Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

E-mail: services@jcprg.org
Internet: http://www.jcprg.org/

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850

Memo CP-E/100

Date: September 22, 2006
To: Distribution
From: OTSUKA Naohiko
Subject: Clarification of spin observables (1)

As the first step of clarification of spin observables (according to the Action 26 of the 2005 NRDC meeting), I checked all EXFOR entries for spin correlations and polarization transfers, i.e. *kq* (*k*, *q*=S, N or L) in SF5 (branch), and D, C or K in SF8 (modifier). Checking for tensor polarization (e.g. A_{yy}, iT^{11}, …) will be made in future.

Three major problems are detected as explained below. The first item proposes the change of the present rule (change of expansion of modifier C). The second and third items are confirmation of the present rule and no change is proposed to the present rule. If my proposal is approved at the 2006 NRDC meeting, I will prepare a memo for improvement of our dictionary.

"LEXFOR" refers LEXFOR version January 2006 through this memo. $\vec{A}$ and $\vec{b}$ I stand for polarized target and incoming particle in initial state, respectively. $\vec{c}$ and $\vec{D}$ stand for polarization of outgoing particle and products (=recoils), respectively.

1) Modifier C

Dictionary 236 defines modifier C as "*final* state spin correlation parameter" (c.f. LEXFOR P11). However this modifier has been always applied to "*initial* state spin correlation parameter" in our compilations. I propose that we will use modifier C for *initial* state spin correlation parameter in future, so that we can keep entries having C in SF8 without any corrections. Consequently we lose quantity codes for *final* state spin correlation parameters (This parameters are rarely measured and there are no entries of this correlation in EXFOR).

	Present rule	My proposal
Initial state spin correlation parameter $A(\vec{b},\vec{c})D$	*kq*,POL,,ANA	*kq*,POL,,C
Final state spin correlation parameter $A(b,\vec{c})\vec{D}$	*kq*,POL,,C	(no code)
Tensor analyzing power in Cartesian coordinate $A(\vec{b},c)D$ (This quantity can be defined when spin of beam $\geq$ 1)	*kq*,POL,,ANA (conflict!)	*kq*,POL,,ANA

2) **Modifier D and K (Polarization transfer)**

Polarization transfer from incoming particle *to outgoing particle* is often denoted by $K_y^{y'}$, $K_x^{z'}$,... by authors of reference (Ohlsen's convention, See [1972Oh] in LEXFOR P.15). Therefore some entries use modifier K for this transfer. However they should be coded with modifier D according to our rule, e.g. NN,,POL,,D for $K_y^{y'}$, and SL,,POL,,D… for $K_x^{z'}$. Modifier K is kept for polarization transfer from incoming particle to *product* as before.

3) **Order of two indices in polarization transfer D**

In our rule, *k* and *q* (*k*, *q*=S, N or L) in SF5 should be spin direction of incoming particle (SF2) and outgoing particle (SF3), respectively, when we use modifier D (polarization transfer from projectile to outgoing particle). See "Representation" in the image of LEXFOR P.13. However position of *k* and *q* is wrong (illegally swapped) some entries when authors of references use notation like $D_{q'k}$.(Dash means spin state in final state). I propose we keep this rule in future, i.e. the first index refers incoming particle and the second index refers outgoing particle.

Conclusion from 1), 2) and 3)

	SF5 (Branch, e.g. SL, LS, …)	SF8 (Modifier)
Initial state spin correlation parameter $\vec{A}(\vec{b},c)D$	1st index: spin state of incoming particle 2nd index: spin state of target	C
Final state spin correlation parameter $A(\vec{b},\vec{c})\vec{D}$	(no code)	
Polarization transfer from projectile to outgoing particle $A(\vec{b},\vec{c})D$	1st index: spin state of incoming particle 2nd index: spin state of outgoing particle	D
Polarization transfer from projectile to product (recoil). $A(\vec{b},\vec{c})\vec{D}$	1st index: spin state of incoming particle 2nd index: spin state of product (recoil)	K
Tensor analyzing power in Cartesian coordinate $A(\vec{b},c)D$		ANA

***Example*:**

`1-H-1(N,EL)1-H-1,SL,POL/DA,,C`

Spin correlation parameter for **S**ideward component of incoming neutron polarization and **L**ongitudinal component of target proton polarization in $^{1}\vec{\mathrm{H}}\,(\vec{n},n_0)^{1}\mathrm{H}$ (Both beam and target are polarized.)

`6-C-12(P,N)7-N-12,SL,POL/DA,,D`

Polarization transfer from **S**ideward component of incoming proton polarization to **L**ongitudinal component of outgoing neutron polarization in $^{12}\mathrm{C}\,(\vec{p},\vec{n})^{12}\mathrm{N}$ (Beam proton is polarized and polarization of neutron is measured.)

`1-H-1(N,EL)1-H-1,SL,POL/DA,,K`

Polarization transfer from **S**ideward component of incoming neutron polarization to **L**ongitudinal component of residual (recoil) proton polarization in $^{1}\mathrm{H}(\vec{n},n_0)^{1}\vec{\mathrm{H}}$ (Beam neutron is polarized and polarization of residual proton is measured.)

