

**$N(1720) \ 3/2^+$**  $I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$  Status: \*\*\*\*

Most of the results published before 1975 were last included in our 1982 edition, *Physics Letters* **111B** 1 (1982). Some further obsolete results published before 1984 were last included in our 2006 edition, *Journal of Physics* (generic for all A,B,E,G) **G33** 1 (2006).

 **$N(1720)$  BREIT-WIGNER MASS**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1700 to 1750 (<math>\approx 1720</math>) OUR ESTIMATE</b>			
1700 $\pm 10$	SHKLYAR	13	DPWA Multichannel
1690 $+ 70$ $- 35$	ANISOVICH	12A	DPWA Multichannel
1763.8 $\pm 4.6$	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1700 $\pm 50$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1710 $\pm 20$	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1720 $\pm 5$	SHRESTHA	12A	DPWA Multichannel
1770 $\pm 100$	ANISOVICH	10	DPWA Multichannel
1720 $\pm 18$	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1790 $\pm 100$	THOMA	08	DPWA Multichannel
1749.6 $\pm 4.5$	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
1705 $\pm 10$	PENNER	02C	DPWA Multichannel
1716 $\pm 112$	VRANA	00	DPWA Multichannel
1713 $\pm 10$	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
1820	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1720	LI	93	IPWA $\gamma N \rightarrow \pi N$
1717 $\pm 31$	MANLEY	92	IPWA $\pi N \rightarrow \pi N \ \& \ N\pi\pi$
1690	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$
1750	<sup>1</sup> LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
1720	<sup>2</sup> LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$

 **$N(1720)$  BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>150 to 400 (<math>\approx 250</math>) OUR ESTIMATE</b>			
152 $\pm 2$	SHKLYAR	13	DPWA Multichannel
420 $\pm 100$	ANISOVICH	12A	DPWA Multichannel
210 $\pm 22$	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
125 $\pm 70$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
190 $\pm 30$	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
200 $\pm 20$	SHRESTHA	12A	DPWA Multichannel
650 $\pm 120$	ANISOVICH	10	DPWA Multichannel
244 $\pm 28$	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
690 $\pm 100$	THOMA	08	DPWA Multichannel
256 $\pm 22$	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
237 $\pm 73$	PENNER	02C	DPWA Multichannel

121 ± 39	VRANA	00	DPWA	Multichannel
153 ± 15	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
354	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
200	LI	93	IPWA	$\gamma N \rightarrow \pi N$
380 ± 180	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \ \& \ N\pi\pi$
120	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$
130	<sup>1</sup> LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$
150	<sup>2</sup> LONGACRE	75	IPWA	$\pi N \rightarrow N\pi\pi$

## N(1720) POLE POSITION

### REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>1660 to 1690 (≈ 1675) OUR ESTIMATE</b>			
1660 ± 30	ANISOVICH	12A	DPWA Multichannel
1666	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1686	<sup>3</sup> HOEHLER	93	SPED $\pi N \rightarrow \pi N$
1680 ± 30	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1670	SHKLYAR	13	DPWA Multichannel
1687	SHRESTHA	12A	DPWA Multichannel
1660 ± 35	ANISOVICH	10	DPWA Multichannel
1691 ± 23	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1630 ± 90	THOMA	08	DPWA Multichannel
1655	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
1692	VRANA	00	DPWA Multichannel
1717	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1675	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90
1716 or 1716	<sup>4</sup> LONGACRE	78	IPWA $\pi N \rightarrow N\pi\pi$
1745 or 1748	<sup>1</sup> LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$

### −2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>150 to 400 (≈ 250) OUR ESTIMATE</b>			
450 ± 100	ANISOVICH	12A	DPWA Multichannel
355	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
187	<sup>3</sup> HOEHLER	93	SPED $\pi N \rightarrow \pi N$
120 ± 40	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
118	SHKLYAR	13	DPWA Multichannel
175	SHRESTHA	12A	DPWA Multichannel
360 ± 80	ANISOVICH	10	DPWA Multichannel
233 ± 23	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
460 ± 80	THOMA	08	DPWA Multichannel
278	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
94	VRANA	00	DPWA Multichannel
388	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
114	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90
124 or 126	<sup>4</sup> LONGACRE	78	IPWA $\pi N \rightarrow N\pi\pi$
135 or 123	<sup>1</sup> LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$

