Energy Levels of Light Nuclei
$A = 6$

F. Ajzenberg-Selove

University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396

Abstract: An evaluation of A = 5–10 was published in *Nuclear Physics A*490 (1995), p. 1. This version of A = 6 differs from the published version in that we have corrected some errors discovered after the article went to press. Figures and introductory tables have been omitted from this manuscript. Also, reference key numbers have been changed to the NNDC/TUNL format — see introduction to references for more information.

(References closed June 1, 1988)

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).

^{6}n

(Not illustrated)

^{6}n has not been observed: see (79AJ01). See also (84DE1D) and (87BE45; theor.).

^{6}H

(Fig. 7)

^{6}H has been reported in the ^{7}Li(^{7}Li, ^{8}B)^{6}H reaction at $E(^7\text{Li}) = 82$ MeV (84AL1F, 85AL1G) [$\sigma(\theta) \sim 60$ nb/sr at $\theta = 10°$] and in the ^{9}Be(^{11}B, ^{14}O)^{6}H reaction at $E(^{11}\text{B}) = 88$ MeV (86BE35) [$\sigma(\theta) \sim 16$ nb/sr at $\theta \sim 8°$]. ^{6}H is unstable with respect to breakup into $^3\text{H} + 3\text{n}$ by 2.7 ± 0.4 MeV, $\Gamma = 1.8 \pm 0.5$ MeV (84AL1F), 2.6 ± 0.5 MeV, $\Gamma = 1.3 \pm 0.5$ MeV (86BE35). We adopt 2.7 ± 0.3 MeV, $\Gamma = 1.6 \pm 0.4$ MeV. See also (87BO40). The atomic mass excess of ^{6}H using the (88WA18) masses for ^{3}H and n, is then 41.9 ± 0.3 MeV. However, there is no evidence for the formation of ^{6}H in the ^{6}Li(π^-, π^+) reaction at $E_{\pi^-} = 220$ MeV (87SE1C, 88SE1C; prelim.). The ground state of ^{6}H is calculated to have $J^\pi = 2^-$. Excited states are predicted at 1.78, 2.80 and 4.79 MeV with $J^\pi = 1^-$, 0^- and 1^+ [$(0+1)\ \hbar\omega$ model space] (85PO10) [see also for $(0+2)\ \hbar\omega$ calculations]. See also (86BE44, 87GOZN, 87GO1Y, 87GO1Z), (83PO1D, 84AJ01, 86FL1A, 87AJ1A, 87PE1C, 88HA1I) and (87HA40, 87KU1F; theor.).

^{6}He

(Figs. 4 and 7)

GENERAL: See also (84AJ01).

Model calculations: (83GA1E, 83LE14, 84FI1E, 84PA08, 84VA06, 85EM01, 85FI1E, 86EM1A, 86FI1F, 86KU08, 86KU1F, 86VA13, 86VO09, 87DA1H, 88KA1J).

Special states: (84FI1A, 84FI1E, 84VA06, 85EM01, 85FI1E, 86EM1A, 86FI1F, 86KU08, 86VA13, 86VO09, 86WI04, 87BL18, 87DA1G, 87DA1H, 87KO39, 87KU1F, 88DA1E).

Electromagnetic transitions: (84VA1B, 85FI1E, 86FI1F).

Complex reactions involving ^{6}He: (82AL1C, 83AN13, 83KU1B, 83OL1A, 84BA1H, 84GL1E, 84KO1A, 84LA27, 84WE03, 85BA1C, 85BO1J, 85JA1B, 85MA02, 85MA13, 85WO11, 86AV1B, 86CS1A, 86EN1B, 86MA1V, 86SA30, 86SI1B, 86WE1C, 87BA1I, 87BA38, 87BA39, 87BO40, 87GR11, 87GU1L, 87KO1Z, 87PE1C, 87TA1F, 87WI09, 87YA16, 88AL1G, 88LI1A, 88ST06, 88TA1A, 88WO10).

Applications: (85TA1D).

Muon and neutrino capture and reactions: (83JU01, 84WA1J).

Table 6.1
Energy levels of ^{6}He

E_x (MeV ± keV)	$J^\pi; T$	$\tau_{1/2}$ or $\Gamma_{c.m.}$	Decay	Reactions
g.s.	0^+; 1	$\tau_{1/2} = 806.7 \pm 1.5$ msec	β^-	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20
1.797 ± 25	$(2)^+$; 1	$\Gamma = 113 \pm 20$ keV	n, α	3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 20
(13.6 ± 500)	$(1^-, 2^-)$; 1	broad		4, 11, 14, 16
(15.5 ± 500)		4 ± 2 MeV		5, 6, 10, 11, 15, 16
(25 ± 1000)		8 ± 2 MeV		6
(32)		≤ 2 MeV		15
(36)		≤ 2 MeV		15

Reactions involving pions, other mesons and baryon states (see also reactions 4 and 5): (82BE1D, 84KO16, 84RE1C, 84ZA1A, 85ER06, 85RE1B, 86AD1A, 86HA1L, 87FA1H, 87JA1C).

Hypernuclei: (82KA1D, 82M01B, 82WA1A, 83BA1D, 83MO1C, 83SH1E, 84BO1D, 84BO1G, 84BO1H, 84CH1G, 84DZ1A, 84KE1C, 84MI1E, 84MO1H, 84ZH1B, 85BA1E, 85GUIJ, 85IK1A, 85MO1F, 86BO1E, 86DA1B, 86PO1G, 86PO1H, 86WA1J, 86ZH1B, 87BO1L, 87BO1O, 87CO1S, 87DZ1B, 87JI1A, 87PO1H, 87SU1K, 87WA1J, 87YA1M, 88GI1B, 88JI1A, 88PO1H, 88TA1B).

Other topics: (83BA1L, 84FI1E, 85AN28, LO86J, 86KU1F, 87AJ1A, 88DA1E).

Ground state of ^{6}He: (83ANZQ, 83GR26, 83LE14, 84FR13, 84PA08, 85AN28, 85FI1E, 85SA32, 86KU08, 86VO09, 87BL18, 87HA30, 87HA34, 87SA15, 88DAZW, 88JO1C).

The interaction nuclear radius of ^{6}He is 2.18 ± 0.02 fm (85TA18, 85TA13) [see also for derived nuclear matter, charge and neutron matter r.m.s. radii].

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

The decay proceeds to the ground state of ^{6}Li [$J^\pi = 1^+$] via a super-allowed Gamow-Teller transition. The half-life is 806.7 ± 1.5 msec; $\log ft = 2.910 \pm 0.002$: see (84AJ01). See also (86RO1L), (85GR1A) and (83LE14, 84BO03, 84PA08, 88SA2J; theor.).

2. (a) ^{3}H(t, n)^{5}He $\quad Q_m = 10.44 \quad E_b = 12.307$

(b) ^{3}H(t, 2n)^{4}He $\quad Q_m = 11.33216$

(c) ^{3}H(t, t)^{3}H

The cross section for reaction (b) has recently been measured for $E_t = 30$ to 115 keV by (86BR1K, 85JA16) who have also calculated the astrophysical S-factors [the extrapolated $S(0) \approx 180$ keV·b] and discussed the earlier measurements. See also (74JA01, 79AJ01) and (86JA1E; applied). For muon-catalyzed fusion see (85ZI1C, 87BR1V, 87PO1M). See also (84BY1A, 84BY1B, 84FI1F, 85BU1B, 85GU1G, 85KA1M, 85VA1B, 86BA73, 86BY1A, 87PR08, 87WY1A, 88RIZW; theor.).

3. ^{4}He(t, p)^{6}He $\quad Q_m = -7.507$

Angular distributions of the protons to ^{6}He*(0, 1.80) have been measured at $E_t = 22$ and 23 MeV. [No L-values were assigned.] No other states are observed with $E_x \leq 4.2$ MeV: see (79AJ01).

4. ^{6}Li(e, π^+)^{6}He $\quad Q_m = -143.075$

(86SH14) report breaks in (e, π^+) spectra at $E_e = 202$ MeV corresponding to $E_x = 7$, 9, 12, 13.6, 17.7 and 24.0 MeV. Using the shape of the virtual photon spectrum results in groups whose angular distributions suggest that the states at 13.6, 17.7 and 24.0 MeV are spin-dipole isovector states [$J^\pi = 1^-, 2^-$]. For the earlier work see (84AJ01). [Note: The states reported here at 7, 9 and 12 MeV are inconsistent with the work reported in reactions 7, 8, 14 and 15, and with the work on the analog region in ^{6}Be].

5. (a) ^{6}Li(π^-, γ)^{6}He $\quad Q_m = 136.062$

(b) ^{6}Li(π^-, π^0)^{6}He $\quad Q_m = 1.097$

The excitation of ^{6}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 has been reported: see (79AJ01). (86PE05) have recently studied the capture branching ratios to ^{6}He*(0, 1.8). For reaction (b) see (84AJ01).

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

Angular distributions of the p_0 group have been reported at $E_n = 4.7$ to 6.8 MeV, at 14 MeV and at 59.6 MeV [see (79AJ01, 84AJ01)] and at 118 MeV (87PO18; prelim.). At $E_n = 59.6$ MeV broad structures in the spectra are ascribed to states at $E_x = 15.5 \pm 0.5$

and 25 ± 1 MeV with $\Gamma = 4 \pm 1.5$ and 8 ± 2 MeV (83BR1C, 84BR03) [see for discussions of the GDR strength]. The ground state reaction has also been studied at $E_n = 198$ MeV (88JA01). See also (86AL1K, 86PO1J, 88MI1E, 86AU1D, 87BR32, 87HE22, 88HA12) and (83GM1A, 85ER06, 86ER1A; theor.).

7. ^{6}Li(d, 2p)^{6}He $\quad Q_m = -4.949$

At $E_d = 55$ MeV, ^{6}He*(0, 1.8) [the latter weak] are populated: no other states are observed with $E_x \leq 25$ MeV [see (84AJ01)].

8. ^{6}Li(t, ^{3}He)^{6}He $\quad Q_m = -3.488$

The ground-state angular distribution has been studied at $E_t = 17$ MeV. At $E_t = 22$ MeV only ^{6}He*(0, 1.8) are populated for $E_x \leq 8.5$ MeV: see (79AJ01). Differential cross sections for the transition to ^{6}He*(1.8) are reported at $E(^6$Li$) = 65$ MeV (87AL1L).

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

Angular distributions have been studied for $E(^6$Li$) = 32$ and 36 MeV for the transitions to ^{6}He$_{g.s.}$, ^{6}Be$_{g.s.}$ and, in inelastic scattering of ^{6}Li [see ^{6}Li], to the analog state ^{6}Li*(3.56): for a discussion of these see the references quoted in (79AJ01).

10. (a) ^{7}Li(γ, p)^{6}He $\quad Q_m = -9.975$
(b) ^{7}Li(e, ep)^{6}He $\quad Q_m = -9.975$

At $E_\gamma = 60$ MeV, the proton spectrum shows two prominent peaks attributed to ^{6}He*($0 + 1.8$, 18 ± 3): see (79AJ01). Reactions (a) and (b) have been studied by (85SE17). See also ^{7}Li, (84AJ01) and (86BA2G; theor.).

11. ^{7}Li(n, d)^{6}He $\quad Q_m = -7.750$

At $E_n = 60$ MeV, the deuteron spectrum shows two prominent peaks attributed to states centered at $E_x = 13.6$, 15.4 and 17.7 MeV (± 0.5 MeV) and a possible state or states (populated with an l_p transfer ≥ 2) at $E_x = 23.7$ MeV. DWBA analyses of the d_0 and d_1 groups are consistent with $l_p = 1$ and $S(1p_{3/2}) = 0.62$ for ^{6}He$_{g.s.}$ and to $S(1p_{1/2}) = 0.35$ for ^{6}He*(1.8): see (79AJ01).

12. ^{7}Li(p, 2p)^{6}He $\qquad Q_m = -9.975$

At $E_p = 1$ GeV the separation energy between 6–7 MeV broad $1p_{3/2}$ and $1s_{1/2}$ peaks is reported to be 14.1 ± 0.7 MeV (85BE1J, 85DO1B). See also (83GO06) and (79AJ01).

13. ^{7}Li(d, ^{3}He)^{6}He $\qquad Q_m = -4.481$

Angular distributions of the ^{3}He ions to ^{6}He*(0, 1.8) have been measured at $E_d = 14.4$ and 22 MeV: they have an $l_p = 1$ character and therefore these two states have $J^\pi = (0\text{–}3)^+$. There is no evidence for any other states of ^{6}He with $E_x < 10.7$ MeV: see (79AJ01). (87BO1W) [$E_d = 30.7$ MeV] deduce that the branching ratio of ^{6}He*(1.8) into a dineutron [n^2: $T = 1$, $S = 0$] and an α-particle is 0.75 ± 0.10. See also (85BO55) and (87DA1N; theor.).

14. ^{7}Li(t, α)^{6}He $\qquad Q_m = 9.839$

The energy of the first-excited state is 1.797 ± 0.025 MeV, $\Gamma = 113 \pm 20$ keV. ^{6}He*(1.80) decays into ^{4}He + 2n. The branching ratio $\Gamma_\gamma/\Gamma_\alpha \leq 2 \times 10^{-6}$: for $\Gamma_{c.m.} = 113 \pm 20$ keV, $\Gamma_\gamma \leq 0.23$ eV. Angular distributions of the α_0 and α_1 groups have been measured at $E_t = 13$ and 22 MeV. No other α-groups are reported corresponding to ^{6}He states with $E_x < 24$ MeV (region between $E_x \sim 13$ and 16 MeV was obscured by the presence of breakup α-particles): see (79AJ01). Angular distributions have been recently reported at $E_t = 0.151$ and 0.272 MeV (87AB09; α_0, α_1) and at $E(^7\text{Li}) = 31$ MeV. (87AL1L; to ^{6}He*(0, 1.8, 13.6)).

15. ^{7}Li(^{3}He, p^{3}He)^{6}He $\qquad Q_m = -9.975$

At $E(^3\text{He}) = 120$ MeV the missing mass spectra show ^{6}He*(0, 1.8) and a strong, broad peak corresponding to ^{6}He*(16) [possibly due to unresolved states]. There is no indication of a state near 23.7 MeV but there is some evidence of structures at $E_x = 32.0$ and 35.7 MeV, with $\Gamma \leq 2$ MeV (85FR01).

16. (a) ^{7}Li(^{6}Li, ^{7}Be)^{6}He $\qquad Q_m = -4.369$
(b) ^{7}Li(^{7}Li, ^{8}Be)^{6}He $\qquad Q_m = 7.280$

In reaction (a) at $E(^6\text{Li}) = 93$ MeV a broad peak ($\Gamma = 5.5$ MeV) is reported at $E_x = 14$ MeV. A second structure may also be present at 15.5 MeV (87GLZW, 88BUZH; prelim.). ^{6}He*(0, 1.8) are also populated (88BUZH). For reaction (b) see ^{8}Be. See also ^{7}Be, (84AJ01), (88BU1Q) and (84BA53; theor.).

17. ^{9}Be(n, α)^{6}He $\qquad$ $Q_m = -0.598$

Angular distributions have been reported for $E_n = 12.2$ to 18.0 MeV (α_0, α_1). No other states are observed with $E_x \leq 7$ MeV: see (79AJ01). For a study of possible dineutron breakup of ^{6}He*(1.8) see (83OT02). See also ^{10}Be and (83SH1J).

18. ^{9}Be(^{6}Li, ^{9}B)^{6}He $\qquad$ $Q_m = -4.575$

See ^{9}B.

19. ^{10}B(n, pα)^{6}He $\qquad$ $Q_m = -7.184$

Not observed: see (84TU02).

20. ^{11}B(^{7}Li, ^{12}C)^{6}He $\qquad$ $Q_m = 5.983$

At $E(^{11}\text{B}) = 88$ MeV the population of the ground state and the first-excited state at $E_x = 1.8 \pm 0.3$ MeV ($\Gamma \leq 0.2$ MeV) is reported (87BEYI). See also (88BEYJ).

^{6}Li

(Figs. 5 and 7)

GENERAL: See also (84AJ01).

Shell model: (83LE14, 83VA31, 84AS07, 84PA08, 84RE1A, 84VA06, 84ZW1A, 85ER06, 85FI1E, 85LO1A, 86AV1F, 86LE21, 87KI1C, 88WO04).

Cluster and α-particle models: (81PL1A, 82WE15, 83CA13, 83DZ1A, 83FD03, 83GA1E, 83GO17, 83SA39, 83SM04, 84BE37, 84CO08, 84DU17, 84GL02, 84JO1A, 84KH05, 84KR10, 84KU03, 84LA33, 84MI1F, 84PA08, 84PL1A, 84WA02, 84WA1H, 85BE60, 85BO05, 85BO1F, 85FI1E, 85KH07, 85KW02, 85KW03, 85LE08, 85LI1F, 85LO02, 85ME02, 850503, 85SA1B, 85ZH1A, 86AV1F, 86BU07, 86CH1L, 86ES1B, 86FI1F, 86GE05, 86KR12, 86KR1E, 86KUO8, 86KU1F, 86SA15, 86SA1D, 86SR02, 86VA13, 86VO09, 87IM04, 87KR07, 87LE1D, 87LO16, 87TA06, 87ZH1E, 88CH05, 88CO1B, 88FR1E, 88KA1J, 88KU1C, 88US1A).

Special states: (81PL1A, 83BI1C, 83RO12, 83VA31, 84AS07, 84DU17, 84FI1A, 84FI1E, 84OH01, 84RE1A, 84VA06, 84WA02, 84ZW1A, 85AL12, 85BA68, 85BE60, 85FI1E, 85GO07, 85KW03, 85ME02, 85MI10, 85OS03, 85PO09, 85WI1A, 85ZH1A, 86AK1C, 86BU07, 86EL1A,

Table 6.2
Energy levels of ^{6}Li

E_x (MeV ± keV)	$J^\pi; T$	$\Gamma_{c.m.}$ (MeV)	Decay	Reactions
g.s.	$1^+; 0$		stable	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54
2.186 ± 2	$3^+; 0$	0.024 ± 0.002	γ, d, α	1, 2, 3, 6, 7, 8, 12, 13, 14, 15, 16, 18, 19, 20, 21, 24, 25, 28, 29, 30, 31, 32, 33, 35, 37, 39, 40, 41, 42, 48, 49
3.56288 ± 0.10	$0^+; 1$	$(8.2 \pm 0.2) \times 10^{-6}$	γ	1, 3, 11, 12, 13, 15, 16, 17, 18, 20, 29, 31, 32, 33, 35, 37, 54
4.31 ± 22	$2^+; 0$	1.7 ± 0.2 [a])	γ, d, α	1, 6, 12, 13, 15, 16, 24, 31, 35, 48
5.366 ± 15	$2^+; 1$	0.540 ± 0.020	γ, n, p, α	1, 12, 15, 31, 32, 33, 35
5.65 ± 50	$1^+; 0$	1.5 ± 0.2	d, α	6, 15, 33, 35
(15.8)	$3^+; 0$	17.8 ± 0.8	d, α	6
21.0	$2^-; 1$	broad	t, ^{3}He	1
21.5	$0^-; 1$	broad	t, ^{3}He	1
(23 ± 2000)	$4^+; 0$	12 ± 2	d, α	1, 6
25.0 ± 1000	$4^-; 1$	$\simeq 4$	γ, n, t, ^{3}He	1
26.6 ± 400 b)	$3^-; 0$	broad	γ, n, d, t, ^{3}He, α	1
(31)	(3^+)	broad	d, t, ^{3}He, α	1

[a]) See also tables 6.4 and 6.5.
[b]) See also table 6.3. For other possible states at high E_x see reactions 6, 31, 33 and 38.

86FI1F, 86GE05, 86KU08, 86SA15, 86VA13, 86VO09, 87KI1C, 87KO39, 87KR07, 87KU1F, 87SV1A, 87WA1J, 87ZH1E, 88US1A).

