ROTATIONAL PROPERTIES OF ONE-QUASIPARTICLE EXCITED STATES OF ODD-A RARE-EARTH NUCLEI

By A. Superson

Institute of Physics, Maria Curie-Skłodowska University, Lublin*

and K. Pomorski**

Institute of Theoretical Physics, University of Regensburg, D-8400 Regensburg, W. Germany

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The theoretical values of the moments of inertia and Coriolis decoupling parameters are obtained foi the odd-A rare-earth nuclei in the ground and the one-quasiparticle excited states. Both these parameters are evaluated within the cranking model and in the adiabatic approximation. The quadrupolly and hexadecapolly deformed Nilsson potential is used. The BCS approximation for the pairing forces is applied.

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1. Introduction

The coupling of the single-particle motion of the odd-valence nucleon to the collective rotation of the even-even core has the significant influence on the position of the excited states of odd-A nuclei. We will discuss the moments of inertia and the Coriolis decoupling parameters in the ground and the excited one-quasiparticle states of the odd-Z and the odd-N nuclei from the rare-earth region.

The energies of the rotational series $E_K(I)$ built on the one-quasiparticle level E_K are given by the formula [1, 2]:

$$E_K(I) = E_K+\frac{\hbar^2}{2J(K)}\{[I(I+1)-K^2]+a(-1)^{I+\frac{1}{2}}(I+\tfrac{1}{2})\delta_{K,\frac{1}{2}}, \tag{1}$$

where I is the total angular momentum and K is its z-component in the intrinsic coordinate system, $J(K)$ is the moment of inertia of a nucleus in the excited state $|K\rangle$ and a is the decoupling parameter occurring in the $K = 1/2$ bands.

* Address: Instytut Fizyki UMCS, Nowotki 10, 20-031 Lublin, Poland.

** On leave of absence from: Department of Theoretical Physics, University MCS, Lublin, Poland.

The moment of inertia is evaluated in the cranking approximation [3, 4]. The Nilsson modified harmonic-oscillator potential is used in our calculations and the residual pairing interaction is included within BCS approximation [5]. The moment of inertia of an odd-A nucleus is equal to the sum of the moments of inertia of proton (odd or even) and neutron (even or odd) systems:

$$J = J_{Z(N)\mathrm{odd}} + J_{N(Z)\mathrm{even}}. \quad (2)$$

The odd particle number system can be in different excited one-quasiparticle states, the even system is assumed to be in the ground BCS state.

The formula for the ground-state moment of inertia of an even particle number system and in the presence of the pairing correlations was developed in Ref. [4]. The similar formula for the moment of inertia of an odd system is given in Ref. [6].

The Coriolis decoupling parameter is simply proportional to the expected value of $\hat{j}_+$ operator between one quasiparticle states $K_\mu = \frac{1}{2}$ [2]:

$$a_\mu = -\langle K_\mu = \tfrac{1}{2} | \hat{j}_+ | \overline{K_\mu = \tfrac{1}{2}} \rangle. \quad (3)$$

The quantities J and a_μ presented here are obtained microscopically without any renormalization and nonstandard phenomenological parameters.

The blocking effect by solving the BCS is generally not taken into consideration, but we discuss its influence on the final results.

The microscopic parameters J and a_μ are evaluated in the potential energy equilibrium points on the $(\varepsilon, \varepsilon_4)$ plane. These equilibrium deformations are obtained in Ref. [7–12] by the Strutinsky shell correction method [5].

Similar results to those given in this paper but for the ground states only are reported in the paper [13] where one can find more details concering calculations.

2. *Results of the calculations*

The numerical calculations are performed with the standard values of the Nilsson potential parameters and the strength of the pairing forces. The parameters μ and κ of the Nilsson potential are listed in Table I for various Z and mass regions of the rare--earth nuclei. These parameters are taken from the papers which references are written in the lowest row of Table I. The theoretical equilibrium deformations of the considered here nuclei are also evaluated in these papers. The pairing strength and the harmonic energy units $\hbar\omega_0$ in the Nilsson potential are taken from Ref. [5].

