See key on page 1343


| | | | |
|---|---|---|---|
| DAHL-JENSEN | 71 | NC 3A 1 | + (CERN, ANKA, LAUS, MPIM, ROMA) |
| LINDQUIST | 71 | PRL 27 612 | +Sumner+ (EFI, WUSL, OSU, ANL) |
| OLSEN | 70 | PRL 24 843 | +Pondrom, Handler, Limon, Smith+ (WISC, MICH) |
| DAUBER | 69 | PR 179 1262 | +Berge, Hubbard, Merrill, Miller (LRL) |
| DOYLE | 69 | UCRL 18139 Thesis | (LRL) |
| MALONEY | 69 | PRL 23 425 | +Sechi-Zorn (UMD) |
| GRIMM | 68 | NC 54A 187 | (HEID) |
| HEPP | 68 | ZPHY 214 71 | +Schleich (HEID) |
| BADIER | 67 | PL 25B 152 | +Bonnet, Briandet, Sadoulet (EPOL) |
| MAYEUR | 67 | U.Libr.Brux.Bul. 32 | +Tompa, Wickens (BELG, LOUC) |
| OVERSETH | 67 | PRL 19 391 | +Roth (MICH, PRIN) |
| PDG | 67 | RMP 39 1 | Rosenfeld, Barbaro-Galtieri, Podolsky+ (LRL, CERN, YALE) |
| BURAN | 66 | PL 20 318 | +Eivindson, Skjeggestad, Tofte+ (OSLO) |
| CHIEN | 66 | PR 152 1171 | +Lach, Sandweiss, Taft, Yeh, Oren+ (YALE, BNL) |
| ENGELMANN | 66 | NC 45A 1038 | +Filthuth, Alexander+ (HEID, REHO) |
| GIBSON | 66 | NC 45A 882 | +Green (BRIS) |
| LONDON | 66 | PR 143 1034 | +Rau, Goldberg, Lichtman+ (BNL, SYRA) |
| SCHMIDT | 65 | PR 140B 1328 | (COLU) |
| BAGLIN | 64 | NC 35 977 | +Bingham+ (EPOL, CERN, LOUC, RHEL, BERG) |
| HUBBARD | 64 | PR 135B 183 | +Berge, Kalbfleisch, Shafer+ (LRL) |
| LIND | 64 | PR 135B 1483 | +Binford, Good, Stern (WISC) |
| RONNE | 64 | PL 11 357 | + (CERN, EPOL, LOUC, BERG+) |
| SCHWARTZ | 64 | UCRL 11360 Thesis | (LRL) |
| BHOWMIK | 63 | NC 28 1494 | +Goyal (DELH) |
| BLOCK | 63 | PR 130 766 | +Gessaroli, Ratti+ (NWES, BGNA, SYRA, ORNL) |
| BROWN | 63 | PR 130 769 | +Kadyk, Trilling, Roe+ (LRL, MICH) |
| CHRETIEN | 63 | PR 131 2208 | + (BRAN, BROW, HARV, MIT) |
| CRONIN | 63 | PR 129 1795 | +Overseth (PRIN) |
| ELY | 63 | PR 131 868 | +Gidal, Kalmus, Oswald, Powell+ (LRL) |
| HUMPHREY | 62 | PR 127 1305 | +Ross (LRL) |
| CORK | 60 | PR 120 1000 | +Kerth, Wenzel, Cronin+ (LRL, PRIN, BNL) |
| CRAWFORD | 59B | PRL 2 266 | +Cresti, Douglass, Good, Ticho+ (LRL) |


## NOTE ON Λ AND Σ RESONANCES

***Introduction:*** There are no new results at all on $\Lambda$ and $\Sigma$ resonances. The field remains at a standstill and will only be revived if a kaon factory is built. What follows is a much abbreviated version of the Note on $\Lambda$ and $\Sigma$ Resonances from our 1990 edition. In particular, see that edition for some representative Argand plots from partial-wave analyses.

Table 1 is an attempt to evaluate the status, both overall and channel by channel, of each $\Lambda$ and $\Sigma$ resonance in the Full Listings. The evaluations are of course partly subjective. A blank indicates there is no evidence at all: either the relevant couplings are small or the resonance does not really exist. The main Baryon Summary Table includes only the established resonances (overall status 3 or 4 stars). A number of the 1- and 2-star entries may eventually disappear, but there are certainly many resonances yet to be discovered underlying the established ones.

***Sign conventions for resonance couplings:*** In terms of the isospin-0 and -1 elastic scattering amplitudes $A_0$ and $A_1$, the amplitude for $K^-p \to \overline{K}^0 n$ scattering is $\pm(A_1 - A_0)/2$, where the sign depends on conventions used in conjunction with the Clebsch-Gordan coefficients (such as, is the baryon or the meson the "first" particle). If this reaction is partial-wave analyzed and if the overall phase is chosen so that, say, the $\Sigma(1775)D_{15}$ amplitude at resonance points along the positive imaginary axis (points "up"), then any $\Sigma$ at resonance will point "up" and any $\Lambda$ at resonance will point "down" (along the negative imaginary axis). Thus the phase at resonance determines the isospin. The above ignores background amplitudes in the resonating partial waves.

That is the basic idea. In a similar but somewhat more complicated way, the phases of the $\overline{K}N \to \Lambda\pi$ and $\overline{K}N \to \Sigma\pi$ amplitudes for a resonating wave help determine the SU(3) multiplet to which the resonance belongs. Again, a convention has to be adopted for some overall arbitrary phases: which way is "up"? Our convention is that of Levi-Setti [1] and is shown in Fig. 1, which also compares experimental results with theoretical predictions for the signs of several resonances. In the Listings, a + or − sign in front of a measurement of an inelastic resonance coupling indicates the sign (the *absence* of a sign means that the sign is not determined, *not* that it is positive). For more details, see Appendix II of our 1982 edition [2].

