

$$\Sigma(1910) \ 3/2^-$$

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

was  $\Sigma(1940)$

For results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** 1 (1982).

Not all analyses require this state. It is not required by the GOYAL 77 analysis of  $K^- n \rightarrow (\Sigma\pi)^-$  nor by the GOPAL 80 analysis of  $K^- n \rightarrow K^- n$ . See also HEMINGWAY 75.

### $\Sigma(1910)$ POLE RESIDUES

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

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow N\bar{K}$

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------------|--------------|------|--------------------------|
| <b>0.03±0.02</b> | <b>-95 ± 60</b> | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Sigma\pi$

| MODULUS          | PHASE (°)        | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|------------------|--------------|------|--------------------------|
| <b>0.16±0.04</b> | <b>-160 ± 15</b> | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda\pi$

| MODULUS          | PHASE (°)      | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|----------------|--------------|------|--------------------------|
| <b>0.04±0.03</b> | <b>25 ± 25</b> | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Xi\pi$

| MODULUS          | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------|--------------|------|--------------------------|
| <b>0.01±0.01</b> |           | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda(1520)\pi, P\text{-wave}$

| MODULUS          | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------|--------------|------|--------------------------|
| <b>0.01±0.01</b> |           | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda(1520)\pi, F\text{-wave}$

| MODULUS  | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                  |
|----------|-----------|--------------|------|--------------------------|
| $\sim 0$ |           | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Delta\bar{K}, S\text{-wave}$

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------------|--------------|------|--------------------------|
| <b>0.03±0.01</b> | <b>120 ± 20</b> | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow N\bar{K}^*(892), S=3/2, S\text{-wave}$

| MODULUS          | PHASE (°)      | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|----------------|--------------|------|--------------------------|
| <b>0.03±0.02</b> | <b>20 ± 35</b> | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow N\bar{K}^*(892), S=1/2, D\text{-wave}$

| MODULUS          | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------|--------------|------|--------------------------|
| <b>0.02±0.01</b> |           | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow N\bar{K}^*(892), S=3/2, D\text{-wave}$

| MODULUS          | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                  |
|------------------|-----------|--------------|------|--------------------------|
| <b>0.01±0.01</b> |           | SARANTSEV 19 | DPWA | $\bar{K} N$ multichannel |

### $\Sigma(1910)$ MASS

| VALUE (MeV)                                                  | DOCUMENT ID    | TECN | COMMENT                                 |
|--------------------------------------------------------------|----------------|------|-----------------------------------------|
| <b>1870 to 1950 (<math>\approx 1910</math>) OUR ESTIMATE</b> |                |      |                                         |
| 1878±12                                                      | SARANTSEV 19   | DPWA | $\bar{K} N$ multichannel                |
| 1920±50                                                      | GOPAL 77       | DPWA | $\bar{K} N$ multichannel                |
| 1950±30                                                      | BAILLON 75     | IPWA | $\bar{K} N \rightarrow \Lambda\pi$      |
| 1949 <sup>+40</sup> <sub>-60</sub>                           | VANHORN 75     | DPWA | $K^- p \rightarrow \Lambda\pi^0$        |
| 1935±80                                                      | KANE 74        | DPWA | $K^- p \rightarrow \Sigma\pi$           |
| 1940±20                                                      | LITCHFIELD 74B | DPWA | $K^- p \rightarrow \Lambda(1520)\pi^0$  |
| 1950±20                                                      | LITCHFIELD 74C | DPWA | $K^- p \rightarrow \Delta(1232)\bar{K}$ |

