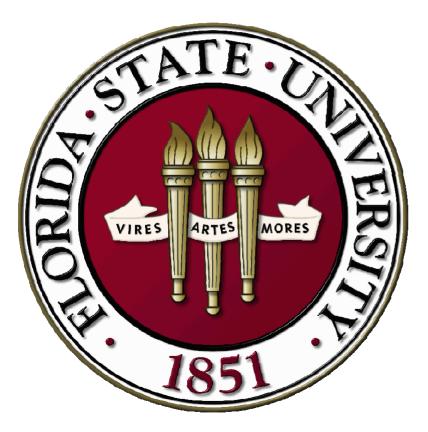
Small, Medium and Big Ideas on Nuclear Data



Paul Cottle

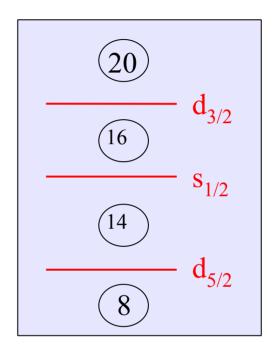
Florida State University



Two-proton knockout reactions as a way to reach neutron-rich isotopes

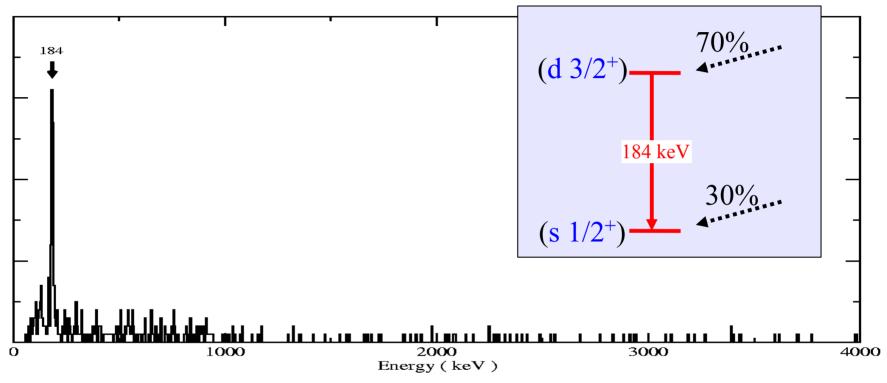
Sc40 4 182 ms 7 3.7 9 1.09 (w), 1.00, 10 3.32 ms, 3.75,	Sc41 7/ 896 ms / 5.5. / 2573 (w), 2959	* Sc42 0+ 1.03 m 682 ms * 540 437.0 1524.6 1227.6 1524.6	Sc43 7/- 3.90 h # 1.20, 42,-, # 7 372,8, E 2.221	340 # 343 h 240 # 393 h 2 147. 7 1001 # 2 1126.1. 1157.0. 1157.0.	SC45 //	18.75 • 83.81 d 17.142.5 7.357 +1120.8 2,8	SGA7 "	1037 A-	SC49 // 57.3 m / 201 // / 1762 (w), 1823	
Ca39 3* 661 ms r 540	Ca40 96,941 8, 41, 22 8, 51, 13 HD	C841 15325.	C842 0.647	Ca43 "	Ca44 2.088	Ca45 // 1627 d /- 258- 1 12.40 (res) 6/15	C345 0.054	Cast "	Ca48 4.187 5619 # P # R, 0.96, 5 47, M255M	Z=20
0+ K38 3+ 124.3 min 7.63 m 17.5021 7.248,- 9.2167,7, 	K39 3* 83.2591 2, 21, 10 2, 43 mb 34.8437068	0.0117 1.27E9 + 1.31, 1.400.5 1.2110	K41 5* 67302 5,146.14 40.8616240	K42 12.360 h 7 352- 7 15244- 6.3.5254	K43 3* 223 h 7 372 A, 617 5 6 1.62	K44 22.1 m 7 56.2 4- 7 1157.0 2150.8- 6.5.06	K45 17.8 m # 21 7 1742 1705.6 E 420	K46 (* 1.8 m 7 1347, 3700 E 7.72	K47 17.5 s 2013.4, 5M 0,- E 6.64	
Ar37 3*	Ar38 0.0632 P. *	Ar39 7**	Ar40 99.6003	Ar41 7/- 1.03 h # 1.196 y 1293.6 8 _y 5	Ar42 33 #	Ar43 (5/-) 5.4 m 7 974.9, 736.1, 1438.8,-	Ar44 11.87 m 7 182.6, 1703.4, 1896.1,	Ar45 21.5 s 7 1020 0, 3707 2, 61.4	Ar46 84 *	
