

Energy Levels of Light Nuclei $A = 6$

F. Ajzenberg-Selove

University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396

Abstract: An evaluation of $A = 5-10$ was published in *Nuclear Physics A*413 (1984), p. 1. This version of $A = 6$ differs from the published version in that we have corrected some errors discovered after the article went to press. Figures and introductory tables have been omitted from this manuscript. Also, [Reference](#) key numbers have been changed to the TUNL/NNDC format.

(References closed June 1, 1983)

The original work of Fay Ajzenberg-Selove was supported by the US Department of Energy [DE-FG02-86ER40279]. Later modification by the TUNL Data Evaluation group was supported by the US Department of Energy, Office of High Energy and Nuclear Physics, under: Contract No. DEFG05-88-ER40441 (North Carolina State University); Contract No. DEFG05-91-ER40619 (Duke University).

Table of Contents for $A = 6$

Below is a list of links for items found within the PDF document. Figures from this evaluation have been scanned and are available on this website or via the link below.

A. Nuclides: [\${}^6\text{n}\$](#) , [\${}^6\text{H}\$](#) , [\${}^6\text{He}\$](#) , [\${}^6\text{Li}\$](#) , [\${}^6\text{Be}\$](#) , [\${}^6\text{B}\$](#) , [\${}^6\text{C}\$](#)

B. Tables of Recommended Level Energies:

[Table 6.1](#): Energy levels of ${}^6\text{He}$

[Table 6.2](#): Energy levels of ${}^6\text{Li}$

[Table 6.6](#): Energy levels of ${}^6\text{Be}$

C. [References](#)

D. Figures: [\${}^6\text{He}\$](#) , [\${}^6\text{Li}\$](#) , [\${}^6\text{Be}\$](#) , [Isobar diagram](#)

E. Erratum to this Publication: [PS](#) or [PDF](#)

${}^6\mathbf{n}$

(Not illustrated)

${}^6\mathbf{n}$ has not been observed in the interaction of 700 MeV protons or of 400 GeV protons with uranium: the cross section is $< 1.1 \times 10^{-3} \mu\text{b}$ (1977TU02; 700 MeV), $< 9 \mu\text{b}$ (1977TU03; 400 GeV). See also (1979AJ01).

${}^6\mathbf{H}$

(Not illustrated)

${}^6\mathbf{H}$ has not been observed: see (1974AJ01). The population of excited states of ${}^6\mathbf{H}_\Sigma$ [a Σ^- hyperon in resonance with a ${}^5\text{He}$ core] is reported by (1982PI02). See also (1982DO1C, 1982DO04, 1982DO1M; theor.).

${}^6\mathbf{He}$

(Figs. 4 and 7)

GENERAL: (See also (1979AJ01).)

Model calculations: (1979SHZV, 1980FI1D, 1981KU13, 1982FI13, 1982KR1B, 1982LE11, 1982VO01).

Special states: (1982FI13, 1983DE16, 1983KR05, 1983LE01).

Electromagnetic transitions: (1982AW02).

Complex reactions involving ${}^6\text{He}$: (1978DU1B, 1978VO1A, 1979BO22, 1979VI05, 1980BO31, 1980WI1L, 1981BO1X, 1981CU05, 1981VO10, 1982BO1Q, 1982BO35, 1982BO40, 1982GU1H, 1982HE1D, 1983JA1C).

Muon and neutrino capture and reactions: (1978SE1B, 1979DE1D, 1979WA1D, 1980BR1A, 1980MU1B).

Reactions involving pion and other mesons: (1978FU09, 1979BA16, 1979BA1M, 1979DO1C, 1979PE1C, 1979SH1D, 1979WI1A, 1980BE20, 1981BA1M, 1981DU1H, 1981NI03, 1981SH06, 1982BO11).

Hypernuclei: (1978PO1A, 1978SO1A, 1980VE2B, 1981BA2P, 1981WA1J, 1982BA1Y, 1982BA2N, 1982BA2R, 1982KO1L).

Other topics: (1978FI12, 1979SHZV, 1979VA1A, 1981PAZZ, 1982AW02, 1982MO1Q, 1982NG01, 1982ZO1B, 1983BA2F, 1983BA3A, 1983DE16, 1983NA03).

Ground state of ${}^6\text{He}$: (1978SM02, 1981AV02, 1981PAZZ, 1982FI13, 1982KR1B, 1982LE11, 1982NG01, 1982VO01, 1983LE01).

Table 6.1: Energy levels of ${}^6\text{He}$

E_x (MeV \pm keV)	$J^\pi; T$	$\tau_{1/2}$ or $\Gamma_{\text{c.m.}}$	Decay	Reactions
g.s.	$0^+; 1$	$\tau_{1/2} = 806.7 \pm 1.5$ msec	β^-	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21
1.797 ± 25	$(2)^+; 1$	$\Gamma = 113 \pm 20$ keV	n, α	3, 5, 6, 8, 9, 11, 12, 13, 14, 15, 16, 19, 20
(13.6 ± 500)		broad		13, 14
(15.5 ± 400)		broad	γ	6, 12, 13, 17
(23.2 ± 700)		broad	γ	6, 13

1. ${}^6\text{He}(\beta^-){}^6\text{Li}$ $Q_m = 3.507$

The decay proceeds to the ground state of ${}^6\text{Li}$ [$J^\pi = 1^+$] and is a super-allowed Gamow-Teller transition. Recent half-life measurements are 808.1 ± 2.0 msec (1974WI14), 798.1 ± 1.0 msec (1981BA58), 805.4 ± 2.0 msec (1982AL17): see Table 6.2 in (1966LA04) for a listing of earlier determinations. We adopt the mean of the (1974WI14, 1982AL17) values, $\tau_{1/2} = 806.7 \pm 1.5$ msec; $\log ft = 2.910 \pm 0.002$. See also (1979AJ01, 1979DO1A) and (1977SA1A, 1978SE1B, 1979DE15, 1981PAZZ; theor.).

2. (a) ${}^3\text{H}(t, n){}^5\text{He}$ $Q_m = 10.44$ $E_b = 12.305$
 (b) ${}^3\text{H}(t, 2n){}^4\text{He}$ $Q_m = 11.3322$
 (c) ${}^3\text{H}(t, d){}^4\text{H}$ $Q_m = -8.9$
 (d) ${}^3\text{H}(t, 3n){}^3\text{He}$ $Q_m = -9.2456$
 (e) ${}^3\text{H}(t, t){}^3\text{H}$

The cross section for neutron production (reactions (a) and (b)) rises monotonically from 40 keV to 2.2 MeV. The zero-energy cross section factor $S_0 \approx 300$ keV \cdot b. The cross section for reaction (b) increases monotonically for $E_t = 34$ to 160 keV. (1981JA1F) suggests that the (t, 2n) cross sections below $E_t = 300$ keV are poorly known and may be subject to large systematic errors. For the earlier work on these reactions, and for references, see (1974AJ01, 1979AJ01). See also (1979OH1B, 1981HA1P), (1982SL1A) and (1979HA1C, 1980HA1Y, 1981GE1C; theor.).

3. ${}^4\text{He}(t, p){}^6\text{He}$ $Q_m = -7.506$

Angular distributions of the protons to ${}^6\text{He}^*(0, 1.80)$ have been measured at $E_t = 22$ and 23 MeV. [No L -values were assigned.] No other states are observed with $E_x \lesssim 4.2$ MeV: see (1979AJ01).

$$4. {}^4\text{He}(\alpha, 2p){}^6\text{He} \quad Q_m = -27.320$$

See (1978GL03, 1982GL01: $E_\alpha = 61.5 \rightarrow 158.2$ MeV). See also ${}^8\text{Be}$.

$$5. {}^6\text{Li}(e, \pi^+){}^6\text{He} \quad Q_m = -143.074$$

From measurements at $E_e = 170, 180$ and 195 MeV, angular distributions of (γ, π^+) to ${}^6\text{He}^*(0, 1.80)$ are derived by (1979SH1D, 1981SH06).

$$6. \text{(a) } {}^6\text{Li}(\pi^-, \gamma){}^6\text{He} \quad Q_m = 136.061$$

$$\text{(b) } {}^6\text{Li}(\pi^-, \pi^0){}^6\text{He} \quad Q_m = 1.098$$

The excitation of ${}^6\text{He}^*(0, 1.8)$ and possibly of (broad) states at $E_x = 15.6 \pm 0.5, 23.2 \pm 0.7$ and 29.7 ± 1.3 MeV is reported by (1973BA62) from E_γ measurements using a pair spectrometer. See also (1979AJ01). The charge-exchange process with stopped pions (reaction (b)) has been studied by (1981BA16).

$$7. {}^6\text{Li}(n, p){}^6\text{He} \quad Q_m = -2.724$$

Angular distributions of the p_0 group are reported at $E_n = 4.7$ to 6.8 MeV and at 14 MeV [see (1979AJ01)] and at $E_n = 59.6$ MeV (1982BR04). There is no evidence for the excitation of ${}^6\text{He}^*(1.8)$ (1982BR04). See also (1980MI02) and ${}^7\text{Li}$.

$$8. {}^6\text{Li}(d, 2p){}^6\text{He} \quad Q_m = -4.949$$

At $E_d = 55$ MeV the population of ${}^6\text{He}^*(0, 1.8)$ [the latter weak] is observed: no other states are observed with $E_x \lesssim 25$ MeV (1979ST15).

$$9. {}^6\text{Li}(t, {}^3\text{He}){}^6\text{He} \quad Q_m = -3.488$$

The ground-state angular distribution has been studied at $E_t = 17$ MeV. At $E_t = 22$ MeV only ${}^6\text{He}^*(0, 1.8)$ are populated with $E_x \lesssim 8.5$ MeV. See (1979AJ01) for additional discussion and for references. See also (1983AB1A).

$$10. {}^6\text{Li}({}^6\text{Li}, {}^6\text{Be}){}^6\text{He} \quad Q_m = -7.795$$

Angular distributions have been studied at $E({}^6\text{Li}) = 32$ and 36 MeV for the transitions to ${}^6\text{He}_{\text{g.s.}}$, ${}^6\text{Be}_{\text{g.s.}}$ and, in inelastic scattering of ${}^6\text{Li}$ [see ${}^6\text{Li}$], to the analog state ${}^6\text{Li}^*(3.56)$: for a discussion of these see the references quoted in (1979AJ01).

$$11. {}^6\text{Li}({}^7\text{Li}, {}^7\text{Be}){}^6\text{He} \quad Q_m = -4.369$$

At $E({}^7\text{Li}) = 78$ MeV, ${}^6\text{He}^*(0, 1.8)$ are populated (1982AL1G).

$$12. (a) {}^7\text{Li}(\gamma, p){}^6\text{He} \quad Q_m = -9.975$$

$$(b) {}^7\text{Li}(e, ep){}^6\text{He} \quad Q_m = -9.975$$

At $E_\gamma = 60$ MeV, the proton spectrum shows two prominent peaks attributed to ${}^6\text{He}^*(0 + 1.8, 18 \pm 3)$: see (1979AJ01). For reaction (b) see (1980AS02: $E_e = 108, 163$ and 198 MeV). See also ${}^7\text{Li}$.

$$13. {}^7\text{Li}(n, d){}^6\text{He} \quad Q_m = -7.750$$

At $E_n = 60$ MeV, the deuteron spectrum shows two prominent peaks attributed to states centered at $E_x = 13.6, 15.4$ and 17.7 MeV (± 0.5 MeV) and a possible state or states (populated with an l_p transfer ≥ 2) at $E_x = 23.7$ MeV. DWBA analyses of the d_0 and d_1 groups are consistent with $l_p = 1$ and $S(1p_{3/2}) = 0.62$ for ${}^6\text{He}_{\text{g.s.}}$ and to $S(1p_{3/2}) = 0.37, S(1p_{1/2}) = 0.32$ for ${}^6\text{He}^*(1.8)$ (1977BR17). See (1974AJ01) for earlier measurements.

$$14. {}^7\text{Li}(p, 2p){}^6\text{He} \quad Q_m = -9.975$$

The summed proton spectrum at $E_p = 100$ MeV shows ${}^6\text{He}^*(0, 1.8)$ and a broad group centered at $E_x \approx 14$ MeV: the angular correlation for ${}^6\text{He}_{\text{g.s.}}$ is in quite good agreement with DWIA: see (1979AJ01).

15. ${}^7\text{Li}(d, {}^3\text{He}){}^6\text{He}$ $Q_m = -4.481$

Angular distributions of the ${}^3\text{He}$ ions to ${}^6\text{He}^*(0, 1.8)$ have been measured at $E_d = 14.4$ and 22 MeV: they have an $l_p = 1$ character and therefore these two states have $J^\pi = (0 - 3)^+$. There is no evidence for any other states of ${}^6\text{He}$ with $E_x < 10.7$ MeV: see (1979AJ01).

16. ${}^7\text{Li}(t, \alpha){}^6\text{He}$ $Q_m = 9.839$

The energy of the first excited state is 1.797 ± 0.025 MeV, $\Gamma = 113 \pm 20$ keV. ${}^6\text{He}^*(1.80)$ decays into ${}^4\text{He} + 2n$. The branching ratio $\Gamma_\gamma/\Gamma_\alpha \leq 2 \times 10^{-6}$: for $\Gamma_{\text{c.m.}} = 113 \pm 20$ keV, $\Gamma_\gamma \leq 0.23$ eV. Angular distributions of the α_0 and α_1 groups have been measured at $E_t = 13$ and 22 MeV. No other α -groups are reported corresponding to ${}^6\text{He}$ states with $E_x < 24$ MeV (region between $E_x \approx 13$ and 16 MeV was obscured by the presence of breakup of α -particles): see (1979AJ01). See also ${}^{10}\text{Be}$.

17. ${}^7\text{Li}({}^3\text{He}, p{}^3\text{He}){}^6\text{He}$ $Q_m = -9.975$

At $E({}^3\text{He}) = 120$ MeV a kinematically complete experiment has been carried out by (1980VO1B): in addition to ${}^6\text{He}_{\text{g.s.}}$ a structure corresponding to $E_x = 17$ MeV, $\Gamma < 5$ MeV is reported.

18. ${}^7\text{Li}({}^7\text{Li}, {}^8\text{Be}){}^6\text{He}$ $Q_m = 7.280$

See (1981BA58).

19. ${}^9\text{Be}(n, \alpha){}^6\text{He}$ $Q_m = -0.598$

Angular distributions have been reported for $E_n = 12.2$ to 18.0 MeV (α_0, α_1). No other states are observed with $E_x \lesssim 7$ MeV: see (1979AJ01). See also ${}^{10}\text{Be}$.

20. ${}^9\text{Be}(t, {}^6\text{Li}){}^6\text{He}$ $Q_m = -5.380$

At $E_t = 21.5$ and 23.5 MeV, angular distributions have been studied for the transitions to ${}^6\text{He}^*(0, 1.8)$ and ${}^6\text{Li}^*(0, 2.19, 3.56)$: see (1979AJ01). See also reaction 38 in ${}^6\text{Li}$ and (1983WE02; theor.).

21. ${}^9\text{Be}({}^3\text{He}, {}^6\text{Be}){}^6\text{He}$ $Q_m = -9.687$

See (1981DE1X, 1983DE14).

${}^6\text{Li}$
(Figs. 5 and 7)

GENERAL: See also (1979AJ01).

Shell model: (1978CH1D, 1978ST19, 1979CA06, 1980MA41, 1981BO1Y, 1982BA52, 1982FI13, 1982LO09).

Cluster and α -particle models: (1978OS07, 1978PL1A, 1978RE1A, 1978SI14, 1979BE39, 1979CA06, 1979LU1A, 1979WI1B, 1980BA04, 1980KU1G, 1981BE1K, 1981HA1Y, 1981KR1J, 1981KU13, 1981VE04, 1981ZH1D, 1982AH09, 1982CH10, 1982GO1G, 1982JI1A, 1982KA24, 1982KR1B, 1982KR09, 1982KU05, 1982LA16, 1982LE08, 1982LE11, 1982LO04, 1982PO1B, 1982RA22, 1982SA16, 1982SI1B, 1982ST15, 1982VO01, 1983DUZX, 1983FU06, 1983KA1K, 1983KR1E, 1983NI03).

Special states: (1978BU19, 1978OS07, 1978ST19, 1979BE39, 1979DU11, 1979GO10, 1979LE1A, 1979SHZV, 1980FI1D, 1980GO1Q, 1980MA41, 1980SH1N, 1981BO1Y, 1982BA52, 1982FI13, 1982VO01, 1983DE16, 1983DUZX, 1983KR05, 1983LE01).

Electromagnetic transitions: (1978KN05, 1981BO1Y, 1981KN06, 1982BA52, 1982LO09, 1982PE06).

Astrophysical questions: (1978CA1C, 1978PO1B, 1978SN1A, 1979RA1C, 1979RO1A, 1980CA1C, 1980RE1B, 1981AU1D, 1981AU1G, 1981RO12).

Applied work: (1978BR34, 1979AN1B, 1979AT01, 1979FL1A, 1979FU1E, 1979GR1C, 1979JA1B, 1979RE1B, 1980CO1H, 1981EG1B, 1981MU1F, 1981UL1A, 1983ST1J).

Complex reactions involving ${}^6\text{Li}$: (1978BH03, 1978DU1B, 1978HE1C, 1978MA40, 1979AL1H, 1979BA34, 1979BO22, 1979FR1D, 1979FR12, 1979LO11, 1979NE06, 1979RU1B, 1979SA1E, 1979SH12, 1979SI1A, 1979ST1D, 1979VI05, 1980AK02, 1980GR10, 1980HI02, 1980MI01, 1980NE05, 1980OL1C, 1980WI1L, 1980WO05, 1981BL1G, 1981BO1X, 1981ME13, 1981MO20, 1981TH07, 1982BO1F, 1982BO1J, 1982BO1Q, 1982BO35, 1982BO40, 1982DA1N, 1982GU1H, 1982LU01, 1982LY1A, 1982MO1K, 1982MO1N, 1982NE02, 1982NI03, 1983NI03, 1983SA06).

Muon and neutrino capture and reactions: (1977GR1C, 1978AN20, 1978BA54, 1978BA58, 1978SE1B, 1979BE1G, 1979DE01, 1979DE1D, 1979DO1E, 1979MI04, 1979MI12, 1979WA1D, 1980BR1A, 1980MU1B, 1981MU1E, 1982AH09, 1982BO11, 1982KR1E, 1982NA01, 1982PR02, 1983BU1F).

Reactions involving pions and other mesons: (1977DE1B, 1978DY01, 1978ER1A, 1978FU09, 1978KI13, 1978LE1E, 1978LE1F, 1978WA1B, 1979AMZY, 1979BA16, 1979BA17, 1979BA1M, 1979BO1B, 1979DE2A, 1979DO1C, 1979DZ08, 1979EP02, 1979KI1C, 1979LE1A, 1979MA1D, 1979ME07, 1979MI1C, 1979NOZX, 1979OH1A, 1979RE1A, 1979SH1D, 1979SH1E, 1979SR1A, 1979TR1A, 1979UL1A, 1979WI1A, 1980AU1C, 1980BE20, 1980CH1L, 1980DE11, 1980HO26, 1980KA11, 1980LE02, 1980SC24, 1980ZA08, 1981AS1H, 1981BA16, 1981BE17, 1981BE45,

1981BE63, 1981BO09, 1981DO1E, 1981DU1H, 1981FE2A, 1981HE1H, 1981HU1B, 1981HU1C, 1981IO01, 1981IS11, 1981LL1A, 1981MC09, 1981SE1H, 1981SEZR, 1981SI1D, 1981TO1H, 1981WH01, 1981WH1D, 1981WHZZ, 1982AS01, 1982BA1R, 1982BE25, 1982BL1G, 1982BO1U, 1982DO1C, 1982DO04, 1982DO1M, 1982ER1E, 1982HO05, 1982IS10, 1982LO1K, 1982MA1K, 1982MO1Q, 1982PI1C, 1982PI02, 1982PI1J, 1982PO1C, 1982RI1A, 1982SE08, 1982TR05, 1982ZO01, 1982ZO1B, 1983AS02, 1983HUZZ, 1983RI1C, 1983SEZV, 1983ZIZZ).

Reactions involving antiprotons: (1981BL1F, 1981YA1B, 1981YA1C).

Hypernuclei: (1980AU1C, 1980IW1A, 1980MA21, 1981BE17, 1981BE45, 1981BO09, 1981DA1C, 1981WA1J, 1982BA1R, 1982BO1U, 1982DO1C, 1982DO1M, 1982ER1B, 1982ER1E, 1982MO1Q, 1982ZO01, 1982ZO1B).

Other topics: (1978EF1A, 1978KN05, 1978OS1B, 1978RO17, 1978SI14, 1978ST19, 1979BA01, 1979DZ08, 1979FA1A, 1979GO10, 1979KI1C, 1979MA1D, 1979OS02, 1979SA39, 1979SHZV, 1980GO1Q, 1980LE1K, 1980MA41, 1980SH1N, 1981BE1K, 1981IS11, 1981PAZZ, 1981PL03, 1982BA2G, 1982BE17, 1982CO02, 1982DE42, 1982GU1J, 1982MA35, 1982NG01, 1982SH1H, 1983BA3A, 1983CO06, 1983DE16, 1983KE1E, 1983NA03).

Ground-state properties of ${}^6\text{Li}$: (1978CH1D, 1978HE1D, 1978KN05, 1978OS07, 1978RO17, 1978ST19, 1979BA01, 1979CA06, 1979OS02, 1979ST09, 1980HO14, 1980MA41, 1981AV02, 1981BO1Y, 1981KU13, 1981PAZZ, 1981SI1G, 1981SU1H, 1981VE04, 1982BA2G, 1982BO31, 1982FI13, 1982KA24, 1982KR1B, 1982KR09, 1982LE11, 1982LO04, 1982LO06, 1982LO09, 1982NG01, 1982PE06, 1982SH1H, 1982VO01, 1983DUZX, 1983KR05, 1983LE01, 1983NI03).

$$\mu = +0.8220467 \text{ (6) nm, } +0.8220560 \text{ (4) nm: see (1978LEZA)}$$

$$Q = -0.644 \text{ (7) mb: see (1978LEZA)}$$

Mass of ${}^6\text{Li}$: The ground-state mass excess of ${}^6\text{Li}$ is 14085.5 ± 1.1 keV based on the Q -value of ${}^6\text{Li}(p, \alpha){}^3\text{He}$ [$Q_0 = 4018.2 \pm 1.1$ keV]. A comparison with previous measurements leads to a new mass excess for ${}^6\text{Li}$ of 14086.2 ± 0.6 keV (1981RO02). Recently A.H. Wapstra (private communication) has adopted 14085.4 ± 0.6 keV and we shall also.