## ***N*(1720) ELASTIC POLE RESIDUE**

### **MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>15±8 OUR ESTIMATE</b>			
22±8	ANISOVICH	12A	DPWA Multichannel
25	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
15	HOEHLER	93	SPED $\pi N \rightarrow \pi N$
8±2	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
12	SHKLYAR	13	DPWA Multichannel
20	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
20	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
39	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
11	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

### **PHASE $\theta$**

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>-130±30 OUR ESTIMATE</b>			
-115±30	ANISOVICH	12A	DPWA Multichannel
-94	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
-160±30	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-45	SHKLYAR	13	DPWA Multichannel
-109	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
-88	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
-70	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
-130	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

## ***N*(1720) INELASTIC POLE RESIDUE**

The “normalized residue” is the residue divided by  $\Gamma_{pole}/2$ .

### **Normalized residue in $N\pi \rightarrow N(1720) \rightarrow N\eta$**

<u>MODULUS (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3±2</b>	ANISOVICH	12A	DPWA Multichannel

### **Normalized residue in $N\pi \rightarrow N(1720) \rightarrow \Lambda K$**

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>6±4</b>	<b>-150 ± 45</b>	ANISOVICH	12A	DPWA Multichannel

### **Normalized residue in $N\pi \rightarrow N(1720) \rightarrow \Delta\pi, P\text{-wave}$**

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>29±8</b>	<b>80 ± 40</b>	ANISOVICH	12A	DPWA Multichannel

### **Normalized residue in $N\pi \rightarrow N(1720) \rightarrow \Delta\pi, F\text{-wave}$**

<u>MODULUS (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3±3</b>	ANISOVICH	12A	DPWA Multichannel

## N(1720) DECAY MODES

The following branching fractions are our estimates, not fits or averages.

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\pi$	$(11 \pm 3) \%$
$\Gamma_2$ $N\eta$	$(4 \pm 1) \%$
$\Gamma_3$ $\Lambda K$	1–15 %
$\Gamma_4$ $\Sigma K$	
$\Gamma_5$ $N\pi\pi$	$>70 \%$
$\Gamma_6$ $\Delta\pi$	
$\Gamma_7$ $\Delta(1232)\pi$ , <i>P</i> -wave	$(75 \pm 15) \%$
$\Gamma_8$ $N\rho$	70–85 %
$\Gamma_9$ $N\rho$ , $S=1/2$ , <i>P</i> -wave	large
$\Gamma_{10}$ $N\rho$ , $S=3/2$ , <i>P</i> -wave	
$\Gamma_{11}$ $N(\pi\pi)_{S\text{-wave}}^{I=0}$	
$\Gamma_{12}$ $p\gamma$	0.05–0.25 %
$\Gamma_{13}$ $p\gamma$ , helicity=1/2	0.05–0.15 %
$\Gamma_{14}$ $p\gamma$ , helicity=3/2	0.002–0.16 %
$\Gamma_{15}$ $n\gamma$	0.0–0.016 %
$\Gamma_{16}$ $n\gamma$ , helicity=1/2	0.0–0.01 %
$\Gamma_{17}$ $n\gamma$ , helicity=3/2	0.0–0.015 %