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

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1886 or 1893  
1940
<sup>1</sup> MARTIN 77 DPWA  $\bar{K}N$  multichannel  
 DEBELLEFON 76 IPWA  $K^- p \rightarrow \Lambda \pi^0, F_{17}$   
 wave
 **$\Sigma(1910)$  WIDTH**

| VALUE (MeV)                                                                   | DOCUMENT ID         | TECN | COMMENT                                       |
|-------------------------------------------------------------------------------|---------------------|------|-----------------------------------------------|
| <b>150 to 300 (<math>\approx 220</math>) OUR ESTIMATE</b>                     |                     |      |                                               |
| 224 $\pm$ 25                                                                  | SARANTSEV           | 19   | DPWA $\bar{K}N$ multichannel                  |
| 170 $\pm$ 25                                                                  | CAMERON             | 78B  | DPWA $K^- p \rightarrow N \bar{K}^*$          |
| 300 $\pm$ 80                                                                  | GOPAL               | 77   | DPWA $\bar{K}N$ multichannel                  |
| 150 $\pm$ 75                                                                  | BAILLON             | 75   | IPWA $\bar{K}N \rightarrow \Lambda \pi$       |
| 160 <sup>+70</sup> <sub>-40</sub>                                             | VANHORN             | 75   | DPWA $K^- p \rightarrow \Lambda \pi^0$        |
| 330 $\pm$ 80                                                                  | KANE                | 74   | DPWA $K^- p \rightarrow \Sigma \pi$           |
| 60 $\pm$ 20                                                                   | LITCHFIELD          | 74B  | DPWA $K^- p \rightarrow \Lambda(1520) \pi^0$  |
| 70 <sup>+30</sup> <sub>-20</sub>                                              | LITCHFIELD          | 74C  | DPWA $K^- p \rightarrow \Delta(1232) \bar{K}$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                     |      |                                               |
| 157 or 159                                                                    | <sup>1</sup> MARTIN | 77   | DPWA $\bar{K}N$ multichannel                  |

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 **$\Sigma(1910)$  DECAY MODES**

| Mode                                             | Fraction ( $\Gamma_i/\Gamma$ )  |
|--------------------------------------------------|---------------------------------|
| $\Gamma_1$ $N \bar{K}$                           | 0.01 to 0.05 ( $\approx 0.02$ ) |
| $\Gamma_2$ $\Lambda \pi$                         | ( 6 $\pm$ 4 ) %                 |
| $\Gamma_3$ $\Sigma \pi$                          | (86 $\pm$ 21 ) %                |
| $\Gamma_4$ $\Xi K$                               |                                 |
| $\Gamma_5$ $\Sigma(1385) \pi$                    | seen                            |
| $\Gamma_6$ $\Sigma(1385) \pi$ , S-wave           |                                 |
| $\Gamma_7$ $\Lambda(1520) \pi$                   | seen                            |
| $\Gamma_8$ $\Lambda(1520) \pi$ , P-wave          |                                 |
| $\Gamma_9$ $\Lambda(1520) \pi$ , F-wave          |                                 |
| $\Gamma_{10}$ $\Delta(1232) \bar{K}$             | ( 3.0 $\pm$ 1.0 ) %             |
| $\Gamma_{11}$ $\Delta(1232) \bar{K}$ , S-wave    |                                 |
| $\Gamma_{12}$ $\Delta(1232) \bar{K}$ , D-wave    |                                 |
| $\Gamma_{13}$ $N \bar{K}^*(892)$                 | seen                            |
| $\Gamma_{14}$ $N \bar{K}^*(892)$ , S=3/2, S-wave |                                 |
| $\Gamma_{15}$ $N \bar{K}^*(892)$ , S=1/2, D-wave | ( 1.0 $\pm$ 1.0 ) %             |
| $\Gamma_{16}$ $N \bar{K}^*(892)$ , S=3/2, D-wave |                                 |

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DESIG=3

DESIG=183

DESIG=8;OUR EST

DESIG=81

DESIG=181;OUR EST

DESIG=4

DESIG=5

DESIG=182

DESIG=6

DESIG=7

DESIG=9;OUR EST

DESIG=91

DESIG=185

DESIG=184

 **$\Sigma(1910)$  BRANCHING RATIOS**

See "Sign conventions for resonance couplings" in the Note on  $\Lambda$  and  $\Sigma$  Resonances.