1. (a) ${}^3\text{He}({}^3\text{H}, \gamma){}^6\text{Li}$	$Q_m = 15.7958$	
(b) ${}^3\text{He}({}^3\text{H}, p){}^5\text{He}$	$Q_m = 11.21$	$E_b = 15.7958$
(c) ${}^3\text{He}({}^3\text{H}, p){}^4\text{He} + n$	$Q_m = 12.0959$	
(d) ${}^3\text{He}({}^3\text{H}, n){}^5\text{Li}$	$Q_m = 10.13$	
(e) ${}^3\text{He}({}^3\text{H}, d){}^4\text{He}$	$Q_m = 14.3205$	
(f) ${}^3\text{He}({}^3\text{H}, {}^3\text{H}){}^3\text{He}$		
(g) ${}^3\text{He}({}^3\text{H}, dn){}^3\text{He}$	$Q_m = -6.2573$	
(h) ${}^3\text{He}({}^3\text{H}, p2n){}^3\text{He}$	$Q_m = -8.4819$	

Table 6.2: Energy levels of ${}^6\text{Li}$

E_x (MeV \pm keV)	$J^\pi; T$	$\Gamma_{\text{c.m.}}$ (MeV)	Decay	Reactions
g.s.	$1^+; 0$		stable	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56
2.186 ± 2	$3^+; 0$	0.024 ± 0.002	γ, d, α	1, 2, 3, 6, 7, 8, 12, 14, 15, 16, 18, 19, 20, 31, 32, 34, 36, 37, 38, 40, 41, 42, 50, 51
3.56288 ± 0.10	$0^+; 1$	$(8.2 \pm 0.2) \times 10^{-6}$	γ	1, 3, 11, 12, 15, 16, 17, 18, 20, 31, 34, 35, 36, 37, 38, 46, 56
4.31 ± 22	$2^+; 0$	$1.7 \pm 0.2^{\text{a}}$	γ, d, α	1, 5, 6, 12, 15, 16, 18, 20, 34, 36, 37, 50
5.366 ± 15	$2^+; 1$	0.540 ± 0.020	$\gamma, \text{n}, \text{p}, \alpha$	1, 12, 18, 34, 35, 36, 37
5.65 ± 50	$1^+; 0$	1.5 ± 0.2	d, α	6, 14, 36, 37
(15.8)	$3^+; 0$	17.8 ± 0.8	d, α	6
21.0	$2^-; 1$	broad	$\text{t}, {}^3\text{He}$	1, 39
21.5	$0^-; 1$	broad	$\text{t}, {}^3\text{He}$	1, 39
(23 ± 2000)	$4^+; 0$	12 ± 2	d, α	6
25.0 ± 1000	$4^-; 1$	≈ 4	$\gamma, \text{n}, \text{t}, {}^3\text{He}$	1
$26.6 \pm 400^{\text{b}}$	$3^-; 0$	broad	$\gamma, \text{n}, \text{d}, \text{t}, {}^3\text{He}, \alpha$	1, 6
(31)	(3^+)	broad	$\text{d}, \text{t}, {}^3\text{He}, \alpha$	1

^a See also Tables 6.4 and 6.5.

^b See also Table 6.3.

- (i) ${}^3\text{He}({}^3\text{H}, 2\text{d}){}^2\text{H}$ $Q_{\text{m}} = -9.5263$
(j) ${}^3\text{He}({}^3\text{H}, \text{pd}){}^3\text{H}$ $Q_{\text{m}} = -5.4936$

Capture γ -rays (reaction (a)) to the first three states of ${}^6\text{Li}$ [$\gamma_0, \gamma_1, \gamma_2$] have been observed for $E({}^3\text{He}) = 0.5$ to 25.8 MeV, while the yields of γ_3 and γ_4 have been measured for $E({}^3\text{He}) = 12.6$ to 25.8 MeV: see (1974AJ01). The γ_2 excitation function does not show resonance structure. However, the $\gamma_0, \gamma_1, \gamma_3$ and γ_4 yields do show broad maxima at $E({}^3\text{He}) = 5.0 \pm 0.4$ [γ_0, γ_1], 20.6 ± 0.4 [γ_1], ≈ 21 [γ_3] and 21.8 ± 0.8 [γ_4] MeV. The magnitude of the ground-state-capture cross section is well accounted for by a direct-capture model; that for the γ_1 capture indicates a non-direct contribution above $E({}^3\text{He}) = 10$ MeV, interpreted as a resonance due to a state with $E_{\text{x}} = 25 \pm 1$ MeV, $\Gamma_{\text{c.m.}} = 4$ MeV, $T = 1$ (because the transition is E1, to a $T = 0$ final state) [the E1 radiative width $|M|^2 \gtrsim 5.2/(2J + 1)$ W.u.], $J^{\pi} = (2, 3, 4)^{-}$, $\alpha + \text{p} + \text{n}$ parentage. The γ_4 resonance is interpreted as being due to a broad state at $E_{\text{x}} = 26.6$ MeV with $T = 0$. $J^{\pi} = 3^{-}$ is consistent with the measured angular distribution. The ground and first excited state reduced widths for ${}^3\text{He} + \text{t}$ parentage, $\theta_0^2 = 0.8 \pm 0.2$ and $\theta_1^2 = 0.6 \pm 0.3$ (1973VE1B).

The angular distribution and polarization of the neutrons in reaction (d) have been measured at $E({}^3\text{He}) = 2.70$ and 3.55 MeV. The excitation function for $E({}^3\text{He}) = 0.7$ to 3.8 MeV decreases monotonically with energy. The excitation function for n_0 has been measured for $E({}^3\text{He}) = 2$ to 6 MeV and for $E({}^3\text{He}) = 14$ to 26 MeV; evidence for a broad structure at $E({}^3\text{He}) = 20.5 \pm 0.8$ MeV is reported [${}^6\text{Li}^*(26.1)$]: see (1979AJ01).

Angular distributions of deuterons (reaction (e)) have been measured for $E_{\text{t}} = 1.04$ to 3.27 MeV and at $E({}^3\text{He}) = 0.29$ to 32 MeV. Polarization measurements are reported for $E_{\text{t}} = 9.02$, 12.86 and 17.02 MeV and an excitation function for $E_{\text{t}} = 9.02$ to 17.27 MeV: see (1979AJ01). See also (1978ZA06).

Elastic scattering (reaction (f)) angular distributions have been measured at $E({}^3\text{He}) = 5.00$ to 32.3 MeV and excitation functions have been reported for $E({}^3\text{He}) = 4.3$ to 33.4 MeV: see (1974AJ01) and (1977VL01). At the lower energies the elastic yield is structureless and decreases monotonically with energy. Polarization measurements are reported for $E_{\text{t}} = 9.02$ to 17.02 MeV (1977HA17) and $E({}^3\text{He}) = 19.9 \rightarrow 33.3$ MeV (1977KA10, 1977VL01). A strong change occurs in the analyzing power angular distributions at $E_{\text{t}} = 15$ MeV (1977HA17). A phase-shift analysis by (1977VL01) [single-level R -matrix formalism, $L \leq 4$] yields P-states [$0^{-}, 2^{-}; T = 1$] at $E_{\text{x}} \approx 21.5$ and 21.0 MeV and F-states [$3^{-}, 4^{-}; T = 1$] at $E_{\text{x}} \approx 26.7$ and 25.7 MeV. There is some indication also of $T = 0, 3^{-}, 5^{-}$ and 3^{+} states at $E_{\text{x}} \approx 25, 29.5$ and 31.5 MeV whose decay is presumably primarily by $\text{d} + \alpha$ (1977VL01).

At $E({}^3\text{He}) = 50, 65$ and 78 MeV (1979LA14) have examined reactions (g), (h), (i), (j) and have compared the results with PWIA: deviations are observed. See also (1966LA04, 1974AJ01) and (1978FE08, 1978TA1A; theor.).

2. ${}^3\text{H}(\alpha, \text{n}){}^6\text{Li}$ $Q_{\text{m}} = -4.7820$

Neutron groups corresponding to ${}^6\text{Li}^*(0, 2.19)$ have been detected: see ${}^7\text{Li}$ and (1974AJ01).

$$3. \text{}^3\text{He}(\text{}^3\text{He}, \pi^+)\text{}^6\text{Li} \quad Q_m = -123.790$$

At $E(^3\text{He}) = 268.5$ and 282 MeV ${}^6\text{Li}^*(0, 2.19, 3.56)$ are populated with cross sections in the range $9 - 43$ nb/sr at $\theta_{\text{lab}} = 20^\circ - 60^\circ$ (1981LE24). See also (1982LE1L, 1982WA1G), (1982HU1F) and (1981GE07, 1981KL07; theor.).

$$4. \text{}^4\text{He}(\text{d}, \gamma)\text{}^6\text{Li} \quad Q_m = 1.4753$$

The cross section for the capture cross section has been measured for $E_\alpha = 3$ to 25 MeV by detecting the recoiling ${}^6\text{Li}$ ions: the direct capture is overwhelmingly E2 with a small E1 contribution. The spectroscopic overlap between the ${}^6\text{Li}_{\text{g.s.}}$ and $\alpha + \text{d}$ is 0.85 ± 0.04 . The results show that the production of ${}^6\text{Li}$ in the big bang is five times smaller than previously calculated (1981RO12).

5. (a) ${}^4\text{He}(\text{d}, \text{n})\text{}^5\text{Li}$	$Q_m = -4.19$	$E_b = 1.4753$
(b) ${}^4\text{He}(\text{d}, \text{p})\text{}^5\text{He}$	$Q_m = -3.11$	
(c) ${}^4\text{He}(\text{d}, \text{np})\text{}^4\text{He}$	$Q_m = -2.2246$	
(d) ${}^4\text{He}(\text{d}, \text{t})\text{}^3\text{He}$	$Q_m = -14.3205$	
(e) ${}^4\text{He}(\text{d}, \text{d})\text{p} + \text{}^3\text{H}$	$Q_m = -19.8140$	
(f) ${}^4\text{He}(\text{d}, \text{d})\text{}^2\text{H}^2\text{H}$	$Q_m = -23.8467$	

The proton yield gives no evidence of states in ${}^6\text{Li}$ with $6.5 < E_x < 8.7$ MeV. Polarization measurements at $E_d = 8.5, 10$ and 11 MeV indicate scattering through the first two states of ${}^5\text{He}$. See also ${}^5\text{He}$ and ${}^5\text{Li}$, (1974AJ01), and (1978LE10; $E_\alpha = 100$ MeV; polarization of n).

Reaction (c) has been studied to $E_\alpha = 165$ MeV: see (1979AJ01). Kinematically complete experiments have been reported recently at $E_\alpha = 9.74$ to 11.30 MeV (1980DA05, 1980DA17), 9.85 to 13.99 MeV (1982BR17), $10.27, 11.3$ and 13 MeV (1981BR25) and $13, 15$ and 18 MeV (1982GL10), at $E_d = 12$ and 17 MeV (1983SL01), 14 MeV (1982ST16) and at $E_d = 18$ MeV (1981OS02: VAP and differential cross sections). (1980DA05, 1980DA17) find that three-body forces are required to understand the results and suggest that ${}^6\text{Li}^*(4.3)$ may be involved. At $E_\alpha = 140$ MeV three-body model calculations are in good agreement with the experimental data (1982LA14). The isospin-forbidden proton-neutron FSI in the ${}^1S_0, T = 1$ state account for bumps observed near $E_{\text{pn}} = 0$ (1982ST16).

At $E_\alpha = 28.3$ MeV (1979AN24, 1981BE1G) report measurements of the angular correlation between the n and ${}^5\vec{\text{Li}}$ and the angular distribution of the subsequent decay to ${}^4\text{He} + \text{p}$, permitting the calculation of the tensor moments of ${}^5\text{Li}$. Polarization measurements are reported at $E_d = 5.4, 6.1$ and 6.8 MeV (1982LUZX), 12 and 17 MeV (1983SL01) and 12.0 and 21.0 MeV (1982IS06). For total cross sections for reaction (c) see (1979GR10: $E_\alpha = 20.4, 24.2, 28.1$ MeV). See also (1977KO42, 1982WI09). For a spallation study at an α -momentum of 4 GeV/c see (1981BE1R).

Reaction (d) has been studied at $E_d = 32.4$ MeV, $E_d = 45.8$ MeV and $E_\alpha = 48.3$ to 166 MeV: see (1979AJ01). For reaction (e) see (1974AJ01). See also (1981NO1B) and (1978NA12, 1978TA1A, 1978TH1A, 1980KO04, 1980ME02, 1981BO1Q, 1981WE10; theor.).

6. ${}^4\text{He}(d, d){}^4\text{He}$

$$E_b = 1.4753$$

Elastic differential cross-section measurements have been studied at many energies up to $E_\alpha = 166$ MeV and polarization measurements have been carried out for E_d to 45 MeV: see (1974AJ01, 1979AJ01). Recent measurements are reported at $E_\alpha = 5.96$ to 13.91 MeV (1980BR19, 1982BR09; $\sigma(\theta)$) and 28.5 MeV (1982WI09), $E_d = 0.87$ to 1.43 MeV (1979BA30, 1980BA60; $\sigma(\theta)$, VAP), $E_d = 8 - 13$ MeV (1983JE03; VAP, TAP), 11.9 MeV (1981EL1A; polarization transfer coefficient at $\theta = 37^\circ$), 12 to 17 MeV (1979GR13; $\sigma(\theta)$, TAP), 12.6 MeV (1981BI1D; VAP, TAP), 17 to 42.8 MeV (1980GR03; VAP, TAP), 17 to 45 MeV (1980ST01; $\sigma(\theta)$, TAP) and 20.2 MeV (1980FR01; $\sigma(\theta)$, VAP, TAP).

Table 6.3: Levels of ${}^6\text{Li}$ from ${}^4\text{He}(d, d){}^4\text{He}$ ^a

E_d (MeV)	$J^\pi; T$	E_x (MeV)	$\Gamma_{\text{c.m.}}$ (MeV)	Γ_d/Γ ^b	γ_d^2 ^c
1.070 ± 0.003 ^d	$3^+; 0$	2.187			0.27
4.34 ± 0.04	$2^+; 0$	4.36	1.32 ± 0.04	0.967	0.511
5.7 ± 0.1 ^e	$1^+; 0$	5.3	1.9 ± 0.1	0.74	0.34
(19.3 ± 1.3)	$3^+; 0$	(14.3)	26.7 ± 1.0	0.34	1.69
(21.6 ± 1.1)	$3^+; 0$	(15.8)	17.8 ± 0.8	0.76	0.77
33 ± 2	4^+	23	12 ± 2	0.15	0.14
34 ± 5	3^-	24	16 ± 3	0.30	0.24
39_{-9}^{+3}	2^-	27	22 ± 7	0.43	0.42

^a The data in this table are mostly from the S -matrix analysis of (1983JE03). The results are unique up to $E_d = 15$ MeV. See also Table 6.4 in (1974AJ01) and Table 6.3 in (1979AJ01).

^b The errors in Γ_d/Γ are typically 0.03.

^c In units of the Wigner limit $\gamma_{\text{W}}^2 = 2.93$ MeV for a radius of 4.0 fm. I am indebted to W. Gruebler for pointing out an error to me.

^d $E_d = 1067 \pm 3$ keV, $\Gamma = 20 \pm 2.8$ keV (1979BA30).

^e 6.26 MeV (1977HA34; R -matrix analysis); $E_x = 5.65$ MeV.

Phase-shift analyses have been carried out for $E_d = 0.3$ to 27 MeV [see (1974AJ01)], and for $E_d = 3$ to 43 MeV by (1983JE03) [using all available differential cross-section, vector and tensor

analyzing power measurements, and $L \leq 5$], for $E_d = 6$ to 14 MeV by (1982BR09), as well as in the vicinity of the 1^+ ; $T = 0$ state ${}^6\text{Li}^*(5.65)$ by (1977HA34) [R -matrix analysis: see Table 6.3]. On the basis of these analyses it is found that the d-wave shifts are split and exhibit resonances at $E_x = 2.19$ (4D_3), 4.7 (3D_2) and 5.65 MeV (3D_1). (1983JE03) suggest very broad G_3 and G_4 resonances at $E_d = (19.3)$ and 33 MeV, a D_3 resonance at 22 MeV and F_3 and F_2 resonances at ≈ 34 and ≈ 39 MeV: see Table 6.3. The states reported by (1983JE03) are primarily of (d+ α) parentage. A contour plot of the TAP to $E_d = 54$ MeV is presented by (1980GR03): it appears that $A_{yy} \approx 1$ near $E_d = 35$ MeV, $\theta_{c.m.} = 150^\circ$. See also (1980ST01). The total cross section has been measured for momenta of 1.55 and 2.89 GeV/ c per nucleon (1978JA16). (1980MC09) looked for narrow resonances, due to quark effects, at deuteron momenta of 2.22 to 5.75 GeV/ c : none were observed.

The direct breakup of 22.2 MeV ${}^6\text{Li}$ on ${}^{118}\text{Sn}$ was measured in a kinematically complete experiment. The d, α angular correlation is in agreement with a semi-classical model for Coulomb breakup (1980GE08). (1980RO1B; preliminary) have attempted to see the $\alpha + d$ (forbidden) breakup of ${}^6\text{Li}^*(3.56)$ [0^+ ; $T = 1$]: $\Gamma_\alpha < 1 \times 10^{-5}$ eV. See also (1977BO40, 1979TO1A, 1983YO01), (1978BR1A, 1982FI1C) and (1978IN02, 1978KO07, 1979SE04, 1979SUZW, 1979WI1B, 1980FU1G, 1980KA15, 1980NI07, 1981AO02, 1982KA24, 1982PR02, 1982SA16, 1983AO03, 1983BA2G, 1983SH04; theor.).

7. (a) ${}^4\text{He}({}^3\text{He}, p){}^6\text{Li}$ $Q_m = -4.0182$
 (b) ${}^4\text{He}({}^3\text{He}, pd){}^4\text{He}$ $Q_m = -5.4936$

Angular distributions have been measured at $E({}^3\text{He}) = 8$ to 18 MeV and $E_\alpha = 42, 71.7$ and 81.4 MeV: see (1974AJ01). At $E_\alpha = 28, 63.7, 71.7$ and 81.4 MeV the α -spectra show that the sequential decay (reaction (b)) involves ${}^6\text{Li}^*(2.19)$ and possibly ${}^5\text{Li}$: see (1979AJ01). See also ${}^7\text{Be}$.

8. (a) ${}^4\text{He}(\alpha, d){}^6\text{Li}$ $Q_m = -22.3714$
 (b) ${}^4\text{He}(\alpha, \alpha d){}^2\text{H}$ $Q_m = -23.84673$

Reaction (a) has been studied to $E_\alpha = 158.2$ MeV: see (1979AJ01) and (1979AL34, 1982GL01). For reaction (b) [and excited states of ${}^4\text{He}$] see (1980KA20; $E_\alpha = 119$ MeV); ${}^6\text{Li}^*(2.19)$ is involved in the process.

9. ${}^6\text{He}(\beta^-){}^6\text{Li}$ $Q_m = 3.507$

See ${}^6\text{He}$.

- | | |
|---|------------------|
| 10. (a) ${}^6\text{Li}(\gamma, n){}^5\text{Li}$ | $Q_m = -5.66$ |
| (b) ${}^6\text{Li}(\gamma, p){}^5\text{He}$ | $Q_m = -4.59$ |
| (c) ${}^6\text{Li}(\gamma, d){}^4\text{He}$ | $Q_m = -1.4753$ |
| (d) ${}^6\text{Li}(\gamma, t){}^3\text{He}$ | $Q_m = -15.7958$ |

The (γ, n) and (γ, xn) cross sections increase from threshold to a maximum at $E_\gamma \approx 12$ MeV then decrease to $E_\gamma = 32$ MeV without clear evidence of additional structure. The cross section for photoproduction (reaction (b)) is generally flat up to 90 MeV. [The previously reported hump at $E_\gamma \approx 16$ MeV is almost certainly due to oxygen contamination (1979SK02).] The integrated cross section for $6.4 \rightarrow 30$ MeV is 16.3 ± 2.5 MeV \cdot mb (1979JU02). The cross section for reaction (c) is $\lesssim 5$ μb in the range $E_\gamma = 2.6$ to 17 MeV consistent with the expected inhibition of dipole absorption by isospin selection rules: see (1966LA04). See also (1979JU02, 1982KIZW). The 90° differential cross section for reaction (d) decreases monotonically for $E_\gamma = 18$ to 70 MeV: reaction (d) contributes $\approx \frac{1}{3}$ of the total cross section for ${}^6\text{Li} + \gamma$, consistent with a ${}^3\text{H} + {}^3\text{He}$ cluster description of ${}^6\text{Li}_{\text{g.s.}}$ with $\theta^2 \approx 0.68$. The agreement with the inverse reaction, ${}^3\text{H}({}^3\text{He}, \gamma)$ [see reaction 1] is good. The integrated cross section for $20 \rightarrow 30$ MeV is 7.0 ± 1.0 MeV \cdot mb (1979JU02). See also (1978VO03).

The absorption cross section has been studied in the range $E_\gamma \approx 100$ to 340 MeV; it shows a broad bump centered at ≈ 125 MeV and a fairly smooth increase to a maximum at ≈ 320 MeV (1979AH1A, 1979ZI1A). For spallation studies see (1978VO03: $(\gamma, n2p)$, (γ, pd)) and (1974AJ01). For pion production see (1979AJ01), ${}^6\text{He}$ and (1979EP02, 1982DO12). For references to the earlier work see (1979AJ01). See also (1979DE2A, 1980AH1A) and (1979LE1A, 1979TA1C, 1980KU06, 1981DZ01, 1981IS11, 1981SU1H, 1982HO05, 1982LO04, 1982LO06, 1983BU1F; theor.).

11. ${}^6\text{Li}(\gamma, \gamma){}^6\text{Li}$

The width, Γ_γ , of ${}^6\text{Li}^*(3.56) = 8.1 \pm 0.5$ eV: see (1974AJ01) and Table 6.4 in (1979AJ01); $E_x = 3562.88 \pm 0.10$ keV (1981RO02).

- | | |
|--|-----------------|
| 12. (a) ${}^6\text{Li}(e, e){}^6\text{Li}$ | |
| (b) ${}^6\text{Li}(e, ep){}^5\text{He}$ | $Q_m = -4.59$ |
| (c) ${}^6\text{Li}(e, ed){}^4\text{He}$ | $Q_m = -1.4735$ |

The elastic scattering has been studied for $E_e = 85$ to 600 MeV [see (1974AJ01, 1979AJ01)] and at $E_e = 80.0$ to 297.8 MeV (1982BE11). The latter find that the results appear to require that the ground state be viewed as an α -d cluster in which the deuteron cluster is deformed and aligned.

