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THE NUCLEUS ^{198}Au INVESTIGATED WITH NEUTRON CAPTURE AND TRANSFER REACTIONS. II. CONSTRUCTION OF THE LEVEL SCHEME AND CALCULATION OF LEVEL DENSITIES

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The level scheme of ^{198}Au was constructed. Up to 1560 keV a total of 111 (d,p) and 125 (n,γ) levels was included, frequently with spin and parity assignments. The results for level densities are calculated in interacting boson–fermion–fermion model (IBFFM) and Gaussian polynomial method (GPM) and are compared to the present data.

1. *Introduction*

In the preceding paper [1], which will be referred to as I, new measurements were reported for ^{198}Au, performed with the bent crystals spectrometers GAMS for (n,γ) radiation and the conversion electron spectrometer BILL for the (n,e) reaction, and with the Q3D spectrograph for the (d,p) reaction. On the basis of these data, we extend here the level scheme up to 1560 keV. Details of this level scheme can be found in Ref. 2.

The most recent compilation of ^{198}Au was published in 1995 [3]. This compilation mentions that γ lines of ^{198}Au are recommended as calibration standards (which is actually only true for the decay lines), but it uses still γ-lines which were measured and calibrated more than 20 years ago. Our new (n,γ) measurements give energies which are by a factor about 1.0005 larger than the previous values, although these previous energies are given with an error of about $2 \cdot 10^{-5}$.

The calculation of low-lying states in ^{198}Au was performed previously in the framework of interacting boson-fermion-fermion model IBFFM [3,4]. The IBFFM model is based on coupling one proton and one neutron quasiparticle to the IBM boson core [5,6], which corresponds to a generalisation of the interacting boson model (IBM) of Iachello and Arima [7,8]. In the present paper, we perform the IBFFM calculation for ^{198}Au up to higher excitation energies than given in Refs. 3 and 4.

In the second step, we perform the calculation of the nuclear level densities of ^{198}Au by using generating function method which is based on the Gaussian polynomial method [9–11].

2. *Construction of the level scheme*

The level scheme of ^{198}Au, including spin and parity assignments in Table 1, was constructed up to 1560 keV using the following data and arguments: i) All experimental information from previous experiments and compilations [3,4,12]. These

TABLE 1.

Comparision of levels obtained from secondary γ-rays [1] and summed coincidences [16]. n – number of secondary transitions from (n,$\gamma\gamma$). "Q"– the correspondence between the levels in both experiments is questionable.

Levels from secondary γ-rays [1]		(n,$\gamma\gamma$) data [16]			
E_{level}	I^{π}	E_{level}	$I_{\gamma\gamma}$	n	
.0	2^-				
55.2	1^-				
91.0	0^-				
192.9	1^-	192.8	2.5	1	
215.0	4^-				
236.0	3^-	235.8	21.1	1	
247.6	1^-	247.6	8.7	1	
259.3	1^-	260.5	43.4	3	Q
261.4	2^-	260.5	43.4	3	Q
312.2	5^+				
328.5	3^-				
339.3	0^-				
346.9	2^-	346.6	6.2	2	
362.9	2^-	362.5	12.6	2	
368.3	1^-	367.7	1.1	1	
381.2	3^+	380.9	1.5	1	
406.0	2^-	406.1	9.5	1	
449.6	3^-				
453.8	2^-	453.1	2.8	1	
482.3	4^+				
495.5	1^-	495.0	2.9	1	
511.5	3^-	511.6	18.3	4	
516.4	6^+				
529.2	3^-	528.5	126.4	6	Q
530.5	1^-	528.5	126.4	6	Q
544.0	4^-				
548.9	2^-	548.9	1.6	1	
571.2	1^-	570.4	28.9	7	
		576.2	5.7	2	
625.4	3^-	625.4	4.2	2	
632.5	$1,2^-$	631.3	27.8	5	
637.1	4^+				
646.4	0^+				
672.7	$1,2^-$	672.4	16.8	4	
696.7	8^+				
		699.0	5.0	1	
702.5	2^-	702.4	51.5	10	Q
703.7	1^-	702.4	51.5	10	Q
728.6	0^-	726.6	5.0	3	
745.2	$1,2^-$	744.4	11.4	4	
758.4	4^+				
764.5	4^-				
		769.4	3.1	1	
		776.9	5.3	2	

Levels from secondary γ-rays [1]				(n,$\gamma\gamma$) data [16]	
E_{level}	I^{π}	E_{level}	$I_{\gamma\gamma}$	n	
786.5	2^-	788.9	29.2	6	Q
789.3	1^-	788.9	29.2	6	Q
800.0	2^-	800.8	144.5	13	Q
801.7	$1,2^-$	800.8	144.5	13	Q
		804.0	8.8	1	
810.4	3^+				
824.6	3^+				
835.4	3^-	835.6	16.9	3	
868.8	3^-	868.1	9.6	2	
891.6	$1,2^-$	891.4	38.4	9	
894.3	3^-	896.1	0.9	1	Q
896.6	$1,2^-$	896.1	0.9	1	Q
		911.6	1.7	1	
916.4	$1,2^-$	915.2	3.6	1	
918.6	$1,2^-$	918.2	56.1	11	
		921.5	1.6	1	
		926.3	2.0	1	
932.0	3^-				
951.4	3^+				
957.0	$1,2^-$				
960.6	3^+				
971.8	3^-	971.0	16.0	6	
983.1	2^+	983.5	1.9	1	
987.6	3^-	986.6	86.0	16	
		992.0	9.8	2	
999.2	$1,2^-$	998.7	15.0	5	
		1005.5	4.0	1	
1018.4	$1,2^-$	1018.1	54.4	8	
		1025.8	3.3	1	
1032.2	3^-				
1038.3	3^-	1038.0	60.3	11	
1047.4	$1,2^-$	1046.0	14.5	6	
1056.7	2^-				
1061.3	3^-				
1075.6	$1\text{-}3^-$				
		1083.7	1.8	1	
1092.9	0^-	1092.6	15.5	4	
1095.5	3^+				
1104.8	$0\text{-}2^-$				
1108.9	$1,2^-$	1109.7	7.8	4	
1115.3	3^-	1116.7	14.7	3	
1124.9	2^-	1123.8	11.0	5	
		1146.3	16.3	5	
		1153.1	1.9	1	
1157.2	3^-	1156.8	45.0	8	
1160.0	3^-	1163.6	12.2	4	
1191.6	$1\text{-}3^+$	1194.9	0.6	1	
1202.3	2^-	1203.9	43.1	9	
		1206.8	6.3	1	
1209.4	3^-	1210.5	2.5	2	
		1217.1	1.5	1	
1232.8	3^-	1232.3	68.2	10	
1240.4	3^-	1240.2	4.8	1	
1256.0	$1,2^-$				
1265.5	$1\text{-}3^-$				
1272.1	3^-	1275.5	2.0	1	
1286.7	2^-	1286.2	42.4	11	
1293.9	$1,2^-$	1290.9	28.6	6	

Levels from secondary γ-rays [1]				(n,$\gamma\gamma$) data [16]	
E_{level}	I^{π}	E_{level}	$I_{\gamma\gamma}$	n	
1297.1	$1\text{-}3^-$	1296.9	1.4	1	
1301.1	2^-	1304.9	21.6	7	Q
1304.8	3^-	1304.9	21.6	7	Q
1306.9	2^-	1304.9	21.6	7	Q
		1312.6	1.6	1	
1318.6	$1,2^-$				
1325.9	2^-				
1335.5	$1\text{-}3^-$	1337.3	18.3	5	Q
1338.2	3^-	1337.3	18.3	5	Q
		1342.1	3.5	2	
1359.1	$1\text{-}3^-$				
1363.4	$1\text{-}3^-$	1363.2	47.5	11	
1371.5	$1,2^-$	1370.8	50.4	9	
1376.0	$1,2^-$	1378.5	5.2	3	Q
1380.9	3^-	1378.5	5.2	3	Q
1390.2	2^-				
1396.2	3^-	1395.6	9.6	4	
1399.4	$2,3^-$	1401.8	3.0	2	Q
1402.1	$1,2^-$	1403.7	12.6	2	Q
1404.9	$2,3^-$	1404.9	10.2	3	Q
1409.4	3^-	1408.8	163.3	13	Q
		1414.2	18.6	6	
1418.7	$3,4^+$	1420.4	1.8	1	
1423.8	3^-	1426.8	31.5	5	
1431.6	$2,3^-$	1430.6	4.2	1	
1434.6	$1,2^-$	1434.8	32.8	6	
		1440.1	2.4	1	
1444.4	3^-				
1453.9	3^-				
1459.0	3^-				
		1465.9	2.7	1	
1472.1	3^-	1470.2	26.6	6	
1475.6	2^-	1476.4	14.0	4	
		1482.0	4.4	2	
1487.1	$1,2^-$	1488.2	4.2	2	
1496.2	3^-				
1505.2	$1,2^-$	1504.9	4.8	2	
1513.6	$1,2^-$	1512.6	88.7	13	
		1517.9	1.9	1	
1530.7	$1,2^-$	1530.4	2.3	1	
1536.4	$0\text{-}3^-$	1538.5	17.0	5	
1542.8	3^-	1544.7	1.6	1	
1554.4	$1,2^-$	1554.0	97.9	15	
1560.4	3^-	1560.0	6.2	1	
		1563.1	2.4	1	
		1573.4	7.3	3	
		1580.6	4.0	1	
		1585.8	3.7	2	
		1605.8	3.7	1	
		1608.5	41.1	12	
		1614.7	41.2	9	
		1624.5	38.8	9	
		1645.4	31.5	9	
		1659.0	39.8	7	
		1666.4	17.2	6	
		1710.3	14.1	1	
		1712.0	112.8	16	
		1715.9	12.0	3	

TABLE 2.

