

Energy Levels of Light Nuclei $A = 6$

F. Ajzenberg-Selove

University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396

Abstract: An evaluation of $A = 5-10$ was published in *Nuclear Physics A320* (1979), 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. [Reference](#) key numbers have been changed to the TUNL/NNDC format.

(References closed in 1978)

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

Table of Contents for $A = 6$

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

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

B. Tables of Recommended Level Energies:

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

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

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

C. [References](#)

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

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

${}^6\mathbf{n}$

(Not illustrated)

${}^6\mathbf{n}$ has not been observed in the interaction of 700 MeV protons or of 400 GeV protons with uranium: the cross section is $< 1.1 \times 10^{-3} \mu\text{b}$ (1977TU02; 700 MeV), $< 9 \mu\text{b}$ (1977TU03; 400 GeV). See also (1977DE08) [and footnote 10 in (1977TU03) and (1976GO1C, 1978SA1E; theor.)].

${}^6\mathbf{H}$

(Not illustrated)

${}^6\mathbf{H}$ has not been observed in the interaction of π^- and ${}^{14}\text{N}$: see (1972AG01).

${}^6\mathbf{He}$

(Figs. 4 and 7)

GENERAL: (See also (1974AJ01)).

Model calculations: (1974GH01, 1974IR04, 1975FI1C, 1975FI1D, 1975VE01, 1976CE03, 1976IR1B).

Astrophysical questions: (1976VI1A).

Electromagnetic interactions: (1975VE01).

Special reactions: (1974BO08, 1975FE1A, 1975ZE01, 1976BO08, 1976VA29, 1977FE1B, 1977YA1A).

Muon and neutrino capture and reactions: (1973MU1B, 1974CA04, 1975DO1F, 1976WA02, 1977PR1B, 1978DE15, 1978HW01).

Pion capture and reactions (See reaction 10 in ${}^6\text{Li}$. See also reaction 5 here.): (1974CA24, 1974DE1C, 1974KO27, 1975BE1G, 1975MO22, 1976AL1F, 1976CA20, 1976TR1A, 1976TZ1A, 1977AR1C, 1977AU02, 1977BA1Q, 1977CO1E, 1977DO06, 1977RA1A, 1977SH1C).

Other topics: (1973DZ1A, 1974GH01, 1974IR04, 1974KA1E, 1974MC04, 1975KU08, 1976IR1B, 1976RO1D, 1978PA02).

Ground state properties: (1974GH01, 1975BE31, 1976BE1G, 1976HA1E).

Mass of ${}^6\text{He}$: The mass excess of ${}^6\text{He}$ is 17593.7 ± 1.1 keV [see ${}^7\text{Li}(d, {}^3\text{He}){}^6\text{He}$] (1978RO01). Including previous values of the mass excess, the adopted mass excess of ${}^6\text{He}$ is 17594.0 ± 1.1 keV.

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

$$Q_m = 3.507$$

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

E_x (MeV \pm keV)	$J^\pi; T$	$\tau_{1/2}$ or $\Gamma_{\text{c.m.}}$	Decay	Reactions
g.s.	$0^+; 1$	$\tau_{1/2} = 808.1 \pm 2.0$ msec	β^-	1, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 18, 20
1.797 ± 25	$(2)^+; 1$	$\Gamma = 113 \pm 20$ keV	n, α	4, 5, 7, 10, 12, 13, 14, 15, 18, 20
(13.6 ± 500)		broad		12, 13
(15.5 ± 400)		broad	γ	5, 12, 13
(23.2 ± 700)		broad	γ	5, 12

The decay proceeds to the ground state of ${}^6\text{Li}$ ($J^\pi = 1^+$) and is a super-allowed Gamow-Teller transition. The half-life is 808.1 ± 2.0 msec (1974WI14): see Table 6.2 in (1966LA04) for a listing of earlier determinations. Using Q_m and this $\tau_{1/2}$, $\log ft = 2.910 \pm 0.002$: see (1974WI14, 1978RO01).

The internal bremsstrahlung spectrum has been measured by (1965BI09). The electron-neutrino correlation results are in good agreement with pure axial vector interaction. An upper limit to the possible admixture of tensor interaction is 0.4% (1963JO15). See also (1974AJ01, 1978CA1H) and (1974KU06, 1974VE02, 1975BE42, 1975CA35, 1975DO05, 1975KR14, 1976BE1E, 1976KU07, 1976WA02, 1977AZ02, 1977KL09, 1977SA1G, 1977TE1B, 1977WA1F, 1978PA02; theor.).

2. (a) ${}^3\text{H}(t, n){}^5\text{He}$ $Q_m = 10.44$ $E_b = 12.305$
 (b) ${}^3\text{H}(t, 2n){}^4\text{He}$ $Q_m = 11.3321$
 (c) ${}^3\text{H}(t, d){}^4\text{H}$ $Q_m = -9.2$
 (d) ${}^3\text{H}(t, 3n){}^3\text{He}$ $Q_m = -9.2457$

The cross section for neutron production (reactions (a) and (b)) rises monotonically from 40 keV to 2.2 MeV: see (1974AJ01). The zero-energy cross section factor $S_0 \approx 300$ keV \cdot b (1964PA1A). At $E_t = 1.90$ MeV, the total cross section for production of α -particles is 106 ± 5 mb (1958JA06). The cross section for reaction (b) increases monotonically for $E_t = 34$ to 160 keV (1977SE11). For a review of a_{nn} determinations see (1972KU08). See also (1974LA02). (1977BA23) find that the cross section for the reaction ${}^3\text{H}(t, d){}^4\text{He} + e^- + \bar{\nu}$ is ≤ 0.3 nb/sr at $E_t = 1.4$ MeV: see also reaction 1 in ${}^6\text{Be}$. For the earlier work on these reactions see (1974AJ01). See also (1975KU1C), (1975FO19; astrophysical questions) and (1974DE18, 1974NE1B; theor.).

3. ${}^3\text{H}(t, t){}^3\text{H}$ $E_b = 12.305$

Differential cross sections have been measured for $E_t = 1.58$ to 2.01 MeV: see (1974AJ01). See also (1975AB1C; theor.).

4. ${}^4\text{He}(t, p){}^6\text{He}$ $Q_m = -7.509$

At $E_t = 22$ (1971ST05) and 23 MeV (1978AJ02), angular distributions of the protons to ${}^6\text{He}^*(0, 1.80)$ have been measured. No other states are observed with $E_x \lesssim 4.2$ MeV (1971ST05). See also (1974LA1A).

5. ${}^6\text{Li}(\pi^-, \gamma){}^6\text{He}$ $Q_m = 13.060$

The excitation of ${}^6\text{He}^*(0, 1.8)$ and possibly of (broad) states at $E_x = 15.6 \pm 0.5$, 23.2 ± 0.7 and 29.7 ± 1.3 MeV is reported by (1973BA62) from E_γ measurements using a pair spectrometer. $(4.4 \pm 0.6)\%$ of stopped pions were absorbed radiatively: the branching ratios of ${}^6\text{He}^*(0, 1.8)$ are $(0.31 \pm 0.04)\%$ and $(0.15 \pm 0.03)\%$ respectively (1973BA62). (1978RE05) find $(0.34 \pm 0.03)\%$ and $(0.11 \pm 0.01)\%$, respectively.

6. ${}^6\text{Li}(n, p){}^6\text{He}$ $Q_m = -2.725$

Angular distributions have been measured at $E_p = 4.71$, 5.24 and 6.77 MeV (1977RO01: p_0). At $E_n = 14$ MeV the p_0 angular distribution is similar in shape to the angular distributions in ${}^6\text{Li}(p, p'){}^6\text{Li}^*(3.56)$ and in ${}^6\text{Li}(p, n){}^6\text{Be}_{g.s.}$. The ratios of the cross sections for these isobaric analog transitions are consistent with charge independence (1972ME05). For measurements at 800 MeV see (1977RI07). See also (1976KI1D, 1976MI1C), (1976SL2A) and ${}^7\text{Li}$.

7. ${}^6\text{Li}(t, {}^3\text{He}){}^6\text{He}$ $Q_m = -3.489$

The ground state angular distribution has been studied at $E_t = 17$ MeV. The weighted average of the experimental ratio of the differential cross sections at twelve angles ($\theta_{c.m.} \approx 28^\circ \rightarrow 72^\circ$) for population of ${}^6\text{He}_{g.s.}$ to that for population of the analog state, ${}^6\text{Li}^*(3.56)$, reached in the (t, t') reaction [see ${}^6\text{Li}$] is 2.28 ± 0.16 , rather than 2 as predicted by geometrical isospin considerations. Corrections based on a microscopic DWBA calculation of charge exchange and inelastic scattering do not appear to account for the difference (1976SH14). At $E_t = 22$ MeV only ${}^6\text{He}^*(0, 1.80)$ are populated with $E_x \lesssim 8.5$ MeV (1971ST05).

8. ${}^6\text{Li}({}^3\text{He}, 3p){}^6\text{He}$ $Q_m = -10.442$

See (1970BA41; $E(^3\text{He}) = 53.2$ MeV).

9. $^6\text{Li}(^6\text{Li}, ^6\text{Be})^6\text{He}$ $Q_m = -7.795$

Angular distributions have been studied at $E(^6\text{Li}) = 32$ and 36 MeV for the reactions involving the ground states of ^6He and ^6Be and for the inelastic scattering of ^6Li to $^6\text{Li}^*(3.56)$ [see reaction 18 in ^6Li]: these three states in ^6He , ^6Li and ^6Be are analog states. At 32 MeV the ratios of the differential cross sections for populating $^6\text{Li}^*(3.56)$ to those for populating $^6\text{He}_{\text{g.s.}}$ varies with angle from 0.17 to more than 1.65 . These variations indicate that charge dependent effects are important and that additional analysis would require a better knowledge of the wave functions of these isospin multiplet states than is currently available (1974WH01, 1974WH02, 1974WH07, 1975WH01).

10. $^7\text{Li}(\gamma, \text{p})^6\text{He}$ $Q_m = -9.976$

At $E_\gamma = 60$ MeV, the proton spectrum shows two prominent peaks attributed to $^6\text{He}^*(0 + 1.8, 18 \pm 3)$ (1973GA16, 1976MA34). (1974DE52) using bremsstrahlung radiation ($E_{\text{bs}} \leq 28$ MeV) suggest states at $E_x = 2.5$ and 8.5 MeV in ^6He , in addition to $^6\text{He}^*(0, 1.8)$. See also (1975MA1E).

11. $^7\text{Li}(\text{e}, \text{ep})^6\text{He}$ $Q_m = -9.976$

See ^7Li .

12. $^7\text{Li}(\text{n}, \text{d})^6\text{He}$ $Q_m = -7.751$

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

13. $^7\text{Li}(\text{p}, 2\text{p})^6\text{He}$ $Q_m = -9.976$

The summed proton spectrum at $E_p = 100$ MeV shows ${}^6\text{He}^*(0, 1.8)$ and a broad group centered at $E_x \approx 14$ MeV: the angular correlation for ${}^6\text{He}_{\text{g.s.}}$ is in quite good agreement with DWIA (1976BH02). In a lower resolution experiment (1967RO06) suggest states at $E_x = (13.4 \pm 0.5)$ MeV [$\Gamma = 1.2$ MeV] and (15.3 ± 0.3) MeV [partially resolved]. See also (1966LA04).



On the basis of a very accurate measurement of the Q -value of this reaction (1978RO01) find the atomic mass excess of ${}^6\text{He} = 17593.7 \pm 1.1$ keV. The weighted average of this value and of the previous determinations leads to 17594.0 ± 1.1 keV (1978RO01) which we adopt and use in calculating Q_m .

Angular distributions of the ${}^3\text{He}$ ions to ${}^6\text{He}^*(0, 1.80)$ have been measured at $E_d = 14.4$ and 22 MeV: they are consistent with $l = 1$ and therefore with $J^\pi = 0^+, 2^+$ for these two states: see (1974AJ01). There is no evidence for any other states of ${}^6\text{He}$ with $E_x < 10.7$ MeV (1971ST05). See also (1974DI1A, 1975DI1B) and reaction 28 in ${}^6\text{Li}$.



The energy of the first excited state is 1.797 ± 0.025 MeV, $\Gamma = 113 \pm 20$ keV (1965AJ01). ${}^6\text{He}^*(1.80)$ decays into ${}^4\text{He} + 2n$. The branching ratio Γ_γ/Γ_n is $< 4 \times 10^{-4}$ (1964HU1A), $\Gamma_\gamma/\Gamma_\alpha \leq 2 \times 10^{-6}$ (1966LI1A). Angular distributions of the α_0 and α_1 groups have been measured at $E_t = 13$ and 22 MeV: they are consistent with $l = 1$ pickup and therefore with $J^\pi = 0^+, 2^+$ for ${}^6\text{He}^*(0, 1.80)$: see (1974AJ01). No other α -groups are reported corresponding to ${}^6\text{He}$ states with $E_x < 12$ MeV (1965AJ01), $E_x < 24$ MeV (1971ST05: $E_t = 16 \rightarrow 22$ MeV; region between $E_x \approx 13$ and 16 MeV was obscured by presence of breakup α -particles). See also (1975KO1B).



See (1970BA41: $E({}^3\text{He}) = 53.2$ MeV). See also (1976WA12).



See (1968ST12).



Angular distributions have been measured at $E_n = 12.2, 14.1$ and 18.0 MeV (1976SM02: α_0, α_1), 13.99 MeV (1974PE06: α_0, α_1) and at 14.4 MeV (1967PA03: α_0). No other states are observed below $E_x \approx 7$ MeV (1974PE06). See also ^{10}Be .

$$19. \text{}^9\text{Be}(p, \text{}^4\text{Li})\text{}^6\text{He} \quad Q_m = -24.1$$

See (1970DE17).

$$20. \text{}^9\text{Be}(t, \text{}^6\text{Li})\text{}^6\text{He} \quad Q_m = -5.383$$

At $E_t = 21.5$ and 23.5 MeV, angular distributions have been studied for the transitions to $^6\text{He}^*(0, 1.80)$ and $^6\text{Li}^*(0, 2.19, 3.56)$ (1973VO08, 1975VO08): see discussion in reaction 32 in ^6Li . See also (1974CA04, 1975BR1E; theor.).

$$21. \text{}^9\text{Be}(\text{}^7\text{Li}, \text{}^{10}\text{B})\text{}^6\text{He} \quad Q_m = -3.390$$

See (1977KE09) and ^{10}B .

$$22. \text{(a) } ^{10}\text{B}(\text{}^7\text{Li}, \text{}^6\text{He})^{11}\text{C} \quad Q_m = -1.284$$

$$\text{(b) } ^{11}\text{B}(\text{}^7\text{Li}, \text{}^6\text{He})^{12}\text{C} \quad Q_m = 5.982$$

See (1968ST12).

$$23. \text{}^{18}\text{O}(\text{}^6\text{Li}, \text{}^{18}\text{F})\text{}^6\text{He} \quad Q_m = -5.161$$

See ^{18}F in (1978AJ03).

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

GENERAL: (See also (1974AJ01).)

Shell model: (1974KA11, 1975DI04, 1975GO1B, 1975VE01, 1976CE03, 1976GHZY).

Collective, rotational and deformed models: (1974BO25).

Cluster and α -particle models: (1972KR1A, 1973DO09, 1973LI23, 1974BA30, 1974GR24, 1974JA1K, 1974KA11, 1974NO03, 1974PA1B, 1974SH08, 1974WO1B, 1975BL1C, 1975GO08, 1975GR26, 1975HA48, 1975KR1A, 1975LE1A, 1975LI1C, 1975MI09, 1975NO03, 1975PA11, 1975RA32, 1975SH05, 1975TH1C, 1975VI08, 1976PL02, 1976RO02, 1976SC34, 1977BO35, 1977CH07, 1977SI10, 1977SM1A, 1977TA1C, 1978BO43, 1978DE1K, 1978HO1E, 1978IO1A, 1978LO1B, 1978OS1D).

Astrophysical questions: (1973TI1A, 1973TR1B, 1973WE1D, 1974AU1A, 1974CA1C, 1974JA11, 1974PA10, 1974RE1A, 1975BR1B, 1975ME1E, 1975TR1A, 1976AU1B, 1976AU1C, 1976BE1C, 1976CL1A, 1976CO1B, 1976EP1A, 1976GI1C, 1976HA1F, 1976SI1C, 1976VI1A, 1977CA1B, 1977MA1H, 1977MO1D, 1977MO1E, 1977SC1D, 1977WE1D, 1978AU1C, 1978DW1A).

Electromagnetic transitions: (1973WE18, 1974HA1C, 1974KU06, 1974MU13, 1974NO03, 1974VE02, 1974VE10, 1974YA01, 1975VE01, 1976KU07, 1977DO06, 1978KI08).

Special levels: (1974DZ07, 1974IR04, 1974KA11, 1974KU06, 1975DI04, 1975DO05, 1975LI20, 1975LO1D, 1975SH01, 1976IR1B, 1976PR07, 1977FA09, 1978FA1C, 1978HO1E).

Applied work: (1975GE1C, 1977BR1H, 1977MO1B, 1978KA1E).

Special reactions: (1973SI38, 1974BA70, 1974BO08, 1974JA11, 1974LA18, 1974PA10, 1974QU01, 1974TI02, 1975BA1G, 1975EC02, 1975KU01, 1975RA14, 1975RA21, 1975ZE01, 1976BE67, 1976BO08, 1976BU16, 1976CRZX, 1976LE1F, 1976LO03, 1976MI13, 1976NA11, 1976OS04, 1976RA1C, 1976RO12, 1977AU1B, 1977BO21, 1977CA22, 1977FE1B, 1977GI08, 1977MO1C, 1977PA27, 1977RE08, 1977RO23, 1977SH1D, 1977ST34, 1977YA1B, 1978BI08, 1978CA15, 1978DI04, 1978FL03, 1978GE1C, 1978GE04, 1978GR1F, 1978LA1F, 1978OT1A).

Muon and neutrino capture and reactions: (1973MU1B, 1974CA04, 1974DO1C, 1974EN10, 1974WA1C, 1974WI01, 1975BE42, 1975CH22, 1975DO1F, 1975FE1B, 1976WA02, 1977BA1P, 1977BA1R, 1977CA1C, 1977MU1A, 1977PR1B, 1977WA1F, 1977WA1G, 1978DE15, 1978HW01, 1978LE04, 1978MI1C).

Pion and kaon and other meson capture and reactions: (1972BA1C, 1973AL1A, 1973AR1B, 1973BA1G, 1973BA1E, 1973BA30, 1973NA20, 1973RO1F, 1973WI1A, 1974AM01, 1974CA24, 1974CL04, 1974DE1C, 1974GO04, 1974HU14, 1974JA1K, 1974KO27, 1974NO03, 1974TA18, 1974VE02, 1975AR02, 1975BA1L, 1975BE1G, 1975BR1D, 1975BU1A, 1975CA32, 1975DE1D, 1975MO22, 1975PN1A, 1975SA01, 1975TA1C, 1975VE05, 1975YA02, 1976AL1F, 1976AS1B,

1976BA1G, 1976BO32, 1976CA20, 1976DU1B, 1976DYZY, 1976HU1C, 1976HUZK, 1976LE1H, 1976LE1G, 1976LI26, 1976PI1B, 1976RO14, 1976TR1A, 1976TZ1A, 1977AB09, 1977AL1C, 1977AL1D, 1977AM1A, 1977AR1C, 1977AU02, 1977BA1Q, 1977BE1L, 1977BO1E, 1977BU25, 1977CO1E, 1977DO06, 1977HA1K, 1977HO1B, 1977MA35, 1977NA08, 1977RA1A, 1977SH1C, 1977SI03, 1977SI10, 1977TE1A, 1977VE05, 1977WA1H, 1978EI1A, 1978KA1C, 1978KI08, 1978MO01, 1978OT1A, 1978RE05, 1978WIZO).

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

E_x (MeV \pm keV)	$J^\pi; T$	$\Gamma_{\text{c.m.}}$ (keV)	Decay	Reactions
g.s.	$1^+; 0$		stable	1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54
2.185 ± 3	$3^+; 0$	26	γ, d, α	1, 2, 5, 6, 11, 12, 13, 14, 16, 17, 22, 25, 27, 29, 31, 32, 36, 37, 38, 45, 47
3.56289 ± 0.10	$0^+; 1$	< 5	γ	6, 9, 11, 13, 15, 16, 18, 27, 28, 29, 31, 32, 53
4.31 ± 30	$2^+; 0$	1700 ± 200^a	γ, d, α	1, 5, 11, 13, 14, 16, 27
5.366 ± 15	$2^+; 1$	540 ± 20	γ	1, 11, 13, 16, 27, 28, 29, 31, 41
5.65 ± 50	$1^+; 0$	1000^{+600}_{-400}	d, α	5, 13
21.0	$2^-; 1$	broad	$t, {}^3\text{He}$	1
21.5	$0^-; 1$	broad	$t, {}^3\text{He}$	1
25.0 ± 1000	$4^-; 1$	≈ 4000	$\gamma, n, t, {}^3\text{He}$	1
26.6 ± 400	$3^-; 0$	broad	$\gamma, n, t, {}^3\text{He}$	1
(31)	(3^+)	broad	$d, t, {}^3\text{He}, \alpha$	1

^a See, however, Tables 6.4 and 6.5.

Anti-proton interactions: (1977WE1E).

Other topics: (1973DZ1A, 1974DZ07, 1974IR04, 1974KU06, 1974MU13, 1974RE1B, 1974SE1B, 1975BL1C, 1975DO05, 1975ER09, 1975GO1B, 1975GO08, 1975HE09, 1975KU01, 1975KU08,

1975LI1C, 1975LI20, 1975LO1B, 1975NO03, 1975RA32, 1975SH01, 1976GHZY, 1976IR1B, 1976MA04, 1976MI1B, 1976MI1E, 1976PR07, 1977BL1B, 1977BU1D, 1977FA09, 1978DE1K, 1978FA1C, 1978FR1E, 1978JE1B, 1978LE05, 1978PA02).