Table 6.4: Levels of ${}^6\text{Li}$ from ${}^6\text{Li}(e, e')$ and ${}^6\text{Li}(\gamma, \gamma')$ ^a

E_x (MeV)	$J^\pi; T$	Γ_{γ_0} (eV)	Multipolarity
2.183 ± 0.009 ^b	$3^+; 0$	$(4.40 \pm 0.34) \times 10^{-4}$	E2
3.563 ± 0.010	$0^+; 1$	8.19 ± 0.17 ^c	M1
4.27 ± 0.04	$2^+; 0$	$(5.4 \pm 2.8) \times 10^{-3}$	E2
5.379 ± 17 ^{c, d}	$2^+; 1$	0.27 ± 0.05 ^e	M1

^a See Table 6.4 in (1979AJ01) for references and for the earlier work.

^b $B(E2) \uparrow = 21.8 \pm 4.8 e^2 \cdot \text{fm}^4$; see Fig. 10 in (1974YE01).

^c Weighted mean of values shown in Table 6.4 in (1979AJ01).

^d $\Gamma = 540 \pm 20$ keV; see (1979AJ01).

^e (1980BE20). See also (1979AJ01).

The ground-state M1 current density has also been calculated (1982BE11). A model-independent analysis of the elastic scattering yields $r_{\text{rms}} = 2.51 \pm 0.10$ fm.

Table 6.4 summarizes the results obtained in the inelastic scattering of electrons. Form factors have been measured for ${}^6\text{Li}^*(2.19)$ ($E_e = 140.5$ to 278.2 MeV), ${}^6\text{Li}^*(3.56)$ ($E_e = 140.5$ to 330.7 MeV) and ${}^6\text{Li}^*(5.37)$ ($E_e = 76$ to 278.2 MeV) (1979BE38, 1980BE20). The transition current density for ${}^6\text{Li}^*(3.56)$ has been calculated by (1979BE38). (1980BE28) have measured the form factor of the (t, ${}^3\text{He}$) continuum up to 4 MeV above threshold at $E_e = 102$ and 123 MeV: no narrow structures corresponding to ${}^6\text{Li}$ states are observed. The radiative capture cross section is in good accord with the t- ${}^3\text{He}$ cluster model with a spectroscopic factor $\theta_0^2 = 0.67$ (1980BE28). Quasi-elastic processes have been studied by (1978KU06: $250 \rightarrow 580$ MeV/c). At $E_e = 700$ MeV the proton separation spectra (reaction (b)) are similar to those observed in (p, 2p) (1978NA05). For reaction (c) see (1979AJ01). For π^+ production see ${}^6\text{He}$. The cross section for inelastic scattering has been measured at $E_e = 1.28$ GeV by (1981ES1B; prelim.).

For the earlier work, and for references, see (1979AJ01). See also (1979DO1A, 1979DO1C, 1979TI1A, 1979WA1D, 1980DR1B, 1982PE06, 1983MO1F) and (1978BA1C, 1979BE1G, 1979BE39, 1979BU1A, 1979CA06, 1979FR1B, 1979FR1C, 1979GL10, 1979NA1C, 1979SA39, 1980BU10, 1980HO26, 1980PA06, 1981BU04, 1981DE1T, 1981KU13, 1981LA1E, 1981LO07, 1981SU1H, 1982BO31, 1982KA24, 1982RE1F, 1982SA16, 1982VO01, 1983KR05; theor.).

13. ${}^6\text{Li}(\pi^\pm, \pi^\pm){}^6\text{Li}$ (See also the ‘‘GENERAL’’ section here.)

An elastic angular distribution has been measured at $E_{\pi^+} \approx 50$ MeV and compared with that for ${}^7\text{Li}(\pi^+, \pi^+)$: see ${}^7\text{Li}$ (1978DY01). For a study of inclusive reactions at $E_{\pi^\pm} = 100, 160, 220$ MeV, see (1981MC09).

14. (a) ${}^6\text{Li}(n, n'){}^6\text{Li}^*$
 (b) ${}^6\text{Li}(n, nd){}^4\text{He}$ $Q_m = -1.4753$
 (c) ${}^6\text{Li}(n, nt){}^3\text{He}$ $Q_m = -15.7958$

Angular distributions have been reported for n_0 at $E_n = 1.0$ to 14.2 MeV and for n_1 at $E_n = 7.5$ to 14.1 MeV: see (1979AJ01). Recent measurements are reported at $E_n = 1.5$ to 4.0 MeV (1982SM02; n_0), 4.0 to 7.5 MeV (1979KN01; n_0), 7.47 to 13.94 MeV (1979HO11; n_0, n_1) and 14.6 MeV (1980MI02; n_0). For reaction (b) see (1978RI02; $E_n = 800$ MeV). See also (1977HA1E, 1977KN1A, 1981DAZZ) and (1981KO1M, 1982KO1U, 1982LA16, 1982LE10, 1982VO1B, 1983FU06, 1983GU1F; theor.) and ${}^7\text{Li}$.

15. (a) ${}^6\text{Li}(p, p){}^6\text{Li}$
 (b) ${}^6\text{Li}(p, 2p){}^5\text{He}$ $Q_m = -4.59$
 (c) ${}^6\text{Li}(p, pd){}^4\text{He}$ $Q_m = -1.4753$
 (d) ${}^6\text{Li}(p, p^3\text{H}){}^3\text{He}$ $Q_m = -15.7958$
 (e) ${}^6\text{Li}(p, pn){}^5\text{Li}$ $Q_m = -5.66$
 (f) ${}^6\text{Li}(p, 2d){}^3\text{He}$ $Q_m = -19.8285$
 (g) ${}^6\text{Li}(p, 3p){}^4\text{H}$ $Q_m = -26.1$
 (h) ${}^6\text{Li}(p, nd){}^4\text{Li}$ $Q_m = -25.0$

Proton angular distributions have been measured at $E_p = 0.5$ to 600 MeV [see (1974AJ01, 1966LA04)] and at $E_p = 24.4$ MeV (1982PE06; p_0, p_1, p_2), 136 MeV (1981HE21; p_0, p_1, p_2), 144 MeV (1980MO01; p_0) and 800 MeV (1979MO1E; p_3). For a summary of the results on excited states see Table 6.5. At $E_p = 31$ and 32 MeV the spin-flip probabilities for ${}^6\text{Li}^*(2.19, 3.56)$ have been determined by (1981CO08). The cross-section data at $E_p \approx 25$ and 50 MeV have been reviewed by (1982PE06): some difficulties are encountered in describing the cross section for populating ${}^6\text{Li}^*(3.56)$. For reaction (b) at $E_p = 47$ and 70 MeV see (1983VD03) and at 800 MeV see (1980CH05, 1981FR24). See also ${}^5\text{He}$ and (1979AJ01).

Reaction (c) has been studied at $E_p = 9$ MeV to 1 GeV [see (1974AJ01, 1979AJ01)] and at $E_p = 600$ MeV (1978LA11) and 670 MeV (1980AL10). At $E_p = 100$ MeV the agreement with DWIA is good: $S_\alpha = 0.58 \pm 0.02$ (1977RO02). A study of reaction (f) indicates dominance, at $E_p = 100$ MeV, of the direct quasi-free reaction process ($p + \alpha \rightarrow d + {}^3\text{He}$): $S_\alpha = 0.52 \pm 0.03$ (1977CO07). See also (1982ER06; $E_p = 670$ MeV).

(1975VO04) have compared yields from reactions (b), (c) and (e): by comparing yields in the isospin allowed and forbidden (reaction (c)) channels, they set an upper limit of $\alpha^2 \leq 8 \times 10^{-3}$ for a possible $T = 0$ admixture in the $T = 1$ state, ${}^6\text{Li}^*(5.37)$. Reaction (e), at $E_p = 47$ MeV, may proceed by sequential decay involving ${}^6\text{Li}^*(21, 30)$ or states in ${}^6\text{Be}$ [see reaction 3 in ${}^6\text{Be}$] (1977WA05). Reaction (d), studied at $E_p = 100$ MeV, and compared with the ($p, p\alpha$)

reaction indicates that the ${}^3\text{He} + t$ parentage of ${}^6\text{Li}$ is comparable with the $\alpha + d$ parentage: the quantitative estimates depend strongly on the wave functions used in the estimate (1976RO02). See also (1974AJ01) for the earlier work.

For reaction (g) see (1979NA14; $E_p = 640$ MeV). For reaction (h) see (1979AL11; $E_p = 670$ MeV). See also ${}^7\text{Be}$, (1979BA28, 1981PA25), (1978CH1C, 1982YA1A, 1983MO1F) and (1978BA1C, 1978GO1B, 1978PL1A, 1979AH04, 1979CH1A, 1979KH01, 1979KO1C, 1979YA1B, 1980BA04, 1980BO12, 1980MU1E, 1981CH1J, 1981FE04, 1981GU1F, 1981SM1B, 1981VE07, 1981ZH1D, 1982GO1G, 1982GO1H, 1982GO1J, 1982JI1A, 1982LE08, 1982ZH1J, 1983GO1U; theor.).

16. (a) ${}^6\text{Li}(d, d'){}^6\text{Li}^*$	
(b) ${}^6\text{Li}(d, pn){}^6\text{Li}$	$Q_m = -2.2246$
(c) ${}^6\text{Li}(d, 2d){}^4\text{He}$	$Q_m = -1.4753$
(d) ${}^6\text{Li}(d, \alpha p){}^3\text{H}$	$Q_m = 2.5574$
(e) ${}^6\text{Li}(d, \alpha n){}^3\text{He}$	$Q_m = 1.7936$

Angular distributions of deuterons have been measured at $E_d = 4.5$ to 19.6 MeV: see (1979AJ01). The $T = 1, 0^+$ state, ${}^6\text{Li}^*(3.56)$ is not appreciably populated. For a summary of the results on excited states see Table 6.5.

At $E_d = 21$ MeV reaction (b) shows spectral peaking (characteristic of 1S_0 for the pn system [$T = 1$]) when ${}^6\text{Li}^*(3.56)$ is formed, in contrast with the much broader shape (characteristic of 3S_1) seen when ${}^6\text{Li}^*(0, 2.19)$ are populated. A study of reaction (c) at $E_d = 52$ MeV shows that the α -clustering probability, $N_{\text{eff}} = 0.12_{-0.06}^{+0.12}$ if a Hankel function is used (1973HA31) [see this reference also for a discussion of other results on momentum distributions and α -clustering probability in ${}^6\text{Li}$]. The α -particle and the deuteron clusters in ${}^6\text{Li}$ have essentially a relative orbital momentum of $l = 0$. The D-state probability of the ground state of ${}^6\text{Li}$ is $\approx 5\%$ of the S-state (1973HA31). Quasi-free scattering is an important process even for $E_d = 6$ to 11 MeV. Interference effects are evident in reaction (c) proceeding through ${}^6\text{Li}^*(2.19, 4.31)$: this is due to the experimental being unable to determine whether the detected particle was emitted first or second in the sequential decay. Reactions (c) and (d) studied at $E_d = 7.5$ to 10.5 MeV indicate that the three-body breakup of ${}^6\text{Li}$ at these low energies is dominated by sequential decay processes. See (1979AJ01) for references. For pion production see (1978PE12). See also (1980KI1D) and (1979YA1B, 1980LE07, 1982JI1A, 1982LE10, 1983GO1U; theor.).

17. ${}^6\text{Li}(t, t'){}^6\text{Li}^*$

At $E_t = 17$ MeV angular distributions have been measured for the tritons to ${}^6\text{Li}^*(0, 3.56)$ (1976SH14).

Table 6.5: Parameters of levels of ${}^6\text{Li}$ ^a

E_x (MeV \pm keV)	$\Gamma_{\text{c.m.}}$ (keV)	Reactions
2.185 \pm 3	20.0 \pm 2.8	${}^4\text{He}(d, d){}^4\text{He}$
2.187 \pm 3		${}^4\text{He}(d, d){}^4\text{He}$
2.183 \pm 9		${}^6\text{Li}(e, e'){}^6\text{Li}$
2.188 \pm 6	24 \pm 2 ^c	${}^6\text{Li}(p, p'), (d, d'), {}^7\text{Li}(d, t){}^6\text{Li}$
2.203 \pm 6		${}^9\text{Be}(p, \alpha){}^6\text{Li}$ ^g
2.186 \pm 2	24 \pm 2	“best” values
3.56288 \pm 0.10	(8.2 \pm 0.2) $\times 10^{-3}$	${}^6\text{Li}(\gamma, \gamma){}^6\text{Li}$
3.563 \pm 10		${}^6\text{Li}(e, e'){}^6\text{Li}$
3.5629 \pm 0.6	< 5	${}^6\text{Li}(p, p'), {}^9\text{Be}(p, \alpha){}^6\text{Li}$
4.34 \pm 40		${}^4\text{He}(d, d){}^4\text{He}$
4.27 \pm 40		${}^6\text{Li}(e, e'){}^6\text{Li}$
4.40 \pm 120	1490 \pm 150	${}^6\text{Li}(p, p'){}^6\text{Li}$
4.32 \pm 40	1820 \pm 110	${}^6\text{Li}(d, d'){}^6\text{Li}$
4.3 \pm 100	600 \pm 100	${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}$
4.3 \pm 200 ^d	1600 \pm 300	${}^7\text{Li}({}^3\text{He}, \alpha d){}^4\text{He}$
4.30 \pm 10	850 \pm 50, 480 \pm 80	${}^9\text{Be}(p, \alpha){}^6\text{Li}$ ^g
4.312 \pm 22	1700 \pm 100	“best” values
5.379 \pm 17 ^e	540 \pm 20 ^e	${}^6\text{Li}(e, e'){}^6\text{Li}$
5.33 \pm 80	560 ⁺³⁴⁰ ₋₁₀₀	${}^6\text{Li}(p, p'){}^6\text{Li}$
5.34 \pm 20	560 \pm 40 ^b	${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}$
5.325 \pm 5	270 \pm 12	${}^9\text{Be}(p, \alpha){}^6\text{Li}$ ^g
5.366 \pm 15	540 \pm 20	“best” values
5.65 \pm 50 ^f		${}^4\text{He}(d, d){}^4\text{He}$
5.7	1000 ⁺⁶⁰⁰ ₋₄₀₀ ^b	${}^6\text{Li}(p, p'){}^6\text{Li}$
5.65 \pm 200	1650 \pm 300	${}^7\text{Li}({}^3\text{He}, \alpha d){}^4\text{He}$
5.65 \pm 40	900 \pm 60, 1260 \pm 120	${}^9\text{Be}(p, \alpha){}^6\text{Li}$ ^g
5.65 \pm 50	1500 \pm 200	“best” values

^a For references see Table 6.5 in (1979AJ01).

^b See footnotes ^c and ^d in Table 6.5 in (1979AJ01).

^c And C.P. Browne, private communication.

^d (1983AR05).

^e See Table 6.4 in (1979AJ01).

^f See Table 6.3 in (1979AJ01).

^g (1983DE15).

18. (a) ${}^6\text{Li}({}^3\text{He}, {}^3\text{He}){}^6\text{Li}$

(b) ${}^6\text{Li}({}^3\text{He}, t){}^3\text{He}{}^3\text{He}$ $Q_m = -15.7958$

(c) ${}^6\text{Li}({}^3\text{He}, p\alpha){}^4\text{He}$ $Q_m = 16.8779$

Angular distributions have been measured at $E({}^3\text{He}) = 8$ to 217 MeV [see (1979AJ01)] and at $E({}^3\vec{\text{He}}) = 33.3$ (1981BA37; to ${}^6\text{Li}^*(0, 2.19)$) and $E({}^3\text{He}) = 44.04$ MeV (1979GO07; to ${}^6\text{Li}_{g.s.}$). For polarization measurements see ⁹B. For reaction (b) at $E({}^3\text{He}) = 45$ MeV see (1977HA19). For reaction (c) at $E({}^3\text{He}) = 2.9$ MeV see (1979BA66). For pion production see (1982PI1C). See also (1979KA1G) and (1979BA1H, 1980LE06, 1982LE10; theor.).

19. (a) ${}^6\text{Li}(\alpha, \alpha'){}^6\text{Li}^*$

(b) ${}^6\text{Li}(\alpha, 2\alpha){}^2\text{H}$ $Q_m = -1.4753$

(c) ${}^6\text{Li}(\alpha, \alpha p){}^5\text{He}$ $Q_m = -4.59$

Angular distributions (reaction (a)) have been measured at $E_\alpha = 3.0$ to 166 MeV [see (1974AJ01, 1979AJ01)] and at $E_\alpha = 1.39$ to 2.98 MeV (1981HE05; α_0), $E({}^6\vec{\text{Li}}) = 15.1$ to 22.7 MeV (1979EG01; ${}^6\text{Li}_{g.s.}$) and $E_\alpha = 59$ MeV (1979FO21; α_0). For yield and polarization measurements see ¹⁰B.

Reaction (b) has been studied at $E_\alpha = 23.6$ to 79.6 MeV [see (1974AJ01, 1979AJ01)] and at $E_\alpha = 6.6$ to 13.0 MeV (1983GO07), 18 MeV (1980ZH1A) and 700 MeV (1979DO04). Using a width parameter of 60.6 MeV/c, (1979DO04) find that the effective number of $\alpha + d$ clusters for ${}^6\text{Li}_{g.s.}$, $n_{\text{eff}} = 0.98 \pm 0.05$; the results are very model dependent. See also (1980KI1D), (1979AJ01) and ⁸Be. For reaction (c) see ⁵He (1979NA06). For pion production see (1978PE12, 1982AN1H). See also (1978CH1C) and (1978AN20, 1979SU06, 1979SU09, 1979SU1F, 1980HA1P, 1981BA20, 1981LA13, 1982JI1A, 1982LE10; theor.).

20. (a) ${}^6\text{Li}({}^6\text{Li}, {}^6\text{Li}){}^6\text{Li}$

(b) ${}^6\text{Li}({}^6\text{Li}, 2d){}^4\text{He}{}^4\text{He}$ $Q_m = -2.9507$

Angular distributions of ${}^6\text{Li}$ ions have been studied for $E({}^6\text{Li}) = 3.2$ to 36 MeV [see (1974AJ01, 1979AJ01)] and at $E({}^6\text{Li}) = 20$ MeV (1981AV1B; to ${}^6\text{Li}^*(0, 2.19)$). At $E({}^6\text{Li}) = 32$ and 36 MeV the ratios for populating ${}^6\text{Li}^*(3.56)$ and ${}^6\text{He}_{\text{g.s.}} + {}^6\text{Be}_{\text{g.s.}}$ [the analog states] vary with angle: see reaction 10 in ${}^6\text{He}$. Reaction (b) has been studied for $E({}^6\text{Li}) = 36$ to 47 MeV: enhancements in yield, due to double spectator poles, have been observed in d-d and $\alpha - \alpha$ but not in α -d double coincidence spectra. The widths of the peaks are smaller than those predicted from the momentum distribution of $\alpha + \text{d}$ clusters in ${}^6\text{Li}$. Reaction (b) also proceeds via ${}^6\text{Li}^*(2.19)$ (1979WA13, 1981WA15, 1982WA07). See also ${}^8\text{Be}$.

See also (1981NO06, 1982LA19), (1981HE02, 1981DY02; theor.) and ${}^{12}\text{C}$ in (1980AJ01, 1985AJ01).

21. ${}^6\text{Li}({}^7\text{Li}, {}^7\text{Li}){}^6\text{Li}$

See (1981GU1B; theor.).

22. ${}^6\text{Li}({}^9\text{Be}, {}^9\text{Be}){}^6\text{Li}$

The elastic scattering has been studied at $E({}^6\text{Li}) = 4.0, 6.0$ and 24 MeV: see (1979AJ01).

23. ${}^6\text{Li}({}^{10}\text{B}, {}^{10}\text{B}){}^6\text{Li}$

The elastic scattering has been studied at $E({}^6\text{Li}) = 5.8$ and 30 MeV: see (1979AJ01).

24. (a) ${}^6\text{Li}({}^{12}\text{C}, {}^{12}\text{C}){}^6\text{Li}$

(b) ${}^6\text{Li}({}^{13}\text{C}, {}^{13}\text{C}){}^6\text{Li}$

The elastic scattering (reaction (a)) has been studied at $E({}^6\text{Li}) = 4.5$ to 100 MeV [see (1975AJ02, 1980AJ01)] and at $E({}^6\text{Li}) = 36$ MeV (1982WO09; also to ${}^{12}\text{C}^*(4.4)$), 90 MeV (1981GL03), 99 MeV (1981SC16) and 156 MeV [see (1982CO19) and (1982MA21, 1982MI1D)]. See also (1979FUZS, 1982AS1B, 1982TA23). For fusion cross sections see (1982DE30). The elastic scattering (reaction (b)) has been studied for $E({}^7\text{Li}) = 5.8$ to 34 MeV [see (1979AJ01, 1981AJ01)] and at 40 MeV (1979ZE01). For fusion cross sections see (1982DE30). See also ${}^{18}\text{F}$ and ${}^{19}\text{F}$ in (1983AJ01), (1978HO1C, 1978MA1B, 1982TA23) and (1979BE59, 1979SU1F, 1980ST22, 1981GR17, 1981GU1B, 1981ME1E, 1981OS1D, 1981TH07, 1982DE28, 1982DR1D, 1982KO1Z, 1982MA21, 1982MA35, 1982RA22; theor.).

25. ${}^6\text{Li}({}^{14}\text{N}, {}^{14}\text{N}){}^6\text{Li}$

See (1981AJ01).

26. ${}^6\text{Li}({}^{16}\text{O}, {}^{16}\text{O}){}^6\text{Li}$

Elastic angular distributions have been measured at $E({}^6\text{Li}) = 4.5$ to 50.6 MeV and at $E({}^{16}\text{O}) = 36$ MeV [see (1979AJ01, 1982AJ01)] as well as at $E({}^6\text{Li}) = 32$ MeV (1980AN16) and 36 MeV (1982WO09). See also (1978HO1C) and (1981ME1E, 1982AL02, 1982RA22; theor.).

27. (a) ${}^6\text{Li}({}^{24}\text{Mg}, {}^{24}\text{Mg}){}^6\text{Li}$

(b) ${}^6\text{Li}({}^{25}\text{Mg}, {}^{25}\text{Mg}){}^6\text{Li}$

(c) ${}^6\text{Li}({}^{26}\text{Mg}, {}^{26}\text{Mg}){}^6\text{Li}$

The elastic scattering has been studied at $E({}^6\text{Li}) = 87.8$ MeV (1981FU04), and at 36 MeV (1982WO09; reaction (c)). See also (1981CO06, 1982CO18, 1982KO1Z; theor.).

