Energy Levels of Light Nuclei
$A = 6$

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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.

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^{6}n
(Not illustrated)

^{6}n has not been observed in the interaction of 700 MeV protons or of 400 GeV protons with uranium: the cross section is $< 1.1 \times 10^{-3}$ μb (1977TU02; 700 MeV), < 9 μb (1977TU1B; 400 GeV). See also (1979AJ01).

^{6}H
(Not illustrated)

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

^{6}He
(Figs. 4 and 7)

GENERAL: (See also (1979AJ01).)

Model calculations: (1979SH1C, 1980FI1D, 1981KU13, 1982FI13, 1982KR1B, 1982LE11, 1982VO01).

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

Electromagnetic transitions: (1982AW02).

Complex reactions involving ^{6}He: (1978DU1B, 1978VO1A, 1979BO22, 1979VI05, 1980BO31, 1980WI1L, 1981BO1X, 1981CU05, 1981VO10, 1982BO1Q, 1982BO35, 1982BO1Y, 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, 1979SH1C, 1979VA1A, 1981PA1C, 1982AW02, 1982MO1Q, 1982NG01, 1982ZO1B, 1983BA2F, 1983BA3A, 1983DE16, 1983NA03).

Ground state of ^{6}He: (1978SM02, 1981AV02, 1981PA1C, 1982FI13, 1982KR1B, 1982LE11, 1982NG01, 1982VO01, 1983LE01).

Table 6.1: Energy levels of ^{6}He

E_x (MeV $\pm$ keV)	$J^\pi; T$	$\tau_{1/2}$ or $\Gamma_{c.m.}$	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}He(β^-)^{6}Li $\qquad Q_m = 3.507$

The decay proceeds to the ground state of ^{6}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, 1981PA1C; theor.).

2. (a) ^{3}H(t, n)^{5}He $\qquad Q_m = 10.44 \qquad E_b = 12.305$
(b) ^{3}H(t, 2n)^{4}He $\qquad Q_m = 11.3322$
(c) ^{3}H(t, d)^{4}H $\qquad Q_m = -8.9$
(d) ^{3}H(t, 3n)^{3}He $\qquad Q_m = -9.2456$
(e) ^{3}H(t, t)^{3}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}He(t, p)^{6}He $\qquad Q_m = -7.506$

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

4. ^{4}He(α, 2p)^{6}He $\qquad Q_{\rm m} = -27.320$

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

5. ^{6}Li(e, π^+)^{6}He $\qquad Q_{\rm m} = -143.074$

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

6. (a) ^{6}Li(π^-, γ)^{6}He $\qquad Q_{\rm m} = 136.061$
(b) ^{6}Li(π^-, π^0)^{6}He $\qquad Q_{\rm m} = 1.098$

The excitation of ^{6}He*(0, 1.8) and possibly of (broad) states at $E_{\rm x} = 15.6 \pm 0.5$, 23.2 ± 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}Li(n, p)^{6}He $\qquad Q_{\rm m} = -2.724$

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

8. ^{6}Li(d, 2p)^{6}He $\qquad Q_{\rm m} = -4.949$

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

9. ^{6}Li(t, ^{3}He)^{6}He $\qquad Q_{\rm m} = -3.488$

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

10. ^{6}Li(^{6}Li, ^{6}Be)^{6}He $\qquad Q_{\rm m} = -7.795$

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

11. ^{6}Li(^{7}Li, ^{7}Be)^{6}He $\qquad Q_{\rm m} = -4.369$

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

12. (a) ^{7}Li(γ, p)^{6}He $\qquad Q_{\rm m} = -9.975$

(b) ^{7}Li(e, ep)^{6}He $\qquad Q_{\rm m} = -9.975$

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

13. ^{7}Li(n, d)^{6}He $\qquad Q_{\rm m} = -7.750$

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

14. ^{7}Li(p, 2p)^{6}He $\qquad Q_{\rm m} = -9.975$

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

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

Angular distributions of the ^{3}He ions to ^{6}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}He with $E_x < 10.7$ MeV: see (1979AJ01).

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

The energy of the first excited state is 1.797 ± 0.025 MeV, $\Gamma = 113 \pm 20$ keV. ^{6}He*(1.80) decays into ^{4}He + 2n. The branching ratio $\Gamma_\gamma/\Gamma_\alpha \leq 2 \times 10^{-6}$: for $\Gamma_{c.m.} = 113 \pm 20$ 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}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}Be.

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

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

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

See (1981BA58).

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

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}Be.

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

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

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

See (1981DE1X, 1983DE14).

^{6}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, 1983DU1B, 1983FU06, 1983KA1K, 1983KR1E, 1983NI03).

Special states: (1978BU19, 1978OS07, 1978ST19, 1979BE39, 1978DU1C, 1979GO10, 1979LE1A, 1979SH1C, 1980FI1D, 1980GO1Q, 1980MA41, 1980SH1N, 1981BO1Y, 1982BA52, 1982FI13, 1982VO01, 1983DE16, 1983DU1B, 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}Li: (1978BH03, 1978DU1B, 1978HE1C, 1978MA40, 1979AL1H, 1979BA34, 1979BO22, 1979FR1D, 1979FR12, 1979LO11, 1979NE06, 1979RU1B, 1979SA1E, 1979SH12, 1979SI1A, 1979ST1D, 1979VI05, 1980AK1C, 1980GR10, 1980HI02, 1980MI01, 1980NE05, 1980OL1C, 1980WI1L, 1980WO05, 1981BL1G, 1981BO1X, 1981ME13, 1981MO20, 1981TH07, 1982BO1F, 1982BO1J, 1982BO1Q, 1982BO35, 1982BO1Y, 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, 1979AM1B, 1979BA16, 1979BA17, 1979BA1M, 1979BO1B, 1979DE2A, 1979DO1C, 1979DZ08, 1979EP02, 1979KI1C, 1979LE1A, 1979MA1D, 1979ME07, 1979MI1C, 1979NO1A, 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, 1981SE1B, 1981SI1D, 1981TO1H, 1981TR1C, 1981WH01, 1981WH1C, 1981WH1D, 1982AS01, 1982BA1R, 1982BE25, 1982BL1G, 1982BO1U, 1982DO1C, 1982DO04, 1982DO1M, 1982ER1E, 1982HO05, 1982IS10, 1982LO1K, 1982MA1K, 1982MO1Q, 1982PI1C, 1982PI02, 1982PI1J, 1982PO1C, 1982RI1A, 1982SE08, 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, 1979SH1C, 1980GO1Q, 1980LE1K, 1980MA41, 1980SH1N, 1981BE1K, 1981IS11, 1981PA1C, 1981PL03, 1982BA2G, 1982BE17, 1982CO02, 1982DE42, 1982GU1J, 1982MA35, 1982NG01, 1982SH1H, 1983BA3A, 1983CO06, 1983DE16, 1983KE1E, 1983NA03).