Ground state properties: (1974BL1B, 1974DE1E, 1974DZ07, 1974KU06, 1974MU13, 1974PA1B, 1974SHYR, 1974VE02, 1974WO1B, 1974YA01, 1975BE31, 1975CA32, 1975DO05, 1975GO04, 1975JO1A, 1975RA32, 1976FU06, 1976GHZY, 1976RO02, 1977AN21, 1977BO35, 1977BU09, 1977DU01, 1977FA09, 1977MA35, 1978AN07, 1978BO43, 1978FA1C, 1978LE05, 1978ZA1D).

$$\mu = 0.8220467 (6) \text{ nm (1974BE50),}$$

$$Q = -0.644 (7) \text{ mb (V. Shirley, private communication).}$$

1. (a) ${}^3\text{He}({}^3\text{H}, \gamma){}^6\text{Li}$	$Q_m = 15.7940$	$E_b = 15.7940$
(b) ${}^3\text{He}({}^3\text{H}, \text{p}){}^5\text{He}$	$Q_m = 11.20$	
(c) ${}^3\text{He}({}^3\text{H}, \text{p}){}^4\text{He} + \text{n}$	$Q_m = 12.0959$	
(d) ${}^3\text{He}({}^3\text{H}, \text{n}){}^5\text{Li}$	$Q_m = 10.13$	
(e) ${}^3\text{He}({}^3\text{H}, \text{d}){}^4\text{He}$	$Q_m = 14.3205$	
(f) ${}^3\text{He}({}^3\text{H}, {}^3\text{H}){}^3\text{He}$		
(g) ${}^3\text{He}({}^3\text{H}, \text{dn}){}^3\text{He}$	$Q_m = -6.2573$	
(h) ${}^3\text{He}({}^3\text{H}, \text{p}2\text{n}){}^3\text{He}$	$Q_m = -8.4820$	
(i) ${}^3\text{He}({}^3\text{H}, 2\text{d}){}^2\text{H}$	$Q_m = -9.5263$	
(j) ${}^3\text{He}({}^3\text{H}, \text{pd}){}^3\text{H}$	$Q_m = -5.4936$	

Capture γ -rays (reaction (a)) to the first three states of ${}^6\text{Li}$ [$\gamma_0, \gamma_1, \gamma_2$] have been observed for $E({}^3\text{He}) = 0.5$ to 25.8 MeV, while the yields of γ_3 and γ_4 have been measured for $E({}^3\text{He}) = 12.6$ to 25.8 MeV: see (1974AJ01). The γ_2 excitation function does not show resonance structure. However, the $\gamma_0, \gamma_1, \gamma_3$ and γ_4 yields do show broad maxima at $E({}^3\text{He}) = 5.0 \pm 0.4$ [γ_0, γ_1], 20.6 ± 0.4 [γ_1], ≈ 21 [γ_3] and 21.8 ± 0.8 [γ_4] MeV. The magnitude of the ground state capture cross section is well accounted for by a direct capture model; that for the γ_1 capture indicates a non-direct contribution above $E({}^3\text{He}) = 10$ MeV, interpreted as a resonance due to a state with $E_x = 25 \pm 1$ MeV, $\Gamma_{\text{c.m.}} = 4$ MeV, $T = 1$ (because the transition is E1, to a $T = 0$ final state) [the E1 radiative width $|M|^2 \gtrsim 5.2/(2J + 1)$ W.u.], $J^\pi = (2, 3, 4)^-$, $\alpha + \text{p} + \text{n}$ parentage (1973VE09, 1973VE1B). 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 (1973VE1B). The ground and first excited state reduced widths for ${}^3\text{He} + \text{t}$ parentage, $\theta_0^2 = 0.8 \pm 0.2$ and $\theta_1^2 = 0.6 \pm 0.3$ (1971VE10, 1973VE09, 1973VE1B).

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 (1968IV01). Polarization measurements are reported for $E_{\bar{t}} = 9.02$ to 17.02 MeV (1977HA17) and $E(^3\text{He}) = 19.9 \rightarrow 33.3$ MeV (1977KA10, 1977VL01). A strong change occurs in the analyzing power angular distributions at $E_{\bar{t}} = 15$ 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 $d + \alpha$ (1977VL01).

For reactions (b) and (c) see ^5He and ^5Li and (1966LA04, 1974AJ01). See also (1975SC1F). 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 (1971KL04). The excitation function for n_0 has been measured for $E(^3\text{He}) = 2$ to 6 MeV (1975AB11) and for $E(^3\text{He}) = 14$ to 26 MeV (1974CH15: $\theta = 20^\circ$); evidence for a broad structure at $E(^3\text{He}) = 20.5 \pm 0.8$ MeV is reported [$^6\text{Li}^*(26.1)$]. Since reaction (d) is not restricted to $T = 0$ or $T = 1$ the structure could correspond to both $^6\text{Li}^*(25.0, 26.6)$ (1974CH15). See (1973NO07) for suggestions of ^6Li states at ≈ 16.2 and ≈ 17 MeV.

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 0.80 MeV: see (1974AJ01). Recent measurements are reported at $E(^3\text{He}) = 4.25$ to 9.85 MeV (1975SC1F) and 32 MeV (1974RO01). (1977HA42) have studied the polarization in this reaction at $E_{\bar{t}} = 9.02$, 12.86 and 17.02 MeV and report an excitation function at $\theta_{\text{c.m.}} = 90^\circ$ for $E_t = 9.02$ to 17.27 MeV. The angular distributions show marked deviations from the antisymmetric shape predicted by a simple particle-transfer model incorporating charge symmetry (1977HA42). An excitation curve for $E(^3\text{He}) = 17$ to 33 MeV shows resonant behavior at about $E_x = 31$ MeV, corresponding to the 3^+ , $T = 0$ state suggested in the elastic scattering (1978EN1A; prelim.).

For reaction (c) see (1972KU08, 1975SC1F). For reactions (c), (i) and (j) see (1973SL03, 1974AL01). See also (1974RE1C), (1975FO19; astronomical considerations), (1974LO1B, 1974SL04, 1976CO1E, 1976HA1C) and (1973KO14, 1973SL1C, 1974BR30, 1975KU09, 1975SH1B, 1975TA1A, 1977KA1D, 1977KA1G, 1978FE1C; theor.).

$$2. \ ^3\text{H}(\alpha, n)^6\text{Li} \quad Q_m = -4.7839$$

Neutron groups corresponding to $^6\text{Li}^*(0, 2.19)$ have been detected: see ^7Li (1967SP10). See also ^7Li .

$$3. \ ^4\text{He}(d, \gamma)^6\text{Li} \quad Q_m = 1.4735$$

Searches for γ -rays from resonant capture by ${}^6\text{Li}^*(3.56)$ [$J^\pi = 0^+$; $T = 1$] have been unsuccessful: the upper limit for its parity-forbidden heavy particle width, $\Gamma_{d\alpha}$, is 1.7×10^{-2} eV (1975BA06), 8×10^{-4} eV (1975BE44). The radiative capture has been observed at seven energies in the range $E_\alpha = 5.4$ to 25 MeV (1978RO1E; prelim.). See also (1974AJ01, 1977BI1D).

4. (a) ${}^4\text{He}(d, n){}^5\text{Li}$	$Q_m = -4.19$	$E_b = 1.4735$
(b) ${}^4\text{He}(d, p){}^5\text{He}$	$Q_m = -3.12$	
(c) ${}^4\text{He}(d, np){}^4\text{He}$	$Q_m = -2.2246$	
(d) ${}^4\text{He}(d, t){}^3\text{He}$	$Q_m = -14.3205$	
(e) ${}^4\text{He}(d, d)p + {}^3\text{H}$	$Q_m = -19.8140$	
(f) ${}^4\text{He}(d, d){}^2\text{H}^2\text{H}$	$Q_m = -23.8467$	

The proton yield gives no evidence of states in ${}^6\text{Li}$ with $6.5 < E_x < 8.7$ MeV (1964OH01). Polarization measurements at $E_d = 8.5, 10$ and 11 MeV (1971KE16) indicate scattering through the first two states of ${}^5\text{He}$. See also ${}^5\text{He}$ and ${}^5\text{Li}$ and (1974AJ01).

Reaction (c) has been studied at $E_d = 8.9$ MeV (1977SA21) to determine the n- α FSI [see ${}^5\text{He}$]; at $E_\alpha = 14.99$ MeV (1977KO18) to determine the n-p FSI and the sequential decay via states of ${}^6\text{Li}$; and at $E_d = 6.78$ MeV (1977NO1C), 8.7, 11.4 and 14.4 MeV (1975WA1G, 1976LI1V; \vec{n}), and 15 MeV (1978NA08), $E_\alpha = 18$ MeV (1976SA29, 1978SA07), 27.2 MeV (1977KO42), 39.4 MeV (1975KN02) and 100 MeV (1977LE18) and $E_d = 50$ MeV (1977LE18) for polarization and angular distribution measurements, most analyzed by the modified impulse approximation (MIA). (1976SA29) report destructive interference between the MIA matrix elements and the n-p FSI for $E_{np} \lesssim 0.6$ MeV. For other measurements to $E_\alpha = 165$ MeV see ${}^5\text{He}$, reaction 5(b) in (1974AJ01) and (1977FO07).

Studies of the t and ${}^3\text{He}$ differential cross sections (reaction (d)) at $E_d = 45.8$ MeV (1974RO01), $E_\alpha = 48.3$ MeV (1971WA20), 49.9, 64.3 and 82.1 MeV (1970GR07, 1972GR07) and 166 MeV (1974BA09), and of the vector analyzing power at $E_d = 32.41$ MeV (1976DA1C), show pronounced deviations from $90^\circ_{\text{c.m.}}$ symmetry which are angle and energy dependent [the asymmetry is appreciably less at 166 MeV (1974BA09)]. These deviations appear to be reproduced by (1974WE13) who used an exact finite-range multi-interaction DWBA analysis which includes all appropriate one-particle transfer reaction mechanisms, and Coulomb and other effects. See also (1974BA09).

For reactions (d) and (e) see (1972LI04). See also (1978MC1D), (1977MO1E; astrophys.), (1972CH1B, 1974NA10, 1975HE1D, 1976HA1C, 1976NA12, 1976SC34, 1977CL1A, 1977CO1B, 1977OS06, 1977OS1B, 1978KO13; theor.).

5. ${}^4\text{He}(d, d){}^4\text{He}$		$E_b = 1.4735$
---------------------------------------	--	----------------

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

E_d (MeV)	1.070 ± 0.003 ^b	4.8 ± 0.1 ^c	6.26 ± 0.05 ^d
$J^\pi; T$	$3^+; 0$	$2^+; 0$	$1^+; 0$
E_x (MeV)	2.185	4.7	5.65
reduced elastic width:			
$\gamma_\lambda^2, l = 0$			0.005
$\gamma_\lambda^2, l = 2$	0.80	1.6	2.5
reduced width for proton emission:			
$\gamma_\lambda^2, l = 1$		1.3	0.8
reduced width for neutron emission:			
$\gamma_\lambda^2, l = 1$		1.3	0.8
interaction radius a (fm)	3.5	4.2	4.12

^a See also Table 6.4 in (1974AJ01).

^b (1955GA74).

^c (1972SC14).

^d (1977HA34); error in E_d is estimated.

Elastic scattering differential cross-section measurements have been carried out at many energies up to $E_\alpha = 166$ MeV: see (1974AJ01). Recent measurements are those of (1978KA11) at $E_d = 7.8$ MeV and (1974WI13) at $E_d = 29.8, 32.3, 34.8, 37.3$ and 39.8 MeV. See also (1974CH1G). Polarization measurements have been carried out for E_d to 45 MeV [see listing in Table 6.3 of (1974AJ01)] and at $E_d = 2.38$ to 13.60 MeV (1976SC15), 4 to 5 and 10 to 12.5 MeV (1975GR09, 1975GR10), 6.04 to 7.05 MeV (1977HA34), 2 to 17 MeV (1978BR1F), 15 to 44.9 MeV (1976CO1D, 1976CO1H, 1976ST1D; preliminary results) and 30.6 MeV (1976HE1D; prelim.). See also (1977SE1C, 1978SE01).

Phase shift analyses have been carried out for $E_d = 0.3$ to 27 MeV: see (1974AJ01) and for $E_d = 3$ to 17 MeV by (1975GR09, 1975GR10) [using all available differential cross-section, vector and tensor analyzing power measurements, and $L \geq 4$] and in the vicinity of the $1^+; T = 0$ state ${}^6\text{Li}^*(5.65)$ by (1977HA34) [R -matrix analysis: see Table 6.3]. On the basis of these analyses it is found that the d-wave shifts are split and exhibit resonances at $E_x = 2.19$ (3D_3), 4.7 (3D_2) and 5.65 MeV (3D_1): see Table 6.3. The P-wave phase shifts remain small below $E_d = 17$ MeV, as do the F and G phase shifts (1975GR09, 1975GR10; see also for contour plots of analyzing power) [see, however, (1978BR1F)]. See also (1974DO1D).

The breakup of ${}^6\text{Li}$ with $E = 22.2$ and 23.0 MeV in the bombardment of ${}^{118}\text{Sn}$ and ${}^{208}\text{Pb}$ proceeds primarily by the sequential decay via ${}^6\text{Li}^*(2.19) \rightarrow \alpha + d$ (1977SC25). Total cross sections are reported at $E = 0.87$ and 2.1 GeV/nucleon by (1975JA1A). See also (1975CA1D, 1978FI1E) and (1973KO14, 1974BL1B, 1974HA21, 1974HE21, 1974TH05, 1975AB1C, 1975BA76, 1975DU09,

1975HA1E, 1975KU09, 1975LI1C, 1975PL1B, 1975TA1A, 1975WI1C, 1976BA1E, 1976CH1C, 1976HA1C, 1976KO21, 1976LE17, 1977CH07, 1977CO1B, 1977EL1B, 1977FL13, 1977FR12, 1978KA1F; theor.).

6. (a) ${}^4\text{He}({}^3\text{He}, \text{p}){}^6\text{Li}$ $Q_{\text{m}} = -4.0201$
 (b) ${}^4\text{He}({}^3\text{He}, \text{n}2\text{p}){}^4\text{He}$ $Q_{\text{m}} = -7.7182$

Angular distributions have been measured at $E({}^3\text{He}) = 8$ to 18 MeV and $E_{\alpha} = 42, 71.7$ and 81.4 MeV: see (1974AJ01). At $E_{\alpha} = 28, 63.7, 71.7$ and 81.4 MeV the α -spectra show that the sequential decay (reaction (b)) involves ${}^6\text{Li}^*(2.19)$ and possibly ${}^5\text{Li}$ (1973HA50, 1977KO09). See also ${}^7\text{Be}$.

7. ${}^4\text{He}(\alpha, \text{d}){}^6\text{Li}$ $Q_{\text{m}} = -22.3733$

See (1977KI12; $E_{\alpha} = 46.7$ to 49.5 MeV) and (1975MA1G; $E_{\alpha} = 140$ MeV). See also (1974KO1C; astrophys.) and ${}^8\text{Be}$.

8. ${}^6\text{He}(\beta^{-}){}^6\text{Li}$ $Q_{\text{m}} = 3.507$

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

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

The width, Γ_{γ} , of ${}^6\text{Li}^*(3.56) = 8.1 \pm 0.5$ eV (1969RA20): see Table 6.4; $E_{\text{x}} = 3569.0 \pm 1.7$ keV (1977WE1C), 3562.89 ± 0.10 keV (R.G.H. Robertson and J.A. Nolen, private communication).

10. (a) ${}^6\text{Li}(\gamma, \text{n}){}^5\text{Li}$ $Q_{\text{m}} = -5.66$
 (b) ${}^6\text{Li}(\gamma, \text{p}){}^5\text{He}$ $Q_{\text{m}} = -4.59$
 (c) ${}^6\text{Li}(\gamma, \text{d}){}^4\text{He}$ $Q_{\text{m}} = -1.4735$
 (d) ${}^6\text{Li}(\gamma, \text{t}){}^3\text{He}$ $Q_{\text{m}} = -15.7940$
 (e) ${}^6\text{Li}(\gamma, \text{pd}){}^3\text{H}$ $Q_{\text{m}} = -21.2875$
 (f) ${}^6\text{Li}(\gamma, \text{nd}){}^3\text{He}$ $Q_{\text{m}} = -22.0513$
 (g) ${}^6\text{Li}(\gamma, \pi^{+}){}^6\text{He}$ $Q_{\text{m}} = -143.074$

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

E_x (MeV)	$J^\pi; T$	Γ_{γ_0} (eV)	Multipolarity	Refs.
2.183 ± 0.009 ^b	$3^+; 0$	$(4.40 \pm 0.34) \times 10^{-4}$	E2	(1969EI06)
3.563 ± 0.010	$0^+; 1$	8.31 ± 0.36	M1	(1969EI06)
		8.1 ± 0.5 ^c	M1	(1969RA20)
		8.16 ± 0.19	M1	(1975BE42)
4.27 ± 0.04	$2^+; 0$	$(5.4 \pm 2.8) \times 10^{-3}$	E2	(1969EI06) ^d
5.37 ^e	$2^+; 1$	0.19 ± 0.04 ^f	M1	(1970HU09)

^a See also Tables 6.5 in (1974AJ01) and 6.6 in (1966LA04).

^b $B(E2)\uparrow = 21.8 \pm 0.8 e^2 \cdot \text{fm}^4$ (1974YE01).

^c From (γ, γ') .

^d $\Gamma = 690 \pm 120$ keV.

^e $E_x = 5.32 \pm 0.05$ MeV, $\Gamma = 330_{-40}^{+120}$ keV (1969HU05), $E_x = 5.38 \pm 0.02$ MeV, $\Gamma = 530 \pm 30$ keV (1970HU09), $E_x = 5.41 \pm 0.04$ MeV, $\Gamma = 540 \pm 30$ keV (1971NE03), $\Gamma = 440 \pm 100$ keV (1969EI06). The excitation of this state shows a transverse angular dependence (1969EI06).

^f Probable value but 0.08 ± 0.04 eV cannot be excluded: see (1970HU09).

The (γ, n) and the (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: see (1975BE1F, 1976BE1H).

The cross section for photoproton production (reaction (b)) is generally flat up to 90 MeV with a slight evidence of a hump at $E_\gamma \approx 16$ MeV (1970WO10). The spectra of photoprotons have been studied at $E_{\text{bs}} = 60, 80$ and 100 MeV; angular distributions of the highest energy protons were measured at $E_{\text{bs}} = 60$ MeV. The spectra show a broad asymmetric peak corresponding to the first two states of ${}^5\text{He}$ ($\sigma = 34.1 \pm 1.6 \mu\text{b}$) and another broad peak centered at $E_x \approx 20$ MeV (1976MA34). The cross section for reaction (c) is $\lesssim 5 \mu\text{b}$ 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 (1976SK02).

The 90° differential cross section for reaction (d) decreases monotonically for $E_\gamma = 18$ to 70 MeV: reaction (d) contributes $\approx \frac{1}{3}$ of the total cross section for ${}^6\text{Li} + \gamma$, consistent with a ${}^3\text{H} + {}^3\text{He}$ cluster description of ${}^6\text{Li}_{\text{g.s.}}$ with $\theta^2 \approx 0.68$. The agreement with the inverse reaction, ${}^3\text{H}({}^3\text{He}, \gamma)$ [see reaction 1] is good (1975SH05).

(1974DE1C, 1977AU02) have measured the yield of π^+ (reaction (g)) near threshold and up to 7.2 MeV above it: transitions are observed to ${}^6\text{He}^*(0, 1.8)$. See also (1974GO04, AL77Z, 1977AR1C) and (1975BE42, 1976RA42; theor.).

For the earlier work on ${}^6\text{Li} + \gamma$, see (1974AJ01). See also (1974BU1A, 1975BE60, 1975BE1G, 1975DO05; reviews), (1975FO19; astrophys.) and (1973CI1A, 1974CL01, 1974GH03, 1974SH08, 1974YA01, 1975LO1D, 1975LO1C, 1975NO1A, 1977TA1C; theor.).

11. (a) ${}^6\text{Li}(e, e){}^6\text{Li}$
 (b) ${}^6\text{Li}(e, ep){}^5\text{He}$ $Q_m = -4.59$
 (c) ${}^6\text{Li}(e, ed){}^4\text{He}$ $Q_m = -1.4735$
 (d) ${}^6\text{Li}(e, e\pi^+){}^6\text{He}$ $Q_m = -143.074$

Elastic scattering has been measured at $E_e = 85$ to 600 MeV [see (1974AJ01)] and at 82 to 292 MeV (1977BU09). The diffraction feature in F^2 indicates a lowering of the central charge density (1971LI10). A model independent analysis of the scattering yields $r_{\text{rms}} = 2.51 \pm 0.10$ fm (1972BU01).

Table 6.4 summarizes the results obtained in the inelastic scattering of electrons. Form factors have been measured for ${}^6\text{Li}^*(2.19)$ (1974YE01; $E_e = 60$ MeV), (1976BE22; $E_e = 107.6$ MeV) and ${}^6\text{Li}^*(3.56)$ (1975BE42; $E_e = 124.9$ MeV). Values at $E_e = 40.5$ and 50.5 MeV have also been obtained for ${}^6\text{Li}^*(5.37)$ (1977FA02). See (1974AJ01) for the earlier work. (1975BE42) find that the $1p$ harmonic oscillator radial wave functions do not give a good description of the form factor for ${}^6\text{Li}^*(3.56)$. The monopole breakup appears to be predominant near threshold but the influence of ${}^6\text{Li}^*(4.31)$ [$J^\pi = 2^+$] becomes important a few MeV above threshold (1976BE22). The inelastic electron groups are superposed on a large quasi-continuous background: see (1974AJ01) and (1974WH05). A study of the scattering at $E_e = 2.5$ and 2.7 GeV finds that a shell model analysis including short range correlations fits the data when a correlation parameter $q_e \approx 250$ MeV/ c is used (1974HE20).

Because of the astrophysical implications of a 0^+ state in ${}^6\text{Be}$ near the ${}^3\text{He} + {}^3\text{He}$ binding energy, several attempts have been made to locate the analog state in ${}^6\text{Li}$ at $E_x \approx 15.2$ MeV. The results are negative: e.g., $\Gamma_\gamma < 3$ eV for the M1 width of the $0^+ \rightarrow 1^+$ transition to ${}^6\text{Li}_{\text{g.s.}}$ (1973FA04). See also (1974AJ01). At $E_e = 700$ MeV the proton separation spectra (reaction (b)) are similar to those observed in (p, 2p) (1978NA05). See also (1973KU19, 1974HE17, 1975AN11). For reaction (c) see (1974GE10, 1974HE17, 1975GE12, 1976SK02, 1977TA1B). For π^+ production (reaction (d)) see (1977SH1C) and (1977TO20; theor.).

See also (1973BI1A, 1974DE1E, 1975FA1A) and (1973GA19, 1974BA30, 1974BE10, 1974GR24, 1974KU06, 1974ME24, 1974PE08, 1974TO08, 1974WA1C, 1975BA1H, 1975CA32, 1975DO1D, 1975GO30, 1975GR26, 1975JA1B, 1975JA1C, 1975ME27, 1975VI08, 1976BU1B, 1976DU05, 1976TO07, 1976WA02, 1977BR37, 1977KU12, 1977TO03, 1977WA1F, 1977WA1G, 1978BO24; theor.).