The nine lowest shells for protons and ten for neutrons are taken into account. The coupling of the harmonic oscillator shells via the hexadecapole term in the Nilsson potential is included.

The theoretical and experimental values of the moments of inertia for the ground and lowest excited states of the odd-Z nuclei are listed in Table II. The equilibrium deformations $\varepsilon^{\mathrm{eq}}$ and $\varepsilon_4^{\mathrm{eq}}$ of the ground state (columns 2 and 3) are taken from Ref. [a–d] (listed in Table I) written in the column 4. The value of the moment of inertia $2/\hbar^2 J_{\mathrm{ee}}$ evaluated

TABLE I

The parameters of the Nilsson potential

	a				b	c	d	
	Z				"A = 161"	"A = 178"	"A = 165"	"A = 187"
	63–65	67–69	71–73	75				
κ_p	0.0648	0.0637	0.0628	0.0620	0.0641	0.0624	0.0637	0.0620
μ_p	0.591	0.600	0.608	0.614	0.597	0.609	0.600	0.614
κ_n	0.0637	0.0637	0.0636	0.0636	0.0637	0.0636	0.0637	0.0636
μ_n	0.438	0.438	0.405	0.393	0.425	0.404	0.420	0.393
Ref.	[7]				[8]	[9, 10]	[11, 12]	

a — Z-odd, b, c, d — N-odd.

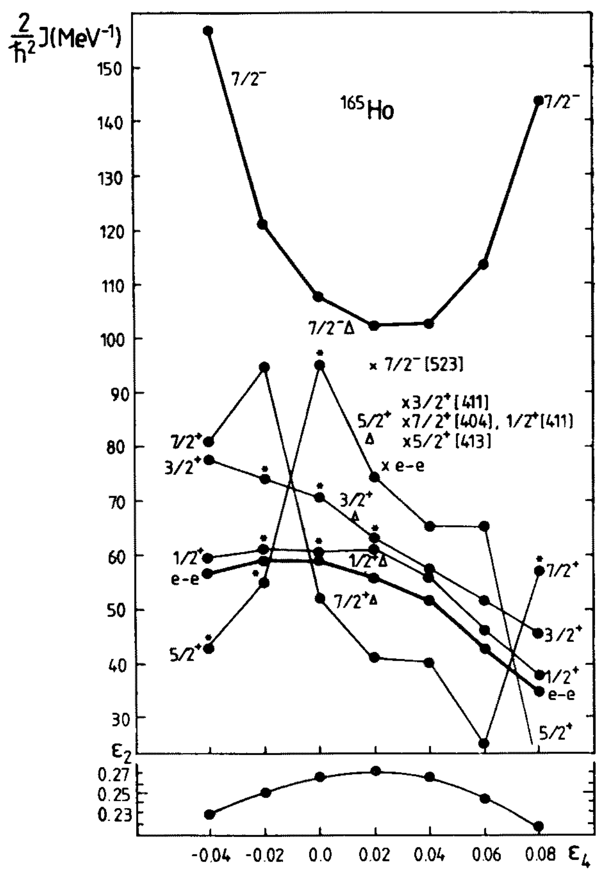

Fig. 1. Dependence on deformations of the moment of inertia of ^{165}Ho in the ground and excited states. Experimental values of J are marked by crosses