Ground-state properties of ^{6}Li: (1978CH1D, 1978HE1D, 1978KN05, 1978OS07, 1978RO17, 1978ST19, 1979BA01, 1979CA06, 1979OS02, 1979ST09, 1980HO14, 1980MA41, 1981AV02, 1981BO1Y, 1981KU13, 1981PA1C, 1981SI1G, 1981SU1H, 1981VE04, 1982BA2G, 1982BO31, 1982FI13, 1982KA24, 1982KR1B, 1982KR09, 1982LE11, 1982LO04, 1982LO06, 1982LO09, 1982NG01, 1982PE06, 1982SH1H, 1982VO01, 1983DU1B, 1983KR05, 1983LE01, 1983NI03).

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

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

Mass of ^{6}Li: The ground-state mass excess of ^{6}Li is 14085.5 ± 1.1 keV based on the Q-value of ^{6}Li(p, α)^{3}He [$Q_0 = 4018.2 \pm 1.1$ keV]. A comparison with previous measurements leads to a new mass excess for ^{6}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}He(^{3}H, γ)^{6}Li	$Q_m = 15.7958$	
(b) ^{3}He(^{3}H, p)^{5}He	$Q_m = 11.21$	$E_b = 15.7958$
(c) ^{3}He(^{3}H, p)^{4}He + n	$Q_m = 12.0959$	
(d) ^{3}He(^{3}H, n)^{5}Li	$Q_m = 10.13$	
(e) ^{3}He(^{3}H, d)^{4}He	$Q_m = 14.3205$	
(f) ^{3}He(^{3}H, ^{3}H)^{3}He		
(g) ^{3}He(^{3}H, dn)^{3}He	$Q_m = -6.2573$	
(h) ^{3}He(^{3}H, p2n)^{3}He	$Q_m = -8.4819$	

Table 6.2: Energy levels of ^{6}Li

E_x (MeV $\pm$ keV)	$J^\pi; T$	$\Gamma_{c.m.}$ (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 ± 0.2 [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	γ, n, p, α	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	t, ^{3}He	1, 39
21.5	$0^-; 1$	broad	t, ^{3}He	1, 39
(23 ± 2000)	$4^+; 0$	12 ± 2	d, α	6
25.0 ± 1000	$4^-; 1$	≈ 4	γ, n, t, ^{3}He	1
26.6 ± 400 [b]	$3^-; 0$	broad	γ. n, d, t, ^{3}He, α	1, 6
(31)	(3^+)	broad	d, t, ^{3}He, α	1

[a] See also Tables 6.4 and 6.5.

[b] See also Table 6.3.

(i) ^{3}He(^{3}H, 2d)^{2}H $Q_m = -9.5263$

(j) ^{3}He(^{3}H, pd)^{3}H $Q_m = -5.4936$

Capture γ-rays (reaction (a)) to the first three states of ^{6}Li [γ_0, γ_1, γ_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 γ_0, γ_1, γ_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 $E_x = 25 \pm 1$ MeV, $\Gamma_{c.m.} = 4$ 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 $E_x = 26.6$ 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 exciation 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}Li*(26.1)]: see (1979AJ01).

Angular distributions of deuterons (reaction (e)) have been measured for $E_t = 1.04$ to 3.27 MeV and at $E(^3\text{He}) = 0.29$ to 32 MeV. Polarization measurements are reported for $E_t = 9.02$, 12.86 and 17.02 MeV and an excitation function for $E_t = 9.02$ 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 $E_t = 9.02$ to 17.02 MeV (1977HA17) and $E(^3\text{He}) = 19.9 \to 33.3$ MeV (1977KA10, 1977VL01). A strong change occurs in the analyzing power angular distributions at $E_t = 15$ MeV (1977HA17). A phase-shift analysis by (1977VL01) [single-level R-matrix formalism, $L \leq 4$] yields P-states [0^-, 2^-; $T = 1$] at $E_x \approx 21.5$ and 21.0 MeV and F-states [3^-, 4^-; $T = 1$] at $E_x \approx 26.7$ and 25.7 MeV. There is some indication also of $T = 0$, 3^-, 5^- and 3^+ states at $E_x \approx 25$, 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}H(α, n)^{6}Li $Q_m = -4.7820$

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

3. ^{3}He(^{3}He, π^+)^{6}Li $\qquad Q_\mathrm{m} = -123.790$

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

4. ^{4}He(d, γ)^{6}Li $\qquad Q_\mathrm{m} = 1.4753$

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

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

The proton yield gives no evidence of states in ^{6}Li with $6.5 < E_\mathrm{x} < 8.7$ MeV. Polarization measurements at $E_\mathrm{d} = 8.5$, 10 and 11 MeV indicate scattering through the first two states of ^{5}He. See also ^{5}He and ^{5}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 $E_{\vec{\mathrm{d}}} = 12$ and 17 MeV (1983SL01), 14 MeV (1982ST16) and at $E_{\vec{\mathrm{d}}} = 18$ MeV (1981OS02: VAP and differential cross sections). (1980DA05, 1980DA17) find that three-body forces are required to understand the results and suggest that ^{6}Li*(4.3) may be involved. At $E_\alpha = 140$ MeV three-body model calculations are in good agreement with the experimentl data (1982LA14). The isospin-forbidden proton-neutron FSI in the $^1S_0$, $T = 1$ state account for bumps observed near $E_\mathrm{pn} = 0$ (1982ST16).

At $E_\alpha = 28.3$ MeV (1979AN24, 1981BE1G) report measurements of the angular correlation between the n and $^5\vec{\mathrm{Li}}$ and the angular distribution of the subsequent decay to ^{4}He + p, permitiing the calculation of the tensor moments of ^{5}Li. Polarization measurements are reported at $E_\mathrm{d} = 5.4$, 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 $E_{\rm d} = 32.4$ MeV, $E_{\rm d} = 45.8$ 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}He(d, d)^{4}He $\quad E_{\rm b} = 1.4753$

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 $E_{\rm d}$ to 45 MeV: see (1974AJ01, 1979AJ01). Recent measurments are reported at $E_\alpha = 5.96$ to 13.91 MeV (1980BR19, 1982BR09; $\sigma(\theta)$) and 28.5 MeV (1982WI09), $E_{\rm d} = 0.87$ to 1.43 MeV (1979BA30, 1980BA60; $\sigma(\theta)$, VAP), $E_{\rm d} = 8-13$ MeV (1983JE03; VAP, TAP), 11.9 MeV (1981EL1A; polarization transfer coefficient at $\theta = 37°$), 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}Li from ^{4}He(d, d)^{4}He [a]

$E_{\rm d}$ (MeV)	$J^\pi; T$	$E_{\rm x}$ (MeV)	$\Gamma_{\rm c.m.}$ (MeV)	$\Gamma_{\rm d}/\Gamma$ [b]	$\gamma^2_{\rm d}$ [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^{+3}_{-9}	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 $E_{\rm d} = 15$ MeV. See also Table 6.4 in (1974AJ01) and Table 6.3 in (1979AJ01).
[b] The errors in $\Gamma_{\rm d}/\Gamma$ are typically 0.03.
[c] In units of the Wigner limit $\gamma^2_{\rm W} = 2.93$ MeV for a radius of 4.0 fm. I am indebted to W. Gruebler for pointing out an error to me.
[d] $E_{\rm d} = 1067 \pm 3$ keV, $\Gamma = 20 \pm 2.8$ keV (1979BA30).
[e] 6.26 MeV (1977HA34; R-matrix analysis): $E_{\rm x} = 5.65$ MeV.