C136 #* 3.0153 a 700 0 - 10 0 - 10 0 - 10 0 - 10 0 - 0 - 0 - 0	37 842732 C137 3'* 24.22 sy (.05 * 38), 32	E 54 CI38 2- 15 ms 37.2 m 7 6713 #4.91, 1.11,- 2.2167.7, 1642.4	36 ME2343123 CI39 3/+ 55.6 m // 1.91 / 1267.2, 250.3, 1517.5,-	E 2.482 C140 2- 1.38 m F =3.2 - 7 1460 8, 2840 2, 2621 8,-	E 40 CI41 34 5 # 3.8- 7 167 1359	C142 6.8 s	E 3.55 CI43 3.1 s 7 781.6, 1031.6,	CI44 0.56 s 1158 1 452 8 2796.0, 2010 2	CI45 0.41 s	
E- 7086 E+1.1421 S35 3/* 87.2 d F. 1874 79.7	56 5656006 536 6.02 9, 20, 17	E 4.917 \$37 7/- \$.05 m 7.176- 7.3104.0,-	E3.44 S38 2.84 h 7 1941.9,-	E 7.48 S39 (71-7) 11.5 s 7 1300.5. 1696.6. 396.3	540 91 7212, 432, 888, 678	E #4 S41 2.0 s 7 130, 554, 781,- (m) 7	E 7.8 S42 1.0 s 7 118.6, 1281.6, 7 23.5, 470.7,-	E 12.3 S43 0.26 s 7 325, 612, 878,	E 11 S44 0.12 *	
E 1671 P34 1* 124 s F 51, 32- 7 2127 7-	B MITORON P35 (1/*) 47 s 123 1572.3	E 4.8653 P36 5.7 • 3290.5.902.4 1638.2, 2540,	E 2.54 P37 2.3 + 7 646.2, 1562.9,-	E 6.6 P38 0.6 s 7 1292,3, 2224, (n)	E 4.7 P39 0.3 + 7 340, 398, 1126, 1525 (n)	E 8.7 P40 0.15 s y 903.7,- (n)	P41 0.14 s	E 12 P42 0.11 s	P43 33 ms	
E 5.37 Si33 (2)* 6.1 s F 3.52- 7 3547 £	E 3.969 Si34 2.8 s 7.3.09 1178.5, 429.1, 1807.6.	E 10.41 SI35 0.6 s 4101, 2366, 3880, 241.4,	E 7.90 8136 0.5 s 7 174.7, 250.3, 876,	E 12.4 SI37 -0.09 s (11)	E 10.5 SI38	E 14.5 SI39	E14 Si40	E 17 Si41	E 16 Si42 0.02 *	Z=14
E 5.65 A132 1* 32 me 7 1941 A, 3042, - (0) #	E 4.60 Al33 40 ms	E 10.50 AI34 56 ms 929.0.3328, 124.2 N)	(n) E 7.5 AI35 39 ms J ² y 64.0, 910.1,	E 12.5 AI36 0.09 s	E 10.7 AI37	E 14.8 AI38	E 14 AI39	E 17 AI40	Al41	
E 13.0 Mg31(3)* 0.24 s 7 1612.6 947. 1624.646	E 12.0 Mg32 8.10 s 2765, 735, 2467	E 17.1 Mg33(7/+ 0.09 s	E 14.3	6 18.3 Mg35 0.07 s	Mg36	6 10 Mg37	Mg38		N=2	28
E 11.7 Na30 2* 50.ms	E 10.3 Na313/(* 17.2 ms	E 13.7 Na32 13.3 ms	E 11.3 Na33 8.3 ma	E 18.4 Na34 11 Sims	E 15 Na35 1.5 ms	£ 19	Na37			