12. (a) ${}^6\text{Li}(n, n'){}^6\text{Li}^*$
 (b) ${}^6\text{Li}(n, nd){}^4\text{He}$ $Q_m = -1.4735$

Angular distributions have been reported at $E_n = 1.0$ to 14.2 MeV (see (1974AJ01)), 2.3 and 2.8 MeV (1978KN1D; n_0) and at $E_n = 4.0$ to 7.5 MeV (1976KN1D, 1976LA1C; n_0), 7.5 to 14 MeV (1976BI1B, 1976VO1B, 1977HO1A; n_0, n_1) and 14.1 MeV (1974HY01; n_0, n_1). See also

(1976KN1C, 1976MI1C, 1978LI1C). For reaction (b) see (1975AN1C) and (1978RI02; $E_n = 800$ MeV; the quasi-elastic and quasi-free yields of deuterons do not show special enhancement from $A^{1/3}$ systematics). See also ${}^7\text{Li}$ and (1978ST05; theor.).

13. (a) ${}^6\text{Li}(p, p){}^6\text{Li}$	
(b) ${}^6\text{Li}(p, 2p){}^5\text{He}$	$Q_m = -4.59$
(c) ${}^6\text{Li}(p, pd){}^4\text{He}$	$Q_m = -1.4735$
(d) ${}^6\text{Li}(p, p^3\text{H}){}^3\text{He}$	$Q_m = -15.7940$
(e) ${}^6\text{Li}(p, pn){}^5\text{Li}$	$Q_m = -5.66$
(f) ${}^6\text{Li}(p, 2d){}^3\text{He}$	$Q_m = -19.8258$

Proton angular distributions have been measured at $E_p = 0.5$ to 600 MeV: see (1966LA04, 1974AJ01) for a listing of the references. Inelastic groups corresponding to excited states of ${}^6\text{Li}$ are displayed in Table 6.5 (1957BR12, 1965HA17, 1975VO04, 1977KI08).

Angular correlations of protons (reaction (b)) are discussed in reaction 14 of ${}^5\text{He}$ (1974BH03). See also (1974MI05, 1975VO04, 1976COZN, 1977RO1E) and the earlier work described in reaction 12 of ${}^6\text{Li}$ in (1974AJ01).

Reaction (c) has been studied at $E_p = 9$ MeV to 1 GeV: see (1974AJ01) for the earlier work and (1975VO04; 11 MeV), (1976BOZP; $E_p = 28.5$ MeV, (1977BO35; $E_p = 39.8$ MeV), (1974DU10; 40 MeV), (1976RO02, 1977RO02; 100 MeV), (1975KI02; 590 MeV), (1978CH1H, 1978CH1K; 795 MeV) and (1976COZN; 800 MeV). See also (1974BE46, 1975MI1A, 1978DE1J). At $E_p = 100$ MeV the agreement with DWIA is good: $S_\alpha = 0.58 \pm 0.02$ (1977RO02). A study of reaction (f) indicates dominance, at $E_p = 100$ MeV, of the direct quasi-free reaction process ($p + \alpha \rightarrow d + {}^3\text{He}$): $S_\alpha = 0.52 \pm 0.03$ (1977CO07).

(1975VO04) have compared yields from reactions (b), (c) and (e): by comparing yields in the isospin allowed and forbidden (reaction (c)) channels, they set an upper limit of $\alpha^2 \leq 8 \times 10^{-3}$ for a possible $T = 0$ admixture in the $T = 1$ state, ${}^6\text{Li}^*(5.37)$. Reaction (e), at $E_p = 47$ MeV, may proceed by sequential decay involving ${}^6\text{Li}^*(21, 30)$ or states in ${}^6\text{Be}$ [see reaction 3 in ${}^6\text{Be}$] (1977WA05). See also (1974MI05, 1977BO35). Reaction (d), studied at $E_p = 100$ MeV, and compared with the $(p, p\alpha)$ reaction indicates that the ${}^3\text{He} + t$ parentage of ${}^6\text{Li}$ is comparable with the $\alpha + d$ parentage: the quantitative estimates depend strongly on the wave functions used in the estimate (1976RO02). See also (1976COZN) and (1974AJ01) for the earlier work.

See also ${}^7\text{Be}$, (1976MOZF, 1977BR33, 1978FR1D), (1973TH1A, 1976SL2A, 1977CO1C, 1978CH1G) and (1973DO09, 1973LI23, 1974GO1G, 1974HA36, 1974JA1F, 1974PR1C, 1974PR10, 1974RA1D, 1974SA09, 1974ZH01, 1975CH1C, 1975HA48, 1975LE1A, 1975PR1A, 1975SA01, 1976GO1E, 1976GO04, 1976OH04, 1978BE1K, 1978KA1C, 1978WO13; theor.).

14. (a) ${}^6\text{Li}(d, d'){}^6\text{Li}^*$

Table 6.5: Levels of ${}^6\text{Li}$ from ${}^6\text{Li}(\text{p}, \text{p}')$, ${}^6\text{Li}(\text{d}, \text{d}')$, ${}^7\text{Li}(\text{d}, \text{t})$, ${}^7\text{Li}({}^3\text{He}, \alpha)$ and ${}^9\text{Be}(\text{p}, \alpha)$ ^a

Reaction	Refs.	E_x (MeV \pm keV)	$\Gamma_{\text{c.m.}}$ (keV)
(p, p'), (d, d'), (d, t)	(1957BR12)	2.188 ± 6	26.3
(${}^3\text{He}, \alpha$)	(1968CO07)	2.17 ± 20	
(p, p'), (p, α)	(1957BR12)	3.560 ± 6	< 5
(p, p' γ), (p, $\alpha\gamma$)	(1977KI08)	3.5629 ± 0.6	
(p, p')	(1975VO04)	4.40 ± 0.12	1490 ± 150
(d, d')	(1975BR21)	4.32 ± 0.04	1820 ± 110
(${}^3\text{He}, \alpha$)	(1975SC31)	4.3 ± 0.1	600 ± 100 ^b
(p, p')	(1975VO04)	5.33 ± 0.08	560^{+340}_{-100}
(${}^3\text{He}, \alpha$)	(1968CO07)	5.34 ± 0.02	560 ± 40 ^{c,d}
(p, p')	(1975VO04)	5.7	1000^{+600}_{-400} ^d

^a See also Table 6.6 in (1974AJ01).

^b See also Table 6.4.

^c 600 ± 50 keV (1976DE30) [p, α].

^d See also (1965HA17).

(b) ${}^6\text{Li}(\text{d}, \text{pn}){}^6\text{Li}$	$Q_m = -2.2246$
(c) ${}^6\text{Li}(\text{d}, 2\text{d}){}^4\text{He}$	$Q_m = -1.4735$
(d) ${}^6\text{Li}(\text{d}, \alpha\text{p}){}^3\text{H}$	$Q_m = 2.5592$
(e) ${}^6\text{Li}(\text{d}, \alpha\text{n}){}^3\text{He}$	$Q_m = 1.7954$

Angular distributions of deuterons have been measured at $E_d = 4.5$ to 19.6 MeV: see (1974AJ01), (1976AB11; $E_d = 4$ to 10 MeV; d_0) and (1978FU03; $E_d = 13.6$ MeV; d_0). The $T = 1, 0^+$ state, ${}^6\text{Li}^*(3.56)$ is not appreciably populated. For a summary of the results on excited states see Table 6.5 (1957BR12, 1975BR21).

At $E_d = 21$ MeV reaction (b) shows spectral peaking (characteristic of 1S_0 for the pn system [$T = 1$]) when ${}^6\text{Li}^*(3.56)$ is formed, in contrast with the much broader shape (characteristic of 3S_1) seen when ${}^6\text{Li}^*(0, 2.19)$ are populated (1972BR03). A study of reaction (c) at $E_d = 52$ MeV shows that the α -clustering probability, $N_{\text{eff}} = 0.12^{+0.12}_{-0.06}$ 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 ${}^6\text{Li}$]. The α -particle and the deuteron clusters in ${}^6\text{Li}$ have essentially a relative orbital momentum of $l = 0$. The D-state probability of the ground state of ${}^6\text{Li}$ is $\approx 5\%$ of the S-state (1973HA31). Quasifree scattering is an important process even for $E_d = 6$ to 11 MeV (1973MI20). Interference effects are evident in reaction (c) proceed-

ing through ${}^6\text{Li}^*(2.19, 4.31)$: this is due to the experiment being unable to determine whether the detected particle was emitted first or second in the sequential decay (1968LE15). Reactions (c) and (d) studied at $E_d = 7.5$ to 10.5 MeV indicate that the three-body breakup of ${}^6\text{Li}$ at these low energies is dominated by sequential decay processes (1974MI10, 1977MI13). See also (1977BR33, 1977FU1B, 1977TE1A, 1978FU03), (1975GR41, 1975RO1B) and (1972CH1B, 1973JA1B, 1974CH58, 1974WE1B, 1975GO27, 1975KO1A; theor.).

15. ${}^6\text{Li}(t, t'){}^6\text{Li}^*$

At $E_t = 17$ MeV angular distributions have been measured for the tritons to ${}^6\text{Li}^*(0, 3.56)$ (1976SH14): see also reaction 7 in ${}^6\text{He}$.

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

(b) ${}^6\text{Li}({}^3\text{He}, t){}^3\text{He}{}^3\text{He}$ $Q_m = -15.7940$

Angular distributions have been measured at $E({}^3\text{He}) = 8$ to 217 MeV [see (1974AJ01)] and at 70 MeV (1975DA1A; abstract; d_0). Reaction (b) has been studied by (1977HA19) at 45 MeV. See also (1974AJ01), (1975GR41) and (1976VR01, 1978HA1H; theor.).

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

(b) ${}^6\text{Li}(\alpha, 2\alpha){}^2\text{H}$ $Q_m = -1.4735$

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

Angular distributions (reaction (a)) have been measured at $E_\alpha = 3.0$ to 166 MeV [see (1974AJ01)] and at $E_\alpha = 34.8, 39.8$ and 45.0 MeV (1975BE11; α_0, α_1). In the range $E_\alpha = 12.5$ to 18.5 MeV the optical model gives good agreement with the elastic angular distributions when a target spin-orbit potential is included (1971BI12). At $E_\alpha = 104$ MeV the elastic angular distribution shows a pronounced diffraction pattern (1969HA14) while at 166 MeV there is some backward peaking in addition to a single strong forward peak (1972BA89).

Reaction (b) has been studied at $E_\alpha = 50.4, 59.0, 60.5, 70.3$ and 79.6 MeV (1969PU01, 1971WA19) and at 700 MeV by (1975DO11). The low energy work, summarized in (1974AJ01), reported a width for the momentum distribution of α particles in ${}^6\text{Li}$ of 29 ± 2 MeV/ c , and an effective number of $\alpha + d$ clusters for ${}^6\text{Li}_{g.s.}$, $N_{\text{eff}} = 0.08 \pm 0.04$ (1971WA19). On the other hand (1975DO11), using a width parameter of 60.5 MeV/ c , find $N_{\text{eff}} = 1.05 \pm 0.12$, and suggest that the lower value reported by (1971WA19) arises from the low energies of the outgoing α -particles in that experiment and consequent nuclear distortions. For other measurements of reaction (b)

[$E_\alpha = 23.6$ to 64.3 MeV] see (1974AJ01). See also (1974MA49) and ^8Be . For reaction (c) see (1978CA1E).

See also ^{10}B , (1975GR41, 1975RO1B, 1977BR33, 1978CH1G) and (1973LI23, 1974CL03, 1974GR43, 1974HA36, 1974JA27, 1974NO03, 1975BA43, 1975CL01, 1975GO27, 1975MI09, 1975VO1B, 1976AV05, 1976ME20, 1977BE1M, 1977TR1A, 1978JA1C, 1978SU1C; theor.).

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

Angular distributions of ^6Li ions have been studied for $E(^6\text{Li}) = 3.2$ to 32 MeV [see (1974AJ01)] and at 32 and 36 MeV for the reaction in which both outgoing ions are excited to $^6\text{Li}^*(3.56)$ (1974WH01, 1974WH02, 1975WH01). The ratios for populating $^6\text{Li}^*(3.56)$ and $^6\text{He}_{\text{g.s.}} + ^6\text{Be}_{\text{g.s.}}$ [the analog states] vary with angle: see reaction 9 in ^6He . See also ^{12}C in (1975AJ02), (1975NO1C, 1978NO08) and (1976OG1A).

19. $^6\text{Li}(^9\text{Be}, ^9\text{Be})^6\text{Li}$

The elastic scattering has been studied at $E(^6\text{Li}) = 4.0$ and 6.0 MeV (1974VO06) and 24 MeV (1968DA20).

20. $^6\text{Li}(^{10}\text{B}, ^{10}\text{B})^6\text{Li}$

The elastic scattering has been studied at $E(^6\text{Li}) = 5.8$ MeV (1976PO02) and 30 MeV (1977KE09).

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

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

The elastic scattering has been studied recently at $E(\overline{^6\text{Li}}) = 9$ MeV (1978DR07) and $E(^6\text{Li}) = 4.5$ to 13 MeV (1976PO02), 36.4 and 40 MeV (1974BI04), 59.8 MeV (1975BI06) and 100 MeV (1977SC1B). For the earlier work, and for inelastic scattering to excited states of ^{12}C , see ^{12}C in (1975AJ02). See also (1975GR41, 1976OG1A, 1978FI1E) and (1975TH1C, 1976AM01, 1977KU07, 1978NO08, 1978PE1C; theor.). For reaction (b) see (1976PO02; 4.5 to 13 MeV) and (1978DR07).

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

(b) $^6\text{Li}(^{14}\text{N}, ^{14}\text{N})^4\text{He} + ^2\text{H} \quad Q_m = -1.4735$

See (1977KU06; $E(^{14}\text{N}) = 19.5$ MeV).

23. ${}^6\text{Li}({}^{16}\text{O}, {}^{16}\text{O}){}^6\text{Li}$

Elastic angular distributions have been measured at $E({}^6\text{Li}) = 4.5$ to 13 MeV (1976PO02) and at $E({}^{16}\text{O}) = 36$ MeV (1971OR02). See also (1975GR41, 1978FI1E) and (1976OH03, 1978PE1C; theor.).

24. ${}^6\text{Li}({}^{28}\text{Si}, {}^{28}\text{Si}){}^6\text{Li}$

See (1976PO02, 1977DE23).

25. ${}^7\text{Li}(\gamma, n){}^6\text{Li}$ $Q_m = -7.251$

The (γ, n_0) and (γ, n_1) transitions have been studied for $E_{\text{bs}} = 13$ to 25 MeV (1977FE05): see ${}^7\text{Li}$.

26. ${}^7\text{Li}(n, 2n){}^6\text{Li}$ $Q_m = -7.251$

See ${}^8\text{Li}$.

27. (a) ${}^7\text{Li}(p, d){}^6\text{Li}$ $Q_m = -5.026$
(b) ${}^7\text{Li}(p, pn){}^6\text{Li}$ $Q_m = -7.251$
(c) ${}^7\text{Li}(p, 2d){}^4\text{He}$ $Q_m = -6.499$
(d) ${}^7\text{Li}(p, pd){}^5\text{He}$ $Q_m = -9.62$

Angular distributions of deuterons (reaction (a)) have been studied at $E_p = 17.5$ to 155.6 MeV: see (1966LA04, 1974AJ01) and at $E_p = 16.7$ and 17.7 MeV (1977GU14; to ${}^6\text{Li}^*(0, 2.19, 3.56)$) and 185 MeV (1976FA03): to ${}^6\text{Li}^*(0, 2.19, 3.56, 4.31, 5.37)$). A DWBA analysis of the 185 MeV data leads to $C^2S = 0.87, 0.67, 0.24, (0.05), 0.14$, respectively (1976FA03). No other states are seen below $E_x \approx 20$ MeV (1976FA03). At $E_p = 800$ MeV ${}^6\text{Li}^*(2.19)$ is populated much more strongly than the ground state (1978SH1C). See also (1974KA28) and (1974AJ01). At $E_p = 12$ MeV (1969CO06) have studied the ratio of the cross section of the (p, d) reaction to that for the (p, \bar{d}) reaction, in which singlet deuterons are formed: $\sigma(p, d)/\sigma(p, \bar{d}) = 41.0$.

For reaction (b) see (1977WA05). A kinematically complete experiment at $E_p = 45$ MeV shows that reaction (c) proceeds via low-lying excited states of ${}^6\text{Li}$ (1972FU07). For reaction (d) see (1969DE04).

28. ${}^7\text{Li}(d, t){}^6\text{Li}$ $Q_m = -0.993$

A study at $E_d = 23.6$ MeV of the relative cross sections of the analog reactions ${}^7\text{Li}(d, t){}^6\text{Li}$ (to the first two $T = 1$ states at 3.56 and 5.37 MeV) and ${}^7\text{Li}(d, {}^3\text{He}){}^6\text{He}$ (to the ground and 1.80 MeV excited states) shows that ${}^6\text{Li}^*(3.56, 5.37)$ have high isospin purity ($\alpha^2 < 0.008$): this is explained in terms of antisymmetrization effects which prevent mixing with nearby $T = 0$ states (1971DE08). See also (1974AJ01) and (1975KU27, 1976KU07; theor.).

29. (a) ${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}$ $Q_m = 13.327$
 (b) ${}^7\text{Li}({}^3\text{He}, d\alpha){}^4\text{He}$ $Q_m = 11.854$
 (c) ${}^7\text{Li}({}^3\text{He}, tp){}^6\text{Li}$ $Q_m = -6.487$
 (d) ${}^7\text{Li}({}^3\text{He}, t{}^3\text{He}){}^4\text{He}$ $Q_m = -2.467$
 (e) ${}^7\text{Li}({}^3\text{He}, n{}^3\text{He}){}^6\text{Li}$ $Q_m = -7.251$

Angular distributions have been reported at $E({}^3\text{He}) = 5.1$ to 18 MeV: see (1974AJ01). At $E({}^3\text{He}) = 16$ to 18 MeV, in a region where there are no sharp or strong resonances in the compound nucleus, both the forward and the backward maxima in the α_0 angular distributions are reproduced by conventional DWBA without inclusion of exchange terms. However, the cross section derived from zero-range DWBA is a factor of 25 smaller than the observed cross section. For finite-range analysis no appreciable renormalization is necessary (1971ZA07). Excited states observed in this reaction are displayed in Table 6.5 (1968CO07, 1975SC31). See also (1969LI06). No other states are reported below $E_x = 10$ MeV (1968CO07).

Several attempts have been made to look at the isospin decay of ${}^6\text{Li}^*(5.37)$ [$J^\pi = 2^+$; $T = 1$] via ${}^7\text{Li}({}^3\text{He}, \alpha){}^6\text{Li}^* \rightarrow d + \alpha$: the branching is $< 2\%$ (1971CO22), $< 1\%$ (1973BR20). If $\Gamma(5.37) = 560$ keV, $\Gamma_d \leq 12$ keV and $\theta_d^2(5.37) \leq 0.5\%$ (1971CO22). See, however, (1973BR20). $\Gamma_p/\Gamma = 0.35 \pm 0.10$ and $\Gamma_{p+n}/\Gamma = 0.65 \pm 0.10$ for ${}^6\text{Li}^*(5.37)$ (1973AR05). See also (1976DA24) for reaction (b). For reactions (c), (d), (e) see (1976WA12). See also ${}^{10}\text{B}$, (1976STYX, 1978SM1B) and (1974WE12; theor.).

30. ${}^9\text{Be}(\gamma, t){}^6\text{Li}$ $Q_m = -17.689$

See ${}^9\text{Be}$.

31. (a) ${}^9\text{Be}(p, \alpha){}^6\text{Li}$ $Q_m = 2.125$
 (b) ${}^9\text{Be}(p, d){}^4\text{He}{}^4\text{He}$ $Q_m = 0.651$

Angular distributions of α -particles (reaction (a)) have been measured at $E_p = 0.11$ to 45 MeV [see (1974AJ01)] and at 4.6, 4.8 and 5.5 MeV (1974YA1C: $\alpha_0, \alpha_1, \alpha_2$). At $E_p = 45$ MeV the reaction appears to proceed by a direct process, with a rise at back angles attributed to a pickup process (1972DE01, 1972DE02). ${}^6\text{Li}^*(3.56)$ decays by γ -emission consistent with M1 (1954MA26); $\Gamma_\alpha/\Gamma < 0.025$ (1971AR37) [forbidden by spin and parity conservation]. (1974DU08) report a state of ${}^6\text{Li}$ at 14.0 MeV ($\Gamma < 0.1$ MeV) while (1976DE30) find no evidence for it but report a state at $E_x = 8.2 \pm 0.2$ MeV ($\Gamma = 2.2 \pm 0.2$ MeV). See also Table 6.5 (1977KI08).

At $E_p = 9$ MeV, the yield of reaction (b) is dominated by FSI through ${}^8\text{Be}^*(0, 2.9)$ and ${}^6\text{Li}^*(2.19)$ with little or no yield from a direct three-body decay (1971EM01).

See also ${}^{10}\text{B}$, (1966YO1A, 1976KI1C, 1977KI04), (1978PR1A; applied) and (1974LO1B).

32. ${}^9\text{Be}(t, {}^6\text{He}){}^6\text{Li}$ $Q_m = -5.383$

Angular distributions of ${}^6\text{He}_{g.s.} + {}^6\text{Li}_{g.s.}$, ${}^6\text{Li}_{g.s.} + {}^6\text{He}_{g.s.}$, ${}^6\text{Li}^*_{3.56} + {}^6\text{He}_{g.s.}$, and ${}^6\text{He}_{g.s.} + {}^6\text{Li}^*_{3.56}$ [the second listed ion being the detected one] have been measured at $E_t = 21.5$ and 23.5 MeV. In the latter two cases the final state is composed of two isobaric analog states: angular distributions are symmetric about $90^\circ_{c.m.}$, within the overall experimental errors. In the reaction leading to the ground states of ${}^6\text{He}$ and ${}^6\text{Li}$ differences from symmetry of as much as 40% are observed at forward angles. Angular distributions involving ${}^6\text{He}_{g.s.} + {}^6\text{Li}^*(2.19)$ and ${}^6\text{Li}_{g.s.} + {}^6\text{He}^*(1.8)$ have also been measured. This reaction appears to proceed predominantly by means of the direct pickup of triton or ${}^3\text{He}$ from ${}^9\text{Be}$ (1973VO08, 1975VO08). See also (1975BR1E; theor.) and ${}^{12}\text{B}$ in (1980AJ01).

33. ${}^9\text{Be}({}^3\text{He}, {}^6\text{Li}){}^6\text{Li}$ $Q_m = -1.895$

Angular distributions of the ${}^6\text{Li}$ ions have been obtained at $E({}^3\text{He}) = 6$ to 10 MeV [see (1974AJ01)]: these and the fairly smooth yield curves [see ${}^{12}\text{C}$ in (1975AJ02)] seem to suggest that the mechanism of the reaction is essentially direct (1972YO02). See also (1974CA04; theor.).

34. ${}^9\text{Be}({}^7\text{Li}, {}^{10}\text{Be}){}^6\text{Li}$ $Q_m = -0.439$

See (1977KE09; abstract).

35. (a) $^{10}\text{B}(\gamma, \alpha)^6\text{Li}$ $Q_m = -4.460$
 (b) $^{10}\text{B}(\text{n}, \text{n}\alpha)^6\text{Li}$ $Q_m = -4.460$
 (c) $^{10}\text{B}(\text{p}, \text{p}\alpha)^6\text{Li}$ $Q_m = -4.460$
 (d) $^{10}\text{B}(\text{d}, \text{d}\alpha)^6\text{Li}$ $Q_m = -4.460$
 (e) $^{10}\text{B}(\alpha, 2\alpha)^6\text{Li}$ $Q_m = -4.460$

See (1974AJ01) and ^{10}B here. For reaction (b) see (1977TU1D).

36. $^{10}\text{B}(\text{d}, ^6\text{Li})^6\text{Li}$ $Q_m = -2.987$

Angular distributions have been measured for the ^6Li ions to $^6\text{Li}^*(0, 2.19)$. The ground state transition in two orders of magnitude greater than predicted by the shell model (1971GU07).

37. $^{10}\text{B}(^3\text{He}, ^7\text{Be})^6\text{Li}$ $Q_m = -2.874$

Angular distributions of the ^7Be ions [$^7\text{Be}^*(0, 0.43)$] corresponding to formation of $^6\text{Li}^*(0, 2.19)$ have been measured at $E(^3\text{He}) = 30$ MeV (1970DE12, 1972OH01).

38. $^{10}\text{B}(\alpha, ^8\text{Be})^6\text{Li}$ $Q_m = -4.552$

At $E_\alpha = 72.5$ MeV only $^6\text{Li}^*(0, 2.18 \pm 0.03)$ are observed: the latter is excited much more strongly than is the ground state [S_α for the ground state is 0.4 that for $^6\text{Li}^*(2.19)$]. The angular distributions for both transitions are flat (1974WO1C, 1976WO11). See also (1974CE1A).

39. $^{10}\text{B}(^{16}\text{O}, ^{20}\text{Ne})^6\text{Li}$ $Q_m = 0.270$

See ^{20}Ne in (1978AJ03).

40. $^{11}\text{B}(\text{d}, ^7\text{Li})^6\text{Li}$ $Q_m = -7.192$

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

41. $^{11}\text{B}(^3\text{He}, ^8\text{Be})^6\text{Li}$ $Q_m = 4.570$

Angular distributions of ^6Li ions are reported at $E(^3\text{He}) = 3.0$ and 5.2 MeV. The reaction has been observed to lead to $^8\text{Be}^*(2.9) + ^6\text{Li}(0)$ and to $^8\text{Be}(0) + ^6\text{Li}^*(3.56)$. It is suggested that $^6\text{Li}^*(3.56)$ contains a far smaller admixture of the $(^3\text{He} + t)$ configuration than does $^6\text{Li}(0)$ (1964YO06, 1967YO02).

42. $^{12}\text{C}(p, ^7\text{Be})^6\text{Li}$ $Q_m = -22.568$

Angular distributions of the ^6Li ions corresponding to the transition to $^7\text{Be}^*(0 + 0.43)$ have been measured at five energies in the range $E_p = 36.0$ to 56.8 MeV and the data have been analyzed using zero-range and finite-range DWBA assuming the pickup of ^5He and ^6Li clusters as the dominant mechanism (1971HO25). See also (1971BR07) and (1978KU02; theor.).

43. $^{12}\text{C}(d, ^8\text{Be})^6\text{Li}$ $Q_m = -5.893$

Angular distributions of ^6Li ions are reported at $E_d = 19.5$ MeV (1971GU07; transition to $^8\text{Be}(0)$) and at 51.8 MeV (1970EI05; transitions to $^8\text{Be}^*(0, 2.9)$).

44. $^{12}\text{C}(^3\text{He}, ^9\text{B})^6\text{Li}$ $Q_m = -11.572$

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

45. $^{12}\text{C}(\alpha, ^{10}\text{B})^6\text{Li}$ $Q_m = -23.714$

Angular distributions have been obtained of ^6Li and ^{10}B ions corresponding to transitions to $^6\text{Li}^*(0, 2.19)$ and $^{10}\text{B}^*(0, 0.72, 2.15)$ (1972RU03; $E_\alpha = 42$ MeV).

46. $^{13}\text{C}(p, ^8\text{Be})^6\text{Li}$ $Q_m = -8.615$

At $E_p = 45$ MeV, the angular distribution of the ^6Li ions corresponding to $^8\text{Be}^*(0, 2.9)$ have been measured by (1971BR07). The production of ^6Li has been studied for $E_p = 10$ to 18 MeV (1975OB01). See also ^{14}N in (1976AJ04).

$$47. \text{ (a) } {}^{14}\text{N}(\alpha, {}^{12}\text{C}){}^6\text{Li} \quad Q_m = -8.799$$

$$\text{ (b) } {}^{14}\text{N}(\alpha, \alpha\text{d}){}^{12}\text{C} \quad Q_m = -10.2724$$

For reaction (a) see (1975AJ02). Reaction (b), studied at $E_\alpha = 22.9$ MeV, appears to involve ${}^6\text{Li}^*(2.19)$ (1969BA17).

$$48. {}^{16}\text{O}(\text{p}, {}^{11}\text{C}){}^6\text{Li} \quad Q_m = -22.185$$

See (1974AJ01).

$$49. {}^{16}\text{O}(\text{d}, {}^{12}\text{C}){}^6\text{Li} \quad Q_m = -5.688$$

Angular distributions of ${}^6\text{Li}$ ions have been obtained at $E_d = 19.5$ MeV corresponding to formation of ${}^{12}\text{C}^*(0, 4.4)$ (1971GU07). See also ${}^{12}\text{C}$ in (1975AJ02).

$$50. {}^{16}\text{O}({}^3\text{He}, {}^{13}\text{N}){}^6\text{Li} \quad Q_m = -9.239$$

Angular distributions of ${}^6\text{Li}$ ions have been measured at $E({}^3\text{He}) = 30.0$ and 40.7 MeV (1972OH01).

$$51. {}^{16}\text{O}(\alpha, {}^{14}\text{N}){}^6\text{Li} \quad Q_m = -19.263$$

Angular distributions have been obtained of ${}^6\text{Li}$ and ${}^{14}\text{N}$ ions corresponding to the population of the ground states (1972RU03; $E_\alpha = 42$ MeV).

$$52. {}^{19}\text{F}(\text{d}, {}^{15}\text{N}){}^6\text{Li} \quad Q_m = -2.540$$

See ${}^{15}\text{N}$ in (1976AJ04).

$$53. {}^{19}\text{F}({}^3\text{He}, {}^{16}\text{O}){}^6\text{Li} \quad Q_m = 4.094$$

Angular distributions have been measured at $E(^3\text{He}) = 11$ to 40.7 MeV involving $^6\text{Li}^*(0, 3.56)$ and various state of ^{16}O : see (1974AJ01). The angular distributions involving $^{16}\text{O}_{\text{g.s.}}$ show pronounced diffraction structure. The direct-reaction mechanism appears to involve coupling ^3He and t with $l = 0$ angular momentum to either a singlet or triplet state. The ratio $\sigma_{\text{g.s.}}/\sigma_{3.56} = 2.24 \pm 0.07$ rather than 3 (from the ratios of $2J + 1$) but this is accounted for by the Q -value dependence of the cross sections (1970KL09; $E(^3\text{He}) = 28$ MeV).

$$54. \ ^{19}\text{F}(\alpha, ^{17}\text{O})^6\text{Li} \quad Q_{\text{m}} = -12.340$$

See ^{17}O in (1977AJ02).

⁶Be
(Figs. 6 and 7)

GENERAL (See also (1974AJ01).)

Model calculations: (1974IR04, 1976CE1B, 1976HE07, 1976IR1B).

Other topics: (1973WE18, 1974DA1B, 1974MC04, 1975BE31, 1975FE01, 1977SI1D).

1. (a) ${}^3\text{He}({}^3\text{He}, \gamma){}^6\text{Be}$	$Q_m = 11.488$	$E_b = 11.488$
(b) ${}^3\text{He}({}^3\text{He}, p){}^5\text{Li}$	$Q_m = 10.89$	
(c) ${}^3\text{He}({}^3\text{He}, 2p){}^4\text{He}$	$Q_m = 12.8596$	
(d) ${}^3\text{He}({}^3\text{He}, 3p){}^3\text{H}$	$Q_m = -6.9544$	
(e) ${}^3\text{He}({}^3\text{He}, {}^3\text{He}){}^3\text{He}$		
(f) ${}^3\text{He}({}^3\text{He}, d){}^4\text{Li}$	$Q_m = -8.4$	
(g) ${}^3\text{He}({}^3\text{He}, 2p){}^2\text{H}^2\text{H}$	$Q_m = -10.987$	

The yield of γ -rays to ${}^6\text{Be}^*(1.7)$ (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 ${}^6\text{Be}(0)$ [$\sigma < 0.01$ μb at $E({}^3\text{He}) = 1.4$ MeV]. This is understood in terms of a direct capture of ${}^3\text{He}$ by ${}^3\text{He}$ 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) (1967HA24) [see below]. 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], $\Gamma_{\text{c.m.}} \approx 5$ MeV (1973VE1B, 1974VE01). This appears to be a ${}^{33}\text{F}$ cluster resonance which decays by an E1 transition to ${}^6\text{Be}^*(1.7)$. The γ -ray angular distributions are consistent with $J^\pi = 3^-$ (1974VE01).

For reaction (b) see ${}^5\text{Li}$ and (1976IR02; polarization measurements at $E({}^3\text{He}) = 13.6$ MeV).

Measurements of the total cross section for reaction (c) have been carried out for $E({}^3\text{He}) = 60$ to 300 keV (1974DW01) and 0.16 to 2.2 MeV (1969DW1A, 1971DW01). The measurements of (1974DW01), down to $E_{\text{c.m.}} = 30$ keV, eliminate the possibility of a resonance [which might help explain the observed absence of solar neutrinos], unless it is extremely narrow ($\Gamma \lesssim 100$ eV): $\theta_p^2 \approx 3 \times 10^{-6}$ (1974DW01). (1972BB10) has commented that such a high ${}^3\text{He} + {}^3\text{He}$ cluster for a ${}^6\text{Be}$ state at ≈ 11.5 MeV is not expected. The cross section factor $S(E_{\text{c.m.}}) = [5.2 - 2.8 E_{\text{c.m.}} + 1.4 E_{\text{c.m.}}^2]$ MeV \cdot b [error in S is $\pm 20\%$ for $E_{\text{c.m.}} > 40$ keV] (1974DW01). For the earlier work see (1966LA04, 1974AJ01). For polarization measurements (reaction (c)), see (1976SL1A). The cross section of reaction (c) has been compared with that for ${}^3\text{H}({}^3\text{He}, \alpha)d$ [see reaction 1 in ${}^6\text{Li}$] at the same c.m. energy (16 MeV). At $E({}^3\text{He}) = 13$ MeV a

Table 6.6: Energy levels of ${}^6\text{Be}$

E_x (MeV \pm keV)	$J^\pi; T$	$\Gamma_{\text{c.m.}}$	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	${}^3\text{He}$	1, 3
26	2^-	broad	${}^3\text{He}$	1, 3
27	3^-	broad	${}^3\text{He}$	1, 3

^a See Table 6.8 in (1974AJ01).

deviation from the ratio of 2 is observed, which is qualitatively accounted for by a distorted wave zero-range calculation (1974RO01).

The elastic scattering (reaction (e)) has been studied for $E({}^3\text{He}) = 3$ to 32 MeV [see (1974AJ01)], at 32 MeV (1974RO01) and at 120 MeV (1977TA1A; also inelastic processes). The optical model fit at 120 MeV appears to be poor (1977TA1A). The excitation function shows a smooth monotonic behavior except for an anomaly at $E({}^3\text{He}) = 25$ MeV in the $l = 3$ partial wave corresponding to a broad state in ${}^6\text{Be}$ at $E_x \approx 24$ MeV (1970JE02). Polarization measurements have been reported at $E({}^3\text{He}) = 4.33$ to 17.5 MeV: the polarization is consistent with zero at $\theta \approx 63^\circ$, consistent with a description of the scattering which leaves the P- and F-wave phase shifts unsplit (1972BO42, 1972HA64). Polarization measurements have also been carried out at $E({}^3\text{He}) = 8.9$ to 34.8 MeV on a polarized ${}^3\text{He}$ target (1974BA1G, 1975BI1C, 1976BA1H; abstracts) and at eight energies in the range $E({}^3\text{He}) = 17.91$ to 32.9 MeV (1978VL01). A two level R -matrix analysis of the phase shifts ($L \leq 5$) suggests three broad F-wave states at $E_x \approx 23.4$ (4^-), 26.2 (2^-) and 26.7 MeV (3^-) (1978VL01), in disagreement with the capture γ -ray results described above. Measurements of various of these reactions in order to obtain a total reaction cross section at $E({}^3\text{He}) = 17.9$ and 21.7 MeV have been carried out by (1975PO1B; abstract). For reaction (f) see also (1974AJ01). Reaction (g) has been studied at 50 and 78 MeV to look at the quasi-free scattering of the two deuterons. The cross sections are an order of magnitude smaller than those predicted by PWIA (1978AL21).

(1977DA11) have searched at $E({}^3\text{He}) = 15$ and 25 MeV for the ${}^3\text{He} + {}^3\text{He} \rightarrow \text{d} + \alpha + \text{e}^+ + \nu$ reaction [which had been reported by (1975SL01, 1976PIZS, 1977SL1B) to occur with a cross section of 3.4 nb/MeV \cdot sr at $E({}^3\text{He}) = 13.6$ MeV]. (1977DA11) find no evidence for this process with a cross section twenty times lower than reported by (1975SL01); thus the cross section for the p + p process at solar energies is not in error and cannot account for the solar neutrino puzzle.

At 120 MeV (1977FU1A) have studied ${}^3\text{He} + {}^3\text{He} \rightarrow \text{p} + \text{d} + {}^3\text{He}$ and have interpreted the results as possible evidence for a 3N resonance. See also (1971BA1A, 1974UL1B, 1975FE01, 1976BA1J, 1976MC04, 1976NE1A, 1976NO1C, 1978RO1D; astrophysical considerations), (1975TO1A, 1976MI1F, 1978SL1B), (1977MC1C; applied) and (1974DE18, 1976AS05, 1976HE07; theor.).

2. ${}^4\text{He}({}^3\text{He}, n){}^6\text{Be}$ $Q_m = -9.090$

Neutron groups to ${}^6\text{Be}^*(0, 1.7)$ have been observed at $E({}^3\text{He}) = 19.4$ to 38.61 MeV: see Table 6.8 in (1974AJ01) for the parameters of the first excited state. There is no evidence for other states of ${}^6\text{Be}$ with $E_x \lesssim 5$ MeV (1966EC01), nor for a state near the ${}^3\text{He}$ threshold at 11.5 MeV: for the latter the differential cross section is $\lesssim 7 \mu\text{b/sr}$ at $\theta_{\text{lab}} = 7.3^\circ$ (1977MC10; $E({}^3\text{He}) = 38.61$ MeV), $\lesssim 7.5 \mu\text{b/sr}$ at $\theta = 0^\circ$ (1975VI04; 36.2 MeV).

3. (a) ${}^6\text{Li}(p, n){}^6\text{Be}$ $Q_m = -5.070$
 (b) ${}^6\text{Li}(p, pn){}^5\text{Li}$ $Q_m = -5.66$

Neutron groups have been observed to ${}^6\text{Be}^*(0, 1.7)$ as has the ground state threshold. The width of the ground state is 95 ± 28 keV (1967HO01). The parameters of ${}^6\text{Be}^*(1.7)$ are displayed in Table 6.8 of (1974AJ01). Angular distributions have been reported at $E_p = 8.3$ to 49.4 MeV [see (1974AJ01)] and at 14.9 and 17.8 MeV (1974AR05; n_0). For a study at $E_p = 800$ MeV see (1977RI07). In reaction (b) (1977WA05) report, at $E_p = 47$ MeV, some evidence for sequential decay via ${}^6\text{Be}^*(15.5 \pm 2, 24 \pm 2)$. See also (1976SL2A) and (1975FE01; theor.).

4. ${}^6\text{Li}({}^3\text{He}, t){}^6\text{Be}$ $Q_m = -4.306$

Triton groups have been observed to ${}^6\text{Be}^*(0, 1.7)$. The width of the ground state is 89 ± 6 keV (1966WH01). 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 (1966MA36; $E({}^3\text{He}) + 40$ MeV), < 10 MeV (1966RO06; $E({}^3\text{He}) = 31$ MeV). An attempt has been made at $E({}^3\text{He}) = 25.5$ MeV (1973PA1C) and at 46.3 MeV (1973HA45) to observe the possible ${}^6\text{Be}$ state at $E_x = 11.5$ MeV, of astrophysical interest: $d\sigma/d\Omega \leq 0.19 \mu\text{b/sr}$ at $\theta_{\text{c.m.}} = 45^\circ$ at the lower energy; $d\sigma/d\Omega \leq 1.6 \mu\text{b/sr}$ at 8.4° and at 46.3 MeV. Upper limits for the spectroscopic factor are $S \leq 0.006$ (1973PA1C) and ≤ 0.001 (1973HA45). See also (1975CH1D). The ground state angular distribution shows a pronounced oscillatory character, consistent with $l = 0$; that for the 1.7 MeV state is relatively structureless (1966RO06). Angular distributions are also reported by (1972GI07; n_0 ; 27.0 MeV). The α -spectrum following the $\alpha + p + p$ 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. See also (1977HA19) and (1975FE01, 1978HA1H); theor.).

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

See reactions 9 in ${}^6\text{He}$ and 18 in ${}^6\text{Li}$ (1974WH01, 1974WH02, 1974WH07, 1975WH01).

6. ${}^9\text{Be}({}^3\text{He}, {}^6\text{He}){}^6\text{Be}$

$$Q_m = -9.690$$

See (1974AJ01).

${}^6\text{C}$

(Not illustrated)

See (1976GO1C; theor.).

References

(Closed 1978)

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.

- 1954MA26 R.J. Mackin, Jr., Phys. Rev. 94 (1954) 648
- 1955GA74 A. Galonsky and M.T. McEllistrem, Phys. Rev. 98 (1955) 590
- 1957BR12 C.P. Browne and C.K. Bockelman, Phys. Rev. 105 (1957) 1301
- 1958JA06 N. Jarmie and R.C. Allen, Phys. Rev. 111 (1958) 1121
- 1963JO15 C.H. Johnson, F. Pleasonton and T.A. Carlson, Phys. Rev. 132 (1963) 1149
- 1964HU1A Hunchen, Kropf and Waffler, Nucl. Phys. 58 (1964) 477
- 1964OH01 G.G. Ohlsen and P.G. Young, Phys. Rev. 136 (1964) B1632
- 1964PA1A Parker, Bahcall and Fowler, Astrophys. J. 139 (1964) 602
- 1964YO06 F.C. Young, P.D. Forsyth, M.L. Roush, W.F. Hornyak and J.B. Marion, Phys. Lett. 13 (1964) 50
- 1965AJ01 F. Ajzenberg-Selove, J.W. Watson and R. Middleton, Phys. Rev. 139 (1965) B592
- 1965BI09 J.K. Bienlein and F. Pleasonton, Nucl. Phys. 68 (1965) 17
- 1965HA17 D. Hasselgren, P.U. Renberg, O. Sundberg and G. Tibell, Nucl. Phys. 69 (1965) 81
- 1966EC01 S.F. Eccles, C. Wong and J.D. Anderson, Phys. Lett. 20 (1966) 190
- 1966LA04 T. Lauritsen and F. Ajzenberg-Selove, Nucl. Phys. 78 (1966) 1
- 1966LI1A I. Linck, J. Linck, R. Seltz and D. Magnac-Valette, J. Phys. (Paris) 27 (1966) C1-59
- 1966MA36 N. Mangelson, F. Ajzenberg-Selove, M. Reed and C.C. Lu, Nucl. Phys. 88 (1966) 137
- 1966RO06 P.C. Rogers and H.E. Wegner, Phys. Rev. Lett. 17 (1966) 148
- 1966WH01 W. Whaling, Phys. Rev. 150 (1966) 836
- 1966YO1A Young et al., Nucl. Instrum. Meth. Phys. Res. 44 (1966) 109
- 1967HA24 W.D. Harrison, W.E. Stephens, T.A. Tombrello and H. Winkler, Phys. Rev. 160 (1967) 752
- 1967HO01 J.L. Honsaker, Nucl. Phys. A90 (1967) 545
- 1967PA03 G. Paic, D. Rendic and P. Tomas, Nucl. Phys. A96 (1967) 476
- 1967RO06 J.C. Roynette, M. Arditì, J.C. Jacmart, F. Mazloum, M. Riou and C. Ruhla, Nucl. Phys. A95 (1967) 545

1967SP10 R.J. Spiger and T.A. Tombrello, Phys. Rev. 163 (1967) 964
 1967YO02 F.C. Young, P.D. Forsyth and J.B. Marion, Nucl. Phys. A91 (1967) 209
 1968CO07 C.L. Cocke, Nucl. Phys. A110 (1968) 321
 1968DA20 V.V. Davydov, A.A. Ogloblin, S.B. Sakuta and V.I. Chuev, Yad. Fiz. 7 (1968) 758;
 Sov. J. Nucl. Phys. 7 (1968) 463
 1968IV01 M. Ivanovich, P.G. Young and G.G. Ohlsen, Nucl. Phys. A110 (1968) 441
 1968LE15 J.C. Legg, W.D. Simpson and S.T. Emerson, Nucl. Phys. A119 (1968) 209
 1968ST12 R.A. Stryk and J.M. Blair, Phys. Rev. 169 (1968) 767
 1969BA17 K. Bahr, T. Becker, R. Jahr and W.R. Kuhlmann, Nucl. Phys. A129 (1969) 388
 1969CO06 B.L. Cohen, E.C. May, T.M. O'Keefe and C.L. Fink, Phys. Rev. 179 (1969) 962
 1969DE04 D.W. Devins, S.M. Bunch, H.H. Forster, J. Hoxhikian and C.C. Kim, Nucl. Phys.
 A126 (1969) 261
 1969DW1A Dwarakanath, Thesis, CalTech (1969)
 1969EI06 F. Eigenbrod, Z. Phys. 228 (1969) 337
 1969HA14 G. Hauser, R. Lohken, H. Rebel, G. Schatz, G.W. Schweimer and J. Specht, Nucl.
 Phys. A128 (1969) 81
 1969HU05 R.M. Hutcheon and H.S. Caplan, Nucl. Phys. A127 (1969) 417
 1969LI06 I. Linck, R. Bilwes, L. Kraus, R. Seltz and D. Magnac-Valette, J. Phys. (Paris) 30
 (1969) 17
 1969PU01 H.G. Pugh, J.W. Watson, D.A. Goldberg, P.G. Roos, D.I. Bonbright and R.A.J. Riddle,
 Phys. Rev. Lett. 22 (1969) 408
 1969RA20 V.K. Rasmussen and C.P. Swann, Phys. Rev. 183 (1969) 918
 1970BA41 A.D. Bacher, R.L. McGrath, J. Cerny, R. de Swiniarski, J.C. Hardy and R.J. Slobodrian,
 Nucl. Phys. A153 (1970) 409
 1970DE12 C. Detraz, H.H. Duhm and H. Hafner, Nucl. Phys. A147 (1970) 488
 1970DE17 R.M. Devries, G. Paic, J.L. Perrenoud, M. Singh and J.W. Sunier, Phys. Lett. B32
 (1970) 193
 1970EI05 W. Eichelberger, R.D. Plieninger and E. Velten, Nucl. Phys. A149 (1970) 441
 1970GR07 E.E. Gross, E. Newman, W.J. Roberts, R.W. Rutkowski and A. Zucker, Phys. Rev.
 Lett. 24 (1970) 473
 1970HU09 R.M. Hutcheon, R. Neuhausen and F. Eigenbrod, Z. Naturforsch. A25 (1970) 973
 1970JE02 J.G. Jenkin, W.D. Harrison and R.E. Brown, Phys. Rev. C1 (1970) 1622
 1970KL09 W.J. Klages, H.H. Duhm, H. Yoshida, P.E. Schumacher and C. Detraz, Nucl. Phys.
 A156 (1970) 65

- 1970WO10 C.F. Wong, R.M. Hutcheon, Y.M. Shin and H.S. Caplan, *Can. J. Phys.* 48 (1970) 1917
- 1971AR37 K.P. Artemov, V.Z. Goldberg, I.P. Petrov, V.P. Rudakov and I.N. Serikov, *Yad. Fiz.* 14 (1971) 1105; *Sov. J. Nucl. Phys.* 14 (1972) 615
- 1971BA1A Barnes, *Advances in Nucl. Phys.* 4 (1971) 133
- 1971BI12 H.G. Bingham, K.W. Kemper and N.R. Fletcher, *Nucl. Phys.* A175 (1971) 374
- 1971BR07 K.H. Bray, M. Jain, K.S. Jayaraman, G. LoBianco, W.T.H. Van Oers and Y.I. Wu, *Nucl. Phys.* A163 (1971) 649
- 1971CO22 C.L. Cocke and J.C. Adloff, *Nucl. Phys.* A172 (1971) 417
- 1971DE08 P.T. Debevec, G.T. Garvey and B.E. Hingerty, *Phys. Lett.* B34 (1971) 497
- 1971DW01 M.R. Dwarakanath and H. Winkler, *Phys. Rev.* C4 (1971) 1532
- 1971EM01 S.T. Emerson, V. Valkovic, W.R. Jackson, C. Joseph, A. Niiler, W.D. Simpson and G.C. Phillips, *Nucl. Phys.* A169 (1971) 317
- 1971GU07 H.H. Gutbrod, H. Yoshida and R. Bock, *Nucl. Phys.* A165 (1971) 240
- 1971HO25 A.B. Holman, J.-L. Perrenoud, J.C. Young, M.B. Epstein and B.T. Wright, *Nucl. Phys.* A174 (1971) 161
- 1971KE16 L.G. Keller and W. Haeberli, *Nucl. Phys.* A172 (1971) 625
- 1971KL04 J.T. Klopčič and S.E. Darden, *Phys. Rev.* C3 (1971) 2171; *Erratum Phys. Rev.* C4 (1971) 1494
- 1971LI10 G.C. Li, I. Sick, R.R. Whitney and M.R. Yearian, *Nucl. Phys.* A162 (1971) 583
- 1971NE03 R. Neuhausen and R.M. Hutcheon, *Nucl. Phys.* A164 (1971) 497
- 1971OR02 J. Orloff and W.W. Daehnick, *Phys. Rev.* C3 (1971) 430
- 1971ST05 R.H. Stokes and P.G. Young, *Phys. Rev.* C3 (1971) 984
- 1971VE10 E. Ventura, C.C. Chang and W.E. Meyerhof, *Nucl. Phys.* A173 (1971) 1
- 1971WA19 J.W. Watson, H.G. Pugh, P.G. Roos, D.A. Goldberg, R.A.J. Riddle and D.I. Bonbright, *Nucl. Phys.* A172 (1971) 513
- 1971WA20 G.J. Wagner, C.C. Foster and B. Greenebaum, *Nucl. Phys.* A174 (1971) 123
- 1971ZA07 A.R. Zander, K.W. Kemper and N.R. Fletcher, *Nucl. Phys.* A173 (1971) 273
- 1972AG01 N.M. Agababyan, Y.A. Batusov, S.A. Bunyatov, G.P. Gulkanyan, V.M. Sidorov and V.A. Yarba, *Yad. Fiz.* 15 (1972) 18; *Sov. J. Nucl. Phys.* 15 (1972) 10
- 1972BA1C Bamberger et al., *Proc. Int. Conf. on Few Particle Problems in Nucl. Interaction, Los Angeles, 1972* (1972) 182
- 1972BA89 D. Bachelier, M. Bernas, J.L. Boyard, H.L. Harney, J.C. Jourdain, P. Radvanyi and M. Roy-Stephan, *Nucl. Phys.* A195 (1972) 361
- 1972BB10 F.C. Barker, *Phys. Lett.* B42 (1972) 313

- 1972BO42 W.R. Boykin, S.D. Baker and D.M. Hardy, Nucl. Phys. A195 (1972) 241
- 1972BR03 W.J. Braithwaite, J.M. Cameron, J.G. Cramer, C.R. Rudy and W.W. Eidson, Phys. Lett. B38 (1972) 67
- 1972BU01 F.A. Bumiller, F.R. Buskirk, J.N. Dyer and W.A. Monson, Phys. Rev. C5 (1972) 391
- 1972CH1B Chemarin, Thesis, Univ. of Lyon (1972)
- 1972DE01 R.M. Devries, J.W. Sunier, J.-L. Perrenoud, M. Singh, G. Paic and I. Slaus, Nucl. Phys. A178 (1972) 417
- 1972DE02 R.M. Devries, J.-L. Perrenoud, I. Slaus and J.W. Sunier, Nucl. Phys. A178 (1972) 424
- 1972FU07 M. Furic, R.K. Cole, H.H. Forster, C.C. Kim, D.Y. Park, J. Rucker, H. Spitzer and C.N. Waddell, Phys. Lett. B39 (1972) 629
- 1972GI07 R.W. Givens, M.K. Brussel and A.I. Yavin, Nucl. Phys. A187 (1972) 490
- 1972GR07 E.E. Gross, E. Newman, M.B. Greenfield, R.W. Rutkowski, W.J. Roberts and A. Zucker, Phys. Rev. C5 (1972) 602
- 1972HA64 D.M. Hardy, R.J. Spiger, S.D. Baker, Y.S. Chen and T.A. Tombrello, Nucl. Phys. A195 (1972) 250
- 1972KR1A Kramer and Schenzle, Proc. Int. Conf. on Few Particle Problems in Nucl. Interaction, Los Angeles, 1972 (1972) 983
- 1972KU08 B. Kuhn, H. Kumpf, S. Parzhitsky and S. Tesch, Nucl. Phys. A183 (1972) 640
- 1972LI04 E.K. Lin, R. Hagelberg and E.L. Haase, Nucl. Phys. A179 (1972) 65
- 1972ME05 F. Merchez, R. Bouchez and A.I. Yavin, Nucl. Phys. A182 (1972) 428
- 1972OH01 I.K. Oh, C.S. Zaidins, C.D. Zafiratos and S.I. Hayakawa, Nucl. Phys. A178 (1972) 497
- 1972RU03 C. Rudy, R. Vandenbosch, P. Russo and W.J. Braithwaite, Nucl. Phys. A188 (1972) 430.
- 1972SC14 P.A. Schmelzbach, W. Gruebler, V. Konig and P. Marmier, Nucl. Phys. A184 (1972) 193
- 1972YO02 F.C. Young and A.R. Knudson, Nucl. Phys. A184 (1972) 563
- 1973AL1A Allardyce et al., Rept. RL-73-038, Rutherford High Energy Lab. (1973)
- 1973AR05 K.P. Artemov, V.Z. Goldberg, I.P. Petrov, V.P. Rudakov, I.N. Serikov and V.A. Timofeev, Yad. Fiz. 17 (1973) 225; Sov. J. Nucl. Phys. 17 (1974) 115
- 1973AR1B Arthur, Thesis LA 5230 T (1973)
- 1973BA1E Batty, Squier and Turner, Nucl. Phys. B67 (1973) 492
- 1973BA1G Backenstoss et al., Nucl. Phys. B66 (1973) 125
- 1973BA30 Y.D. Bayukov, L.S. Vorobev, V.M. Kolybasov, G.A. Leksin, V.L. Stolin, V.B. Fedorov and V.D. Khovanskii, Yad. Fiz. 17 (1973) 916; Sov. J. Nucl. Phys. 17 (1974) 479

- 1973BA62 H.W. Baer, J.A. Bistirlich, K.M. Crowe, N. de Botton, J.A. Helland and P. Truol, Phys. Rev. C8 (1973) 2029
- 1973BI1A Bishop, in Munich, 2 (1973) 460
- 1973BR20 K.H. Bray, J.M. Cameron, H.W. Fearing, D.R. Gill and H.S. Sherif, Phys. Rev. C8 (1973) 881
- 1973CI1A Ciofi degli Atti, Nucl. Many-Body Problem, 1972, Vol. 2 (1973) 365
- 1973DO09 I.S. Dotsenko and A.D. Fursa, Yad. Fiz. 17 (1973) 770; Sov. J. Nucl. Phys. 17 (1974) 402
- 1973DZ1A Dzhibuti, Izv. Akad. Nauk SSSR Ser. Fiz. 37 (1973) 1562
- 1973FA04 L.W. Fagg, W.L. Bendel, N. Ensslin and E.C. Jones, Jr., Phys. Lett. B44 (1973) 163
- 1973GA16 S.N. Gardiner, J.L. Matthews and R.O. Owens, Phys. Lett. B46 (1973) 186
- 1973GA19 S. Gamba, G. Ricco and G. Rottigni, Nucl. Phys. A213 (1973) 383
- 1973HA31 R. Hagelberg, E.L. Haase and Y. Sakamoto, Nucl. Phys. A207 (1973) 366
- 1973HA45 M.L. Halbert, D.C. Hensley and H.G. Bingham, Phys. Rev. C8 (1973) 1226
- 1973HA50 M.L. Halbert, A. van der Woude and N.M. O'Fallon, Phys. Rev. C8 (1973) 1621
- 1973JA1B Jain and Sarma, Recent Developments in Theor. Nucl. Phys., La Toussuire, 1973 (1973) S11/1
- 1973KO14 V.P. Korennoi, I.V. Kurdyumov, V.G. Neudachin and Y.F. Smirnov, Yad. Fiz. 17 (1973) 750; Sov. J. Nucl. Phys. 17 (1974) 391
- 1973KU19 E.L. Kuplennikov, N.G. Afanasev, V.A. Goldshtein, V.I. Ogurtsov and V.G. Vlasenko, Yad. Fiz. 18 (1973) 20; Sov. J. Nucl. Phys. 18 (1974) 10
- 1973LI23 T.K. Lim, Phys. Lett. B47 (1973) 397
- 1973MI20 D. Miljanic, T. Zabel, R.B. Liebert, G.C. Phillips and V. Valkovic, Nucl. Phys. A215 (1973) 221
- 1973MU1B Mukhopadhyay, Lett. Nuovo Cim. 7 (1973) 460
- 1973NA20 V.S. Nadezhdin, N.I. Petrov, V.I. Satarov and I.K. Vzorov, Yad. Fiz. 17 (1973) 1134; Sov. J. Nucl. Phys. 17 (1973) 590
- 1973NO07 U. Nocken, U. Quast, A. Richter and G. Schrieder, Nucl. Phys. A213 (1973) 97
- 1973PA1C Parker, Pisano, Cobern and Marks, Nature 241 (1973) 110
- 1973RO1F Roig and Pascual, Nucl. Phys. B66 (1973) 173
- 1973SI38 J. Sieminska and K. Soltynski, Acta Phys. Pol. B4 (1973) 639
- 1973SL03 I. Slaus, R.G. Allas, L.A. Beach, R.O. Bondelid, E.L. Petersen, J.M. Lambert and D.L. Shannon, Phys. Rev. C8 (1973) 444
- 1973SL1C Slaus, Nucl. Many-Body Problem, 1972, Vol. 1 (1973) 315

- 1973TH1A Thirion, in Munich, 2 (1973) 782
- 1973TI1A Tinsley, Explosive Nucleosynthesis (1973) 22
- 1973TR1B Truran, Cosmochemistry; Ed., Cameron (1973) 23
- 1973VE09 E. Ventura, J.R. Calarco, W.E. Meyerhof and A.M. Young, Phys. Lett. B46 (1973) 364
- 1973VE1B Ventura, Thesis, Stanford Univ. (1973)
- 1973VO08 W. von Oertzen, E.R. Flynn, J.D. Garrett and E. Cosman, Phys. Rev. Lett. 31 (1973) 724; Erratum Phys. Rev. Lett. 32 (1974) 34
- 1973WE18 C. Werntz and H. Uberall, Z. Phys. 265 (1973) 405
- 1973WE1D Webber, Lezniak, Kish and Damle, Astrophys. Space Sci. 24 (1973) 17
- 1973WI1A Wilkin et al., Nucl. Phys. B62 (1973) 61
- 1974AJ01 F. Ajzenberg-Selove and T. Lauritsen, Nucl. Phys. A227 (1974) 1
- 1974AL01 R.G. Allas, L.A. Beach, R.O. Bondelid, E.M. Diener, E.L. Petersen, J.M. Lambert, P.A. Treado and I. Slaus, Phys. Rev. C9 (1974) 787
- 1974AM01 J. Amato, R.L. Burman, R. Macek, J. Oostens, W. Schlaer, E. Arthur, S. Sobottka and W.C. Lam, Phys. Rev. C9 (1974) 501
- 1974AR05 U.R. Arifkhanov, M. Gulyamov, B.I. Islamov, M. Kayumov and E. Ergashov, Yad. Fiz. 19 (1974) 25; Sov. J. Nucl. Phys. 19 (1974) 12
- 1974AU1A Audouze and Tinsley, Astrophys. J. 192 (1974) 487
- 1974BA09 D. Bachelier, M. Bernas, J.L. Boyard, T. Hennino, J.C. Jourdain, P. Radvanyi and M. Roy-Stephan, Nucl. Phys. A219 (1974) 573
- 1974BA1G Bacher et al., Bull. Amer. Phys. Soc. 19 (1974) 1035
- 1974BA30 B.I. Barts and Y.L. Bolotin, Yad. Fiz. 19 (1974) 570; Sov. J. Nucl. Phys. 19 (1974) 288
- 1974BA70 G. Baroni, S. Di Liberto, S. Petrera and G. Romano, Nucl. Phys. A231 (1974) 521
- 1974BE10 J. Bernabeu and J. Ros, Nucl. Phys. A220 (1974) 1
- 1974BE46 J.L. Beveridge, R. Corfu, J.P. Egger, F. Foroughi, J. Piffaretti, J. Rossel, J. Arvieux, J.L. Durand and C. Perrin, Helv. Phys. Acta 47 (1974) 211
- 1974BE50 A. Beckmann, K.D. Boklen and D. Elke, Z. Phys. 270 (1974) 173
- 1974BH03 R.K. Bhowmik, C.C. Chang, P.G. Roos and H.D. Holmgren, Nucl. Phys. A226 (1974) 365
- 1974BI04 P.K. Bindal, K. Nagatani, M.J. Schneider and P.D. Bond, Phys. Rev. C9 (1974) 2154
- 1974BL1B Blokhintsev, JETP Lett. 19 (1974) 362

- 1974BO08 V.I. Bogatin, V.K. Bondarev, V.F. Litvin, O.V. Lozhkin, N.A. Perfilov, Y.P. Yakovlev and V.P. Bochin, *Yad. Fiz.* 19 (1974) 32; *Sov. J. Nucl. Phys.* 19 (1974) 16
- 1974BO25 M. Bouten and M.-C. Bouten, *Lett. Nuovo Cim.* 10 (1974) 161
- 1974BR30 R.E. Brown, F.S. Chwieroth, Y.C. Tang and D.R. Thompson, *Nucl. Phys.* A230 (1974) 189
- 1974BU1A Bulow and Forkman, IAEA, STI/DOC/10/156 (1974) 475
- 1974CA04 F. Cannata and C. Werntz, *Phys. Rev.* C9 (1974) 782
- 1974CA1C Canal, *Astrophys. J.* 189 (1974) 531
- 1974CA24 F. Cannata, C.W. Lucas, Jr. and C.W. Werntz, *Rev. Lett.* 33 (1974) 1316
- 1974CE1A Cerny, in *Nashville*, Vol. 2 (1974) 483
- 1974CH15 C.C. Chang and E. Ventura, *Phys. Rev.* C9 (1974) 1671
- 1974CH1G Chant, Burdzik, Leeman and Pugh, *Bull. Amer. Phys. Soc.* 19 (1974) 1035
- 1974CH58 I.P. Chernov, B.I. Kuznetsov, V.V. Kozyr and V.A. Matusevich, *Izv. Akad. Nauk SSSR Ser. Fiz.* 38 (1974) 2530; *Bull. Acad. Sci. USSR Phys. Ser.* 38 (1974) 58
- 1974CL01 D. Clement and W. Zahn, *Phys. Lett.* B48 (1974) 183
- 1974CL03 D. Clement, E.J. Kanellopoulos and K. Wildermuth, *Phys. Lett.* B52 (1974) 309
- 1974CL04 A.S. Clough, G.K. Turner, B.W. Allardyce, C.J. Batty, D.J. Baugh, W.J. McDonald, R.A.J. Riddle, L.H. Watson, M.E. Cage, G.J. Pyle et al., *Nucl. Phys.* B76 (1974) 15
- 1974DA1B Davis et al., *Lett. Nuovo Cim.* 10 (1974) 139
- 1974DE18 M.L.V.L. de Slobodrian, *Phys. Lett.* B50 (1974) 225
- 1974DE1C J. Deutsch, D. Favart, R. Prieels, B. Van Ostaeyen, G. Audit, N. de Botton, J.-L. Faure, Cl. Schuhl, G. Tamas, and C. Tzara, *Phys. Rev. Lett.* 33 (1974) 316
- 1974DE1E De Jager, De Vries and De Vries, *At. Data Nucl. Data Tables* 14 (1974) 479
- 1974DE52 V.P. Denisov and I.Y. Chubukov, *Yad. Fiz.* 20 (1974) 1106; *Sov. J. Nucl. Phys.* 20 (1975) 579
- 1974DI1A Didelez et al., *Bull. Amer. Phys. Soc.* 19 (1974) 1022
- 1974DO1C T.W. Donnelly, D. Hitlin, M. Schwartz, J.D. Walecka and S.J. Wiesner, *Phys. Lett.* B49 (1974) 8
- 1974DO1D Dodder, Crosthwaite and Ohlsen, *Bull. Amer. Phys. Soc.* 19 (1974) 477
- 1974DU08 A.D. Duisebaev, G.N. Ivanov, E.I. Kebin, Y.I. Nechaev, Y.V. Solovev, V.G. Sukharevskii and V.A. Khaimin, *Pisma Zh. Eksp. Teor. Fiz.* 19 (1974) 531; *JETP Lett.* 19 (1974) 280
- 1974DU10 J.L. Durand, J. Arvieux, C. Perrin and G. Perrin, *Phys. Lett.* B53 (1974) 57
- 1974DW01 M.R. Dwarakanath, *Phys. Rev.* C9 (1974) 805

- 1974DZ07 R.I. Dzhibuti and K.M. Sallam, *Izv. Akad. Nauk SSSR Ser. Fiz.* 38 (1974) 2054; *Bull. Acad. Sci. USSR Phys. Ser.* 38 (1974) 35
- 1974EN10 R. Engfer, H. Schneuwly, J.L. Vuilleumier, H.K. Walter and A. Zehnder, *At. Data Nucl. Data Tables* 14 (1974) 509
- 1974GE10 J.P. Genin, J. Julien, M. Rambaut, C. Samour, A. Palmeri and D. Vinciguerra, *Phys. Lett.* B52 (1974) 46
- 1974GH01 A. Ghovanlou and D.R. Lehman, *Phys. Rev.* C9 (1974) 1730
- 1974GH03 A. Ghovanlou and F. Prats, *Phys. Rev.* C10 (1974) 1309
- 1974GO04 N.V. Goncharov, S.G. Tonapetyan and V.M. Khvorostyan, *Yad. Fiz.* 19 (1974) 21; *Sov. J. Nucl. Phys.* 19 (1974) 10
- 1974GO1G Golovanova, Ilin, Neudachin and Smirnov, *JETP Lett.* 20 (1974) 310
- 1974GR24 Z. Gromadzki and J.V. Noble, *Phys. Lett.* B51 (1974) 9
- 1974GR43 K.A. Gridnev and Y.V. Kangropol, *Izv. Akad. Nauk SSSR Ser. Fiz.* 38 (1974) 2539; *Bull. Acad. Sci. USSR Phys. Ser.* 38 (1974) 66
- 1974HA1C Hanna, *Proc. Int. Conf. Nucl. Struct. Spectroscopy, Amsterdam, 1974, Vol. 2* (1974) 249
- 1974HA21 H.H. Hackenbroich, P. Heiss and Le-Chi-Niem, *Nucl. Phys.* A221 (1974) 461
- 1974HA36 R.D. Haracz and T.K. Lim, *Phys. Rev.* C10 (1974) 431
- 1974HE17 F.H. Heimlich, E. Rossle, M. Kobberling, J. Moritz, K.H. Schmidt, D. Wegener, D. Zeller, J.K. Bienlein, J. Bleckwenn and H. Dinter, *Nucl. Phys.* A228 (1974) 478
- 1974HE20 F.H. Heimlich, M. Kobberling, J. Moritz, K.H. Schmidt, D. Wegener, D. Zeller, J.K. Bienlein, J. Bleckwenn and H. Dinter, *Nucl. Phys.* A231 (1974) 509
- 1974HE21 P. Heiss, H.H. Hackenbroich and K. Prescher, *Phys. Lett.* B52 (1974) 411
- 1974HU14 J. Hufner, L. Tauscher and C. Wilkin, *Nucl. Phys.* A231 (1974) 455
- 1974HY01 M. Hyakutake, M. Sonoda, A. Katase, Y. Wakuta, M. Matoba, H. Tawara and I. Fujita, *J. Nucl. Sci. Tech.* 11 (1974) 407
- 1974IR04 J.M. Irvine, G.S. Mani and M. Vallieres, *Czech. J. Phys.* B24 (1974) 1269
- 1974JA11 W.W. Jacobs, D. Bodansky, D. Chamberlin and D.L. Oberg, *Phys. Rev.* C9 (1974) 2134
- 1974JA1F Jackson, *Prog. in Phys.* 37 (1974) 55
- 1974JA1K B.K. Jain, *Nucl. Phys.* A221 (1974) 421
- 1974JA27 A.K. Jain and N. Sarma, *Nucl. Phys.* A233 (1974) 145
- 1974KA11 S.G. Kadenskii, A.A. Martynov and Y.I. Kharitonov, *Yad. Fiz.* 19 (1974) 529; *Sov. J. Nucl. Phys.* 19 (1974) 267
- 1974KA1E Kawazoe and Matsuzaki, *Prog. Theor. Phys.* 52 (1974) 707

- 1974KA28 J. Kallne, B. Fagerstrom, O. Sundberg and G. Tibell, Phys. Lett. B52 (1974) 313
- 1974KO1C Kozlovsky and Ramaty, Astron. Astrophys. 34 (1974) 477
- 1974KO27 J.H. Koch and T.W. Donnelly, Phys. Rev. C10 (1974) 2618
- 1974KU06 N. Kumar, Nucl. Phys. A225 (1974) 221
- 1974LA02 R. Larose-Poutissou and H. Jeremie, Nucl. Phys. A218 (1974) 559
- 1974LA18 H. Laumer, S.M. Austin and L.M. Panggabean, Phys. Rev. C10 (1974) 1045
- 1974LA1A Lambert et al., Bull. Amer. Phys. Soc. 19 (1974) 506
- 1974LO1B Lorenzen and Brune, IAEA, STI/DOC/10/156 (1974) 325
- 1974MA49 S. Matsuki, S. Yamashita, N. Fujiwara, K. Fukunaga, D.C. Nguyen and T. Yanabu, Bull. Inst. Chem. Res. Kyoto Univ. 52 (1974) 202
- 1974MC04 R.J. McCarthy and G.E. Walker, Phys. Rev. C9 (1974) 809
- 1974ME24 Y.P. Melnik, V.Y. Gonchar and E.V. Inopin, Ukr. Fiz. Zh. 19 (1974) 965
- 1974MI05 C.A. Miller, J.W. Watson, D.I. Bonbright, F.J.S. Wilson and D.O. Wells, Phys. Rev. Lett. 32 (1974) 684
- 1974MI10 D. Miljanic, J. Hudomalj, G.S. Mutchler, E. Andrade and G.C. Phillips, Phys. Lett. B50 (1974) 330
- 1974MU13 N.C. Mukhopadhyay and F. Cannata, Phys. Lett. B51 (1974) 225
- 1974NA10 H. Nakamura, Nucl. Phys. A223 (1974) 599
- 1974NE1B Negele, Proc. Int. Conf. Nucl. Struct. Spectroscopy, Amsterdam, 1974, Vol. 2 (1974) 618
- 1974NO03 J.V. Noble, Phys. Rev. C9 (1974) 1209
- 1974PA10 L.M. Panggabean, S.M. Austin and H. Laumer, Phys. Rev. C10 (1974) 1605
- 1974PA1B Park, Cap, Leung and Rickett, Bull. Amer. Phys. Soc. 19 (1974) 666
- 1974PE06 J.P. Perroud and C. Sellem, Nucl. Phys. A227 (1974) 330
- 1974PE08 D.C. Peaslee and C.F. Williamson, Phys. Rev. C10 (1974) 1229
- 1974PR10 F. Prats, Nucl. Phys. A227 (1974) 469
- 1974PR1C Prats and Ghovanlou, Bull. Amer. Phys. Soc. 19 (1974) 507
- 1974QU01 J.L. Quebert, B. Frois, L. Marquez, G. Sousbie, R. Ost, K. Bethge and G. Gruber, Phys. Rev. Lett. 32 (1974) 1136; Erratum Phys. Rev. Lett. 32 (1974) 1396
- 1974RA1D Rai, Ghovanlou and Lehman, Bull. Amer. Phys. Soc. 19 (1974) 553
- 1974RE1A Reeves, Ann. Rev. Astron. Astrophys. 12 (1974) 437
- 1974RE1B E.F. Redish, Nucl. Phys. A235 (1974) 82
- 1974RE1C Rendic, Fiz. Suppl. 6 (1974) 22

1974RO01 W.J. Roberts, E.E. Gross and E. Newman, Phys. Rev. C9 (1974) 149
1974SA09 Y. Sakamoto, P. Cuer and F. Takeutchi, Phys. Rev. C9 (1974) 2440
1974SE1B Serov, Izv. Akad. Nauk SSSR Ser. Fiz. 38 (1974) 84
1974SH08 C.M. Shakin and M.S. Weiss, Phys. Rev. C9 (1974) 1679
1974SHYR V.S. Shirley and C.M. Lederer, LBL-3450 (1974)
1974SL04 I. Slaus, Czech. J. Phys. B24 (1974) 1255
1974TA18 L. Tauscher and W. Schneider, Z. Phys. 271 (1974) 409
1974TH05 D.R. Thompson and Y.C. Tang, Phys. Rev. C10 (1974) 1566
1974TI02 A.I. Titov, Yad. Fiz. 19 (1974) 292; Sov. J. Nucl. Phys. 19 (1974) 143
1974TO08 M. Toyama and Y. Sakamoto, Phys. Lett. B51 (1974) 217
1974UL1B Ulrich, Astrophys. J. 188 (1974) 369
1974VE01 E. Ventura, J. Calarco, C.C. Chang, E.M. Diener, E. Kuhlmann and W.E. Meyerhof, Nucl. Phys. A219 (1974) 157
1974VE02 J.D. Vergados, Nucl. Phys. A220 (1974) 259
1974VE10 J.D. Vergados, Phys. Lett. B53 (1974) 151
1974VO06 P.L. Von Behren, E. Norbeck and G.L. Payne, Phys. Rev. C10 (1974) 550
1974WA1C Walecka, Proc. Int. Conf. Nucl. Struct. Spectroscopy, Amsterdam, 1974 (1974) 438
1974WE12 M.F. Werby and S. Edwards, Nucl. Phys. A234 (1974) 1
1974WE13 M.F. Werby and D. Robson, Nucl. Phys. A234 (1974) 346
1974WE1B Werby and Edwards, Bull. Amer. Phys. Soc. 19 (1974) 507
1974WH01 W.R. Wharton, J.G. Cramer, J.R. Calarco and K.G. Nair, Phys. Rev. C9 (1974) 156
1974WH02 W.R. Wharton, Phys. Rev. C9 (1974) 164
1974WH05 R.R. Whitney, I. Sick, J.R. Ficenc, R.D. Kephart and W.P. Trower, Phys. Rev. C9 (1974) 2230
1974WH07 W.R. Wharton and P.T. Debevec, Phys. Lett. B51 (1974) 451
1974WI01 B.R. Wienke and S.L. Meyer, Phys. Rev. C9 (1974) 943
1974WI13 H. Willmes, C.R. Messick, T.A. Cahill, D.J. Shadoan and R.G. Hammond, Phys. Rev. C10 (1974) 1762
1974WI14 D.H. Wilkinson and D.E. Alburger, Phys. Rev. C10 (1974) 1993
1974WO1B Wood and Lodhi, Bull. Amer. Phys. Soc. 19 (1974) 526
1974WO1C Wozniak, LBL-2999 (1974)
1974YA01 H.L. Yadav and B.K. Srivastava, Can. J. Phys. 52 (1974) 202
1974YA1C Yasue et al., Bull. Inst. Chem. Res. Kyoto Univ. 52 (1974) 177

- 1974YE01 R. Yen, L.S. Cardman, D. Kalinsky, J.R. Legg and C.K. Bockelman, Nucl. Phys. A235 (1974) 135
- 1974ZH01 M.A. Zhusupov, E.Z. Magzumov and V.I. Markov, Phys. Lett. B48 (1974) 84
- 1975AB11 U. Abbondanno, F. Demanins, C. Tuniz and G. Nardelli, Nuovo Cim. A29 (1975) 187
- 1975AB1C Abulaffio and Peres, Nucl. Cross Sections and Tech., Pt. III, Washington, D.C., 1975 (1975) 701
- 1975AJ02 F. Ajzenberg-Selove, Nucl. Phys. A248 (1975) 1
- 1975AN11 Y.P. Antufev, V.L. Agranovich, V.S. Kuzmenko and P.V. Sorokin, Yad. Fiz. 21 (1975) 1206; Sov. J. Nucl. Phys. 21 (1976) 622
- 1975AN1C Antolkovic and Turk, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 307
- 1975AR02 E.D. Arthur, W.C. Lam, J. Amato, D. Axen, R.L. Burman, P. Fessenden, R. Macek, J. Oostens, W. Shlaer, S. Sobottka et al., Phys. Rev. C11 (1975) 332
- 1975BA06 J. Barrette, W. Del Bianco, P. Depommier, S. Kundu, N. Marquardt and A. Richter, Nucl. Phys. A238 (1975) 176
- 1975BA1G Baldin, AIP Conf. Proc. 26 (1975) 621
- 1975BA1H Balashov, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 281
- 1975BA1L Batty, Czech. J. Phys. 25 (1975) 286
- 1975BA43 A.G. Baryshnikov and L.D. Blokhintsev, Yad. Fiz. 22 (1975) 104; Sov. J. Nucl. Phys. 22 (1976) 50
- 1975BA76 A.I. Baz, V.F. Demin and M.V. Zhukov, Fiz. Elem. Chastits At. Yadra 6 (1975) 515; Sov. J. Part. Nucl. 6 (1975) 207
- 1975BE11 M. Bernas, R. DeVries, B.G. Harvey, D. Hendrie, J. Mahoney, J. Sherman, J. Steyaert and M.S. Zisman, Nucl. Phys. A242 (1975) 149
- 1975BE1F Berman and Fultz, Rev. Mod. Phys. 47 (1975) 713
- 1975BE1G Bertozzi, AIP Conf. Proc. 26 (1975) 409
- 1975BE31 M. Beiner, R.J. Lombard and D. Mas, Nucl. Phys. A249 (1975) 1
- 1975BE42 J.C. Bergstrom, I.P. Auer and R.S. Hicks, Nucl. Phys. A251 (1975) 401
- 1975BE44 E. Bellotti, E. Fiorini, P. Negri, A. Pullia, L. Zanotti and I. Filosofo, Nuovo Cim. A29 (1975) 106
- 1975BE60 B.L. Berman, At. Data Nucl. Data Tables 15 (1975) 319
- 1975BI06 H.G. Bingham, M.L. Halbert, D.C. Hensley, E. Newman, K.W. Kemper and L.A. Charlton, Phys. Rev. C11 (1975) 1913
- 1975BI1C Biegert, Baker, May and Bacher, Bull. Amer. Phys. Soc. 20 (1975) 1179
- 1975BL1C Blokhintsev and Dolinskii, Izv. Akad. Nauk SSSR Ser. Fiz. 39 (1975) 2092

- 1975BR1B Brault and Muller, Solar Phys. 41 (1975) 43
- 1975BR1D Brown and Weise, Phys. Rept. C22 (1975) 279
- 1975BR1E Braun-Muzinger, Gelbke, Harney and Agassi, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 152
- 1975BR21 K.H. Bray, A.D. Frawley, T.R. Ophel and P.B. Treacy, Aust. J. Phys. 28 (1975) 235
- 1975BU1A Bugg, Few Body Problems, Quebec, 1974 (1975) 267
- 1975CA1D Cadmus and Haeberli, Nucl. Instrum. Meth. Phys. Res. 129 (1975) 403
- 1975CA32 J.B. Cammarata, Nucl. Phys. A254 (1975) 422
- 1975CA35 F.P. Calaprice, Phys. Rev. C12 (1975) 2016
- 1975CH1C Chang, Bhowmik, Chant and Roos, ORO-4856-32 (1975)
- 1975CH1D Chang et al., Bull. Amer. Phys. Soc. 20 (1975) 1156
- 1975CH22 P. Christillin, A. Dellafiore and M. Rosa-Clot, Phys. Rev. C12 (1975) 691
- 1975CL01 D. Clement, E.J. Kanellopoulos and K. Wildermuth, Phys. Lett. B55 (1975) 19
- 1975DA1A Dam et al., Bull. Amer. Phys. Soc. 20 (1975) 1156
- 1975DE1D Deutsch et al., AIP Conf. Proc. 26 (1975) 445
- 1975DI04 H. Dirim, J.P. Elliott and J.A. Evans, Nucl. Phys. A244 (1975) 301
- 1975DI1B Didelez et al., Jul-Conf-16 (1975) 90
- 1975DO05 S.B. Doma, T.I. Kopaleishvili and Z. Machabeli, Yad. Fiz. 21 (1975) 720; Sov. J. Nucl. Phys. 21 (1975) 371
- 1975DO11 W. Dollhopf, C.F. Perdrisat, P. Kitching and W.C. Olsen, Phys. Lett. B58 (1975) 425
- 1975DO1D Donnelly and Walecka, Ann. Rev. Nucl. Sci 25 (1975) 329
- 1975DO1F Donnelly, AIP Conf. Proc. 26 (1975) 454
- 1975DU09 S. Dubnicka and O. Dumbrajs, Phys. Lett. B57 (1975) 327
- 1975EC02 M. Eckhause, J.R. Kane, B.L. Roberts, R.E. Welsh, R.P. Redwine, R.E. Segel, P.D. Barnes, R.A. Eisenstein, W.C. Lam, J. Miller et al., Phys. Rev. C11 (1975) 1056
- 1975ER09 K.M. Erokhin, N.V. Orlova, Y.F. Smirnov and K.V. Shitikova, Yad. Fiz. 22 (1975) 1102; Sov. J. Nucl. Phys. 22 (1975) 574
- 1975FA1A Fagg, Rev. Mod. Phys. 47 (1975) 683
- 1975FE01 V.N. Fetisov and Y.S. Kopysov, Nucl. Phys. A239 (1975) 511
- 1975FE1A Feather, Commun. Roy. Soc. Edinburgh (Phys. Sci.) 2 (1975) 19
- 1975FE1B Feinberg, AIP Conf. Proc. 26 (1975) 468
- 1975FI1C Filippov, Ovcharenko, Maksimenko and Steshenko, Problems of Vibrational Nucl., Zagreb, 1974 (1975) 333

- 1975FI1D Filippov and Maksimenko, *Izv. Akad. Nauk SSSR Ser. Fiz.* 39 (1975) 489
- 1975FO19 W.A. Fowler, G.R. Caughlan and B.A. Zimmerman, *Ann. Rev. Astron. Astrophys.* 13 (1975) 69
- 1975GE12 J.P. Genin, J. Julien, M. Rambaut, C. Samour, A. Palmeri and D. Vinciguerra, *Lett. Nuovo Cim.* 13 (1975) 693
- 1975GE1C German, Liran and Hodara, *Nucl. Instrum. Meth. Phys. Res.* 128 (1975) 163
- 1975GO04 D. Goss, *Phys. Rev. C*11 (1975) 1054
- 1975GO08 P. Goode and D.S. Koltun, *Nucl. Phys. A*243 (1975) 44
- 1975GO1B P. Goode, *Nucl. Phys. A*241 (1975) 311
- 1975GO27 V.Z. Goldberg, K.A. Gridnev, E.F. Hefter and B.G. Novatskii, *Phys. Lett.* B58 (1975) 405
- 1975GO30 V.Y. Gonchar, E.V. Inopin and Y.P. Melnik, *Ukr. Fiz. Zh.* 20 (1975) 782
- 1975GR09 W. Gruebler, P.A. Schmelzbach, V. Konig, R. Risler and D. Boerma, *Nucl. Phys. A*242 (1975) 265
- 1975GR10 W. Gruebler, P.A. Schmelzbach, V. Konig, R. Risler, B. Jenny and D. Boerma, *Nucl. Phys. A*242 (1975) 285
- 1975GR26 Z. Gromadzki and J.V. Noble, *Nucl. Phys. A*251 (1975) 105
- 1975GR41 K.A. Gridnev and A.A. Ogloblin, *Fiz. Elem. Chastits At. Yad. (USSR)* 6 (1975) 393; *Sov. J. Part. Nucl.* 6 (1976) 158
- 1975HA1E Hackenbroich, Clustering Phenom. in *Nucl.*, II, ORO-4856-26 (1975) 107
- 1975HA48 M.Y.M. Hassan and S.A.E. Khallaf, *Z. Phys. A*275 (1975) 169
- 1975HE09 P. Heiss, *Z. Phys. A*272 (1975) 267
- 1975HE1D Heiss and Hackenbroich, Few Body Problems, Quebec, 1974 (1975) 426
- 1975JA1A Jaros et al., *Bull. Amer. Phys. Soc.* 20 (1975) 666
- 1975JA1B Jain and Jain, Clustering Phenom. in *Nucl.*, II, ORO-4856-26 (1975) 301
- 1975JA1C Jain and Jain, Few Body Problems, Quebec, 1974 (1975) 775
- 1975JO1A Johansson and Rosengren, *J. Phys.* F5 (1975) L15
- 1975KI02 P. Kitching, W.C. Olsen, H.S. Sherif, W. Dollhopf, C. Lunke, C.F. Perdrisat, J.R. Priest and W.K. Roberts, *Phys. Rev. C*11 (1975) 420
- 1975KN02 H.D. Knox, R.G. Graves, F.N. Rad, M.L. Evans, L.C. Northcliffe, H. Nakamura and H. Noya, *Phys. Lett.* B56 (1975) 33
- 1975KO1A S. Kohmoto and Y. Sakamoto, *Phys. Rev. Lett.* 34 (1975) 550
- 1975KO1B Kolalis, Seltz and Magnac-Valette, Few Body Problems, Quebec, 1974 (1975) 406
- 1975KR14 S. Krol and S. Szpikowski, *Acta Phys. Pol.* B6 (1975) 409

- 1975KR1A Kramer, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 56
- 1975KU01 D. Kurath and D.J. Millener, Nucl. Phys. A238 (1975) 269
- 1975KU08 K.-I. Kubo, Nucl. Phys. A246 (1975) 246
- 1975KU09 V.I. Kukulín, V.G. Neudatchin and Y.F. Smirnov, Nucl. Phys. A245 (1975) 429
- 1975KU1C Kuhn, Few Body Problems, Quebec, 1974 (1975) 122
- 1975KU27 N. Kumar and S.K. Soni, Indian J. Pure Appl. Phys. 13 (1975) 826
- 1975LE1A Lehman, Rai and Ghovanlou, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 297
- 1975LI1C T.K. Lim, Phys. Lett. B56 (1975) 321
- 1975LI20 D.L. Lin and M.Y. Chen, Nucl. Phys. A251 (1975) 457
- 1975LO1B Lodhi and Amburgev, Bull. Amer. Phys. Soc. 20 (1975) 1185
- 1975LO1C Lodhi and Rustgi, Few Body Problems, Quebec, 1974 (1975) 758
- 1975LO1D Lodhi and Wood, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 193
- 1975MA1E Matthews, AIP Conf. Proc. 26 (1975) 437
- 1975MA1G Mathews et al., Bull. Amer. Phys. Soc. 20 (1975) 710
- 1975ME1E Meneguizzi and Reeves, Astron. Astrophys. 40 (1975) 91, 99
- 1975ME27 Y.P. Melnik and E.V. Inopin, Ukr. Fiz. Zh. 20 (1975) 2032
- 1975MI09 B. Mithra and R. Laverriere, Phys. Lett. B58 (1975) 17
- 1975MI1A Miljanic, Zabel and Phillips, Few Body Problems, Quebec, 1974 (1975) 669
- 1975MO22 M. Moreno, J. Pestieau and J. Urias, Phys. Rev. C12 (1975) 514
- 1975NO03 J.V. Noble, Phys. Lett. B55 (1975) 433
- 1975NO1A Noguchi and Prats, Bull. Amer. Phys. Soc. 20 (1975) 630
- 1975NO1C Norbeck, Fox and Payne, Bull. Amer. Phys. Soc. 20 (1975) 1174
- 1975OB01 D.L. Oberg, D. Bodansky, D. Chamberlin and W.W. Jacobs, Phys. Rev. C11 (1975) 410
- 1975PA11 G.L. Payne and R.R. Carlson, Phys. Rev. C12 (1975) 1260
- 1975PL1B Plattner, Bornard and Alder, Helv. Phys. Acta 48 (1975) 555
- 1975PN1A Pniewski and Zakrzewski, Nukleonika (Poland) 20 (1975) 43
- 1975PO1B Poppe, Brown, Hegland and Koepke, Bull. Amer. Phys. Soc. 20 (1975) 578
- 1975PR1A Prats, Ghovanlou and Lehman, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 295
- 1975RA14 G.M. Raisbeck, J. Lestringuez and F. Yiou, Phys. Lett. B57 (1975) 186