Phase-shift analyses have been carried out for $E_{\rm d} = 0.3$ to 27 MeV [see (1974AJ01)], and for $E_{\rm d} = 3$ to 43 MeV by (1983JE03) [using all available differential cross-section, vector and tensor analyzing power measurements, and $L \leq 5$], for $E_{\rm d} = 6$ to 14 MeV by (1982BR09), as well as in the vicinity of the 1^+; $T = 0$ state ^{6}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 $E_{\rm x} = 2.19$ ($^4D_3$), 4.7 ($^3D_2$) and 5.65 MeV ($^3D_1$). (1983JE03) suggest very broad G_3 and G_4 resonances at $E_{\rm d} = (19.3)$ 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 $E_{\rm d} = 54$ MeV is presented by (1980GR03): it appears that $A_{\rm yy} \approx 1$ near $E_{\rm d} = 35$ MeV, $\theta_{\rm c.m.} = 150°$. 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}Li on ^{118}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 α + d (forbidden) breakup of ^{6}Li*(3.56) [0^+; $T = 1$]: $\Gamma_\alpha < 1 \times 10^{-5}$ eV. See also (1977BO40, 1979TO1A, 1983YO01), (1978BR1A, 1982FI1C) and (1978IN02, 1978KO07, 1979SE04, 1979SU1C, 1979WI1B, 1980FU1G, 1980KA15, 1980NI07, 1981AO02, 1982KA24, 1982PR02, 1982SA16, 1983AO03, 1983BA2G, 1983SH04; theor.).

7. (a) ^{4}He(^{3}He, p)^{6}Li $\qquad Q_{\rm m} = -4.0182$
   (b) ^{4}He(^{3}He, pd)^{4}He $\qquad Q_{\rm m} = -5.4936$

Angular distributions have been measured at $E(^3{\rm He}) = 8$ 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}Li*(2.19) and possibly ^{5}Li: see (1979AJ01). See also ^{7}Be.

8. (a) ^{4}He(α, d)^{6}Li $\qquad Q_{\rm m} = -22.3714$
   (b) ^{4}He(α, αd)^{2}H $\qquad Q_{\rm m} = -23.84673$

Reaction (a) has been studied to $E_\alpha = 158.2$ MeV: see (1979AJ01) and (1979AL1F, 1982GL01). For reaction (b) [and excited states of ^{4}He] see (1980KA20; $E_\alpha = 119$ MeV); ^{6}Li*(2.19) is involved in the process.

9. ^{6}He(β^-)^{6}Li $\qquad Q_{\rm m} = 3.507$

See ^{6}He.

10. (a) ^{6}Li(γ, n)^{5}Li $\quad Q_{\rm m} = -5.66$

(b) ^{6}Li(γ, p)^{5}He $\quad Q_{\rm m} = -4.59$

(c) ^{6}Li(γ, d)^{4}He $\quad Q_{\rm m} = -1.4753$

(d) ^{6}Li(γ, t)^{3}He $\quad Q_{\rm m} = -15.7958$

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}Li + γ, consistent with a ^{3}H + ^{3}He cluster description of ^{6}Li$_{\rm g.s.}$ with $\theta^2 \approx 0.68$. The agreement with the inverse reaction, ^{3}H(^{3}He, γ) [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: (γ, n2p), (γ, pd)) and (1974AJ01). For pion production see (1979AJ01), ^{6}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}Li(γ, γ)^{6}Li

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

12. (a) ^{6}Li(e, e)^{6}Li

(b) ^{6}Li(e, ep)^{5}He $\quad Q_{\rm m} = -4.59$

(c) ^{6}Li(e, ed)^{4}He $\quad Q_{\rm m} = -1.4735$

The elastic scattering has been studied for $E_{\rm e} = 85$ to 600 MeV [see (1974AJ01, 1979AJ01)] and at $E_{\rm e} = 80.0$ 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}Li from ^{6}Li(e, e′) and ^{6}Li(γ, γ') [a]

E_x (MeV)	$J^\pi; T$	$\Gamma_{\gamma 0}$ (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)↑$= 21.8 \pm 4.8\ e^2 \cdot$ 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 $r_{\rm rms} = 2.51 \pm 0.10$ fm.

Table 6.4 summarizes the results obtained in the inelastic scattering of electrons. Form factors have been measured for ^{6}Li*(2.19) ($E_e = 140.5$ to 278.2 MeV), ^{6}Li*(3.56) ($E_e = 140.5$ to 330.7 MeV) and ^{6}Li*(5.37) ($E_e = 76$ to 278.2 MeV) (1979BE38, 1980BE20). The transition current density for ^{6}Li*(3.56) has been calculated by (1979BE38). (1980BE28) have measured the form factor of the (t, ^{3}He) continuum up to 4 MeV above threshold at $E_e = 102$ and 123 MeV: no narrow structures corresponding to ^{6}Li states are observed. The radiative capture cross section is in good accord with the t–^{3}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}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}Li($\pi^\pm$, $\pi^\pm$)^{6}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}Li(π^+, π^+): see ^{7}Li (1978DY01). For a study of inclusive reactions at $E_{\pi^\pm} = 100$, 160, 220 MeV, see (1981MC09).

14. (a) ^{6}Li(n, n$'$)^{6}Li*

(b) ^{6}Li(n, nd)^{4}He $\quad Q_{\rm m} = -1.4753$

(c) ^{6}Li(n, nt)^{3}He $\quad Q_{\rm m} = -15.7958$

Angular distributions have been reported for n$_0$ at $E_{\rm n} = 1.0$ to 14.2 MeV and for n$_1$ at $E_{\rm n} = 7.5$ to 14.1 MeV: see (1979AJ01). Recent measurements are reported at $E_{\rm n} = 1.5$ 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; $E_{\rm n} = 800$ MeV). See also (1977HA1E, 1977KN1A, 1981DA1K) and (1981KO1M, 1982KO1U, 1982LA16, 1982LE10, 1982VO1B, 1983FU06, 1983GU1F; theor.) and ^{7}Li.