<u>List of entries which have modifier D, C or K in SF8 (as of Sept. 20, 2006)</u>

(*Original references should be checked by compilers before corrections*. "Ok" means no correction is required if my proposal (1) is approved.)

AN	SAN	Indices (SF5)	Modifier (SF8)	Remarks
13175	003	Ok	Ok	
13563	002	Ok	Ok	
13595	002	Ok	Ok	
13608	003	Ok	Ok	
13610	003	Ok	Ok	
13611	002	Ok	Ok	
13612	002	Ok	Ok	
13617	002-005	Ok	Ok	
13619	002-003	Ok	Ok	
C0140	004, 007	Ok	Ok	
C0144	008,009,012	Ok	Ok	
C0434	002-003	Ok	Ok	
C0437	002-004	Ok	Ok	
C0466	002	Ok	Ok	
C0543	002-003	Ok	Should be D	
C0558	002	Ok	Should be D	
C0567	003,005	Ok	Ok	

C0587	010,018,020,022,024	Ok	Ok	
C0591	002,003	Ok	Ok	
C0592	003	Ok	Ok	
C0611	002	Ok	Ok	
C0639	002,003	Ok	Ok	
C0640	003	Ok	Ok	
C0660	002-005	Ok	Ok	1
C0662	004-005	Ok	Ok	
C0676	003-004	Ok	Ok	
	006-007, 009-010	Ok	Ok	1
C0680	002-003,005-006,008-009	Ok	Ok	1
C0681	002-003	Ok	Ok	
C0682	002-003	Ok	Ok	
C0787	002-003	Ok	Ok	
C0792	005-008	Ok	Ok	
C0805	003-005	Ok	Ok	
C0823	008-010	Should be swapped	Ok	
C0863	012-013	Should be swapped	Ok	2
C0864	003-004,006,007-009	Should be swapped	Ok	3
C0865	003-004	See remark	Ok	4
C0866	004	Ok	Ok	5
C0880	006-007	Should be swapped	Ok	
C0943	002-004	Ok	Should be D	
C0964	002-005	Ok	Ok	6
C0975	002	Ok	Ok	
C0979	002	Ok	Should be D	
C1291	004,006-008	Ok	Ok	
C1327	004	Ok	Ok	
C1414	002	Ok?	Ok?	7
C1415	004-008	Ok	Ok	
E1315	022-026	Ok	Ok	
E1579	003-005	Ok	Ok	
E1718	017-041	Should be swapped	Ok	
E1726	004-005	Ok	Ok	
E1768	002	Ok	Ok	
E1773	023,025	Ok	Ok	
E1783	004	Ok	Ok	
E1801	004-008	Should be swapped	Ok	

E1807	005-006	Ok	Ok	
E1857	003	Ok	Ok	
E1898	011,013-016	Should be swapped	Ok	
E1900	011-025	Should be swapped	Ok	
E1907	003	Ok	Ok	
E1909	003-005	Ok	Ok	
E1912	026,030,034,038	Ok	Ok	
O0789	002-004	Ok	Ok	
O1178	002-004	Ok	Ok	
O1218	002-004	Ok	Ok	
T0074	006	Ok	Should be D	

Remark to the table:

1: Kinematical restrictions for quasi-elastic (=quasi-free) scattering peaks are missing.

2: SF3 and SF4 should be X and 0-NN-1 if data are for inclusive measurement of neutrons

3: N in SF7 is redundant and should be deleted.

4: SF5 should be corrected to SS (003), LS (004 #1), LS (004 #2), SL (004 #3), LL (004 #4). See table II of reference.

5: Negative sign is required for data coded under DATA #2. See Table II of reference.

6: SF3 and SF4 should be X and 1-H-1 if data are for inclusive measurement of protons

7: This reference is not available at JCPRG. Probably this compilation is correct, because
- polarized proton is used (see INC-SOURCE in 001)
- outgoing neutron is detected (see DETECTOR in 001)
- "Longitudinal polarization-transfer coefficient" is given (Free text in REACTION)

Distribution:

S. Babykina, CAJaD
J.H. Chang, KAERI
M. Chiba, JCPRG
F.E. Chukreev, CAJaD
S. Dunaeva, IAEA-NDS
Z.G. Ge, CNDC
O. Gritzay, KINR
A. Hasegawa, JAEA
H. Henriksson, NEA-DB
A. Kaltchenko, KINR
J. Katakura, JAEA
K. Katō, JCPRG
Y.O. Lee, KAERI
S. Maev, CJD
V.N. Manokhin, CJD
V. McLane, NNDC
A. Mengoni IAEA-NDS
M. Mikhaylyukova, CJD
C. Nordborg, NEA-DB
P. Obložinský, NNDC
Y. Ohbayasi, JCPRG
A. Ohnishi, JCPRG
N. Otuka, JCPRG
V. Pronyaev, CJD
D. Rochman, NNDC
O. Schwerer, IAEA-NDS
S. Tákacs, ATOMKI
S. Taova, VNIIEF
T. Tárkányi, ATOMKI
V. Varlamov, CDFE
M. Vlasov, KINR
M. Wirtz, IAEA-NDS
H.W. Yu, CNDC
V. Zerkin, IAEA-NDS
Y.X. Zhuang, CNDC
EXFOR, NEA-DB