28. ${}^6\text{Li}({}^{27}\text{Al}, {}^{27}\text{Al}){}^6\text{Li}$

The elastic scattering has been studied at $E({}^6\text{Li}) = 88$ MeV (1981FU04). See also (1982TA23) and (1980CO11, 1982KO1Z; theor.).

29. ${}^6\text{Li}({}^{28}\text{Si}, {}^{28}\text{Si}){}^6\text{Li}$

The elastic scattering has been studied at $E({}^6\text{Li}) = 13, 20$ and 25 MeV (1981HU08), 27 and 34 MeV (1983VIZZ), 32 MeV (1980AN16), $60, 75$ and 90 MeV (1981GL03), 99 MeV (1981SC16) and 154 MeV (1980SC12). At $E({}^6\text{Li}) = 156$ MeV the inelastic scattering of ${}^6\text{Li}$ ions proceeds predominantly via direct one-nucleon removal (1981NI06). See also (1979AJ01, 1980ZI02) and (1979SA1E, 1980HI1B, 1980HU09, 1980ST22, 1981HU07, 1981ME1E, 1981PH1A, 1982BR1D, 1982CO02, 1982CO18, 1982KU05, 1982SA16; theor.).

30. (a) ${}^6\text{Li}({}^{39}\text{K}, {}^{39}\text{K}){}^6\text{Li}$

(b) ${}^6\text{Li}({}^{40}\text{Ca}, {}^{40}\text{Ca}){}^6\text{Li}$

(c) ${}^6\text{Li}({}^{44}\text{Ca}, {}^{44}\text{Ca}){}^6\text{Li}$

(d) ${}^6\text{Li}({}^{48}\text{Ca}, {}^{48}\text{Ca}){}^6\text{Li}$

Elastic scattering has been studied at $E(^6\text{Li}) = 26$ and 30 MeV for reaction (b) (1982CO12), 28 and 34 MeV for reactions (a) (1981SZ02), (b) and (d) (1977CU02), at 88 MeV for reactions (b) and (c) (1981FU04) and at 99 MeV for reaction (b) (1981SC16). See also (1980JA1C, 1982CO18, 1982KO1Z, 1982KU05, 1982SA16; theor.).

$$31. \text{ (a) } ^7\text{Li}(e, n)^6\text{Li} \quad Q_m = -7.250$$

$$\text{ (b) } ^7\text{Li}(\gamma, n)^6\text{Li} \quad Q_m = -7.250$$

Reaction (a) has been studied by (1980AS02) at $E_e = 108, 163$ and 198 MeV: equivalent (γ, n) cross sections are derived for $E_x \approx 70$ to 120 MeV. Transitions to $^6\text{Li}^*(0, 2.19, 3.56)$ have been observed in reaction (b): see (1979AJ01) and (1978DE13). See also ^7Li .

$$32. ^7\text{Li}(\pi^+, p)^6\text{Li} \quad Q_m = 133.100$$

Differential cross sections have been measured at $E_\pi = 75$ and 175 MeV for the transition to $^6\text{Li}^*(0, 2.19)$ (1980KA11).

$$33. ^7\text{Li}(n, 2n)^6\text{Li} \quad Q_m = -7.250$$

See (1980MI02). See also ^8Li .

$$34. \text{ (a) } ^7\text{Li}(p, d)^6\text{Li} \quad Q_m = -5.025$$

$$\text{ (b) } ^7\text{Li}(p, pn)^6\text{Li} \quad Q_m = -7.250$$

Angular distributions of deuterons (reaction (a)) have been studied for $E_p = 16.7$ to 185 MeV [see (1979AJ01)], at $E_p = 18.6$ MeV (1983BEYY; p_0), 200 and 400 MeV (1981LI1B; prelim.), 530 MeV (1981IR1A; prelim.) and at $E_p = 800$ MeV (1980BA02; d_0, d_1). A DWBA analysis of the 185 MeV data leads to $C^2S = 0.87, 0.67, 0.24, (0.05), 0.14$, respectively for $^6\text{Li}^*(0, 2.19, 3.56, 4.31, 5.37)$. No other states were seen below $E_x \approx 20$ MeV (1976FA03). At $E_p = 800$ MeV $^6\text{Li}^*(2.19)$ is populated much more strongly than $^6\text{Li}_{\text{g.s.}}$ and the angular distribution of d_1 is not reproduced by FRDWBA (1980BA02). For reaction (b) see (1977WA05). See also ^8Be , (1979AJ01) and (1983FO01; theor.).

$$35. ^7\text{Li}(d, t)^6\text{Li} \quad Q_m = -0.993$$

A study at $E_d = 23.6$ MeV of the relative cross sections of the analog reactions ${}^7\text{Li}(d, t){}^6\text{Li}$ (to the first two $T = 1$ states at 3.56 and 5.37 MeV) and ${}^7\text{Li}(d, {}^3\text{He}){}^6\text{He}$ (to the ground and 1.80 MeV excited states) shows that ${}^6\text{Li}^*(3.56, 5.37)$ have high isospin purity ($\alpha^2 < 0.008$): this is explained in terms of antisymmetrization effects which prevent mixing with nearby $T = 0$ states (1971DE08). See also (1974AJ01) and (1979DO19; theor.).

36. (a) ${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}$ $Q_m = 13.328$
 (b) ${}^7\text{Li}({}^3\text{He}, d\alpha){}^4\text{He}$ $Q_m = 11.852$

Angular distributions have been reported at $E({}^3\text{He}) = 5.1$ to 18 MeV [see (1974AJ01)] and at $E({}^3\text{He}) = 0.6$ to 2.5 MeV (1979LIZT, 1980LI1D, 1980LI1F; prelim.; α to ${}^6\text{Li}^*(0, 2.19, 3.56, 5.37)$) and $E({}^3\vec{\text{He}}) = 33.3$ MeV (1981BA38; $\alpha_0, \alpha_1, \alpha_2$). Excited states observed in this reaction are displayed in Table 6.5. No other states are reported below $E_x = 10$ MeV: see (1979AJ01). See also ¹⁰B.

Several attempts have been made to look at the isospin decay of ${}^6\text{Li}^*(5.37)$ [$J^\pi; T = 2^+; 1$] via ${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}^* \rightarrow d + \alpha$: the branching is $< 1\%$. $\Gamma_p/\Gamma = 0.35 \pm 0.10$ and $\Gamma_{p+n}/\Gamma = 0.65 \pm 0.10$ for ${}^6\text{Li}^*(5.37)$: see (1979AJ01). ${}^4\text{He} + d$ spectra suggest the excitation of ${}^6\text{Li}^*(4.3)$ [$E_x = 4.3 \pm 0.2$ MeV, $\Gamma = 1.6 \pm 0.3$ MeV] (1983AR05) and ${}^6\text{Li}^*(5.7)$ [$E_x = 5.65 \pm 0.2$ MeV, $\Gamma = 1.65 \pm 0.3$ MeV] (1982AR08; $E({}^3\text{He}) = 2.5$ and 5 MeV).

37. (a) ${}^9\text{Be}(p, \alpha){}^6\text{Li}$ $Q_m = 2.126$
 (b) ${}^9\text{Be}(p, d){}^4\text{He}{}^4\text{He}$ $Q_m = 0.651$

Angular distributions of α -particles (reaction (a)) have been measured at $E_p = 0.11$ to 45 MeV: see (1974AJ01, 1979AJ01). ${}^6\text{Li}^*(2.19, 4.31, 5.37, 5.65)$ are populated at $E_p = 30$ and 50 MeV (1983DE15). See also Table 6.5 and (1981DE1X). ${}^6\text{Li}^*(3.56)$ decays by γ -emission consistent with M1; $\Gamma_\alpha/\Gamma < 0.025$ [forbidden by spin and parity conservation] [see (1981AR08) for a discussion of a possible experiment to study this problem]. At $E_p = 9$ MeV the yield of reaction (b) is dominated by FSU through ${}^8\text{Be}^*(0, 2.9)$ and ${}^6\text{Li}^*(2.19)$ with little or no yield from direct three-body decay: see (1979AJ01). For a study of the continuum see (1983DE14). See also ¹⁰B.

38. ${}^9\text{Be}(t, {}^6\text{He}){}^6\text{Li}$ $Q_m = -5.380$

Angular distributions of ${}^6\text{He}_{g.s.} + {}^6\text{Li}_{g.s.}$, ${}^6\text{Li}_{g.s.} + {}^6\text{He}_{g.s.}$, ${}^6\text{Li}_{3.56}^* + {}^6\text{He}_{g.s.}$, and ${}^6\text{He}_{g.s.} + {}^6\text{Li}_{3.56}^*$ [the second listed ion being the detected one] have been measured at $E_t = 21.5$ and 23.5 MeV. In the latter two cases the final state is composed of two isobaric analog states: angular distributions

are symmetric about 90°_{cm} , within the overall experimental errors. In the reaction leading to the ground states of ${}^6\text{He}$ and ${}^6\text{Li}$ differences from symmetry of as much as 40% are observed at forward angles. Angular distributions involving ${}^6\text{He}_{\text{g.s.}} + {}^6\text{Li}^*(2.19)$ and ${}^6\text{Li}_{\text{g.s.}} + {}^6\text{He}^*(1.8)$ have also been measured. This reaction appears to proceed predominantly by means of the direct pickup of a triton or ${}^3\text{He}$ from ${}^9\text{Be}$ (1975VO08). Differential cross sections are also reported at $E_t = 17$ MeV (1979FL03). See also ${}^{12}\text{B}$ in (1980AJ01) and (1983WE02; theor.).

$$39. {}^9\text{Be}({}^3\text{He}, {}^6\text{Li}){}^6\text{Li} \quad Q_m = -1.892$$

Angular distributions of ${}^6\text{Li}$ ions have been obtained at $E({}^3\text{He}) = 6$ to 10 MeV: see (1974AJ01). The continuum has been studied by (1983DE14) at $E({}^3\text{He}) = 45$ MeV: subtraction of the phase space contribution suggests the population of ${}^6\text{Li}$ states at $E_x = 8 - 12$, ≈ 21 and 21.5 MeV. See also (1981DE1X).

$$40. {}^{10}\text{B}(\text{d}, {}^6\text{Li}){}^6\text{Li} \quad Q_m = -2.985$$

Angular distributions of the ${}^6\text{Li}$ ions to ${}^6\text{Li}^*(0, 2.19)$ have been measured at $E_d = 13.6$ MeV (1982DO1E) and 19.5 MeV (1971GU07).

$$41. {}^{10}\text{B}({}^3\text{He}, {}^7\text{Be}){}^6\text{Li} \quad Q_m = -2.873$$

Angular distributions of the ${}^7\text{Be}$ ions [${}^7\text{Be}^*(0, 0.43)$] corresponding to formation of ${}^6\text{Li}^*(0, 2.19)$ have been measured at $E({}^3\text{He}) = 30$ MeV: see (1974AJ01).

$$42. {}^{10}\text{B}(\alpha, {}^8\text{Be}){}^6\text{Li} \quad Q_m = -4.552$$

At $E_\alpha = 72.5$ MeV only ${}^6\text{Li}^*(0, 2.18 \pm 0.03)$ are observed: the latter is excited much more strongly than is the ground state (S_α for the ground state is 0.4 that for ${}^6\text{Li}^*(2.19)$). The angular distributions for both transitions are flat (1976WO11). Angular distributions are also reported at $E_\alpha = 27.2$ MeV to ${}^8\text{Be}^*(0, 2.9)$ and ${}^6\text{Li}_{\text{g.s.}}$ (1982DO1F). See also (1981DEZX).

$$43. {}^{11}\text{B}(\text{p}, {}^6\text{Li}){}^6\text{Li} \quad Q_m = -12.215$$

See (1980HO14; theor.).

44. $^{11}\text{B}(\text{d}, ^7\text{Li})^6\text{Li}$ $Q_m = -7.189$

Angular distributions of ^6Li ions are reported at $E_d = 13.6$ MeV (1983DOZY), 19.5 MeV (1971GU07) for transitions to $^7\text{Li}^*(0, 0.48)$. See also (1974AJ01).

45. $^{11}\text{B}(^3\text{He}, ^8\text{Be})^6\text{Li}$ $Q_m = 4.571$

Angular distributions of ^6Li ions are reported at $E(^3\text{He}) = 3.0$ and 5.2 MeV. The reaction has been observed to lead to $^8\text{Be}^*(2.9) + ^6\text{Li}(0)$ and to $^8\text{Be}(0) + ^6\text{Li}^*(3.56)$. It is suggested that $^6\text{Li}^*(3.56)$ contains a far smaller admixture of the $(^3\text{He} + \text{t})$ configuration than does $^6\text{Li}(0)$: see (1974AJ01).

46. $^{12}\text{C}(\gamma, \text{pn}\alpha)^6\text{Li}$ $Q_m = -31.8707$

See (1982DO1G) and ^{12}C in (1985AJ01).

47. $^{12}\text{C}(\text{p}, ^7\text{Be})^6\text{Li}$ $Q_m = -22.565$

Angular distributions of the ^6Li ions corresponding to the transition to $^7\text{Be}^*(0+0.43)$ have been measured at five energies in the range $E_p = 36.0$ to 56.8 MeV and the data have been analyzed using ZR and FRDWBA assuming the pickup of ^5He and ^6Li clusters as the dominant mechanism: see (1974AJ01, 1979AJ01). See also (1979HA52; theor.).

48. $^{12}\text{C}(\text{d}, ^8\text{Be})^6\text{Li}$ $Q_m = -5.891$

Angular distributions of ^6Li ions are reported at $E_d = 19.5$ and 51.8 MeV: see (1974AJ01). See also ^8Be .

49. $^{12}\text{C}(^3\text{He}, ^9\text{B})^6\text{Li}$ $Q_m = -11.570$

Angular distributions of ^6Li have been obtained at $E(^3\text{He}) = 28$ to 40.7 MeV: see (1974AJ01).

50. (a) $^{12}\text{C}(\alpha, ^{10}\text{B})^6\text{Li}$ $Q_m = -23.710$
 (b) $^{12}\text{C}(\alpha, \text{d}\alpha)^{10}\text{B}$ $Q_m = -25.1858$

Angular distributions (reaction (a)) have been obtained at $E_\alpha = 42$ MeV involving ${}^6\text{Li}^*(0, 2.19)$: see (1974AJ01). At $E_\alpha = 65$ MeV reaction (b) goes via ${}^6\text{Li}^*(2.19, 4.31)$ (1978SA26). See also ${}^{10}\text{B}$.

$$51. {}^{12}\text{C}({}^{10}\text{B}, {}^{16}\text{O}){}^6\text{Li} \quad Q_m = 2.7017$$

At $E({}^{10}\text{B}) = 68$ MeV transitions to ${}^6\text{Li}^*(2.19)$ and to a number of states of ${}^{16}\text{O}$ are observed by (1981BI07). See also ${}^{16}\text{O}$ in (1982AJ01).

$$52. {}^{13}\text{C}(\text{p}, {}^8\text{Be}){}^6\text{Li} \quad Q_m = -8.613$$

At $E_p = 45$ MeV, the angular distribution of the ${}^6\text{Li}$ ions corresponding to ${}^8\text{Be}^*(0, 2.9)$ have been measured: see (1974AJ01).

$$53. {}^{16}\text{O}(\text{d}, {}^{12}\text{C}){}^6\text{Li} \quad Q_m = -5.687$$

See (1980AJ01).

$$54. {}^{16}\text{O}({}^3\text{He}, {}^{13}\text{N}){}^6\text{Li} \quad Q_m = -9.237$$

See (1981AJ01).

$$55. {}^{16}\text{O}(\alpha, {}^{14}\text{N}){}^6\text{Li} \quad Q_m = -19.261$$

See (1981AJ01).

$$56. {}^{19}\text{F}({}^3\text{He}, {}^{16}\text{O}){}^6\text{Li} \quad Q_m = 4.096$$

Angular distributions have been measured at $E({}^3\text{He}) = 11$ to 40.7 MeV involving ${}^6\text{Li}^*(0, 3.56)$ and various states of ${}^{16}\text{O}$: see (1974AJ01, 1977AJ02).

⁶Be
(Figs. 6 and 7)

GENERAL: See also (1979AJ01).

Model calculations: (1979SHZV, 1981HO23, 1982DE42, 1982HO05, 1982KR1B, 1982NG01, 1982VO01, 1983DE16).

Other topics: (1979KO1D, 1983BA3A, 1983NA03).

Table 6.6: Energy levels of ⁶Be

E_x (MeV \pm keV)	$J^\pi; T$	$\Gamma_{c.m.}$	Decay	Reactions
g.s.	$0^+; 1$	92 ± 6 keV	p, α	2, 3, 4, 5
1.67 ± 50 ^a	$(2)^+; 1$	1.16 ± 0.06 MeV	p, α	1, 2, 3, 4
23	4^-	broad	γ , ³ He	1, 3
26	2^-	broad	³ He	1, 3
27	3^-	broad	³ He	1

^a See Table 6.8 in (1974AJ01).

1. (a) ³He(³He, γ)⁶Be $Q_m = 11.489$
- (b) ³He(³He, p)⁵Li $Q_m = 10.90$ $E_b = 11.489$
- (c) ³He(³He, 2p)⁴He $Q_m = 12.8596$
- (d) ³He(³He, ³He)³He
- (e) ³He(³He, pd)³He $Q_m = -5.4936$
- (f) ³He(³He, 2p)²H²H $Q_m = -10.987$
- (g) ³He(³He, 3p)³H $Q_m = -6.9544$

The yield of γ -rays to ⁶Be*(1.7) (reaction (a)) increases smoothly from 0.4 to 9.3 μ b (assuming isotropy) for $0.86 < E(^3\text{He}) < 11.8$ MeV (90°). No transitions were observed to ⁶Be(0) [$\sigma < 0.01$ μ b at $E(^3\text{He}) = 1.4$ MeV]. This is understood in terms of a direct capture of ³He by ³He in the singlet spin state and with zero angular momentum: the $0^+ \rightarrow 0^+$ γ -transition is forbidden. Reaction (a) is thus of negligible astrophysical importance compared to reaction (c): see (1979AJ01). The capture cross section from $E(^3\text{He}) = 12$ MeV to 27 MeV continues to increase smoothly with energy at first and then shows a broad structure centered at $E(^3\text{He}) = 23 \pm 1$ MeV [$E_x = 23.0 \pm 0.5$ MeV], $\Gamma_{c.m.} \approx 5$ MeV (1974VE01). This appears to be a ³³F cluster resonance

which decays by an E1 transition to ${}^6\text{Be}^*(1.7)$. The γ -ray angular distributions are consistent with $J^\pi = 3^-$ (1974VE01).

The analyzing power angular distribution has been measured at $E({}^3\vec{\text{He}}) = 14$ MeV for the p_0 group (reaction (b)) (1981KO34). See also (1979AJ01) and ${}^5\text{Li}$.

Measurements of the total cross section for reaction (c) have been carried out for $E({}^3\text{He}) = 60$ keV to 2.2 MeV. The measurements of (1974DW01), down to $E_{c.m.} = 30$ keV, eliminate the possibility of a resonance [which might help explain the observed absence of solar neutrinos], unless it is extremely narrow ($\Gamma \lesssim 100$ eV): $\theta_p^2 \approx 3 \times 10^{-6}$ (1974DW01). The cross section factor $S(E_{c.m.}) = [5.2 - 2.8E_{c.m.} + 1.4E_{c.m.}^2]$ MeV \cdot b [error in S is $\pm 20\%$ for $E_{c.m.} > 40$ keV] (1974DW01). For the earlier work see (1966LA04, 1974AJ01). For polarization measurements (reaction (c)), see (1979AJ01).

The elastic scattering (reaction (d)) has been studied for $E({}^3\text{He}) = 3$ to 32 MeV [see (1979AJ01)] and at 120 MeV (1980TA11; also inelastic processes). The excitation function shows a smooth monotonic behavior except for an anomaly at $E({}^3\text{He}) = 25$ MeV in the $L = 3$ partial wave corresponding to a broad state in ${}^6\text{Be}$ at $E_x \approx 24$ MeV. Polarization measurements have been carried out at $E({}^3\vec{\text{He}}) = 17.9$ to 32.9 MeV (1978VL01). A two level R -matrix analysis of the phase shifts ($L \leq 5$) suggests three broad F-wave states at $E_x \approx 23.4(4^-)$, 26.2(2^-) and 26.7 MeV(3^-) (1978VL01), in disagreement with the capture γ -ray results described above. See also (1979AJ01).

A kinematically complete experiment (reaction (e)) has been performed at $E({}^3\text{He}) = 120$ MeV: large peaks were observed which appear to correspond to ${}^3\text{He}$ -d quasi-free scattering followed by p-d FSI. No evidence was seen for excited states of ${}^3\text{He}$ (1978FU08). See also (1980TA11). At $E({}^3\text{He}) = 50, 65$ and 78 MeV (1978AL21, 1979LA14) have examined reactions (c), (e), (f), (g) and have compared the results with PWIA: deviations are observed. See also (1979PI11), (1979AJ01, 1982SL1A), (1980PE1N, 1982BA80, 1983TR1F; astrophysics) and (1978FE07, 1979FU1F, 1981BA25, 1981HO23; theor.).

$$2. {}^4\text{He}({}^3\text{He}, n){}^6\text{Be} \quad Q_m = -9.089$$

Neutron groups to ${}^6\text{Be}^*(0, 1.7)$ have been observed at $E({}^3\text{He}) = 19.4$ to 38.61 MeV: see Table 6.8 in (1974AJ01) for the parameters of the first excited state. There is no evidence for other states of ${}^6\text{Be}$ with $E_x \lesssim 5$ MeV, not for a state near the ${}^3\text{He}$ threshold at 11.5 MeV: see (1979AJ01).

$$3. (a) {}^6\text{Li}(p, n){}^6\text{Be} \quad Q_m = -5.070$$

$$(b) {}^6\text{Li}(p, pn){}^5\text{Li} \quad Q_m = -5.66$$

Neutron groups have been observed to ${}^6\text{Be}^*(0, 1.7)$ as has the ground-state threshold. The width of the ground state is 95 ± 28 keV. The parameters of ${}^6\text{Be}^*(1.7)$ are displayed in Table 6.8 of (1974AJ01). Angular distributions have been reported at $E_p = 8.3$ to 49.4 MeV [see (1979AJ01)] and at $E_p = 144$ MeV (1980MO10; n_0). See also (1982KI1F; $E_p = 800$ MeV). In reaction (b)

(1977WA05) report, at $E_p = 47$ MeV, some evidence for sequential decay via ${}^6\text{Be}^*(15.5 \pm 2, 24 \pm 2)$. See also (1979RAZI, 1980GO1J), (1982PE06) and (1980BA2H, 1980DU16, 1983GU1G; theor.).