15. (a) ^{6}Li(p, p)^{6}Li

(b) ^{6}Li(p, 2p)^{5}He $\quad Q_{\rm m} = -4.59$

(c) ^{6}Li(p, pd)^{4}He $\quad Q_{\rm m} = -1.4753$

(d) ^{6}Li(p, p^{3}H)^{3}He $\quad Q_{\rm m} = -15.7958$

(e) ^{6}Li(p, pn)^{5}Li $\quad Q_{\rm m} = -5.66$

(f) ^{6}Li(p, 2d)^{3}He $\quad Q_{\rm m} = -19.8285$

(g) ^{6}Li(p, 3p)^{4}H $\quad Q_{\rm m} = -26.1$

(h) ^{6}Li(p, nd)^{4}Li $\quad Q_{\rm m} = -25.0$

Proton angular distributions have been measured at $E_{\rm p} = 0.5$ to 600 MeV [see (1974AJ01, 1966LA04)] and at $E_{\rm p} = 24.4$ 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 $E_{\rm p} = 31$ and 32 MeV the spin-flip probabilities for ^{6}Li*(2.19, 3.56) have been determined by (1981CO08). The cross-section data at $E_{\rm p} \approx 25$ and 50 MeV have been reviewed by (1982PE06): some difficulties are encountered in describing the cross section for populating ^{6}Li*(3.56). For reaction (b) at $E_{\rm p} = 47$ and 70 MeV see (1983VD03) and at 800 MeV see (1980CH05, 1981FR24). See also ^{5}He and (1979AJ01).

Reaction (c) has been studied at $E_{\rm p} = 9$ MeV to 1 GeV [see (1974AJ01, 1979AJ01)] and at $E_{\rm p} = 600$ MeV (1978LA11) and 670 MeV (1980AL10). At $E_{\rm p} = 100$ MeV the agreement with DWIA is good: $S_\alpha = 0.58 \pm 0.02$ (1977RO02). A study of reaction (f) indicates dominance, at $E_{\rm p} = 100$ MeV, of the direct quasi-free reaction process (p + $\alpha \rightarrow$ d + ^{3}He): $S_\alpha = 0.52 \pm 0.03$ (1977CO07). See also (1982ER06; $E_{\rm p} = 670$ 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}Li*(5.37). Reaction (e), at $E_{\rm p} = 47$ MeV, may proceed by sequential decay involving ^{6}Li*(21, 30) or states in ^{6}Be [see reaction 3 in ^{6}Be] (1977WA05). Reaction (d), studied at $E_{\rm p} = 100$ MeV, and compared with the (p, pα)

reaction indicates that the ^{3}He + t parentage of ^{6}Li is comparable with the α + 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}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}Li(d, d′)^{6}Li*

(b) ^{6}Li(d, pn)^{6}Li	$Q_m = -2.2246$
(c) ^{6}Li(d, 2d)^{4}He	$Q_m = -1.4753$
(d) ^{6}Li(d, αp)^{3}H	$Q_m = 2.5574$
(e) ^{6}Li(d, αn)^{3}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}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}Li*(3.56) is formed, in contrast with the much broader shape (characteristic of $^3S_1$) seen when ^{6}Li*(0, 2.19) are populated. A study of reaction (c) at E_d = 52 MeV shows that the α-clustering probability, $N_{\rm eff} = 0.12^{+0.12}_{-0.06}$ 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}Li]. The α-particle and the deuteron clusters in ^{6}Li have essentailly a relative orbital momentum of $l = 0$. The D-state probability of the ground state of ^{6}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}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}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}Li(t, t′)^{6}Li*

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

Table 6.5: Parameters of levels of ^{6}Li [a]

E_x (MeV ± keV)	$\Gamma_{c.m.}$ (keV)	Reactions
2.185 ± 3	20.0 ± 2.8	^{4}He(d, d)^{4}He
2.187 ± 3		^{4}He(d, d)^{4}He
2.183 ± 9		^{6}Li(e, e′)^{6}Li
2.188 ± 6	24 ± 2 [c]	^{6}Li(p, p′), (d, d′), ^{7}Li(d, t)^{6}Li
2.203 ± 6		^{9}Be(p, α)^{6}Li [g]
2.186 ± 2	24 ± 2	"best" values
3.56288 ± 0.10	$(8.2 \pm 0.2) \times 10^{-3}$	^{6}Li(γ, γ')^{6}Li
3.563 ± 10		^{6}Li(e, e′)^{6}Li
3.5629 ± 0.6	< 5	^{6}Li(p, p′), ^{9}Be(p, α)^{6}Li
4.34 ± 40		^{4}He(d, d)^{4}He
4.27 ± 40		^{6}Li(e, e′)^{6}Li
4.40 ± 120	1490 ± 150	^{6}Li(p, p′)^{6}Li
4.32 ± 40	1820 ± 110	^{6}Li(d, d′)^{6}Li
4.3 ± 100	600 ± 100	^{7}Li(^{3}He, α)^{6}Li
4.3 ± 200 [d]	1600 ± 300	^{7}Li(^{3}He, αd)^{4}He
4.30 ± 10	850 ± 50, 480 ± 80	^{9}Be(p, α)^{6}Li [g]
4.312 ± 22	1700 ± 100	"best" values
5.379 ± 17 [e]	540 ± 20 [e]	^{6}Li(e, e′)^{6}Li
5.33 ± 80	560^{+340}_{-100}	^{6}Li(p, p′)^{6}Li
5.34 ± 20	560 ± 40 [b]	^{7}Li(^{3}He, α)^{6}Li
5.325 ± 5	270 ± 12	^{9}Be(p, α)^{6}Li [g]
5.366 ± 15	540 ± 20	"best" values
5.65 ± 50 [f]		^{4}He(d, d)^{4}He
5.7	1000^{+600}_{-400} [b]	^{6}Li(p, p′)^{6}Li
5.65 ± 200	1650 ± 300	^{7}Li(^{3}He, αd)^{4}He
5.65 ± 40	900 ± 60, 1260 ± 120	^{9}Be(p, α)^{6}Li [g]
5.65 ± 50	1500 ± 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}Li(^{3}He, ^{3}He)^{6}Li
(b) ^{6}Li(^{3}He, t)^{3}He^{3}He $Q_m = -15.7958$
(c) ^{6}Li(^{3}He, pα)^{4}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}Li*(0, 2.19)) and $E(^3\text{He}) = 44.04$ MeV (1979GO07; to $^6\text{Li}_{\text{g.s.}}$). For polarization measurments see ^{9}B. 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}Li(α, α')^{6}Li*
(b) ^{6}Li(α, 2α)^{2}H $Q_m = -1.4753$
(c) ^{6}Li(α, αp)^{5}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; $^6\text{Li}_{\text{g.s.}}$) and $E_\alpha = 59$ MeV (1979FO21; α_0). For yield and polarization measurements see ^{10}B.

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 α + d clusters for $^6\text{Li}_{\text{g.s.}}$, $n_{\text{eff}} = 0.98 \pm 0.05$; the results are very model dependent. See also (1980KI1D), (1979AJ01) and ^{8}Be. For reaction (c) see ^{5}He (1979NA06). For pion production see (1978PE12, 1982AN1H). See also (1978CH1C) and (1978AN20, 1979SU06, 1979SU09, 1979SU1F, 1980HA1P, 1981BA20, 1981LA13, 1982JI1A, 1982LE10; theor.).