γ decay of the levels (a: multipolarity; m = multiply placed).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
55.2	1^-				
	.0	2^-	55.2	100(4)	95M1+5E2
91.0	0^-				
	.0	2^-	91.0	53(10)	E2
	55.2	1^-	35.8	46.6(16)	M1
192.9	1^-				
	.0	2^-	192.9	27.6(4)	E2
	55.2	1^-	137.8	11.3(5)	M1
	91.0	0^-	101.9	61(3)	M1
215.0	4^-				
	.0	2^-	215.0	100(2)	E2
236.0	3^-				
	.0	2^-	236.0	86.6(5)	M1+E2
	55.2	1^-	180.9	13.3(4)	E2
247.6	1^-				
	.0	2^-	247.6	58(3)	M1
	55.2	1^-	192.4	40.5(3)	M1
	91.0	0^-	156.6	.96(18)	M1
259.3	1^-				
	.0	2^-	259.3	.41(4)	M1
	91.0	0^-	168.3	91.9(7)	M1
	192.9	1^-	66.4	7.5(19)	
261.4	2^-				
	.0	2^-	261.4	89(3)	M1
	55.2	1^-	206.2	3.91(19)	M1
	91.0	0^-	170.4	6.7(4)	
312.2	5^+				
	215.0	4^-	97.2	100(17)	E1
328.5	3^-				
	.0	2^-	328.5	91.9(4)	M1
	55.2	1^-	273.3	2.5(8)	
	215.0	4^-	113.5	5.5(19)	M1+E2
339.3	0^-				
	55.2	1^-	284.1	33(4)	M1
	192.9	1^-	146.3	66(6)	M1
346.9	2^-				
	.0	2^-	346.9	23.55(19)	M1
	55.2	1^-	291.7	56(5)	M1
	91.0	0^-	255.9	1.27(23)	
	192.9	1^-	154.0	3.0(8)	(M1)
	215.0	4^-	132.0	9(2)	E2
	247.6	1^-	99.3	6.5(19)	M1
362.9	2^-				
	55.2	1^-	307.7	22.9(6)	M1+E2
	91.0	0^-	271.9	10.4(4)	
	192.9	1^-	170.0	6.7(10)	m
	259.3	1^-	103.6	59(8)	M1
368.3	1^-				
	.0	2^-	368.2	8.92(10)	M1
	55.2	1^-	313.1	3.45(19)	m
	91.0	0^-	277.2	17(2)	M1
	192.9	1^-	175.3	6.8(10)	
	259.3	1^-	108.9	63(8)	M1
381.2	3^+				
	.0	2^-	381.2	78.3(3)	E1
	215.0	4^-	166.2	9.4(6)	E1
	236.0	3^-	145.2	12.2(8)	E1
406.0	2^-				
	.0	2^-	406.0	2.02(17)	
	55.2	1^-	350.8	56.6(4)	M1
	192.9	1^-	213.1	5.7(5)	M1
	236.0	3^-	170.0	7.6(11)	m
	259.3	1^-	146.7	16.8(17)	M1
	261.4	2^-	144.6	11.0(18)	M1
449.6	3^-				
	.0	2^-	449.6	37.7(3)	M1
	55.2	1^-	394.4	.90(6)	
	215.0	4^-	234.6	3.5(8)	m

		236.0	3^-	213.5	1.07(16)	M1
		261.4	2^-	188.2	48.4(13)	M1
		328.5	3^-	121.1	8.2(24)	M1
453.8	2^-					
		.0	2^-	453.8	4.79(18)	
		55.2	1^-	398.7	4.1(3)	
		192.9	1^-	260.9	70(5)	M1
		328.5	3^-	125.3	6(2)	M1
		346.9	2^-	106.9	13(3)	M1
482.3	4^+					
		312.2	5^+	170.1	100.0(15)	M1
495.5	1^-					
		55.2	1^-	440.3	64.4(4)	M1
		91.0	0^-	404.5	1.82(15)	M1
		192.9	1^-	302.6	.94(5)	
		236.0	3^-	259.5	1.56(15)	
		247.6	1^-	247.9	4.4(5)	
		259.3	1^-	236.2	18(3)	
		261.4	2^-	234.1	5.7(5)	M1
		346.9	2^-	148.6	2.7(13)	m,M1
511.5	3^-					
		.0	2^-	511.5	81(7)	M1
		215.0	4^-	296.5	2.9(3)	
		236.0	3^-	275.5	5.0(9)	m
		261.4	2^-	250.1	6.0(8)	
		362.9	2^-	148.6	4.6(22)	m,M1
516.4	6^+					
		312.2	5^+	204.2	100(9)	M1
529.2	3^-					
		.0	2^-	529.2	86(2)	M1
		55.2	1^-	474.0	2.22(4)	
		215.0	4^-	314.2	1.26(10)	
		236.0	3^-	293.1	4.0(10)	M1
		261.4	2^-	267.8	3.4(3)	
		346.9	2^-	182.3	2.6(7)	
530.5	1^-					
		.0	2^-	530.5	7.25(21)	
		192.9	1^-	337.5	26.2(4)	M1
		247.6	1^-	282.9	2.4(5)	M1
		259.3	1^-	271.1	15.3(13)	m,(M1)
		261.4	2^-	269.1	22.6(17)	M1
		339.3	0^-	191.2	26.0(23)	M1
544.0	4^-					
		.0	2^-	544.0	68.1(23)	E2
		215.0	4^-	329.0	2.43(10)	
		328.5	3^-	215.5	6.4(12)	M1
		406.0	2^-	138.0	22(5)	
548.9	2^-					
		.0	2^-	548.9	63.2(16)	M1
		215.0	4^-	334.0	3.08(14)	
		247.6	1^-	301.4	1.40(14)	
		406.0	2^-	142.9	32(3)	M1
571.2	1^-					
		55.2	1^-	516.1	24.8(5)	M1
		91.0	0^-	480.2	2.22(15)	
		192.9	1^-	378.3	12.8(3)	M1
		236.0	3^-	335.2	1.00(10)	
		259.3	1^-	311.9	33.8(8)	m,M1
		328.5	3^-	242.8	1.5(4)	m
		346.9	2^-	224.3	4.9(8)	
		362.9	2^-	208.3	.21(21)	
		368.3	1^-	203.0	18.4(7)	M1
625.4	3^-					
		.0	2^-	625.4	61(3)	M1
		236.0	3^-	389.3	3.4(9)	
		259.3	1^-	366.1	7.8(6)	
		261.4	2^-	364.0	16.0(4)	m,M1
		362.9	2^-	262.5	7.4(13)	
		449.6	3^-	175.9	3.2(13)	
632.5	$1,2^-$					
		.0	2^-	632.5	7.7(5)	
		55.2	1^-	577.3	26.3(5)	M1
		236.0	3^-	396.4	.65(7)	
		259.3	1^-	373.2	7.6(11)	M1
		261.4	2^-	371.1	43.9(4)	M1
		362.9	2^-	269.6	3.5(7)	

TABLE 2. (continuation).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	368.3	1^-	264.2	6.1(6)	m
	406.0	2^-	226.5	4.0(7)	
637.1	4^+				
	312.2	5^+	324.9	20.9(8)	
	482.3	4^+	154.8	79(5)	m,M1
646.4	0^+				
	55.2	1^-	591.2	100.0(18)	
672.7	$1,2^-$				
	.0	2^-	672.7	45.3(16)	M1
	215.0	4^-	457.7	2.9(10)	m
	236.0	3^-	436.6	2.48(12)	
	247.6	1^-	425.1	2.12(6)	
	259.3	1^-	413.3	4.42(12)	
	328.5	3^-	344.2	1.63(12)	m
	346.9	2^-	325.8	7.20(18)	M1
	406.0	2^-	266.6	19.6(5)	M1
	449.6	3^-	223.1	2.5(5)	
	453.8	2^-	218.8	11.6(10)	(M1)
696.7	8^+				
	516.4	6^+	180.3	100(7)	E2
702.5	2^-				
	.0	2^-	702.5	65.1(9)	M1
	55.2	1^-	647.3	15.7(9)	m,M1
	247.6	1^-	454.9	3.97(18)	m
	261.4	2^-	441.1	11.1(3)	M1
	362.9	2^-	339.6	2.93(9)	m
	368.3	1^-	334.2	.94(9)	
703.7	1^-				
	.0	2^-	703.8	2.8(3)	m,M1
	55.2	1^-	648.6	2.1(3)	m
	91.0	0^-	612.7	7.6(3)	M1
	192.9	1^-	510.8	2.4(3)	
	247.6	1^-	456.2	10.2(9)	M1
	259.3	1^-	444.4	40.7(3)	M1
	339.3	0^-	364.4	1.29(16)	
	406.0	2^-	297.7	4.47(21)	M1
	548.9	2^-	154.8	28.2(18)	m,M1
728.7	0^-				
	55.2	1^-	673.5	53(3)	M1
	192.9	1^-	535.8	5.5(12)	
	259.3	1^-	469.3	36.2(22)	M1
	406.0	2^-	322.8	4.8(22)	m
745.2	$1,2^-$				
	.0	2^-	745.2	23.2(16)	
	55.2	1^-	690.0	61.9(22)	M1
	259.3	1^-	485.9	5.6(4)	
	362.9	2^-	382.3	6.49(23)	M1
	495.5	1^-	249.7	2.5(7)	m
758.4	4^+				
	236.0	3^-	522.4	25.4(4)	
	312.2	5^+	446.2	15.1(4)	M1
	482.3	4^+	276.1	59(4)	M1
764.5	4^-				
	215.0	4^-	549.5	10.0(4)	
	247.6	1^-	516.9	4.6(4)	m
	362.9	2^-	401.6	5.01(20)	
	406.0	2^-	358.5	3.6(4)	
	449.6	3^-	314.9	72.9(12)	M1
	529.2	3^-	235.3	3.8(20)	m
786.5	2^-				
	236.0	3^-	550.5	2.9(4)	
	247.6	1^-	539.0	1.4(3)	
	259.3	1^-	527.2	4.5(5)	
	261.4	2^-	525.1	29.3(9)	
	328.5	3^-	458.0	25.3(3)	m,M1
	346.9	2^-	439.6	6.7(23)	
	362.9	2^-	423.6	1.62(6)	
	368.3	1^-	418.3	1.81(6)	
	453.8	2^-	332.7	2.33(12)	M1
	495.5	1^-	291.0	1.6(3)	m
	548.9	2^-	237.6	1.6(4)	
	571.2	1^-	215.3	16.7(11)	M1