Triton groups have been observed to ${}^6\text{Be}^*(0, 1.7)$. The width of the ground state is 89 ± 6 keV. The parameters of the excited state are displayed in Table 6.8 of (1974AJ01). No other excited states have been seen with $E_x < 13$ MeV. There is no evidence for a state near 11.5 MeV; see (1979AJ01). The angular distribution of t_0 has been studied by (1981BA37: $E({}^3\text{He}) = 33.3$ MeV). The α -spectrum following the $\alpha + p + p$ decay of ${}^6\text{Be}_{g.s.}$ has been measured by (1977GE02): the yield of low-energy α -particles appears to be enhanced compared with calculations based on the available phase space. The continuum has also been studied by (1983DE14). See also (1981DE1X), (1979BA1H; theor.) and ${}^9\text{B}$.



See reactions 10 in ${}^6\text{He}$ and 20 in ${}^6\text{Li}$.



Discrete states are not observed: see (1981DE1X, 1983DE14) [see also for a study of the continuum].

${}^6\text{B}$

(Not illustrated)

Not observed: see (1982NG01; theor.).

${}^6\text{C}$

(Not illustrated)

Not observed: see (1979AJ01).

References

(Closed 1 June 1983)

References are arranged and designated by the year of publication followed by the first two letters of the first-mentioned author's name and then by two additional characters. Most of the references appear in the National Nuclear Data Center files (Nuclear Science References Database) and have NNDC key numbers. Otherwise, TUNL key numbers were assigned with the last two characters of the form 1A, 1B, etc. In response to many requests for more informative citations, we have, when possible, included up to ten authors per paper and added the authors' initials.

- 1966LA04 T. Lauritsen and F. Ajzenberg-Selove, Nucl. Phys. 78 (1966) 1
- 1971DE08 P.T. Debevec, G.T. Garvey and B.E. Hingerty, Phys. Lett. B34 (1971) 497
- 1971GU07 H.H. Gutbrod, H. Yoshida and R. Bock, Nucl. Phys. A165 (1971) 240
- 1973BA62 H.W. Baer, J.A. Bistirlich, K.M. Crowe, N. de Botton, J.A. Helland and P. Truol, Phys. Rev. C8 (1973) 2029
- 1973HA31 R. Hagedberg, E.L. Haase and Y. Sakamoto, Nucl. Phys. A207 (1973) 366
- 1973VE1B Ventura, Thesis, Stanford Univ. (1973)
- 1974AJ01 F. Ajzenberg-Selove and T. Lauritsen, Nucl. Phys. A227 (1974) 1
- 1974DW01 M.R. Dwarakanath, Phys. Rev. C9 (1974) 805
- 1974VE01 E. Ventura, J. Calarco, C.C. Chang, E.M. Diener, E. Kuhlmann and W.E. Meyerhof, Nucl. Phys. A219 (1974) 157
- 1974WI14 D.H. Wilkinson and D.E. Alburger, Phys. Rev. C10 (1974) 1993
- 1974YE01 R. Yen, L.S. Cardman, D. Kalinsky, J.R. Legg and C.K. Bockelman, Nucl. Phys. A235 (1974) 135
- 1975AJ02 F. Ajzenberg-Selove, Nucl. Phys. A248 (1975) 1
- 1975VO04 W. von Witsch, G.S. Mutchler and D. Miljanic, Nucl. Phys. A248 (1975) 485
- 1975VO08 W. von Oertzen and E.R. Flynn, Ann. Phys. 95 (1975) 326
- 1976FA03 B. Fagerstrom, J. Kallne, O. Sundberg and G. Tibell, Phys. Scr. 13 (1976) 101
- 1976RO02 P.G. Roos, D.A. Goldberg, N.S. Chant, R. Woody, III and W. Reichart, Nucl. Phys. A257 (1976) 317
- 1976SH14 J.D. Sherman, E.R. Flynn, N. Stein, J.W. Sunier and D.G. Burke, Phys. Rev. C13 (1976) 2122
- 1976WO11 G.J. Wozniak, D.P. Stahel, J. Cerny and N.A. Jelley, Phys. Rev. C14 (1976) 815
- 1977AJ02 F. Ajzenberg-Selove, Nucl. Phys. A281 (1977) 1
- 1977BO40 A.E. Borzakovskij and S.V. Romanovskij, Ukr. Fiz. Zh. 22 (1977) 2056
- 1977BR17 F.P. Brady, N.S.P. King, B.E. Bonner, M.W. McNaughton, J.C. Wang and W.W. True, Phys. Rev. C16 (1977) 31

- 1977CO07 A.A. Cowley, P.G. Roos, N.S. Chant, R. Woody, III, H.D. Holmgren and D.A. Goldberg, Phys. Rev. C15 (1977) 1650
- 1977CU02 R.I. Cutler, M.J. Nadworny and K.W. Kemper, Phys. Rev. C15 (1977) 1318; Erratum Phys. Rev. C16 (1977) 1692
- 1977DE1B de Botton, Bull. Inf. Sci. Tech. (France) 224-225 (1977) 94
- 1977GE02 D.F. Geesaman, R.L. McGrath, P.M.S. Lesser, P.P. Urone and B. VerWest, Phys. Rev. C15 (1977) 1835
- 1977GR1C Grechukhin and Soldatov, Zh. Eksp. Teor. Fiz. 72 (1977) 390
- 1977HA17 R.F. Haglund, Jr., G.G. Ohlsen, R.A. Hardekopf, N. Jarmie, R.E. Brown and P.A. Schmelzbach, Phys. Rev. C15 (1977) 1613
- 1977HA19 M.I. Haftel, R.G. Allas, L.A. Beach, R.O. Bondelid, E.L. Petersen, I. Slaus, J.M. Lambert and P.A. Treado, Phys. Rev. C16 (1977) 42
- 1977HA1E Hale, Proc. Int. Specialists Symp. on Neutron Standards and Applicaitons, 1977 (1977) 30
- 1977HA34 R.A. Hardekopf, W. Gruebler, B. Jenny, V. Konig, R. Risler, H.R. Burgi and J. Nurzynski, Nucl. Phys. A287 (1977) 237
- 1977KA10 O. Karban, A.K. Basak, C.O. Blyth, W. Dahme, J.B.A. England, J.M. Nelson, N.T. Okumusoglu, S. Roman, G.G. Shute and R. Vlastou, J. Phys. (London) G3 (1977) 571
- 1977KN1A Knitter, Proc. Int. Specialists Symp. on Neutron Standards and Applicaitons, 1977 (1977) 3
- 1977KO42 V.A. Kornilov, M.V. Sokolov and K.O. Terenetskii, Izv. Akad. Nauk SSSR Ser. Fiz. 41 (1977) 2138; Bull. Acad. Sci. USSR Phys. Ser. 41 (1977) 127
- 1977RO02 P.G. Roos, N.S. Chant, A.A. Cowley, D.A. Goldberg, H.D. Holmgren and R. Woody, III, Phys. Rev. C15 (1977) 69
- 1977SA1A Sato, Yamme and Morita, Prog. Theor. Phys. 58 (1977) 1218
- 1977TU02 A. Turkevich, J.R. Cadieux, J. Warren, T. Economou, J. La Rosa and H.R. Heydegger, Phys. Rev. Lett. 38 (1977) 1129
- 1977TU03 A. Turkevich, J.R. Cadieux, J. Warren, T. Economou and J. LaRosa, Phys. Lett. B72 (1977) 163
- 1977VL01 R. Vlastou, J.B.A. England, O. Karban and S. Baird, Nucl. Phys. A292 (1977) 29
- 1977WA05 C.N. Waddell, E.M. Diener, R.G. Allas, L.A. Beach, R.O. Bondelid, E.L. Petersen, A.G. Pieper, R.B. Theus, C.C. Chang and N.S. Chant, Nucl. Phys. A281 (1977) 418
- 1978AL21 R.G. Allas, L.A. Beach, R.O. Bondelid, L.T. Myers, E.L. Petersen, J.M. Lambert, P.A. Treado and I. Slaus, Nucl. Phys. A304 (1978) 461

- 1978AN20 M.K. Anikina, G.L. Vardenga, A.I. Golokhvastov, M.S. Zhuravleva, V.L. Ilina, E.S. Kuznetsova, Y. Lukstinsh, E.O. Okonov, T.G. Ostanevich, S.A. Khorozov et al., *Yad. Fiz.* 27 (1978) 724; *Sov. J. Nucl. Phys.* 27 (1978) 387
- 1978BA1C Balashov, *AIP Conf. Proc.* 47 (1978) 252
- 1978BA54 G. Bardin, J. Duclos, J. Joseph, A. Magnon, J. Martino and E. Zavattini, *Phys. Lett.* B79 (1978) 52
- 1978BA58 Y.A. Batusov, S.A. Bunyatov, L.D. Vizireva, D.A. Galstyan, G.A. Gulkanyan, N.I. Kostanashvili, P. Cuer, J.P. Massue, F.K. Mirsalikhova, V.M. Sidorov et al., *Yad. Fiz.* 28 (1978) 459; *Sov. J. Nucl. Phys.* 28 (1978) 233
- 1978BH03 R.K. Bhowmik, E.C. Pollacco, N.E. Sanderson, J.B.A. England and G.C. Morrison, *Phys. Lett.* B80 (1978) 41
- 1978BR1A Brown, *AIP Conf. Proc.* 47 (1978) 90
- 1978BR34 L. Brown, R.S. Rajan, R.B. Roberts, F. Tera and D.J. Whitford, *Nucl. Instrum. Meth.* 156 (1978) 541
- 1978BU19 A.V. Bursak, V.V. Verzhbitskii, A.M. Gorbatov, Y.N. Krylov, A.B. Solovei and Y.L. Shein, *Yad. Fiz.* 28 (1978) 39; *Sov. J. Nucl. Phys.* 28 (1978) 19
- 1978CA1C Canal, Isern and Sanahuja, *Astrophys. J.* 220 (1978) 606
- 1978CH1C Chant, *AIP Conf. Proc.* 47 (1978) 415
- 1978CH1D Chen, Lu and Vu, *Phys. Energ. Fortis Phys. Nucl. (China)* 2 (1978) 267
- 1978DE13 V.P. Denisov and I.Y. Chubukov, *Yad. Fiz.* 27 (1978) 882
- 1978DU1B Dubna-Warsaw-Leningrad Collaboration, *Yad. Fiz.* 27 (1978) 1246
- 1978DY01 S.A. Dytman, J.F. Amann, P.D. Barnes, J.N. Craig, K.G.R. Doss, R.A. Eisenstein, J.D. Sherman, W.R. Wharton, G.R. Burleson, S.L. Verbeck et al., *Phys. Rev.* C18 (1978) 2316
- 1978EF1A Efros, *Yad. Fiz.* 27 (1978) 845
- 1978ER1A Ericson, *Prog. Part. Nucl. Phys.* 1 (1978) 67
- 1978FE07 F. Fernandez, F. Pascual and J.C. Nalda, *Prog. Theor. Phys.* 60 (1978) 624
- 1978FE08 F. Fernandez and J.C. Nalda, *Fizika Suppl.* 10 (1978) 61
- 1978FI12 G.F. Filippov, S.A. Badalov and V.M. Belenkii, *Izv. Akad. Nauk SSSR Ser. Fiz.* 42 (1978) 2320; *Bull. Acad. Sci. USSR Phys. Ser.* 42 (1978) 88
- 1978FU08 K. Fukunaga, N. Fujiwara, S. Kakigi, T. Ohsawa, H. Nakamura-Yokota, S. Tanaka, A. Okihana, T. Sekioka, T. Higo and T. Miyanaga, *J. Phys. Soc. Jpn.* 45 (1978) 1783
- 1978FU09 S. Furui, *Nucl. Phys.* A312 (1978) 311
- 1978GL03 B.G. Glagola, G.J. Mathews, H.F. Breuer, V.E. Viola, Jr., P.G. Roos, A. Nadasen and S.M. Austin, *Phys. Rev. Lett.* 41 (1978) 1698

- 1978GO1B Golovanova, Zhusupov, Ibraeva and Novozhilova, *Yad. Fiz.* 27 (1978) 1385
- 1978HE1C Hendrie, *AIP Conf. Proc.* 47 (1978) 402
- 1978HE1D Heitzmann, *Atomkernenergie* 31 (1978) 262
- 1978HO1C Hodgson, *Riv. Nuovo Cim.* 1 (1978) 1
- 1978IN02 V.I. Inozemtsev, *Yad. Fiz.* 27 (1978) 345; *Sov. J. Nucl. Phys.* 27 (1978) 187
- 1978JA16 J. Jaros, A. Wagner, L. Anderson, O. Chamberlain, R.Z. Fuzesy, J. Gallup, W. Gorn, L. Schroeder, S. Shannon, G. Shapiro et al., *Phys. Rev. C* 18 (1978) 2273
- 1978KI13 H.R. Kissener, G.E. Dogotar, R.A. Eramzhyan and R.A. Sakaev, *Nucl. Phys.* A312 (1978) 394
- 1978KN05 V.A. Knyr and Y.F. Smirnov, *Yad. Fiz.* 28 (1978) 330; *Sov. J. Nucl. Phys.* 28 (1978) 167
- 1978KO07 Y. Koike, *Prog. Theor. Phys. Jpn.* 59 (1978) 87
- 1978KU06 E.L. Kuplennikov, V.A. Goldshtein and N.G. Afanasev, *Sov. J. Nucl. Phys.* 27 (1978) 313
- 1978LA11 G. Landaud, A. Devaux, P. Delpierre, J. Kahane, R. Sene, J. Yonnet and R. Anne, *Phys. Rev. C* 18 (1978) 1776
- 1978LE10 P. Leleux, M. Bosman, P. Lipnik, P. Macq, J.P. Meulders, C. Pirart and G. Valenduc, *Nucl. Instrum. Meth.* 152 (1978) 495
- 1978LE1E Lebedev, Tryasuchev and Fetisov, *Sov. J. Nucl. Phys.* 27 (1978) 834
- 1978LE1F Lebedev, Tryasuchev and Fetisov, *Yad. Fiz.* 27 (1978) 1584
- 1978LEZA C.M. Lederer, V.S. Shirley, E. Browne, J.M. Dairiki, R.E. Doebler, A.A. Shihab-Eldin, L.J. Jardine, J.K. Tuli and A.B. Buyrn, *Table of Isotopes 7th Ed.* (1978)
- 1978MA1B Makowska-Rzeszutko et al., *Proc. Int. Conf. on Resonances in Heavy Ion Reactions, Hvar, 1977* (1978) 407
- 1978MA40 Z. Majka, H.J. Gils and H. Rebel, *Z. Phys.* A288 (1978) 139
- 1978NA05 K. Nakamura, S. Hiramatsu, T. Kamae, H. Muramatsu, N. Izutsu and Y. Watase, *Nucl. Phys.* A296 (1978) 431
- 1978NA12 H. Nakamura and H. Noya, *Nucl. Phys.* A309 (1978) 115
- 1978OS07 A. Osman, *Nuovo Cim.* A48 (1978) 121
- 1978OS1B Osman, *Nuovo Cim.* A46 (1978) 477
- 1978PE12 C.F. Perdrisat, S. Frankel and W. Frati, *Phys. Rev. C* 18 (1978) 1764
- 1978PL1A Plattner, *Few Body Syst. Nucl. Forces, Graz, 1978, Springer Lect. Notes* 87 (1978) 376
- 1978PO1A B. Povh, *Ann. Rev. Nucl. Part. Sci.* 28 (1978) 1

- 1978PO1B Podosek, *Ann. Rev. Astron. Astrophys.* 16 (1978) 293
- 1978RE1A Redish, *Few Body Syst. Nucl. Forces*, Graz, 1978, Springer Lect. Notes 87 (1978) 427
- 1978RI02 P.J. Riley, C.W. Bjork, C.R. Newsom, R.A. Kenefick, M.L. Evans, G. Glass, J. Hiebert, M. Jain, L.C. Northcliffe, B.E. Bonner et al., *Phys. Rev. C* 17 (1978) 1881
- 1978RO17 D. Robson, *Nucl. Phys.* A308 (1978) 381
- 1978SA26 A. Saha, R. Kamermans, J. van Driel and H.P. Morsch, *Phys. Lett.* B79 (1978) 363
- 1978SE1B B.D. Serot, *Nucl. Phys.* A308 (1978) 457
- 1978SI14 I.V. Simenog and A.I. Sitnichenko, *Ukr. Fiz. Zh.* 23 (1978) 2052
- 1978SM02 Y.F. Smirnov and G.F. Filippov, *Yad. Fiz.* 27 (1978) 73; *Sov. J. Nucl. Phys.* 27 (1978) 39
- 1978SN1A Sneden, Lambert, Tomkin and Peterson, *Astrophys. J.* 222 (1978) 585
- 1978SO1A Sokol, *Izv. Akad. Nauk SSSR Ser. Fiz.* 42 (1978) 1829
- 1978ST19 G.L. Strobel, *Phys. Rev. C* 18 (1978) 2395
- 1978TA1A Tang, Lemere and Thompson, *Phys. Rept.* 47 (1978) 167
- 1978TH1A Thompson, *AIP Conf. Proc.* 47 (1978) 69
- 1978VL01 R. Vlastou, J.B.A. England, O. Karban, S. Baird and Y.-W. Lui, *Nucl. Phys.* A303 (1978) 368
- 1978VO03 Y.M. Volkov, G.A. Kolomenskii, E.F. Lakovichev, E.D. Makhnovskii, A.V. Nadtochii, V.V. Popov, V.P. Fominenko and V.P. Chizhov, *Yad. Fiz.* 27 (1978) 868; *Sov. J. Nucl. Phys.* 27 (1978) 461
- 1978VO1A Volkov, *AIP Conf. Proc.* 47 (1978) 352
- 1978WA1B Walter, *AIP Conf. Proc.* 47 (1978) 444
- 1978ZA06 N.I. Zaika, V.S. Semenov, P.L. Shmarin, V.V. Kozyr, V.A. Matusevich and I.P. Chernov, *Izv. Akad. Nauk SSSR Ser. Fiz.* 42 (1978) 1545; *Bull. Acad. Sci. USSR Phys. Ser.* 42 (1978) 168
- 1979AH04 I. Ahmad and Z.A. Khan, *Phys. Scr.* 20 (1979) 26
- 1979AH1A Ahrens et al., 1978 RPI Symp., *Photopion Nucl. Phys.* (1979) 385
- 1979AJ01 F. Ajzenberg-Selove, *Nucl. Phys.* A320 (1979) 1
- 1979AL11 D. Albrecht, J. Ero, Z. Fodor, I. Hernyes, Hong Sung Mu, B.A. Khomenko, N.N. Khovanskij, P. Koncz, Z.V. Krumstein, Y.P. Merekov et al., *Nucl. Phys.* A322 (1979) 512
- 1979AL1H Alma-Ata-Dubna-Warsaw Collaboration, *Conf. Proc. TRIUMF, Vancouver* (1979) Paper 6D23

- 1979AL34 J.P. Alard, M.M. Avome Nze, J.P. Costilhes, J. Fargeix and G. Roche, Nucl. Instrum. Meth. 160 (1979) 419
- 1979AMZY J.F. Amann, P.D. Barnes, B. Bassalleck, N.J. Colella, K.G.R. Doss, S.A. Dytman, R.A. Eisenstein, R. Grace, D.R. Marlow, R.J. Rieder, et al., Bull. Amer. Phys. Soc. 24 (1979) 819, AD6
- 1979AN1B L.W. Anderson and G.A. Nimmo, Phys. Rev. Lett. 42 (1979) 1520
- 1979AN24 B. Anders, U. Berghaus, H. Bruckmann, P. Lara, C. Pegel, H. Salehi, A. Schutte, K. Sinram and K. Wick, Phys. Lett. B87 (1979) 346
- 1979AT01 M. Attrep, Jr., W.B. Ledbetter and D.K. Riddle, J. Inorg. Nucl. Chem. 41 (1979) 1
- 1979BA01 J. Bang and C. Gignoux, Nucl. Phys. A313 (1979) 119
- 1979BA16 B. Bassalleck, H.-D. Engelhardt, W.D. Klotz, F. Takeutchi, H. Ullrich and M. Furic, Nucl. Phys. A319 (1979) 397
- 1979BA17 B. Bassalleck, E.L. Haase, W.-D. Klotz, F. Takeutchi, H. Ullrich, M. Furic and Y. Sakamoto, Phys. Rev. C19 (1979) 1893
- 1979BA1H Bassel and Haftel, Bull. Amer. Phys. Soc. 24 (1979) 21
- 1979BA1M Bassalleck et al., Conf. Proc. TRIUMF, Vancouver (1979) Paper 1E28
- 1979BA28 Y.D. Bayukov, V.I. Efremenko, S. Frankel, W. Frati, M. Gazzaly, G.A. Leksin, N.A. Nikiforov, C.F. Perdrisat, V.I. Tchistilin and Y.M. Zaitsev, Phys. Rev. C20 (1979) 764
- 1979BA30 I.Y. Barit, Y.G. Balashko, L.S. Dulkova and V.P. Zavarzina, Yad. Fiz. 29 (1979) 1137; Sov. J. Nucl. Phys. 29 (1979) 585
- 1979BA34 Y.D. Bayukov, V.I. Efremenko, S. Frankel, W. Frati, M. Gazzaly, G.A. Leksin, N.A. Nikiforov, C.F. Perdrisat, V.I. Tchistilin and Y.M. Zaitsev, Phys. Lett. B85 (1979) 315
- 1979BA66 S. Barbarino, M. Lattuada, F. Riggi, C. Spitaleri, C.M. Sutera and D. Vinciguerra, Nuovo Cim. A53 (1979) 327
- 1979BE1G J. Bernabeu and P. Pascual, Nucl. Phys. A324 (1979) 365
- 1979BE38 J.C. Bergstrom, U. Deutschmann and R. Neuhausen, Nucl. Phys. A327 (1979) 439
- 1979BE39 J.C. Bergstrom, Nucl. Phys. A327 (1979) 458
- 1979BE59 G. Bertsch and R. Schaeffer, J. Phys. (Paris) 40 (1979) 1
- 1979BO1B Booth, Dodson, Roberts and Comuzzi, Int. Conf. Nucl. Phys. with Electromag. Interact., Mainz (1979) 63
- 1979BO22 V.I. Bogatin, O.V. Lozhkin and Y.P. Yakovlev, Nucl. Phys. A326 (1979) 508
- 1979BU1A Burov and Lukyanov, Nucl Int. Canberra, Australia (1979) 385
- 1979CA06 F. Catara and U. Lombardo, Nucl. Phys. A320 (1979) 373
- 1979CH1A Chen, Li and Jin. Phys. Energ. Fortis Phys. Nucl. (China) 3 (1978) 226
- 1979DE01 P. Desgrolard and P.A.M. Guichon, Phys. Rev. C19 (1979) 120