Electromagnetic transitions and giant resonances: (83GM1A, 84AS07, 85FI1E, 85GO23, 85ME02, 86AK1C, 86ER1A, 86FI1F, 86ME13, 86SRO2, 86VA13, 87KI1C, 87KR07, 87ZH1E).

Astrophysical questions: (82AU1A, 82CA1A, 82GR1A, 82WA1B, 84RA1E, 84TR1C, 85BO1E, 85BO1K, 85H01A, 85MI1E, 85SC1C, 85WA1K, 86HU1D, 86LA27, 86RE1C, 87AL1C, 87AR1J, 87AR1C, 87AU1A, 87HO1M, 87MA2C, 87PA1F, 87RO1D, 88RE1B).

Complex reactions involving ^{6}Li: (83CH23, 83GU1A, 83GU1B, 83KU1B, 83MA53, 83MU08, 83NA08, 83OL1A, 83SA39, 83ST1A, 84BA1H, 84BE1E, 84CO08, 84EC01, 84EV1A, 84GO03, 84GR08, 84HI1A, 84KH05, 84MO29, 84NE1A, 84RE1A, 84ST1B, 84TS03, 84UM04, 85BO1F, 85FA02, 85CL1C, 85GO20, 85GU11, 85JA1B, 85MA1A, 85MA13, 85MO17, 85PO09, 85ST1B, 85WI1A, 85WO11, 86CH10, 86CS1A, 86HA1B, 86JO1A, 86KA1C, 86KA1R, 86LI13, 86ME06, 86MO1C, 86RA02, 86SA1K, 86SAZL, 86SA30, 86SA1N, 86SI1B, 86SR02, 86TA1G, 86TA1M, 86WE1C, 86XU1B, 86YA1L, 87AR19, 87AU1C, 87BA38, 87VE1D, 87VE1D, 87BL13, 87BL1K, 87CH08, 87CH26, 87CH33, 87CH32, 87DE37, 87DO13, 87DU07, 87FA01, 87FA02, 87FE1A, 87FR1G, 87FE1B, 87GL1G, 87GR11, 87HA1M, 87JA06, 87JE03, 87KO15, 87LY04, 87LY1D, 87NA01, 87PO1I, 87RO10, 87SA21, 87TA1F, 87TR05, 87WA09, 87YA16, 88BE09, 88BL09, 88CA11, 88CEZZ, 88FR1B, 88FR1F, 88GO1H, 88K-I05, 88RU01, 88SA19, 88SH1E, 88ST06, 88TA1B, 88TS03, 88VA1E, 88WO10).

Polarization of ^{6}Li *(See also "Complex reactions" and "Applications"*: (84JO1A, 84NI01, 86CH1Q, 86SA15, 86TA1G, 87FI1D, 88FR1E).

Applications: (83AM1A, 83AS03, 86AU1A, 86CL1C, 86EN1A, 86FI1D, 86MA1S, 86SA1M, 86ST1E, 86SU1K, 86ZA1C, 87DO07).

Muon and neutrino capture and reactions: (83GM1A, 83GU10, 83JU01, 83MI14, 84RO1B, 87KU23, 87SU06).

Reactions involving pions, other mesons and baryon states (See also reactions 3, 13, 29 and 30): (82BE1D, 82RA28, 83AB1B, 83AS1B, 83BA26, 83BA1A, 83BA1G, 83DZ1A, 83FE07, 83GE12, 83GM1A, 83HE17, 83LO10, 83PO1D, 84AB1B, 84BA1U, 84BO1H, 84BR22, 84EF03, 84GE1B, 84GL02, 84GL09, 84JI03, 84KO16, 84KR23, 84KU13, 84MO09, 84MO1H, 84NA1D, 84RE1C, 84TR1B, 84ZA1A, 85BE1C, 85CA1B, 85DO19, 85ER06, 85LA20, 85MA1G, 85MO1F, 85RE1B, 85RO17, 85ST1A, 86AK1A, 86AS1A, 86BA1W, 86CE04, 86CH1I, 86ER1A, 86FI1A, 86GE05, 86HA30, 86HU1B, 86PE05, 86RA1J, 86RO03, 86SH14, 86SZ1A, 86WH03, 86YO06, 86ZO1A, 87BE2A, 87BO1P, 87BU20, 87CH10, 87G-M02, 87GM04, 87HA40, 87JA1C, 87LE1E, 87LE1B, 87MA1I, 87NA04, 87PO1H, 87RA1I, 87SE1C, 87WE1A, 87YO1C, 88BA1F, 88BA1G, 88FR1E, 88GA10, 88GIZU, 88KA1J, 88ROZZ).

Reactions involving antiprotons: (84GU06, 85DU05, 85LE1B, 86DU10, 86KO1E, 87AS06, 87GR1I, 87PO05).

Hypernuclei: (82KA1D, 82MO1B, 83FE07, 83A1F, 83MO1C, 83PO1D, 83SH38, 84BO1H, 84HA1D, 84MA1G, 84MO09, 85MO1F, 86BA1W, 86ER1A, 86HU1B, 86MA1C, 86SZ1A,

87PO1H, 88BA1F, 88BA1G, 88GA1A, 88HA1I).

Other topics: (83BI1C, 83FO03, 83RO12, 84FI1E, 84NA19, 84OH01, 85AN28, 85GO07, 85GO23, 85MI10, 85PO09, 86KO1N, 86KU1F, 86MA1X, 87AJ1A, 87SV1A, 88HA1K).

Ground-state properties of ^{6}*Li*: (83ANZQ, 83FO03, 83GR26, 83KU06, 85LE19, 83VA31, 84BE37, 84BR25, 84DU17, 84GE05, 84GL02, 84KO1H, 84KU03, 84KU06, 84MI1A, 84MI1B, 84MI1F, 84NI01, 84OH01, 84PA08, 85AL12, 85AN28, 85BE60, 85BO05, 85CL1A, 85FI1E, 85HA18, 85KH07, 85LO1A, 85ME02, 85SA32, 85SH1A, 85WI1A, 85ZH1A, 85ZI05, 86ES1B, 86GL1A, 86KO1U, 86KU08, 86LA27, 86LE21, 86ME13, 86OS1E, 86RO03, 86SY1A, 86VO09, 87HA34, 87KI1C, 87KR07, 87LE1C, 87LO16, 87SV1A, 88CH05, 88CO1B, 88PO1E, 88VA03, 88WO04).

$$\mu = +0.8220467(6) \text{ n.m.}, +0.8220560(4) \text{ n.m.: see (78LEZA)},$$
$$Q = -0.83 \text{ mb (84SU09)}.$$

The interaction nuclear radius of ^{6}Li is 2.09 ± 0.02 fm (85TA18) [see also for derived matter, charge and neutron matter r.m.s. radii].

Isotopic abundance: $(7.5 \pm 0.2)\%$ (84DE1A). See also (87LA1J, 88LA1C).

For estimates of the parity-violating α-decay width of ^{6}Li*(3.56) [0^+; $T = 1$] see (83RO12, 84BU01, 86BU07).

1. (a) ^{3}He(^{3}H, γ)^{6}Li	$Q_m = 15.7955$	
(b) ^{3}He(^{3}H, n)^{5}Li	$Q_m = 10.13$	$E_b = 15.7955$
(c) ^{3}He(^{3}H, d)^{4}He	$Q_m = 14.32049$	
(d) ^{3}He(^{3}H, ^{3}H)^{3}He		

Capture γ-rays (reaction (a)) to the first three states of ^{6}Li [γ_0, γ_1, γ_2] have been observed for $E(^3\text{He}) = 0.5$ to 25.8 MeV, while the yields of γ_3 and γ_4 have been measured for $E(^3\text{He}) = 12.6$ to 25.8 MeV. The γ_2 excitation function does not show resonance structure. However, the γ_0, γ_1, γ_3 and γ_4 yields do show broad maxima at $E(^3\text{He}) = 5.0 \pm 0.4$ [γ_0, γ_1], 20.6 ± 0.4 [γ_1], ~ 21 [γ_3] and 21.8 ± 0.8 [γ_4] MeV. The magnitude of the ground-state-capture cross section is well accounted for by a direct-capture model; that for the γ_1 capture indicates a non-direct contribution above $E(^3\text{He}) = 10$ MeV, interpreted as a resonance due to a state with $E_x = 25 \pm 1$ MeV, $\Gamma_{\text{c.m.}} = 4$ MeV, $T = 1$ (because the transition is E1, to a $T = 0$ final state) [the E1 radiative width $|\text{M}|^2 \geq 5.2/(2J + 1)$ W.u.], $J^\pi = (2, 3, 4)^-$, $\alpha + \text{p} + \text{n}$ parentage. The γ_4 resonance is interpreted as being due to a broad state at $E_x = 26.6$ MeV with $T = 0$. $J^\pi = 3^-$ is consistent with the measured angular distribution. The ground and first excited state reduced widths for $^3\text{He} + \text{t}$ parentage, $\theta_0^2 = 0.8 \pm 0.2$ and $\theta_1^2 = 0.6 \pm 0.3$: see (74AJ01). See also (85MO1C, 86MO1G, 87MO1I; theor.).

The angular distribution and polarization of the neutrons in reaction (b) have been measured at $E(^3\text{He}) = 2.70$ and 3.55 MeV. The excitation function for $E(^3\text{He}) = 0.7$ to 3.8 MeV decreases monotonically with energy. The excitation function for n_0 has been measured for $E(^3\text{He}) = 2$ to 6 MeV and for $E(^3\text{He}) = 14$ to 26 MeV; evidence for a broad structure at $E(^3\text{He}) = 20.5 \pm 0.8$ MeV is reported [^{6}Li*(26.1)]: see (79AJ01).

Angular distributions of deuterons (reaction (c)) have been measured for $E_t = 1.04$ to 3.27 MeV and at $E(^3\text{He}) = 0.29$ to 32 MeV. Polarization measurements are reported for $E_t = 9.02$ to 17.27 MeV [see (79AJ01)], as well as at $E(^3\vec{\text{He}}) = 18.0$ and 33.0 MeV (86RA1C). See also (86KO1K) and (85CA41).

Elastic scattering (reaction (d)) 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 (79AJ01). At the lower energies the elastic yield is structureless and decreases monotonically with energy. Polarization measurements are reported for $E_t = 9.02$ to 33.3 MeV. A strong change occurs in the analyzing power angular distributions at $E_t = 15$ MeV. A phase-shift analysis [single level R-matrix formalism, $L \leq 4$] yields P-states [0^-, 2^-; $T = 1$] at $E_x \sim 21.5$ and 21.0 MeV and F-states [3^-, 4^-; $T = 1$] at $E_x \sim 26.7$ and 25.7 MeV. There is some indication also of $T = 0$, 3^-, 5^- and 3^+ states at $E_x \sim 25$, 29.5 and 31.5 MeV whose decay is presumably primarily by $\text{d} + \alpha$: see (79AJ01).

For other channels see (84AJ01). See also (84KR1B; theor.).

2. ^{3}H(α, n)^{6}Li $\qquad Q_m = -4.7823$

^{6}Li*(0, 2.19) have been populated: see (74AJ01). See also ^{7}Li, (83CO1E) and (83FU11; theor.).

3. ^{3}He(^{3}He, π^+)^{6}Li $\qquad Q_m = -123.792$

Differential cross sections are reported for the transitions to ^{6}Li*(0, 2.19) for $E(^3\text{He}) =$ 350, 420, 500 and 600 MeV (83LE26). See also (84AJ01), (83BR1B, 83JA13) and (84GE05; theor.).

4. ^{4}He(d, γ)^{6}Li $\qquad Q_m = 1.4750$

No resonance has been observed corresponding to formation of ^{6}Li*(3.56) [0^+; $T = 1$]: the parity-forbidden $\Gamma_\alpha \leq 6 \times 10^{-7}$ eV (84RO04). See also p. 32.

The cross section for the capture cross section has been measured for $E_\alpha = 3$ to 25 MeV by detecting the recoiling ^{6}Li ions: the direct capture is overwhelmingly E2 with a small E1 contribution. The spectroscopic overlap between the $^6\text{Li}_{\text{g.s.}}$ and $\alpha + \text{d}$ is 0.85 ± 0.04: see (84AJ01). See also (82KI1A), (85CA41, 86LA22, 86LA27) and (84AK01, 85AK1B, 86AK1C, 86BA1R; theor.).

Table 6.3
Levels of ^{6}Li from ^{4}He(d, d)^{4}He [a]

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

[a] The data in this table are mostly from the S-matrix analysis of (83JE03). The results are unique up to $E_d = 15$ MeV. See also table 6.4 in (74AJ01), tables 6.3 in (79AJ01) and (84AJ01).
[b] The errors in Γ_d/Γ are typically 0.03.
[c] In units of the Wigner limit $\gamma_w^2 = 2.93$ MeV for a radius of 4.0 fm. I am indebted to W. Gruebler for pointing out an error to me.
[d] 6.26 MeV (R-matrix analysis): $E_x = 5.65$ MeV.

5. (a) ^{4}He(d, np)^{4}He $\quad Q_m = -2.22459 \quad E_b = 1.4750$
   (b) ^{4}He(d, t)^{3}He $\quad Q_m = -14.32049$

Reaction (a) has been studied to $E_\alpha = 165$ MeV and to $E_d = 21.0$ MeV: see (79AJ01, 84AJ01). Recent measurements are reported at $E_{\vec{d}} = 5.4$, 6.0 and 6.8 MeV (85LU08; VAP, TAP), 6 to 11 MeV (85OS02; VAP), 10.05 MeV (83BR23; VAP, TAP) and 12.0 and 21.0 MeV (83IS10; VAP, TAP) and at $E_\alpha = 11.3$ MeV (87BR07). It is clear that Coulomb effects need to be taken into account to understand the data. See also (86DO1K).

(86BR1N, 86VU1A, 86VA23, 87VU1A; prelim.) have measured VAP and TAP at $E_{\vec{d}} = 35$ and 45 MeV in reaction (b). See also (87GA1A). For the earlier work, and for the other breakup channels, see (74AJ01, 79AJ01, 84AJ01). See also (88PUZZ) and (83BA42, 85DO03, 86KO1J, 87KA1M, 87KU1F, 87MI06, 88KA1J, theor.).

6. ^{4}He(d, d)^{4}He $\quad E_b = 1.4750$

Elastic differential cross-section and polarization measurements have been carried out up to $E_\alpha = 166$ MeV and $E_d = 45$ MeV: see (74AJ01, 79AJ01, 84AJ01). Recent measurements are reported at $E_d = 0.87$ to 1.43 MeV (84BA19, 85BA1K; prelim.), at $E_{\vec{d}} = 11.9$ MeV (88EL01; TAP), 21 MeV (see 86MI1E; VAP, TAP), 24.0 and 38.2 MeV (86GR1D; TAP; prelim.), 31.8 to 39.0 MeV (86KO1M; TAP; prelim.), 56 MeV (85NI1A; VAP, TAP) and at $E_\alpha = 7.0$ GeV/c (84SA1C). For a study of the inclusive inelastic scattering at $E_\alpha = 7.0$ GeV/c see (87BA13).

Phase-shift analyses, particularly that by (83JE03) which uses all available differential cross section, vector and tensor analyzing power measurements and $L \leq 5$, in the range $E_d = 3$ to 43 MeV lead to the results displayed in table 6.3. 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 ($^3D_1$). (83JE03) suggest very broad G_3 and G_4 resonances at $E_d = (19.3)$ and 33 MeV, a D_3 resonance at 22 MeV and F_3 and F_2 resonances at ∼34 and ∼39 MeV, corresponding to states which are primarily of $(d + \alpha)$ parentage.

(85JE04) have investigated the points where $A_{yy} = 1$ and report four such points at $E_d = 4.30$ [$\theta_{c.m.} = 120.7°$], 4.57 (58.0°), 11.88 (55.1°) and 36.0±1.0 MeV (150.1±0.3°). [For the latter see also (86KO1M)]. The correspondence of these polarization maxima to ^{6}Li states is discussed by (85JE04). For a discussion of the M-matrix see (88EL01). For recent work on $(\alpha + d)$ correlations involving ^{6}Li*(0, 2.19, 4.31 + 5.65) see (87CH08, 87CH33, 87PO03) and (87FO08). See also p. 31.

See also (84AJ01, 84PL1A, 87GR08) and (83HA1K, 83SA39, 83SU1B, 84KA1E, 84LO1C, 84SC1A, 84WA1H, 85FI01, 85FR1F, 85HA04, 85KA20, 85LI1F, 85MI1F, 85SA1B, 85ZH1A, 86BO01, 86FI1F, 86FR12, 86KO1J, 86MI1D, 86MI1E, 86SA1D, 87HA34, 87KU1G, 87LE1C, 87MI06, 87PR08, 86SA1D, 88BR1E, 88BU1G, 88KA1J, 88VA18; theor.).

7. (a) ^{4}He(^{3}He, p)^{6}Li $\qquad Q_m = -4.0185$
   (b) ^{4}He(^{3}He, pd)^{4}He $\qquad Q_m = -5.49354$

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 (74AJ01). At $E_\alpha = 28$, 63.7, 71.7 and 81.4 MeV the α-spectra show that the sequential decay (reaction (b)) involves ^{6}Li*(2.19) and possibly ^{5}Li: see (79AJ01).

8. (a) ^{4}He(α, d)^{6}Li $\qquad Q_m = -22.3717$
   (b) ^{4}He(α, pn)^{6}Li $\qquad Q_m = -24.5963$
   (c) ^{4}He(α, αd)^{2}H $\qquad Q_m = -23.84674$

Reactions (a) and (b) have been studied to $E_\alpha = 158.2$ MeV [see (79AJ01, 84AJ01)] and at 198.4 MeV (85WO11). The dependence of the cross section on energy shows that the $\alpha + \alpha$ process does not contribute significantly to ^{6}Li (and ^{7}Li) synthesis above $E_\alpha = 250$ MeV (85WO11) [and see for additional comments on astrophysical problems]. For reaction (c) [and excited states of ^{4}He] see (84AJ01): ^{6}Li*(2.19) is involved in the process.

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

See ^{6}He.

10. (a) ^{6}Li(γ, n)^{5}Li $Q_m = -5.67$
(b) ^{6}Li(γ, p)^{5}He $Q_m = -4.59$
(c) ^{6}Li(γ, d)^{4}He $Q_m = -1.4750$
(d) ^{6}Li(γ, t)^{3}He $Q_m = -15.7955$

The (γ, n) and (γ, Xn) cross sections increase from threshold to a maximum at $E_\gamma \sim$ 12 MeV then decrease to $E_\gamma = 32$ MeV: see (84AJ01) and (88DI02). (84DY01) also report a broad peak at 16 MeV. The cross section for photoproton production (reaction (b)) is generally flat up to 90 MeV. [The previously reported hump at $E_\gamma \sim 16$ MeV is almost certainly due to oxygen contamination: see (84AJ01).] See also (88CA11) and ^{5}He. The cross section for reaction (c) is ≤ 5 μb in the range $E_\gamma = 2.6$ to 17 MeV consistent with the expected inhibition of dipole absorption by isospin selection rules: see (66LA04). The onset of quasideuteron photodisintegration between 25 and 65 MeV is suggested by the study of (84WA18; $E_{bs} = 67$ MeV). The 90° differential cross section for reaction (d) decreases monotonically for $E_\gamma = 18$ to 70 MeV: reaction (d) contributes $\sim \frac{1}{3}$ of the total cross section for ^{6}Li $+ \gamma$, consistent with a ^{3}H $+$ ^{3}He cluster description of ^{6}Li$_{g.s.}$ with $\theta^2 \simeq 0.68$. The agreement with the inverse reaction, ^{3}H(^{3}He, γ) [see reaction 1] is good: see (84AJ01). See also (86LI1F).