20. (a) ^{6}Li(^{6}Li, ^{6}Li)^{6}Li
(b) ^{6}Li(^{6}Li, 2d)^{4}He^{4}He $Q_m = -2.9507$

Angular distributions of ^{6}Li ions have been studied for $E(^6\text{Li}) = 3.2$ to 36 MeV [see (1974AJ01, 1979AJ01)] and ay $E(^6\vec{\text{Li}}) = 20$ MeV (1981AV1B; to ^{6}Li*(0, 2.19)). At $E(^6\text{Li}) = 32$ and 36 MeV the ratios for populating ^{6}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}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}Li. Reaction (b) also proceeds via ^{6}Li*(2.19) (1979WA13, 1981WA15, 1982WA07). See also ^{8}Be.

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

21. ^{6}Li(^{7}Li, ^{7}Li)^{6}Li

See (1981GU1B; theor.).

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

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

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

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

24. (a) ^{6}Li(^{12}C, ^{12}C)^{6}Li
(b) ^{6}Li(^{13}C, ^{13}C)^{6}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}C*(4.4)), 90 MeV (1981GL03), 99 MeV (1981SC16) and 156 MeV [see (1982CO19) and (1982MA21, 1982MI1D)]. See also (1979FU1D, 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}F and ^{19}F in (1983AJ01), (1978HO1C, 1978MA1B, 1982TA23) and (1979BE59, 1979SU1F, 1980ST22, 1981GR17, 1981GU1B, 1981ME1E, 1981OS1D, 1981TH07, 1982DE28, 1982DR1D, 1982KO1Z, 1982MA21, 1982MA35, 1982RA22; theor.).

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

See (1981AJ01).

26. ^{6}Li(^{16}O, ^{16}O)^{6}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}Li(^{24}Mg, ^{24}Mg)^{6}Li
(b) ^{6}Li(^{25}Mg, ^{25}Mg)^{6}Li
(c) ^{6}Li(^{26}Mg, ^{26}Mg)^{6}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}Li(^{27}Al, ^{27}Al)^{6}Li

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

29. ^{6}Li(^{28}Si, ^{28}Si)^{6}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}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}Li(^{39}K, ^{39}K)^{6}Li
(b) ^{6}Li(^{40}Ca, ^{40}Ca)^{6}Li
(c) ^{6}Li(^{44}Ca, ^{44}Ca)^{6}Li
(d) ^{6}Li(^{48}Ca, ^{48}Ca)^{6}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. (a) ^{7}Li(e, n)^{6}Li $\qquad Q_m = -7.250$

(b) ^{7}Li(γ, n)^{6}Li $\qquad Q_m = -7.250$

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}Li*(0, 2.19, 3.56) have been observed in reaction (b): see (1979AJ01) and (1978DE13). See also ^{7}Li.

32. ^{7}Li(π^+, p)^{6}Li $\qquad Q_m = 133.100$

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

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

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

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

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

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 (1983BE1D; 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}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}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 ^{8}Be, (1979AJ01) and (1983FO01; theor.).

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

A study at $E_d = 23.6$ MeV of the relative cross sections of the analog reactions ^{7}Li(d, t)^{6}Li (to the first two $T = 1$ states at 3.56 and 5.37 MeV) and ^{7}Li(d, ^{3}He)^{6}He (to the ground and 1.80 MeV excited states) shows that ^{6}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}Li(^{3}He, α)^{6}Li $\qquad Q_m = 13.328$

(b) ^{7}Li(^{3}He, dα)^{4}He $\qquad Q_m = 11.852$

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 (1979LI1B, 1980LI1D, 1980LI1F; prelim.; α to ^{6}Li*(0, 2.19, 3.56, 5.37)) and $E(^3\vec{\text{He}}) = 33.3$ MeV (1981BA38; α_0, α_1, α_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 ^{10}B.

Several attempts have been made to look at the isospin decay of ^{6}Li*(5.37) [J^π; $T = 2^+$; 1] via ^{7}Li(^{3}He, α)^{6}Li* $\rightarrow$ d + α: the branching is < 1%. $\Gamma_p/\Gamma = 0.35 \pm 0.10$ and $\Gamma_{p+n}/\Gamma = 0.65 \pm 0.10$ for ^{6}Li*(5.37): see (1979AJ01). ^{4}He + d spectra suggest the excitation of ^{6}Li*(4.3) [$E_x = 4.3 \pm 0.2$ MeV, $\Gamma = 1.6 \pm 0.3$ MeV] (1983AR05) and ^{6}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}Be(p, α)^{6}Li $\qquad Q_m = 2.126$

(b) ^{9}Be(p, d)^{4}He^{4}He $\qquad Q_m = 0.651$

Angular distributions of α-particles (reaction (a)) have been measured at $E_p = 0.11$ to 45 MeV: see (1974AJ01, 1979AJ01). ^{6}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}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}Be*(0, 2.9) and ^{6}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 ^{10}B.

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

Angular distributions of $^6\text{He}_{\text{g.s.}} + {}^6\text{Li}_{\text{g.s.}}$, $^6\text{Li}_{\text{g.s.}} + {}^6\text{He}_{\text{g.s.}}$, $^6\text{Li}^*_{3.56} + {}^6\text{He}_{\text{g.s.}}$, and $^6\text{He}_{\text{g.s.}} + {}^6\text{Li}^*_{3.56}$ [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 $90^{\circ}_{\rm cm}$, within the overall experimental errors. In the reaction leading to the ground states of ^{6}He and ^{6}Li differences from symmetry of as much as 40% are observed at forward angles. Angular distributions involving $^6{\rm He}_{\rm g.s.} + {^6}$Li*(2.19) and $^6{\rm Li}_{\rm g.s.} + {^6}$He*(1.8) have also been measured. This reaction appears to proceed predominantly by means of the direct pickup of a triton or ^{3}He from ^{9}Be (1976VO1A). Differential cross sections are also reported at $E_{\rm t} = 17$ MeV (1979FL03). See also ^{12}B in (1980AJ01) and (1983WE02; theor.).

39. ^{9}Be(^{3}He, ^{6}Li)^{6}Li $\qquad Q_{\rm m} = -1.892$

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

40. ^{10}B(d, ^{6}Li)^{6}Li $\qquad Q_{\rm m} = -2.985$

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

41. ^{10}B(^{3}He, ^{7}Be)^{6}Li $\qquad Q_{\rm m} = -2.873$

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

42. ^{10}B(α, ^{8}Be)^{6}Li $\qquad Q_{\rm m} = -4.552$

At $E_\alpha = 72.5$ MeV only ^{6}Li*(0, 2.18 ± 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}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}Be*(0, 2.9) and $^6{\rm Li}_{\rm g.s.}$ (1982DO1F). See also (1981DE1C).

43. ^{11}B(p, ^{6}Li)^{6}Li $\qquad Q_{\rm m} = -12.215$

See (1980HO14; theor.).

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

Angular distributions of ^{6}Li ions are reported at $E_d = 13.6$ MeV (1983DO1E), 19.5 MeV (1971GU07) for transitions to ^{7}Li*(0, 0.48). See also (1974AJ01).

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

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

46. ^{12}C(γ, pnα)^{6}Li $\quad Q_m = -31.8707$

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

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

Angular distributions of the ^{6}Li ions corresponding to the transition to ^{7}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 ^{5}He and ^{6}Li clusters as the dominant mechanism: see (1974AJ01, 1979AJ01). See also (1979HA1D; theor.).