- 1979DE15 P. Desgrolard and P.A.M. Guichon, *Z. Phys.* A290 (179) 373
- 1979DE1D Deutsch et al., *Conf. Proc. TRIUMF, VaNcouver* (1979) paper 5B12
- 1979DE2A N. de Botton, *Proc. Mainz, 1979, Springer Lect. Notes in Phys.*108 (1979) 339
- 1979DO04 W.E. Dollhopf, C.F. Perdrisat, P. Kitching and W.C. Olsen, *Nucl. Phys.* A316 (179) 350
- 1979DO19 E.I. Dolinskii, A.M. Mukhamedzhanov and R. Yarmukhamedov, *Izv. Akad. Nauk SSSR Ser. Fiz.* 43 (1979) 167; *Bull. Acad. Sci. USSR Phys. Ser.* 43 (1979) 140
- 1979DO1A Donnelly, 1978 RPI Symp., *Photopion Nucl. Phys.* (1979) 51
- 1979DO1C Donnelly, *AIP Conf. Proc.* 54 (1979) 367
- 1979DO1E Donnelly and Peccei, *Phys. Rept.* 50 (1979) 1
- 1979DU11 E.I. Dubovoi, *Izv. Akad. Nauk SSSR Ser. Fiz.* 43 (1979) 2111; *Bull. Acad. Sci. USSR Phys. Ser.* 43 (1979) 80
- 1979DZ08 R.E. Dzhibuti, N.B. Krupennikova and V.Yu. Tomchinskii, *Izv. Akad. Nauk SSSR Ser. Fiz.* 43 (1979) 2343; *Bull. Acad. Sci. USSR Phys. Ser.* 43 (1979) 86
- 1979EG01 P. Egelhof, J. Barrette, P. Braun-Munzinger, W. Dreves, C.K. Gelbke, D. Kassen, E. Steffens, W. Weiss and D. Fick, *Phys. Lett.* B84 (1979) 176
- 1979EP02 V.N. Eponeshnikov and Y.F. Krechetov, *Pisma Zh. Eksp. Teor. Fiz.* 29 (1979) 442; *JETP Lett.* 29 (1979) 401
- 1979FA1A K.K. Fang, *Phys. Rev.* C19 (1979) 1637
- 1979FL03 E.R. Flynn, R.E. Brown, R.F. Haglund, Jr., R.A. Hardekopf, P.A. Schmelzbach, J.W. Sunier and W. von Oertzen, *Nucl. Phys.* A319 (1979) 61
- 1979FL1A Fleischer, *American Scientist* 67 (1979) 194
- 1979FO21 F. Foroughi, E. Bovet and C. Nussbaum, *J. Phys. (London)* G5 (1979) 1731
- 1979FR12 S. Frankel, W. Frati, M. Gazzaly, Y.D. Bayukov, V.I. Efremenko, G.A. Leksin, N.A. Nikiforov, V.I. Tchistilin, Y.M. Zaitsev and C.F. Perdrisat, *Phys. Rev.* C20 (1979) 2257
- 1979FR1B Franz et al., *Int. Conf. Nucl. Phys. with Electromag. interact., Mainz* (1979) 11
- 1979FR1C Franz et al., *Conf. Proc. TRIUMF, Vancouver* (1979) Papers 5C5, 5C6
- 1979FR1D Frankfurt and Strikman, *Phys. Lett.* B83 (1979) 407
- 1979FU1E Fujii et al., *Isotopenpraxis* 15 (1979) 203
- 1979FU1F Fukunaga and Kakigi, *Bull. Inst. Chem. Res. Kyoto Univ., Japan*, 57 (1979) 92
- 1979FUZS B.R. Fulton, T.M. Cormier and B.J. Herman, *Bull. Amer. Phys. Soc.* 24 (1979) 843, FB13
- 1979GL10 U. Glawe, U. Strohbush, J. Franz, P. Grosse-Wiesmann, G. Guzielski, G. Huber, C. Mecklenbrauck, W. Mecklenbrauck and E. Rossle, *Phys. Lett.* B89 (1979) 44

- 1979GO07 R. Gorgen, F. Hinterberger, R. Jahn, P. von Rossen and B. Schuller, Nucl. Phys. A320 (1979) 296
- 1979GO10 A.M. Gorbatov, Y.N. Krylov and A.B. Solovei, Yad. Fiz. 29 (1979) 866; Sov. J. Nucl. Phys. 29 (1979) 445
- 1979GR10 S. Graubmann, U. Berghaus, H. Bruckmann, P. Lara, H.G. Korber, H.P. Meyer-Rassow, K. Sinram and K. Wick, Nucl. Phys. A325 (1979) 72
- 1979GR13 W. Gruebler, R.E. Brown, F.D. Correll, R.A. Hardekopf, N. Jarmie and G.G. Ohlsen, Nucl. Phys. A331 (1979) 61
- 1979GR1C Gregory, Jones, Cochavi and Bernad, Bull. Amer. Phys. Soc. 24 (1979) 823
- 1979HA1C Hale, Bull. Amer. Phys. Soc. 24 (1979) 881
- 1979HA52 M.Y. M.Hassan, A. Rabie and M. Ismail, Atomkernernerg. Kerntech. 33 (1979) 215
- 1979HO11 H.H. Hogue, P.L. von Behren, D.W. Glasgow, S.G. Glendinning, P.W. Lisowski, C.E. Nelson, F.O. Purser, W. Tornow, C.R. Gould and L.W. Seagondollar, Nucl. Sci. Eng. 69 (1979) 22
- 1979JA1B Jassby, Bull. Amer. Phys. Soc. 24 (1979) 872
- 1979JU02 G. Junghans, K. Bangert, U.E.P. Berg, R. Stock and K. Wienhard, Z. Phys. A291 (1979) 353
- 1979KA1G Karban, Microscopic Optical Potentials. Hamburg, Germany (1979) 264
- 1979KH01 S.A.E. Khallaf, Z. Phys. A289 (1979) 283
- 1979KI1C Kilian, AIP Conf. Proc. 54 (1979) 666
- 1979KN01 H.D. Knox, R.M. White and R.O. Lane, Nucl. Sci. Eng. 69 (1979) 223
- 1979KO1C Kolybasov, Izv. Akad. Nauk SSSR Ser. Fiz. 43 (1979) 2033
- 1979KO1D Kopysov, AIP Conf. Proc. 52 (1979) 28
- 1979LA14 J.M. Lambert, L.T. Myers, P.A. Treado, R.G. Allas, R.O. Bondelid, L.A. Beach, E.L. Petersen and I. Slaus, Nucl. Phys. A329 (1979) 25
- 1979LE1A Lebedev, Tryasuchev and Fetisov, Sov. Phys.-Lebedev Inst. Rept. (USA) (1979) 1
- 1979LIZT B.S. Lin and P.M.S. Lesser, Bull. Amer. Phys. Soc. 24 (1979) 593, BM5
- 1979LO11 H. Lohner, B. Ludewigt, D. Frekers, G. Gaul and R. Santo, Z. Phys. A292 (1979) 35
- 1979LU1A Lu et al., Scientia Sinica 22 (1979) 1248
- 1979MA1D Majling et al., Conf. Proc. TRIUMF, Vancouver (1979) Paper 5E12
- 1979ME07 G. Mechttersheimer, G. Buche, U. Klein, W. Kluge, H. Matthay, D. Munchmeyer and A. Moline, Nucl. Phys. A324 (1979) 379
- 1979MI04 S.L. Mintz, Phys. Rev. C19 (1979) 476
- 1979MI12 S.L. Mintz, Phys. Rev. C20 (1979) 286

- 1979MI1C Milder et al., 1978 RPI Symp., Photopion Nucl. Phys. (1979) 245
- 1979MO1E Moss et al., Conf. Proc. TRIUMF, Vancouver (1979) Paper 4A11
- 1979NA06 A. Nadasen, T.A. Carey, P.G. Roos, N.S. Chant, C.W. Wang and H.L. Chen, Phys. Rev. C19 (1979) 2099
- 1979NA14 V.S. Nadezhdin, N.I. Petrov, A.M. Rozanova and V.I. Satarov, Pisma Zh. Eksp. Teor. Fiz. 29 (1979) 436; JETP Lett. 29 (1979) 395
- 1979NA1C Nagornyi and Inopin, Ukr. Fiz. Zh. 24 (1979) 591
- 1979NE06 B. Neumann, J. Buschmann, H. Klewe-Nebenius, H. Rebel and H.J. Gils, Nucl. Phys. A329 (1979) 259
- 1979NOZX E. Norbeck, Bull. Amer. Phys. Soc. 24 (1979) 816, AB9
- 1979OH1A Ohashi et al., 1978 RPI Symp., Photopion Nucl. Phys. (1979) 193
- 1979OH1B Ohlsen et al., Bull. Amer. Phys. Soc. 24 (1979) 822
- 1979OS02 A. Osman, Phys. Rev. C19 (1979) 1127
- 1979PE1C Perroud, 1978 RPI Symp., Photopion Nucl. Phys. (1979) 69
- 1979PI11 R. Pigeon and R.J. Slobodrian, Nuovo Cim. A52 (1979) 387
- 1979RA1C Ramaty, Kozlovsky and Lingenfelter, Astrophys. J. Suppl. Series 40 (1979) 487
- 1979RAZI J. Rapaport, D.E. Bainum, C.D. Goodman, C.C. Foster, T.E. Ward, C.A. Goulding and M.B. Greenfield, Bull. Amer. Phys. Soc. 24 (1979) 830, BD17
- 1979RE1A Redwine, AIP Conf. Proc. 54 (1979) 501
- 1979RE1B Renier and Martin, Bull. Amer. Phys. Soc. 24 (1979) 887
- 1979RO1A Robert, Merlivat and Javoy, Nature 282 (1979) 785
- 1979RU1B C.L. Ruiz, R.W. Huggett and P.N. Kirk, Phys. Rev. Lett. 43 (1979) 334
- 1979SA1E Satchler and Love, Phys. Rept. 55 (1979) 183
- 1979SA39 M.Y. Safin, Y.P. Bogdanov, B.K. Kerimov and I.M. Al-Hamis, Izv. Akad. Nauk SSSR, Ser. Fiz. 43 (1979) 209; Bull. Acad. Sci. USSR, Phys. Ser. 43, No.1 (1979) 177
- 1979SE04 F. Seiler and H.W. Roser, Nucl. Phys. A315 (1979) 45
- 1979SH12 A.C. Shotter, C.K. Gelbke, T.C. Awes, B.B. Back, J. Mahoney, T.J.M. Symons and D.K. Scott, Phys. Rev. Lett. 43 (1979) 569
- 1979SH1D Shoda, Ohashi, Nakahara and Yamazaki, Int. Conf. Nucl. Phys. with Electromag. Interact., Mainz (1979) 6.11
- 1979SH1E Shoda, Nahara, Ohashi and Yamazaki, Conf. Proc. TRIUMF, Vancouver (1979) Paper 5A4
- 1979SHZV J.Y. Shapiro, D.O. Vona and R.H. Richardson, Bull. Amer. Phys. Soc. 24 (1979) 590, BK2

- 1979SI1A P. Singer, N.C. Mukhopadhyay and R.D. Amado, Phys. Rev. Lett. 42 (1979) 162
- 1979SK02 D.M. Skopik, J.J. Murphy II and J. Asai, Phys. Rev. C19 (1979) 1144
- 1979SR1A Sridhar, Srinivasa Rao and Susila, 1978 RPI Symp., Photopion Nucl. Phys. (1979) 249
- 1979ST09 G.L. Strobel, Phys. Rev. C20 (1979) 364
- 1979ST15 D.P. Stahel, R. Jahn, G.J. Wozniak and J. Cerny, Phys. Rev. C20 (1979) 1680
- 1979ST1D Stanley, Glover and Petrovich, Bull. Amer. Phys. Soc. 24 (1979) 816
- 1979SU06 W. Sunkel, Phys. Lett. B82 (1979) 17
- 1979SU09 W. Sunkel and Y.C. Tang, Nucl. Phys. A329 (1979) 10
- 1979SU1F Suzuki and Kubo, Tsukuba Symp. on Polarization Phenomena, Nov. 1979; Ed., K. Yagi (1979) 211
- 1979SUZW T.S. Subramanian, J.L. Romero, F.P. Brady, D.H. Fitzgerald, R. Garrett, G. Needham, J.L. Ullmann, J.W. Watson and C. Zanelli, Bull. Amer. Phys. Soc. 24 (1979) 593, BM1
- 1979TA1C Taneichi, Ueno and Shoda, Nucl. Interact., Canberra, Australia (1979) 456
- 1979TI1A Titov, Int. Conf. Nucl. Phys. with Electromag. Interact., Mainz (1979) 6.14
- 1979TO1A Tonsfeldt, Clegg and Ludwig, Bull. Amer. Phys. Soc. 24 (1979) 652
- 1979TR1A Tryasuchev, Lebedev and Fetisov, Conf. Proc. TRIUMF, Vancouver (1979) Paper 5A7
- 1979UL1A Ullrich, AIP Conf. Proc. 54 (1979) 154
- 1979VA1A Vasilevskii, Maksimenko and Filippov, Yad. Fiz. 29 (1979) 256
- 1979VI05 A. Vidal-Quadras and M. Ortega, Nuovo Cim. A49 (1979) 235
- 1979WA13 R.E. Warner, D.C. Martin, G.C. Ball, W.G. Davies, A.J. Ferguson and D. Horn, Nucl. Phys. A326 (1979) 209
- 1979WA1D Walecka, Proc. Mainz, 1979, Springer Lect. Notes 108 (1979) 484
- 1979WI1A Winhold, 1978 RPI Symp., Photopion Nucl. Phys. (1979) 19
- 1979WI1B Wildermuth and Kanellopoulos, Rept. Prog. Phys. 42 (1979) 1719
- 1979YA1B Yao, Chen and King, Conf. Proc. TRIUMF, Vancouver (1979) Paper 4C30
- 1979ZE01 A.F. Zeller, K.W. Kemper, D.C. Weissner, T.R. Ophel, D.F. Hebbard and A. Johnston, Nucl. Phys. A323 (1979) 477
- 1979ZI1A Ziegler, Proc. Mainz, 1979, Springer Lecture Notes 108 (1979) 148
- 1980AH1A J. Ahrens, Nucl. Phys. A335 (1980) 67
- 1980AJ01 F. Ajzenberg-Selove and C.L. Busch, Nucl. Phys. A336 (1980) 1
- 1980AK02 V.D. Aksinenko, for the SKM-200 Collaboration, Nucl. Phys. A348 (1980) 518

- 1980AL10 D. Albrecht, M. Csatlos, J. Ero, Z. Fodor, I. Hernyes, Hongsung Mu, B.A. Khomenko, N.N. Khovansky, P. Koncz, Z.V. Krumstein et al., Nucl. Phys. A338 (1980) 477
- 1980AN16 N. Anantaraman, H.W. Fulbright and P.M. Stwertka, Phys. Rev. C22 (1980) 501
- 1980AS02 J. Asai, J.J. Murphy II and D.M. Skopik, Phys. Rev. C21 (1980) 469
- 1980AU1C N. Auerbach and N. Van Giai, Phys. Lett. B90 (1980) 354
- 1980BA02 T.S. Bauer, G.S. Adams, G.J. Igo, G. Pauletta, C.A. Whitten, G.R. Smith, J.R. Shepard, R.E. Anderson, R.L. Boudrie, N.J. DiGiacomo et al., Phys. Rev. C21 (1980) 757
- 1980BA04 S. Barbarino, M. Lattuada, F. Riggi, C. Spitaleri and D. Vinciguerra, Phys. Rev. C21 (1980) 1104
- 1980BA2H Baryshnikov, Gulyamov and Krekoten, IAN (1980) 2421
- 1980BA60 I.Ya. Barit, Yu.G. Balashko, L.S. Dulkova and V.P. Zavarzina, Izv. Akad. Nauk SSSR Ser. Fiz. 44 (1980) 1071; Bull. Acad. Sci. USSR Phys. Ser. 44 (1980) 150
- 1980BE20 J.C. Bergstrom, Phys. Rev. C21 (1980) 2496; Erratum Phys. Rev. C22 (1980) 1809
- 1980BE28 J.C. Bergstrom, Nucl. Phys. A341 (1980) 13
- 1980BO12 D.H. Boal, Phys. Rev. C21 (1980) 1913
- 1980BO31 V.I. Bogatin, E.A. Ganza, O.V. Lozhkin, Yu.A. Murin and V.S. Oplavin, Yad. Fiz. 32 (1980) 27; Sov. J. Nucl. Phys. 32 (1980) 14
- 1980BR19 M. Bruno, F. Cannata, M. D'Agostino, C. Maroni and M. Lombardi, Lett. Nuovo Cim. 27 (1980) 265
- 1980BR1A W.H. Breunlich, Nucl. Phys. A335 (1980) 137
- 1980BU10 V.V. Burov and V.N. Dostovalov, Yad. Fiz. 31 (1980) 922; Sov. J. Nucl. Phys. 31 (1980) 476
- 1980CA1C Canal, Isern and Sanahuja, Astrophys. J. 235 (1980) 504
- 1980CH05 R.E. Chrien, T.J. Krieger, R.J. Sutter, M. May, H. Palevsky, R.L. Stearns, T. Kozlowski and T. Bauer, Phys. Rev. C21 (1980) 1014
- 1980CH1L Chandrasekhar and Waghmare, Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 726
- 1980CO11 J. Cook, J.M. Barnwell, N.M. Clarke and R.J. Griffiths, J. Phys. (London) G6 (1980) 1251
- 1980CO1H Cochran and Hill, Bull. Amer. Phys. Soc. 25 (1980) 784
- 1980DA05 S.S. Dasgupta, R. Roy, C. Rioux, F. Lahlou and R.J. Slobodrian, Phys. Lett. B91 (1980) 32
- 1980DA17 S.S. Dasgupta, R.J. Slobodrian, R. Roy, C. Rioux and F. Lahlou, Phys. Rev. C22 (1980) 1815; Erratum Phys. Rev. C25 (1982) 1073
- 1980DE11 A. Deloff, Phys. Rev. C21 (1980) 1516
- 1980DR1B D. Drechsel, Nucl. Phys. A335 (1980) 17

- 1980DU16 O. Dumbrajs, Phys. Rev. C22 (1980) 2151
- 1980FI1D Filippov, Vasilevskii and Kruchinin, Bull. Acad. Sci. USSR Phys. Ser. 44 (1980) 2313
- 1980FR01 R. Frick, H. Clement, G. Graw, P. Schiemenz and N. Seichert, Phys. Rev. Lett. 44 (1980) 14
- 1980FU1G Furutani et al., Suppl. Prog. Theor. Phys. 68 (1980) 193
- 1980GE08 H. Gemmeke, B. Deluigi, D. Scholz and L. Lassen, Phys. Lett. B96 (1980) 47
- 1980GO1J Goulding et al., Bull. Amer. Phys. Soc. 25 (1980) 728
- 1980GO1Q Gorbatov, Krylov and Solovei, Yad. Fiz. 32 (1980) 636
- 1980GR03 W. Gruebler, V. Konig, P.S chmelzbach, B. Jenny, H.R. Burgi, R.A. Hardekopf, J. Nurzynski, R. Risler, G. Heidenreich, F. Seiler et al., Nucl. Phys. A334 (1980) 365
- 1980GR10 R.E.L. Green and R.G. Korteling, Phys. Rev. C22 (1980) 1594
- 1980HA1P Han and Zhuang, Phys. Energ. Fortis Phys. Nucl. (China) 4 (1980) 121
- 1980HA1Y Hale and Dodder, Proc. Int. Conf. on Nucl. Cross Sect. for Tech., Knoxville, TN (1980) 650
- 1980HI02 T.F. Hill and W.E. Frahn, Ann. Phys. 124 (1980) 1
- 1980HI1B Hill and Frahn, South African J. Phys. 3 (1980) 11
- 1980HO14 T. Honda, Y. Kudo and H. Horie, Prog. Theor. Phys. 63 (1980) 872
- 1980HO26 Y. Horikawa, F. Lenz and N.C. Mukhopadhyay, Phys. Rev. C22 (1980) 1680
- 1980HU09 M. Hugi, L. Jarczyk, B. Kamys, J. Lang, R. Muller, A. Strzalkowski, E. Ungricht and W. Zipper, J. Phys. (Londond) G6 (1980) 1257
- 1980IW1A Iwao, Lett. Nuovo Cim. 29 (1980) 40
- 1980JA1C Jadraque, Lozano and Madurga, Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 413
- 1980KA11 J. Kallne, J. Davis, P.C. Gugelot, J.S. McCarthy, G.R. Smith, R.L. Boudrie, B. Hoistad and C.L. Morris, Phys. Rev. C21 (1980) 2681
- 1980KA15 H. Kanada, T. Kaneko, H. Nishioka and S. Saito, Prog. Theor. Phys. 63 (1980) 842
- 1980KA20 S. Kakigi, K. Fukunaga, T. Ohsawa, S. Tanaka, A. Okihana, H. Nakamura-Yokota, T. Sekioka and N. Fujiwara, J. Phys. Soc. Jpn. 48 (1980) 1797
- 1980KI1D King, Chen, Yao and Lui, Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 930
- 1980KO04 Y. Koike, Nucl. Phys. A337 (1980) 23
- 1980KU06 M. Kusuhara, Phys. Rev. C21 (1980) 1165
- 1980KU1G Kumar and Jain, Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 925
- 1980LE02 T.-S.H. Lee and D. Kurath, Phys. Rev. C21 (1980) 293
- 1980LE06 M. LeMere and Y.C. Tang, Phys. Rev. C21 (1980) 1170

