

$$N(1675) \ 5/2^-$$

$$I(J^P) = \frac{1}{2}(\frac{5}{2}^-) \text{ Status: } ****$$

Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014).

N(1675) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1650 to 1660 (\approx 1655) OUR ESTIMATE			
1652 \pm 2	ROENCHEN 22	DPWA	Multichannel
1655 \pm 4	SOKHOYAN 15A	DPWA	Multichannel
1654 \pm 2	¹ SVARC 14	L+P	$\pi N \rightarrow \pi N$
1660 \pm 10	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1646	HUNT 19	DPWA	Multichannel
1646	ROENCHEN 15A	DPWA	Multichannel
1640	SHKLYAR 13	DPWA	Multichannel
1654 \pm 4	ANISOVICH 12A	DPWA	Multichannel
1658 \pm 9	BATINIC 10	DPWA	$\pi N \rightarrow N\pi, N\eta$
1657	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$
1674	VRANA 00	DPWA	Multichannel
1656	HOEHLER 93	ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
120 to 150 (\approx 135) OUR ESTIMATE			
119 \pm 1	ROENCHEN 22	DPWA	Multichannel
147 \pm 5	SOKHOYAN 15A	DPWA	Multichannel
125 \pm 3 \pm 1	¹ SVARC 14	L+P	$\pi N \rightarrow \pi N$
140 \pm 10	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
146	HUNT 19	DPWA	Multichannel
125	ROENCHEN 15A	DPWA	Multichannel
108	SHKLYAR 13	DPWA	Multichannel
151 \pm 5	ANISOVICH 12A	DPWA	Multichannel
137 \pm 7	BATINIC 10	DPWA	$\pi N \rightarrow N\pi, N\eta$
139	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$
120	VRANA 00	DPWA	Multichannel
126	HOEHLER 93	ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

$N(1675)$ ELASTIC POLE RESIDUE

MODULUS $|r|$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
22 to 32 (≈ 26) OUR ESTIMATE			
22 \pm 1	ROENCHEN	22 DPWA	Multichannel
28 \pm 1	SOKHOYAN	15A DPWA	Multichannel
23 \pm 1	¹ SVARC	14 L+P	$\pi N \rightarrow \pi N$
31 \pm 5	CUTKOSKY	80 IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
24	ROENCHEN	15A DPWA	Multichannel
20	SHKLYAR	13 DPWA	Multichannel
28 \pm 1	ANISOVICH	12A DPWA	Multichannel
25	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
27	ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
23	HOEHLER	93 ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

PHASE θ

<u>VALUE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-27 to -17 (≈ -22) OUR ESTIMATE			
-17 \pm 1	ROENCHEN	22 DPWA	Multichannel
-24 \pm 4	SOKHOYAN	15A DPWA	Multichannel
-25 \pm 2	¹ SVARC	14 L+P	$\pi N \rightarrow \pi N$
-30 \pm 10	CUTKOSKY	80 IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-22	ROENCHEN	15A DPWA	Multichannel
-49	SHKLYAR	13 DPWA	Multichannel
-26 \pm 4	ANISOVICH	12A DPWA	Multichannel
-16	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
-21	ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
-22	HOEHLER	93 ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

$N(1675)$ INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Delta\pi, D$ -wave

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.33 \pm 0.04	90 \pm 15	SOKHOYAN	15A DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.33 \pm 0.05	82 \pm 10	ANISOVICH	12A DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow N\eta$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.063 \pm 0.005	-39 \pm 1	ROENCHEN	22 DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.044	-43	ROENCHEN	15A DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Lambda K$

<u>MODULUS</u>	<u>PHASE ($^{\circ}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.001 ± 0.001	174 ± 80	ROENCHEN	22	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.001	100	ROENCHEN	15A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Sigma K$

<u>MODULUS</u>	<u>PHASE ($^{\circ}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.024 ± 0.001	-166 ± 3	ROENCHEN	22	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.031	-175	ROENCHEN	15A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow N\sigma$

<u>MODULUS</u>	<u>PHASE ($^{\circ}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13 ± 0.03	125 ± 20	SOKHOYAN	15A	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.15 ± 0.04	132 ± 18	ANISOVICH	12A	DPWA Multichannel

$N(1675)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1665 to 1680 (≈ 1675) OUR ESTIMATE			
1669 ± 2	¹ HUNT	19	DPWA Multichannel
1663 ± 4	SOKHOYAN	15A	DPWA Multichannel
1666 ± 2	¹ SHKLYAR	13	DPWA Multichannel
1674.1 ± 0.2	¹ ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1675 ± 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1679 ± 8	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1664 ± 5	ANISOVICH	12A	DPWA Multichannel
1679 ± 1	¹ SHRESTHA	12A	DPWA Multichannel
1679 ± 9	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1685 ± 4	VRANA	00	DPWA Multichannel

¹Statistical error only.