***Errors on masses and widths:*** The errors quoted on resonance parameters from partial-wave analyses are often only statistical, and the parameters can change by more than these errors when a different parametrization of the waves is used. Furthermore, the different analyses use more or less the same data, so it is not really appropriate to treat the different determinations of the resonance parameters as independent or

Table 1. The status of the $\Lambda$ and $\Sigma$ resonances. Only those with an overall status of *** or **** are included in the main Baryon Summary Table.

| | | | Status as seen in — | | | |
|---|---|---|---|---|---|---|
| Particle | $L_{I\,2J}$ | Overall status | $N\overline{K}$ | $\Lambda\pi$ | $\Sigma\pi$ | Other channels |
| $\Lambda(1116)$ | $P_{01}$ | **** | | F | | $N\pi$(weakly) |
| $\Lambda(1405)$ | $S_{01}$ | **** | **** | o | **** | |
| $\Lambda(1520)$ | $D_{03}$ | **** | **** | r | **** | $\Lambda\pi\pi$, $\Lambda\gamma$ |
| $\Lambda(1600)$ | $P_{01}$ | *** | *** | b | ** | |
| $\Lambda(1670)$ | $S_{01}$ | **** | **** | i | **** | $\Lambda\eta$ |
| $\Lambda(1690)$ | $D_{03}$ | **** | **** | d | **** | $\Lambda\pi\pi$, $\Sigma\pi\pi$ |
| $\Lambda(1800)$ | $S_{01}$ | *** | *** | d | ** | $N\overline{K}^*$, $\Sigma(1385)\pi$ |
| $\Lambda(1810)$ | $P_{01}$ | *** | *** | e | ** | $N\overline{K}^*$ |
| $\Lambda(1820)$ | $F_{05}$ | **** | **** | n | **** | $\Sigma(1385)\pi$ |
| $\Lambda(1830)$ | $D_{05}$ | **** | *** | F | **** | $\Sigma(1385)\pi$ |
| $\Lambda(1890)$ | $P_{03}$ | **** | **** | o | ** | $N\overline{K}^*$, $\Sigma(1385)\pi$ |
| $\Lambda(2000)$ | | * | | r | * | $\Lambda\omega$, $N\overline{K}^*$ |
| $\Lambda(2020)$ | $F_{07}$ | * | * | b | * | |
| $\Lambda(2100)$ | $G_{07}$ | **** | **** | i | *** | $\Lambda\omega$, $N\overline{K}^*$ |
| $\Lambda(2110)$ | $F_{05}$ | *** | ** | d | * | $\Lambda\omega$, $N\overline{K}^*$ |
| $\Lambda(2325)$ | $D_{03}$ | * | * | d | | $\Lambda\omega$ |
| $\Lambda(2350)$ | | *** | *** | e | * | |
| $\Lambda(2585)$ | | ** | ** | n | | |
| $\Sigma(1193)$ | $P_{11}$ | **** | | | | $N\pi$(weakly) |
| $\Sigma(1385)$ | $P_{13}$ | **** | | **** | **** | |
| $\Sigma(1480)$ | | * | * | * | * | |
| $\Sigma(1560)$ | | ** | | ** | ** | |
| $\Sigma(1580)$ | $D_{13}$ | ** | * | * | | |
| $\Sigma(1620)$ | $S_{11}$ | ** | ** | * | * | |
| $\Sigma(1660)$ | $P_{11}$ | *** | *** | * | ** | |
| $\Sigma(1670)$ | $D_{13}$ | **** | **** | **** | **** | several others |
| $\Sigma(1690)$ | | ** | * | ** | * | $\Lambda\pi\pi$ |
| $\Sigma(1750)$ | $S_{11}$ | *** | *** | ** | * | $\Sigma\eta$ |
| $\Sigma(1770)$ | $P_{11}$ | * | | | | |
| $\Sigma(1775)$ | $D_{15}$ | **** | **** | **** | *** | several others |
| $\Sigma(1840)$ | $P_{13}$ | * | * | ** | * | |
| $\Sigma(1880)$ | $P_{11}$ | ** | ** | ** | | $N\overline{K}^*$ |
| $\Sigma(1915)$ | $F_{15}$ | **** | *** | **** | *** | $\Sigma(1385)\pi$ |
| $\Sigma(1940)$ | $D_{13}$ | *** | * | *** | ** | quasi-2-body |
| $\Sigma(2000)$ | $S_{11}$ | * | | * | | $N\overline{K}^*$, $\Lambda(1520)\pi$ |
| $\Sigma(2030)$ | $F_{17}$ | **** | **** | **** | ** | several others |
| $\Sigma(2070)$ | $F_{15}$ | * | * | | * | |
| $\Sigma(2080)$ | $P_{13}$ | ** | | ** | | |
| $\Sigma(2100)$ | $G_{17}$ | * | | * | * | |
| $\Sigma(2250)$ | | *** | *** | * | * | |
| $\Sigma(2455)$ | | ** | * | | | |
| $\Sigma(2620)$ | | ** | * | | | |
| $\Sigma(3000)$ | | * | * | * | | |
| $\Sigma(3170)$ | | * | | | | multi-body |

| | |
|---|---|
| **** | Existence is certain, and properties are at least fairly well explored. |
| *** | Existence ranges from very likely to certain, but further confirmation is desirable and/or quantum numbers, branching fractions, *etc.* are not well determined. |
| ** | Evidence of existence is only fair. |
| * | Evidence of existence is poor. |