The absorption cross section has been studied in the range $E_\gamma \sim 100$ to 340 MeV; it shows a broad bump centered at ∼125 MeV and a fairly smooth increase to a maximum at ∼320 MeV: see (84AJ01). For spallation studies see (74AJ01, 84AJ01). For pion production see (86GL07, 87GL01) and (84AJ01). See also (87GA22, 87LI32, 87PI06) and (83BU1A, 84BU1C, 84IR1A, 85LO02, 85KO22, 85VA1C, 86AH03, 86AK1B, 86AV1E, 87BA2C, 87BU04, 87DU09, 87LU1B, 88BU1D; theor.).

11. ^{6}Li(γ, γ)^{6}Li

The width, Γ_γ, of ^{6}Li*(3.56) $= 8.1 \pm 0.5$ eV: see (74AJ01) and table 6.4 in (79AJ01); $E_x = 3562.88 \pm 0.10$ keV: see (84AJ01). See also (87PI06).

12. (a) ^{6}Li(e, e)^{6}Li
(b) ^{6}Li(e, ep)^{5}He $Q_m = -4.59$
(c) ^{6}Li(e, ed)^{4}He $Q_m = -1.4750$

The elastic scattering has been studied for $E_e = 85$ to 600 MeV: see (74AJ01, 79AJ01, 84AJ01). The results appear to require that the ground state be viewed as an α-d cluster in which the deuteron cluster is deformed and aligned. The ground-state M1 current density has also been calculated (82BE11). A model-independent analysis of the elastic scattering yields $r_{r.m.s.} = 2.51 \pm 0.10$ fm. See also the discussion in (84DO1A).

Table 6.4 here and table 6.4 in (84AJ01) summarize the results obtained in the inelastic scattering of electrons. Form factors have been measured for ^{6}Li*(2.19, 3.56, 5.37) as well as

Table 6.4
Levels of ^{6}Li from ^{6}Li(e, e′) and ^{6}Li(γ, γ') [a]

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

[a] See tables 6.4 in (79AJ01, 84AJ01) for references and for the earlier work.
[b] $B(\text{E2})\uparrow = 21.8 \pm 4.8\ e^2 \cdot \text{fm}^4$.
[c] Weighted mean of values shown in table 6.4 in (79AJ01).
[d] $\Gamma = 540 \pm 20$ keV.

for the t+^{3}He continuum up to 4 MeV above threshold [no narrow structures corresponding to ^{6}Li states are observed]: see (84AJ01).

For reaction (b) see ^{5}He and (87VA08) and (87VA1N). Angular distributions for the d_0 group in the (e, d_0) reaction have been measured for $E_x = 10$ to 28 MeV. The deduced E1 and E2 components of the (γ, d_0) cross section show no structure. The E1 strength implies non-negligible isospin mixing in this energy region (86TA06). At $E_e = 480$ MeV (reaction (c)) the α-d momentum distribution in the ground state of ^{6}Li has been studied. The results are well accounted for by an αNN model. The α-d probability in the ground state of ^{6}Li is 0.73 [estimated $\pm$ 0.1]. The data are consistent with the expected $2S$ character of the α-d relative wave function (86EN05). See also (86EV1A). π^0 production involving ^{6}Li*(2.19, 3.56, 5.37) is reported at $E_e = 500$ MeV (87NA1I; prelim.).

For the earlier work see (79AJ01, 84AJ01). See also (86BA1T), (86PE05, 87DE1A) and (83RE15, 83SA39, 84CH20, 84CO08, 184KO16, 84KR10, 84KU03, 84PA08, 84YP01, 84ZH1A, 85CH01, 85ER06, 85KH07, 85LO1A, 86AK1A, 86AZ1A, 86BE1L, 86CH1L, 86DO11, 86KE1F, 86KR12, 86KR1E, 86RE1D, 86SA1D, 87KR07, 87LE1C, 87LO16, 88CH1D, 88KU1C; theor.).

13. (a) ^{6}Li($\pi^\pm$, $\pi^\pm$)^{6}Li
(b) ^{6}Li(π^+, π^+p)^{5}He $Q_m = -4.59$
(c) ^{6}Li(π^+, ^{3}He)^{3}He $Q_m = 123.792$
(d) ^{6}Li(π^+, π^+d)^{4}He $Q_m = -1.4750$

Elastic angular distributions have been measured at $E_{\pi^+} \simeq 50$ MeV [see (84AJ01)] and at $E_{\pi^\pm} = 100$, 180 and 240 MeV (86AN04; also to ^{6}Li*(2.19)). Differential cross sections are also reported for $E_{\pi^+} = 100$ to 260 MeV to ^{6}Li*(0, 2.19, 3.56, 4.25). The excitation function for the unnatural-parity transition to ^{6}Li*(3.56) has an anomalous energy dependence (84KI16). For reaction (b) see (87HU02) and for reaction (c) see (83BA26, 83LO10, 85MC05, 86MC11). For a study of reaction (d) at $E_{\pi^+} = 130$ MeV see

(87HU13). For the (π^+, 2p) reaction at $E_{\pi^+} = 59.4$ MeV to states in ^{4}He see (86RI01). See also p. 32.

14. (a) ^{6}Li(n, n)^{6}Li
    (b) ^{6}Li(n, nd)^{4}He $\qquad Q_m = -1.4750$

Angular distributions involving the groups to ^{6}Li*(0, 2.19) have been reported at E_n = 1.0 to 14.6 MeV [see (84AJ01)] and at 4.2, 5.4 and 14.2 MeV (85CH37; n_0, n_1), 7.5 to 14 MeV (83DA22; n_0), 8.9 MeV (84FE1A; n_0), 8.0 and 24 MeV (86HA1S; n_0, n_1) and at $E_{\vec{n}} = 5$ to 17 MeV (86PF1A; prelim.; n_0). For reaction (b) see (85CH37, 84AJ01). See also ^{7}Li, (87SC08) and (84UD1A, 85HO1E, 85LI1F, 86BE1L; theor.).

15. (a) ^{6}Li(p, p)^{6}Li
    (b) ^{6}Li(p, 2p)^{5}He $\qquad Q_m = -4.59$
    (c) ^{6}Li(p, pd)^{4}He $\qquad Q_m = -1.4750$
    (d) ^{6}Li(p, p^{3}H)^{3}He $\qquad Q_m = -15.7955$
    (e) ^{6}Li(p, pn)^{5}Li $\qquad Q_m = -5.67$

Proton angular distributions have been measured for E_p = 0.5 to 800 MeV [p_0, p_1, p_2, p_3] [see (66LA04, 74AJ01, 84AJ01)] and at $E_{\vec{p}} = 5$ to 17 MeV (86PF1A; prelim.; p_0). Double-differential cross sections for the continuum yield [E_x = 1.5–3.5 MeV] are reported at $E_p = 65$ MeV (87TO06; prelim.). See also (83GL1A, 83PO1B, 83PO1C). For a summary of the results on excited states see table 6.5.

Reaction (b) has recently been studied at 70 MeV (83GO06), at 50–100 MeV (84PA1B, 85PA1B; prelim.) and 1 GeV (85BE1J): see ^{5}He and (84AJ01) for the earlier work. Reaction (c) has been studied at $E_p = 9$ MeV to 1 GeV [see (74AJ01, 79AJ01, 84AJ01)] and at 20 and 42 MeV (83CA13) [report involvement of ^{6}Li*(4.31, 5.65)], at 70 MeV (83GO06, 85PA1C, 85PA04) and at 119.6 and 200.2 MeV (84WA09, 85WA25). In the latter experiments the spectroscopic factors for ^{6}Li$_{\mathrm{g.s.}}$ are deduced to be 0.76 [at 119.6 MeV] and 0.84 [at 200.2 MeV] using DWIA and a bound-state Woods-Saxon 2S wave function (84WA09, 85WA25).

Work on reaction (d) has suggested that the ^{3}He + t parentage of ^{6}Li is comparable with the α + d parentage: see (84AJ01). See also (85PA1C). For reaction (e) see ^{5}Li, ^{6}Be and (85BE1J). The (p, 3p) reaction has been studied by (84NA17). For antiproton studies see (87AS06) and p. 32. See also (84AJ01) for the earlier work and ^{7}Be, (83AN18, 86SA1Q, 87GAZM, 87SA46, 88MI1E), (84LA33, 85AL1F, 86CH1J, 86WA11, 87LE1D) and (82CH28, 83GO17, 83KA1A, 83SM04, 84GU14, 84KO1E, 84KU03, 84KU06, 84MU01, 85BE60, 85DO1B, 85KA1D, 85PA03, 86CH1L, 86IM1A, 86IM1B, 86OS08, 86VL1A, 86ZH03, 87FA1H, 87HA01, 87IM1F, 87IM04, 87VD01, 87ZH1D, 88CH06, 88VD1A; theor.).

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

E_x (MeV ± keV)	$\Gamma_{c.m.}$ (keV)	Reactions
2.185 ± 3	20.0 ± 2.8	^{4}He(d, d)^{4}He
2.187 ± 3		^{4}He(d, d)^{4}He
2.188 ± 6	24 ± 2 [c]	^{6}Li(p, p′), (d, d′), ^{7}Li(d, t)^{6}Li
2.203 ± 6		^{9}Be(p, α)^{6}Li
2.186 ± 2	24 ± 2	"best" values
3.56288 ± 0.10	$(8.2 \pm 0.2) \times 10^{-3}$	table 6.4
4.34 ± 40		^{4}He(d, d)^{6}Li
4.27 ± 40		^{6}Li(e, e′)^{6}Li
4.40 ± 120	1490 ± 150	^{6}Li(p, p′)^{6}Li
4.32 ± 40	1820 ± 110	^{6}Li(d, d′)^{6}Li
4.3 ± 100	600 ± 100	^{7}Li(^{3}He, α)^{6}Li
4.3 ± 200	1600 ± 300	^{7}Li(^{3}He, αd)^{4}He
4.30 ± 10	850 ± 50, 480 ± 80	^{9}Be(p, α)^{6}Li
4.312 ± 22	1700 ± 100	"best" values
5.379 ± 17 [d]	540 ± 20 [d]	^{6}Li(e, e′)^{6}Li
5.33 ± 80	560^{+340}_{-100}	^{6}Li(p, p′)^{6}Li
5.34 ± 20	560 ± 40 [b]	^{7}Li(^{3}He, α)^{6}Li
5.325 ± 5	270 ± 12	^{9}Be(p, α)^{6}Li
5.366 ± 15	540 ± 20	"best" values
5.65 ± 50 [e]		^{4}He(d, d)^{4}He
5.7	1000^{+600}_{-400} [b]	^{6}Li(p, p′)^{6}Li
5.65 ± 200	1650 ± 300	^{7}Li(^{3}He, αd)^{4}He
5.65 ± 40	900 ± 60, 1260 ± 120	^{9}Be(p, α)^{6}Li
5.65 ± 50	1500 ± 200	"best" values

[a]) For references and other values see tables 6.5 in (79AJ01, 84AJ01).
[b]) See references (c) and (d) in table 6.5 in (79AJ01).
[c]) And C.P. Browne, private communication.
[d]) See table 6.4 in (79AJ01).
[e]) See table 6.3 in (79AJ01).

16. (a) ^{6}Li(d, d)^{6}Li

(b) ^{6}Li(d, pn)^{6}Li $\qquad Q_m = -2.22459$

(c) ^{6}Li(d, 2d)^{4}He $\qquad Q_m = -1.4750$

(d) ^{6}Li(d, αp)^{3}H $\qquad Q_m = 2.5577$

Angular distributions of deuterons have been measured at $E_d = 4.5$ to 19.6 MeV [see (79AJ01)] and at 50 MeV (88KO1C; prelim.). The $T = 1$, 0^+ state, ^{6}Li*(3.56) is not appreciably populated. For a summary of the results on excited states see table 6.5.

At $E_d = 21$ MeV reaction (b) shows spectral peaking (characteristic of $^1S_0$ for the pn system [$T = 1$]) when ^{6}Li*(3.56) is formed, in contrast with the much broader shape (characteristic of $^3S_1$) seen when ^{6}Li*(0, 2.19) are populated. A study of reaction (c) at $E_d = 52$ MeV shows that the α-clustering probability, $N_{\text{eff}} = 0.12^{+0.12}_{-0.06}$ if a Hankel function is used. The α-particle and the deuteron clusters in ^{6}Li have essentially a relative orbital momentum of $l = 0$. The D-state probability of the ground state of ^{6}Li is $\simeq$5% of the S-state. Quasi-free scattering is an important process even for $E_d = 6$ to 11 MeV. Interference effects are evident in reaction (c) proceeding through ^{6}Li*(2.19, 4.31): this is due to the experiment being unable to determine whether the detected particle was emitted first or second in the sequential decay. Reactions (c) and (d) studied at $E_d = 7.5$ to 10.5 MeV indicate that the three-body breakup of ^{6}Li at these low energies is dominated by sequential decay processes. See (79AJ01) for references.

See also ^{8}Be, (87AL1L) and (82CH28, 83GO1J, 83LY04, 84BL21, 84KU15, 85LI1C, 86AV1C; theor.).

17. ^{6}Li(t, t)^{6}Li

At $E_t = 17$ MeV angular distributions have been measured for the tritons to ^{6}Li*(0, 3.56): see (79AJ01).

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

(b) ^{6}Li(^{3}He, pα)^{4}He $\qquad Q_m = 16.8782$

Angular distributions have been measured at $E(^3\text{He}) = 8$ to 217 MeV [see (79AJ01, 84AJ01)] and at 34, 50, 60 and 72 MeV (86BR1M; elastic). For reaction (b) see ^{5}Li (84AR17, 87ZA07). See also ^{9}B.

19. (a) $^6Li(\alpha, \alpha)^6Li$

(b) $^6Li(\alpha, 2\alpha)^2H$ $Q_m = -1.4750$

Angular distributions (reaction (a)) have been measured at $E_\alpha = 1.39$ to 166 MeV [see (74AJ01, 79AJ01, 84AJ01)] and at $E_\alpha = 36.6$ and 50.5 MeV (86BR1M). See also (87BU1E, 86RO1M). See also ^{10}B.

Reaction (b) has been studied at $E_\alpha = 6.6$ to 700 MeV: see (74AJ01, 79AJ01, 84AJ01). At the latter energy and using a width parameter of 60.6 MeV/c the effective number of α + d clusters for $^6Li_{g.s.}$, $n_{eff} = 0.98 \pm 0.05$. The results are very model dependent: see (84AJ01). At $E_\alpha = 27.2$ MeV ^{6}Li*(2.19) is very strongly populated (85KO29). See also (82CH28, 83AV1A, 83BE1H, 83BU15, 85BE60, 86GA1F, 86ZE01, 87KO1L, 88LE06; theor.).

20. (a) $^6Li(^6Li, ^6Li)^6Li$

(b) $^6Li(^6Li, 2d)2\ ^4He$ $Q_m = -2.9501$

(c) $^6Li(^6Li, \alpha)2\ ^4He$ $Q_m = 20.897$

Angular distributions of ^{6}Li ions have been studied for $E(^6Li) = 3.2$ to 36 MeV [see (74AJ01, 79AJ01, 84AJ01)] and at $E(^6Li) = 2.0$ to 5.5 MeV (83NO08) and 156 MeV (85SA36; ^{6}Li*(0, 2.19)), (85MI05; elastic; ^{6}Li*(2.19, 3.56) are also populated), (87EY01; several states in ^{12}C). Reaction (b) has been studied for $E(^6Li) = 36$ to 47 MeV: enhancements in yield, due to double spectator poles, have been observed in d-d and α-α but not in α-d double coincidence spectra. The widths of the peaks are smaller than those predicted from the momentum distribution of α + d clusters in ^{6}Li. ^{6}Li*(2.19) was also populated. See references in (84AJ01). Recent work on reaction (b) is reported by (84LA19: 2.4 and 4.2 MeV) and by (85NO1A). For reaction (c) see (87LA25). See also ^{12}C in (85AJ01), (83CH59) and (84CH1E, 86KA1B, 86SA1D, 87AR13; theor.).

21. $^6Li(^7Li, ^7Li)^6Li$

Angular distributions have been measured at $E(^7Li) = 78$ MeV to ^{6}Li*(0, 2.19) (86GL1D; prelim.).

22. $^6Li(^9Be, ^9Be)^6Li$

The elastic scattering has been studied at $E(^6Li) = 4.0$, 6.0 and 24 MeV [see (79AJ01)], at 32 MeV (85CO09) and at 50 MeV (88TRZY; prelim.; also inelastic). For the interaction cross section at $E(^6Li) = 790$ MeV/A see (85TA18).

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

The elastic scattering has been studied at $E(^6\text{Li}) = 5.8$ and 30 MeV: see (79AJ01).

24. (a) ^{6}Li(^{12}C, ^{12}C)^{6}Li
(b) ^{6}Li(^{13}C, ^{13}C)^{6}Li
(c) ^{6}Li(^{14}C, ^{14}C)^{6}Li

The elastic scattering (reaction (a)) has been studied at $E(^6\text{Li}) = 4.5$ to 156 MeV [see (84AJ01)] and at $E(^6\text{Li}) = 19.2$ MeV (83RU09), 36 and 45 MeV [and $E(^{12}\text{C}) = 72$ and 90 MeV] (84VI02, 85VI03; also to ^{6}Li*(2.19, 4.31) and to various states of ^{12}C), 90 MeV (87DE02; also to various states of ^{12}C), 123.5 and 168.6 MeV (88KA09; and to various states of ^{12}C), 150 MeV (87TA21; also VAP), 156 MeV (87EY01; and to various states in ^{12}C) and at 210 MeV (88NA02). See also (86SH1Q, 87PA12). At $E(^6\text{Li}) = 34$ MeV the d-α angular correlations involve ^{6}Li*(0, 2.19) (85CU04). See also ^{12}C in (85AJ01, 90AJ01). For pion production see (84CH16). For the interaction cross section at $E(^6\text{Li}) = 790$ MeV/A see (85TA18). For VAP measurements at $E(^6\vec{\text{Li}}) = 30$ MeV see (88VAZY).

The elastic scattering (reaction (b)) has been studied for $E(^7\text{Li}) = 5.8$ to 40 MeV: see (84AJ01). The elastic scattering (reaction (c)) has been measured for $E(^6\text{Li}) = 93$ MeV (87DE02). See also ^{18}F and ^{19}F in (87AJ02), (86MC1C, 88MCZY), (83BI1A, 84HA53) and (82GU1B, 83BU15, 83DE1E, 83OS03, 83SH24, 84BR08, 84GR05, 84MU1D, 84SA1B, 85CO21, 85SH1A, 86BE45, 86IO01, 86KA1B, 86MI24, 86SAZL, 86SA1D, 87AR13, 87KA1I, 87SA21, 88DEZU, 88DE1F, 88SA15; theor.).

25. ^{6}Li(^{16}O, ^{16}O)^{6}Li

Elastic angular distributions have been reported at $E(^6\text{Li}) = 4.5$ to 50.6 MeV [see (84AJ01)], at $E(^6\text{Li}) = 35.3$ and $E(^{16}\text{O}) = 94.2$ MeV (84VI02) and at 50 MeV (88TRZY; prelim.; also inelastic). At $E(^6\text{Li}) = 25.7$ and $E(^{16}\text{O}) = 68.6$ MeV (85VI03, 84VI01) report some $\sigma(\theta)$ to ^{6}Li*(2.19) [and to ^{16}O*(6.13)]. See (85VI03, 86SC28) for studies of the breakup. The VAP has been measured at $E(^6\text{Li}) = 25.7$ MeV, and also using ^{16}O ions (87VAZY; prelim.). For fusion cross sections see (86MA19). See also ^{16}O in (86AJ04), (86MO1E, 87PA12) and (83BU15, 83JO1A, 84WI08, 85CO21, 85SA13, 86SAZS; theor.).