		632.5	$1,2^-$	154.1	3.8(11)	(M1)
789.3	1^-					
		55.2	1^-	734.1	7.2(5)	M1
		91.0	0^-	698.3	14.9(7)	M1
		236.0	3^-	553.0	2.5(13)	m
		259.3	1^-	529.9	40.8(15)	M1
		346.9	2^-	442.4	3.75(15)	m
		406.0	2^-	383.3	24.5(3)	
		571.2	1^-	218.0	6.1(13)	M1
800.0	2^-					
		.0	2^-	800.1	6.0(12)	
		55.2	1^-	744.9	10.0(6)	m
		236.0	3^-	564.0	1.7(3)	m
		247.6	1^-	552.5	9.60(21)	M1
		346.9	2^-	453.1	2.61(14)	
		362.9	2^-	437.1	1.69(7)	
		381.2	3^+	418.8	67.3(4)	E2
		449.6	3^-	350.5	.77(14)	
801.7	$1,2^-$					
		.0	2^-	801.7	13.9(6)	M1
		91.0	0^-	710.7	3.7(3)	
		192.9	1^-	608.8	.84(21)	
		247.6	1^-	554.1	1.11(10)	
		259.3	1^-	542.4	7.46(15)	m
		261.4	2^-	540.3	34.7(8)	M1
		328.5	3^-	473.2	1.00(15)	
		362.9	2^-	438.8	.74(5)	
		368.3	1^-	433.5	1.64(5)	
		406.0	2^-	395.7	4.6(4)	M1
		453.8	2^-	347.9	7.67(15)	m,M1
		495.5	1^-	306.2	3.91(10)	m,M1
		511.5	3^-	290.2	1.1(3)	
		530.5	1^-	271.2	12.1(6)	(M1)
		632.5	$1,2^-$	169.2	5.2(10)	M1
810.4	3^+					
		215.0	4^-	595.4	13.0(15)	
		328.5	3^-	481.9	31.2(15)	
		362.9	2^-	447.5	20.5(8)	m
		449.6	3^-	360.9	13.0(8)	
		482.3	4^+	328.1	7.9(8)	
		625.4	3^-	185.0	14(4)	E1
824.6	3^+					
		.0	2^-	824.6	60(11)	
		362.9	2^-	461.7	12.9(8)	m
		482.3	4^+	342.2	12(4)	
		511.5	3^-	313.2	13(6)	
835.4	3^-					
		215.0	4^-	620.4	5.8(7)	m
		261.4	2^-	574.0	63.4(12)	
		453.8	2^-	381.6	14.8(3)	M1
		529.2	3^-	306.2	10.3(3)	m,M1
		632.5	$1,2^-$	202.9	5.3(23)	m
868.8	3^-					
		.0	2^-	868.8	64(6)	M1
		55.2	1^-	813.6	3.2(10)	m
		215.0	4^-	653.8	6.9(6)	m
		346.9	2^-	521.9	2.5(5)	m
		449.6	3^-	419.2	11.67(22)	M1
		453.8	2^-	415.0	3.7(3)	
		482.3	4^+	386.4	.57(11)	m
		529.2	3^-	339.6	3.54(11)	m
		625.4	3^-	243.3	2.9(9)	
891.6	$1,2^-$					
		.0	2^-	891.6	10.7(21)	
		55.2	1^-	836.4	52(7)	M1
		247.6	1^-	644.0	6.51(24)	
		259.3	1^-	632.3	18.6(7)	m,M1
		261.4	2^-	630.2	4.8(4)	M1
		449.6	3^-	442.1	1.31(16)	
		529.2	3^-	362.5	3.7(4)	m
		571.2	1^-	320.3	1.64(24)	
894.3	3^-					
		328.5	3^-	565.8	95.5(12)	M1
		548.9	2^-	345.2	4.4(18)	m
896.6	$1,2^-$					
		247.6	1^-	649.0	11.7(6)	M1

TABLE 2. (continuation).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	261.4	2^-	635.2	48.7(19)	M1
	328.5	3^-	568.1	6.7(12)	
	346.9	2^-	549.7	3.1(6)	m
	449.6	3^-	447.0	3.01(15)	m
	571.2	1^-	325.3	1.80(15)	
	625.4	3^-	271.1	21.0(18)	m,(M1)
	632.5	$1,2^-$	264.1	3.6(3)	
916.4	$1,2^-$				
	.0	2^-	916.4	33.0(16)	M1
	236.0	3^-	680.4	13.0(8)	
	261.4	2^-	655.0	9.9(5)	M1
	406.0	2^-	510.4	24(8)	M1
	529.2	3^-	387.3	5.9(6)	M1
	571.2	1^-	345.2	2.3(10)	m
	625.4	3^-	291.0	2.4(5)	m
	632.5	$1,2^-$	283.9	8.2(15)	
918.6	$1,2^-$				
	259.3	1^-	659.2	12.1(3)	M1
	339.3	0^-	579.3	25.4(16)	
	346.9	2^-	571.7	23.9(9)	M1
	362.9	2^-	555.7	5.99(17)	M1
	406.0	2^-	512.6	8.3(21)	M1
	449.6	3^-	469.0	1.54(7)	
	453.8	2^-	464.8	8(2)	
	495.5	1^-	423.1	1.00(7)	
	529.2	3^-	389.4	1.40(4)	
	548.9	2^-	369.6	.68(7)	
	672.7	$1,2^-$	246.0	.35(7)	
	703.7	1^-	214.9	9.3(18)	
	745.2	$1,2^-$	173.4	1.6(5)	
932.0	3^-				
	261.4	2^-	670.6	45(6)	
	381.2	3^+	550.7	30(4)	
	544.0	4^-	387.9	8.4(10)	
	548.9	2^-	383.0	15.7(10)	

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
951.4	3^+				
	312.2	5^+	639.2	100(7)	
957.0	$1,2^-$				
	192.9	1^-	764.0	46.2(15)	M1
	236.0	3^-	720.9	12.5(5)	M1
	247.6	1^-	709.4	7.5(10)	
	259.3	1^-	697.6	13.8(10)	
	362.9	2^-	594.2	7.8(13)	m
	406.0	2^-	550.9	6.1(7)	
	571.2	1^-	385.7	2.0(3)	
	625.4	3^-	331.6	1.09(13)	
	703.7	1^-	253.2	2.6(3)	
960.6	3^+				
	362.9	2^-	597.7	24.6(18)	m
	449.6	3^-	511.1	69(10)	
	482.3	4^+	478.3	5.9(9)	
971.8	3^-				
	449.6	3^-	522.2	45(3)	
	625.4	3^-	346.4	17.3(8)	M1
	632.5	$1,2^-$	339.3	25.3(16)	
	672.7	$1,2^-$	299.2	11.8(12)	m
983.1	2^+				
	.0	2^-	983.0	11.2(10)	m
	368.3	1^-	615.0	1.7(7)	m
	495.5	1^-	487.6	7.6(6)	m
	824.6	3^+	158.5	79(3)	M1
987.6	3^-				
	215.0	4^-	772.6	3.8(5)	
	236.0	3^-	751.6	6.3(12)	m
	261.4	2^-	726.2	4.5(15)	
	346.9	2^-	640.7	61(4)	M1
	449.6	3^-	538.0	2.34(15)	m
	453.8	2^-	533.7	5.6(3)	
	495.5	1^-	492.1	8.02(15)	
	530.5	1^-	457.1	.75(22)	m
	625.4	3^-	362.1	5.6(5)	

		632.5	$1,2^-$	355.1	1.59(22)	m
999.2	$1,2^-$					
		247.6	1^-	751.6	19(3)	m
		362.9	2^-	636.3	8.0(5)	
		368.3	1^-	630.9	10.6(18)	
		406.0	2^-	593.2	48(2)	M1
		449.6	3^-	549.7	4.9(9)	m
		625.4	3^-	373.8	8.4(5)	
1018.4	$1,2^-$					
		.0	2^-	1018.4	15.4(10)	
		91.0	0^-	927.4	25(9)	m
		192.9	1^-	825.5	25(2)	M1
		261.4	2^-	757.0	4.7(4)	m
		339.3	0^-	679.1	5.9(6)	
		362.9	2^-	655.5	17.0(5)	M1
		495.5	1^-	522.9	2.21(24)	
		529.2	3^-	489.3	2.95(18)	m
1032.3	3^-					
		236.0	3^-	796.2	23.7(16)	
		261.4	2^-	770.8	35.4(21)	E2
		328.5	3^-	703.8	6.3(7)	m,M1
		511.5	3^-	520.6	31(12)	m
		548.9	2^-	483.4	1.68(12)	m
		625.4	3^-	406.8	.84(12)	m
1038.3	3^-					
		55.2	1^-	983.0	22.1(19)	m
		259.3	1^-	779.0	10.7(13)	m
		406.0	2^-	632.3	39.1(13)	m,M1
		672.7	$1,2^-$	365.6	16.4(5)	
		810.4	3^+	227.8	4.8(17)	
		835.4	3^-	202.9	6(2)	m
1047.1	$1,2^-$					
		.0	2^-	1047.1	65.6(18)	m
		346.9	2^-	700.3	17.3(22)	
		449.6	3^-	597.5	7.8(15)	m
		646.4	0^+	400.7	9.1(15)	m
1056.7	2^-					
		339.3	0^-	717.3	37(8)	m
		449.6	3^-	607.2	11(2)	
		632.5	$1,2^-$	424.2	23.8(8)	M1
		764.5	4^-	292.3	20.4(22)	
		786.5	2^-	270.2	6.8(8)	
1061.3	3^-					
		55.2	1^-	1006.3	22.3(21)	m
		247.6	1^-	813.6	4.9(15)	m
		482.3	4^+	579.0	8.9(7)	
		511.5	3^-	549.7	3.6(7)	m
		529.2	3^-	532.2	2.9(4)	m
		625.4	3^-	435.9	1.40(17)	
		894.3	3^-	167.0	5.8(10)	m,M1
		896.6	$1,2^-$	164.7	49(4)	
1075.5	$1\text{-}3^-$					
		236.0	3^-	839.5	93(22)	
		362.9	2^-	712.7	4.4(6)	m
		511.5	3^-	564.0	2.3(4)	m
1092.9	0^-					
		453.8	2^-	639.0	43.3(22)	m
		632.5	$1,2^-$	460.4	56.6(22)	
1095.5	3^+					
		529.2	3^-	566.3	13.3(20)	m
		637.1	4^+	458.4	86.6(12)	M1
1104.8	$0\text{-}2^-$					
		247.6	1^-	857.2	29(6)	m
		530.5	1^-	574.4	60.5(17)	M1
		672.7	$1,2^-$	432.2	4.4(3)	
		728.7	0^-	376.2	5.3(3)	
1108.9	$1,^-$					
		192.9	1^-	915.9	20(3)	m
		236.0	3^-	872.9	29(3)	m
		259.3	1^-	849.6	25(4)	M1
		339.3	0^-	769.6	14(2)	m
		625.4	3^-	483.4	3.18(22)	m
		702.5	2^-	406.4	3.1(5)	m
		835.4	3^-	273.5	3.8(5)	
1115.3	3^-					
		530.5	1^-	584.7	22(8)	