$N(1675)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
130 to 160 (≈ 145) OUR ESTIMATE			
161 ± 8	¹ HUNT	19	DPWA Multichannel
146 ± 6	SOKHOYAN	15A	DPWA Multichannel
148 ± 1	¹ SHKLYAR	13	DPWA Multichannel
146.5 ± 1.0	¹ ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
160 ± 20	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
120 ± 15	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$

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

152 ± 7	ANISOVICH	12A	DPWA	Multichannel
145 ± 4	¹ SHRESTHA	12A	DPWA	Multichannel
152 ± 8	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
131 ± 10	VRANA	00	DPWA	Multichannel

¹Statistical error only.

N(1675) DECAY MODES

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\pi$	38–42 %
Γ_2 $N\eta$	< 1 %
Γ_3 ΛK	<0.04 %
Γ_4 $N\pi\pi$	25–45 %
Γ_5 $\Delta(1232)\pi, D\text{-wave}$	23–37 %
Γ_6 $N\rho$	0.1–0.9 %
Γ_7 $N\rho, S=1/2$	<0.2 %
Γ_8 $N\rho, S=3/2, D\text{-wave}$	0.1–0.7 %
Γ_9 $N\sigma$	3–7 %
Γ_{10} $p\gamma$	0–0.02 %
Γ_{11} $p\gamma, \text{helicity}=1/2$	0–0.01 %
Γ_{12} $p\gamma, \text{helicity}=3/2$	0–0.01 %
Γ_{13} $n\gamma$	0–0.15 %
Γ_{14} $n\gamma, \text{helicity}=1/2$	0–0.05 %
Γ_{15} $n\gamma, \text{helicity}=3/2$	0–0.10 %

N(1675) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE (%)	DOCUMENT ID	TECN	COMMENT

38 to 42 (≈ 40) OUR ESTIMATE

33 ± 1	¹ HUNT	19	DPWA	Multichannel
41 ± 2	SOKHOYAN	15A	DPWA	Multichannel
41 ± 1	¹ SHKLYAR	13	DPWA	Multichannel
39.3±0.1	¹ ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
38 ± 5	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
38 ± 3	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$

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

40 ± 3	ANISOVICH	12A	DPWA	Multichannel
38.6±0.6	¹ SHRESTHA	12A	DPWA	Multichannel
35 ± 4	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
35 ± 1	VRANA	00	DPWA	Multichannel

¹Statistical error only.

$\Gamma(N\eta)/\Gamma_{\text{total}}$				Γ_2/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.5±0.5	MUELLER	20	DPWA	Multichannel
2.0±0.3	¹ HUNT	19	DPWA	Multichannel
<1	SHKLYAR	13	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<1	¹ SHRESTHA	12A	DPWA	Multichannel
0.1±0.1	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
3 ±3	THOMA	08	DPWA	Multichannel
0 ±1	VRANA	00	DPWA	Multichannel
¹ Statistical error only.				
$\Gamma(\Lambda K)/\Gamma_{\text{total}}$				Γ_3/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.04 % OUR ESTIMATE				
<0.04	¹ HUNT	19	DPWA	Multichannel
¹ Statistical error only.				
$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{\text{total}}$				Γ_5/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
58.3±0.2	¹ HUNT	19	DPWA	Multichannel
30 ±7	SOKHOYAN	15A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
33 ±8	ANISOVICH	12A	DPWA	Multichannel
46 ±1	¹ SHRESTHA	12A	DPWA	Multichannel
63 ±2	VRANA	00	DPWA	Multichannel
¹ Statistical error only.				
$\Gamma(N\rho, S=1/2)/\Gamma_{\text{total}}$				Γ_7/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.2 % OUR ESTIMATE				
<0.2	¹ HUNT	19	DPWA	Multichannel
¹ Statistical error only.				
$\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{\text{total}}$				Γ_8/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.1–0.7 % OUR ESTIMATE				
0.4±0.3	¹ HUNT	19	DPWA	Multichannel
¹ Statistical error only.				
$\Gamma(N\sigma)/\Gamma_{\text{total}}$				Γ_9/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
5±2	SOKHOYAN	15A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
7±3	ANISOVICH	12A	DPWA	Multichannel