- 1980LE07 M. LeMere and Y.C. Tang, Nucl. Phys. A339 (1980) 43
- 1980LE1K Lezoch, Trost and Strohbush, Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 473
- 1980LI1D Lin and Lesser, Bull. Amer. Phys. Soc. 25 (1980) 578
- 1980LI1F Lin and Lesser, Bull. Amer. Phys. Soc. 25 (1980) 577
- 1980MA21 L. Majling, M. Sotona, J. Zofka, V.N. Fetisov and R.A. Eramzhyan, Phys. Lett. B92 (1980) 256
- 1980MA41 Y. Matsui, Phys. Rev. C22 (1980) 2591
- 1980MC09 J.B. McClelland, J.B. Carroll, G.J. Igo, J. Oostens, F. Brochard, V. Perez-Mendez, A.L. Sagle, R. Talaga, E.T.B. Whipple and F. Zarbakhsh, Phys. Rev. Lett. 45 (1980) 1674
- 1980ME02 J.V. Meboniya and T.I. Kvaratskhelia, Phys. Lett. B90 (1980) 17
- 1980MI01 T. Mikumo, M. Sasagase, M. Sato, T. Ooi, Y. Higashi, Y. Nagashima and M. Yamanoichi, Phys. Rev. C21 (1980) 620
- 1980MI02 D. Miljanic, S. Blagus, V. Pecar and D. Rendic, Nucl. Phys. A334 (1980) 189
- 1980MO01 G.L. Moake and P.T. Debevec, Phys. Rev. C21 (1980) 25
- 1980MO10 G.L. Moake, L.J. Gutay, R.P. Scharenberg, P.T. Debevec and P.A. Quin, Phys. Rev. C21 (1980) 2211
- 1980MU1B N.C. Mukhopadhyay, Nucl. Phys. A335 (1980) 111
- 1980MU1E Mughrabi, Ellis and Tang, Bull. Amer. Phys. Soc. 25 (1980) 747
- 1980NE05 B. Neumann, H. Rebel, J. Buschmann, H.J. Gils, H. Klewe-Nebenius and S. Zagromski, Z. Phys. A296 (1980) 113
- 1980NI07 H. Nishioka, S. Saito, H. Kanada and T. Kaneko, Prog. Theor. Phys. (Kyoto) 63 (1980) 438
- 1980OL1C Olson et al., Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 200
- 1980PA06 G.L. Payne and B.P. Nigam, Phys. Rev. C21 (1980) 1177
- 1980PE1N Peak, Aust. J. Phys. 33 (1980) 821
- 1980RE1B Read et al., Bull. Amer. Phys. Soc. 25 (1980) 592
- 1980RO1B Robertson et al., Bull. Amer. Phys. Soc. 25 (1980) 577
- 1980SC12 P. Schwandt, S. Kailas, W.W. Jacobs, M.D. Kaitchuk, W. Ploughe and P.P. Singh, Phys. Rev. C21 (1980) 1656
- 1980SC24 I. Schwanner, R. Abela, G. Backenstoss, W. Kowald, P. Pavlopoulos, L. Tauscher, H.J. Weyer, P. Blum, M. Dorr, W. Fetscher et al., Phys. Lett. B96 (1980) 268
- 1980SH1N K.V. Shiticova, Nucl. Phys. A331 (1979) 365

- 1980ST01 E.J. Stephenson, H.E. Conzett, R.M. Larimer, B.T. Leemann, R. Roy and P. von Rossen, Phys. Rev. C21 (1980) 44
- 1980ST22 D.P. Stanley, F. Petrovich and P. Schwandt, Phys. Rev. C222 (1980) 1357
- 1980TA11 S. Tanaka, N. Fujiwara, K. Fukunaga, T. Higo, T. Ohsawa, A. Okihana, T. Sekioka, T. Miyanaga and T. Yanabu, Nucl. Phys. A341 (1980) 199
- 1980VE2B S.P. Verma and D.P. Sural, Phys. Rev. C22 (1980) 229
- 1980VO1B von Witsch et al., Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 257
- 1980WI1L L. Winsberg, Phys. Rev. C22 (1980) 2123
- 1980WO05 C.L. Woods, N.A. Jelley, A.A. Pilt and J.S. Winfield, J. Phys. (London) G6 (1980) L187
- 1980ZA08 V.P. Zavarzina, V.A. Sergeev and A.V. Stepanov, Izv. Akad. Nauk SSSR Ser. Fiz. 44 (1980) 1107; Bull. Acad. Sci. USSR Phys. Ser. 44 (1980) 184
- 1980ZH1A Zhang et al., Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) 920
- 1980ZI02 M.S. Zisman, J.G. Cramer, D.A. Goldberg, J.W. Watson and R.M. DeVries, Phys. Rev. C21 (1980) 2398
- 1981AJ01 F. Ajzenberg-Selove, Nucl. Phys. A360 (1981) 1
- 1981AO02 K. Aoki and H. Horiuchi, Prog. Theor. Phys. 66 (1981) 1903
- 1981AR08 K.P. Artemov, V.Z. Goldberg, V.P. Rudakov, I.P. Petrov, I.N. Serikov and V.A. Timofeev, Yad. Fiz. 33 (1981) 289; Sov. J. Nucl. Phys. 33 (1981) 151
- 1981AS1H Aslanides et al., Proc. Versailles Conf. (1981) 203
- 1981AU1D Audouze, Prog. Part. Nucl. Phys. 6 (1981) 125
- 1981AU1G Austin, Prog. Part. Nucl. Phys. 7 (1981) 1
- 1981AV02 I.K. Averyanov, A.I. Golubev and A.A. Sadovoy, Yad. Fiz. 33 (1981) 66
- 1981AV1B Avrigneanu et al., Santa Fe 1980, AIP Conf. Proc. 69 (1981) 93
- 1981BA16 B. Bassalleck, F. Corriveau, M.D. Hasinoff, T. Marks, D.F. Measday, J.-M. Poutissou and M. Salomon, Nucl. Phys. A362 (1981) 445
- 1981BA1M Bachelier et al., Proc. Versailles Conf. (1980) 208
- 1981BA20 O.L. Bartaya and J.V. Mebonia, Yad. Fiz. 33 (1981) 987
- 1981BA25 D. Baye and M. Hanck, J. Phys. (London) G7 (1981) 1073
- 1981BA2P Bando, Ikeda and Motoba, Prog. Theor. Phys. 66 (1981) 1344
- 1981BA37 A.K. Basak, O. Karban, S. Roman, G.C. Morrison, C.O. Blyth and J.M. Nelson, Nucl. Phys. A368 (1981) 74
- 1981BA38 A.K. Basak, O. Karban, S. Roman, G.C. Morrison, C.O. Blyth and J.M. Nelson, Nucl. Phys. A368 (1981) 93

- 1981BA58 P.H. Barker, T.B. Ko and M.J. Scandle, Nucl. Phys. A372 (1981) 45
- 1981BE17 R. Bertini, O. Bing, P. Birien, K. Braune, W. Bruckner, H. Catz, A. Chaumeaux, M.A. Faessler, R.-W. Frey, D. Garreta et al., Nucl. Phys. A360 (1981) 315
- 1981BE1G Berghaus, Bruckmann, Lara and Wick, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1305
- 1981BE1K T. Berggren, Nucl. Phys. A361 (1981) 102
- 1981BE1R Berger et al., Proc. Versailles Conf. (1981) 569
- 1981BE45 R. Bertini, O. Bing, P. Birien, K. Braune, W. Bruckner, A. Chaumeaux, M.A. Faessler, R.W. Frey, D. Garreta, T.J. Ketel et al., Nucl. Phys. A368 (1981) 365
- 1981BE63 V.B. Belyaev and O.P. Solovtsova, Yad. Fiz. 33 (1981) 699; Sov. J. Nucl. Phys. 33 (1981) 363
- 1981BI07 A.N. Bice, A.C. Shotter, D.P. Stahel and J. Cerny, Phys. Lett. B101 (1981) 27
- 1981BI1D Birchall, Okumusoglu, de Jong, Al-Ghazi and McKee, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1290
- 1981BL1F Blum et al., Proc. Versailles Conf. (1981) 383
- 1981BL1G M. Blann and T.T. Komoto, Phys. Rev. C24 (1981) 426
- 1981BO09 A. Bouyssy, Phys. Lett. B99 (1981) 373
- 1981BO1Q Borbely, J. Phys. (London) G7 (1981) 771
- 1981BO1X Bogatin et al., Yad. Fiz. 34 (1981) 104
- 1981BO1Y Bouten and Bouten, Prog. Part. Nucl. Phys. 5 (1981) 55
- 1981BR25 M. Bruno, F. Cannata, M. D'Agostino, M.L. Fiandri, M. Frisoni, G. Vannini, M. Lombardi and Y. Koike, Phys. Rev. C24 (1981) 2751
- 1981BU04 V.V. Burov, V.N. Dostovalov, M. Kaschiev and K.V. Shitikova, J. Phys. (London) G7 (1981) 137
- 1981CH1J Chao, Chen and King, Institute of Atomic Energy, Beijing, China (1981)
- 1981CO06 J. Cook, J. Phys. (London) G7 (1981) L67
- 1981CO08 W.D. Cornelius, J.M. Moss and T. Yamaya, Phys. Rev. C23 (1981) 1364
- 1981CU05 D.E. Cumpstey and D.G. Vass, Nucl. Phys. A359 (1981) 377
- 1981DA1C R.H. Dalitz, Nucl. Phys. A354 (1981) 101
- 1981DAZZ J.H. Dave, C.R. Gould, L.W. Seagondollar, S.G. Glendinning, C.R. Howell, R.S. Pedroni, F.O. Purser and R.L. Walter, Bull. Amer. Phys. Soc. 26 (1981) 551, BG7
- 1981DE1T Dementij, Fartushnyj and Afanas'ev, Proc. Versailles Conf. (1981) 127
- 1981DE1X Delbar, IPC-N-8102 (1981)

- 1981DEZX D.W. Devins, J.M. Lambert, P.A. Treado, R.O. Bondelid, M. Hawamdah, B.J. Lambert and I. Slaus, *Bull. Amer. Phys. Soc.* 26 (1981) 26, DE8
- 1981DO1E Dorr et al., *Proc. Versailles Conf.* (1981) 335
- 1981DU1H Dumbrajs, *Fortschr. Phys.* 29 (1981) 487
- 1981DY02 R. Dymarz, J.L. Molina and K.V. Shitikova, *Z. Phys.* A299 (1981) 245
- 1981DZ01 R.I. Dzhibuti, N.B. Krupennikova and V.Yu. Tomchinsky, *Yad. Fiz.* 34 (1981) 1185
- 1981EG1B Egelhof et al., *Santa Fe 1980, AIP Conf. Proc.* 69 (1981) 916
- 1981EL1A Elsener et al., *Santa Fe 1980, AIP Conf. Proc.* 69 (1981) 1296
- 1981ES1B Esaulov, Titov, Akhmerov and Omelaenko, *Proc. Versailles Conf.* (1981) 105
- 1981FE04 F. Fernandez, Th.A.J. Maris, C. Schneider and C.A.Z. Vasconcellos, *Phys. Lett.* B106 (1981) 15
- 1981FE2A H.W. Fearing, *Prog. Part. Nucl. Phys.* 7 (1981) 113
- 1981FR24 S. Frankel, W. Frati, C.F. Perdrisat and O.B. Van Dyck, *Phys. Rev.* C24 (1981) 2684
- 1981FU04 C.B. Fulmer, G.R. Satchler, E.E. Gross, F.E. Bertrand, C.D. Goodman, D.C. Hensley, J.R. Wu, N.M. Clarke and M.F. Steeden, *Nucl. Phys.* A356 (1981) 235
- 1981GE07 J.-F. Germond and C. Wilkin, *Phys. Lett.* B106 (1981) 449
- 1981GE1C Gerstein et al., *Proc. Versailles Conf.* (1981) 302
- 1981GL03 Yu.A. Glukhov, A.S. Demyanova, S.I. Drozdov, M.V. Zhukov, V.I. Manko, B.G. Novatsky, A.A. Ogloblin, S.B. Sakuta, D.N. Stepanov and L.V. Chulkov, *Yad. Fiz.* 34 (1981) 312; *Sov. J. Nucl. Phys.* 34 (1981) 177
- 1981GR17 K.A. Gridnev, K. Mikulas, V.M. Semenov and E.F. Khefter, *Izv. Akad. Nauk SSSR Ser. Fiz.* 45 (1981) 134
- 1981GU1B Gurbanovich and Zelenskaya, *Proc. Versailles Conf.* (1981) 142
- 1981GU1F S.A. Gurvitz, *Phys. Rev. Lett.* 47 (1981) 560
- 1981HA1P Hardekopf et al., *Nucl. Sci.* 28 (1981) 1339
- 1981HA1Y Han, Lu, Zhuang and Zheng, *Phys. Energ. Fortis Phys. Nucl. (China)* 5 (1981) 489
- 1981HE02 K.T. Hecht, E.J. Reske, T.H. Seligman and W. Zahn, *Nucl. Phys.* A356 (1981) 146
- 1981HE05 P. Heusi, M. Berta, V. Meyer and R.E. Pixley, *Nucl. Phys.* A357 (1981) 381
- 1981HE1H Heusi, *Proc. Versailles Conf.* (1981) 331
- 1981HE21 R.S. Henderson, S.F. Collins, B.M. Spicer, G.G. Shute, V.C. Officer, D.W. Devins, D.L. Friesel and W.P. Jones, *Nucl. Phys.* A372 (1981) 117
- 1981HO23 H.M. Hofmann and W. Zahn, *Nucl. Phys.* A368 (1981) 29
- 1981HU07 M. Hugi, L. Jarczyk, B. Kamys, J. Lang, R. Muller, J. Sromicki, A. Strzalkowski, E. Ungricht, G. Willim, Z. Wrobel et al., *J. Phys. (London)* G7 (1981) 1395

- 1981HU08 M. Hugi, J. Lang, R. Muller, E. Ungricht, K. Bodek, L. Jarczyk, B. Kamys, A. Magiera, A. Strzalkowski and G. Willim, Nucl. Phys. A368 (1981) 173
- 1981HU1B Hungerford et al., Bull. Amer. Phys. Soc. 26 (1981) 606
- 1981HU1C Ed V. Hungerford, Nucl. Phys. A353 (1981) 75
- 1981IO01 D.B. Ion and R. Ion-Mihai, Nucl. Phys. A360 (1981) 400
- 1981IR1A Irom et al., Proc. Versailles Conf. (1981) 546
- 1981IS11 B.S. Ishkhanov, I.M. Kapitonov, V.G. Neudachin and R.A. Eramzhyan, Fiz. Elem. Chastits At. Yadra 12 (1981) 905; Sov. J. Part. Nucl. 12 (1981) 362
- 1981JA1F Jarmie, Nucl. Sic. Eng. 78 (1981) 404
- 1981KL07 K. Klingenberg, M. Dillig and M.G. Huber, Phys. Rev. Lett. 47 (1981) 1654
- 1981KN06 W. Knapfer and A. Richter, Phys. Lett. B101 (1981) 375
- 1981KO1M Komoda and Sekiya, Atomkernernerg. Kerntech. 37 (1981) 134
- 1981KO34 H.-G. Korber, R. Beckmann, D. Frohling and U. Holm, Nucl. Phys. A372 (1981) 109
- 1981KR1J Kramer, John and Schenzle, Clustering Phenomena in Nuclei 2 (1981)
- 1981KU13 V.I. Kukulín, V.M. Krasnopolsky, M.A. Miselkhi and V.T. Voronchev, Yad. Fiz. 34 (1981) 21
- 1981LA13 M. Lattuada, F. Riggi, C. Spitaleri, D. Vinciguerra and C.M. Suter, Nuovo Cim. A63 (1981) 530
- 1981LA1E Laget and Chretien-Marquet, Proc. Versailles Conf. (1981) 418
- 1981LE24 Y. Le Bornec, L. Bimbot, N. Koori, F. Reide, A. Willis, N. Willis and C. Wilkin, Phys. Rev. Lett. 47 (1981) 1870
- 1981LI1B Liljestränd et al., Proc. Versailles Conf. (1981) 544
- 1981LL1A Lleshi and Mach, Proc. Versailles Conf. (1981) 271
- 1981LO07 M.A.K. Lodhi, Lett. Nuovo Cim. 30 (1981) 311
- 1981MC09 R.D. McKeown, S.J. Sanders, J.P. Schiffer, H.E. Jackson, M. Paul, J.R. Specht, E.J. Stephenson, R.P. Redwine and R.E. Segel, Phys. Rev. C24 (1981) 211
- 1981ME13 M.C. Mermaz, J. Barrette and H.E. Wegner, Phys. Rev. C24 (1981) 2148
- 1981ME1E Meyer and Elbaz, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1091
- 1981MO20 J. Mougey, R. Ost, M. Buenerd, A.J. Cole, C. Guet, D. Lebrun, J.M. Loiseaux, P. Martin, M. Maurel, E. Monnard et al., Phys. Lett. B105 (1981) 25
- 1981MU1E Mukhopadhyay and Hintermann, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1068
- 1981MU1F Murnick, Chung, Niv and McGlashan-Powell, Bull. Amer. Phys. Soc. 26 (1981) 623
- 1981NI03 T. Nishi, I. Fujiwara, N. Imanishi, H. Moriyama, K. Otozai, R. Arakawa, S. Saito, T. Tsuneyoshi, N. Takahashi, S. Iwata et al., Nucl. Phys. A352 (1981) 461

- 1981NI06 W. Nitsche, G.J. Wagner, K.T. Knopfle, P. Grabmayr and H. Riedesel, Z. Phys. A300 (1981) 109
- 1981NO06 E. Norbeck, C.R. Chen, M.D. Strathman and D.A. Fox, Phys. Rev. C23 (1981) 2557
- 1981NO1B Northcliffe, Cornelius, York and Hiebert, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1335
- 1981OS02 H. Oswald, W. Burgmer, D. Gola, C. Heinrich, H.J. Helten, H.Paetz gen. Schieck and Y. Koike, Phys. Rev. Lett. 46 (1981) 307
- 1981OS1D Osman and Youssef, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1094
- 1981PA25 M.V. Pasechnik, V.P. Badovsky, O.K. Gorpnich, E.P. Kadkin, S.N. Kondratev, G.P. Palkin, L.S. Saltykov, V.V. Tokarevsky and A.D. Fursa, Izv. Akad. Nauk SSSR Ser. Fiz. 45 (1981) 2160
- 1981PAZZ W.C. Parke and D.R. Lehman, Bull. Amer. Phys. Soc. 26 (1981) 566, DG11
- 1981PH1A Pham, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 1088
- 1981PL03 G.R. Plattner and R.D. Viollier, Nucl. Phys. A365 (1981) 8
- 1981RO02 R.G.H. Robertson, J.A. Nolen, Jr., T. Chapuran and R. Vodhanel, Phys. Rev. C23 (1981) 973
- 1981RO12 R.G.H. Robertson, P. Dyer, R.A. Warner, R.C. Melin, T.J. Bowles, A.B. McDonald, G.C. Ball, W.G. Davies and E.D. Earle, Phys. Rev. Lett. 47 (1981) 1867; Erratum Phys. Rev. Lett. 75 (1997) 4334
- 1981SC16 P. Schwandt, W.W. Jacobs, M.D. Kaitchuck, P.P. Singh, W.D. Ploughe, F.D. Becchetti and J. Janecke, Phys. Rev. C24 (1981) 1522
- 1981SE1H Sennhauser et al., Proc. Versailles Conf. (1981) 330
- 1981SEZR K.K. Seth, 4th Int. Conf. on Nucl. Far from Stability, Helsingor, Denmark, Vol. 2 (1981) 655; CERN 81-09 (1981)
- 1981SH06 K. Shoda, O. Sasaki and T. Kohmura, Phys. Lett. B101 (1981) 124
- 1981SI1D Singham and Tabakin, Proc. Versailles Conf. (1981) 129
- 1981SI1G Singh and Jain, Proc. Versailles Conf. (1981) 545
- 1981SM1B Smirnov and Chuvilski, Proc. Samarkand Conf. (1981) 484
- 1981SU1H Susila and Srinivasa Rao, Acta Phys. Pol. B12 (1981) 799
- 1981SZ02 J. Szymakowski, K.W. Kemper and A.D. Frawley, Nucl. Phys. A355 (1981) 221
- 1981TH07 I.J. Thompson and M.A. Nagarajan, Phys. Lett. B106 (1981) 163
- 1981TO1H Tonapetyan et al., Proc. Versailles Conf. (1981) 121
- 1981UL1A Ulbricht, Beckman and Holm, Santa Fe 1980, AIP Conf. Proc. 69 (1981) 964
- 1981VE04 L. Vegh and J. Ero, Phys. Rev. C23 (1981) 2371

1981VE07 L. Vegh, J. Phys. (London) G7 (1981) 1045
 1981VO10 V.V. Volkov, Izv. Akad. Nauk SSSR Fiz. 45 (1981) 1810
 1981WA15 R.E. Warner, G.C. Ball, W.G. Davies and J.S. Forster, Nucl. Phys. A365 (1981) 142
 1981WA1J Wang, Zhang, Li and Ruan, Proc. Versailles Conf. (1981) 374
 1981WE10 C. Wernitz and F. Cannata, Phys. Rev. C24 (1981) 349
 1981WH01 W.R. Wharton and B.D. Keister, Phys. Rev. C23 (1981) 1141
 1981WH1D Wharton et al., Proc. Versailles Conf. (1981) 327
 1981WHZZ W.R. Wharton, J.F. Amann, P.D. Barnes, B. Bassalleck, N.J. Colella, K.G.R. Doss, R.A. Eisenstein, R. Grace, D.R. Marlow, C. Maher, et al., Bull. Amer. Phys. Soc. 26 (1981) 581, EH3
 1981YA1B Yavin, Proc. Versailles Conf. (1981) 181
 1981YA1C Yavin, CEA-N-2211 (1981)
 1981ZH1D Zhao, Chen and King, Proc. Versailles Conf. (1981) 553
 1982AH09 I. Ahmad and S.K. Singh, Pramana 19 (1982) 249
 1982AJ01 F. Ajzenberg-Selove, Nucl. Phys. A375 (1982) 1
 1982AL02 J. Albinski and F. Michel, Phys. Rev. C25 (1982) 213
 1982AL17 D.E. Alburger, Phys. Rev. C26 (1982) 252
 1982AL1G Aleksandrov et al., in Kiev (1982) 358
 1982AN1H Anikina et al., JETP Lett. 36 (1982) 331
 1982AR08 N. Arena, Seb. Cavallaro, G. Fazio, G. Giardina and F. Mezzanares, Lett. Nuovo Cim. 34 (1982) 97
 1982AS01 E. Aslanides, A.M. Bergdolt, O. Bing, P. Fassnacht, F. Hibou, N. Willis, P. Kitching, Y. Le Bornec, B. Tatischeff, K. Baba et al., Phys. Lett. B108 (1982) 91
 1982AS1B E. Aslanides, T. Bressani, M. Caria, E. Chiavassa, S. Costa, G. Dellacasa, P. Fassnacht, M. Gallio, F. Hibou, B. Minetti et al., Proc. Int. Conf. on Nucleus-Nucleus Collisions, 26 Sept.-1 Oct. 1982, East Lansing, MI, USA (1982) 2
 1982AW02 A.M. Awin and P.E. Shanley, Nucl. Phys. A386 (1982) 101
 1982BA1R P.D. Barnes, Nucl. Phys. A374 (1982) 415
 1982BA1Y Bando, Prog. Theor. Phys. 67 (1982) 699
 1982BA2G B.F. Bayman, P.J. Ellis and Y.C. Tang, Phys. Rev. Lett. 49 (1982) 532
 1982BA2N Bando, Ikeda and Motoba, Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 135
 1982BA2R Bando, Ikeda and Motoba, Prog. Theor. Phys. 67 (1982) 508
 1982BA52 F.C. Barker, Aust. J. Phys. 35 (1982) 291