TABLE 2. (continuation).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	548.9	2^-	566.3	11.5(17)	m
	786.5	2^-	328.8	54.1(7)	M1
	800.0	2^-	315.2	12(3)	m
1124.9	2^-	1146.			
	236.0	3^-	888.6	19(6)	m
	247.6	1^-	877.3	70(15)	M1
	764.5	4^-	360.4	9.9(5)	
1157.2	3^-				
	.0	2^-	1157.3	15(4)	M1
	247.6	1^-	909.6	10.3(13)	m
	328.5	3^-	828.9	5.8(11)	m
	632.5	$1,2^-$	524.7	30(8)	
	672.7	$1,2^-$	484.5	1.35(16)	m
	758.4	4^+	398.8	1.27(8)	
	801.7	$1,2^-$	355.5	35.4(6)	M1
1160.0	3^-				
	236.0	3^-	923.9	10.4(8)	m
	261.4	2^-	898.5	18(2)	m
	362.9	2^-	797.1	7.3(13)	
	702.5	2^-	457.7	4.5(15)	m
	703.7	1^-	456.3	58.7(6)	
1191.6	$1\text{-}3^+$				
	215.0	4^-	976.5	12(2)	m
	328.5	3^-	863.0	33(3)	m
	362.9	2^-	828.9	11.4(23)	m
	571.2	1^-	620.4	6.9(8)	m
	786.5	2^-	405.1	1.65(16)	
	824.6	3^+	367.0	1.65(16)	m
	868.8	3^-	322.8	2.4(11)	m
	957.0	$1,2^-$	234.6	10.4(23)	m
	1032.3	3^-	159.3	19(3)	
1202.3	2^-				
	339.3	0^-	863.0	48(5)	m
	745.2	$1,2^-$	457.1	2.3(7)	m
	835.4	3^-	367.0	2.39(23)	m
	916.4	$1,2^-$	285.8	4.7(5)	
	957.0	$1,2^-$	245.3	35(3)	
	960.6	3^+	241.7	6.2(21)	
1209.4	3^-				
	192.9	1^-	1016.3	5.6(8)	m
	261.4	2^-	947.9	45.5(14)	M1
	328.5	3^-	881.0	11.0(22)	m
	381.2	3^+	828.0	5.7(22)	
	449.6	3^-	759.7	11.6(15)	
	745.2	$1,2^-$	464.2	1.05(10)	m
	896.6	$1,2^-$	312.8	3.2(3)	
	960.6	3^+	248.7	16.1(10)	
1232.8	3^-				
	449.6	3^-	783.2	29(4)	M1
	453.8	2^-	779.0	12.1(15)	m
	745.2	$1,2^-$	487.6	17.0(13)	m
	800.0	2^-	433.0	4(2)	
	868.8	3^-	364.0	28.2(8)	m,M1
	932.0	3^-	300.8	4.1(4)	
	983.1	2^+	249.7	4.3(11)	m
1240.4	3^-				
	215.0	4^-	1025.5	10.5(8)	m
	495.5	1^-	744.9	23.9(15)	m
	544.0	4^-	696.4	9.7(5)	M1
	625.4	3^-	615.0	3.3(13)	m
	632.5	$1,2^-$	607.9	6.8(7)	
	987.6	3^-	252.8	7.8(20)	
	1157.2	3^-	83.1	37(15)	
1256.0	$1,2^-$				
	55.2	1^-	1200.8	16.7(13)	M1
	215.0	4^-	1040.8	14.8(7)	m
	328.5	3^-	927.4	50(19)	m
	530.5	1^-	725.5	11.1(7)	
	894.3	3^-	361.7	6.4(8)	
1265.5	$1\text{-}3^-$				
	259.3	1^-	1006.3	23.5(22)	m
	449.6	3^-	816.0	25(3)	M1

		453.8	2^-	811.7	20.5(11)	
		625.4	3^-	640.1	11.1(9)	
		646.4	0^+	619.1	19.4(9)	
1272.1	3^-					
		.0	2^-	1272.2	10.5(11)	m
		192.9	1^-	1079.2	25.6(20)	(M1,E2)
		259.3	1^-	1012.8	6.1(6)	m
		449.6	3^-	822.5	11.1(12)	m
		453.8	2^-	818.3	7.9(11)	
		495.5	1^-	776.6	12.9(13)	m
		529.2	3^-	742.9	4.9(18)	m
		632.5	$1,2^-$	639.7	5.5(4)	
		810.4	3^+	461.7	1.30(8)	m
		824.6	3^+	447.5	4.23(16)	m
		894.3	3^-	377.9	6.6(4)	
		957.0	$1,2^-$	315.2	2.8(7)	m
1286.7	2^-					
		236.0	3^-	1050.7	51(5)	M1
		261.4	2^-	1025.5	8.6(7)	m
		362.9	2^-	923.9	15.4(12)	m
		544.0	4^-	742.9	8(3)	m
		810.4	3^+	476.2	2.2(3)	
		835.4	3^-	451.4	1.65(13)	
		951.4	3^+	335.3	4.9(3)	M1
		987.6	3^-	299.2	3.8(4)	m
		1047.1	$1,2^-$	239.6	2.8(10)	m
1293.9	$1,2^-$					
		247.6	1^-	1046.2	32.4(19)	
		259.3	1^-	1034.5	18.4(10)	
		495.5	1^-	798.4	24(2)	m,M1
		891.6	$1,2^-$	402.3	2.8(9)	
		896.6	$1,2^-$	397.3	1.97(21)	
		1018.4	$1,2^-$	275.5	12.5(21)	m
		1092.9	0^-	201.0	7.2(21)	M1
1297.1	$1\text{-}3^-$					
		.0	2^-	1297.1	53(10)	M1
		362.9	2^-	934.3	6.5(5)	
		381.2	3^+	915.9	8.1(13)	m

		406.0	2^-	891.2	10(4)	
		529.2	3^-	767.9	12.1(10)	m
		530.5	1^-	766.7	3.2(10)	
		835.4	3^-	461.7	1.46(9)	m
		891.6	$1,2^-$	405.5	1.46(9)	
		957.0	$1,2^-$	340.2	3.2(9)	
1301.0	2^-					
		.0	2^-	1300.9	26(10)	
		236.0	3^-	1064.8	26(5)	m
		544.0	4^-	757.0	10.5(8)	m
		632.5	$1,2^-$	668.6	28.9(13)	
		810.4	3^+	490.6	6.1(3)	
		894.3	3^-	406.8	.94(13)	m
1304.8	3^-					
		.0	2^-	1304.8	31(5)	
		236.0	3^-	1068.5	6.9(6)	m
		328.5	3^-	976.5	7.2(15)	m
		482.3	4^+	822.5	12.7(13)	m
		511.5	3^-	793.4	3.0(9)	m
		868.8	3^-	436.0	2.13(18)	
		918.6	$1,2^-$	386.2	.74(9)	
		957.0	$1,2^-$	347.9	13.4(3)	m,M1
		960.6	3^+	344.2	2.50(18)	m
		987.6	3^-	317.3	11.0(21)	
		1032.3	3^-	272.6	8.4(6)	
1306.8	2^-					
		.0	2^-	1306.8	54.0(10)	E2
		368.3	1^-	938.7	6.5(3)	M1
		449.6	3^-	857.2	5.7(12)	m
		529.2	3^-	777.7	6.6(8)	M1
		544.0	4^-	762.9	2.5(4)	
		625.4	3^-	681.4	1.4(3)	
		764.5	4^-	542.4	8.05(17)	m
		932.0	3^-	374.9	3.7(3)	m
		1104.8	$0\text{-}2^-$	202.0	6.6(7)	M1
		1124.9	2^- 1146.	182.0	4.6(11)	M1
1318.6	$1,2^-$					
		339.3	0^-	979.5	12.7(23)	

TABLE 2. (continuation).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	368.3	1^-	950.4	9.9(11)	M1
	453.8	2^-	864.8	11.9(19)	
	511.5	3^-	807.0	6.8(11)	
	530.5	1^-	788.2	17.3(22)	M1
	548.9	2^-	769.6	7.6(14)	m
	703.7	1^-	615.0	2.4(10)	m
	745.2	$1,2^-$	573.3	21.3(6)	m
	786.5	2^-	532.2	2.08(24)	m
	801.7	$1,2^-$	516.9	2.82(24)	m
	835.4	3^-	483.3	2.08(12)	m
	960.6	3^+	357.9	2.7(6)	m
1325.8	2^-				
	192.9	1^-	1132.9	31(4)	M1
	261.4	2^-	1064.5	11.8(6)	
	346.9	2^-	978.9	17.3(11)	
	672.7	$1,2^-$	653.2	2.5(5)	
	800.0	2^-	525.8	5.8(6)	
	868.8	3^-	457.1	.9(3)	m
	932.0	3^-	393.9	27.4(5)	M1
	983.1	2^+	342.8	2.1(4)	
1335.5	$1\text{-}3^-$				
	.0	2^-	1335.5	32(6)	M1
	215.0	4^-	1120.5	14.7(15)	
	259.3	1^-	1076.4	13.2(21)	m
	511.5	3^-	824.1	5.5(18)	
	891.6	$1,2^-$	443.9	17(2)	m
	960.6	3^+	374.9	9.9(8)	m
	999.2	$1,2^-$	336.3	6.3(12)	
1338.2	3^-				
	.0	2^-	1338.1	18(2)	M1
	261.4	2^-	1076.8	16.5(20)	m
	449.6	3^-	888.6	8(3)	m
	544.0	4^-	794.2	25.9(12)	M1
	625.4	3^-	712.7	5.3(7)	m
	894.3	3^-	443.9	12.8(19)	m
	971.8	3^-	366.3	1.43(11)	
	983.1	2^+	355.1	2.3(3)	m
	1047.1	$1,2^-$	291.0	2.7(6)	m
	1056.7	2^-	281.4	5.8(16)	
1359.1	$1\text{-}3^-$				
	247.6	1^-	1111.6	28(2)	M1+E2
	362.9	2^-	996.1	7.0(12)	m
	548.9	2^-	810.1	20.5(5)	M1
	646.4	0^+	712.7	2.7(3)	m
	745.2	$1,2^-$	613.8	3.49(23)	
	1047.1	$1,2^-$	311.9	37.2(9)	m,M1
1363.3	$1\text{-}3^-$				
	.0	2^-	1363.4	17.2(11)	M1
	55.2	1^-	1308.5	7.7(12)	M1
	91.0	0^-	1272.2	6.4(7)	m
	261.4	2^-	1101.9	11.5(4)	M1
	346.9	2^-	1016.3	2.6(4)	m
	362.9	2^-	1000.4	7.1(11)	
	449.6	3^-	913.8	20(2)	M1
	453.8	2^-	909.6	6.0(8)	m
	482.3	4^+	881.0	5.1(10)	m
	632.5	$1,2^-$	730.8	4.5(14)	m
	764.5	4^-	598.8	1.48(14)	
	810.4	3^+	553.0	1.6(8)	m
	891.6	$1,2^-$	471.7	1.33(10)	
	918.6	$1,2^-$	444.8	3.26(10)	
	957.0	$1,2^-$	406.4	.69(10)	m
	1124.9	1146.	238.5	2.8(7)	
1371.5	$1,2^-$				
	55.2	1^-	1316.5	51(4)	
	571.2	1^-	800.3	6.9(19)	
	625.4	3^-	746.1	31.7(15)	m
	801.7	$1,2^-$	570.0	4.9(4)	
	957.0	$1,2^-$	414.6	1.9(4)	
	1075.5	$1\text{-}3^-$	296.0	2.6(5)	m
1376.0	$1,2^-$				
	247.6	1^-	1128.5	17.5(8)	E2