$N(1675)$ PHOTON DECAY AMPLITUDES AT THE POLE **$N(1675) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.025 ± 0.002	-1.2 ± 3.9	ROENCHEN	22	DPWA Multichannel
0.022 ± 0.003	-12 ± 7	SOKHOYAN	15A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.032	36	ROENCHEN	15A	DPWA Multichannel

 $N(1675) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.051 ± 0.002	-1.0 ± 1.9	ROENCHEN	22	DPWA Multichannel
0.028 ± 0.006	-17 ± 6	SOKHOYAN	15A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.051	-9.3	ROENCHEN	15A	DPWA Multichannel

 $N(1675) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.053 ± 0.004	-3 ± 5	ANISOVICH	17E	DPWA Multichannel

 $N(1675) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.073 ± 0.005	-12 ± 5	ANISOVICH	17E	DPWA Multichannel

 $N(1675)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES **$N(1675) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.010 to 0.025 (≈ 0.018) OUR ESTIMATE			
0.026 ± 0.002	¹ HUNT	19	DPWA Multichannel
0.022 ± 0.003	SOKHOYAN	15A	DPWA Multichannel
0.009 ± 0.001	¹ SHKLYAR	13	DPWA Multichannel
0.013 ± 0.001	¹ WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
0.018 ± 0.002	¹ DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.024 ± 0.003	ANISOVICH	12A	DPWA Multichannel
0.011 ± 0.001	¹ SHRESTHA	12A	DPWA Multichannel
0.015	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$

¹Statistical error only. **$N(1675) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$**

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.015 to 0.030 (≈ 0.022) OUR ESTIMATE			
0.005 ± 0.002	¹ HUNT	19	DPWA Multichannel
0.027 ± 0.006	SOKHOYAN	15A	DPWA Multichannel
0.021 ± 0.001	¹ SHKLYAR	13	DPWA Multichannel
0.016 ± 0.001	¹ WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
0.021 ± 0.001	¹ DUGGER	07	DPWA $\gamma N \rightarrow \pi N$

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

0.025±0.007	ANISOVICH	12A	DPWA	Multichannel
0.020±0.001	¹ SHRESTHA	12A	DPWA	Multichannel
0.022	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$

¹Statistical error only.

$N(1675) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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–0.065 to –0.055 (≈ –0.060) OUR ESTIMATE

–0.069±0.005	¹ HUNT	19	DPWA	Multichannel
–0.053±0.004	ANISOVICH	17E	DPWA	Multichannel
–0.058±0.002	¹ CHEN	12A	DPWA	$\gamma N \rightarrow \pi N$

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

–0.060±0.007	ANISOVICH	13B	DPWA	Multichannel
–0.040±0.004	¹ SHRESTHA	12A	DPWA	Multichannel
–0.062	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$

¹Statistical error only.

$N(1675) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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–0.095 to –0.075 (≈ –0.085) OUR ESTIMATE

–0.031±0.005	¹ HUNT	19	DPWA	Multichannel
–0.072±0.005	ANISOVICH	17E	DPWA	Multichannel
–0.080±0.005	¹ CHEN	12A	DPWA	$\gamma N \rightarrow \pi N$

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

–0.088±0.010	ANISOVICH	13B	DPWA	Multichannel
–0.068±0.004	¹ SHRESTHA	12A	DPWA	Multichannel
–0.084	DRECHSEL	07	DPWA	$\gamma N \rightarrow \pi N$

¹Statistical error only.

$N(1675)$ REFERENCES

For early references, see Physics Letters **111B** 1 (1982).

ROENCHEN	22	EPJ A58 229	D. Roenchen <i>et al.</i>	(JULI, GWU, BONN+)
MUELLER	20	PL B803 135323	J. Mueller <i>et al.</i>	(CBELSA/TAPS Collab.)
HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
ANISOVICH	17E	PR C96 055202	A.V. Anisovich <i>et al.</i>	(BONN, PNPI, JLAB+)
ROENCHEN	15A	EPJ A51 70	D. Roenchen <i>et al.</i>	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan <i>et al.</i>	(CBELSA/TAPS Collab.)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
SVARC	14	PR C89 045205	A. Svarc <i>et al.</i>	(RBI Zagreb, UNI Tuzla)
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>	
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)
CHEN	12A	PR C86 015206	W. Chen <i>et al.</i>	(DUKE, GWU, MSST, ITEP+)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
WORKMAN	12A	PR C86 015202	R. Workman <i>et al.</i>	(GWU)
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>	(JLab CLAS Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman, T.-S.H. Lee	(PITT, ANL)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
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
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP
