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New gamma transitions from the decay of 1.7h ^{149}Nd

ILCA MARLI MOITINHO AMARAL MEDEIROS, CIBELE BUGNO ZAMBONI, JOSÉ AGOSTINHO GONÇALVES DE MEDEIROS, FREDERICO ANTONIO GENEZINI
Instituto de Pesquisas Energéticas e Nucleares, IPEN/CNEN-SP
MANOEL TIAGO FREITAS DA CRUZ, JUAN YURY ZEVÁLLOS CHÁVEZ
Instituto de Física da Universidade de São Paulo

The level structure in the odd-mass (Z=61) isotopes indicates a shape transition from spherical to deformed as the neutron number increases from 86 to 90, providing a chance for testing nuclear models. The nuclei ^{149} Pm ^{151}Eu and ^{153}Tb have been described primarily as spherical while the corresponding ^{151}Pm, ^{153}Eu and ^{155}Tb isotones, with N=90, have been interpreted in terms of the particle-core approaches [1, 2, 3].
The present investigation into the beta decay of ^{149}Nd offers the opportunity to investigate the extent to which susceptibility to deformation affects the low-lying states of this transitional nucleus. In this work, γ-ray singles and coincidence measurements, were performed using high resolution HPGe spectrometers coupled a multidetector acquisition system [4], allowing the identification of many new γ- ray and complex multiplets. Sources of ^{149} Nd were to produced by thermal neutron irradiation of neodymium oxide powder enriched to 94% in ^{148} Nd. Samples (~5mg) were irradiated for few minutes in the IEA-R1 reactor at IPEN-SP. Singles and coincidence spectra were measured using several large volume detectors (>55cm^3). Several ^{149}Nd spectra were taken with standards (^{60} Co, ^{109}Cd, ^{133}Ba, ^{137}Cs and ^{152}Eu) for the purpose of the precise energy calibration of γ transitions. The sources of ^{133}Ba and ^{152}Eu were used for the relative efficiency calibration of the detectors. Areas of the peaks were evaluated by using the IDF computer code[5]. Table I lists all the transitions observed in the singles experiment as well as additional transitions established on the basis of coincidence in formation. The intensity values are relative to a value of 1000 for the gamma intensity of the 211keV transition.

Table1: Results of Energy (Eγ) and relative intensity (Iγ). The results of Schneider *et al* [1] were included for comparison.