	261.4	2^-	1114.5	22.0(10)	
	362.9	2^-	1012.8	7.1(7)	m
	449.6	3^-	926.6	4.0(4)	m
	728.7	0^-	647.3	15.6(8)	m,M1
	916.4	$1,2^-$	459.5	2.43(18)	
	999.2	$1,2^-$	376.8	3.5(11)	
	1092.9	0^-	283.1	2.2(5)	M1
	1104.8	$0\text{-}2^-$	271.1	13.1(11)	m,(M1)
	1240.4	3^-	135.6	12(3)	
1380.9	3^-				
	192.9	1^-	1187.7	19(4)	m
	368.3	1^-	1012.8	7.3(7)	m
	381.2	3^+	999.7	30.1(15)	M1+E2
	482.3	4^+	898.5	19(2)	m
	764.5	4^-	616.4	5.6(8)	
	789.3	1^-	591.6	3.7(5)	m
	891.6	$1,2^-$	489.3	4.6(3)	m
	932.0	3^-	448.9	3.09(19)	
	1018.4	$1,2^-$	362.5	4.4(5)	m
	1061.3	3^-	319.6	2.4(3)	
1390.2	2^-				
	362.9	2^-	1027.1	24.9(13)	
	544.0	4^-	846.2	38(7)	
	672.7	$1,2^-$	717.7	13(2)	
	894.3	3^-	496.0	13.1(16)	
	1032.3	3^-	357.9	5.8(13)	m
	1160.0	3^-	230.2	4.5(8)	
1396.1	3^-				
	.0	2^-	1396.1	21.5(20)	m,M1
	247.6	1^-	1148.7	41.4(14)	M1
	346.9	2^-	1049.2	16.1(16)	M1
	362.9	2^-	1033.1	8.1(6)	m,M1
	896.6	$1,2^-$	499.6	1.94(22)	m
	932.0	3^-	464.2	1.14(11)	m
	987.6	3^-	408.6	3.09(11)	
	1038.3	3^-	357.9	2.5(6)	m
	1095.5	3^+	300.6	4.00(22)	
1399.4	$2,3^-$				
	55.2	1^-	1344.3	24(3)	M1
	381.2	3^+	1018.0	16(3)	
	625.4	3^-	774.1	8.3(12)	
	703.7	1^-	695.7	7.0(3)	
	786.5	2^-	612.9	13.6(24)	m
	801.7	$1,2^-$	597.7	5.8(4)	m
	824.6	3^+	574.8	15.4(3)	
	835.4	3^-	564.0	2.7(4)	m
	957.0	$1,2^-$	442.4	5.29(21)	m
	1061.3	3^-	338.1	.97(10)	
1402.1	$1,2^-$				
	215.0	4^-	1187.3	13.7(7)	m
	406.0	2^-	996.1	7.9(14)	m
	449.6	3^-	952.5	16.6(11)	(E2)
	529.2	3^-	872.9	8.5(11)	m
	571.2	1^-	830.8	6.3(8)	M1
	625.4	3^-	776.6	10.3(10)	m
	632.5	$1,2^-$	769.6	4.0(8)	m
	786.5	2^-	615.6	4.6(3)	m
	789.3	1^-	612.9	8.2(15)	m
	810.4	3^+	591.6	2.5(3)	m
	835.4	3^-	566.8	1.8(3)	m
	916.4	$1,2^-$	485.6	14.1(12)	
	918.6	$1,2^-$	483.4	.91(7)	m
1405.0	$2,3^-$				
	215.0	4^-	1189.8	30(6)	
	328.5	3^-	1076.4	18(2)	m
	672.7	$1,2^-$	732.2	29.8(12)	m,M1
	789.3	1^-	615.6	15.0(8)	m
	957.0	$1,2^-$	448.0	2.75(21)	
	1108.9	$1,^-$	296.0	3.1(6)	m
1409.4	3^-				
	192.9	1^-	1216.6	13.4(8)	m,E2
	346.9	2^-	1062.6	4.9(3)	
	381.2	3^+	1028.2	6.5(16)	
	571.2	1^-	838.2	7.7(12)	
	745.2	$1,2^-$	664.2	3.4(3)	

TABLE 2. (continuation).

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	894.3	3^-	515.1	6.2(3)	m
	1075.5	1-3^-	333.8	6.81(13)	M1
	1095.5	3^+	313.8	.64(13)	m
	1286.7	2^-	122.7	50(4)	
1418.7	3,4^+				
	406.0	2^-	1012.8	6.4(6)	m
	529.2	3^-	889.5	8.2(17)	
	625.4	3^-	793.4	2.7(8)	m
	632.5	1,2^-	786.2	6.6(10)	m
	672.7	1,2^-	746.1	15.1(8)	m
	758.4	4^+	660.3	7.3(5)	
	764.5	4^-	654.2	10.2(8)	M1
	801.7	1,2^-	617.0	2.2(3)	m
	824.6	3^+	594.2	4.8(8)	m
	957.0	1,2^-	461.7	1.35(8)	m
	960.6	3^+	458.0	33.1(3)	m,M1
	1032.3	3^-	386.4	.42(8)	m
	1104.8	0-2^-	313.8	1.1(3)	m
1423.8	3^-				
	236.0	3^-	1187.7	21(4)	m
	346.9	2^-	1076.8	16.5(20)	m
	362.9	2^-	1060.9	28.6(15)	M1
	625.4	3^-	798.4	12.3(14)	m,M1
	800.0	2^-	623.8	6.3(4)	M1
	835.4	3^-	588.4	9.69(22)	
	891.6	1,2^-	532.2	1.87(22)	m
	971.8	3^-	451.9	2.09(11)	
	1038.3	3^-	385.6	.77(11)	m
1431.6	2,3^-				
	.0	2^-	1431.4	10.1(21)	
	215.0	4^-	1216.6	15.2(9)	m,E2
	236.0	3^-	1195.5	10.5(7)	
	362.9	2^-	1068.5	3.8(3)	m
	406.0	2^-	1025.5	3.2(3)	m
	495.5	1^-	936.1	2.9(5)	
	511.5	3^-	920.1	5.9(13)	M1
	529.2	3^-	902.5	27.1(23)	
	625.4	3^-	806.1	4.6(5)	
	646.4	0^+	785.4	2.7(7)	m
	983.1	2^+	448.6	8.25(15)	
	1056.7	2^-	374.9	3.4(3)	m
	1075.5	1-3^-	356.1	.77(5)	
	1095.5	3^+	336.1	.31(5)	
	1108.9	1,$^-$	322.8	.7(4)	m
1434.6	1,2^-				
	55.2	1^-	1379.4	9.4(8)	M1
	247.6	1^-	1187.3	10.5(5)	m
	406.0	2^-	1028.6	31.0(22)	M1
	449.6	3^-	984.9	6.8(14)	
	548.9	2^-	885.6	11.4(12)	M1
	702.5	2^-	732.2	7.1(3)	m,M1
	703.7	1^-	730.8	4.5(14)	m
	896.6	1,2^-	538.0	1.56(10)	m
	987.6	3^-	447.0	1.00(5)	m
	1061.3	3^-	373.4	1.7(5)	
	1092.9	0^-	341.7	5.4(9)	
	1297.1	1-3^-	137.5	9(2)	m
1444.4	3^-				
	362.9	2^-	1081.6	31(7)	
	368.3	1^-	1076.4	21(3)	m
	453.8	2^-	990.6	22(7)	(M1)
	764.5	4^-	679.8	8.6(12)	
	786.5	2^-	657.8	7.1(22)	m
	891.6	1,2^-	553.0	8(4)	m
1453.9	3^-				
	346.9	2^-	1107.0	6.3(10)	M1
	368.3	1^-	1085.5	6.23(24)	
	406.0	2^-	1047.7	3.06(19)	
	637.1	4^+	816.6	1.4(3)	
	800.0	2^-	653.8	1.47(12)	m
	932.0	3^-	521.9	.53(10)	m
	951.4	3^+	502.5	5.3(11)	

	1032.3	3^-	421.6	.87(7)	
	1047.1	$1,2^-$	406.8	.169(24)	m
	1371.5	$1,2^-$	82.4	74(8)	E1
1459.0	3^-				
	482.3	4^+	976.5	15(3)	m
	511.5	3^-	947.6	17(4)	
	672.7	$1,2^-$	786.2	15.3(23)	m
	810.4	3^+	648.6	7.6(10)	m
	891.6	$1,2^-$	567.3	3.9(10)	
	894.3	3^-	564.7	5.1(6)	
	957.0	$1,2^-$	502.0	5.6(19)	
	971.8	3^-	487.2	15.7(8)	
	1061.3	3^-	397.7	1.76(19)	
	1108.9	$1,^-$	350.1	9.0(6)	
	1124.9	2^- 1146.	334.1	2.75(19)	m
1472.1	3^-				
	261.4	2^-	1210.7	14.9(13)	
	362.9	2^-	1109.3	36(6)	M1+E2
	495.5	1^-	976.5	4.3(9)	m
	511.5	3^-	960.5	5.4(4)	
	702.5	2^-	769.6	3.4(7)	m
	789.3	1^-	682.8	8.1(3)	
	896.6	$1,2^-$	575.5	2.76(22)	
	951.4	3^+	520.6	14(5)	m
	957.0	$1,2^-$	515.1	7.5(4)	m
	987.6	3^-	484.5	.88(11)	m
	1209.4	3^-	262.7	1.3(6)	
1475.6	2^-				
	236.0	3^-	1239.6	47(5)	m,E2
	529.2	3^-	946.5	9.6(4)	
	548.9	2^-	926.6	3.1(3)	m
	646.4	0^+	829.3	2.8(10)	
	758.4	4^+	717.3	7.1(15)	m
	918.6	$1,2^-$	557.0	2.5(3)	
	987.6	3^-	488.0	2.74(21)	
	1209.4	3^-	266.3	3.6(8)	
	1232.8	3^-	242.8	2.1(5)	m
	1240.4	3^-	235.3	1.3(7)	m
	1304.8	3^-	170.8	3.7(16)	
	1338.2	3^-	137.5	13(4)	m
1487.1	$1,2^-$				
	.0	2^-	1487.3	8.3(10)	m,M1
	55.2	1^-	1432.0	9.7(10)	
	91.0	0^-	1396.1	5.8(6)	m,M1
	215.0	4^-	1272.2	4.0(4)	m
	247.6	1^-	1239.6	20.7(22)	m,E2
	453.8	2^-	1033.1	2.22(15)	m,M1
	571.2	1^-	915.9	2.7(5)	m
	632.5	$1,2^-$	854.6	6.3(7)	M1
	987.6	3^-	499.6	.53(6)	m
	1032.3	3^-	454.9	1.31(6)	m
	1047.1	$1,2^-$	440.1	2.9(10)	
	1363.3	$1\text{-}3^-$	123.8	34(3)	
1496.2	3^-				
	406.0	2^-	1090.1	41(7)	M1
	1095.5	3^+	400.7	10.1(17)	m
	1363.3	$1\text{-}3^-$	132.9	48(9)	
1505.2	$1,2^-$				
	.0	2^-	1505.5	5.7(8)	m
	511.5	3^-	993.7	14(2)	
	571.2	1^-	933.9	33(9)	
	800.0	2^-	705.1	3.2(5)	
	932.0	3^-	573.3	9.2(3)	m
	957.0	$1,2^-$	548.2	1.5(3)	
	1047.1	$1,2^-$	458.0	20.72(21)	m,M1
	1061.3	3^-	443.9	6.1(10)	m
	1160.0	3^-	345.2	1.2(5)	m
	1256.0	$1,2^-$	249.2	.74(10)	
	1265.5	$1\text{-}3^-$	239.6	1.1(4)	m
	1338.2	3^-	167.0	1.7(3)	m,M1
1513.6	$1,2^-$				
	91.0	0^-	1422.7	3.6(7)	
	261.4	2^-	1252.1	6.1(8)	
	362.9	2^-	1150.6	12.3(9)	M1
	406.0	2^-	1107.7	25(3)	E2
	530.5	1^-	983.0	4.6(4)	m

TABLE 2. *(continuation)*.