- 1975RA21 G.M. Raisbeck, P. Boerstling, R. Klapisch and T.D. Thomas, Phys. Rev. C12 (1975) 527
- 1975RA32 M. Rai, D.E. Lehman and A. Ghovanlou, Phys. Lett. B59 (1975) 327
- 1975RO1B Roos and Chant, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 242, 265
- 1975SA01 Y. Sakamoto, P. Cuer and F. Takeutchi, Phys. Rev. C11 (1975) 668
- 1975SC1F Schrieder et al., Few Body Problems, Quebec, 1974 (1975) 80
- 1975SC31 H. Schwartz and C.M. Fou, J. Phys. (London) G1 (1975) L57
- 1975SH01 P.E. Shanley, Phys. Rev. Lett. 34 (1975) 218
- 1975SH05 Y.M. Shin, D.M. Skopik and J.J. Murphy, Phys. Lett. B55 (1975) 297
- 1975SH1B C.M. Shakin and M.S. Weiss, Phys. Rev. C11 (1975) 756
- 1975SL01 R.J. Slobodrian, R. Pigeon and M. Irshad, Phys. Rev. Lett. 35 (1975) 19
- 1975TA1A Tang and Thompson, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 119
- 1975TA1C Tauscher, AIP Conf. Proc. 26 (1975) 541
- 1975TH1C Thompson, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 230
- 1975TO1A Tombrello, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 167
- 1975TR1A Trimble, Rev. Mod. Phys. 47 (1975) 877
- 1975VE01 J.D. Vergados, Nucl. Phys. A239 (1975) 271
- 1975VE05 J.D. Vergadosk, Phys. Rev. C12 (1975) 1278
- 1975VI04 W. Viefers, W. Von Witsch and A. Richter, Nucl. Phys. A248 (1975) 518
- 1975VI08 D. Vinciguerra, E. Modica, A. Palmeri, J. Julien, C. Samour and J.P. Genin, Lett. Nuovo Cim. 14 (1975) 333
- 1975VO04 W. Von Witsch, G.S. Mutchler and D. Miljanic, Nucl. Phys. A248 (1975) 485
- 1975VO08 W. von Oertzen and E.R. Flynn, Ann. Phys. 95 (1975) 326
- 1975VO1B Von Oertzen and Bohlen, Phys. Rept. 19 (1975) 1
- 1975WA1G Walter, Lisowski and Clegg, Few Body Problems, Quebec, 1974 (1975) 593
- 1975WH01 W.R. Wharton and P.T. Debevec, Phys. Rev. C11 (1975) 1963
- 1975WI1C Wildermuth, Clustering Phenom. in Nucl., II, ORO-4856-26 (1975) 89
- 1975YA02 Y.-Y. Yam, Phys. Rev. C11 (1975) 73
- 1975ZE01 A.M. Zebelman, A.M. Poskanzer, J.D. Bowman, R.G. Sextro and V.E. Viola, Jr., Phys. Rev. C11 (1975) 1280
- 1976AB11 S.N. Abramovich, B.Y. Guzhovskii, B.M. Dzyuba, A.G. Zvenigorodskii, S.V. Trusillo and G.N. Sleptsov, Izv. Akad. Nauk SSSR Ser. Fiz. 40 (1976) 842; Bull. Acad. Sci. USSR Phys. Ser. 40 (1976) 129

- 1976AJ04 F. Ajzenberg-Selove, Nucl. Phys. A268 (1976) 1
- 1976AL1F Alder et al., Meson-Nucl. Phys., 1976 (1976) 158
- 1976AM01 H. Amakawa and K.-I. Kubo, Nucl. Phys. A266 (1976) 521
- 1976AS05 J. Asai and R.J. Slobodrian, Phys. Lett. B64 (1976) 257
- 1976AS1B Aslanides, Meson-Nucl. Phys., 1976 (1976) 204
- 1976AU1B Audouze and Lequeux, Astron. Astrophys. 49 (1976) 133
- 1976AU1C Audouze, Meneguzzi and Reeves, Spallation Nucl. Reactions and Their Applications; Eds., Shen and Merker (1976) 113
- 1976AV05 G.V. Avakov and E.I. Dolinsky, Nucl. Phys. A270 (1976) 74
- 1976BA1E Baz and Filippov, Proc. Dubna Conf. JINR-9920, Vol. II (1976) 268
- 1976BA1G Bassalleck et al., Meson-Nucl. Phys., 1976 (1976) 272
- 1976BA1H Bacher et al., Polarization, Zurich, 1975 (1976) 575
- 1976BA1J Bahcall and Davis, Science 191 (1976) 264
- 1976BE1C Beaudet, J. Royal Astron. Soc. Canada 70 (1976) 247
- 1976BE1E Behrens and Lzybisz, Phys. Data 6-1; ZAED (1976)
- 1976BE1G Berlovich, Izv. Akad. Nauk SSSR Ser. Fiz. 40 (1976) 756
- 1976BE1H Berman, Preprint UCRL-78482 (1976)
- 1976BE22 J.C. Bergstrom and E.L. Tomusiak, Nucl. Phys. A262 (1976) 196
- 1976BE67 B.N. Belyaev, V.D. Domkin, Y.G. Korobulin and L.M. Krizhanskii, Yad. Fiz. 24 (1976) 1177; Sov. J. Nucl. Phys. 24 (1976) 617
- 1976BH02 R.K. Bhowmik, C.C. Chang, J.-P. Didelez and H.D. Holmgren, Phys. Rev. C13 (1976) 2105
- 1976BI1B Bilpuch et al., Lowell Conf., 760715-P2 (1976) 1309
- 1976BO08 V.I. Bogatin, V.F. Litvin, O.V. Lozhkin, N.A. Perfilov and Y.P. Yakovlev, Nucl. Phys. A260 (1976) 446
- 1976BO32 J.E. Bolger, W.J. Braithwaite, J.J. Kraushaar, J. McGill, C.F. Moore, C.L. Morris, R.J. Peterson, R.A. Ristinen, G. Smith, L.E. Smith et al., Phys. Rev. Lett. 37 (1976) 1206
- 1976BOZP D.I. Bonbright, D.J. Roberts and J.W. Watson, Bull. Amer. Phys. Soc. 21 (1976) 535, BF12
- 1976BU16 M. Buenerd, C.K. Gelbke, B.G. Harvey, D.L. Hendrie, J. Mahoney, A. Menchaca-Rocha, C. Olmer and D.K. Scott, Phys. Rev. Lett. 37 (1976) 1191
- 1976BU1B Burov and Lukyanov, Contrib. to Dubna Conf. on Selected Topics in Nucl. Struct., Vol. 1, JINR-9682 (1976) 154
- 1976CA20 J.B. Cammarata and T.W. Donnelly, Nucl. Phys. A267 (1976) 365

- 1976CE03 R. Ceuleneer, M. Erculisse and M. Gilles, Phys. Lett. B65 (1976) 101
- 1976CE1B Ceuleneer, Erculisse and Gilles, Contrib. to Dubna Conf. on Selected Topics in Nucl. Struct., Vol.1, JINR D-9682 (1976) 23
- 1976CH1C Charnomordic, Thesis, Univ. of Lyon (1976)
- 1976CL1A Clayton and Dwek, Astrophys. J. 206 (1976) L59
- 1976CO1B Colgate, Audouze and Fowler, OAP-458 (1976)
- 1976CO1D Conzett et al., Polarization, Zurich, 1975 (1976) 568
- 1976CO1E Conzett, Polarization, Zurich, 1975 (1976) 105
- 1976CO1H Conzett et al., Polarization, Zurich, 1975 (1976) 566
- 1976COZN R. Cole, C. Waddell, R. Eisberg, L. Agnew, M. Baker, C. Hwang, J. Jarmer, D.M. Lee and P. Thompson, Bull. Amer. Phys. Soc. 21 (1976) 586, EH15
- 1976CRZX J.G. Cramer, R.M. DeVries, D.A. Goldberg, M.S. Zisman and C.F. Maguire, Bull. Amer. Phys. Soc. 21 (1976) 554, DE6
- 1976DA1C Dahme et al., Polarization, Zurich, 1975 (1976) 497
- 1976DA24 V. D'Amico, G. Fazio, S. Jannelli, F. Mezzaneres, N. Arena, G. Calvi and R. Potenza, Lett. Nuovo Cim. 15 (1976) 563
- 1976DE30 T. Delbar, G. Gregoire, J. Lega, G. Paic and P. Wastyn, Phys. Rev. C14 (1976) 1659
- 1976DU05 J. Dubach, J.H. Koch and T.W. Donnelly, Nucl. Phys. A271 (1976) 279
- 1976DU1B Dumbrajs, Meson-Nucl. Phys., 1976 (1976) 192
- 1976DYZY 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, R.J. Peterson, G. Burleson et al., Bull. Amer. Phys. Soc. 21 (1976) 998, DE3
- 1976EP1A Epsteain, Arnett and Schramm, Astrophys. J. Suppl. 31 (1976) 111
- 1976FA03 B. Fagerstrom, J. Kallne, O. Sundberg and G. Tibell, Phys. Scr. 13 (1976) 101
- 1976FU06 G.H. Fuller, J. Phys. Chem. Ref. Data 5 (1976) 835
- 1976GHZY A. Ghovanlou, D.R. Lehman and M. Rai, Bull. Amer. Phys. Soc. 21 (1976) 585, EH6
- 1976GI1C Ginzburg and Ptjskin, Rev. Mod. Phys. 48 (1976) 161
- 1976GO04 N.F. Golovanova, I.M. Ilin, V.G. Neudachin, Y.F. Smirnov and Y.M. Chuvilskii, Yad. Fiz. 23 (1976) 64; Sov. J. Nucl. Phys. 23 (1976) 33
- 1976GO1C Goldanskii, Cargese Conf., CERN 76-13 (1976) 88
- 1976GO1E N.F. Golovanova, I.M. Il'in, V.G. Neudatchin, Yu.F. Smirnov and Yu.M. Tchuvilsky, Nucl. Phys. A262 (1976) 444
- 1976HA1C Hackenbroich, Polarization, Zurich, 1975 (1975) 133
- 1976HA1E Hautot, Atti Fond. Giorgio Ronchi (Italy) 31 (1976) 373

- 1976HA1F Hainebach, Schramm and Blake, *Astrophys. J.* 205 (1976) 920
- 1976HE07 P. Heiss and H.H. Hackenbroich, *Phys. Lett.* B61 (1976) 339
- 1976HE1D Heidenreich et al., *Polarization, Zurich, 1975* (1976) 570
- 1976HU1C Hudomalj-Gabitzsch et al., *Meson-Nucl. Phys.*, 1976 (1976) 274
- 1976HUZK J. Hudomalj-Gabitzsch, J. Clement, W. Dragoset, R. Felder, G.S. Mutchler, T.W. Williams, G.C. Phillips, E.V. Hungerford, M. Warneke, L. Pinsky et al., *Bull. Amer. Phys. Soc.* 21 (1976) 998, DE6
- 1976IR02 M. Irshad, J. Asai, S. Sen, R. Pigeon and R.J. Slobodrian, *Nucl. Phys.* A265 (1976) 349
- 1976IR1B Irvine et al., *Ann. Phys.* 102 (1976) 129
- 1976KI1C Kish, Koltai and Sabo, *Izv. Akad. Nauk SSSR Ser. Fiz.* 40 (1976) 800
- 1976KI1D King et al., *Lowell Conf.*, CONF-760715-P2 (1976) 1344
- 1976KN1C Knitter and Budtz-Jorgensen, *Lowell Conf.*, CONF-760715-P2 (1976) 1387
- 1976KN1D Knox, White and Lane, *Lowell Conf.*, CONF-760715-P2 (1976) 1307
- 1976KO21 Y. Koike, *Prog. Theor. Phys.* 55 (1976) 2016
- 1976KU07 N. Kumar and O. Prakash, *Z. Phys.* A278 (1976) 105
- 1976LA1C Lane, White and Knox, *Lowell Conf.*, CONF-760715-P2 (1976) 1042
- 1976LE17 M. Lemere, Y.C. Tang and D.R. Thompson, *Nucl. Phys.* A266 (1976) 1
- 1976LE1F Lefort, *Rept. Prog.* 39 (1976) 129
- 1976LE1G Lebedev, Tryasuchev and Fetisov, *Sov. Phys.-Lebedev Inst. Rept. No. 2* (1976) 11
- 1976LE1H Lebedev, Trjasuchev and Fetisov, *Meson-Nucl. Phys.*, 1976 (1976) 636
- 1976LI1V Lisowski, Byrd, Walter and Clegg, *Polarization, Zurich, 1975* (1976) 573
- 1976LI26 E. Lipparini, S. Stringari and M. Traini, *Nuovo Cim.* A34 (1976) 48
- 1976LO03 M. Lowry, J.S. Schweitzer, R. Dayras and R.G. Stokstad, *Nucl. Phys.* A259 (1976) 122
- 1976MA04 F. Malaguti and P.E. Hodgson, *Nucl. Phys.* A257 (1976) 37
- 1976MA34 J.L. Matthews, D.J.S. Findlay, S.N. Gardiner and R.O. Owens, *Nucl. Phys.* A267 (1976) 51
- 1976MC04 J.S.C. McKee and C. Randell, *Nucl. Phys.* A260 (1976) 344
- 1976ME20 D.V. Meboniya and I.G. Surmava, *Yad. Fiz.* 24 (1976) 308; *Sov. J. Nucl. Phys.* 24 (1976) 161
- 1976MI13 T. Mikumo, I. Kohno, K. Katori, T. Motobayashi, S. Nakajima, M. Yoshie and H. Kamitsubo, *Phys. Rev.* C14 (1976) 1458
- 1976MI1B Miranda, Shapiro and Chou, *Bull. Amer. Phys. Soc.* 21 (1976) 47

- 1976MI1C Miljanic, Pecar, Rendic and Tomas, Lowell Conf., CONF-760715-P2 (1976) 1343
- 1976MI1E M.V. Mihailovic, L.J.B. Goldfarb and M.A. Nagarajan, Nucl. Phys. A273 (1976) 207
- 1976MI1F Miljanic, Proc. 7th Int. Conf. on Few Body Problems in Nucl. Particle Phys., Delhi, 1975 (1976) 238
- 1976MOZF J.M. Moss, D.R. Brown and W.D. Cornelius, Bull. Amer. Phys. Soc. 21 (1976) 990, CF5
- 1976NA11 M.N. Namboodiri, E.T. Chulick and J.B. Natowitz, Nucl. Phys. A263 (1976) 491
- 1976NA12 H. Nakamura and H. Noya, Nucl. Phys. A264 (1976) 54
- 1976NE1A M.J. Newman and W.A. Fowler, Phys. Rev. Lett. 36 (1976) 895
- 1976NO1C Norgaard and Fricke, Astron. Astrophys. 49 (1976) 337
- 1976OG1A Ogloblin, Proc. Dubna Conf. JINR D-9920, Vol. II (1976) 31
- 1976OH03 M. Ohta, Prog. Theor. Phys. 55 (1976) 1782
- 1976OH04 G. Ohlen and T. Berggren, Nucl. Phys. A272 (1976) 21
- 1976OS04 R. Ost, N.E. Sanderson, S. Mordechai, J.B.A. England, B.R. Fulton, J.M. Nelson and G.C. Morrison, Nucl. Phys. A265 (1976) 142
- 1976PI1B Pilkuhn, Schlaile and Zoyko, Meson-Nucl. Phys., 1976 (1976) 194
- 1976PIZS R. Pigeon, M. Irshad and R.J. Slobodrian, Bull. Amer. Phys. Soc. 21 (1976) 774, BA2
- 1976PL02 G.R. Plattner, M. Bornand and K. Alder, Phys. Lett. B61 (1976) 21
- 1976PO02 J.E. Poling, E. Norbeck and R.R. Carlson, Phys. Rev. C13 (1976) 648
- 1976PR07 M. Prakash, Y.R. Waghmare and I. Mehrotra, Z. Phys. A278 (1976) 155
- 1976RA1C Raisbeck and Yiou, Spallation Nucl. Reactions and Their Applications; Eds., Shen and Merker (1976) 83
- 1976RA42 G.M. Radutskii and V.A. Serdyutskii, Izv. Vyssh. Ucheb. Zaved. Fiz. 11 (1976) 127
- 1976RO02 P.G. Roos, D.A. Goldberg, N.S. Chant, R. Woody, III and W. Reichart, Nucl. Phys. A257 (1976) 317
- 1976RO12 C.T. Roche, R.G. Clark, G.J. Mathews and V.E. Viola, Jr., Phys. Rev. C14 (1976) 410
- 1976RO14 C. Rogers, Nucl. Phys. A271 (1976) 447
- 1976RO1D Roy-Choudhury, Gajtam and Sural, Proc. 7th Int. Conf. on Few Body Problems in Nucl. Particle Phys., Delhi, 1975 (1976) 157
- 1976SA29 K. Sagara, T. Motobayashi, N. Takahashi, Y. Hashimoto, M. Hara, Y. Nogami, H. Noya and H. Nakamura, Nucl. Phys. A273 (1976) 493
- 1976SC15 P.A. Schmelzbach, W. Gruebler, V. Konig, R. Risler, D.O. Boerma and B. Jenny, Nucl. Phys. A264 (1976) 45

- 1976SC34 W. Schutte, H.H. Hackenbroich, H. Stowe, P. Heiss and H. Aulenkamp, Phys. Lett. B65 (1976) 214
- 1976SH14 J.D. Sherman, E.R. Flynn, N. Stein, J.W. Sunier and D.G. Burke, Phys. Rev. C13 (1976) 2122
- 1976SI1C Simpson, Bull. Amer. Phys. Soc. 21 (1976) 602
- 1976SK02 D.M. Skopik, E.L. Tomusiak, E.T. Dressler, Y.M. Shin and J.J. Murphy, II, Phys. Rev. C14 (1976) 789
- 1976SL1A Slobodrian et al., Proc. 7th Int. Conf. on Few Body Problems in Nucl. Particle Phys., Delhi, 1975 (1976) 263
- 1976SL2A I. Slaus, Lowell Conf., CONF-760715-P1 (1976) 272
- 1976SM02 W. Smolec, S. Burzynski, K. Rusek, I.M. Turkiewicz, J. Turkiewicz and P. Zupranski, Nucl. Phys. A257 (1976) 397
- 1976ST1D Stevenson et al., Bull. Amer. Phys. Soc. 21 (1976) 636
- 1976STYX D.P. Stahel, R. Jahn, G.J. Wozniak and J. Cerny, Bull. Amer. Phys. Soc. 21 (1976) 1295, CC8
- 1976TO07 M. Toyama and Y. Sakamoto, Nucl. Phys. A268 (1976) 469
- 1976TR1A Truol, Meson-Nucl. Phys., 1976 (1976) 581
- 1976TZ1A Tzara, Meson-Nucl. Phys., 1976 (1976) 566
- 1976VA29 G.V. Valskii, Yad. Fiz. 24 (1976) 270; Sov. J. Nucl. Phys. 24 (1976) 140
- 1976VI1A Vidal-Quadras et al., Nuovo Cim. B34 (1976) 380
- 1976VO1B Von Behren et al., Bull. Amer. Phys. Soc. 21 (1976) 29
- 1976VR01 D. Vranic and I. Slaus, Fizika 8 (1976) 155
- 1976WA02 J.D. Walecka, Nucl. Phys. A258 (1976) 397
- 1976WA12 R.E. Warner, G.C. Ball, W.G. Davies, A.J. Ferguson and J.S. Forster, Nucl. Phys. A269 (1976) 286
- 1976WO11 G.J. Wozniak, D.P. Stahel, J. Cerny and N.A. Jelley, Phys. Rev. C14 (1976) 815
- 1977AB09 B.M. Abramov, I.A. Dukhovskoi, V.V. Kishkurno, L.A. Kondratyuk, A.P. Krutenkova, V.V. Kulikov, M.A. Matsyuk, I.A. Radkevich, E.N. Turdakina, V.S. Fedorets et al., Pisma Zh. Eksp. Teor. Fiz. 25 (1977) 123; JETP Lett. 25 (1977) 111
- 1977AJ02 F. Ajzenberg-Selove, Nucl. Phys. A281 (1977) 1
- 1977AL1C Alder et al., Helv. Phys. Acta 50 (1977) 197
- 1977AL1D Albanese et al., in Tokyo (1977) 808
- 1977AM1A Amann et al., Bull. Amer. Phys. Soc. 22 (1977) 525
- 1977AN21 I. Angeli and M. Csatlos, Nucl. Phys. A288 (1977) 480

- 1977AR1C Argan et al., Proc., Zurich-Sin. (1977) 259
- 1977AU02 G. Audit, A. Bloch, N. de Botton, C. Schuhl, G. Tamas, C. Tzara, J. Deutsch, D. Favart, R. Prieels and B. Van Oystaeyen, Phys. Rev. C15 (1977) 1415
- 1977AU1B Austin, MSUCL-254 (1977)
- 1977AZ02 G. Azuelos and J.E. Kitching, Nucl. Phys. A285 (1977) 19
- 1977BA1P Batusov and Eramzhyan, Fiz. Elem. Chastits At. Yad. (USSR) 8 (1977) 229
- 1977BA1Q Baer, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 245
- 1977BA1R Bardin et al., Proc., Zurich-Sin. (1977) 342
- 1977BA23 T.T. Bardin, J.A. Becker, D. Kohler and B.A. Watson, Phys. Rev. C15 (1977) 1933
- 1977BE1L Bernstein, Bull. Amer. Phys. Soc. 22 (1977) 522
- 1977BE1M Beck, Mihailovoc, Nagarajan and Polusak, Fiz. Suppl. 9 (1977) 7
- 1977BI1D Bizzeti, Nucl. Instrum. Meth. Phys. Res. 146 (1977) 285
- 1977BL1B Blokhintsev and Shvarts, Izv. Akad. Nauk SSSR Ser. Fiz. 41 (1977) 139
- 1977BO1E Boschitz, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 133
- 1977BO21 H. Bohn, K.A. Eberhard, R. Vandenbosch, K.G. Bernhardt, R. Bangert and Y-D. Chan, Phys. Rev. C16 (1977) 665
- 1977BO35 D.I. Bonbright, J.S.C. McKee and J.W. Watson, J. Phys. (London) G3 (1977) 1359
- 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
- 1977BR1H Brown, Blitz and Anbar, Int. J. Mass Spectrom. Ion Phys. 25 (1977) 167
- 1977BR33 H. Brody, S. Frankel, W. Frati, D. Yang, C.F. Perdrisat, J.C. Comiso and K.O.H. Ziock, Phys. Lett. B71 (1977) 79
- 1977BR37 F.A. Brieva and A. Dellafiore, Nucl. Phys. A292 (1977) 445
- 1977BU09 A.Yu. Buki, N.G. Shevchenko, V.D. Efros and I.I. Chkalov, Yad. Fiz. 25 (1977) 457; Sov. J. Nucl. Phys. 25 (1977) 246
- 1977BU1D Bursak, Gorbатов, Krylov and Solovei, Sov. J. Nucl. Phys. 25 (1977) 401
- 1977BU25 G.G. Bunatyan and Y.S. Pol, Yad. Fiz. 25 (1977) 535; Sov. J. Nucl. Phys. 25 (1977) 287
- 1977CA1B Canal, Isern and Sanahuja, Astrophys. J. 214 (1977) 189
- 1977CA1C Castro and Dominguez, in Tokyo (1977) 824
- 1977CA22 C.M. Castaneda, H.A. Smith, Jr., T.E. Ward and T.R. Nees, Phys. Rev. C16 (1977) 1437
- 1977CH07 B. Charnomordic, C. Fayard and G.H. Lamot, Phys. Rev. C15 (1977) 864
- 1977CL1A W.L. Clinton, K.P. Mandal, and J.A. McClure, Phys. Rev. Lett. 38 (1977) 143

