PL 16 171	J. Badier *et al.*	(EPOL, SACL, AMST)	I
SMITH	65B	Athens Conf. 251	G.A. Smith, J.S. Lindsey	(LRL)	
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MERRILL	68	PR 167 1202	D.W. Merrill, J. Button-Shafer	(LRL)	
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