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

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

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

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

50. (a) ^{12}C(α, ^{10}B)^{6}Li $\quad Q_m = -23.710$

(b) ^{12}C(α, dα)^{10}B $\quad Q_m = -25.1858$

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

51. ^{12}C(^{10}B, ^{16}O)^{6}Li $\qquad Q_\mathrm{m} = 2.7017$

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

52. ^{13}C(p, ^{8}Be)^{6}Li $\qquad Q_\mathrm{m} = -8.613$

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

53. ^{16}O(d, ^{12}C)^{6}Li $\qquad Q_\mathrm{m} = -5.687$

See (1980AJ01).

54. ^{16}O(^{3}He, ^{13}N)^{6}Li $\qquad Q_\mathrm{m} = -9.237$

See (1981AJ01).

55. ^{16}O(α, ^{14}N)^{6}Li $\qquad Q_\mathrm{m} = -19.261$

See (1981AJ01).

56. ^{19}F(^{3}He, ^{16}O)^{6}Li $\qquad Q_\mathrm{m} = 4.096$

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

^{6}Be

(Figs. 6 and 7)

GENERAL: See also (1979AJ01).

Model calculations: (1979SH1C, 1981HO23, 1982DE42, 1982HO05, 1982KR1B, 1982NG01, 1982VO01, 1983DE16).

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

Table 6.6: Energy levels of ^{6}Be

E_x (MeV ± 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) ^{3}He(^{3}He, γ)^{6}Be — $Q_m = 11.489$
   (b) ^{3}He(^{3}He, p)^{5}Li — $Q_m = 10.90$ — $E_b = 11.489$
   (c) ^{3}He(^{3}He, 2p)^{4}He — $Q_m = 12.8596$
   (d) ^{3}He(^{3}He, ^{3}He)^{3}He
   (e) ^{3}He(^{3}He, pd)^{3}He — $Q_m = -5.4936$
   (f) ^{3}He(^{3}He, 2p)^{2}H^{2}H — $Q_m = -10.987$
   (g) ^{3}He(^{3}He, 3p)^{3}H — $Q_m = -6.9544$

The yield of γ-rays to ^{6}Be*(1.7) (reaction (a)) increases smoothly from 0.4 to 9.3 μb (assuming isotropy) for $0.86 < E(^3\text{He}) < 11.8$ MeV (90°). No transitions were observed to ^{6}Be(0) [$\sigma < 0.01$ μb at $E(^3\text{He}) = 1.4$ MeV]. This is understood in terms of a direct capture of ^{3}He by ^{3}He 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 ^{33}F cluster resonance which decays by an E1 transition to ^{6}Be*(1.7). The γ-ray angular distributions are consistent with $J^\pi = 3^-$ (1974VE01).

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

Measurements of the total cross section for reaction (c) have been carried out for $E(^3{\rm He}) = 60$ keV to 2.2 MeV. The measurements of (1974DW01), down to $E_{\rm c.m.} = 30$ 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): $\theta_{\rm p}^2 \approx 3 \times 10^{-6}$ (1974DW01). The cross section factor $S(E_{\rm c.m.}) = [5.2 - 2.8E_{\rm c.m.} + 1.4E_{\rm c.m.}^2]$ MeV · b [error in S is $\pm$ 20% for $E_{\rm c.m.} > 40$ 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 $E(^3{\rm He}) = 3$ to 32 MeV [see (1979AJ01)] and at 120 MeV (1980TA11; also inelastic processes). The excitation function shows a smooth monotonic behavior except for an anmaly at $E(^3{\rm He}) = 25$ MeV in the $L = 3$ partial wave corresponding to a broad state in ^{6}Be at $E_{\rm x} \approx 24$ MeV. Polarization measurements have been carried out at $E(^3\vec{\rm He}) = 17.9$ 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 $E_{\rm x} \approx 23.4(4^-)$, $26.2(2^-)$ 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 $E(^3{\rm He}) = 120$ MeV: large peaks were observed which appear to correspond to ^{3}He–d quasi-free scattering followed by p–d FSI. No evidence was seen for excited states of ^{3}He (1978FU08). See also (1980TA11). At $E(^3{\rm He}) = 50$, 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}He(^{3}He, n)^{6}Be $\qquad Q_{\rm m} = -9.089$

Neutron groups to ^{6}Be*(0, 1.7) have been observed at $E(^3{\rm He}) = 19.4$ 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}Be with $E_{\rm x} \lesssim 5$ MeV, not for a state near the ^{3}He threshold at 11.5 MeV: see (1979AJ01).

3. (a) ^{6}Li(p, n)^{6}Be $\qquad Q_{\rm m} = -5.070$
(b) ^{6}Li(p, pn)^{5}Li $\qquad Q_{\rm m} = -5.66$

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

(b) (1977WA05) report, at $E_p = 47$ MeV, some evidence for sequential decay via ^{6}Be*(15.5 ± 2, 24 ± 2). See also (1979RA1B, 1980GO1J), (1982PE06) and (1980BA2H, 1980DU16, 1983GU1G; theor.).

4. ^{6}Li(^{3}He, t)^{6}Be $\qquad Q_m = -4.307$

Triton groups have been observed to ^{6}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 α+p+p decay of $^6\text{Be}_{\text{g.s.}}$ 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}B.

5. ^{6}Li(^{6}Li, ^{6}He)^{6}Be $\qquad Q_m = -7.795$

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

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

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

^{6}B
(Not illustrated)

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

^{6}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. Hagelberg, 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

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

1976VO1A Von Oertzen and Flynn, Ann. Phys. 95 (1976) 326

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. (USSR) 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; Phys. Abs. 522 (1977)

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 (Nat. Bur. Standards, Wash., DC, 1977) p. 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 (Nat. Bur. Standards, Wash., DC, 1977) p. 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

1977TU1B 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, in Clustering, Winnipeg 1978, 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, in Clustering, Winnipeg 1978, 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. 220 (1978) 606

1978CH1C Chant, in Clustering, Winnipeg 1978, AIP Conf. Proc. 47 (1978) 415

1978CH1D Chen, Lu and Vu, Phys. Energ. Fortis Phys. Nucl. (China) 2 (1978) 267; Phys. Abs. 78290 (1978)

1978DE13 V.P. Denisov and I.Y. Chubukov, Yad. Fiz. 27 (1978) 882

1978DU1B Dubna-Warsaw-Leningrad Collaboration, Yad. Fiz. 27 (1978) 1246

1978DU1C Dubovoi, Izv. Akad. Nauk SSSR Ser. Fiz. 43 (1979) 2111

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, in Clustering, Winnipeg 1978, 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. C18 (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. C18 (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. (John Wiley and Sons, Inc., New York, 1978)

1978MA1B Makowska-Rzeszutko et al., Proc. Int. Conf. on Resonances in Heavy Ion Reactions, Hvar, 1977 (North-Holland, Netherlands, 1978) p. 407; Phys. Abs. 13344 (1979)