The theoretical and experimental values of the moments of inertia in

	ε^{eq}	ε_4^{eq}	Ref.			
				e−e	$\frac{5}{2}^-[532]$	$\frac{5}{2}^+[413]$
1	2	3	4	5	6	7
^{153}Eu	0.235	−0.038	a	49.54 49.02	129.08 129.87	67.50* 84.03
^{155}Eu	0.245	−0.038	a	58.93 69.93	131.33 108.70	75.24* 89.29
^{155}Tb	0.235	−0.028	a	45.29 45.90	277.74* 303.95	60.16* 109.89
^{157}Tb	0.250	−0.028	a	54.16 63.70	270.82* 222.00	64.99* 87.18
^{159}Tb	0.255	−0.024	a	55.93 72.50	270.06* 271.00	65.42* 86.21
^{161}Tb	0.260	−0.015	a	58.72 76.90	161.42 66.20	66.71* 87.70
^{161}Ho	0.254	−0.012	a	51.58 63.69	44.83	45.74
^{163}Ho	0.264	−0.002	a	55.70 69.93	55.37	91.51*
^{165}Ho	0.271	0.009	a	58.92 78.13	63.61	81.04 82.62
^{167}Tm	0.270	0.017	a	56.01 71.43		56.15
^{169}Tm	0.276	0.029	a	58.94 72.99		59.53
^{171}Tm	0.280	0.038	a	63.29 75.76		64.15
^{171}Lu	0.265	0.028	a	54.40 67.11		
^{173}Lu	0.269	0.038	a	58.33 70.92		
^{175}Lu	0.266	0.047	a	61.69 72.99		
^{177}Lu	0.259	0.057	a	59.76 68.49		

TABLE II

the ground and lowest excited states of the odd-Z rare-earth nuclei

$\frac{2}{\hbar^2} J(\varepsilon^{eq}, \varepsilon_4^{eq}; K)$ [MeV^{-1}]

$\frac{3}{2}^+[411]$	$\frac{7}{2}^-[523]$	$\frac{1}{2}^+[411]$	$\frac{7}{2}^+[404]$	$\frac{9}{2}^-[514]$	$\frac{5}{2}^+[402]$	$\frac{1}{2}^-[541]$
8	9	10	11	12	13	14
54.22 71.94						
67.27* 81.30						
58.49* 76.34	191.89 63.05	50.17				
66.11* 81.97	188.42 65.49	58.50				
67.43* 86.21	187.11 69.01	60.07 83.30				
69.70* 89.29	246.38* 125.79	62.60				
64.36* 67.25	107.05 90.91	52.84* 88.60	85.62* 76.22			
66.74* 62.42	104.11 98.04	56.79* 99.30	49.92 79.94			
65.45 86.21	103.66 95.24	63.46* 85.47	38.86 85.47			
80.93* 57.27	110.55 99.00	59.10 80.65	58.70 77.52	46.46*	39.77 43.38	83.35 104.82
73.94	113.52 96.15	61.85 80.65	60.73 76.92	47.98*	46.27	92.22 108.93
74.88 81.97	118.08 94.79	66.09 83.33	64.56	50.99*	54.12 81.70	101.79 112.74
	37.86* 71.43	57.30 75.76	56.24 73.53	99.73 88.50	54.78 70.42	92.45 (92.59)
	53.56	61.03 78.74	59.43 76.79	88.07 53.62	58.29	104.70 116.28
	64.74	64.23 74.13	62.40 79.37	84.60 82.78	61.33 78.13	123.70 127.40
	89.29	62.14 70.42	60.17 76.92	78.94 79.37	59.10 74.63	160.57 141.24

	ε^{eq}	ε_4^{eq}	Ref.			
				e—e	$\frac{5}{2}^-[532]$	$\frac{5}{2}^+[413]$
1	2	3	4	5	6	7
^{177}Ta	0.254	0.046	a	54.64 60.61		
^{179}Ta	0.247	0.057	a	53.90 60.98		
^{181}Ta	0.241	0.067	a	60.23 62.11		
^{183}Ta	0.230	0.072	a	50.80 57.41		
^{181}Re	0.232	0.054	a	50.57 52.08		
^{183}Re	0.225	0.064	a	54.14 54.64		
^{185}Re	0.215	0.067	a	47.70 48.31		
^{187}Re	0.200	0.067	a	41.78 43.29		