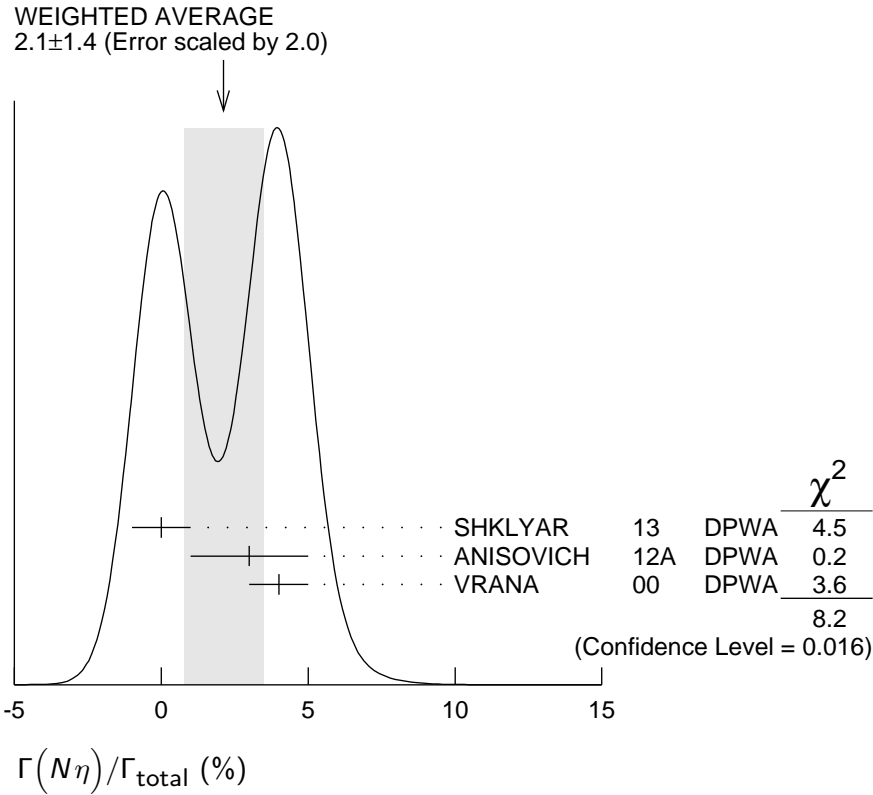
## N(1720) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$	$\Gamma_1/\Gamma$
VALUE (%)	DOCUMENT ID    TECN    COMMENT
<b>11 <math>\pm</math> 3    OUR ESTIMATE</b>	
17 $\pm$ 2	SHKLYAR    13    DPWA    Multichannel
10 $\pm$ 5	ANISOVICH    12A    DPWA    Multichannel
9.4 $\pm$ 0.5	ARNDT    06    DPWA $\pi N \rightarrow \pi N, \eta N$
10 $\pm$ 4	CUTKOSKY    80    IPWA $\pi N \rightarrow \pi N$
14 $\pm$ 3	HOEHLER    79    IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
13.6 $\pm$ 0.6	SHRESTHA    12A    DPWA    Multichannel
14 $\pm$ 5	ANISOVICH    10    DPWA    Multichannel
18 $\pm$ 3	BATINIC    10    DPWA $\pi N \rightarrow N\pi, N\eta$
9 $\pm$ 6	THOMA    08    DPWA    Multichannel
19.0 $\pm$ 0.4	ARNDT    04    DPWA $\pi N \rightarrow \pi N, \eta N$
17 $\pm$ 2	PENNER    02C    DPWA    Multichannel
5 $\pm$ 5	VRANA    00    DPWA    Multichannel
16	ARNDT    95    DPWA $\pi N \rightarrow N\pi$
13 $\pm$ 5	MANLEY    92    IPWA $\pi N \rightarrow \pi N \ \& \ N\pi\pi$

$\Gamma(N\eta)/\Gamma_{\text{total}}$

$\Gamma_2/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2.1±1.4 OUR AVERAGE</b>	Error includes scale factor of 2.0. See the ideogram below.		
0 ±1	SHKLYAR	13	DPWA Multichannel
3 ±2	ANISOVICH	12A	DPWA Multichannel
4 ±1	VRANA	00	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
< 1	SHRESTHA	12A	DPWA Multichannel
0 ±1	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
10 ±7	THOMA	08	DPWA Multichannel
0.2±0.2	PENNER	02C	DPWA Multichannel



$\Gamma(\Lambda K)/\Gamma_{\text{total}}$

$\Gamma_3/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>4.4±0.4 OUR AVERAGE</b>			
4.3±0.4	SHKLYAR	05	DPWA Multichannel
9 ±3	PENNER	02C	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2.8±0.4	SHRESTHA	12A	DPWA Multichannel
12 ±9	THOMA	08	DPWA Multichannel

$\Gamma(\Delta(1232)\pi, P\text{-wave})/\Gamma_{\text{total}}$

$\Gamma_7/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>75±15</b>	ANISOVICH	12A	DPWA Multichannel

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1720) \rightarrow \Lambda K$				$(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
<b>−0.14 to −0.06 OUR ESTIMATE</b>				
−0.09	BELL	83	DPWA	$\pi^- p \rightarrow \Lambda K^0$
−0.11	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$

Note: Signs of couplings from  $\pi N \rightarrow N\pi\pi$  analyses were changed in the 1986 edition to agree with the baryon-first convention; the overall phase ambiguity is resolved by choosing a negative sign for the  $\Delta(1620) S_{31}$  coupling to  $\Delta(1232)\pi$ .