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. C18 (1978) 1764

1978PL1A Plattner, in Few Body Syst. and 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, in Few Body Syst. and 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. C17 (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; Phys. Abs. 26384 (1979)

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. C18 (1978) 2395

1978TA1A Tang, Lemere and Thompson, Phys. Rept. 47 (1978) 167

1978TH1A Thompson, in Clustering, Winnipeg 1978, 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, in Clustering, Winnipeg 1978, AIP Conf. Proc. 47 (1978) 352

1978WA1B Walter, in Clustering, Winnipeg 1978, 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., (Plenum Press, New York, 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 (19179) 512

1979AL1F Alard et al., Nucl. Instrum. Meth. Phys. Res. 160 (1979) 419

1979AL1H Alma-Ata-Dubna-Warsaw Collaboration, in Conf. Proc. TRIUMF, Vancouver (1979) Paper 6D23

1979AM1B Amann et al., Bull. Amer. Phys. Soc. 24 (1979) 819

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., in 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. Int., 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 (Springer-Verlag 1979) 385; Phys. Abs. 9260 (1980)

1979CA06 F. Catara and U. Lombardo, Nucl. Phys. A320 (1979) 373

1979CH1A Chen, Li and Jin. Phys. Energ. Fortis Phys. Nucl. (China) 3 (1978); Phys. Abs. 59068 (1979)

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., in 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, in 1978 RPI Symp. ”Photopion Nucl. Phys.”, (Plenum Press, New York, 1979) p. 51

1979DO1C Donnelly, in Houston, AIP Conf. Proc. 54 (1979) 367

1979DO1E Donnelly and Peccei, Phys. Rept. 50 (1979) 1

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. 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 Electromagnetic interact., Mainz (1979) 11

1979FR1C Franz et al., in Conf. Proc. TRIUMF, Vancouver (1979) Papers 5C5, 5C6

1979FR1D Frankfurt and Strikman, Phys. Lett. B83 (1979) 407

1979FU1D Fulton, Cormier and Herman, Bull. Amer. Phys. Soc. 24 (1979) 843

1979FU1E Fujii et al., Isotopenpraxis 15 (1979) 203

1979FU1F Fukunaga and Kakigi, Bull. Inst. Chem. Res. Kyoto Univ. (Japan) 57 (1979) 92; Phys. Abs. 27593 (1980)

1979GL10 U. Glawe, U. Strohbusch, 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

1979HA1D Hassan and Ismail, Atomkernernerg. Kerntech (Germany) 33 (1979) 215; Phys. Abs. 85467 (1979)

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 (Springer-Verlag 1979) p. 264; Phys. Abs. 97712 (1979)

1979KH01 S.A.E. Khallaf, Z. Phys. A289 (1979) 283

1979KI1C Kilian, in Houston, 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, in Long Distance Neutrino Detection-1978, 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) p.1; Phys. Abs. 22808 (1980)

1979LI1B Lin and Lesser, Bull. Amer. Phys. Soc. 24 (1979) 593

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., in Conf. Proc. TRIUMF, Vancouver (1979) Paper 5E12

1979ME07 G. Mechtersheimer, 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.”, (Plenum Press, New York, 1979) p. 245

1979MO1E Moss et al., in 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. (USSR) 24 (1979) 591; Phys. Abs. 67746 (1979)

1979NE06 B. Neumann, J. Buschmann, H. Klewe-Nebenius, H. Rebel and H.J. Gils, Nucl. Phys. A329 (1979) 259

1979NO1A Norbeck, Bull. Amer. Phys. Soc. 24 (1979) 816

1979OH1A Ohashi et al., 1978 RPI Symp. “Photopion Nucl. Phys.”, (Plenum Press, New York, 1979) p. 193

1979OH1B Ohlsen et al., Bull. Amer. Phys. Soc. 24 (1979) 822

1979OS02 A. Osman, Phys. Rev. C19 (1979) 1127

1979PE1C Perroud, in 1978 RPI Symp. “Photopion Nucl. Phys., (Plenum Press, New York, 1979) p. 69

1979PI11 R. Pigeon and R.J. Slobodrian, Nuovo Cim. A52 (1979) 387

1979RA1B Rapaport and Bainum, Bull. Amer. Phys. Soc. 24 (1979) 830

1979RA1C Ramaty, Kozlovsky and Lingenfelter, Astrophys. J. Suppl. Series 40 (1979) 487

1979RE1A Redwine, in Houston, 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

1979SH1C Shapiro, Vona and Richardson, Bull. Amer. Phys. Soc. 24 (1979) 590

1979SH1D Shoda, Ohashi, Nakahara and Yamazaki, Int. Conf. Nucl. Phys. with Electromagnetic Interact., Mainz (1979) 6.11

1979SH1E Shoda, Nahara, Ohashi and Yamazaki, in Conf. Proc. TRIUMF, Vancouver (1979) Paper 5A4

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.”, (Plenum Press, New York, 1979) p. 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

1979SU1C Subramanian et al., Bull. Amer. Phys. Soc. 24 (1979) 593

1979SU1F Suzuki and Kubo, in Tsukuba Symp. on Polarization Phenomena, Nov. 1979, Ed. K.Yagi, (1979) p. 211

1979TA1C Taneichi, Ueno and Shoda, Nucl. Interact., Canberra, Australia (Springer-Verlag 1979) p. 456; Phys. Abs. 63169 (1980)

1979TI1A Titov, Int. Conf. Nucl. Phys. with Electromagnetic Interact., Mainz (1979) 6.14

1979TO1A Tonsfeldt, Clegg and Ludwig, Bull. Amer. Phys. Soc. 24 (1979) 652

1979TR1A Tryasuchev, Lebedev and Fetisov, in Conf. Proc. TRIUMF, Vancouver (1979) Paper 5A7

1979UL1A Ullrich, in Houston, 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.”, (Plenum Press, New York, 1979) p. 19

1979WI1B Wildermuth and Kanellopoulos, Rept. Prog. Phys. 42 (1979) 1719

1979YA1B Yao, Chen and King, in Conf. Proc. TRIUMF, Vancouver (1979) Paper 4C30

1979ZE01 A.F. Zeller, K.W. Kemper, D.C. Weisser, T.R. Ophel, D.F. Hebbard and A. Johnston, Nucl. Phys. A323 (1979) 477

1979ZI1A Ziegler, Proc. Mainz, 1979, Springer Lecrture 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

1980AK1C V.D. Aksinenko et al and 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. 44:5 (1980) 150

1980BE20 J.C. Bergstrom, Phys. Rev. C21 (1980) 2496; 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. 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. 4 (1980) 121; Phys. Abs. 52645 (1980)

1980HA1Y Hale and Dodder, Proc. Int. Conf. on Nucl. Cross Sect. for Tech., Knoxville, TN (1980) 650; Phys. Abs. 3987 (1982)

1980HI02 T.F. Hill and W.E. Frahn, Ann. Phys. (New York) 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. (Kyoto) 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. 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 Strohbusch, 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. Yamanouchi, 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) p. 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. C 22 (1980) 229