• Investigate N=28 magic number



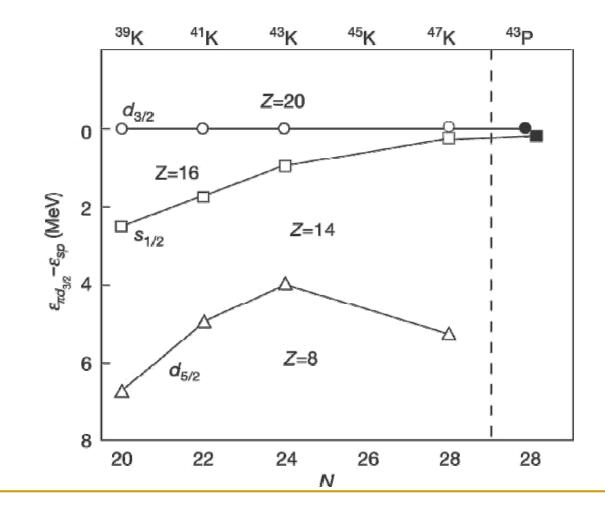
• Investigate Proton-shell structure for extremely Neutron-rich isotopes





- Total production cross section: 7.6(11) mb,
- 70/30 % population of excited and ground state
- Only two final states are populated at large cross sections

Two-nucleon knockout and the number of valence nucleons



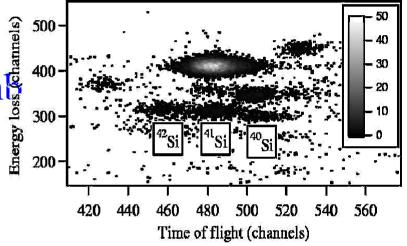


2p-Knockout in *N***=***28* **nuclei** Fridmann *et al.*, Nature 435, 922 (2005).

• Cross sections in previous examples: Bazin et al:

 $^{28}Mg \rightarrow ^{26}Si, \sigma = 1.5 \text{ mb}$ $^{34}Si \rightarrow ^{32}Mg, \sigma = 0.76(10) \text{ mb}$ our experiments:

- Our experiments: ${}^{46}\text{Ar} \rightarrow {}^{44}\text{S}, \sigma = 0.23(2) \text{ mb}$ ${}^{44}\text{S} \rightarrow {}^{42}\text{Si}, \sigma = 0.12(2) \text{ mb}$
- Calculations: (Brown / Tostevin) ${}^{46}\text{Ar} \rightarrow {}^{44}\text{S}, \sigma = 0.19 \text{ mb}$ ${}^{44}\text{S} \rightarrow {}^{42}\text{Si}, \sigma = 0.16 \text{ mb}$



Strawman-calculation: without Z=14-gap ${}^{46}\text{Ar} \rightarrow {}^{44}\text{S}, \sigma = 2.796 \text{ mb}$ ${}^{44}\text{S} \rightarrow {}^{42}\text{Si}, \sigma = 1.698 \text{ mb}$

• Reduced cross sections are result of Z=14 shell closure: Few valence nucleons available for reaction.

"Small" Ideas – small modifications to Nuclear Structure References

• Energy range search for reactions

Example: 135 MeV (p,p') vs. 25 MeV (p,p')

- Polarized beam studies should be able to search for polarized ⁶Li separately from unpolarized ⁶Li
- Default output year order should be descending instead of ascending



A "Medium" Idea for ENSDF

Coverage of A<40 isotopes equivalent to that for heavier isotopes – do not rely on Endt compilations.



A "Big" Idea – A Pub Med revolution for nuclear structure physics

- NIH "Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research" – effective May 2, 2005
- DCRPrinciples 57 publishers approach PubMed on October 29, 2005 with offer of free access for all PubMed users