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1720) \rightarrow \Delta(1232)\pi$ , <i>P-wave</i>				$(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
−0.17	<sup>1</sup> LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1720) \rightarrow N\rho$ , <i>S=1/2, P-wave</i>				$(\Gamma_1 \Gamma_9)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
<b>−0.30 to +0.40 OUR ESTIMATE</b>				
−0.26	<sup>1</sup> LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$
+0.40	<sup>2</sup> LONGACRE	75	IPWA	$\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
+0.34 ± 0.05	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$

$\Gamma(N\rho, S=1/2, P\text{-wave}) / \Gamma_{\text{total}}$				$\Gamma_9 / \Gamma$
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
<b>91 ± 1</b>	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.4 ± 0.5	SHRESTHA	12A	DPWA	Multichannel

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1720) \rightarrow N\rho$ , <i>S=3/2, P-wave</i>				$(\Gamma_1 \Gamma_{10})^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.15	<sup>1</sup> LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1720) \rightarrow N(\pi\pi)_{S\text{-wave}}^{I=0}$				$(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
−0.19	<sup>1</sup> LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

## **$N(1720)$ PHOTON DECAY AMPLITUDES**

Papers on  $\gamma N$  amplitudes predating 1981 may be found in our 2006 edition, *Journal of Physics* (generic for all A,B,E,G) **G33** 1 (2006).

### **$N(1720) \rightarrow p\gamma$ , helicity-1/2 amplitude $A_{1/2}$**

VALUE (GeV <sup>−1/2</sup> )	DOCUMENT ID	TECN	COMMENT	
<b>0.100 ± 0.020 OUR ESTIMATE</b>				
0.110 ± 0.045	ANISOVICH	12A	DPWA	Multichannel
0.095 ± 0.002	WORKMAN	12A	DPWA	$\gamma N \rightarrow N\pi$
0.097 ± 0.003	DUGGER	07	DPWA	$\gamma N \rightarrow \pi N$
0.044 ± 0.066	CRAWFORD	83	IPWA	$\gamma N \rightarrow \pi N$
−0.004 ± 0.007	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$

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

$-0.065 \pm 0.002$	SHKLYAR	13	DPWA	Multichannel
$0.057 \pm 0.003$	SHRESTHA	12A	DPWA	Multichannel
$0.130 \pm 0.050$	ANISOVICH	10	DPWA	Multichannel
0.073	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
-0.053	PENNER	02D	DPWA	Multichannel
$-0.015 \pm 0.015$	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
$0.012 \pm 0.003$	LI	93	IPWA	$\gamma N \rightarrow \pi N$

### $N(1720) \rightarrow p\gamma$ , helicity-3/2 amplitude $A_{3/2}$

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.150 \pm 0.030$	ANISOVICH	12A	DPWA Multichannel
$-0.048 \pm 0.002$	WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
$-0.039 \pm 0.003$	DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
$-0.024 \pm 0.006$	CRAWFORD	83	IPWA $\gamma N \rightarrow \pi N$
$-0.040 \pm 0.016$	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

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

$0.035 \pm 0.002$	SHKLYAR	13	DPWA	Multichannel
$-0.019 \pm 0.002$	SHRESTHA	12A	DPWA	Multichannel
$0.100 \pm 0.050$	ANISOVICH	10	DPWA	Multichannel
-0.011	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
0.027	PENNER	02D	DPWA	Multichannel
$0.007 \pm 0.010$	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
$-0.022 \pm 0.003$	LI	93	IPWA	$\gamma N \rightarrow \pi N$

### $N(1720) \rightarrow n\gamma$ , helicity-1/2 amplitude $A_{1/2}$

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.007 \pm 0.015$	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
$0.002 \pm 0.005$	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

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

$-0.002 \pm 0.001$	SHRESTHA	12A	DPWA	Multichannel
-0.003	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
-0.004	PENNER	02D	DPWA	Multichannel
$0.050 \pm 0.004$	LI	93	IPWA	$\gamma N \rightarrow \pi N$

### $N(1720) \rightarrow n\gamma$ , helicity-3/2 amplitude $A_{3/2}$

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-0.005 \pm 0.025$	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
$-0.015 \pm 0.019$	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

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

$-0.001 \pm 0.002$	SHRESTHA	12A	DPWA	Multichannel
-0.031	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$
0.003	PENNER	02D	DPWA	Multichannel
$-0.017 \pm 0.004$	LI	93	IPWA	$\gamma N \rightarrow \pi N$