E_i (keV)	E_f (keV)	I^π	E_γ (keV)	Branching (%)	Comment[a]
	632.5	$1,2^-$	881.0	3.7(8)	m
	672.7	$1,2^-$	840.8	3.0(9)	
	800.0	2^-	713.6	2.03(21)	
	824.6	3^+	689.0	7.7(6)	
	835.4	3^-	678.3	20(5)	
	896.6	$1,2^-$	617.0	.94(14)	m
	960.6	3^+	553.0	1.2(6)	m
	1047.1	$1,2^-$	466.5	2.98(10)	
	1115.3	3^-	398.3	4.88(14)	
	1306.8	2^-	206.7	.76(10)	
1530.7	$1,2^-$				
	.0	2^-	1530.6	28.6(22)	
	346.9	2^-	1183.8	29.5(21)	(M1,E2)
	453.8	2^-	1076.8	10.3(13)	m
	745.2	$1,2^-$	785.4	3.6(9)	m
	801.7	$1,2^-$	729.0	10.2(11)	M1
	891.6	$1,2^-$	639.0	4.06(20)	m
	918.6	$1,2^-$	612.1	4.00(20)	
	957.0	$1,2^-$	573.8	8.6(5)	
	1191.6	$1\text{-}3^+$	339.1	.82(7)	
1536.4	$0\text{-}3^-$				
	91.0	0^-	1445.5	5.3(9)	
	261.4	2^-	1275.1	9.9(10)	M1
	346.9	2^-	1189.3	3.2(3)	m
	482.3	4^+	1053.9	6.0(10)	
	495.5	1^-	1040.8	3.53(17)	m
	571.2	1^-	965.1	3.10(11)	
	702.5	2^-	833.9	4.1(3)	
	894.3	3^-	642.1	.40(9)	
	983.1	2^+	553.0	.9(5)	m
	1032.3	3^-	504.1	2.41(14)	
	1047.1	$1,2^-$	489.3	1.37(9)	m
	1202.3	2^-	334.1	.40(3)	m
	1240.4	3^-	296.0	.43(9)	m
	1272.1	3^-	264.2	2.41(22)	m
	1286.7	2^-	249.7	.63(17)	m
	1301.0	2^-	235.3	.5(3)	m
	1453.9	3^-	82.5	54(9)	
1542.8	3^-				
	55.2	1^-	1487.3	12.6(15)	m,M1
	259.3	1^-	1283.5	22(6)	
	261.4	2^-	1281.6	31(6)	(E1,E2)
	362.9	2^-	1179.9	7(2)	M1+E2
	495.5	1^-	1047.1	9.8(3)	m
	625.4	3^-	917.4	2.4(6)	M1
	758.4	4^+	784.4	1.8(9)	
	764.5	4^-	778.3	1.2(7)	
	800.0	2^-	742.9	2.8(10)	m
	835.4	3^-	707.4	3.5(3)	
	894.3	3^-	648.6	1.84(23)	m
	1157.2	3^-	385.6	.33(5)	m
	1272.1	3^-	270.6	2.5(9)	
1554.4	$1,2^-$				
	.0	2^-	1554.5	13(4)	
	192.9	1^-	1361.4	14.2(12)	M1
	328.5	3^-	1226.0	14.6(6)	M1+E2
	368.3	1^-	1186.3	8.7(22)	
	529.2	3^-	1025.5	2.47(19)	m
	548.9	2^-	1005.4	7.1(8)	
	625.4	3^-	929.0	6.7(8)	M1
	632.5	$1,2^-$	921.8	4.7(10)	M1
	786.5	2^-	767.9	5.2(4)	m
	789.3	1^-	765.1	8.5(4)	
	896.6	$1,2^-$	657.8	1.1(4)	m
	918.6	$1,2^-$	635.8	4.36(11)	M1
	957.0	$1,2^-$	597.5	.98(19)	m
	987.6	3^-	566.8	1.10(19)	m
	1056.7	2^-	497.7	1.25(8)	
	1075.5	$1\text{-}3^-$	478.8	.90(8)	
	1191.6	$1\text{-}3^+$	362.9	1.65(11)	
	1335.5	$1\text{-}3^-$	218.9	2.4(5)	(M1)
1560.4	3^-				
	55.2	1^-	1505.5	10.4(14)	m

	236.0	3^-	1324.4	24(2)	M1
	495.5	1^-	1064.8	19(3)	m
	544.0	4^-	1016.3	5.0(8)	m
	702.5	2^-	857.9	9.6(20)	
	703.7	1^-	856.6	10.6(20)	
	786.5	2^-	773.8	6.7(18)	m
	894.3	3^-	666.2	6.2(18)	
	1157.2	3^-	403.1	4.48(19)	
	1256.0	$1,2^-$	304.4	2.67(19)	
6512.5	1^+				
	.0	2^-	6512.6	5.0(3)	E1
	55.2	1^-	6457.4	7.3(4)	E1
	236.0	3^-	6276.9	3.2(5)	
	247.6	1^-	6265.0	1.7(3)	
	259.3	1^-	6253.1	9.0(9)	
	261.4	2^-	6251.1	5.3(9)	
	346.9	2^-	6165.6	.64(19)	
	362.9	2^-	6149.6	2.75(14)	
	368.3	1^-	6145.4	1.0(6)	
	406.0	2^-	6106.4	1.74(11)	
	529.2	3^-	5983.2	3.80(19)	
	571.2	1^-	5941.3	1.72(10)	
	632.5	$1,2^-$	5880.1	1.1(3)	
	672.7	$1,2^-$	5839.8	.5(3)	
	702.5	2^-	5808.3	.9(3)	m
	703.7	1^-	5808.3	.9(3)	m
	728.7	0^-	5783.8	.28(14)	
	745.2	$1,2^-$	5766.6	.33(11)	
	786.5	2^-	5724.4	2.0(6)	m
	789.3	1^-	5724.4	2.0(6)	m
	801.7	$1,2^-$	5710.7	4.73(24)	
	835.4	3^-	5677.4	.19(11)	
	868.8	3^-	5643.5	.21(11)	
	891.6	$1,2^-$	5620.7	1.2(3)	m
	894.3	3^-	5620.7	1.2(3)	m
	971.8	3^-	5540.0	.64(19)	
	987.6	3^-	5524.5	2.9(3)	
	1018.4	$1,2^-$	5493.8	1.5(3)	
	1032.3	3^-	5474.5	.76(19)	m
	1038.3	3^-	5474.5	.76(19)	m
	1056.7	2^-	5456.0	.28(14)	
	1092.9	0^-	5418.8	.35(11)	m
	1095.5	3^+	5418.8	.35(11)	m
	1209.4	3^-	5303.0	.71(19)	
	1232.8	3^-	5279.5	1.3(3)	
	1240.4	3^-	5272.1	1.4(7)	
	1265.5	$1\text{-}3^-$	5244.4	1.9(7)	m
	1272.1	3^-	5244.4	1.9(7)	m
	1286.7	2^-	5226.1	1.5(3)	
	1293.9	$1,2^-$	5217.8	.57(21)	m
	1297.1	$1\text{-}3^-$	5217.8	.57(21)	m
	1304.8	3^-	5206.4	.57(21)	m
	1306.8	2^-	5206.4	.57(21)	m
	1338.2	3^-	5174.7	.8(3)	
	1359.1	$1\text{-}3^-$	5153.5	2.1(11)	
	1363.3	$1\text{-}3^-$	5149.9	1.72(21)	
	1371.5	$1,2^-$	5141.1	1.29(21)	
	1390.2	2^-	5118.7	.69(11)	m
	1396.1	3^-	5118.7	.69(11)	m
	1399.4	$2,3^-$	5109.5	.57(11)	m
	1402.1	$1,2^-$	5109.5	.57(11)	m
	1405.0	$2,3^-$	5109.5	.57(11)	m
	1409.4	3^-	5103.0	3.25(21)	
	1423.8	3^-	5086.3	1.84(14)	
	1431.6	$2,3^-$	5080.9	.91(14)	
	1459.0	3^-	5053.7	.21(7)	
	1472.1	3^-	5042.5	.6(3)	
	1475.6	2^-	5035.2	.6(3)	
	1487.1	$1,2^-$	5024.6	.35(21)	
	1505.2	$1,2^-$	5007.5	.21(14)	
	1513.6	$1,2^-$	4999.1	1.1(3)	
	1530.7	$1,2^-$	4980.5	.33(11)	
	1536.4	$0\text{-}3^-$	4973.1	.21(11)	m
	1542.8	3^-	4973.1	.21(11)	m
	1554.4	$1,2^-$	4958.2	2.3(3)	

results used mainly old secondary (n,γ) lines [13], primary (n,γ) transitions [14], conversion electron data [15] and average resonance neutron capture (ARC) data [4]. Half–lives of several levels had also been measured [3]. ii) Ritz combinations of our new secondary (n,γ) measurements with the very precise GAMS spectrometers. iii) Multipolarities of the transitions determined with new (n,e) data from the BILL spectrometer. iv) Level energies, intensities and $\Delta\ell$–values of new (d,p) results. v) Summed γ–γ coincidences. The levels and their γ–decay modes are given in Table 2. The final level energies were calculated with a least squares fit to secondary γ–transitions (Table 2 of Ref. 1). The spins and parities were determined from multipolarities, branching ratios, ARC and transfered $\Delta\ell$–values. In Table 1, the levels from the Ritz combination of secondary γ–rays (Table 1 of Ref. 1 and the present Table 2) and from the summed coincidences [16] are compared. The agreement is very good.

One of the changes compared to our previous results [4] is the decay of the 381.2 keV level. The E1 character of all transitions to negative–parity states is well established confirming the 3^+ spin–parity of this level [3].

3. Calculation of level densities in IBFFM and GPM

The calculation for ^{198}Au was performed previously up to 0.9 MeV [3] in IBFFM [5,6] by coupling valence–shell proton and neutron quasiparticles to the IBM boson core [7,8]. In the first step, the boson core was fitted to the even–even nucleus ^{200}Hg in the O(6) limit [8,17]. Employing the parametrization from Ref. 4, we have performed the IBFFM calculation of energy levels up to 4.5 MeV. In Table 3, the calculated spectrum up to 1.5 MeV is is given. In Fig. 1a, we present the IBFFM cummulative number of levels $J^\pi=1^-,2^-,3^-$ as function of energy, in comparison to the present data. In Fig.1b, the corresponding level densities are shown.

TABLE 3.