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 **$\Gamma(N \bar{K})/\Gamma_{\text{total}}$**  $\Gamma_1/\Gamma$ 

| VALUE                                                        | DOCUMENT ID         | TECN | COMMENT                      |
|--------------------------------------------------------------|---------------------|------|------------------------------|
| <b>0.01 to 0.05 (<math>\approx 0.02</math>) OUR ESTIMATE</b> |                     |      |                              |
| 0.03 $\pm$ 0.02                                              | SARANTSEV           | 19   | DPWA $\bar{K}N$ multichannel |
| <0.04                                                        | GOPAL               | 77   | DPWA $\bar{K}N$ multichannel |
| 0.14 or 0.13                                                 | <sup>1</sup> MARTIN | 77   | DPWA $\bar{K}N$ multichannel |

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 **$\Gamma(\Lambda \pi)/\Gamma_{\text{total}}$**  $\Gamma_2/\Gamma$ 

| VALUE                           | DOCUMENT ID | TECN | COMMENT                      |
|---------------------------------|-------------|------|------------------------------|
| <b>0.06<math>\pm</math>0.04</b> | SARANTSEV   | 19   | DPWA $\bar{K}N$ multichannel |

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 **$\Gamma(\Sigma \pi)/\Gamma_{\text{total}}$**  $\Gamma_3/\Gamma$ 

| VALUE                           | DOCUMENT ID | TECN | COMMENT                      |
|---------------------------------|-------------|------|------------------------------|
| <b>0.86<math>\pm</math>0.21</b> | SARANTSEV   | 19   | DPWA $\bar{K}N$ multichannel |

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 **$\Gamma(\Xi K)/\Gamma_{\text{total}}$**  $\Gamma_4/\Gamma$ 

| VALUE    | DOCUMENT ID | TECN | COMMENT                      |
|----------|-------------|------|------------------------------|
| $\sim 0$ | SARANTSEV   | 19   | DPWA $\bar{K}N$ multichannel |

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$\Gamma(\Lambda(1520)\pi, P\text{-wave})/\Gamma_{\text{total}}$  $\Gamma_8/\Gamma$ 

| VALUE    | DOCUMENT ID  | TECN | COMMENT                 |
|----------|--------------|------|-------------------------|
| $\sim 0$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R02  
 NODE=B098R02

 $\Gamma(\Lambda(1520)\pi, F\text{-wave})/\Gamma_{\text{total}}$  $\Gamma_9/\Gamma$ 

| VALUE    | DOCUMENT ID  | TECN | COMMENT                 |
|----------|--------------|------|-------------------------|
| $\sim 0$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R03  
 NODE=B098R03

 $\Gamma(\Delta(1232)\bar{K})/\Gamma_{\text{total}}$  $\Gamma_{10}/\Gamma$ 

| VALUE           | DOCUMENT ID  | TECN | COMMENT                 |
|-----------------|--------------|------|-------------------------|
| $0.03 \pm 0.01$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R04  
 NODE=B098R04

 $\Gamma(N\bar{K}^*(892))/\Gamma_{\text{total}}$  $\Gamma_{13}/\Gamma$ 

| VALUE           | DOCUMENT ID  | TECN | COMMENT                 |
|-----------------|--------------|------|-------------------------|
| $0.03 \pm 0.02$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R09  
 NODE=B098R09

 $\Gamma(N\bar{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{\text{total}}$  $\Gamma_{15}/\Gamma$ 

| VALUE           | DOCUMENT ID  | TECN | COMMENT                 |
|-----------------|--------------|------|-------------------------|
| $0.01 \pm 0.01$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R06  
 NODE=B098R06