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

The elastic scattering has been studied at $E(^6\mathrm{Li}) = 88$ MeV, and at 36 MeV for reaction (c): see (84AJ01). For the interaction cross section at $E(^6\mathrm{Li}) = 790$ MeV/A (reaction (d)) see (85TA18).

27. (a) ^{6}Li(^{28}Si, ^{28}Si)^{6}Li
(b) ^{6}Li(^{30}Si, ^{30}Si)^{6}Li

The elastic scattering has been studied at $E(^6\mathrm{Li}) = 13$ to 154 MeV [see (84AJ01)], at 27 and 34 MeV (83VI03) and at 210 MeV (88NAZX). For a study of the decay see (87NI04). See also (84PU1A, 85OU1B, 86GR1A) and (78GR22, 82BR1B, 83DE1E, 83JO1A, 83SA39, 83SA1D, 84BR1B, 84VR28, 84KI08, 84WI08, 85BR14, 85SA1D, 86BE45, 86GR1G, 86KA22, 86SAZL, 86SA1D, 87GR1N, 87SA21; theor.). For reaction (b) see (87AR13; theor.).

28. (a) ^{6}Li(^{39}K, ^{39}K)^{6}Li
(b) ^{6}Li(^{40}Ca, ^{40}Ca)^{6}Li
(c) ^{6}Li(^{44}Ca, ^{44}Ca)^{6}Li
(d) ^{6}Li(^{48}Ca, ^{48}Ca)^{6}Li

Elastic scattering has been studied for $E(^6\mathrm{Li}) = 26$ to 99 MeV: see (84AJ01), and at $E(^6\mathrm{Li}) = 34$ MeV (reaction (b)) by (87VA31) and at 210 MeV (88NAZX; reaction (b)). ^{6}Li*(2.19) has been studied at $E(^{40}\mathrm{Ca}) = 227$ MeV (87VA31). For fusion measurements (reaction (b)) see (84BR04). For breakup measurements (reaction (b)) see (84GR20). See also (86PL01) and (83SA39, 84GU09, 85BL18, 85SA1D, 86GR1G, 86SAZL, 86SA1D, 87SA21; theor.).

29. (a) ^{7}Li(γ, n)^{6}Li $\qquad Q_\mathrm{m} = -7.250$
(b) ^{7}Li(γ, pπ^-)^{6}Li $\qquad Q_\mathrm{m} = -146.036$

Transitions to ^{6}Li*(0, 2.19, 3.56) have been observed in reaction (a): see (79AJ01, 84AJ01). Differential cross sections are reported for $E_\mathrm{bs} = 60$ to 120 MeV for the $\mathrm{n}_0 + \mathrm{n}_2$ groups (85SE17). Reaction (b) at 0.9 GeV involves ^{6}Li*(2.19) (85RE1A; prelim.). See also ^{7}Li, (86GO1M) and (85ST1A, 86BA2G; theor.).

30. ^{7}Li(π^+, p)^{6}Li $\qquad Q_m = 133.101$

Differential cross sections have been measured at $E_{\pi^+} = 75$ and 175 MeV for the transitions to ^{6}Li*(0, 2.19): see (84AJ01).

31. (a) ^{7}Li(p, d)^{6}Li $\qquad Q_m = -5.025$
(b) ^{7}Li(p, pn)^{6}Li $\qquad Q_m = -7.250$

Angular distributions of deuterons (reaction (a)) have been studied for $E_p = 167$ to 800 MeV [see (79AJ01, 84AJ01)] and at 18.6 MeV (86GO1N, 87GO27; d_0, d_1, d_2; see for spectroscopic factors), 200 and 400 MeV (85KR13; d_0, d_1; d_2 is weakly populated at 200 MeV) and at 800 MeV (84SM04; d_0, d_1). The ratio of the intensities of the groups to ^{6}Li*(2.19) and ^{6}Li$_{\text{g.s.}}$ increases with energy. It is suggested that this can be understood in terms of a small admixture of 1f orbital in these states (85KR13). A DWBA analysis of $E_p = 185$ MeV data leads to $C^2S = 0.87$, 0.67, 0.24, (0.05), 0.14, respectively for ^{6}Li*(0, 2.19, 3.56, 4.31, 5.37). No other states were seen below $E_x \sim 20$ MeV: see (79AJ01). In reaction (b) at $E_p = 1$ GeV the separation energy between ∼6.5 MeV broad $1p_{3/2}$ and $1s_{1/2}$ groups is reported to be 18.0 ± 0.8 MeV (85BE1J, 85DO1B). See also (83LY04, 88VE1I, 88GU1D; theor.).

32. ^{7}Li(d, t)^{6}Li $\qquad Q_m = -0.993$

A study at $E_d = 23.6$ MeV of the relative cross sections of the analog reactions ^{7}Li(d, t)^{6}Li (to the first two $T = 1$ states at 3.56 and 5.37 MeV) and ^{7}Li(d, ^{3}He)^{6}He (to the ground and 1.80 MeV excited states) shows that ^{6}Li*(3.56, 5.37) have high isospin purity ($\alpha^2 < 0.008$): this is explained in terms of antisymmetrization effects which prevent mixing with nearby $T = 0$ states: see (79AJ01). (87BO1W) [$E_d = 30.7$ MeV] deduce that the branching ratio of ^{6}Li*(4.31) [2^+] into a dinucleon [$T = 1$, $S = 0$] is (85 ± 10)%: see also reactions 13 in ^{6}He and 4 in ^{6}Be. See also (87GU1F; $E_d = 18$ MeV; angular distributions to ^{6}Li*(0, 2.19, 3.56); prelim.) and (84BL21, 86AV1C, 88GU1D; theor.).

33. (a) ^{7}Li(^{3}He, α)^{6}Li $\qquad Q_m = 13.328$
(b) ^{7}Li(^{3}He, dα)^{4}He $\qquad Q_m = 11.8527$

Angular distributions have been reported at $E(^3\text{He}) = 5.1$ to 33.3 MeV [see (74AJ01, 84AJ01): the lower energy work has not been published]. Excited states observed in this reaction are displayed in table 6.5. No other states are reported below $E_x = 10$ MeV: see (79AJ01). (86AN04) have analyzed unpublished data which suggest the involvement of several broad highly excited states of ^{6}Li. See also (87AL1L).

Several attempts have been made to look at the isospin decay of ^{6}Li*(5.37) [J^π; T = 2^+; 1] via ^{7}Li(^{3}He, α)^{6}Li*→ d + α: the branching is < 1%. $\Gamma_p/\Gamma = 0.35 \pm 0.10$ and $\Gamma_{p+n}/\Gamma = 0.65 \pm 0.10$ for ^{6}Li*(5.37): see (79AJ01). ^{4}He + d spectra suggest the excitation of ^{6}Li*(4.3) [$E_x = 4.3 \pm 0.2$ MeV, $\Gamma = 1.6 \pm 0.3$ MeV] and ^{6}Li*(5.7) [$E_x = 5.65 \pm 0.2$ MeV, $\Gamma = 1.65 \pm 0.3$ MeV]: see (84AJ01). See also (85DA29). At E(^{3}He) = 120 MeV the missing mass spectra for (^{3}He, 2d) and (^{3}He, pt) reflects the population of ^{6}Li*(0, 2.19) and suggests broad structures at E_x = 28.5 and 32.9 MeV (85FR01). See also ^{10}B, (88BO1J) and (83KU17; theor.).

34. (a) ^{7}Li(^{6}Li, ^{7}Li)^{6}Li
    (b) ^{7}Li(^{7}Li, ^{8}Li)^{6}Li $Q_m = -5.217$

At E(^{6}Li) = 93 MeV a broad group ($\Gamma \simeq 11$ MeV) centered at E_x = 20 MeV is reported in addition to other peaks at $E_x = 17.1 \pm 0.3$, 18.9 ± 0.3 and 21.2 ± 0.3 MeV (87GLZW; prelim.). See (84KO25) for reaction (b).

35. (a) ^{9}Be(p, α)^{6}Li $Q_m = 2.126$
    (b) ^{9}Be(p, 2α)^{2}H $Q_m = 0.651$
    (c) ^{9}Be(p, pt)^{6}Li $Q_m = -17.688$

Angular distributions of α-particles (reaction (a)) have been measured at E_p = 0.11 to 45 MeV. [see (74AJ01, 79AJ01)] and at E_p = 22.5, 31 and 41 MeV (86HA27; α_0, α_1, α_2; see for spectroscopic factors). See also table 6.5 and (84AJ01). ^{6}Li*(3.56) decays by γ-emission consistent with M1; $\Gamma_\alpha/\Gamma < 0.025$ [forbidden by spin and parity conservation]: see (84AJ01). At E_p = 9 MeV the yield of reaction (b) is dominated by FSI through ^{8}Be*(0, 2.9) and ^{6}Li*(2.19) with little or no yield from direct three-body decay: see (79AJ01). Reactions (b) and (c) at E_p = 58 MeV involve ^{6}Li*(0, 2.19) (85DE17). See also ^{10}B, (86AN26) and (85MA1F, 86KA26; theor.).

36. ^{9}Be(d, ^{5}He)^{6}Li $Q_m = -9.92$

See ^{5}He.

37. ^{9}Be(t, ^{6}He)^{6}Li $Q_m = -5.381$

Angular distributions of ^{6}He$_{g.s.}$ + ^{6}Li$_{g.s.}$ and ^{6}He$_{g.s.}$ + ^{6}Li$^*_{3.56}$ [both listed ions were detected] have been measured at E_t = 21.5 and 23.5 MeV. In the latter case the final state is composed of two isobaric analog states: angular distributions are symmetric about 90° c.m., within the overall experimental errors. In the reaction leading to the ground states of ^{6}He and ^{6}Li differences from symmetry of as much as 40% are observed at forward angles. Angular distributions involving $^6He_{g.s.}$ + ^{6}Li*(2.19) and $^6Li_{g.s.}$ + ^{6}He*(1.8) have also been measured. This reaction appears to proceed predominantly by means of the direct pickup of a triton or ^{3}He from ^{9}Be. Differential cross sections are also reported at $E_t = 17$ MeV: see (84AJ01) for references.

38. ^{9}Be(^{3}He, ^{6}Li)^{6}Li $\qquad Q_m = -1.892$

Angular distributions of ^{6}Li ions have been obtained at $E(^3He) = 6$ to 10 MeV: see (74AJ01). A study of the continuum suggests the population of ^{6}Li states at $E_x = 8$–12, ∼21 and 21.5 MeV: see (84AJ01).

39. ^{10}B(n, ^{5}He)^{6}Li $\qquad Q_m = -5.35$

Differential cross sections are reported at $E_n = 14.4$ MeV involving ^{6}Li*(2.19) and $^5He_{g.s.}$ (84TU02).

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

Angular distributions involving ^{6}Li*(0, 2.19) have been studied at $E_d = 13.6$ MeV (83DO10) and at 19.5 MeV [see (74AJ01)]. See also (84SH1E; theor.).

41. ^{10}B(^{3}He, ^{7}Be)^{6}Li $\qquad Q_m = -2.872$

Angular distributions involving ^{6}Li*(0, 2.19) have been measured at $E(^3He) = 30$ MeV: see (74AJ01).

42. ^{10}B(α, ^{8}Be)^{6}Li $\qquad Q_m = -4.5515$

At $E_\alpha = 72.5$ MeV only ^{6}Li*(0, 2.19) are observed: the latter is excited much more strongly than is the ground state [S_α for the ground state is 0.4 that for ^{6}Li*(2.19)]. The angular distributions for both transitions are flat: see (79AJ01). See also (84AJ01).

43. ^{11}B(d, ^{7}Li)^{6}Li $Q_{\rm m} = -7.189$

See (84AJ01).

44. ^{11}B(^{3}He, ^{8}Be)^{6}Li $Q_{\rm m} = 4.572$

Angular distributions are reported at $E(^{3}\rm He) = 71.8$ MeV involving several states in ^{8}Be (86JA02, 86JA14).

45. ^{12}C(p, ^{7}Be)^{6}Li $Q_{\rm m} = -22.566$

Angular distributions involving ^{7}Be*(0, 0.43) have been measured at $E_{\rm p} = 40.3$ MeV (85DE05). For the earlier work at $E_{\rm p} = 30.6$ to 56.8 MeV see (74AJ01, 79AJ01). See also (83DE1C), (84RE1A) and (87KW01, 87KW03; theor.).

46. ^{12}C(d, ^{8}Be)^{6}Li $Q_{\rm m} = -5.892$

Angular distributions involving several states in ^{8}Be have been studied at $E_{\rm d} = 19.5$ and 51.8 MeV [see (74AJ01)] and at 50 MeV (85GO1G), 54.2 MeV (84UM04) and 78 MeV (86JA14), as well as at $E_{\vec{d}} = 18$ and 22 MeV (87TA07) and 51.7 MeV (86YA12). See also (84NE1A, 87GO1S) and (87KA1L, theor.).

47. ^{12}C(^{3}He, ^{9}B)^{6}Li $Q_{\rm m} = -11.570$

Angular distributions have been obtained at $E(^{3}\rm He) = 28$ to 40.7 MeV [see (74AJ01)] and at $E(^{3}\vec{\rm He}) = 33.4$ MeV (86CL1B; also A_y). See also ^{9}B.

48. (a) ^{12}C(α, ^{10}B)^{6}Li $Q_{\rm m} = -23.712$
(b) ^{12}C(α, dα)^{10}B $Q_{\rm m} = -25.1868$

Angular distributions (reaction (a)) at $E_{\alpha} = 42$ MeV involve ^{6}Li*(0, 2.19): see (74AJ01). At $E_{\alpha} = 65$ MeV reaction (b) goes via ^{6}Li*(2.19, 4.31): see (84AJ01). See also ^{10}B and (87GA20).

49. ^{12}C(^{10}B, ^{16}O)^{6}Li $\qquad Q_{\mathrm{m}} = 2.702$

See ^{16}O in (86AJ04).

50. ^{12}C(^{12}C, ^{12}C)2 ^{6}Li $\qquad Q_{\mathrm{m}} = -28.171$

The fragmentation of ^{12}C into 2 ^{6}Li ions has been observed at $E(^{12}\mathrm{C}) = 2.1$ GeV/A (86LI1D).

51. ^{12}C(^{14}N, ^{20}Ne)^{6}Li $\qquad Q_{\mathrm{m}} = -4.174$

See ^{20}Ne in (88AJ1B).

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

See (74AJ01).

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

Angular distributions involving ^{6}Li ions and several ^{12}C states are reported at $E_{\vec{\mathrm{d}}} =$ 22 MeV (87TA07) and 51.7 MeV (86YA12) and at $E_{\mathrm{d}} = 54.2$ MeV (84UM04). See also (84NE1A), and ^{12}C in (90AJ01) for polarization studies.

54. ^{19}F(^{3}He, ^{16}O)^{6}Li $\qquad Q_{\mathrm{m}} = 4.095$

Angular distributions have been measured at $E(^{3}\mathrm{He}) = 11$ to 40.7 MeV involving ^{6}Li*(0, 3.56) and various states of ^{16}O: see (74AJ01, 77AJ02).

^{6}Be

(Figs. 6 and 7)

GENERAL: See also (84AJ01).

Model calculations: (86KU1F, 86VO09, 87DA1H, 88DA1D, 88DA1E, 88DA1F, 88KA1J).

Other topics: (83ANZQ, 83GR26, 83SH38, 84BA1H, 85AN28, 86HU1D, 86KO1N, 87BA1I, 87KU1F, 87SA15).

1. (a) ^{3}He(^{3}He, γ)^{6}Be	$Q_m = 11.489$	
(b) ^{3}He(^{3}He, p)^{5}Li	$Q_m = 10.89$	$E_b = 11.489$
(c) ^{3}He(^{3}He, 2p)^{4}He	$Q_m = 12.85966$	
(d) ^{3}He(^{3}He, ^{3}He)^{3}He		
(e) ^{3}He(^{3}He, pd)^{3}He	$Q_m = -5.49354$	

The yield of γ-rays to ^{6}Be*(1.7) (reaction (a)) increases smoothly from 0.4 to 9.3 μb (assuming isotropy) for $0.86 < E(^3\text{He}) < 11.8$ MeV (90°). No transitions are observed to ^{6}Be(0) [$\sigma < 0.01$ μb at $E(^3\text{He}) = 1.4$ MeV]. This is understood in terms of a direct capture of ^{3}He by ^{3}He in the singlet spin state and with zero angular momentum: the $0^+ \rightarrow 0^+$ γ-transition is forbidden. Reaction (a) is thus of negligible astrophysical importance compared to reaction (c): see (79AJ01). The capture cross section from $E(^3\text{He}) = 12$ MeV to 27 MeV continues to increase smoothly with energy at first and then shows a broad structure centered at $E(^3\text{He}) = 23 \pm 1$ MeV [$E_x = 23.0 \pm 0.5$ MeV], $\Gamma_{c.m.} \simeq 5$ MeV. This appears to be a ^{33}F cluster resonance which decays by an E1 transition to ^{6}Be*(1.7). The γ-ray angular distributions are consistent with $J^\pi = 3^-$: see (79AJ01).

A_y has been measured for $E(^3\text{He}) = 14$ to 30 MeV [reaction (b)] by (83KI10) using a polarized target. See also ^{5}Li.

Measurements of the total cross section for reaction (c) have been carried out for $E(^3\text{He}) = 60$ keV to 2.2 MeV [see (79AJ01)] and for 36 to 685 keV (87KR09). The measurements are consistent with a non-resonant reaction mechanism, at least down to $E_{c.m.} = 24.5$ keV. Upper limits for $\omega\gamma$ for a resonance below that energy (and with E_R (c.m.) as low as 16.2 keV) [which might help explain the low observed flux of solar neutrinos], are given in (87KR09). [It should be noted that a corresponding mirror state in ^{6}He has not been observed.] The best fit to the data is given by $S(0) = 5.57 \pm 0.31$ MeV $\cdot$ b (87KR09). See (79AJ01) for the earlier work. See also (66LA04, 74AJ01). For recent work on astrophysical considerations see (82BA1J, 82KA1E, 83FO1A, 83VO1C, 84BO1C, 84DA1H, 84HA1M, 85CA41, 85SC1A, 86FI1B, 87AS05, 87RO1D, 88BA1H, 88FO1A). (85SI12) report α-d correlation measurements at $E(^3\text{He}) = 13.6$ MeV, which suggest the breakup of the diproton (^{2}He) into $^2\text{H} + e^+ + \nu$.

The elastic scattering (reaction (d)) has been studied for $E(^3\text{He}) = 3$ to 32 MeV and at 120 MeV. 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

Table 6.6
Energy levels of ^{6}Be

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

[a]) See table 6.8 in (74AJ01).

^{6}Be at $E_x \sim 24$ MeV. Polarization measurements have been carried out at $E(^{3}\vec{\mathrm{He}}) = 17.9$ to 32.9 MeV. A two level R-matrix analysis of the phase shifts ($L \leq 5$) suggests three broad F-wave states at $E_x \sim 23.4$ (4^-), 26.2 (2^-) and 26.7 MeV (3^-), in disagreement with the capture γ-ray results described above: see (79AJ01). See also (84AJ01) and (86FO04).

A kinematically complete experiment (reaction (e)) has been performed at $E(^{3}\mathrm{He}) =$ 120 MeV: large peaks were observed which appear to correspond to ^{3}He-d quasi-free scattering followed by p-d FSI: see (84AJ01).

The total reaction cross sections $\sigma_R = 156.7 \pm 3.8$, 250 ± 14 and 296 ± 12 mb at $E(^{3}\mathrm{He}) = 17.9$, 21.7 and 24.0 MeV (87BR02) [see also for partial cross sections for the breakup reactions and for unpublished results for σ_R for $E(^{3}\mathrm{He}) = 3.0$ to 17.9 MeV]. See also (84AJ01), (86GO1E, 86WI1A; applications) and (83PR1A, 84HA25, 85HA14, 86OS1D, 87AS05, 88RIZW; theor.).