as for the even-even system is given in the next column. The values of the moments of inertia in the one-quasiparticle states are written in the columns 6–14. The theoretical values are in the upper rows and the experimental data are in the lower rows. The experimental values are taken in most cases from the compilation made in Ref. [2] and in the others are obtained from the data listed in Ref. [14] using the formula (1). The values which correspond to the ground state are underlined. In the cases when the theory predicts a different ground state from the experimental one the moment of inertia in the theoretical ground state is underlined by the dashed line. The asterisk indicates the case when the single--particle levels cross close to the Fermi surface and the adiabatic approximation may not be valid in this case. We have assumed in this case that the effect of the quantum repulsion of the levels makes the distance between them not smaller than 100 keV, what corresponds on average to the lowest observed experimentally noncollective excitations of nuclei. For discussion of the levels crossing problem confer for example Ref. [15]. The results for the odd-N nuclei are presented in Table III.

The theoretical and experimental Coriolis decoupling parameters occurring in the states with $K = \frac{1}{2}$ are given in Table IV for the odd-Z nuclei and in Table V for the odd-N nuclei. The meaning of the columns and rows description in the Tables III–V is similar.

TABLE II (continued)

$\frac{2}{\hbar^2} J(\varepsilon^{eq}, \varepsilon_4^{eq}; K)$ [MeV^{-1}]

$\frac{3}{2}^+$[411]	$\frac{7}{2}^-$[523]	$\frac{1}{2}^+$[411]	$\frac{7}{2}^+$[404]	$\frac{9}{2}^-$[514]	$\frac{5}{2}^+$[402]	$\frac{1}{2}^-$[541]
8	9	10	11	12	13	14
	66.80	57.37 62.89	$\frac{58.58^*}{68.49}$	73.97 74.07	53.20* 68.97	129.29 136.05
	69.66	56.40 62.77	$\frac{57.64^*}{67.14}$	72.49 73.26	52.29* 66.40	184.97
	79.39	62.51	$\frac{63.77^*}{66.23}$	78.48 71.94	58.48*	258.32*
	73.51	52.87	$\frac{54.43^*}{62.89}$	70.01	48.98* 61.73	207.19
		54.91	52.67	71.68 66.93	$\frac{52.89}{59.52}$	202.65
		58.39	56.24 59.52	74.98 65.36	$\frac{56.33}{61.35}$	256.77*
		51.30	49.97	69.50 65.36	$\frac{49.90}{55.87}$	249.74*
		44.55	44.17	65.12 60.27	$\frac{44.00}{52.08}$	212.61

Our theoretical predictions for the moments of inertia are on the average by about 25–30% smaller than the experimental values; only for the states with extremely large moment of inertia the theoretical values are larger by about 10–15%. The theoretical values better reproduce the experimental data for the states closer to the Fermi surface.

The Coriolis decoupling parameters evaluated in the cranking model agree reasonably well with the experimental data except the case of the one-quasiparticle state $1/2^+$ [411] where we have got the opposite sign.

3. *Discussion*

Our theoretical estimates of the moments of inertia are dependent on some parameters of calculations. We will not test here the validity of the cranking model and the adiabatic approximation in the case of the odd-A nuclei. Such validity is an open question and a test of it needs rather extensive computations. It seems, however, that the investigation of the dependence of the moment of inertia on some parameters of calculation will give us some information on the accuracy of our theoretical estimates.

The equilibrium deformation can be one of such parameters. In Fig. 1, there is plotted the dependence of the moment of inertia of the nucleus ^{165}Ho on deformations in the ground