 $\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$  $\Gamma_{16}/\Gamma$ 

| VALUE    | DOCUMENT ID  | TECN | COMMENT                 |
|----------|--------------|------|-------------------------|
| $\sim 0$ | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

NODE=B098R08  
 NODE=B098R08

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda\pi$  $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$ 

| VALUE                                                                         | DOCUMENT ID            | TECN | COMMENT                           |
|-------------------------------------------------------------------------------|------------------------|------|-----------------------------------|
| $-0.06 \pm 0.03$                                                              | GOPAL 77               | DPWA | $\bar{K}N$ multichannel           |
| $-0.04 \pm 0.02$                                                              | BAILLON 75             | IPWA | $\bar{K}N \rightarrow \Lambda\pi$ |
| $-0.05 \pm 0.03$<br>$-0.02$                                                   | VANHORN 75             | DPWA | $K^- p \rightarrow \Lambda\pi^0$  |
| $-0.153 \pm 0.070$                                                            | DEVENISH 74B           |      | Fixed- $t$ dispersion rel.        |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                        |      |                                   |
| $-0.15$ or $-0.14$                                                            | <sup>1</sup> MARTIN 77 | DPWA | $\bar{K}N$ multichannel           |

NODE=B098R2  
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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Sigma\pi$  $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$ 

| VALUE                                                                         | DOCUMENT ID            | TECN | COMMENT                       |
|-------------------------------------------------------------------------------|------------------------|------|-------------------------------|
| $-0.08 \pm 0.04$                                                              | GOPAL 77               | DPWA | $\bar{K}N$ multichannel       |
| $-0.14 \pm 0.04$                                                              | KANE 74                | DPWA | $K^- p \rightarrow \Sigma\pi$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                        |      |                               |
| $+0.16$ or $+0.16$                                                            | <sup>1</sup> MARTIN 77 | DPWA | $\bar{K}N$ multichannel       |

NODE=B098R3  
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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Sigma(1385)\pi$  $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$ 

| VALUE              | DOCUMENT ID             | TECN | COMMENT                             |
|--------------------|-------------------------|------|-------------------------------------|
| $+0.066 \pm 0.025$ | <sup>2</sup> CAMERON 78 | DPWA | $K^- p \rightarrow \Sigma(1385)\pi$ |

NODE=B098R8  
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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda(1520)\pi, P\text{-wave}$  $(\Gamma_1\Gamma_8)^{1/2}/\Gamma$ 

| VALUE            | DOCUMENT ID    | TECN | COMMENT                                |
|------------------|----------------|------|----------------------------------------|
| $< 0.03$         | CAMERON 77     | DPWA | $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| $-0.11 \pm 0.04$ | LITCHFIELD 74B | DPWA | $K^- p \rightarrow \Lambda(1520)\pi^0$ |

NODE=B098R4  
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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Lambda(1520)\pi, F\text{-wave}$  $(\Gamma_1\Gamma_9)^{1/2}/\Gamma$ 

| VALUE             | DOCUMENT ID    | TECN | COMMENT                                |
|-------------------|----------------|------|----------------------------------------|
| $0.062 \pm 0.021$ | CAMERON 77     | DPWA | $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| $-0.08 \pm 0.04$  | LITCHFIELD 74B | DPWA | $K^- p \rightarrow \Lambda(1520)\pi^0$ |

NODE=B098R5  
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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Delta(1232)\bar{K}, S\text{-wave}$  $(\Gamma_1\Gamma_{11})^{1/2}/\Gamma$ 

| VALUE            | DOCUMENT ID    | TECN | COMMENT                                 |
|------------------|----------------|------|-----------------------------------------|
| $-0.16 \pm 0.05$ | LITCHFIELD 74C | DPWA | $K^- p \rightarrow \Delta(1232)\bar{K}$ |