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

Neutron groups to ^{6}Be*(0, 1.7) have been observed at $E(^{3}\mathrm{He}) = 19.4$ to 38.61 MeV: see table 6.8 in (74AJ01) for the parameters of the first-excited state. There is no evidence for other states of ^{6}Be with $E_x \leq 5$ MeV, nor for a state near the ^{3}He threshold at 11.5 MeV: see (79AJ01).

3. (a) ^{6}Li(p, n)^{6}Be $\qquad Q_m = -5.071$
(b) ^{6}Li(p, pn)^{5}Li $\qquad Q_m = -5.67$

Neutron groups have been observed to ^{6}Be*(0, 1.7) as has the ground-state threshold. The width of the ground state is 95 ± 28 keV. The parameters of ^{6}Be*(1.7) are displayed in table 6.8 of (74AJ01). Angular distributions have been reported at $E_p = 8.3$ to 144 MeV [see (79AJ01, 84AJ01)] and at 800 MeV (86KI12). The transverse spin transfer coefficient, D_{NN} (0°), at $E_{\vec{p}} = 160$ MeV for the ground-state transition is -0.37 ± 0.04 in agreement with results in other light nuclei (84TA07). See also ^{7}Be, (86SA1Q, 87SA46, 88HE08), (84TA1F, 85GO1F, 86TA1E, 87RA32) and (85SH1C; theor.). In reaction (b) some evidence has been reported at $E_p = 47$ MeV for sequential decay via ^{6}Be*(15.5 ± 2, 24 ± 2): see (79AJ01). See also (88MI1E).

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

Triton groups have been observed to ^{6}Be*(0, 1.7). The width of the ground state is 89 ± 6 keV. The parameters of the excited state are displayed in table 6.8 of (74AJ01). No other excited states have been seen with $E_x < 13$ MeV. There is no evidence for a state near 11.5 MeV: see (79AJ01). (87BO1W) have studied the decay of ^{6}Be*(1.7) at $E(^3\text{He}) = 38.7$ MeV: they report that the branching ratio for decay via the emission of ^{2}He [$T = 1$, $S = 0$] is 0.60 ± 0.15: see also reactions 13 in ^{6}He and 32 in ^{6}Li and (85BO56, 84BO49, 88BO1J). See also (84AJ01), (87DA1N; theor.) and ^{9}B.

^{6}B, ^{6}C

(Not illustrated)

Not observed: see (79AJ01, 84AJ01).

References

(Closed 1 June 1988)

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 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.

66LA04 Lauritsen and Ajzenberg-Selove, Nucl. Phys. 78 (1966) 1

74AJ01 Ajzenberg-Selove and Lauritsen, Nucl. Phys. A227 (1974) 1

77AJ02 Ajzenberg-Selove, Nucl. Phys. A281 (1977) 1

78GR22 Gridnev et al, Izv. Akad. Nauk Sssr Ser. Fiz. 42 (1978) 2361

78LEZA Lederer and Shirley, Table of Isotopes, John Wiley Pubs. (1978)

79AJ01 Ajzenberg-Selove, Nucl. Phys. A320 (1979) 1

81PL1A Plattner, Nukleonika 26 (1981) 1005

82AL1C Aleksandrov et al, Soviet J. Nucl. Phys. 36 (1982) 783

82AU1A Audouze and Reeves, Essays in Nucl. Astrophys. (1982) 355

82BA1J Bahcall and Davis, Essays in Nucl. Astrophys. (1982) P. 243

82BE11 Bergstrom, Kowalski and Neuhausen, Phys. Rev. C25 (1982) 1156

82BE1D Bernstein, Proc. Int. School of Intermediate Energy Nuclear Physics, Verona, Italy, July 1981: Edited by R. Bergere, S. Costa, C. Schaerf, World Scientific, Singapore (1982) P. 125

82BR1B Bragin, Sov. J. Nucl. Phys. 36 (1982) 382

82CA1A Cameron, Essays in Nucl. Astrophys. (1982) P. 23

82CH28 Chen, Chin. J. Nucl. Phys. 4 (1982) 244; Phys. Abs. 29873 (1983)

82GR1A Greenstein, Essays in Nucl. Astrophys. (1982) P. 45

82GU1B Gurbanovich and Zelenskaya, Soviet J. Nucl. Phys. 36 (1982) 688

82KA1D Kar and Parikh, Pramana 19 (1982) 555

82KA1E Kavanagh, Essays in Nucl. Astrophys. (1982) P. 159

82KI1A Kim, J. Korean Phys. Soc. 15 (1982) 101; Phys. Abs. 11324 (1983)

82MO1B Motoba, Proc. Workshop on Hypernuclear Phys., Japan (1982) P. 36; Phys. Abs. 4792 (1984)

82RA28 Radutskii and Serdyutskii, Sov. J. Nucl. Phys. 36 (1982) 501

82WA1A Wang, Zhang and Wang, Kexue Tongbao 27 (1982) 711; Phys. Abs. 45481 (1983)

82WA1B Wagoner, Essays in Nucl. Astrophys. (1982) P. 495

82WE15 Wen, Zhang and Sun, Chin. J. Nucl. Phys. 4 (1982) 289; Phys. Abs. 49875 (1983)

83AB1B Abramov et al, Sov. J. Nucl. Phys. 38 (1983) 491

83AM1A Amsel and Davies, Nucl. Instr. Meth. Phys. Res. 218 (1983) 177

83AN13 Anderson et al, Phys. Rev. C28 (1983) 1224

83AN18 Andronenko et al, Jetp Lett. 37 (1983) 530

83ANZQ Ando, Uno, and Yamada, Jaeri-M-83-025 (1983)

83AS03 Asher and Swinhoe, Nucl. Instr. Meth. Phys. Res. 213 (1983) 503

83AS1B Aslanides et al, in Florence (1983) P. 642

83AV1A Avakov, Dolinskii and Turovtsev, Soviet J. Nucl. Phys. 37 (1983) 192

83BA1A Backenstoss et al, in Florence (1983) P. 372

83BA1D Bando, Prog. Theor. Phys. 69 (1983) 1731

83BA1G Backenstoss et al, Sin Newsl. 15 (1983) 31; Phys. Abs. 84980 (1983)

83BA1L Bando and Nagata, in Florence (1983) P. 688

83BA26 Barnes et al, Nucl. Phys. A402 (1983) 397

83BA42 Bang, Benayoun, Gignoux and Thompson, Nucl. Phys. A405 (1983) 126

83BE1H Belyaeva, Zelenskaya and Teplov, Sov. J. Nucl. Phys. 38 (1983) 540

83BI1A Birkelund and Huizenga, Ann. Rev. Nucl. Part. Sci. 33 (1983) 265

83BI1C Bizzeti, Riv. Nuovo Cim. 6 (1983) 1

83BR1B Bromley, Nucl. Phys. A400 (1983) 3C

83BR1C Brady et al, Phys. Rev. Lett. 51 (1983) 1320

83BR23 Bruno et al, Nucl. Phys. A407 (1983) 29

83BU15 Burov, Knyazkov, Shirokova and Shitikova, Z. Phys. A313 (1983) 319

83BU1A Burkova and Zhusupov, in Florence (1983) 345

83CA13 Calvi et al, Lett. Nuovo Cim. 37 (1983) 279

83CH23 Chambon et al, Z. Phys. A312 (1983) 125

83CH59 Chen, Cheng, Tian and Jin, Chin. J. Nucl. Phys. 5 (1983) 63

83CO1E Conde, Andersson, Nilsson and Nordborg, Proc. Inter. Conf., Antwerp, Belgium 1982 (Dordrecht, Netherlands: Reidel 1983), P. 447; Phys. Abs. 43476 (1984)

83DA22 Dave and Gould, Phys. Rev. C28 (1983) 2212

83DE1C De Leo et al, Report Infn/Be-83/9, 1st. Naz. Fis. Nucl., Bari, Italy (1983); Phys. Abs. 32896 (1984)

83DE1E Dem'yanova and Man'ko, Sov. J. Nucl. Phys. 38 (1983) 716

83DO10 Dobrikov, Nemets, Gass and Shvedov, Izv. Akad. Nauk Sssr Ser. Fiz. 47 (1983) 943

83DZ1A Dzhibuti, Sov. J. Part. & Nucl. 14 (1983) 309

83FE07 Fetisov, Majling, Zofka and Eramzhyan, Z. Phys. A314 (1983) 239

83FO03 Fonte, Lett. Nuovo Cim. 38 (1983) 237

83FO1A Fowler, Aip Conf. Proc. 96 (1983) 80

83FU11 Fujiwara and Tang, Phys. Rev. C28 (1983) 1869

83GA1E Gareev et al, Sov. J. Nucl. Phys. 38 (1983) 41

83GE12 Gensini, Lett. Nuovo Cim. 38 (1983) 469

83GL1A Glover et al, Bull. Amer. Phys. Soc. 28 (1983) 996

83GM1A Gmitro, Kissener, Truol and Eramzhyan, Sov. J. Part. & Nucl. 14 (1983) 323

83GO06 Gorpinich et al, Izv. Akad. Nauk. Sssr, Ser. Fiz. 47 (1983) 185

83GO17 Goryachii and Peresypkin, Izv. Akad. Nauk Sssr Ser. Fiz. 47 (1983) 1013

83GO1J Goryachii and Peresypkin, Sov. J. Nucl. Phys. 38 (1983) 536

83GR26 Gross and Nemes, Phys. Lett. 130B (1983) 131

83GU10 Guidetti, Nali and Quarati, Nuovo Cim. A75 (1983) 191

83GU1A Guet, Nucl. Phys. A400 (1983) 191C

83GU1B Guinet et al, in Florence (1983) P. 531

83HA1K Hale, Dodder and De Veaux, Proc. Inter. Conf., Antwerp, Belgium 1982 (Dordrecht, Netherlands: Reidel 1983) P. 326; Phys. Abs. 37643 (1984)
83HE17 Heusi et al, Nucl. Phys. A407 (1983) 429
83IS10 Ishikawa et al, Phys. Rev. C28 (1983) 1884
83JA13 Jakobsson, Phys. Scr. T5 (1983) 207
83JE03 Jenny et al, Nucl. Phys. A397 (1983) 61
83JO1A Johnson, Nishioka, Tostevin and Windham, in Florence (1983) P. 505
83JU01 Junker, Nucl. Phys. A407 (1983) 460
83KA1A Kadmenskii and Ratis, Sov. J. Nucl. Phys. 38 (1983) 805
83KI10 Kirchner, Beckmann, Holm and Korber, Nucl. Phys. A405 (1983) 159
83KU06 Kukulin, Pomerantsev, Emel'yanov and Klimov, Sov. J. Nucl. Phys. 37 (1983) 514
83KU17 Kumar, Nucl. Phys. A410 (1983) 50
83KU1B Kuznetsov, Nucl. Phys. A400 (1983) 493C
83LE14 Lehman and Parke, Phys. Rev. C28 (1983) 364
83LE26 Le Bornec et al, Phys. Lett. 133B (1983) 149
83LO10 Lolos et al, Phys. Lett. 126B (1983) 20
83LY04 Levshin, Sailer and Foursat, Sov. J. Nucl. Phys. 38 (1983) 377
83MA53 Mateja, Garman and Frawley, Phys. Rev. C28 (1983) 1579
83MI14 Mintz, Phys. Rev. C28 (1983) 1389
83MO1C Motoba, Bando and Ikeda, Prog. Theor. Phys. 70 (1983) 189
83MU08 Murphy and Stokstad, Phys. Rev. C28 (1983) 428
83NA08 Namboodiri et al, Phys. Rev. C28 (1983) 460
83NO08 Norbeck, Wu, Chen and Carlson, Phys. Rev. C28 (1983) 1140
83OL1A Olson et al, Phys. Rev. C28 (1983) 1602
83OS03 Osman, Int. J. Theor. Phys. 22 (1983) 341
83OT02 Otozai et al, Z. Phys. A311 (1983) 303
83PO1B Poppe et al, Aip Conf. Proc. 97 (1983) 226
83PO1C Poppe, Rowley and Dietrich, Bull. Amer. Phys. Soc. 28 (1983) 969
83PO1D Povh, in Proc. of the Int. Conf. on Nucl. Phys., Florence, Aug.-Sept. 1983, Vol. 2, Editors: P. Blasi and R. A. Ricci; Tipografia Compositori Bologna (1983) P. 455
83PR1A Proriol and Jargeaix, Nuovo Cim. 77A (1983) 289
83RE15 Rekalo, Izv. Akad. Nauk Sssr Ser. Fiz. 47 (1983) 2244
83RO12 Robertson and Brown, Phys. Rev. C28 (1983) 443
83RU09 Rusek et al, Nucl. Phys. A407 (1983) 208
83SA1D Satchler, Nucl. Phys. A409 (1983) 3C
83SA39 Sakuragi, Yahiro and Kamimura, Prog. Theor. Phys. 70 (1983) 1047
83SH1E Shi and Zhuang, Phys. Energ. Fortis & Phys. Nucl. 7 (1983) 605
83SH1J Shibata and Shirato, J. Phys. Soc. Jpn. 52 (1983) 3748
83SH24 Shastry and Gambhir, Phys. Rev. C28 (1983) 1109
83SH38 Shi, Phys. Rev. C28 (1983) 2452
83SM04 Smirnov and Tchuvilsky, Czech. J. Phys. 33 (1983) 1215
83ST1A Stocker et al, Nucl. Phys. A400 (1983) 63C
83SU1B Suzuki, Nucl. Phys. A405 (1983) 40

83VA31 Van Hees and Glaudemans, Z. Phys. A314 (1983) 323
83VI03 Vineyard, Cook and Kemper, Nucl. Phys. A405 (1983) 429
83VO1C Vogel, in Symmetries in Nuclear Structure, Edited by Abrahams, Allaart and Dieperink (Plenum Press 1983), P. 203
84AB1B Abramov et al, in Alma Ata (1984) P. 311
84AJ01 Ajzenberg-Selove, Nucl. Phys. A413 (1984) 1
84AK01 Akhiezer and Rekalo, Doklady Akad. Nauk Sssr 274 (1984)1079
84AL1F Aleksandrov et al, Sov. J. Nucl. Phys. 39 (1984) 323
84AR17 Arena et al, Lett. Nuovo Cim. 41 (1984) 59
84AS07 Assafiri and Morrison, Nucl. Phys. A427 (1984) 460
84BA19 Barit, Dul'kova, Kuznetsova and Sobolevskii, Izv. Akad. Nauk Sssr Ser. Fiz. 48 (1984) 380
84BA1H Bang and Gaponov, Izv. Akad. Nauk Sssr Ser. Fiz. 48 (1984) 130
84BA1U Bayukov et al, in Panic (1984) I25
84BA53 Bang, Gareev, Goncharov and Kasacha, Nucl. Phys. A429 (1984) 330
84BE1E Benenson, Bull. Amer. Phys. Soc. 29 (1984) 1046
84BE37 Beck, Dickmann and Kruppa, Phys. Rev. C30 (1984) 1044
84BL21 Blokhintsev, Mukjamaedzhanov and Safronov, Sov. J. Part. & Nucl. 15 (1984) 580
84BO03 Boothroyd, Markey and Vogel, Phys. Rev. C29 (1984) 603
84BO1C Boyd, Turner, Rybarcyk and Joseph, Private Communication (1984)
84BO1D Bodmer, Usmani and Carlson, Nucl. Phys. A422 (1984) 510
84BO1G Bodmer, in Aip Conf. Proc. 123 (1984) 806
84BO1H Bogdanova and Markushin, Sov. J. Part. & Nucl. 15 (1984) 361
84BO49 Bochkarev et al, Jetp Lett. 40 (1984) 969
84BR03 Brady et al, J. Phys. G10 (1984) 363
84BR04 Brzychczyk et al, Nucl. Phys. A417 (1984) 174
84BR08 Brancus et al, Rev. Roum. Phys. 29 (1984) 77
84BR1B Bragin and Tompson, in Alma Ata (1984) 460
84BR22 Bressani et al, Phys. Rev. C30 (1984) 1745
84BR25 Brown, Bronk and Hodgson, J. Phys. G10 (1984) 1683
84BU01 Burov et al, J. Phys. G10 (1984) L21
84BU1C Burkova, Glozman and Zhusupov, in Alma Ata (1984) 368
84BY1A Bystritsky et al, Acta Phys. Pol. B15 (1984) 699
84BY1B Bystritsky et al, Acta Phys. Pol. B15 (1984) 689
84CH16 Chiavassa et al, Nucl. Phys. A422 (1984) 621
84CH1E Chen, Sa and Zhang, Chin. J. Nucl. Phys. 6 (1984) 129; Phys. Abs. 83091 (1984)
84CH1G Chen, Zhuang, Shi and Jin, Chin. J. Nucl. Phys. 6 (1984) 303
84CH20 Cheon, Choi and Jeong, Phys. Lett. 144B (1984) 312
84CO08 Cook, Nucl. Phys. A417 (1984) 477
84DA1H Davis, in Aip Conf. Proc. 123 (1984) P. 1037
84DE1A De Bievre et al, J. Phys. Chem. Ref. Data 13 (1984) 809
84DE1D De Boer et al, Phys. Rev. Lett. 53 (1984) 423
84DO1A Donnelly and Sick, Revs. Mod. Phys. 56 (1984) 461
84DU17 Dubovichenko and Zhusupov, Izv. Akad. Nauk Sssr Ser. Fiz. 48 (1984) 935

84DY01 Dytlewski, Siddiqui and Thies, Nucl. Phys. A430 (1984) 214
84DZ1A Dzhibuti and Tsiklauri, Sov. J. Nucl. Phys. 39 (1984) 704
84EC01 Eck, Kemper and Ophel, Nucl. Phys. A425 (1984) 141
84EF03 Efrosinin and Zaikin, Sov. J. Nucl. Phys. 39 (1984)717
84EV1A Evlanov, Polozov and Sokolov, in Alma Ata (1984) P. 431
84FE1A Ferch et al, Indc (Ccp)-221/L (1984) P. 18
84FI1A Fillipov, Vasilevsky and Nesterov, in Alma Ata (1984) P. 209
84FI1E Filippov, Vasilevskii and Kruchinin, Sov. J. Nucl. Phys. 40 (1984) 229
84FI1F Filchenkov, Somov and Zinov, Nucl. Instr. Meth. Phys. Res. A228 (1984) 174
84FR13 Friedrich, Phys. Lett. 146B (1984) 135
84GE05 Germond and Wilkin, J. Phys. G10 (1984) 745
84GE1B Germond, in Panic (1984) F26
84GL02 Glozman, Kukulin and Neudatchin, Phys. Lett. 136B (1984) 315
84GL09 Glozman, Kukulin and Neudatchin, Nucl. Phys. A430 (1984) 589
84GL1E Glukhov et al, Sov. J. Nucl. Phys. 40 (1984) 41
84GO03 Gokmen et al, Phys. Rev. C29 (1984) 1595
84GR05 Grawert and Mukhopadhyay, Nucl. Phys. A415 (1984) 304
84GR08 Green, Korteling and Jackson, Phys. Rev. C29 (1984) 1806
84GR20 Grotowski et al, Phys. Rev. C30 (1984) 1214
84GU06 Guigas et al, Phys. Lett. 137B (1983) 323
84GU09 Gupta and Kailas, Z. Phys. A317 (1984) 75
84GU14 Gugelot, Phys. Rev. C30 (1984) 654
84HA1D Halderson, Phys. Rev. C30 (1984) 941
84HA1M Haxton, in Aip Conf. Proc. 123 (1984) P. 1026
84HA25 Hanck, Tang and Baye, Nucl. Phys. A419 (1984) 308
84HA53 Haider and Malik, at. Data Nucl. Data Tables 31 (1984) 185
84HI1A Hirsch et al, Phys. Rev. C29 (1984) 508
84IR1A Irgaziev, Yarmukhamedov and Avakov, in Panic (1984) A33
84JI03 Jibuti and Kezerashvili, Nucl. Phys. A430 (1984) 573
84JO1A Johnson, Proc. 4th Inter. Conf. Clustering Aspects of Nucl. Structure, Chester, England 1984 (Dordrecht, Netherlands: Reidel 1985) P. 155; Phys. Abs. 755 (1986)
84KA1E Kanada, Kaneko, Nomoto and Tang, Prog. Theor. Phys. 72 (1984) 369
84KE1C Kerbikov, Sov. J. Nucl. Phys. 39 (1984) 516
84KH05 Khallaf, Fizika 16 (1984) 285; Phys. Abs. 106625 (1984)
84KI08 Kim, Udagawa and Tamura, Phys. Rev. C30 (1984) 1087
84KI16 Kiziah et al, Phys. Rev. C30 (1984) 1643
84KO16 Kobayashi and Kohmura, Prog. Theor. Phys. 71 (1984) 327
84KO1A Koenig et al, Bull. Amer. Phys. Soc. 29 (1984) 672
84KO1E Komarov, Muller and Tesch, in Panic (1984) I20
84KO1H Kostomarov, Kukulin and Sazonov, Moscow Univ. Comput. Math & Cybern. 15 (1984) 1; Phys. Abs. 86774 (1984)
84KO25 Koenig et al, Z. Phys. A318 (1984) 135
84KR10 Krasnopolskii, Kukulin and Neudachin, Izv. Akad. Nauk Sssr Ser. Fiz. 48 (1984) 82