The same as in Table II, but

	ε^{eq}	ε_4^{eq}	Ref.						
				e−e	$\frac{3}{2}^-$[532]	$\frac{11}{2}^-$[505]	$\frac{3}{2}^-$[521]	$\frac{5}{2}^+$[642]	$\frac{5}{2}^-$[523]
1	2	3	4	5	6	7	8	9	10
^{155}Gd$_{91}$	0.222	−0.030	d	47.30 56.50	83.92 84.60	57.41 80.65	86.90 83.33	63.86* 83.61	23.49 97.75
^{157}Dy$_{91}$	0.215	−0.025	b	42.47 50.76	90.28 90.91	52.44 73.96	88.60 81.97	73.34*	19.08* 88.50
^{157}Gd$_{93}$	0.239	−0.028	d	54.47 70.92	42.57 98.04	63.12	74.63 91.74	223.94 135.14	76.12 85.47
^{159}Dy$_{93}$	0.239	−0.025	b	52.24 64.52	39.97 79.37	60.70 89.52	73.89 88.50	233.89 222.71	75.10 81.97
^{161}Er$_{93}$	0.233	−0.018	b	46.68 52.63	34.88	54.88 71.43	73.49 84.03	356.25	70.80 74.07
^{159}Gd$_{95}$	0.245	−0.022	d	55.57 77.52	51.01* 102.04	63.27	83.15* 99.00	151.48 (136.99)	57.43* 86.21
^{161}Dy$_{95}$	0.252	−0.016	b	54.65 71.94	50.69* 80.58	61.72	82.56* 87.72	157.82 158.73	56.41* 90.09
^{163}Er$_{95}$	0.252	−0.007	b	50.92 62.11	47.35*	57.47 76.34	58.19* 83.33	176.04	77.01* 83.33
^{161}Gd$_{97}$	0 254	−0.011	d	58.55 79.72			80.58 (96.15)	315.72	75.72 96.15
^{163}Dy$_{97}$	0.264	−0.005	b	58.84 78.13			77.18 93.46	344.74* 200.00	76.19 95.24
^{165}Er$_{97}$	0.261	0.003	b	55.24 69.93			77.34* 94.34	368.54* 450.45	74.61 90.91
^{165}Dy$_{99}$	0.270	0.008	b	59.91 81.76			50.09	61.16	79.61 94.43
^{167}Er$_{99}$	0.270	0.016	b	58.31 73.53			48.81 86.96	60.12 113.76	79.75 90.91
^{169}Yb$_{99}$	0.250	0.012	d	52.31 69.93			44.68 80.65	38.20 123.92	78.69 90.09
^{169}Er$_{101}$	0.276	0.027	b	61.57 75.19			62.15 90.91	81.62	41.58 80.65
^{171}Yb$_{101}$	0.270	0.034	d	58.75 73.53			59.65 (67.57)	79.89	26.12*

TABLE III

for odd-N rare-earth nuclei

$\frac{2}{\hbar^2} J(\varepsilon^{eq}, \varepsilon_4^{eq}; K)$ [MeV^{-1}]

$\frac{7}{2}^+$[633]	$\frac{1}{2}^-$[521]	$\frac{5}{2}^-$[512]	$\frac{7}{2}^-$[514]	$\frac{9}{2}^+$[624]	$\frac{1}{2}^-$[510]	$\frac{3}{2}^-$[512]	$\frac{7}{2}^-$[503]	$\frac{11}{2}^+$[615]
11	12	13	14	15	16	17	18	19
36.84	46.58 74.07	44.95						
29.79	41.89* 78.13	39.26 83.33						
40.21	44.47 84.53							
36.38	43.54 79.37	48.44 96.24						
27.70	37.99							
27.20	66.29 86.96	48.95* 93.46						
21.47	65.66 84.75	48.20* 86.21						
23.65*	62.56 75.19	43.89* 78.13						
180.05* (140.85)	63.92 95.24	41.66 87.72	50.69		59.07 87.72			
208.80 (108.70)	64.18 98.04	44.99 85.47	50.93		72.49 76.92			
225.51	60.91* 79.37	38.30 73.53	46.58	43.99	55.74* 76.34			
123.46 107.53	64.43 94.34	75.09 90.09	46.99	44.95	61.21 90.09			
130.11 113.64	62.96 89.29	73.64 84.03	44.39	41.87	59.72 86.21			
151.34 126.58	57 34 85.47	68.20 80.00	34.96 76.45	34.54	53.09 80.65			
131.16 119.05	65.39 84.75	67.93 82.64	87.71 83.33	30.61	64.13 85.47			
133.33 125.00	62.89 83.33	67.06 81.87	97.62* 79.37	33.04	60.00 71.43			