Present Work		Schneider *et al*		Present Work		Schneider *et al*	
Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)
122.932 (8)	8.1 (4)	122.40 (6)	*9.9 (6)*	286.562 (3)	35.6 (15)		
126.761 (17)	2.98 (23)	126.60 (8)	4.3 (3)	288.757 (3)	52.0 (20)	288.20 (2)	26.7 (7)
139.591 (21)	12.3(6)	139.20 (3)	19.6 (9)	290.865 (7)	19.9 (12)		
140.54 (7)	2.68 (4)	141.06 (7)	1.50 (10)	295.411 (3)	27.4 (4)	294.79 (2)	22.0 (6)
155.03 (6)	4.4 (3)	155.12 (10)	1.3 (6)	301.598 (9)	12.6 (4)	301.11 (3)	14.0 (4)
156.339 (4)	228.6 93)	155.86 (2)	228.8 (85)	311.575 (3)	17.9 (3)	310.97 (3)	19.7 (5)
171.48 (10)	1.23 (22)			318.55 (12)	6.25 (20)	318 2 (3)	0.33 (17)
175.55 (6)	1.2 (3)	176.25 (4)	1.9 (4)	327.172 (2)	168.7 (20)	326.54 (3)	175.9 (4)
178.225 (14)	5.24 (2)	177.73 (5)	6.0 (6)	332.714 (18)	0.69 (4)		
185.951 (9)	5.76 (14)	185.47 (5)	4.00 (20)	343.68 (5)	1.4 (4)	342.95 (18)	3.2 (7)
189.122 (3)	69.6 (9)	188.64 (2)	69.5 (31)	349.66 (4)	161.7 (27)	349.22 (3)	53.1 (14)
192.515 (4)	21.9 (3)	192.02 (3)	22.00 (7)	357.13 (3)	17.3 (15)	357.02 (4)	4.8 (1)
198.10 (8)	3.13 (3)	197.80 (6)	1.90 (20)	361.043 (12)	22.1 (16)		
199.420 (6)	55.7 (8)	198.93 (2)	53.7 (16)	367.28 (3)	19.0 (3)	366.62 (4)	20.9 (6)
208.688 (3)	105.2 (12)	208.14 (3)	98.3 (4)	372.44 (4)	0.32 (6)		
211.8120 (25)	1000 (12)	211.32 (2)	1000 (40)	381.580 (22)	1.67 (5)	380.66 (5)	2.00 (10)
214.3167 (25)	11.59 (15)	213.97 (7)	15.4 (10)	385.326 (4)	9.61 (14)	384.67 (4)	10.3 (3)
227.467 (9)	5.46 (9)	226.85 (4)	6.30 (20)	391.28 (16)	0.21 (4)	390.96 (7)	0.30 (10)
230.028 (3)	17.76 (22)	229.58 (2)	18.60 (5)	397.519 (12)	3.06 (5)	396.75 (5)	2.80 (10)
239.048 (3)	32.7 (4)			414.358 (15)	0.84 (4)		
240.8829 (22)	120.4 (14)	240.23 (2)	151.8 (60)	424.2391 (25)	260.0 (35)	423.54 (4)	287 (15)
245.32 (15)	0.3 (12)	245.49 (7)	8.5 (40)	426.54 (11)	26.3 (4)	425.33 (6)	10.5 (4)
246.269 (21)	36.4 (15)	245.71 (2)	31.4 (80)	433.45 (7)	0.14 (4)	432.81 (7)	0.54 (25)
251.25 (3)	1.07 (27)	250.83 (4)	1.30 (10)	435.59 (7)	0.14 (4)		
255.218 (15)	3.72 (13)	254.25 (3)	3.30 (10)	439.84 (5)	1.3 (5)	439.65 (14)	1.4 (6)
258.583 (3)	15.84 (27)	258.08 (3)	14.5 (4)			443.7 (3)	3.3 (15)
268.2500 (20)	215.9 (25)	267.70 (2)	232.9 (59)	449.54 (9)	0.39 (15)	448.80 (20)	0.31 (15)
270.7112 (19)	387.1 (4.4)	270.17 (2)	413 (10)	470.452 (20)	0.51 (3)	470.53 (20)	0.40 (20)
276.009 (4)	17.8 (5)	275.42 (2)	25.10 (6)	481.24 (3)	1.33 (15)	480.38 (8)	1.60 (10)
277.526 (8)	12.2 (4)	276.96 (4)	13.2 (4)	484.479 (18)	2.27 (19)	483.61 (6)	2.60 (10)
282.432 (14)	6.96 (23)	282.40 (9)	0.65 (25)	494.65 (15)	1.8 (6))	493.80 (8)	2.30 (20)
283.239 (12)	12.3 (3)	282.46 (2)	23.8 (6)	498.84(7)	1.24 (26)	498.28 (9)	0.40 (10)

Table1: Results of Energy (Eγ) and relative intensity (Iγ). The results of Schneider *et al* [1] were included for comparison.