**$N(1720) \quad \gamma p \rightarrow \Lambda K^+$  AMPLITUDES** **$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$  in  $p\gamma \rightarrow N(1720) \rightarrow \Lambda K^+$  ( $E_{1+}$  amplitude)**VALUE (units  $10^{-3}$ )                      DOCUMENT ID                      TECN

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

$10.2 \pm 0.2$	WORKMAN	90	DPWA
9.52	TANABE	89	DPWA

 **$p\gamma \rightarrow N(1720) \rightarrow \Lambda K^+$  phase angle  $\theta$  ( $E_{1+}$  amplitude)**VALUE (degrees)                      DOCUMENT ID                      TECN

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

$-124 \pm 2$	WORKMAN	90	DPWA
$-103.4$	TANABE	89	DPWA

 **$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$  in  $p\gamma \rightarrow N(1720) \rightarrow \Lambda K^+$  ( $M_{1+}$  amplitude)**VALUE (units  $10^{-3}$ )                      DOCUMENT ID                      TECN

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

$-4.5 \pm 0.2$	WORKMAN	90	DPWA
3.18	TANABE	89	DPWA

 **$N(1720)$  FOOTNOTES**

- <sup>1</sup> LONGACRE 77 pole positions are from a search for poles in the unitarized T-matrix; the first (second) value uses, in addition to  $\pi N \rightarrow N\pi\pi$  data, elastic amplitudes from a Saclay (CERN) partial-wave analysis. The other LONGACRE 77 values are from eyeball fits with Breit-Wigner circles to the T-matrix amplitudes.
- <sup>2</sup> From method II of LONGACRE 75: eyeball fits with Breit-Wigner circles to the T-matrix amplitudes.
- <sup>3</sup> See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of  $N$  and  $\Delta$  resonances as determined from Argand diagrams of  $\pi N$  elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams.
- <sup>4</sup> LONGACRE 78 values are from a search for poles in the unitarized T-matrix. The first (second) value uses, in addition to  $\pi N \rightarrow N\pi\pi$  data, elastic amplitudes from a Saclay (CERN) partial-wave analysis.

 **$N(1720)$  REFERENCES**For early references, see *Physics Letters* **111B** 1 (1982).

SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel	(GIES)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
WORKMAN	12A	PR C86 015202	R. Workman <i>et al.</i>	(GWU)
ANISOVICH	10	EPJ A44 203	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)
THOMA	08	PL B659 87	U. Thoma <i>et al.</i>	(CB-ELSA Collab.)
DRECHSEL	07	EPJ A34 69	D. Drechsel, S.S. Kamalov, L. Tiator	(MAINZ, JINR)
DUGGER	07	PR C76 025211	M. Dugger <i>et al.</i>	(Jefferson Lab CLAS Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
SHKLYAR	05	PR C72 015210	V. Shklyar, H. Lenske, U. Mosel	(GIES)
ARNDT	04	PR C69 035213	R.A. Arndt <i>et al.</i>	(GWU, TRIU)
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman,, T.-S.H. Lee	(PITT+)



ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)
HOEHLER	93	$\pi N$ Newsletter 9 1	G. Hohler	(KARL)
LI	93	PR C47 2759	Z.J. Li <i>et al.</i>	(VPI)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA) IJP
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)
ARNDT	91	PR D43 2131	R.A. Arndt <i>et al.</i>	(VPI, TELE) IJP
WORKMAN	90	PR C42 781	R.L. Workman	(VPI)
TANABE	89	PR C39 741	H. Tanabe, M. Kohno, C. Bennhold	(MANZ)
Also		NC 102A 193	M. Kohno, H. Tanabe, C. Bennhold	(MANZ)
BELL	83	NP B222 389	K.W. Bell <i>et al.</i>	(RL) IJP
CRAWFORD	83	NP B211 1	R.L. Crawford, W.T. Morton	(GLAS)
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELSE, CIT, CERN)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also		NP B197 365	K. Fujii <i>et al.</i>	(NAGO)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
SAXON	80	NP B162 522	D.H. Saxon <i>et al.</i>	(RHEL, BRIS) IJP
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP
LONGACRE	78	PR D17 1795	R.S. Longacre <i>et al.</i>	(LBL, SLAC)
LONGACRE	77	NP B122 493	R.S. Longacre, J. Dolbeau	(SACL) IJP
Also		NP B108 365	J. Dolbeau <i>et al.</i>	(SACL) IJP
LONGACRE	75	PL 55B 415	R.S. Longacre <i>et al.</i>	(LBL, SLAC) IJP

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