	ε^{eq}	ε_4^{eq}	Ref.	e—e	$\frac{3}{2}^-$[532]	$\frac{11}{2}^-$[505]	$\frac{3}{2}^-$[521]	$\frac{5}{2}^+$[642]	$\frac{5}{2}^-$[523]
1	2	3	4	5	6	7	8	9	10
$^{171}Er_{103}$	0.276	0.038	b	66.48 75.66					
$^{173}Yb_{103}$	0.270	0.044	d	63.92 77.52					
$^{155}Hf_{103}$	0.264	0.039	c	57.63 67.11					
$^{175}Yb_{105}$	0.266	0.053	d	64.49 75.76					
$^{177}Hf_{105}$	0.259	0.049	c	57.98 66.23					
$^{179}W_{105}$	0.244	0.044	c	49.79 56.18					
$^{177}Yb_{107}$	0.261	0.065	d	63.56 73.05					
$^{179}Hf_{107}$	0.249	0.058	c	57.15 64.52					
$^{181}W_{107}$	0.238	0.056	c	52.84 59.52					
$^{183}W_{109}$	0.228	0.063	c	52.77 56.82					
$^{185}W_{111}$	0.208	0.063	c	43.26 51.32					
$^{187}Os_{111}$	0.197	0.058	c	41.79 40.98					

(7/2⁻ [523]) and four excited states. The line on (ε, ε_4) plane in the bottom part of the figure represents average positions of the calculated equilibrium of odd-Z nuclei investigated in the present paper. The line denoted by e-e corresponds to the moment of inertia of the even-even core. We can see that the moments of inertia evaluated when the odd nucleon occupies the different one-quasiparticle state, depend in a various way on deformation of nucleus.

As a rule the shell effects are much larger than in the case of even-even systems. The triangles on Fig. 1 denote the values of the moments of inertia obtained at the equilibrium points evaluated for each K_π states separately. The distance between the triangle and the

TABLE III (continued)

$\frac{2}{\hbar^2} J(\varepsilon^{eq}, \varepsilon_4^{eq}; K)$ [MeV^{-1}]

$\frac{7}{2}^+$[633]	$\frac{1}{2}^-$[521]	$\frac{5}{2}^-$[512]	$\frac{7}{2}^-$[514]	$\frac{9}{2}^+$[624]	$\frac{1}{2}^-$[510]	$\frac{3}{2}^-$[512]	$\frac{7}{2}^-$[503]	$\frac{11}{2}^+$[615]
11	12	13	14	15	16	17	18	19
103.06	65.31 83.33	$\frac{73.96}{100.00}$	59.75 78.74	223.27* 100.00	63.67 86.96	55.51 75.76		
215.17 161.29	66.93 82.64	$\frac{76.26}{89.29}$	60.40 80.00	89.94*	68.67 85.47	56.76 78.13		
257.82 178.25	60.92 74.07	$\frac{71.66}{86.21}$	54.31 70.92	133.52* 71.63	63.52*	50.53		
78.35 (97.09)	67.73 72.99	67.73 78.74	$\frac{72.15}{86.21}$	93.56 (93.46)	62.84 86.21	56.90 83.33		
76.10 87.72	60.81 74.29	61.26 72.46	$\frac{66.97}{79.36}$	92.46 144.92	58.97	50.30 67.57		
52.06 94.34	52.92 66.66	55.38 69.93	$\frac{61.54}{75.19}$	108.87 172.41	50.40 53.20	55.38		
88.76	60.40	69.39	71.94 81.30	$\frac{92.43}{89.29}$	76.56 81.30	59.75 78.13		
	45.95 76.34	63.83 72.46	66.55 73.53	$\frac{90.14}{89.29}$	74.98 75.76	60.66 74.07		
	39.77* 68.49	61.16* 63.29	63.13 75.19	$\frac{90.35}{97.07}$	75.45 66.23	57.84 61.73		
	51.31 54.95	56.25 71.94	65.44 61.73	26.59 71.43	$\frac{69.82}{76.92}$	42.51 60.21	51.33 63.29	124.08* 72.99
	41.81 59.88	47.20 71.43	48.70 55.87	57.44 78.74	$\frac{63.27^*}{47.39}$	$\frac{33.71^*}{75.76}$	44.08 60.98	59.87 69.93
	39.73 68.68	45.93	48.01	54.59 64.52	$\frac{62.93^*}{42.19}$	32.43 76.19	43.78 55.37	64.01 80.32