84KR1B Kravtsov, Popov and Solyakin, Jetp Lett. 40 (1984) 875

84KR23 Krupp et al, Phys. Rev. C30 (1984) 1810

84KU03 Kukulin, Krasnopol'sky, Voronchev and Sazonov, Nucl. Phys. A417 (1984) 128

84KU06 Kukulin and Peresypkin, Sov. J. Nucl. Phys. 39 (1984) 259

84KU13 Kudrjavtsev, Mur and Popov, Phys. Lett. 143B (1984) 41

84KU15 Kukulin, Kamal, Voronchev and Krasnopol'sky, J. Phys. G10 (1984) L213

84LA27 Langevin et al, Phys. Lett. 146B (1984) 176

84LA33 Lattuada, Riggi, Spitaleri and Vinciguerra, Nuovo Cim. A83 (1984) 151

84LO1C Lovas, Proc. 4th Inter. Conf. Clustering Aspects of Nucl. Structure, Chester, England 1984 (Dordrecht, Netherlands: Reidel 1985) P. 231; Phys. Abs. 794 (1986)

84MA1G Majling, Sotona, Zofka and Fetisov, in Panic (1984) M20

84MI1A Mikhelamvili, in Alma Ata (1984) P. 216

84MI1B Mitropolskii and Khefter, in Alma Ata (1984) P. 241

84MI1E Millener, in Aip Conf. Proc. 123 (1984) P. 850

84MI1F Mihailovic, Proc. 4th Inter. Conf. Clustering Aspects of Nucl. Structure, Chester, England 1984 (Dordrecht, Netherlands: Reidel 1985) P. 85; Phys. Abs. 726 (1986)

84MO09 Motoba, Bando and Ikeda, Prog. Theor. Phys. 71 (1984) 222

84MO1H Motoba, Bando and Ikeda, Proc. Inter. Summer School, Changchun, China 1983 (Singapore: World Scientific 1984) P. 702; Phys. Abs. 30835 (1985)

84MO29 Morrissey et al, Phys. Lett. 148B (1984) 423

84MU01 Mughrabi, Itaoui, Ellis and Tang, Phys. Rev. C29 (1984) 29

84MU1D Mukhopadhyay and Grawert, J. Phys. Colloq. 45 (C6) (1984) 435

84NA17 Nadezhdin, Petrov, Satarov and Rozanova, Sov. J. Nucl. Phys. 40 (1984) 17

84NA19 Nakaichi-Maeda and Schmid, Z. Phys. A318 (1984) 171

84NA1D Nagamiya, Randrup and Symons, Ann. Rev. Nucl. Part. Sci. 34 (1984) 155

84NE1A Nemets, Rudchik and Chuvilski, in Alma Ata (1984) P. 334

84NI01 Nishioka, Tostevin, Johnson and Kubo, Nucl. Phys. A415 (1984) 230

84OH01 Ohnishi et al, Nucl. Phys. A415 (1984) 271

84PA08 Parke and Lehman, Phys. Rev. C29 (1984) 2319; Ibid C34 (1986) 1496

84PA1B Pasechnik et al, in Alma Ata (1984) P. 288

84PL1A Plattner, Nucl. Phys. A416 (1984) 565C

84PU1A Pugach et al, in Alma Ata (1984) P. 386

84RA1E Rana, Nuovo Cim. B84 (1984) 53

84RE1A Read and Viola, at. Data Nucl. Data Tables 31 (1984) 359

84RE1C Rekalo, Dopov. Akad. Nauk Ukrsr Ser. A7 (1984) 62; Phys. Abs. 5449 (1985)

84RO04 Robertson et al, Phys. Rev. C29 (1984) 755

84RO1B Romanov and Grechukhin, in Alma Ata (1984) P. 280, 281

84SA1B Saupe, Shirokova and Shitikova, in Alma Ata (1984) P. 474

84SA1C Satta et al, Phys. Lett. 139B (1984) 263

84SC1A Schmid, Nucl. Phys. A416 (1984) 347C

84SH1E Shvedov, Dobrikov and Nemets, in Alma Ata (1984) P. 332

84SM04 Smith et al, Phys. Rev. C30 (1984) 593

84ST1B Stokstad, Comments Nucl. Part. Phys. 13 (1984) 231

84SU09 Sundholm, Pyykko, Laaksonen and Sadlej, Chem. Phys. Lett. 112 (1984) 1

84TA07	Taddeucci et al, Phys. Rev. Lett. 52 (1984) 1960
84TA1F	Taddeucci, Bull. Amer. Phys. Soc. 29 (1984) 1032
84TR1B	Tryasuchev, Sov. J. Nucl. Phys. 39 (1984) 380
84TR1C	Truran, Ann. Rev. Nucl. Part. Sci. 34 (1984) 53
84TS03	Tsang et al, Phys. Lett. 134B (1984) 169
84TU02	Turk and Antolkovic, Nucl. Phys. A431 (1984) 381
84UD1A	Uddin and Ali, J. Bangladesh Acad. Sci. 8 (1984) 19; Phys. Abs. 88783 (1985)
84UM04	Umeda et al, Nucl. Phys. A429 (1984) 88
84VA06	Van Hees and Glaudemans, Z. Phys. A315 (1984) 223
84VA1B	Vasilevsky, Chopovski and Fillipov, in Alma Ata (1984) P. 197
84VI01	Vineyard, Kemper and Cook, Phys. Lett. 142B (1984) 249
84VI02	Vineyard, Cook, Kemper and Stephens, Phys. Rev. C30 (1984) 916
84WA02	Walliser and Tang, Phys. Lett. 135B (1984) 344
84WA09	Warner et al, Nucl. Phys. A422 (1984) 205
84WA18	Wade, Brussel, Koester and Smith, Phys. Rev. Lett. 53 (1984) 2540
84WA1H	Wang, Zeng and Zhao, Phys. Energ. Fortis & Phys. Nucl. 8 (1984) 328; Phys. Abs. 102205 (1984)
84WA1J	Walecka, in Aip Conf. Proc. 123 (1984) P. 1
84WE03	Westfall et al, Phys. Rev. C29 (1984) 861
84WI08	Windham, Nishioka, Tostevin and Johnson, Phys. Lett. 138B (1984) 253
84YP01	Ypsilantis and Grypeos, Nuovo Cim. A82 (1984) 93
84ZA1A	Zamani, Zioutas and Charalambous, Nucl. Tracks & Radiat. Meas. 8 (1984) 555
84ZH1A	Zhusupov, Shaksibekova and Ibraeva, in Alma Ata (1984) P. 411
84ZH1B	Zhuang, Chen and Jin, Phys. Energ. Fortis & Phys. Nucl. 8 (1984) 215
84ZW1A	Zwarts, Unpublished Ph.D. Thesis, Utrecht (1984)
85AJ01	Ajzenberg-Selove, Nucl. Phys. A433 (1985) 1
85AK1B	Akhiezer and Rekalo, Dokl. Akad. Nauk Sssr 280 (1985) 83
85AL12	Alhassid et al, Z. Phys. A321 (1985) 677
85AL1F	Alkhazov et al, Sov. J. Nucl. Phys. 42 (1985) 4
85AL1G	Aleksandrov et al, in Questions in Atomic Physics and in Technology, Ussr (1985) 3
85AN28	Antony, Britz, Bueb and Pape, at. Data Nucl. Data Tables 33 (1985) 447
85BA1C	Bayman, Fricke and Tang, Phys. Rev. C31 (1985) 679
85BA1E	Bando, Suppl. Prog. Theor. Phys. 81 (1985) 1
85BA1K	Barit, Balashko, Dulkov and Zuev, in Leningrad (1985) P. 307
85BA68	Barker and Woods, Aust. J. Phys. 38 (1985) 563
85BE1C	Berdnikov et al, in Leningrad (1985) P. 302
85BE1J	Belostotskii et al, Sov. J. Nucl. Phys. 41 (1985) 903
85BE60	Beck, Dickmann and Lovas, Nucl. Phys. A446 (1985) 703
85BL18	Blocki et al, Nucl. Phys. A445 (1985) 367
85BO05	Bouten, Bouten and Cornelissens, J. Phys. G11 (1985) 231
85BO1E	Boyd et al, in Aip Conf. Proc. 126 (1985) 145
85BO1F	Bochkarev et al, Sov. J. Nucl. Phys. 41 (1985) 19
85BO1J	Botvina, Il'inov and Mishustin, Sov. J. Nucl. Phys. 42 (1985) 712

85BO1K Boesgaard and Steigman, Ann. Rev. Astron. Astrophys. 23 (1985) 319
85BO55 Bochkarev et al, Jetp Lett. 42 (1985) 374
85BO56 Bochkarev et al, Jetp Lett. 42 (1985) 377
85BR14 Bragin and Thompson, Sov. J. Nucl. Phys. 41 (1985) 199
85BU1B Bubak, Bystritsky and Gula, Acta Phys. Pol. B16 (1985) 575
85CA1B Cameron, Nucl. Phys. A434 (1985) 261c
85CA41 Caughlan, Fowler, Harris and Zimmerman, at. Data Nucl. Data Tables 32 (1985) 197
85CH01 Christou et al, Phys. Rev. C31 (1985) 250
85CH37 Chiba et al, J. Nucl. Sci. & Technol. (Japan) 22 (1985) 771
85CL1A Close, Nucl. Phys. A446 (1985) 273C
85CO09 Cook and Kemper, Phys. Rev. C31 (1985) 1745
85CO21 Cook, Nucl. Phys. A445 (1985) 350
85CU04 Cunsolo et al, Nuovo Cim. A85 (1985) 343
85DA29 D'amico et al, Can. J. Phys. 63 (1985) 1438
85DE05 D'erasmo, Variale and Pantaleo, Phys. Rev. C31 (1985) 656
85DE17 Descroix et al, Nucl. Phys. A438 (1985) 112
85DO03 Doleschall et al, Phys. Lett. 152B (1985) 1
85DO19 Dorr et al, Nucl. Phys. A445 (1985) 557; Ibid A457 (1986) 742
85DO1B Dotsenko and Starodubskii, Sov. J. Nucl. Phys. 42 (1985) 66
85DU05 Dumbrajs, Phys. Scr. 31 (1985) 485
85EM01 Emelyanov and Klimov, Phys. Lett. 157B (1985) 105
85ER06 Eramzhyan, Kaipov and Kamalov, Z. Phys. A322 (1985) 321
85FA02 Faissner, Kim and Reithler, Phys. Rev. Lett. 54 (1985) 1902
85FI01 Filippov, Vasilevskii and Nesterov, Izv. Akad. Nauk Sssr Ser. Fiz. 49 (1985) 173
85FI1E Filippov, Vasilevskii and Chopovskii, Sov. J. Part. & Nucl. 16 (1985) 153
85FR01 Franke et al, Nucl. Phys. A433 (1985) 351
85FR1F Franco and Yin, Phys. Rev. Lett. 55 (1985) 1059
85GO07 Goldhammer, Phys. Rev. C31 (1985) 1533
85GO1F Goodman, in Aip Conf. Proc. 124 (1985) P. 375
85GO1G Gorionov et al, in Leningrad (1985) P. 310
85GO20 Gomez-Camacho, Lozano and Nagarajan, Phys. Lett. 161B (1985) 39
85GO23 Gomez-Camacho and Nagarajan, J. Phys. G11 (1985) L239
85GR1A Grenacs, Ann. Rev. Nucl. Part. Sci. 35 (1985) 455
85GU11 Gupta, Kailas, Lingappa and Shridhar, Phys. Rev. C31 (1985) 1965
85GU1G Gula, Acta Phys. Pol. B16 (1985) 589
85HA04 Hahn, Schmid and Doleschall, Phys. Rev. C31 (1985) 325
85HA14 Hanck, Nucl. Phys. A439 (1985) 1
85HA18 Hanna and Hugg, Hyperfine Interactions 21 (1985) 59
85HO1E Hofmann, Neandc-222 U; Specialists' Meeting on the Use of the Optical Model For the Calculation of Neutron Cross Sections Below 20 Mev, Paris 1985 (Oecd/Ocde 1986) P. 75
85IK1A Ikeda, Bando and Motoba, Suppl. Prog. Theor. Phys. 81 (1985) 147
85JA16 Jarmie and Brown, Nucl. Instr. Meth. Phys. Res. B10-11 (1985) 405

85JA1B Jacak, Fox and Westfall, Phys. Rev. C31 (1985) 704
85JE04 Jenny, Gruebler, Konig and Schmelzbach, Nucl. Phys. A444 (1985) 93
85KA1D Kadkin, in Leningrad (1985) P. 297
85KA1M Kaschiev, Matveenko and Revai, Phys. Lett. 162B (1985) 18
85KA20 Kanada, Kaneko, Saito and Tang, Nucl. Phys. A444 (1985) 209
85KH07 Khalil, Phys. Rev. C32 (1985) 1631
85KO22 Kotikov and Makhnovskii, Sov. J. Nucl. Phys. 41 (1985) 183
85KO29 Kozyr, Medvedev, Pavlenko and Pugach, Izv. Akad. Nauk Sssr Ser. Fiz. 49 (1985) 1026
85KR13 Kraushaar et al, Phys. Rev. C32 (1985) 1083
85KW02 Kwasniewicz and Jarczyk, Nucl. Phys. A441 (1985) 77
85KW03 Kwasniewicz, Kisiel and Jarczyk, Acta Phys. Pol. B16 (1985) 947
85LA20 Gismatullin et al, Izv. Akad. Nauk Sssr Ser. Fiz. 49 (1985) 143
85LE08 Lehman and Parke, Phys. Rev. C31 (1985) 1920; Ibid C37 (1988) 2266
85LE19 Le Bornec et al, J. Phys. G11 (1985) 1125
85LE1B Lemaire, in Inter. Symp. Medium Energy Nucleon and Anti-Nucleon Scattering (Bad Honnef 1985)
85LI1C Ling, Zhao and Zeng, Phys. Energ. Fortis & Phys. Nucl. 9 (1985) 236; Phys. Abs. 83976 (1985)
85LI1F Ling and Zhao, Chin. Phys. 5 (1985) 77
85LO02 Lodhi and Wald, J. Phys. G11 (1985) 365
85LO1A Lodhi and Hamilton, Phys. Rev. Lett. 54 (1985) 646
85LU08 Luhn et al, Phys. Rev. C32 (1985) 11
85MA02 Machner et al, Phys. Rev. C31 (1985) 443
85MA13 Magda, Pop and Sandulescu, J. Phys. G11 (1985) L75
85MA1F Mazitov and Rasulov, in Leningrad (1985) P. 298
85MA1G Matthews, Aip Conf. Proc. 133 (1985) P. 296
85MC05 Mc Parland et al, Phys. Lett. 156B (1985) 47
85ME02 Merchant and Rowley, Phys. Lett. 150B (1985) 35
85MI05 Micek et al, Nucl. Phys. A435 (1985) 621
85MI10 Mischke, Nucl. Phys. A434 (1985) 505C
85MI1E Michaud, in Aip Conf. Proc. 126 (1985) P. 75
85MI1F Miyagawa et al, Prog. Theor. Phys. 74 (1985) 1264
85MO17 Morrissey et al, Phys. Rev. C32 (1985) 877
85MO1C Mondragon and Hernandez, Bull. Amer. Phys. Soc. 30 (1985) 700
85MO1F Motoba, Bando, Ikeda and Yamada, Suppl. Prog. Theor. Phys. 81 (1985) 42
85NI1A Nisimura et al, Nucl. Phys. A432 (1985) 378
85NO1A Norbeck and Lin, Bull. Amer. Phys. Soc. 30 (1985) 1248
85OS02 Oswald et al, Nucl. Phys. A435 (1985) 77
85OS03 Osman and Farag, Acta Phys. Pol. B16 (1985) 59
85PA03 Pasechnik et al, Izv. Akad. Nauk Sssr Ser. Fiz. 49 (1985) 53
85PA04 Pasechnik et al, Izv. Akad. Nauk Sssr Ser. Fiz. 49 (1985) 58
85PA1B Pasechnik et al, in Leningrad (1985) P. 265
85PA1C Pasechnik et al, in Leningrad (1985) P. 296

85PO09 Pochodzalla et al, Phys. Rev. Lett. 55 (1985) 177
85PO10 Poppelier, Wood, and Glaudemans, Phys. Lett. 157B (1985) 120
85RE1A Repenko, Pleshkov, Stibunov and Tomchakov, in Leningrad (1985) P. 342
85RE1B Rekalo, Sov. Phys. J. 28 (1985) 588
85RO17 Roig and Navarro, Nucl. Phys. A440 (1985) 659
85SA13 Sakuragi, Kamimura, Yahiro and Tanifuji, Phys. Lett. 153B (1985) 372
85SA1B Safronov, in Leningrad (1985) P. 407
85SA1D Sakuragi, Kamimura, Yahiro and Fukushima, J. Phys. Soc. Jpn. 54 (1985) 88
85SA32 Sato and Okuhara, Phys. Lett. 162B (1985) 217
85SA36 Sakuragi et al, Z. Phys. A322 (1985) 627
85SC1A Schatzman, in Aip Conf. Proc. 126 (1985) P. 69
85SC1C Schramm, Nature 317 (1985) 386
85SE17 Sene et al, Nucl. Phys. A442 (1985) 215
85SH1A Shitikova, Sov. J. Part. & Nucl. 16 (1985) 364
85SH1C Shepard, in Aip Conf. Proc. 124 (1985) P. 107
85SI12 Sinha et al, Z. Phys. A321 (1985) 381
85ST1A Stibunov, in Leningrad (1985) P. 341
85ST1B Stokstad, Treatise on Heavy-Ion Science, Vol. 3 (1985) P. 83
85TA13 Tanihata et al, Phys. Lett. 160B (1985) 380
85TA18 Tanihata et al, Phys. Rev. Lett. 55 (1985) 2676
85TA1D Tanihata, Hyperfine Interactions 21 (1985) 251
85VA1B Van Siclen, J. Phys. G11 (1985) 267
85VA1C Varlamov et al, in Leningrad (1985) P. 339
85VI03 Vineyard, Cook and Kemper, Phys. Rev. C31 (1985) 879
85WA1K Walker, Mathews and Viola, Astrophys. J. 299 (1985) 745
85WA25 Warner et al, Nucl. Phys. A443 (1985) 64
85WI1A Wieman et al, Bull. Amer. Phys. Soc. 30 (1985) 767
85WO11 Woo, Kwiatkowski, Zhou and Viola, Phys. Rev. C32 (1985) 706
85ZH1A Zhao, Hou and Zeng, Phys. Energ. Fortis & Phys. Nucl. 9 (1985) 742
85ZI05 Zickendraht, Ann. Phys. 42 (1985) 113
85ZI1C Zinov, Somov and Fil'chenkov, Sov. at. Energy 58 (1985) 226
86AD1A Adelberger, in Aip Conf. Proc. 150 (1986) 1177
86AH03 Ahsan and Thies, Nucl. Instr. Meth. Phys. Res. A243 (1986) 523
86AJ04 Ajzenberg-Selove, Nucl. Phys. A460 (1986) 1
86AK1A Akhiezer and Rekalo, Dokl. Akad. Nauk Sssr 286 (1986) 613
86AK1B Akhiezer and Rekalo, Dopov. Akad. Nauk Ukr. Rsr A-Fiz. #12 (1986) 25
86AK1C Akhiezer and Rekalo, Dokl. Akad. Nauk Sssr 287 (1986) 1365
86AL1K Alford, in Aip Conf. Proc. 150 (1986) P. 710
86AN04 Antonuk et al, Nucl. Phys. A451 (1986) 741
86AN26 Antolkovic, Paic and Kadija, Few-Body Syst. 1 (1986) 159
86AS1A Ashery and Schiffer, Ann. Rev. Nucl. Part. Sci. 36 (1986) 207
86AU1A Aushev et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 1074
86AU1D Auerbach, in Aip Conf. Proc. 150 (1986) P. 520

