LOW-LYING ^{128}I EXCITED STATES FROM (n,γ)-REACTION

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According to a program on the investigation of spherical doubly odd nuclei the ^{128}I has been studied. The gamma and conversion electron spectra following the ^{127}I(n,γ)^{128}I reaction have been measured with bent crystal, magnetic, Ge(Li) and Si(Li) spectrometers in the range 20—600 keV. The gamma-gamma prompt and delayed coincidences in the range 25—600 keV have been taken with the use of Ge(Li) and NaI detectors. The ^{127}I(d,p)^{128}I reaction has been investigated with 22 MeV deuterons at an angle of 40° and an energy resolution of 3.5 keV. The ^{129}I(d,t)^{128}I reaction has been studied with 15 MeV deuterons at an angle of 30° and an energy resolution of 2.5 keV. Preliminary results were published in refs /1,2/. The ^{128}I level scheme involving 40 levels and 90 transitions in the range 0—1000 keV have been constructed (see table). Unique spin values are assigned to 30 levels, parities are established for all the levels. The spin-parities obtained were confirmed by the data from ref /3/. The lives of the 133.611, 137.851 and 167.367 keV levels have been measured to be 12 ± 3 ns, 845 ± 20 ns and 175 ± 15 ns respectively. The isomerism of the 167.367 keV state was established for the first time. Most of the levels in the level scheme have also been observed for the first time. The (n,γ) levels are found to match well with those from the (d,p) and (d,t) reactions. Our level scheme enables us to correct and significantly enlarge the ^{128}I level schemes from the (p,n) and (n,γ) reactions.

A comparison of (n,γ) levels with those of (d,p) and (d,t) enabled us to determine the values l_n of the orbital angular momentum of the transferred neutron and to identify the $pg_{7/2}ns_{1/2}$, $pg_{7/2}nd_{3/2}$, $pg_{7/2}\,nh_{11/2}$, $pd_{5/2}\,ns_{1/2}$, $pd_{5/2}\,nd_{3/2}$ and the $pd_{5/2}\,nh_{11/2}$ two-quasiparticle multiplets of levels. The energy splitting of these p—n configurations by residual interactions taken as a combination of short range Wigner, singlet and tensor forces have been calculated. The mean-squared deviation of the calculated level energies from the experimental ones amounts to 32 keV. The force parameters obtained are: (a) the parameter of Wigner forces $V_0'=-1.3$ MeV for the $pg_{7/2}\,nh_{11/2}$ configuration, $V_0'=-8.2$ MeV for the $pd_{5/2}\,nd_{3/2}$ configuration and $V_0'=23.1$ MeV for the $pd_{5/2}\,nh_{11/2}$ configuration and (b) the singlet force parameter $V_1=13.4$ MeV and the parameter of tensor forces $V_2=-6.3$ MeV for all the configurations considered.

Table

Level energy, keV	J^π	Level energy, keV	J^π
1		2	
0	1^+		
27.3620 (11)	2^+	376.624(5)	4^-
85.470 (3)	3^+	385.447 (5)	2^+
128.233 (7)	4^+	386.592 (5)	$4^-,5^-$
133.6107 (10)	2^-	392.003 (3)	2^+
137.851 (5)	4^-	416.281 (3)	$2^+,3^+$
143.999 (10)	3^-	426.339 (4)	1^+
151.6419 (21)	3^+	434.360 (15)	4^-
160.7563 (11)	2^+	435.511 (5)	3^-
167.367 (6)	6^-	485.421 (10)	1^+
180.377 (3)	3^+	518.455 (5)	4^-
220.9259 (25)	1^+	521.081 (16)	$4^-,5^-$
226.101 (6)	$5^-,6^-$	529.965 (19)	3^+
232.578 (4)	4^+	549.733 (18)	$3^+,4^+$
234.487 (5)	5^-	552.320 (14)	$4^-,7^-$
269.711 (7)	$5^-,6^-$	554.431 (7)	3^-
294.357 (5)	5^-	608.705 (6)	4^-
295.667 (4)	2^+	657.32 (3)	$3^+,5^+$
344.516 (4)	4^+	687.051 (6)	4^-
372.120 (7)	$2^+,3^+$	728.183 (19)	$3^-,6^-$
		934.06 (8)	3^-

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