corresponding K^π line denotes the error we made in Table II assuming the same equilibrium deformation for the ground and the excited states. This error is largest for the state $7/2^+$ and is equal to 13%, typically for other cases this error is 4 times smaller. It seems that for further more accurate calculations one has to calculate the equilibrium point of potential energy for each excited one-quasiparticle state separately and use this deformation for evaluation of the moment of inertia.

We have also tested how important for the magnitude of the moment of inertia is the blocking effect of the single-particle state by the odd nucleon while solving the gap equation. In Fig. 2 there is plotted the dependence of the moments of inertia of ^{165}Ho (like in Fig. 1)

TABLE IV

The theoretical and experimental Coriolis decoupling parameters for the odd-Z rare-earth nuclei with $K = \frac{1}{2}$ in the ground or excited states

	$\frac{1}{2}^+[411]$		$\frac{1}{2}^-[541]$	
	a	a_{exp}	a	a_{exp}
^{153}Eu	0.89			
^{155}Eu	0.87			
^{155}Tb	0.93			
^{157}Tb	0.90			
^{159}Tb	0.91			
^{161}Tb	0.92			
^{161}Ho	0.93		3.35	2.30
^{163}Ho	0.94		3.44	2.55
^{165}Ho	0.94	−0.46	3.57	2.89
^{167}Tm	0.95	−0.72	3.72	3.16
^{169}Tm	0.95	−0.77	3.88	3.83
^{171}Tm	0.96	−0.86	4.00	3.99
^{171}Lu	0.97	−0.71	4.04	3.90
^{173}Lu	0.97	−0.75	4.18	4.20
^{175}Lu	0.99	−0.85	4.38	5.10
^{177}Lu	1.00	−0.91	4.60	6.37
^{177}Ta	1.00	−0.79	4.48	6.06
^{179}Ta	1.03	−0.83	4.68	
^{181}Ta	1.06		4.71	
^{183}Ta	1.08		4.64	
^{181}Re	1.05		4.72	
^{183}Re	1.08		4.74	
^{185}Re	1.11		4.70	
^{187}Re	1.13		4.69	

evaluated including the blocking effect (in BCS equation only). The magnitude of the moment of inertia on the average is the same but the dependence on deformation much smoother. It is due to the fact that the blocking procedure increases the relative distance between the quasiparticle energies and decreases the magnitude of the pairing gap. The blocking effect was not included in the formula for the moment of inertia because the excited states obtained by the blocking procedure are not orthogonal and it complicates the cranking procedure a lot.

The strength of the pairing interaction (G) is also a very important parameter. In the whole paper we have used the values G fitted to the odd-even mass differences [5] and now we would like to see how the results are sensitive to the choice of G. In Fig. 3 there is plotted the dependence of the moment of inertia of ^{165}Ho in the ground and excited states on G (or rather the ratio G to the standard value G_{st}). In the bottom part of the figure the resulting gap parameter is plotted too. A similar picture but for the odd-N nucleus ^{179}W is drawn in Fig. 4. It is very interesting that the moment of inertia of the odd-A system does not always decrease, as a function of growing G, what was a rule in the case of even-even nucleus.