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 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Sigma(1910) \rightarrow \Delta(1232)\bar{K}, D\text{-wave}$  $(\Gamma_1\Gamma_{12})^{1/2}/\Gamma$ 

| VALUE            | DOCUMENT ID    | TECN | COMMENT                                 |
|------------------|----------------|------|-----------------------------------------|
| $-0.14 \pm 0.05$ | LITCHFIELD 74C | DPWA | $K^- p \rightarrow \Delta(1232)\bar{K}$ |

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| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1910) \rightarrow N\bar{K}^*(892)$ | $(\Gamma_1 \Gamma_{13})^{1/2} / \Gamma$ |      |                                     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|-------------------------------------|
| VALUE                                                                                                                  | DOCUMENT ID                             | TECN | COMMENT                             |
| $-0.09 \pm 0.02$                                                                                                       | <sup>3</sup> CAMERON                    | 78B  | DPWA $K^- p \rightarrow N\bar{K}^*$ |

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Σ(1910) FOOTNOTES

- <sup>1</sup> The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.  
<sup>2</sup> The published sign has been changed to be in accord with the baryon-first convention.  
<sup>3</sup> Upper limits on the  $D_1$  and  $D_3$  waves are each 0.03.

Σ(1910) REFERENCES

|            |     |                   |                                             |                         |
|------------|-----|-------------------|---------------------------------------------|-------------------------|
| SARANTSEV  | 19  | EPJ A55 180       | A.V. Sarantsev <i>et al.</i>                | (BONN, PNPI)            |
| PDG        | 82  | PL 111B 1         | M. Roos <i>et al.</i>                       | (HELS, CIT, CERN)       |
| GOPAL      | 80  | Toronto Conf. 159 | G.P. Gopal                                  | (RHEL)                  |
| CAMERON    | 78  | NP B143 189       | W. Cameron <i>et al.</i>                    | (RHEL, LOIC) IJP        |
| CAMERON    | 78B | NP B146 327       | W. Cameron <i>et al.</i>                    | (RHEL, LOIC) IJP        |
| CAMERON    | 77  | NP B131 399       | W. Cameron <i>et al.</i>                    | (RHEL, LOIC) IJP        |
| GOPAL      | 77  | NP B119 362       | G.P. Gopal <i>et al.</i>                    | (LOIC, RHEL) IJP        |
| GOYAL      | 77  | PR D16 2746       | D.P. Goyal, A.V. Sodhi                      | (DELH)                  |
| MARTIN     | 77  | NP B127 349       | B.R. Martin, M.K. Pidcock, R.G. Moorhouse   | (LOUC+) IJP             |
| Also       |     | NP B126 266       | B.R. Martin, M.K. Pidcock                   | (LOUC)                  |
| Also       |     | NP B126 285       | B.R. Martin, M.K. Pidcock                   | (LOUC) IJP              |
| DEBELLEFON | 76  | NP B109 129       | A. de Bellefon, A. Berthon                  | (CDEF) IJP              |
| BAILLON    | 75  | NP B94 39         | P.H. Baillon, P.J. Litchfield               | (CERN, RHEL) IJP        |
| HEMINGWAY  | 75  | NP B91 12         | R.J. Hemingway <i>et al.</i>                | (CERN, HEIDH, MPIM) IJP |
| VANHORN    | 75  | NP B87 145        | A.J. van Horn                               | (LBL) IJP               |
| Also       |     | NP B87 157        | A.J. van Horn                               | (LBL) IJP               |
| DEVENISH   | 74B | NP B81 330        | R.C.E. Devenish, C.D. Froggatt, B.R. Martin | (DESY+)                 |
| KANE       | 74  | LBL-2452          | D.F. Kane                                   | (LBL) IJP               |
| LITCHFIELD | 74B | NP B74 19         | P.J. Litchfield <i>et al.</i>               | (CERN, HEIDH) IJP       |
| LITCHFIELD | 74C | NP B74 39         | P.J. Litchfield <i>et al.</i>               | (CERN, HEIDH) IJP       |

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