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Direct mass measurements of Ga,Ge,As,Se and Br isotopes close to the proton drip line.+

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The masses of proton-rich nuclei close to the proton drip line are an important input for the determination of the path and of the "termination point" of the rapid proton capture process (rp) above the ^{56}Ni. The direct measurement of the masses of these proton rich nuclei was undertaken at GANIL using the time-of-flight (TOF) technique. This technique has been used previously in a series of measurements for lighter neutron-rich nuclei with a resolution of $\sim 3\times10^{-4}$. In the present experiment the radioactive nuclei were produced by the fragmentation of the 73 A.MeV ^{78}Kr beam on a ^{nat}Ni target, placed between the two solenoids of SISSI. Their TOF was measured on a 82 m long flight path between the beam analysis α-spectrometer and the high resolution magnetic spectrometer SPEG, where their magnetic rigidity was measured event by event. A purification technique based on the charge stripping in the α-spectrometer strongly reduced the number of simultaneously transmitted nuclides, but the number of reference masses transmitted was still sufficient for a precise mass determination. The final uncertainties for nuclei produced with many thousand of events, not very far from the stability line as ^{63}Ga, ^{65,66}Ge, ^{67,68,69,70}As, ^{70,71}Se, ^{72,73}Br range from 60-200 keV ($1\text{-}3\times10^{-6}$). The masses of very exotic nuclides as ^{61}Ga, ^{63}Ge, ^{66}As, ^{67,68}Se and ^{70,71}Br are reported for the first time and present final uncertainties of 1-5 $\times10^{-5}$. The mass values in most cases agree well with the Audi-Wapstra predictions.

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ENERGY LEVELS IN ^{149}Pm FROM THE DECAY OF ^{149}Nd

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The level structure of ^{149}Pm has been investigated by studying the gamma rays emitted following the beta decay of ^{149}Nd (T 1/2 = 1.7 h). The single spectra were taken using a HPGe detector of 76 cm^3 with energy resolution of 1.89 keV for the 1172 keV transition of ^{60}Co and a 671 - ORTEC amplifier in pile-up rejection mode. The background radiation was diminished using a lead shielded .The detector was calibrated for energy and efficiency

through the measurements of standard sources. In order to identify the origin of γ-rays spectra were accumulated through four successive half-lifes. The coincidence spectra were measured using several large volume detectors (>55 cm^3) coupled a multidetetor system [1] at IFUSP. The radioactive sources were obtained by irradiation 5 mg of 94% enriched Neodymium for a period of 3 minutes in the IEA - R1m reactor at IPEN-São Paulo, in a thermal neutron flux of 10^{13} $n.cm^{-2}.s^{-1}$.

The energy and relative intensities of 196 gamma rays have been determined with a better overall precision than previously, 45 for the first time. The level energies were obtained through a least-squares fit of the all transitions placed in the decay scheme. This includes 6 new levels. These results are presented in table I. On the basis of beta and gamma selection rules and log *ft* values spin assignment have been suggested or confirmed for a number of the levels.

Table I : The beta-decay branching ratios and log ft for the decay of ^{149}Nd.

Energy level (keV)	* log *ft*	branching ratios	Energy level (keV)	* log *ft*	branching ratios
114.3534 (15)	7.8	2.709	885.82 (14)	8.93	0.015
188.6796 (17)	—	—	924.049 (21)	7.67	0.236
211.3624 (15)	6.8	20.44	942.50 (20)	7.25	0.566
240.3946 (19)	9.15	0.519	956.836 (7)	8.85	0.014
270.2069 (15)	6.9	12.195	1031.75 (4)	7.86	0.090
288.2274 (21)	10.39	0.025	1043.69 (20)	8.51	0.019
360.139 (5)	8.8	0.629	1049.655 (24)	7.78	0.159
387.609 (4)	10.04	0.037	1141.66 (4)	7.83	0.052
396.8556 (23)	7.53	2.189	1156.971 (8)	6.93	0.441
415.559 (5)	8.46	0.262	1181.18 (6)	7.39	0.111
425.2798 (22)	7.8	1.204	1190.728 (7)	6.37	1.063
462.3498 (35)	7.69	1.125	1234.242 (6)	6.09	1.578
515.796 (5)	8.76	0.454	1239.76 (3)	7.04	0.159
537.9789 (20)	6.3	23.81	1264.28 (5)	6.99	0.058
547.076 (6)	8.3	0.249	1290.085 (22)	7.04	0.107
556.233 (4)	8.37	0.704	1293.4 (4)	8.68	0.0025
635.983 (25)	8.96	0.031	1312.506 (20)	6.57	0.273
651.132 (6)	8.37	0.120	1328.79 (9)	733	0.039
654.9478 (23)	6.07	23.89	1363.85 (4)	6.97	0.068
721.929 (26)	8.19	0.167	1367.91 (6)	7.42	0.022
744.575 (6)	7.06	1.984	1391.69 (6)	6.7	0.101
750.491 (15)	8.31	0.343	1406.88 (6)	6.88	0.049
758.076 (19)	8.43	0.236	1411.9 (3)	6.5	0.110
767.482 (12)	7.29	1.083	1449.250 (23)	6.7	0.067
785.860 (26)	8.6	0.049	1495.19 (11)	7.0	0.014
			1568.63 (6)	5.93	0.063

*calculated using Q_{β^-} =1691 keV [2]

References

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