- 1982BA80 J.N. Bahcall, W.F. Huebner, S.H. Lubow, P.D. Parker and R.K. Ulrich, *Rev. Mod. Phys.* 54 (1982) 767
- 1982BE11 J.C. Bergstrom, S.B. Kowalski and R. Neuhausen, *Phys. Rev. C* 25 (1982) 1156
- 1982BE17 T.L. Belyaeva and N.S. Zelenskaya, *Izv. Akad. Nauk SSSR Ser. Fiz.* 46 (1982) 154
- 1982BE25 V.B. Belyaev and O.P. Solovtsova, *Yad. Fiz.* 35 (1982) 868; *Sov. J. Nucl. Phys.* 35 (1982) 505
- 1982BL1G Blin, Bohrmann and Knoll, *Z. Phys.* A306 (1982) 177
- 1982BO11 B. Bosco, C.W. Kim and S.L. Mintz, *Phys. Rev. C* 25 (1982) 1986
- 1982BO1F Botchkarev et al., in *Kiev* (1982) 363
- 1982BO1J D.H. Boal, *Phys. Rev. C* 25 (1982) 3068
- 1982BO1Q Bogatin et al., *Sov. J. Nucl. Phys.* 35 (1982) 49
- 1982BO1U Bouyssy, *Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982* (1982) 11
- 1982BO31 M. Bouten and M.C. Bouten, *J. Phys. (London)* G8 (1982) 1641
- 1982BO35 C. Borcea, E. Gierlik, A.M. Kalinin, R. Kalpakchieva, Yu.Ts. Oganessian, T. Pawlat, Yu.E. Penionzhkevich and A.V. Rykhlyuk, *Nucl. Phys.* A391 (1982) 520
- 1982BO40 V.I. Bogatin, E.A. Ganza, O.V. Loshkin, Yu.A. Murin, V.S. Oplavin, N.A. Perfilov, Yu.P. Yakovlev, *Yad. Fiz.* 36 (1982) 33; *Phys. At. Nucl.* 36 (1980) 19
- 1982BR04 F.P. Brady, C.M. Castaneda, G.A. Needham, J.L. Ullmann, J.L. Romero, T. Ford, M.L. Johnson, N.S.P. King, C.M. Morris, F. Petrovich et al., *Phys. Rev. Lett.* 48 (1982) 860
- 1982BR09 M. Bruno, F. Cannata, M. D'Agostino, C. Maroni, I. Massa and M. Lombardi, *Nuovo Cim.* A68 (1982) 35
- 1982BR17 M. Bruno, F. Cannata, M. D'Agostino, M.L. Fiandri, M. Frisoni, G. Vannini and M. Lombardi, *Nucl. Phys.* A386 (1982) 269
- 1982BR1D Bragin, in *Kiev* (1982) 430
- 1982CH10 D.R. Chakrabarty and M.A. Eswaran, *Phys. Rev. C* 25 (1982) 1933
- 1982CO02 J. Cook, *Nucl. Phys.* A375 (1982) 238
- 1982CO12 J. Cook, K.W. Kemper and M.F. Vineyard, *Phys. Rev. C* 26 (1982) 486
- 1982CO18 J. Cook, *Nucl. Phys.* A388 (1982) 153
- 1982CO19 J. Cook, H.J. Gils, H. Rebel, Z. Majka and H. Klewe-Nebenius, *Nucl. Phys.* A388 (1982) 173
- 1982DA1N S. Das Gupta, B.K. Jennings and M. Peyrow, *Phys. Lett.* B116 (1982) 106
- 1982DE28 A.S. Demyanova and K.V. Shitikova, *Yad. Fiz.* 35 (1982) 1431; *Sov. J. Nucl. Phys.* 35 (1982) 835

- 1982DE30 L.C. Dennis, K.M. Abdo, A.D. Frawley and K.W. Kemper, Phys. Rev. C26 (1982) 981
- 1982DE42 J. Delorme, A. Figureau and N. Giraud, Nucl. Phys. A389 (1982) 509
- 1982DO04 C.B. Dover and A. Gal, Phys. Lett. B110 (1982) 433
- 1982DO12 G.W. Dodson, E.C. Booth, F.L. Milder, B.E. Parad, B.L. Roberts, D.R. Tieger and J. Comuzzi, Phys. Rev. C26 (1982) 2548
- 1982DO1C C.B. Dover, Nucl. Phys. A374 (1982) 359
- 1982DO1E Dobrikov, Nemets, Gass and Shvedov, in Kiev (1982) 318
- 1982DO1F Dobrikov, Nemets, Gass and Shvedov, in Kiev (1982) 319
- 1982DO1G Dogiost, Volochik, Kirichenko and Khodiachik, in Kiev (1982) 563, 564
- 1982DO1M Dover and Walker, Phys. Rept. 89 (1982) 1
- 1982DR1D Drozdov, in Kiev (1982) 404
- 1982ER06 J. Ero, Z. Fodor, P. Koncz, Z. Seres, M. Csatlos, B.A. Khomenko, N.N. Khovanskij, Z.V. Krumstein, Yu.P. Merekov, V.I. Petrukhin et al., Nucl. Phys. A386 (1982) 484
- 1982ER1B Eramzhyan et al., Czech. J. Phys. 32 (1982) 326
- 1982ER1E Eramzhyan, Fetisov, Majling and Zofka, Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 91
- 1982FI13 G.F. Filippov, L.L. Chopovsky and V.S. Vasilevsky, Nucl. Phys. A388 (1982) 47
- 1982FI1C E. Fiorini, Nucl. Phys. A374 (1982) 577
- 1982GL01 B.G. Glagola, V.E. Viola, Jr., H. Breuer, N.S. Chant, A. Nadasen, P.G. Roos, S.M. Austin and G.J. Mathews, Phys. Rev. C25 (1982) 34
- 1982GL10 L. Glantz, I. Koersner, G. Jansen, A. Johansson, B. Sundqvist and Y. Koike, Nucl. Phys. A390 (1982) 365
- 1982GO1G Goriachii and Peresipkin, in Kiev (1982) 395
- 1982GO1H Gorpinitich et al., in Kiev (1982) 295, 296, 297
- 1982GO1J Goriachi et al., in Kiev (1982) 226
- 1982GU1H H.H. Gutbrod, A.I. Warwick and H. Wieman, Nucl. Phys. A387 (1982) 177
- 1982GU1J Gupta and Murthy, Z. Phys. A307 (1982) 187
- 1982HE1D T. Hennino, D. Bachelier, O.M. Bilaniuk, J.L. Boyard, J.C. Jourdain, M. Roy-Stephan, P. Radvanyi, M. Bedjidian, E. Descroix, P. Foessel et al., Phys. Rev. Lett. 48 (1982) 997
- 1982HO05 H.M. Hofmann and W. Zahn, Czech. J. Phys. B32 (1982) 288
- 1982HU1F Huber and Klingenberg, AIP Conf. Proc. 79 (1982) 389

- 1982IS06 M. Ishikawa, S. Seki, K. Furuno, Y. Tagishi, M. Sawada, T. Sugiyama, K. Matsuda, J. Sanada and Y. Koike, *J. Phys. Soc. Jpn.* 51 (1982) 1327
- 1982IS10 H.P. Isaak, P. Heusi, H.S. Pruijs, R. Engfer, E.A. Hermes, T. Kozlowski, U. Sennhauser and H.K. Walter, *Helv. Phys. Acta* 55 (1982) 477
- 1982JI1A Jin, Chen, Yao and Li, *Chin. Phys.* 2 (1982) 755
- 1982KA24 H. Kanada, T. Kaneko and Y.C. Tang, *Nucl. Phys.* A389 (1982) 285
- 1982KI1F King et al., *Bull. Amer. Phys. Soc.* 27 (1982) 720
- 1982KIZW E.R. Kinney, G.S. Adams, J.L. Matthews and W.W. Sapp, *Bull. Amer. Phys. Soc.* 27 (1982) 708, BE5
- 1982KO1L Kolesnikov, Kopilov and Kolesov, in *Kiev* (1982) 187
- 1982KO1U Komoda and Sekiya, *Atomkernenerg. Kerntech.* 40 (1982) 119
- 1982KO1Z Kobos and Mackintosh, *Lecture Notes in Phys.* 168 (1982) 12
- 1982KR09 R. Krivec and M.V. Mihailovic, *J. Phys. (London)* G8 (1982) 821
- 1982KR1B Krasnopolskii, Vorontsev, Sazonov and Kukulini, in *Kiev* (1982) 227
- 1982KR1E Kravtsov, Popov and Solyakin, *Sov. J. Nucl. Phys.* 35 (1982) 876
- 1982KU05 K. Kumar and A.K. Jain, *J. Phys. (London)* G8 (1982) 827
- 1982LA14 J.M. Lambert, P.A. Treado, P.G. Roos, N.S. Chant, A. Nadasen, I. Slaus and Y. Koike, *Phys. Rev. C* 26 (1982) 357
- 1982LA16 L.M. Lazarev, *Izv. Akad. Nauk SSSR Ser. Fiz.* 46 (1982) 914
- 1982LA19 M. Lattuada, F. Riggi, C. Spitaleri, D. Vinciguerra and C.M. Sutura, *Phys. Rev. C* 26 (1982) 1330
- 1982LE08 D.R. Lehman and M. Rajan, *Phys. Rev. C* 25 (1982) 2743
- 1982LE10 M. LeMere, Y.C. Tang and H. Kanada, *Phys. Rev. C* 25 (1982) 2902
- 1982LE11 D.R. Lehman, *Phys. Rev. C* 25 (1982) 3146
- 1982LE1L Le Bornec and Willis, *AIP Conf. Proc.* 79 (1982) 155
- 1982LO04 M.A.K. Lodhi and K.E. Wood, *Nucl. Phys.* A376 (1982) 485
- 1982LO06 M.A.K. Lodhi and M.L. Rustgi, *Lett. Nuovo Cim.* 33 (1982) 47
- 1982LO09 M.A.K. Lodhi, *Lett. Nuovo Cim.* 33 (1982) 513
- 1982LO1K Lolos, *AIP Conf. Proc.* 79 (1982) 201
- 1982LU01 B. Ludewigt, G. Gaul, R. Glasow, H. Lohner and R. Santo, *Phys. Lett.* B108 (1982) 15
- 1982LUZX R.C. Luhn, S. Sen, N.O. Gaiser and S.E. Darden, *Bull. Amer. Phys. Soc.* 27 (1982) 700, AE8

- 1982LY1A U. Lynen, H. Ho, W. Kuhn, D. Pelte, U. Winkler, W. F.J. Muller, Y. -T. Chu, P. Doll, A. Gobbi, K. Hildenbrand et al., Nucl. Phys. A387 (1982) 129
- 1982MA1K R. Mach, Czech. J. Phys. 32 (1982) 127
- 1982MA21 Z. Majka, H.J. Gils and H. Rebel, Phys. Rev. C25 (1982) 2996
- 1982MA35 R.S. Mackintosh and A.M. Kobos, Phys. Lett. B116 (1982) 95
- 1982MI1D Micek, Gils, Rebel and Majka, MSU (1982) 63
- 1982MO1K C.B.O. Mohr, Aust. J. Phys. 35 (1982) 1
- 1982MO1N J. Mougey, Nucl. Phys. A387 (1982) 109
- 1982MO1Q Motoba, Ikeda and bando, Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 129
- 1982NA01 J. Navarro, J. Bernabeu, J.M.G. Gomez and J. Martorell, Nucl. Phys. A375 (1982) 361
- 1982NE02 B. Neumann, H. Rebel, H.J. Gils, R. Planeta, J. Buschmann, H. Klewe-Nebenius, S. Zagromski, R. Shyam and H. Machner, Nucl. Phys. A382 (1982) 296
- 1982NG01 Nguyen Tien Nguyen and I. Ulehla, Czech. J. Phys. B32 (1982) 1040
- 1982NI03 H. Nishioka, R.C. Johnson, J.A. Tostevin and K.-I. Kubo, Phys. Rev. Lett. 48 (1982) 1795
- 1982PE06 F. Petrovich, R.H. Howell, C.H. Poppe, S.M. Austin and G.M. Crawley, Nucl. Phys. A383 (1982) 355
- 1982PI02 H. Piekarz, S. Bart, R. Hackenburg, A.D. Hancock, E.V. Hungerford, B. Mayes, K. Sekharan, J. Piekarz, M. Deutsch, R.E. Chrien et al., Phys. Lett. B110 (1982) 428
- 1982PI1C Pirner and Hiller, Bull. Amer. Phys. Soc. 27 (1982) 468
- 1982PI1J Piekarz, Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 72
- 1982PO1B Pomerantsev, Kukulkin and Klimov, in Kiev (1982) 406
- 1982PO1C Povh, Czech. J. Phys. 32 (1982) 183
- 1982PR02 R. Prasad, R. Vyas and V.S. Mathur, J. Phys. Soc. Jpn. 51 (1982) 38
- 1982RA22 A. Rabie, M.A. El-Gazzar and A.Y. Abul-Magd, Acta Phys. Acad. Sci. Hung. 52 (1982) 89
- 1982RE1F Rekaló, in Kiev (1982) 349
- 1982RI1A Rieder et al., Bull. Amer. Phys. Soc. 27 (1982) 469
- 1982SA16 Y. Sakuragi, M. Yahiro and M. Kamimura, Prog. Theor. Phys. 68 (1982) 322
- 1982SE08 U. Sennhauser, H.-J. Pfeiffer, H.K. Walter, F.W. Schlepütz, H.S. Pruys, R. Engfer, R. Hartmann, E.A. Hermes, P. Heusi, H.P. Isaak et al., Nucl. Phys. A386 (1982) 429
- 1982SH1H Shirokova and Shitikova, MSU (1982) 61

- 1982SI1B P. Singh and A.K. Jain, Phys. Rev. C25 (1982) 1705
- 1982SL1A R.J. Slobodrian, Phys. Rev. Lett. 49 (1982) 300
- 1982SM02 A.B. Smith, P.T. Guenther and J.F. Whalen, Nucl. Phys. A373 (1982) 305
- 1982ST15 D.J. Stubeda, Y. Fujiwara and Y.C. Tang, Phys. Rev. C26 (1982) 2410
- 1982ST16 Z. Steigenhofer and W. von Witsch, Nucl. Phys. A391 (1982) 350
- 1982TA23 S.L. Tabor, L.C. Dennis and K. Abdo, Nucl. Phys. A391 (1982) 458
- 1982TR05 V.A. Tryasuchev, A.I. Lebedev and V.N. Fetisov, Acta Phys. Pol. B12 (1981) 207
- 1982VO01 V.T. Voronchev, V.M. Krasnopol'sky, V.I. Kukul'in and P.B. Sazonov, J. Phys. (London) G8 (1982) 667
- 1982VO1B Vorontsev, Korsakov, Krasnopol'skii and Kukul'in, in Kiev (1982) 407
- 1982WA07 R.E. Warner, Nucl. Phys. A379 (1982) 191
- 1982WA1G P.L. Walden, Nucl. Phys. A374 (1982) 277
- 1982WI09 K. Wick, Nucl. Instrum. Meth. Phys. Res. 203 (1982) 243
- 1982WO09 C.L. Woods, B.A. Brown and N.A. Jelley, J. Phys. (London) G8 (1982) 1699
- 1982YA1A A.I. Yavin, Nucl. Phys. A374 (1982) 297
- 1982ZH1J Zhao, Chen and Jin, Phys. Energ. Fortis Phys. Nucl. (China) 6 (1982) 323
- 1982ZO01 J. Zofka, Czech. J. Phys. B32 (1982) 321
- 1982ZO1B Zofka, Sotona and Fetisov, Proc. Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 85
- 1983AB1A Abramovitch et al., in Moscow (1983) 362
- 1983AJ01 F. Ajzenberg-Selove, Nucl. Phys. A392 (1983) 1; Erratum Nucl. Phys. A413 (1984) 168
- 1983AO03 K. Aoki and H. Horiuchi, Prog. Theor. Phys. (Kyoto) 69 (1983) 857
- 1983AR05 N. Arena, C. Barbagallo, Seb. Cavallaro, P. D'Agostino, G. Fazio, G. Giardina and F. Mezzanares, Lett. Nuovo Cim. 36 (1983) 135
- 1983AS02 E. Aslanides, P. Baumann, G. Bergdolt, P. Engelstein, P. Fassnacht, F. Hibou, E. Chiavassa, G. Dellacasa, M. Gallio, A. Musso et al., Nucl. Phys. A393 (1983) 314
- 1983BA2F Badalov, Belenski and Filippov, in Moscow (1983) 187
- 1983BA2G Barit, Dulkova, Kuznetsova and Sobolevski, in Moscow (1983) 317
- 1983BA3A Bang and Gaponov, in Moscow (1983) 203
- 1983BEYY R.B. Begzhanov, G.S. Valiev, I. Borbely, I.R. Gulamov, T. Iskhakov, A.M. Mukhamedzhanov, G.K. Ni, E.A. Romanovsky, A.V. Tsupin and R. Yarmukhamedov, in Moscow (1983) 282
- 1983BU1F Burkova and Zhusupov, in Moscow (1983) 348

1983CO06 J. Cook and K.W. Kemper, Phys. Lett. B123 (1983) 5
 1983DE14 Th. Delbar, Gh. Gregoire, P. Belery and G. Paic, Phys. Rev. C27 (1983) 1876
 1983DE15 Th. Delbar, Gh. Gregoire and G. Paic, Phys. Rev. C27 (1983) 1887
 1983DE16 Th. Delbar, Gh. Gregoire, B. Antolkovic and G. Paic, Phys. Rev. C27 (1983) 1897
 1983DOZY V.N. Dobrikov, O.F. Nemets, A.S. Gass, A.A. Shvedov and V.A. Stepanenko, in
 Moscow (1983) 327
 1983DUZX S.B. Dubovitshenko and M.A. Zhusupov, in Moscow (1983) 184
 1983FO01 A. Foursat, E. Lyovshin and K. Sailer, Nucl. Phys. A392 (1983) 399
 1983FU06 Y. Fujiwara and Y.C. Tang, Phys. Rev. C27 (1983) 2457
 1983GO07 D. Gola, W. Bretfeld, W. Burgmer, H. Eichner, Ch. Heinrich, H.J. Helten, H. Kretzer,
 K. Prescher, H. Oswald, W. Schnorrenberg et al., Phys. Rev. C27 (1983) 1394
 1983GO1U Goriachin and Perespskin, in Moscow (1983) 455
 1983GU1F Guliamov, Bekbaev, Kim and Islomov, in Moscow (1983) 427
 1983GU1G Guliamov, Kim, Bekbaev and Islomov, in Moscow (1983) 428
 1983HUZZ J. Hurd, J. Boswell, R.C. Minehart, Y. Tzeng, H.J. Ziock and K.O.H. Ziock, Bull.
 Amer. Phys. Soc. 28 (1983) 671
 1983JA1C Jain, Phys. Rev. Lett. 50 (1983) 815
 1983JE03 B. Jenny, W. Gruebler, V. Konig, P.A. Schmelzbach and C. Schweizer, Nucl. Phys.
 A397 (1983) 61
 1983KA1K Kadmenski and Tschuvilski, in Moscow (1983) 181
 1983KE1E Kerimov, Ganiev, Elgavkhari and Safin, in Moscow (1983) 266, 268
 1983KR05 V.M. Krasnopolski, V.I. Kukulini, P.B. Sazonov and V.T. Voronchev, Phys. Lett. B121
 (1983) 96
 1983KR1E Krasnopolski, Kukulini and Neudatchin, in Moscow (1983) 180
 1983LE01 D.R. Lehman and W.C. Parke, Phys. Rev. Lett. 50 (1983) 98
 1983MO1F J. Mougey, Nucl. Phys. A396 (1983) 39
 1983NA03 G. Nagels, Nucl. Phys. A398 (1983) 253
 1983NI03 H. Nishioka, J.A. Tostevin and R.C. Johnson, Phys. Lett. B124 (1983) 17
 1983RI1C Rieder et al., Bull. Amer. Phys. Soc. 28 (1983) 705
 1983SA06 M. Sato, M. Sasagase, Y. Nagashima, J. Shimizu, T. Nakagawa, Y. Fukuchi and T.
 Mikumo, Phys. Rev. C27 (1983) 2621
 1983SEZV U. Sennhauser, R. Engfer, P. Heusi, H.P. Isaak, H.S. Pruiys and H.C. Walter, Bull.
 Amer. Phys. Soc. 28 (1983) 718
 1983SH04 V. Shkolnik and Y.C. Tang, Nucl. Phys. A397 (1983) 132

- 1983SL01 I. Slaus, J.M. Lambert, P.A. Treado, F.D. Correll, R.E. Brown, R.A. Hardekopf, N. Jarmie, Y. Koike and W. Gruebler, Nucl. Phys. A397 (1983) 205
- 1983ST1J Stepanenko et al., in Moscow (1983) 388
- 1983TR1F Trefil, Killy and Rood, Nature 302 (1983) 111
- 1983VD03 A.I. Vdovin, E.P. Kadkin, I.I. Loshchakov, M.V. Pasechnik and L.S. Saltykov, Izv. Akad. Nauk. SSSR, Ser. Fiz. 47 (1983) 2219
- 1983VIZZ M.F. Vineyard, J. Cook and K.W. Kemper, Bull. Amer. Phys. Soc. 28 (1983) 716, GF8
- 1983WE02 C. Werntz, Phys. Rev. C27 (1983) 1375
- 1983YO01 R.L. York, J.C. Hiebert, H.L. Woolverton and L.C. Northcliffe, Phys. Rev. C27 (1983) 46
- 1983ZIZZ K.O.H. Ziock, J. Boswell, J. Hurd, R.C. Minehart, Y. Tzeng and H.J. Ziock, Bull. Amer. Phys. Soc. 28 (1983) 671, BG4
- 1985AJ01 F. Ajzenberg-Selove, Nucl. Phys. A433 (1985) 1; Erratum Nucl. Phys. A449 (1986) 155