86AV1B Avdeichikov, in Dubna (1986) P. 122

86AV1C Avakov, Blokhintsev, Mukhamedzhanov and Yarmukhamedov, Sov. J. Nucl. Phys. 43 (1986) 524

86AV1E Avakov, Irgaziev and Yarmukhamedov, Sov. J. Nucl. Phys. 44 (1986) 607

86AV1F Avakov et al, Sov. J. Nucl. Phys. 44 (1986) 958

86AZ1A Aznauryan and Troshenkova, Sov. J. Nucl. Phys. 43 (1986) 219

86BA1R Baur, Bertulani and Rebel, Proc. Inter. Symp., Heidelberg, Germany (Berlin, Germany: Springer-Verlag 1986) P. 980; Phys. Abs. 49378 (1987)

86BA1T Bagdasaryan et al, Sov. J. Contemp. Phys. 21 (1986) 58; Phys. Abs. 18844 (1988)

86BA1W Bando, Nucl. Phys. A450 (1986) 217C

86BA2G Barlamov, Ishkanov, Chernyaev and Eramzhian, in Kharkov (1986) P. 345

86BA73 Baryshnikov, Blokhintsev, Kapote and Savin, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 1962

86BE1L Bekbaev, Kim, Mazitov and Eramzhian, in Kharkov (1986) P. 436

86BE35 Belozyorov et al, Nucl. Phys. A460 (1986) 352

86BE44 Belozerov et al, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 1936

86BE45 Berezhnoi, Kuznichenko, Onishchenko and Pilipenko, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 2050

86BO01 Boal and Shillcock, Phys. Rev. C33 (1986) 549

86BO1E Bodmer and Usmani, Nucl. Phys. A450 (1986) 257C

86BR1K Brown and Jarmie, in Santa Fe (1985) 45

86BR1M Bragin et al, Sov. J. Nucl. Phys. 44 (1986) 198

86BR1N Bruno et al, Few-Body Syst. Suppl. (Austria) 1 (1986) 211

86BU07 Burov et al, J. Phys. G12 (1986) 509

86BY1A Bystritsky and Wozniak, Acta Phys. Pol. B17 (1986) 309

86CE04 Cernigoi et al, Nucl. Phys. A456 (1986) 599

86CH10 Chitwood et al, Phys. Lett. 172B(1986) 27

86CH1I Chrien, Aip Conf. Proc. 150 (1986) P. 325

86CH1J Chant, Aip Conf. Proc. 142 (1986) P. 246

86CH1L Christou, Lehman and Parke, Bull. Amer. Phys. Soc. 31 (1986) 816

86CH1Q Chaumette et al, Helv. Phys. Acta 59 (1986) 767

86CL1B Clarke et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 756

86CL1C Clegg, J. Phys. Soc. Jpn. Suppl. 55 (1986) 535

86CS1A Csernai and Kapusta, Phys. Rep. 131 (1986) 223

86DA1B Davis and Pniewski, Contemp. Phys. 27 (1986) 91

86DO11 Donnelly and Raskin, Ann. Phys. 169 (1986) 247

86DO1K Doleschall et al, Few-Body Syst. Suppl. (Austria) 1 (1986) 206

86DU10 Dumbrajs et al, Nucl. Phys. A457 (1986) 491

86EL1A Ellis and Tang, Phys. Rev. Lett. 56 (1986) 1309

86EM1A Emelyanov, Klimov and Pomerantsev, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 902

86EN05 Ent et al, Phys. Rev. Lett. 57 (1986) 2367

86EN1A Engelmann and Bardy, Report Cea-R-5340 (1986)

86EN1B Engelage et al, Bull. Amer. Phys. Soc. 31 (1986) 889

86ER1A Eramzhyan, Ishkhanov, Kapitonov and Neudatchin, Phys. Rep. 136 (1986) 229

86ES1B Eskandarian, Lehman and Parke, Bull. Amer. Phys. Soc. 31 (1986) 816
86EV1A Evseev, Buki, Likhachev and Shevchenko, in Kharkov (1986) P. 350
86FI1A Filimonov, Czech. J. Phys. 36 (1986) 431
86FI1B Filippone, Ann. Rev. Nucl. Part. Sci. 36 (1986) 717
86FI1D Fick, J. Phys. Soc. Jpn. Suppl. 55 (1986) 423
86FI1F Filippov, Vasilevskii, Kruchinin and Chopovskii, Sov. J. Nucl. Phys. 43 (1986) 536
86FL1A Flerov, in Harrogate (1986) Supplement 1
86FO04 Fox et al, Phys. Rev. C33 (1986) 1540
86FR12 Franco and Yin, Phys. Rev. C34 (1986) 608
86GA1F Gazdzicki et al, Z. Phys. C31 (1986) 549
86GE05 Germond, J. Phys. G12 (1986) 609
86GL07 Glavanakov et al, Phys. Lett. 178B (1986) 155
86GL1A Glaudemans, Aip Conf. Proc. 142 (1986) 316
86GL1D Glukhov et al, in Kharkov (1986) P. 371
86GO1E Golden, Bull. Amer. Phys. Soc. 31 (1986) 890
86GO1M Goryachev, Sov. J. Nucl. Phys. 44 (1986) 252
86GO1N Goncharov et al, Sov. J. Nucl. Phys. 44 (1986) 191
86GR1A Gregoire and Tamain, Ann. Physique 11 (1986) 323
86GR1D Gruebler et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 884
86GR1G Gridnev, Subbotin and Fadeev, in Dubna (1986) P. 114
86HA1B Harvey, J. Physique 47 (1986) C4-29
86HA1L Hasan and Jain, Phys. Rev. C33 (1986) 1020
86HA1S Hansen, Rapaport, Wang and Barrios, Bull. Amer. Phys. Soc. 31 (1986) 1237
86HA27 Hauser et al, Nucl. Phys. A456 (1986) 253
86HA30 Harakeh et al, Phys. Lett. B176 (1986) 297
86HU1B Hungerford, Nucl. Phys. A450 (1986) 157C
86HU1D Hughes, Bloom and Mathews, Astrophys. J. 311 (1986) 485
86IM1A Imambekov and Uzikov, in Kharkov (1986) P. 410
86IM1B Imambekov, Uzikov and Shevchenko, Sov. J. Nucl. Phys. 44 (1986) 950
86IO01 Ioannides and Mackintosh, Phys. Lett. 169B (1986) 113
86JA02 Jarczyk et al, Nucl. Phys. A448 (1986) 1
86JA14 Jarczyk et al, Nucl. Phys. A459 (1986) 52
86JA1E Jarmie, Preprint La-Ur-86-3705 (1986)
86JO1A Johnson, J. Phys. Soc. Jpn. Suppl. 55 (1986) 7
86KA1B Kamimura et al, Prog. Theor. Phys. Suppl. 89 (1986) 1
86KA1C Kamimura, Sakuragi, Yahiro and Tanifuji, J. Phys. Soc. Jpn. Suppl. 55 (1986) 205
86KA1R Kailas and Gupta, in Santa Fe (1985) 1163
86KA22 Kailas and Gupta, Phys. Rev. C34 (1986) 357
86KA26 Kadija and Paic, Phys. Rev. C34 (1986) 380
86KE1F Kerimov, Buras and El Gavkhari, in Kharkov (1986) P. 472
86KI12 King et al, Phys. Lett. 175B (1986) 279
86KO1E Koch, Aip Conf. Proc. 150 (1986) 490

86KO1J Koike, J. Phys. Soc. Jpn. Suppl. 55 (1986) 272
86KO1K Korber, Beckmann, Holm and Lindner, J. Phys. Soc. Jpn. Suppl. 55 (1986) 632
86KO1M Konig et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 886
86KO1N Korcheninnikov and Chulkov, in Kharkov (1986) P. 319
86KO1U Kostin and Trubnikov, in Kharkov (1986) 422
86KR12 Kruppa, Lovas, Beck and Dickmann, Phys. Lett. 179B (1986) 317
86KR1E Kruppa, Proc. Inter. Symp., Heidelberg, Germany (Berlin, Germany: Springer-Verlag 1986) P. 57; Phys. Abs. 49381 (1987)
86KU08 Kukulin, Krasnopol'sky, Voronchev and Sazonov, Nucl. Phys. A453 (1986) 365
86KU1F Kukulin and Eramzhian, in Kharkov (1986) P. 146
86LA22 Langanke, Nucl. Phys. A457 (1986) 351
86LA27 Langanke and Rolfs, Z. Phys. A325 (1986) 193
86LE21 Lehman and Parke, Few-Body Syst. 1 (1986) 193
86LI13 Liu and Haider, Phys. Rev. C34 (1986) 1845
86LI1D Lindstrom et al, Bull. Amer. Phys. Soc. 31 (1986) 888
86LI1F Likhachev et al, in Kharkov (1986) P. 349
86MA19 Mateja et al, Phys. Rev. C33 (1986) 1649
86MA1C Majling et al, Nucl. Phys. A450 (1986) 189C
86MA1S Masson, Wise, Quin and Haeberli, Nucl. Instr. Meth. Phys. Res. A242 (1986) 196
86MA1V Magda, Pop and Sandulescu, in Harrogate (1986) C208
86MA1X Mackintosh and Ioannides, in Harrogate (1986) A4
86MC11 Mc Parland et al, Nucl. Phys. A456 (1986) 629
86MC1C Mc Master et al, Bull. Amer. Phys. Soc. 31 (1986) 839
86ME06 Mermaz et al, Nucl. Phys. A456 (1986) 186
86ME13 Mertelmeier and Hofmann, Nucl. Phys. A459 (1986) 387
86MI1D Miyagawa, Ueda, Sawada and Takagi, J. Phys. Soc. Jpn. Suppl. 55 (1986) 686
86MI1E Miyagawa et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 890
86MI24 Mikulas et al, Nuovo Cim. A93 (1986) 135
86MO1C Morrissey et al, Nucl. Phys. A447 (1986) 603C
86MO1E Moroz, J. Phys. Soc. Jpn. Suppl. 55 (1986) 221
86MO1G Mondragon and Hernandez, in Harrogate (1986) B10
86OS08 Ostroumov, Loshchakov, and Vdovin, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 916
86OS1D Osman, J. Phys. Soc. Jpn. Suppl. 55 (1986) 744
86OS1E Osman, in Santa Fe (1985) 1151
86PE05 Perroud et al, Nucl. Phys. A453 (1986) 542
86PF1A Pfutzner et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 556
86PL01 Planeta et al, Nucl. Phys. A448 (1986) 110
86PO1G Portilho, Alencar and Coon, Nucl. Phys. A450 (1986) 237C
86PO1H Povh, Nucl. Phys. A450 (1986) 573C
86PO1J Pocanic et al, Bull. Amer. Phys. Soc. 31 (1986) 1216
86RA02 Rama Rao, Ernst and Machner, Nucl. Phys. A448 (1986) 365
86RA1C Rai, Blyth and Farooq, J. Phys. Soc. Jpn. Suppl. 55 (1986) 1010
86RA1J Radutskii, Izv. Vyssh. Uch. Zav. Fiz. Sssr 29 (1986) 45

86RE1C Rebolo et al, Astron. Astrophys. 166 (1986) 195
86RE1D Rekalo, Ukr. Fiz. Zh. 31 (1986) 491; Phys. Abs. 84153 (1986)
86RI01 Rieder et al, Phys. Rev. C33 (1986) 614
86RO03 Rockmore and Saghai, Phys. Rev. C33 (1986) 576
86RO1L Rowland and Robertson, in Santa Fe (1985) 1363
86RO1M Roy et al, in Harrogate (1986) C225
86SA15 Sakuragi et al, Phys. Lett. 175B (1986) 105
86SA1D Sa87c SAKURAGI, YAHIRO, AND KAMIMURA, PROG. THEOR. PHYS. SUPPL. 89 (1986) 136
5.2in 86SA1K Sakuragi et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 770
86SA1M Sawicki, J. Nucl. Mater. A143 (1986) 327
86SA1N Sakuragi, Rep. Joint Seminar on Heavy-Ion Nucl. Phys. & Nucl. Chem. in the Energy Region of Tandem Accelerators (Ii) (Tokai, Ibaraki, Japan: Jaeri 1986) P. 70; Phys. Abs. 36048 (1987)
86SA1Q Sakai et al, J. Phys. Soc. Jpn. Suppl. 55 (1986) 1112
86SA30 Sato and Okuhara, Phys. Rev. C34 (1986) 2171
86SAZL Sakuragi, in Harrogate (1986) 273
86SAZS Sanderson and Kemper, Bull. Amer. Phys. Soc. 31 (1986) 1204
86SC28 Scholz, Ricken, and Kuhlmann, Z. Phys. A325 (1986) 203
86SH14 Shoda et al, Phys. Rev. C33 (1986) 2179
86SH1Q Shimoda et al, in Harrogate (1986) C159
86SI1B Simmonds et al, in Harrogate (1986) C128
86SR02 Srivastava and Rebel, J. Phys. G12 (1986) 717
86ST1E Steffens, J. Phys. Soc. Jpn. Suppl. 55 (1986) 459
86SU1K Su, Nucl. Tracks & Radiat. Meas. 12 (1986) 325; Phys. Abs. 19274 (1987)
86SY1A Symons, Nucl. Phys. A447 (1986) 157C
86SZ1A Szymanski, Aip Conf. Proc. 150 (1986) P. 934
86TA06 Taneichi et al, Nucl. Phys. A448 (1986) 315
86TA1E Taddeucci, J. Phys. Soc. Jpn. Suppl. 55 (1986) 156
86TA1G Tanifuji, Kamimura and Sakuragi, J. Phys. Soc. Jpn. Suppl. 55 (1986) 198
86TA1M Tamain, in Proc. Inter. Nucl. Phys. Conf., Harrogate, U.K. (1986) No. 68, Vol. 2, P. 247; Publ. by Institute of Physics, Bristol, U.K.
86VA13 Vasilevskii, Filippov, Chopovskii and Kruchinin, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 151
86VA23 Van Engelen et al, Nucl. Phys. A457 (1986) 375
86VL1A Vladimirov and Gaponov, in Kharkov (1986) P. 196
86VO09 Voronchev, Kukulin, Krasnopol'skii and Sazonov, Sov. J. Nucl. Phys. 43 (1986) 735
86VU1A Vuaridel et al, in Harrogate (1986) C71
86WA11 Warner et al, Nucl. Phys. A453 (1986) 605
86WA1J Wang, Takaki and Bando, Prog. Theor. Phys. 76 (1986) 865
86WE1C Westfall, Nucl. Phys. A447 (1986) 591C
86WH03 Whisnant, Phys. Rev. C34 (1986) 262
86WI04 Wilkinson, Nucl. Phys. A452 (1986) 296
86WI1A Wilmerding, Maglich, Nering and Powell, Bull. Amer. Phys. Soc. 31 (1986) 890

86XU1B Xu and Lynch, Inter. Conf. on Nucl. & Radiochem. (Beijing, China: Chinese Nucl. Soc. 1986) P. 54; Phys. Abs. 19305 (1987)

86YA12 Yamaya et al, Phys. Rev. C34 (1986) 2369

86YA1L Yamagata et al, in Harrogate (1986) B63

86YO06 Yokota et al, Phys. Rev. Lett. 57 (1986) 807

86ZA1C Zaritskii et al, in Kharkov (1986) P. 401

86ZE01 Zelenskaya and Morzabaev, Sov. J. Nucl. Phys. 43 (1986) 559

86ZH03 Zhusupov, Imambekov and Uzikov, Izv. Akad. Nauk Sssr Ser. Fiz. 50 (1986) 178

86ZH1B Zhuang and Chen, Chin. J. Nucl. Phys. 8 (1986) 325; Phys. Abs 96008 (1987)

86ZO1A Zofka, Nucl. Phys. A450 (1986) 165C

87AB09 Abramovich, Morkin, Serov and Strelnikov, Izv. Akad. Nauk. Sssr Ser. Fiz. 51 (1987) 930

87AJ02 Ajzenberg-Selove, Nucl. Phys. A475 (1987) 1

87AJ1A Ajzenberg-Selove, Dubna (1987) P. 341

87AL1C Alcock, Fuller and Mathews, Private Communication (1987)

87AL1L Aleksandrov et al, Sov. J. Nucl. Phys. 46 (1987) 197

87AR13 Aravantinos and Xenoulis, Phys. Rev. C35 (1987) 1746

87AR19 Arnell et al, Phys. Scripta 36 (1987) 214

87AR1C Arnould, Phil. Trans. Roy. Soc. London 323 (1987) 251

87AR1J Arai, Hashimoto and Fukui, Astron. Astrophys. 179 (1987) 17

87AS05 Assenbaum, Langanke and Rolfs, Z. Phys. A327 (1987) 461

87AS06 Aslanides et al, Nucl. Phys. A470 (1987) 445

87AU1A Audouze, J. Astrophys. Astron. 8 (1987) 147

87AU1C Auchev et al, in Yurmala (1987) P. 395

87BA13 Banaigs et al, Phys. Rev. C35 (1987) 1416

87BA1I Bayman and Tang, Phys. Rep. 147 (1987) 155

87BA2C Barlanov, Surgutanov and Chernyaev, in Yurmala (1987) P. 371

87BA38 Balster et al, Nucl. Phys. A468 (1987) 93

87BA39 Balster et al, Nucl. Phys. A468 (1987) 131

87BE2A Belousov et al, Sov. Phys. - Lebedev Inst. Rep., No. 2 (1987) 13

87BE45 Bevelacqua, Indian J. Phys. A61 (1987) 111; Phys. Abs. 81286 (1987)

87BEYI Belozyorov et al, E15-87-733 (Submitted To Nucl. Phys. A 1987)

87BL13 Bloch et al, Phys. Rev. C36 (1987) 203

87BL18 Blumel and Dietrich, Nucl. Phys. A471 (1987) 453

87BL1K Blokhintsev, Razikov, Ubaidullaeva and Yarmukhamedov, Izv. Akad. Nauk. Sssr Ser. Fiz. 51 (1987) 189

87BO1L Bodmer and Usmani, Nucl. Phys. A463 (1987) C221

87BO1O Bodmer and Usmani, Nucl. Phys. A468 (1987) 653

87BO1P Boschitz et al, Sin Newsl. (Switzerland) 19 (1987) 42; Phys. Abs. 96120 (1987)