- 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
- 1977CO1B H.E. Conzett and F. Seiler, Nucl. Phys. A290 (1977) 93
- 1977CO1C Cole, AIP Conf. Proc. 36 (1977) 174
- 1977CO1E Corriveau et al., Proc., Zurich-Sin (1977) 87
- 1977DA11 W.G. Davies, G.C. Ball, A.J. Ferguson, J.S. Forster, D. Horn and R.E. Warner, Phys. Rev. Lett. 38 (1977) 1119
- 1977DE08 C. Detraz, Phys. Lett. B66 (1977) 333
- 1977DE23 R.M. DeVries, D.A. Goldberg, J.W. Watson, M.S. Zisman and J.G. Cramer, Phys. Rev. Lett. 39 (1977) 450
- 1977DO06 G.E. Dogotar, R.A. Eramzhyan, H.R. Kissener and R.A. Sakaev, Nucl. Phys. A282 (1977) 474
- 1977DU01 O. Dumbrajs and M. Staszal, Z. Phys. A280 (1977) 249
- 1977EL1B Elbaz, Fayard and Lamdt, Proc. Int. Conf. Nucl. Struct., Tokyo (1977); J. Phys. Soc. Jpn. Suppl. 44 (1978) 304
- 1977FA02 L.W. Fagg, R.A. Lindgren, W.L. Bendel and E.C. Jones, Jr., Phys. Rev. C15 (1977) 1181
- 1977FA09 K.K. Fang and E.L. Tomusiak, Phys. Rev. C16 (1977) 2117
- 1977FE05 H. Ferdinande, N.K. Sherman, K.H. Lokan and C.K. Ross, Can. J. Phys. 55 (1977) 428
- 1977FE1B Feshbach, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 291
- 1977FL13 T. Fliessbach and P. Manakos, J. Phys. (London) G3 (1977) 643
- 1977FO07 F. Foroughi, C. Nussbaum and G. Pauletta, Lett. Nuovo Cim. 20 (1977) 49
- 1977FR12 V. Franco and A. Tekou, Phys. Rev. C16 (1977) 658
- 1977FU1A Fujiwara et al., in Tokyo (1977) 20
- 1977FU1B Fujiwara et al., in Tokyo (1977) 10
- 1977GE02 D.F. Geesaman, R.L. McGrath, P.M.S. Lesser, P.P. Urone and B. VerWest, Phys. Rev. C15 (1977) 1835
- 1977GI08 H.J. Gils, H. Rebel, J. Buschmann and H. Klewe-Nebenius, Phys. Lett. B68 (1977) 427
- 1977GU14 M.G. Gulyamov, B.S. Mazitov, G.A. Radyuk, E.I. Rasulov and R. Yarmukhamedov, Izv. Akad. Nauk SSSR Ser. Fiz. 41 (1977) 2214; Bull. Acad. Sci. USSR Phys. Ser. 41 (1977) 189
- 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. C*16 (1977) 42
- 1977HA1K Hasinoff, *Bull. Amer. Phys. Soc.* 22 (1977) 522
- 1977HA34 R.A. Hardekopf, W. Gruebler, B. Jenny, V. Konig, R. Risler, H.R. Burgi and J. Nurzynski, *Nucl. Phys.* A287 (1977) 237
- 1977HA42 R.F. Haglund, Jr., G.G. Ohlsen, R.A. Hardekopf, N. Jarmie and R.E. Brown, *Phys. Rev. C*16 (1977) 2151
- 1977HO1A Hogue, Newson, Purser and Gould, *Bull. Amer. Phys. Soc.* 22 (1977) 632
- 1977HO1B Hoistad, *High Energy Phys. Nucl. Struct., Zurich, 1977* (1977) 215
- 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
- 1977KA1D Kaneko and Kamada, *Prog. Theor. Phys.* 57 (1977) 1277
- 1977KA1G Kanada and Kaneko, in *Tokyo* (1977) 471
- 1977KE09 K.W. Kemper, G.E. Moore, R.J. Puigh and R.L. White, *Phys. Rev. C*15 (1977) 1726
- 1977KI04 A. Kiss, E. Koltay, G. Szabo and L. Vegh, *Nucl. Phys.* A282 (1977) 44
- 1977KI08 J.C. Kim, P. Depommier, W. Del Bianco and S. Kundu, *Nucl. Instrum. Meth. Phys. Res.* 143 (1977) 371
- 1977KI12 C.H. King, S.M. Austin, H.H. Rossner and W.S. Chien, *Phys. Rev. C*16 (1977) 1712
- 1977KL09 W.E. Kleppinger, F.P. Calaprice and B.R. Holstein, *Nucl. Phys.* A293 (1977) 46
- 1977KO09 J.A. Koepke and R.E. Brown, *Phys. Rev. C*16 (1977) 18
- 1977KO18 I. Koersner, L. Glantz, A. Johansson, B. Sundqvist, H. Nakamura and H. Noya, *Nucl. Phys.* A286 (1977) 431
- 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
- 1977KU06 H. Kumpf, J. Mosner, W. Neubert and G. Schmidt, *Yad. Fiz.* 25 (1977) 481; *Sov. J. Nucl. Phys.* 25 (1977) 259
- 1977KU07 K.-J. Kubo, K. Nagatani and K.G. Nair, *Phys. Rev. C*15 (1977) 1758
- 1977KU12 E.L. Kuplennikov, V.A. Goldshtein, N.G. Afanasev and V.G. Vlasenko, *Yad. Fiz.* 25 (1977) 1129; *Sov. J. Nucl. Phys.* 25 (1977) 599
- 1977LE18 P. Leleux, M. Bosman, P. Lipnik, P. Macq, J.P. Meulders, R. Petit, C. Pirart, G. Valenduc, H. Nakamura and H. Noya, *Phys. Lett.* B70 (1977) 163
- 1977MA1H Mason, Garcia-Munoz and Simpson, *Bull. Amer. Phys. Soc.* 22 (1977) 567
- 1977MA35 V.B. Mandelzweig, *Nucl. Phys.* A292 (1977) 333

- 1977MC10 A.B. McDonald, T.K. Alexander, J.R. Beene and H.B. Mak, Nucl. Phys. A288 (1977) 529
- 1977MC1C McNally, Bull. Amer. Phys. Soc. 22 (1977) 581
- 1977MI13 D. Miljanic, E. Andrade, J. Hudomalj-Gabitzsch, G.S. Mutchler and G.C. Phillips, Nucl. Phys. A290 (1977) 27
- 1977MO1B Moller, Hufschmidt and Kamke, Nucl. Instrum. Meth. Phys. Res. 140 (1977) 157
- 1977MO1C Moyle, Glagola, Matthews and Viola, Bull. Amer. Phys. Soc. 22 (1977) 998
- 1977MO1D Montmerle, Astrophys. J. 217 (1977) 878
- 1977MO1E Montmerle, Astrophys. J. 218 (1977) 263
- 1977MU1A Mukhopadhyay, Phys. Rept. C30 (1977) 1
- 1977NA08 V.S. Nadezhdin, N.I. Petrov, V.I. Satarov and I.I. Vzorov, Yad. Fiz. 25 (1977) 490; Sov. J. Nucl. Phys. 25 (1977) 263
- 1977NO1C Noro, Hatanaka, Nakamura and Kobayashi, in Tokyo (1977) 17
- 1977OS06 A. Osman, Lett. Nuovo Cim. 19 (1977) 491
- 1977OS1B Osman, Nuovo Cim. A42 (1977) 397
- 1977PA27 R. Pardo, R.G. Markham, W. Benenson, A.I. Galonsky and E. Kashy, Phys. Lett. B71 (1977) 301
- 1977PR1B Primaokoff, AIP Conf. Proc. 37 (1977) 85
- 1977RA1A Radutskii and Serdyutskii, Sov. J. Nucl. Phys. 26 (1977) 163
- 1977RE08 H. Reiss, H.V. Klapdor, G. Rosner, J.L.C. Ford, Jr. and S.T. Thornton, Nucl. Phys. A283 (1977) 149
- 1977RI07 P.J. Riley, C.W. Bjork, C.R. Newsom, M.L. Evans, G. Glass, J.C. Hiebert, M. Jain, R.A. Kenefick, L.C. Northcliffe, B.E. Bonner et al., Phys. Lett. B68 (1977) 217
- 1977RO01 E. Rosario-Garcia and R.E. Benenson, Nucl. Phys. A275 (1977) 453
- 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
- 1977RO1E Roos, AIP Conf. Proc. 37 (1977) 32
- 1977RO23 P. Roberson, T. King, R. Kunselman, J. Miller, R.J. Powers, P.D. Barnes, R.A. Eisenstein, R.B. Sutton, W.C. Lam, C.R. Cox et al., Phys. Rev. C16 (1977) 1945
- 1977SA1G Sato, Yamine and Morita, in Tokyo (1977) 790
- 1977SA21 K. Sagara, M. Hara, N. Takahashi, T. Motobayashi, F. Takeutchi, F. Soga and Y. Nogami, J. Phys. Soc. Jpn. 42 (1977) 732
- 1977SC1B Schwandt et al., Bull. Amer. Phys. Soc. 22 (1977) 633
- 1977SC1D Schramm and Wagoner, Ann. Rev. Nucl. Sci. 27 (1977) 37

- 1977SC25 D. Scholz, H. Gemmeke, L. Lassen, R. Ost and K. Bethge, Nucl. Phys. A288 (1977) 351
- 1977SE11 V.I. Serov, S.N. Abramovich and L.A. Morkin, At. Energ. 42 (1977) 59; Sov. At. Energy 42 (1977) 66
- 1977SE1C F. Seiler and H.W. Roser, Phys. Lett. B69 (1977) 411
- 1977SH1C Shoda et al., Proc. Int. Conf. Nucl. Struct., Tokyo (1977); J. Phys. Soc. Jpn. Suppl. 44 (1978) 482
- 1977SH1D Shimoda et al., in Tokyo (1977) 703
- 1977SI03 R.R. Silbar, Phys. Rev. C15 (1977) 1158
- 1977SI10 S.K. Singh and I. Ahmad, Phys. Lett. B69 (1977) 422
- 1977SI1D Silberberg and Tsao, Astrophys. J. Suppl. 35 (1977) 129
- 1977SL1B Slobodrian, Pigeon, Roy and Irshad, in Tokyo (1977) 573
- 1977SM1A Yu.F. Smirnov and Yu.M. Tchuvil'sky, Phys. Rev. C15 (1977) 84
- 1977ST34 R.G. Stokstad, M.N. Namboodiri, E.T. Chulick, J.B. Natowitz and D.L. Hanson, Phys. Rev. C16 (1977) 2249
- 1977TA1A Tanaka et al., in Tokyo (1977) 21
- 1977TA1B Taneichi, Ueno and Shoda, in Tokyo (1977) 141
- 1977TA1C Taneichi and Shoda, Bull. Yamagata Univ. (Japan) 9 (1977) 237
- 1977TE1A Terrien, in Tokyo (1977) 843
- 1977TE1B Telegdi, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 367
- 1977TO03 M. Toyama and Y. Sakamoto, Lett. Nuovo Cim. 18 (1977) 33
- 1977TO20 E.L. Tomusiak and E.T. Dressler, Phys. Lett. B72 (1977) 1
- 1977TR1A Traber, Trautman and Alder, Helv. Phys. Acta 50 (1977) 195
- 1977TU02 A. Turkevich, J.R. Cadieux, J. Warren, T. Economou, J. La Rosa and H.R. Heydegger, Phys. Rev. Lett. 38 (1977) 1129
- 1977TU03 A. Turkevich, J.R. Cadieux, J. Warren, T. Economou and J. LaRosa, Phys. Lett. B72 (1977) 163
- 1977TU1D Turk and Antolkovic, Fiz. Suppl. 9 (1977) 49
- 1977VE05 J.D. Vergados and R.M. Woloshyn, Phys. Rev. C16 (1977) 292
- 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
- 1977WA1F J.D. Walecka, Nucl. Phys. A285 (1977) 349
- 1977WA1G Walecka, AIP Conf. Proc. 37 (1977) 125

- 1977WA1H Walter, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 225
- 1977WE1C Wessels et al., Nucl. Instrum. Meth. Phys. Res. 141 (1977) 157
- 1977WE1D Weller, Furst, Tombrello and Burnett, Astrophys. J. 214 (1977) L39
- 1977WE1E Welsh, High Energy Phys. Nucl. Struct., Zurich, 1977 (1977) 95
- 1977YA1A Yasue et al., in Tokyo (1977) 520
- 1977YA1B Yakovlev, Fiz. Elem. Chastits At. Yad. (USSR) 8 (1977) 255
- 1978AJ02 F. Ajzenberg-Selove, E.R. Flynn and O. Hansen, Phys. Rev. C17 (1978) 1283.
- 1978AJ03 F. Ajzenberg-Selove, Nucl. Phys. A300 (1978) 1
- 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
- 1978AN07 I. Angeli and M. Csatlos, Atomki Kozlem. 20 (1978) 1
- 1978AU1C Austin, Bull. Amer. Phys. Soc. 23 (1978) 609
- 1978BE1K T. Berggren, Phys. Lett. B73 (1978) 389
- 1978BI08 R. Billerey, C. Cerruti, A. Chevarier, N. Chevarier and A. Demeyer, Z. Phys. A285 (1978) 389
- 1978BO24 M. Bouten, M-C. Bouten and P. Van Leuven, Lett. Nuovo Cim. 22 (1978) 415
- 1978BO43 M.P. Bornand, G.R. Plattner, R.D. Viollier and K. Alder, Nucl. Phys. A294 (1978) 492
- 1978BR1F Brown et al., LA-7378-MS (1978)
- 1978CA15 C.M. Castaneda, H.A. Smith, Jr., P.P. Singh, J. Jastrzebski, H. Karwowski and A.K. Gaigalas, Phys. Lett. 877 (1978) 371
- 1978CA1E Carey et al., Bull. Amer. Phys. Soc. 23 (1978) 594
- 1978CA1H Calaprice, Hyperfine Interactions 4 (1978) 25
- 1978CH1G Chant, 3rd Int. Conf. on Clustering Aspects of Nucl. Struct. Nucl. Reactions, Winnipeg (1978)
- 1978CH1H Chrien et al., Proc., Cluster, Winnipeg (1978) D5
- 1978CH1K Chrien et al., Bull. Amer. Phys. Soc. 23 (1978) 81
- 1978DE15 P. Desgrolard, P.A.M. Guichon and J. Joseph, Nuovo Cim. A43 (1978) 475
- 1978DE1J Devaux et al., Proc., Cluster, Winnipeg (1978) D4
- 1978DE1K B. Desplanques and J. Missimer, Nucl. Phys. A300 (1978) 286
- 1978DI04 S. Di Liberto, F. Meddi, G. Romano, G. Rosa and C. Sgarbi, Nucl. Phys. A296 (1978) 519
- 1978DR07 W. Dreves, P. Zupranski, P. Egelhof, D. Kassen, E. Steffens, W. Weiss and D. Fick, Phys. Lett. B78 (1978) 36

- 1978DW1A Dwek, Bull. Amer. Astron. Soc. (1978); to be published
- 1978EI1A Eisenstein et al., Bull. Amer. Phys. Soc. 23 (1978) 80
- 1978EN1A England et al., Proc., Cluster, Winnipeg (1978) 833
- 1978FA1C M. Fabre de la Ripelle, Nucl. Phys. A302 (1978) 205
- 1978FE1C Fernandez and Nalda, Proc., Cluster, Winnipeg (1978) 87
- 1978FI1E Fick, 3rd Int. Conf. on Clustering Aspects of Nucl. Struct. Nucl. Reactions, Winnipeg (1978)
- 1978FL03 J.G. Fleissner, D.A. Rakel, F.P. Venezia, E.G. Funk, J.W. Mihelich and H.A. Smith, Jr., Phys. Rev. C17 (1978) 1001
- 1978FR1D S. Frankel, W. Frati, G. Blanpied, G.W. Hoffmann, T. Kozlowski, C. Morris, H.A. Thiessen, O. Van Dyck, R. Ridge and C. Whitten, Phys. Rev. C18 (1978) 1375
- 1978FR1E S. Frankel, Phys. Rev. C17 (1978) 694
- 1978FU03 K. Fukunaga, T. Ohsawa, N. Fujiwara, S. Tanaka, A. Okihana and T. Yanabu, J. Phys. Soc. Jpn. 44 (1978) 1413
- 1978GE04 H. Gemmeke, B. Deluigi, L. Lassen and D. Scholz, Z. Phys. A286 (1978) 73
- 1978GE1C Gelbke et al., Phys. Rept. C42 (1978) 311
- 1978GR1F Green and Korteling, Proc., Cluster, Winnipeg (1978) 89
- 1978HA1H Haftel and Bassel, Proc., Cluster, Winnipeg (1978) 82, 83
- 1978HO1E Horiuchi, 3rd Int. Conf. on Clustering Aspects of Nucl. Struct. Nucl. Reactions, Winnipeg (1978)
- 1978HW01 W-Y.P. Hwang, Phys. Rev. C17 (1978) 1799; Erratum Phys. Rev. C18 (1978) 1553
- 1978IO1A Ioannides and Johnson, Proc., Cluster, Winnipeg (1978) 831
- 1978JA1C Jackson and Ioannides, Proc., Cluster, Winnipeg (1978) 821
- 1978JE1B A.S. Jensen and S.E. Koonin, Phys. Lett. B73 (1978) 243
- 1978KA11 T. Kambara, M. Takai, M. Nakamura and S. Kobayashi, J. Phys. Soc. Jpn. 44 (1978) 704
- 1978KA1C Kallne et al., Proc., Cluster, Winnipeg (1978) B29
- 1978KA1E Kassen et al., Nucl. Instrum. Meth. Phys. Res. 150 (1978) 333
- 1978KA1F Kanada, Kaneko, Nishidka and Saito, Proc., Cluster, Winnipeg (1978) A1
- 1978KI08 H.R. Kissener, G.E. Dogotar, R.A. Eramzhyan and R.A. Sakaev, Nucl. Phys. A302 (1978) 523
- 1978KN1D Knox et al., Bull. Amer. Phys. Soc. 23 (1978) 942
- 1978KO13 Y. Koike, Nucl. Phys. A301 (1978) 411
- 1978KU02 Y. Kudo, T. Honda and H. Horie, Prog. Theor. Phys. 59 (1978) 101

- 1978LA1F Lattuada, Vinciguerra and Riggi, *Lett. Nuovo Cim.* 21 (1978) 497
- 1978LE04 H.C. Lee, *Nucl. Phys. A*294 (1978) 473
- 1978LE05 D.R. Lehman, M. Rai and A. Ghovanlou, *Phys. Rev. C*17 (1978) 744
- 1978LI1C Lisowski et al., *Bull. Amer. Phys. Soc.* 23 (1978) 635
- 1978LO1B Lodhi, Ray and Yen, *Bull. Amer. Phys. Soc.* 23 (1978) 500
- 1978MC1D McClelland et al., *Bull. Amer. Phys. Soc.* 23 (1978) 951
- 1978MI1C Mintz, *Bull. Amer. Phys. Soc.* 23 (1978) 603
- 1978MO01 C.L. Morris, R.L. Boudrie, J.J. Kraushaar, R.J. Peterson, R.A. Ristinen, G.R. Smith, J.E. Bolger, W.J. Braithwaite, C.F. Moore and L.E. Smith, *Phys. Rev. C*17 (1978) 227
- 1978NA05 K. Nakamura, S. Hiramatsu, T. Kamae, H. Muramatsu, N. Izutsu and Y. Watase, *Nucl. Phys. A*296 (1978) 431
- 1978NA08 H. Nakamura, H. Noya, S.E. Darden and S. Sen, *Nucl. Phys. A*305 (1978) 1
- 1978NO08 E. Norbeck, M.D. Strathman and D.A. Fox, *Phys. Rev. C*18 (1978) 1275
- 1978OS1D Osman, *Proc., Cluster, Winnipeg* (1978) 89
- 1978OT1A Otteson et al., *Proc., Cluster, Winnipeg* (1978) D13
- 1978PA02 W.C. Parke, A. Ghovanlou, C.T. Noguchi, M. Rajan and D.R. Lehman, *Phys. Lett. B*74 (1978) 158
- 1978PE1C F. Petrovich, D. Stanley, L.A. Parks and P. Nagel, *Phys. Rev. C*17 (1978) 1642
- 1978PR1A Pronko, Okamoto and Wiedersich, *Nucl. Instrum. Meth. Phys. Res.* 149 (1978) 77
- 1978RE05 D. Renker, W. Dahme, W. Hering, H. Panke, C. Zupancic, J.C. Alder, B. Gabioud, C. Joseph, J.F. Loude, N. Morel et al., *Phys. Rev. Lett.* 41 (1978) 1279
- 1978RI02 P.J. Riley, C.W. Bjork, C.R. Newsom, R.A. Kenefick, M.L. Evans, G. Glass, J. Hiebert, M. Jain, L.C. Northcliffe, B.E. Bonner et al., *Phys. Rev. C*17 (1978) 1881
- 1978RO01 R.G.H. Robertson, E. Kashy, W. Benenson and A. Ledebuhr, *Phys. Rev. C*17 (1978) 4
- 1978RO1D Rolfs and Trautvetter, *Ann. Rev. Nucl. Part. Sci.* 28 (1978) 115
- 1978RO1E Robertson et al., *Bull. Amer. Phys. Soc.* 23 (1978) 518
- 1978SA07 K. Sagara, T. Motobayashi, N. Takahashi, Y. Hashimoto, M. Hara, Y. Nogami, H. Nakamura and H. Noya, *Nucl. Phys. A*299 (1978) 77
- 1978SA1E Satpathy and Navak, *J. Phys. (London)* G4 (1978) L161
- 1978SE01 F. Seiler, F.N. Rad, H.E. Conzett and R. Roy, *Nucl. Phys. A*296 (1978) 205
- 1978SH1C Shepard et al., *Bull. Amer. Phys. Soc.* 23 (1978) 626
- 1978SL1B Slaus, *Proc. Int. Conf. Nucl. Struct., Tokyo* (1977); *J. Phys. Soc. Jpn. Suppl.* 44 (1978) 57

1978SM1B Smith, Shepard, Peterson and Digiacomio, Bull. Amer. Phys. Soc. 23 (1978) 951
1978ST05 D.J. Stubeda, M. LeMere and Y.C. Tang, Phys. Rev. C17 (1978) 447
1978SU1C Sunkel, Proc., Cluster, Winnipeg (1978) A20
1978VL01 R. Vlastou, J.B.A. England, O. Karban, S. Baird and Y.-W. Lui, Nucl. Phys. A303
(1978) 368
1978WIZO T.M. Williams, J.W. Lo, E.V. Hungerford, J.C. Allred, B.W. Mayes, L.S. Pinsky, M.L.
Warneke, J.M. Clement, W.H. Dragoset, R.D. Felder et al., Bull. Amer. Phys. Soc. 23
(1978) 951, EC1
1978WO13 R.M. Woloshyn, Nucl. Phys. A306 (1978) 333
1978ZA1D Zalm, Van Hienen and Glaudemans, Z. Phys. A287 (1978) 255
1980AJ01 F. Ajzenberg-Selove and C.L. Busch, Nucl. Phys. A336 (1980) 1
AL77Z Unknown Source