Present Work		Schneider *et al*		Present Work		Schneider *et al*	
Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)	Energy (keV)	Iγ (%)
500.23 (13)	0.82 (13)			763.16 (8)	0.75 (27)		
516.07 (19)	3.2 (12)	515.78 (10)	1.40 (20)	768.984 (13)	3.37 (9)	768.19 (6)	2.30 (20)
528.0 (3)	1.75 (12)	527.60 (20)	0.45 (12)	807.29 (7)	1.20 (10)	808.89 (5)	7.3 (5)
534.106 (3)	1.37 (18)	533.23 (6)	3.50 (20)	810.112 (11)	5.97 (18)		
541.361 (3)	249.2 (32)	540.49 (5)	253.6 (94)	844.67 (6)	0.61 (4)		
547.07 (24)	4.0 (13)	547.13 (6)	0.6 (3)	851.23 (5)	1.5 (12)		
549.6 (4)	3.5 (9)			866.09 (3)	2.76 (27)		
556.64 (3)	18.5 (14)	555.88 (9)	22.6 (12)	872.68 (7)	0.9 (3)	871.37 (7)	1.30 (10)
557.58 (4)	25.0 (10)	556.83 (9)	16.8 (20)	887.88 (16)	0.22 (9)	886.63 (20)	0.21 (4)
568.20 (13)	0.6 (3)	567.60 (20)	0.64 (13)	894.30 (9)	0.30 (5)	893.10 (10)	0.17 (4)
580.07 (4)	1.2 (4)	579.28 (6)	2.90 (20)	898.45 (22)	0.12 (4)		
591.66 (17)	0.17 (4)			908.72 (13)	6.7 (17)	907.69 (14)	0.17 (3)
595.47 (5)	0.49 (7)	594.34 (9)	1.10 (10)	925.12 (15)	3.5 (8)		
598.94 (4)	0.68 (7)	598.02 (8)	1.10 (10)	927.19 (6)	1.63 (18)		
631.203 (9)	6.32 (15)	630.23 (5)	7.30 (10)	944.61 (21)	0.33 (14)	945.74 (8)	0.83 (7)
635.8 (5)	11.20 (17)	635.50 (5)	2.6 (5)	947.27 (14)	0.41 (16)		
636.9 (4)	1.35 (12)	636.21 (11)	2.0 (4)	977.4 (4)	0.22 (13)	978.8 (5)	0.60 (20)
653.754 (7)	27.8 (4)			980.385 (26)	2.88 (28)		
655.850 (4)	290.7 (35)	654.83 (3)	307 (15)	994.08 (14)	2.2 (9)	994.00 (20)	0.15 (7)
661.99 (3)	1.29 (5)	661.48 (23)	0.20 (8)	1017.52 (18)	0.49 (15)		
675.42 (14)	0.43 (5)	675.86 (12)	0.98 (7)	1024.26 (8)	4.7 (5)		
677.21 (9)	0.53 (7)			1029.05 (3)	0.45 (14)		
682.52 (15)	0.24 (5)	681.34 (15)	0.31 (6)	1043.39 (8)	0.70 (6)		
687.964 (16)	3.59 (23)	686.97 (4)	3.40 (20)	1043.50 (8)	0.52 (9)		
697.264 (9)	5.92 (13)	696.26 (4)	6.6 (4)	1052.92 (20)	0.16 (9)	1051.90 (20)	0.17 (5)
713.638 (19)	2.58 (9)	712.59 (5)	2.70 (20)	1077.5 (5)	0.4 (3))	1078.77 (8)	2.44 (27)
719.54 (4)	1.27 (6)	718.42 (9)	1.90 (20)	1080.16 (29)	1.6 (15)		
737.31 (11)	0.75 (17)			1081.2 (3)	1.6 (15)		
741.80 (7)	0.88 (17)	740.61 (9)	0.55 (1)	1102.41 (5)	1.2 (4)		
751.30 (13)	1.2 (10)			1127.08 (4)	2.9 (3)	1126.6 (3)	0.12 (3)
755.58 (5)	3.8 (19)	754.34 (6)	1.50 (10)	1182.31 (26)	1.7 (12)		
760.29 (8)	3.2 (17)	761.49 (9)	1.10 (10)	1236.15 (5)	0.91 (9)		

In this study 127 gamma rays have been identified in the range of 120 to 1700 keV region. We present energies of 36 new transitions in the 1.7h ^{149}Nd beta decay. Our compilation shows important changes when compared with the previously accepted one [6].

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