IBFFM energy spectrum of ^{198}Au up to 1.5 MeV. *S – spin and P – parity.*

S	*P*	*ENERGY*	*S*	*P*	*ENERGY*	*S*	*P*	*ENERGY*	*S*	*P*	*ENERGY*
2	-	0.0000	6	+	0.4711	5	-	0.6208	5	+	0.7293
1	-	0.0199	7	+	0.4831	3	-	0.6414	2	+	0.7415
0	-	0.0373	2	-	0.4968	4	-	0.6451	6	-	0.7446
1	-	0.1143	2	-	0.5059	2	-	0.6525	7	+	0.7495
1	-	0.1877	1	-	0.5090	6	+	0.6559	3	+	0.7576
2	-	0.2011	4	-	0.5116	8	+	0.6602	5	-	0.7577
4	-	0.2249	3	-	0.5130	4	-	0.6631	3	-	0.7614
3	-	0.2814	5	-	0.5178	7	+	0.6635	2	-	0.7633
2	-	0.2891	3	-	0.5398	2	-	0.6669	5	+	0.7711
5	+	0.3122	0	-	0.5569	5	-	0.6683	6	+	0.7742
0	-	0.3173	6	+	0.5610	1	-	0.6696	4	-	0.7771
3	-	0.3226	3	-	0.5780	3	-	0.6798	3	+	0.7836
4	-	0.3468	1	-	0.5798	6	+	0.6803	1	-	0.7849
2	-	0.3510	2	-	0.5807	4	+	0.6957	3	-	0.7887
3	-	0.3655	5	+	0.5888	4	+	0.7074	2	+	0.7941
3	+	0.3876	1	-	0.5922	2	-	0.7098	4	+	0.7976
2	-	0.3989	7	+	0.5946	0	-	0.7118	8	+	0.7984
1	-	0.4021	4	-	0.6012	1	-	0.7163	3	+	0.8048
3	-	0.4123	2	-	0.6025	5	-	0.7234	1	+	0.8075
4	+	0.4250	6	-	0.6055	4	-	0.7243	7	+	0.8084
5	+	0.4360	0	-	0.6183	1	-	0.7279	9	+	0.8143

TABLE 3. (continuation).

S	P	$ENERGY$	S	P	$ENERGY$	S	P	$ENERGY$
12	-	0.8180	4	-	1.0086	1	-	1.1396
4	-	0.8201	3	-	1.0100	5	+	1.1405
8	+	0.8230	5	+	1.0120	2	+	1.1434
2	-	0.8314	7	+	1.0138	3	+	1.1468
8	+	0.8414	5	+	1.0138	7	-	1.1487
6	+	0.8477	5	+	1.0165	11	+	1.1516
7	+	0.8498	6	-	1.0194	2	-	1.1522
4	-	0.8504	3	-	1.0203	5	+	1.1530
2	-	0.8508	2	-	1.0216	2	-	1.1545
5	+	0.8543	5	-	1.0228	6	+	1.1546
3	-	0.8544	4	+	1.0236	9	+	1.1561
6	-	0.8560	2	-	1.0245	10	+	1.1565
4	+	0.8582	11	-	1.0262	13	-	1.1638
0	-	0.8586	8	-	1.0298	2	+	1.1644
5	+	0.8646	3	+	1.0410	7	+	1.1670
4	+	0.8684	6	+	1.0449	1	-	1.1674
4	-	0.8690	7	+	1.0524	8	+	1.1677
5	-	0.8765	3	-	1.0542	9	+	1.1685
3	-	0.8773	8	+	1.0552	8	-	1.1696
8	+	0.8775	7	-	1.0563	6	-	1.1704
3	-	0.8782	4	-	1.0599	7	+	1.1712
5	-	0.8853	2	-	1.0600	1	+	1.1717
7	-	0.8904	6	+	1.0613	10	+	1.1740
6	+	0.8920	7	+	1.0614	2	-	1.1747
2	-	0.8926	1	-	1.0661	4	+	1.1761
7	+	0.8979	7	+	1.0687	3	-	1.1781
5	+	0.9044	9	+	1.0715	4	-	1.1785
1	-	0.9045	3	-	1.0738	5	-	1.1854
4	+	0.9046	0	+	1.0749	9	+	1.1858
6	-	0.9052	1	-	1.0760	3	-	1.1862
3	-	0.9115	6	+	1.0819	5	-	1.1871
4	-	0.9216	6	+	1.0878	1	+	1.1891
3	+	0.9217	2	-	1.0913	3	+	1.1895
8	+	0.9244	5	+	1.0915	4	+	1.1912
2	-	0.9247	3	+	1.0921	2	+	1.1925
6	+	0.9269	5	-	1.0921	2	-	1.1953
4	-	0.9342	1	+	1.0923	7	+	1.1998
7	+	0.9392	4	+	1.0928	1	-	1.2006
5	-	0.9408	8	+	1.0944	6	-	1.2009
6	+	0.9436	6	-	1.0963	4	+	1.2010
9	+	0.9458	6	+	1.0966	14	-	1.2018
3	-	0.9485	2	+	1.0991	10	-	1.2031
2	-	0.9523	4	+	1.1050	3	+	1.2035
5	+	0.9536	7	+	1.1096	3	-	1.2041
1	-	0.9608	0	-	1.1102	4	-	1.2055
8	+	0.9625	8	+	1.1106	1	-	1.2058
7	+	0.9694	4	-	1.1126	2	+	1.2083
4	-	0.9703	3	-	1.1142	11	-	1.2094
9	+	0.9718	1	+	1.1143	8	+	1.2114
2	-	0.9754	5	+	1.1168	7	-	1.2132
9	+	0.9857	2	+	1.1239	10	+	1.2147
3	-	0.9865	2	-	1.1253	8	+	1.2211
5	-	0.9869	3	-	1.1257	6	+	1.2215
7	-	0.9879	10	+	1.1281	2	-	1.2245
6	-	0.9905	7	-	1.1291	3	+	1.2247
10	+	0.9957	6	-	1.1295	5	+	1.2255
6	+	0.9994	4	-	1.1316	4	+	1.2265
4	-	1.0009	5	-	1.1323	7	+	1.2273
1	-	1.0068	3	+	1.1334	6	-	1.2277

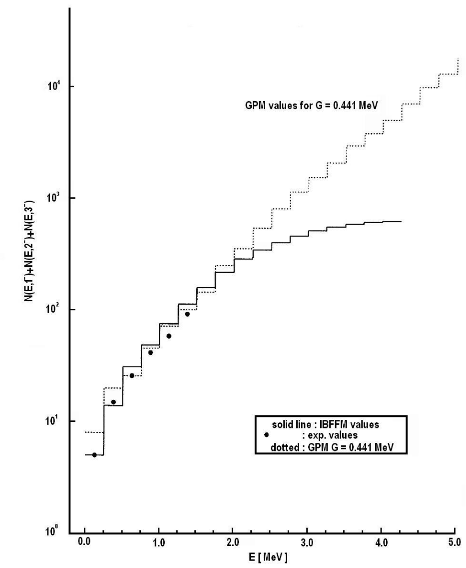
TABLE 3. (continuation).

S	*P*	*ENERGY*	*S*	*P*	*ENERGY*	*S*	*P*	*ENERGY*
8	-	1.2291	5	-	1.3196	6	+	1.4036
9	+	1.2293	9	-	1.3197	7	+	1.4039
5	-	1.2318	4	+	1.3205	4	+	1.4047
4	+	1.2327	1	+	1.3213	4	-	1.4060
1	-	1.2374	10	+	1.3214	11	+	1.4061
6	-	1.2378	9	+	1.3235	3	-	1.4073
9	+	1.2384	5	+	1.3250	8	+	1.4073
0	-	1.2396	2	-	1.3268	8	-	1.4080
6	+	1.2398	5	+	1.3287	5	-	1.4089
6	+	1.2398	4	-	1.3288	9	+	1.4110
7	+	1.2430	3	+	1.3298	6	+	1.4130
4	-	1.2500	11	+	1.3319	4	-	1.4131
10	+	1.2502	10	-	1.3346	7	-	1.4132
5	+	1.2503	1	-	1.3368	6	+	1.4135
3	-	1.2503	12	-	1.3399	3	+	1.4157
5	+	1.2572	6	+	1.3406	2	+	1.4161
6	-	1.2600	4	+	1.3431	6	-	1.4165
4	-	1.2602	6	-	1.3441	4	+	1.4183
11	+	1.2614	2	-	1.3449	10	-	1.4184
8	+	1.2645	8	+	1.3460	1	+	1.4187
6	+	1.2647	3	-	1.3460	2	+	1.4188
1	-	1.2652	3	-	1.3482	3	-	1.4221
0	-	1.2653	3	+	1.3500	7	+	1.4225
7	+	1.2686	7	+	1.3516	2	-	1.4241
2	-	1.2696	5	+	1.3518	6	+	1.4257
5	-	1.2696	2	+	1.3527	4	-	1.4275
8	+	1.2735	2	-	1.3573	0	-	1.4280
5	+	1.2738	4	-	1.3583	4	-	1.4280
3	-	1.2764	5	-	1.3593	3	-	1.4290
6	+	1.2771	9	+	1.3604	1	-	1.4292
7	+	1.2812	4	+	1.3607	5	+	1.4302
1	-	1.2815	4	-	1.3617	10	+	1.4316
2	-	1.2815	3	-	1.3630	4	+	1.4324
7	+	1.2837	4	+	1.3631	12	-	1.4326
7	-	1.2856	13	-	1.3646	5	+	1.4343
7	-	1.2861	3	+	1.3654	1	-	1.4350
9	+	1.2866	8	-	1.3674	7	-	1.4353
3	-	1.2889	9	-	1.3684	2	+	1.4354
9	-	1.2892	6	+	1.3694	8	+	1.4376
5	-	1.2905	5	+	1.3694	7	+	1.4385
0	-	1.2919	10	+	1.3751	3	+	1.4396
11	+	1.2922	4	+	1.3758	1	+	1.4417
4	-	1.2930	5	+	1.3766	5	-	1.4472
8	-	1.2945	5	-	1.3784	4	+	1.4486
3	+	1.2965	2	+	1.3785	8	+	1.4486
8	+	1.2977	6	-	1.3798	1	-	1.4491
6	+	1.2992	8	+	1.3803	2	-	1.4508
8	+	1.3026	2	-	1.3837	5	+	1.4510
4	+	1.3039	7	-	1.3845	3	-	1.4532
2	+	1.3040	9	+	1.3847	7	+	1.4533
4	-	1.3040	3	+	1.3862	0	+	1.4541
1	-	1.3051	1	-	1.3903	3	-	1.4556
4	+	1.3069	2	-	1.3905	10	+	1.4584
3	+	1.3076	6	-	1.3939	8	+	1.4588
5	+	1.3108	5	+	1.3955	4	-	1.4607
2	-	1.3112	5	+	1.3980	6	-	1.4609
12	+	1.3116	6	+	1.3983	8	-	1.4619
3	-	1.3134	5	-	1.3983	5	+	1.4636
6	+	1.3141	4	+	1.3992	7	+	1.4639
7	+	1.3152	9	+	1.3997	12	+	1.4655
0	-	1.3167	1	-	1.4033	8	-	1.4688

TABLE 3. (continuation).