87BO1W Bochkarev et al, Sov. J. Nucl. Phys. 46 (1987) 7

87BO40 Borcea et al, Rev. Roum. Phys. 32 (1987) 497

87BR02 Brown et al, Phys. Rev. C35 (1987) 383

87BR07 Bruno et al, Phys. Rev. C35 (1987) 1563

87BR1V Breunlich et al, Muon Catalysed Fusion (Switzerland) 1 (1987) 121; Phys. Abs. 141117 (1987)
87BR32 Brady, Can. J. Phys. 65 (1987) 578
87BU04 Burkova and Zhusupov, Izv. Akad. Nauk. Sssr Ser. Fiz. 51 (1987) 182
87BU1E Burtebaev, Duisebaev, Sadkovskii and Feofilov, Izv. Akad. Nauk Sssr Ser. Fiz. 51 (1987) 615
87BU20 Burgov et al, Sov. J. Nucl. Phys. 45 (1987) 463
87CH08 Chen et al, Phys. Lett. B186 (1987) 280
87CH10 Chrien, Hungerford, and Kishimoto, Phys. Rev. C35 (1987) 1589
87CH26 Chen et al, Nucl. Phys. A473 (1987) 564
87CH32 Chen et al, Phys. Lett. B199 (1987) 171
87CH33 Chen et al, Phys. Rev. C36 (1987) 2297
87CO1S Coon, Bull. Amer. Phys. Soc. 32 (1987) 1549
87DA1G Danilin et al, in Yurmala (1987) P. 200
87DA1H Danilin et al, in Yurmala (1987) P. 467
87DA1N Danilin et al, Sov. J. Nucl. Phys. 46 (1987) 225
87DE02 Demiyanova et al, Phys. Lett. B184 (1987) 129
87DE1A De Vries, De Jager and De Vries, at. Data Nucl. Data Tables 36 (1987) 495
87DE37 Deak et al, Nucl. Instr. Meth. Phys. Res. A258 (1987) 67
87DO07 Domogala, Freiesleben and Hippert, Nucl. Instr. Meth. Phys. Res. A257 (1987) 7
87DO13 Doss et al, Phys. Rev. Lett. 59 (1987) 2720
87DU07 Duflo, Phys. Rev. C36 (1987) 1425
87DU09 Dubovoi and Chitanava, Sov. J. Nucl. Phys. 45 (1987) 423
87DZ1B Dzhibuti, Mikhelashvili and Shitikova, Sov. J. Nucl. Phys. 45 (1987) 419
87EY01 Eyrich et al, Phys. Rev. C36 (1987) 416
87FA01 Fatyga et al, Phys. Rev. C35 (1987) 568
87FA02 Fahli et al, Z. Phys. A326 (1987) 169
87FA1H Faldt, Lazard and Lombard, Phys. Rev. C36 (1987) 1037
87FE1A Feng et al, Chin. Phys. 7 (1987) 121
87FI1D Fick, Phys. Bl. (West Germany) 43 (1987) 446; Phys. Abs. 51853 (1988)
87FO08 Fox et al, Phys. Rev. C36 (1987) 640
87FR1G Friedman, Nucl. Phys. A471 (1987) C327
87GA1A Gaiser et al, Bull. Amer. Phys. Soc. 32 (1987) 1059
87GA20 Ganguly, Chaudhuri and Baliga, Nuovo Cim. A97 (1987) 639
87GA22 Ganenko et al, Jetp Lett. 46 (1987) 272
87GAZM Gaidaenko et al, in Yurmala (1987) P. 299
87GL01 Glavanakov et al, Sov. J. Nucl. Phys. 45 (1987) 1; 46 (1987) 384
87GL1G Glukhov, Dem'yanova, Ogloblin and Sakuta, Sov. J. Nucl. Phys. 45 (1987) 767
87GLZW Glukhov, Sakuta and Stepanov, in Yurmala (1987) 383
87GM02 Gmitro, Kamalov and Mach, Phys. Rev. C36 (1987) 1105
87GM04 Gmitro, Kamalov and Mach, Prog. Theor. Phys. Suppl. 91 (1987) 60
87GO1S Goryunov et al, in Yurmala (1987) P. 474
87GO1Y Gornov et al, in Yurmala (1987) 270
87GO1Z Gornov et al, in Yurmala (1987) 271

87GO27 Goncharov et al, Czech. J. Phys. 37 (1987) 168
87GOZN Gornov et al, in Yurmala (1987) 269
87GR08 Gruebler, Nucl. Phys. A463 (1987) C193
87GR11 Green et al, Phys. Rev. C35 (1987) 1341
87GR1I Green and Niskanen, Prog. Part. Nucl. Phys. 18 (1987) 93
87GR1N Gridnev, Subbotin and Fadeev, in Yurmala (1987) P. 426
87GU1F Gulamov et al, in Yurmala (1987) P. 344
87GU1L Gusev and Seliverstov, Dubna (1987) P. 217
87HA01 Haneishi and Fujita, Phys. Rev. C35 (1987) 70
87HA1M Hahn and Stocker, Phys. Rev. C35 (1987) 1311
87HA30 Hansen and Jonson, Europhys. Lett. 4 (1987) 409
87HA34 Hahn, Phys. Rev. C36 (1987) 1692
87HA40 Hausmann, Siegel, Weise and Kohno, Phys. Lett. B199 (1987) 17
87HE22 Helmer, Can. J. Phys. 65 (1987) 588
87HO1M Hobbs and Duncan, Astrophys. J. 317 (1987) 796
87HU02 Hurd et al, Nucl. Phys. A462 (1987) 605
87HU13 Hurd et al, Nucl. Phys. A475 (1987) 743
87IM04 Imambekov and Uzikov, Izv. Akad. Nauk. Sssr Ser. Fiz. 51 (1987) 947
87IM1F Imambekov, Uzikov and Zhusupov, in Panic (1987) P. 276
87JA06 Jacak et al, Phys. Rev. C35 (1987) 1751
87JA1C Jain and Gupta, Z. Phys. A326 (1987) 191
87JE03 Jelitto, Gils, Rebel and Zagromski, Rev. Roum. Phys. 32 (1987) 629
87JI1A Jiang and Jin, Phys. Energ. Fortis & Phys. Nucl. (China) 11 (1987) 226; Phys. Abs. 102830 (1987)
87KA1I Kamimura et al, Ins-Rep.-606 (1986)
87KA1L Kadmenskii, Kadmenskii, Lukyanovich and Rudchik, in Yurmala (1987) P. 473
87KA1M Karmanov et al, in Yurmala (1987) P. 509
87KI1C Kissener, Rotter and Goncharova, Fortschr. Phys. 35 (1987) 277
87KO15 Kozik et al, Z. Phys. A326 (1987) 421
87KO1L Kozmyr and Sokolov, in Yurmala (1987) 331
87KO1Z Kobayashi et al, in Panic (1987) P. 478
87KO39 Korsheninnikov and Chulkov, Izv. Akad. Nauk Sssr Ser. Fiz. 51 (1987) 124
87KR07 Kruppa, Beck and Dickmann, Phys. Rev. C36 (1987) 327
87KR09 Krauss et al, Nucl. Phys. A467 (1987) 273
87KU1F Kukulin, Yurmala (1987) 151
87KU1G Kuznetzova, Krasnopolskii and Kukulin, Yurmala (1987) 500
87KU23 Kuno, Nagamine and Yamazaki, Nucl. Phys. A475 (1987) 615
87KW01 Kwasniewicz and Kisiel, J. Phys. G13 (1987) 121
87KW03 Kwasniewicz and Kisiel, Rev. Roum. Phys. 32 (1987) 607
87LA1J Lamberty, Michiels and De Bievre, Int. J. Mass Spectrom. Ion Proc. 79 (1987) 311
87LA25 Lattuada et al, Z. Phys. A328 (1987) 497
87LE1B Lenz, Prog. Theor. Phys. Suppl. 91 (1987) 27
87LE1C Lehman, Bull. Am. Phys. Soc. 32 (1987) 1025

87LE1D Levin, Nucl. Phys. A463 (1987) C487
87LE1E Leisi et al, Helv. Phys. Acta. 60 (1987) 316
87LI32 Likhachev et al, Ukr. Fiz. Zh. 32 (1987) 1293; Phys. Abs. 5473 (1988)
87LO16 Lovas et al, Nucl. Phys. A474 (1987) 451
87LU1B Lubovoi and Chitanava, Yurmala (1987) 512
87LY04 Lynch, Nucl. Phys. A471 (1987) 309C
87LY1D Lynch, Ann. Rev. Nucl. Part. Sci. 37 (1987) 493
87MA1I Matthews et al, in Panic (1987) 360
87MA2C Malaney and Fowler, Oap-680, To Be Published in Origin and Distribution of the Elements (1987)
87MI06 Miyagawa et al, Nucl. Phys. A463 (1987) C411
87MO1I Mondragon and Hernandez, 6th Inter. Symp. on Capture Gamma-Ray Spectroscopy, Leuven (1987)
87NA01 Namboodiri et al, Phys. Rev. C35 (1987) 149
87NA04 Navarro and Roig, Nucl. Phys. A465 (1987) 628
87NA1I Naumenko et al, in Yurmala (1987) 370
87NI04 Nitsche et al, Z. Phys. A326 (1987) 435
87PA12 Padalino et al, Phys. Rev. C35 (1987) 1692
87PA1F Pallavicini, Cerruti-Sola and Duncan, Astron. Astrophys. 174 (1987) 116
87PE1C Penionshkevich, Dubna (1987) 364
87PI06 Piskarev, Sov. J. Nucl. Phys. 45 (1987) 758
87PO03 Pochodzalla et al, Phys. Rev. C35 (1987) 1695
87PO05 Poth et al, Nucl. Phys. A466 (1987) 667
87PO18 Pocanic et al, Can. J. Phys. 65 (1987) 687
87PO1H Povh, Prog. Part. Nucl. Phys. (Gb) 18 (1987) 183
87PO1I Pochodzalla, Nucl. Phys. A471 (1987) C289
87PO1M Ponomarev and Fiorentini, Muon Catalysed Fusion (Switzerland) 1 (1987) 3
87PR08 Pratt and Tsang, Phys. Rev. C36 (1987) 2390
87RA1I Ransome et al, Bull. Amer. Phys. Soc. 32 (1987) 1560
87RA32 Rapaport, Can. J. Phys. 65 (1987) 574
87RO10 Royer et al, Nucl. Phys. A466 (1987) 139
87RO1D Rolfs, Trautvetter and Rodney, Rep. Prog. Phys. 50 (1987) 233
87SA15 Sagawa and Toki, J. Phys. G13 (1987) 453
87SA21 Sakuragi, Phys. Rev. C35 (1987) 2161
87SA46 Sakai et al, Nucl. Instr. Meth. Phys. Res. A257 (1987) 279
87SC08 Schmidt et al, Nucl. Sci. & Eng. 96 (1987) 159
87SE1C Seth, Parker and Soundranayagam, in Panic (1987) 528
87SU06 Suzuki, Measday, and Roalsvig, Phys. Rev. C35 (1987) 2212
87SU1K Sural, Indian J. Phys. B61 (1987) 201; Phys. Abs. 109089 (1987)
87SV1A Sviciulis and Kalinauskas, Sov. Phys.-Collect. 27 (1987) 10
87TA06 Tang, Nucl. Phys. A463 (1987) C377
87TA07 Tagishi et al, Phys. Rev. C35 (1987) 1153
87TA1F Tanihata et al, in Panic (1987) 474

87TA21 Tanaka et al, Phys. Rev. C36 (1987) 2146

87TO06 Tosaki et al, Nucl. Phys. A463 (1987) C429

87TR05 Trautmann et al, Nucl. Phys. A471 (1987) 191C

87VA08 Van Der Steenhoven et al, Phys. Rev. Lett. 58 (1987) 1727

87VA1N Van Der Steenhoven et al, in Panic (1987) 618

87VA31 Van Verst et al, Phys. Rev. C36 (1987) 1865

87VAZY Van Verst et al, Bull. Amer. Phys. Soc. 32 (1987) 1547

87VD01 Vdovin and Loshchakov, Sov. J. Nucl. Phys. 45 (1987) 42

87VE1D Vetoshkin et al, in Yurmala (1987) 387

87VU1A Vuaridel et al, Helv. Phys. Acta 60 (1987) 326

87WA09 Wada et al, Phys. Rev. Lett. 58 (1987) 1829

87WA1J Wang, Bando and Takaki, Z. Phys. A327 (1987) 59

87WE1A Weyer, Helv. Phys. Acta (Switzerland) 60 (1987) 667

87WI09 Winfield et al, Phys. Rev. C35 (1987) 1734

87WY1A Wyman, Stone and Harms, Nucl. Sci. & Eng. 96 (1987) 46

87YA16 Yakovlev, Sov. J. Nucl. Phys. 46 (1987) 244

87YA1M Yamamoto, Phys. Rev. C36 (1987) 2166

87YO1C Yokota et al, Phys. Rev. Lett. 58 (1987) 191

87ZA07 Zadro et al, Nucl. Phys. A474 (1987) 373

87ZH1D Zhusupov, Imambekov and Uzikov, in Yurmala (1987) 455

87ZH1E Zhao et al, in Panic (1987) 710

88AJ1B Ajzenberg- Selove, in Interactions and Structures in Nuclei, Proc. in Honor of D.H.Wilkinson, Sussex, September 7-9 (1987); Adam Hilger Pub. (1988) P. 181

88AL1G Aleksandrov et al, Baku (1988) 377

88BA1F Barnes, Nucl. Phys. A478 (1988) 127C

88BA1G Barnes, Nucl. Phys. A479 (1988) 89C

88BA1H Bahcall and Ulrich, Rev. Mod. Phys. 60 (1988) 297

88BE09 Bertulani and Baur, Nucl. Phys. A480 (1988) 615

88BEYJ Belozerov et al, Baku (1988) 380

88BL09 Bloch et al, Phys. Rev. C37 (1988) 2469

88BO1J Bochkarev et al, Baku (1988) 347

88BR1E Brovkina et al, Baku (1988) 430

88BU1D Burkova et al, Baku (1988) 315

88BU1G Burkova, Zhusupov, Kuzhevsky and Makhanov, Baku (1988) 426

88BU1Q Buranov et al, Baku (1988) 363

88BUZH Buranov et al, Baku (1988) 362

88CA11 Carlos et al, Phys. Lett. B203 (1988) 33

88CEZZ Cebra et al, Bull. Amer. Phys. Soc. 33 (1988) 963

88CH05 Christou, Lehman and Parke, Phys. Rev. C37 (1988) 445

88CH06 Christou, Lehman and Parke, Phys. Rev. C37 (1988) 458

88CH1D Christou, Lehman and Parke, Phys. Rev. C37 (1988) 477

88CO1B Cook, Bull. Amer. Phys. Soc. 33 (1988) 1022

88DA1D Danilin et al, Baku (1988) 163

88DA1E Danilin et al, Baku (1988) 398

88DA1F Danilin et al, Baku (1988) 399

88DAZW Danilin et al, Baku (1988) 142

88DE1F Demyanova et al, Baku (1988) 332

88DEZU Demyanova et al, Baku (1988) 330

88DI02 Dietrich and Berman, at. Data Nucl. Data Tables 38 (1988) 199

88EL01 Elsener et al, Nucl. Phys. A481 (1988) 227

88FO1A Fowler, Iin Nteractions and Structures in Nuclei, Proc. in Honor of D.H. Wilkinson, Sussex, September7-9 (1987); Adam Hilger Publ. (1988) P. 119

88FR1B Friedman, Phys. Rev. C37 (1988) 976

88FR1E Frankfurt and Strikman, Phys. Rep. 160 (1988) 235

88FR1F Friedman, Phys. Rev. Lett. 60 (1988) 2125

88GA10 Gagliardi et al, Phys. Rev. C37 (1988) 2889

88GA1A Gal, Nucl. Phys. A479 (1988) 97C

88GI1B Gibson, Nucl. Phys. A479 (1988) 115C

88GIZU Gismatullin et al, Baku, (1988) 293

88GO1H Goryonov et al, Baku (1988) 367

88GU1D Gulyamov, Mukhamedzhanov and Ni, Baku (1988) 300

88HA12 Hanna, J. Phys. G14 (1988) S283

88HA1I Hausmann, Nucl. Phys. A479 (1988) 247C

88HA1K Hausser, in Aip Conf. Proc. 164 (1988) P. 604

88HE08 Henneck et al, Phys. Rev. C37 (1988) 2224

88JA01 Jackson et al, Phys. Lett. B201 (1988) 25

88JI1A Jiang and Jin, Comm. Theor. Phys. 9 (1988) 33

88JO1C Jonson et al, in Aip Conf. Proc. 164 (1988) P. 223

88KA09 Katori et al, Nucl. Phys. A480 (1988) 323

88KA1J Kaganov et al, Baku (1988) 161

88KI05 Kidd et al, Phys. Rev. C37 (1988) 2613

88KO1C Kozchy, Mashkarov and Rudchik, Baku (1988) 350

88KU1C Kukulin et al, Baku (1988) 160

88LA1C Lamberty and De Bievre, Intl. J. Mass Spectrom. Ion Proc. 83 (1988) 135

88LE06 Lemere and Tang, Phys. Rev. C37 (1988) 1369

88LI1A Liu et al, Bull. Am. Phys. Soc. 33 (1988) 903

88MCZY Mcmaster et al, Bull. Amer. Phys. Soc. 33 (1988) 1102

88MI1E Mildenberger et al, Bull. Am. Phys. Soc. (1988) 1180

88NA02 Nadasen et al, Phys. Rev. C37 (1988) 132

88NAZX Nadasen et al, Bull. Am. Phys. Soc. 33 (1988) 1101

88PO1E Poppelier et al, Aip Conf. Proc. 164 (1988) 334

88PO1H Povh, Prog. Part. Nucl. Phys. 20 (1988) 353

88PUZZ Punjabi et al, Bull. Amer. Phys. Soc. 33 (1988) 962

88RE1B Rebolo et al, Astron. Astrophys. 193 (1988) 193

88RIZW Ribkin, Vasilevsky and Velaskes, Baku (1988) 428

88ROZZ Rothenberger et al, Bull. Am. Phys. Soc. 33 (1988) 903, Ai12

88RU01 Rubchenya and Yavshits, Z. Phys. A329 (1988) 217
88SA15 Sakuragi, Kamimura and Katori, Phys. Lett. 205B (1988) 204
88SA19 Sato, Phys. Rev. C37 (1988) 2902
88SA2J Samsonenko, Adamu and Samgin, Baku (1988) 263
88SE1C Seth, Aip Conf. Proc. 164 (1988) 324
88SH1E Shvedov, Nemets and Rudchik, Baku (1988) 351
88ST06 Stevenson et al, Phys. Rev. C37 (1988) 2220
88TA1A Tanihata, Nucl. Phys. A478 (1988) 795C
88TA1B Tamura et al, Nucl. Phys. A479 (1988) 161C
88TRZY Trcka et al, Bull. Amer. Phys. Soc. 33 (1988) 1101
88TS03 Tsang et al, Phys. Rev. Lett. 60 (1988) 1479
88US1A Usmanov, Zhusupov and Ivkina, Baku (1988) 168
88VA03 Van Hees, Wolters and Glaudemans, Nucl. Phys. A476 (1988) 61
88VA18 Varga and Lovas, Phys. Rev. C37 (1988) 2906
88VA1E Vagner et al, Baku (1988) 383
88VAZY Van Verst et al, Bull. Amer. Phys. Soc. 33 (1988) 1101
88VD1A Vdovin, Golikov, Zhukov and Lozchakov, Baku (1988) 274
88WA18 Wapstra, Audi and Hoekstra, at. Data Nucl. Data Tables 39 (1988) 281
88WO04 Wolters, Van Hees and Glaudemans, Europhys. Lett. 5 (1988) 7
88WO10 Woods et al, Austr. J. Phys. 41 (1988) 525
90AJ01 Ajzenberg-Selove, Nucl. Phys. A506 (1990) 1