^{142,143}Nd($\vec{p}, \alpha$)^{139,140}Pr Reactions at 23.5 MeV

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To identify the ^{140}Pr states homologous to the low excitation energy states of ^{139}Pr [1] and the spectator role of the unpaired neutron $2f_{7/2}$ of the ^{143}Nd target nucleus the ^{142,143}Nd($\vec{p}, \alpha$)^{139,140}Pr reactions have been measured at 23.5 MeV incident proton energy from the Munich MP Tandem accelerator and the Stern-Gerlach atomic beam source of negative polarized hydrogen ions [2]. The proton beam current intensity was up to 1.5 μA and the beam polarization $\sim$ 60 %. 82 μg/cm^2 thick ^{142,143}Nd$_2$O$_3$ isotopically enriched targets (98.26 %, 91.68 %, respectively) were evaporated on an 8 μg/cm^2 carbon backing. The reaction products were analyzed with the Q3D magnetic spectrograph and detected by the focal plane detector with cathode strip readout [3].

Adopted E_{exc} (keV)	**This work** E_{exc} (keV)	**Adopted** E_{exc} (keV)	**This work** E_{exc} (keV)
0	0.0	1624.31	1623
113.92	114		1655
405.11	405	1722.17	
589.41	590		1762
	624	1782	1783
821.98		1790.22	
827.92	828	1833.99	1831
851.87	850		1857
916.92	917	1867.6	
	1009	1910	1908
1023.91		1926.90	1926
1074.21		1941.50	
1124.02		1942.0	
1147			1955
	1154		1975
1311.8	1313	1980	
1328.43	1328	2029.51	2033
1369.7		2048.57	2050
1405.5		2098	2097
1449.0	1455		2127
	1478		2149
1493	1492	2174.49	
1501.3		2187.48	
1523.11		2196.45	
1532.0	1532	2205.8	2205
1584.27			

Table 1: Column 1 gives the adopted energies [5] of the ^{139}Pr levels; column 2 the energies of the levels observed in the present work.

To provide the energy calibration of the ^{139,140}Pr spectra, the ^{123}Sb($\vec{p}, \alpha$)^{120}Sn reaction data have been used.

In Table 1 the levels of ^{139}Pr seen in this work are compared with the compilation of the NDS, while Table 2 refers to ^{140}Pr.

Spectra of the two reactions can be seen in Ref. [1].

Adopted E_{exc} (keV)	**This work** E_{exc} (keV)	**Adopted** E_{exc} (keV)	**This work** E_{exc} (keV)
0	0.0		1405
27.23		1430	
29.5	30		1484
127.5	129		1502
191.8	192		1525
271.0	272		1565
287.1	288		1586
331.0	332		1652
390.4	393		1672
419.9	421		1684
576.6	578		1718
604.4			1751
630			1768
642	643		1825
670.2		1860	
763.3			1939
784	787	1960	
862.0	863		1973
888.0			1984
889	889		2020
904.1			2117
913.4			2221
967.0			2277
983.4			2333
1018			2349
1033.9	1034		2416
	1045		2446
1053.8			2466
	1058		2491
1061.6			2542
	1079		2570
1147.1			2602
1183.2			2632
1204	1208		2655
	1217		2748
1230	1231		2822
1293			2859
1320			2895
	1327		2929
	1335		2953
1370			2990
	1378		3005
	1385		

Table 2: Column 1 gives the adopted energies [4] of the ^{140}Pr levels; column 2 the energies of the levels observed in the present work.

References

[1] P. Guazzoni et al., *Search for homologous states in ^{139,140}Pr by means of the ($\vec{p}, \alpha$) reaction*, this report p. 13
[2] R. Hertenberger et al., Annual report 2000, p. 70
[3] H.-F. Wirth et al., Annual report 2000, p. 71
[4] L.K. Peker, NDS 73, (1994) 261
[5] T.W. Burrows, NDS 92, (2001) 623