S	*P*	*ENERGY*	*S*	*P*	*ENERGY*	*S*	*P*	*ENERGY*	*S*	*P*	*ENERGY*
6	+	1.4692	3	+	1.4788	7	-	1.4871	3	+	1.4945
2	-	1.4692	1	+	1.4791	7	+	1.4880	2	-	1.4949
2	-	1.4742	4	-	1.4798	10	+	1.4899	3	-	1.4951
12	+	1.4747	6	+	1.4808	3	-	1.4914	13	+	1.4972
5	-	1.4747	9	+	1.4830	11	+	1.4919	7	-	1.4975
8	+	1.4760	2	+	1.4833	0	-	1.4920	3	+	1.4979
0	+	1.4772	4	+	1.4840	2	-	1.4926	3	-	1.4980
4	+	1.4773	10	+	1.4846	9	-	1.4927	9	+	1.4983
7	+	1.4775	11	+	1.4867	10	-	1.4927	5	-	1.4987
5	+	1.4782	4	-	1.4871	3	-	1.4932	6	+	1.4988

The calculation of energy spectrum of ^{198}Au was also performed using the Gaussian polynomial (GPM) method from Ref. 18 with Seegers single–particle energies. The GPM gives an exact energy spectrum of the Hamiltonian consisting of a single–particle part and a pairing force that acts only within the levels. The effective strength of this diagonal pairing force is fitted to the experimental level density of the $J^{\pi}=1^{+},2^{+}$ levels, obtained from the neutron resonance data [19,20], as shown in Fig. 2. Using this value of the effective pairing strength G, we have calculated the corresponding level density (Figs.1a and b).



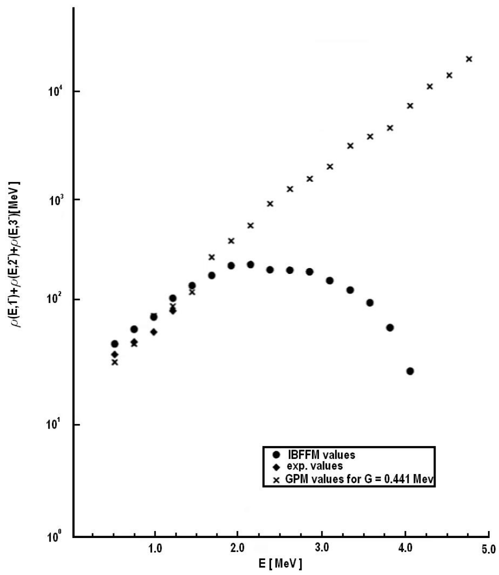


Fig. 1a. Cummulative number of states $J^{\pi}=1^{-},2^{-},3^{-}$ in ^{198}Au *up to* 5 MeV, *calculated in IBFFM (solid line) and GPM (dotted line) in comparison to the present experimental data (closed circles).*
Fig. 1b. Level density of combined levels $J^{\pi}=1^{-},2^{-},3^{-}$ in ^{198}Au *up to* 5 MeV, *calculated in IBFFM (closed circles) and GPM (×'s) in comparison to the present experimental data (closed diamonds).*

As seen from Fig.1b, up to ≈1.2 MeV, the IBFFM and GPM results are rather close to each other. The experimental value have a similar trend, lying slightly below the IBFFM results. This is in accordance with the expectation that the IBFFM levels capture most of the states in the low–energy region. However, with increasing energy, an increasing fraction of states is expected to lie outside the frame of the IBFFM model space. In particular, one could expect additional states arising from an extension to the IBM2 approach [8], with neutron and proton bosons with different values for the single boson energies, before invoking extension of the boson space, octupole and other degrees of freedom. Thus, the present IBFFM spectrum represent only a subset of the total energy spectrum of ^{198}Au. The actual level density of a nucleus increases with the excitation energy, but the IBFFM level density, similarly as in the case of shell–model level densities [20,21], is based on a finite spectroscopic space. Hence, the IBFFM level densities should coincide with the actual level densities only up to some critical excitation energy, and above this energy the model space should rapidly fall below the actual space. In the present case, we find the critical excitation energy 1.2 MeV. In fact, the whole IBFFM spectrum could be approximately fitted by the Gaussian, as demostrated for the ^{132}Pr IBFFM calculation in Ref. 22.

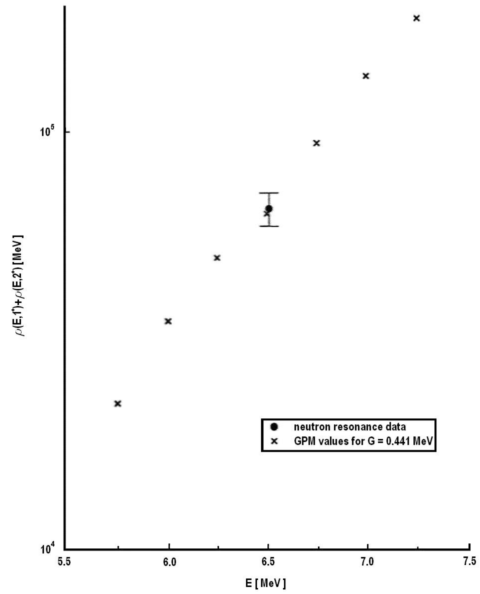
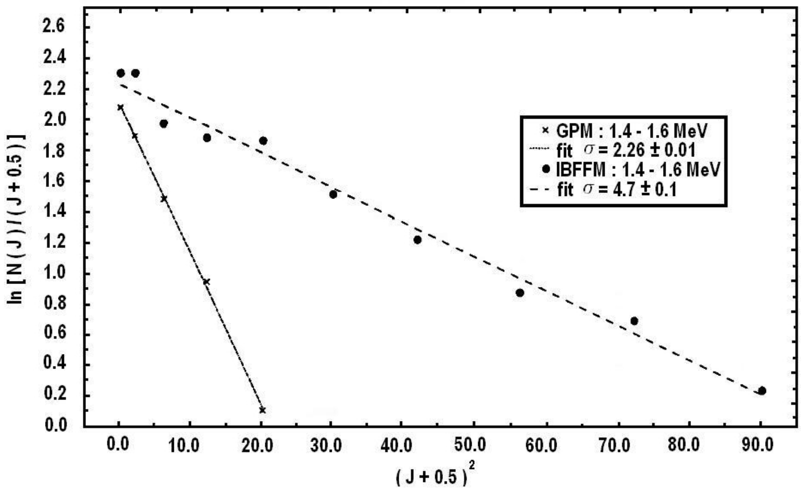


Fig. 2. Level density of the combined levels $J^\pi = 1^+, 2^+$ calculated in GPM by fitting to the experimental neutron resonance data (closed circle).

Above the energy $\bar{E}$ ≈1.2 MeV, the actual level density is described by the GPM calculation in Fig. 1b. Above the low–energy section, the GPM level density approximately corresponds to the Bethe formula.



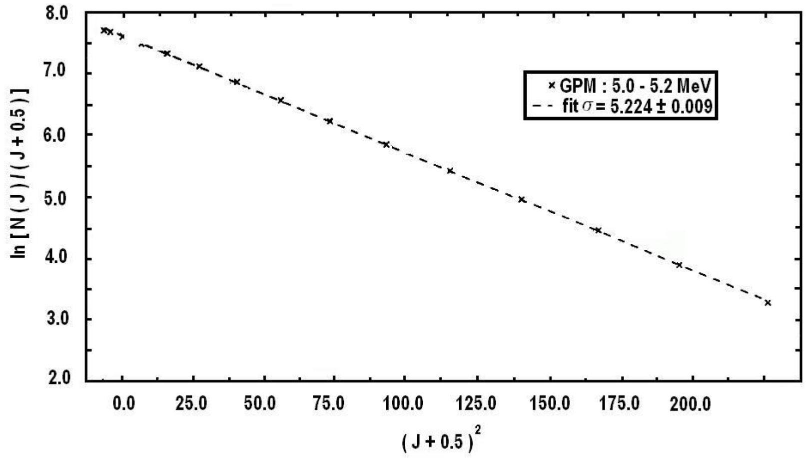


Fig. 3. Calculated spin distribution for ^{198}Au. *The calculated values denoted by* $y_H = \ln[N(J)_{E,E+\Delta E}/(J+\frac{1}{2})]$ *are presented for the energy intervals (a)* $1.4 - 1.6$ MeV *and (b)* $5.0 - 5.2$ MeV. *The IBFFM results are presented by closed circles (diagram a) and GPM results by (×'s) (diagrams a nad b).* $N(J)_{E,E+\Delta E}$ *denotes the number of levels of spin J obtained by IBFFM or GPM calculations in the corresponding energy interval. Dashed lines present the fits of the spin–dependent Bethe formula to the states of spin 0-10. The fitted value of the spin cut–off parameter* σ *is 4.7 for IBFFM results in diagram a, 2.26 for GPM results in diagram a and 5.224 for GPM results in diagram b.*

We have also investigated the IBFFM and GPM spin distributions. In Fig. 3 we present the spin distributions corresponding to the IBFFM and GPM calculations for two energy intervals: 1.4–1.6 MeV and 5.0–5.2 MeV. The plots of $\ln[N(J)_{E,E+\Delta E}/(J+\frac{1}{2})]$ versus $(J+\frac{1}{2})^2$ are displayed and the spin–dependent Bethe formula is presented by a straight line in this diagram. As seen from Fig. 3, the IBFFM and GPM calculations for ^{198}Au are in approximate accordance with prediction of the Bethe formula.

4. *Conclusions*

Compared to previous data on ^{198}Au, the level scheme is now well established and very precise up to 1560 keV. Information on 132 levels, mostly with spin and parity assignments, was obtained. As a consequence of the ARC measurements, the level scheme is supposed to be complete for levels with spin and parity 0^-, 1^-, $2^-$and 3^-up to 700 keV. Levels with positive parity are much less frequent and start at 312 keV. Since ARC intensities are smaller for positive parities in our case, the completeness is less guaranteed for 0^+– 3^+levels. Due to such a large number of levels with detailed spectroscopic information, ^{198}Au is now among the best experimentally studied nuclei. It is, therefore, an ideal example to test models for transitional heavy odd–odd nuclei.

Here we have performed the total level density calculations up tp 4.5 MeV by using the restricted IBFFM configuration space and generating function method. Up to the energy of 1.2 MeV, the two calculated level densities and experimental level density in the spin/parity window $J^\pi=1^-,2^-,3^-$ are in an approximate agreement. Above this energy the actual level density is expected to be described by the GPM result, while the IBFFM result falls rapidly below due to effect of truncation of the configuration space. It is also found that the spin distributions in both model calculations are in an approximate accordance with the spin–dependent Bethe formula, and the value of the spin cut–off parameter σ in GPM increases with increasing energy.

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PROUČAVANJE JEZGRE ^{198}Au POMOĆU NEUTRONSKOG UHVATA I (d,p) REAKCIJOM
II. KONSTRUKCIJA SHEME NIVOA I IZRAČUNAVANJE GUSTOĆE NIVOA

Sastavljena je shema raspada ^{198}Au. Do energije uzbude od 1560 keV, uključeno je 111 stanja određenih (d,p) reakcijom i 125 stanja (n,γ) reakcijom. Za mnoga stanja određeni su momenti impulsa i parnost. Primjenom modela uzajamno djelujućih bozon–fermion–fermiona i metode Gaussovih polinoma, izračunate su gustoće stanja i uspoređene s izmjerenim vrijednostima.