1980VO1B von Witsch et al., Proc. Int. Conf. on Nucl. Phys., Berkeley (1980) p. 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. 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) p. 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) p. 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 Avrigeanu 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. (19801) p. 208

1981BA20 O.L. Bartaya and J.V. Mebonia, Yad. Fiz. 33 (1981) 987

1981BA25 D. Baye and M. Hanck, J. Phys. 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) p. 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) p. 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. 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. 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

1981DA1K Dave et al., Bull. Amer. Phys. Soc. 26 (1981) 551

1981DE1C Devins et al., Bull. Amer. Phys. Soc. 26 (1981) 26

1981DE1T Dementij, Fartushnyj and Afanas'ev, Proc. Versailles Conf. (1981) p.127

1981DE1X Delbar, IPC-N-8102 (1981)

1981DO1E Dorr et al., Proc. Versailles Conf. (1981) p. 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) p. 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) p. 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) p. 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. 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) p. 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. 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. Klingenbeck, M. Dillig and M.G. Huber, Phys. Rev. Lett. 47 (1981) 1654

1981KN06 W. Knupfer 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. Kukulin, 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. Sutera, Nuovo Cim. A63 (1981) 530

1981LA1E Laget and Chretien-Marquet, Proc. Versailles Conf. (1981) p. 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 Liljestrand et al., Proc. Versailles Conf. (1981) 544

1981LL1A Lleshi and Mach, Proc. Versailles Conf. (1981) p. 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. Monnand 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

1981PA1C Parke and Lehman, Bull. Amer. Phys. Soc. 26 (1981) 566

1981PA25 M.V. Pasechnik, V.P. Badovsky, O.K. Gorpinich, 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

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

1981SE1B Seth, in Helsingor, June 1981 Conf., CERN 81-09 (1981) 655

1981SE1H Sennhauser et al., Proc. Versailles Conf. (1981) 330

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, in Proc. of 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, Physs. Lett. B106 (1981) 163

1981TO1H Tonapetyan et al., Proc. Versailles Conf. (1981) 121

1981TR1C Tryasuchev, Lebedev and Fetisov, Acta Phys. Pol. B12 (1981) 207

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. 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. Werntz and F. Cannata, Phys. Rev. C24 (1981) 349

1981WH01 W.R. Wharton and B.D. Keister, Phys. Rev. C23 (1981) 1141

1981WH1C Wharton et al., Bull. Amer. Phys. Soc. 26 (1981) 581

1981WH1D Wharton et al., Proc. Versialles Conf. (1981) 327

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., Heodelberg, 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. C25 (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. C25 (1982) 1986

1982BO1F Botchkarev et al., in Kiev (1982) 363

1982BO1J D.H. Boal, Phys. Rev. C25 (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

1982BO1Y Bogatin et al., Yad. Fiz. 36 (1982) 33

1982BO31 M. Bouten and M.C. Bouten, J. Phys. 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

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. C25 (1982) 1933

1982CO02 J. Cook, Nucl. Phys. A375 (1982) 238

1982CO12 J. Cook, K.W. Kemper and M.F. Vineyard, Phys. Rev. C26 (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

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, Fetisovm 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 Gorpinitch et al., in Kiev (1982) 295

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 Klingenbeck, in “Pion Production and Absorption in Nuclei-Indiana 1981”, 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. Pruys, 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 andf Kolesov, in Kiev (1982) 187

1982KO1U Komoda and Sekiya, Atomkernernerg. Kerntecyhy. 40 (1982) 119

1982KO1Z Kobos and Mackintosh, in Lecture Notes in Phys. 168, Springer-Verlag (Heavy-Ion Collisions Proc., La Rabida, 1982) 12

1982KR09 R. Krivec and M.V. Mihailovic, J. Phys. G8 (1982) 821

1982KR1B Krasmopolskii, Vorontsev, Sazonov and Kukulin, 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. 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. C26 (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. Sutera, Phys. Rev. C26 (1982) 1330

1982LE08 D.R. Lehman and M. Rajan, Phys. Rev. C25 (1982) 2743

1982LE10 M. LeMere, Y.C. Tang and H. Kanada, Phys. Rev. C25 (1982) 2902

1982LE11 D.R. Lehman, Phys. Rev. C25 (1982) 3146

1982LE1L Le Bornec and Willis, in “Pion Production and Absorption in Nuclei-Indiana 1981”, 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, in “Pion Production and Absorption in Nuclei-Indiana 1981”, 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. WinklerW. 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, in 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, in Conf. on Hypernucl. Kaon Phys., Heidelberg, June 1982 (1982) 72

1982PO1B Pomerantsev, Kukulin and Klimov, in Kiev (1982) p. 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 Rekalo, in Kiev (1982) p. 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. Schleputz, 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, in MSU (1982) p. 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

1982VO01 V.T. Voronchev, V.M. Krasnopol'sky, V.I. Kukulin and P.B. Sazonov, J. Phys. G8 (1982) 667

1982VO1B Vorontsev, Korsakov, Krasnopolskii and Kukulin, in Kiev (1982) p. 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. G8 (1982) 1699

1982YA1A A.I. Yavin, Nucl. Phys. A374 (1982) 297

1982ZH1J Zhao, Chen and Jin, Phys. Energ. Fortis Phys. Nucl. 6 (1982) 323

1982ZO01 J. Zofka, Czech. J. Phys. B32 (1982) 321

1982ZO1B Zofka, Sotona and Fetisov, Proc. Conf. on Hypernuclear and Kaon Phys., Heidelberg, June 1982 (1982) p. 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) p. 187

1983BA2G Barit, Dulkova, Kuznetsova and Sobolevski, in Moscow (1983) p. 317

1983BA3A Bang and Gaponov, in Moscow (1983) p. 203

1983BE1D Begzhanov et al., in Moscow (1983) 282

1983BU1F Burkova and Zhusupov, in Moscow (1983) p. 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

1983DO1E Dobrikov et al., in Moscow (1983) p. 327

1983DU1B Dubovitshenko and Zhusupov, in Moscow (1983) p. 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 Perespkin, in Moscow (1983) p. 455

1983GU1F Guliamov, Bekbaev, Kim and Islomov, in Moscow (1983) p. 427

1983GU1G Guliamov, Kim, Bekbaev and Islomov, in Moscow (1983) p. 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) p. 181

1983KE1E Kerimov, Ganiev, Elgavkhari and Safin, in Moscow (1983) p. 266, 268

1983KR05 V.M. Krasnopolski, V.I. Kukulin, P.B. Sazonov and V.T. Voronchev, Phys. Lett. B121 (1983) 96

1983KR1E Krasnopolski, Kukulin and Neudatchin, in Moscow (1983) p.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. Schimizu, T. Nakagawa, Y. Fukuchi and T. Mikumo, Phys. Rev. C27 (1983) 2621

1983SEZV U. Sennhauser, R. Engfer, P. Heusi, H.P. Isaak, H.S. Pruys 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.