TABLE V

The same as in Table IV but for odd-N nuclei

	$\frac{1}{2}^-[521]$		$\frac{1}{2}^-[510]$	
	a	a_{exp}	a	a_{exp}
$^{155}Gd_{91}$	0.81			
$^{157}Gd_{93}$	0.83	0.15		
$^{159}Gd_{95}$	0.85	0.45		
$^{161}Gd_{97}$	0.87		−0.14	
$^{157}Dy_{91}$	0.83			
$^{159}Dy_{93}$	0.85	0.40		
$^{161}Dy_{95}$	0.87	0.45		
$^{163}Dy_{97}$	0.90	0.26	−0.94	
$^{165}Dy_{99}$	0.92	0.58	−0.14	
$^{161}Er_{93}$	0.86			
$^{163}Er_{95}$	0.89	0.50	−0.09	−0.29
$^{165}Er_{97}$	0.91	0.56	−0.10	0.06
$^{167}Er_{99}$	0.93	0.70	−0.13	0.10
$^{169}Er_{101}$	0.94	0.83	−0.14	
$^{171}Er_{103}$	0.94	0.58	−0.09	0.13
$^{169}Yb_{99}$	0.90	0.79	−0.05	
$^{171}Yb_{101}$	0.88	0.82	0.03	−0.09
$^{173}Yb_{103}$	0.89	0.74	0.04	0.25
$^{175}Yb_{105}$	0.88	0.76	0.07	0.18
$^{177}Yb_{107}$	0.87		0.12	0.18
$^{175}Hf_{103}$	0.90	0.74	0.01	−0.99
$^{177}Hf_{105}$	0.89	0.58	0.05	
$^{179}Hf_{107}$	0.87	0.65	0.10	0.16
$^{179}W_{105}$	0.87	0.82	0.09	−0.04
$^{181}W_{107}$	0.84	0.48	0.13	0.58
$^{183}W_{109}$	0.80	0.68	0.19	0.19
$^{185}W_{111}$	0.71	0.98	0.27	0.12
$^{187}Os_{111}$	0.67	0.38	0.31	0.05

It happens in the nuclei in which the contribution to the total moment of inertia coming from the odd particle J_{odd} is large. The increasing pairing correlations decrease the relative distance between the quasiparticles energies and increase the part of the moment of inertia while the J_{even} part is always the decreasing function of G. The slope of the theoretical curves is also rather large; it means that the proper estimation of the pairing strength is important. It is seen that decreasing the magnitude of G to 89% of G_{st} we can reproduce the experimental data for both nuclei (except the moment of inertia in the state $7/2^-$ [523] for ^{165}Ho).

The decoupling parameter a depends more smoothly on the deformation (see Fig. 5) except for the cases when on the Fermi surface two single-particle levels with $K = 1/2$ and the same parity cross. We have also to say that it would not be possible to obtain theoretically its magnitude comparable with the experimental data without taking into

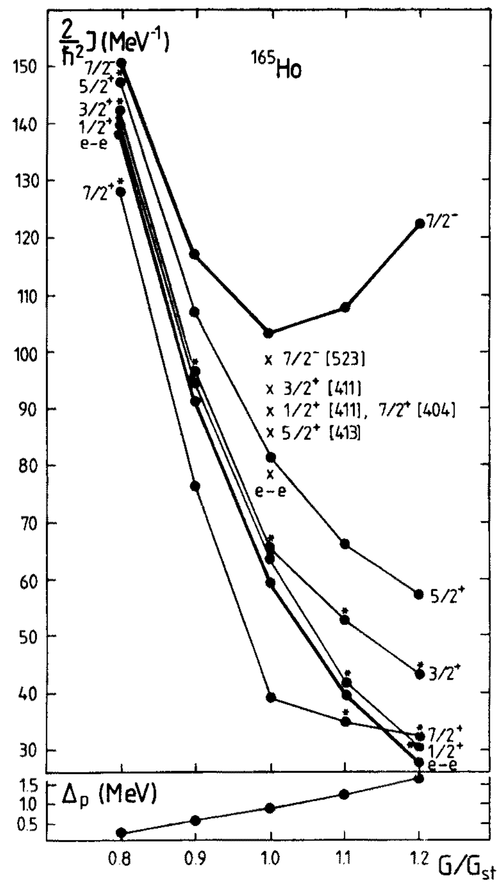

Fig. 2

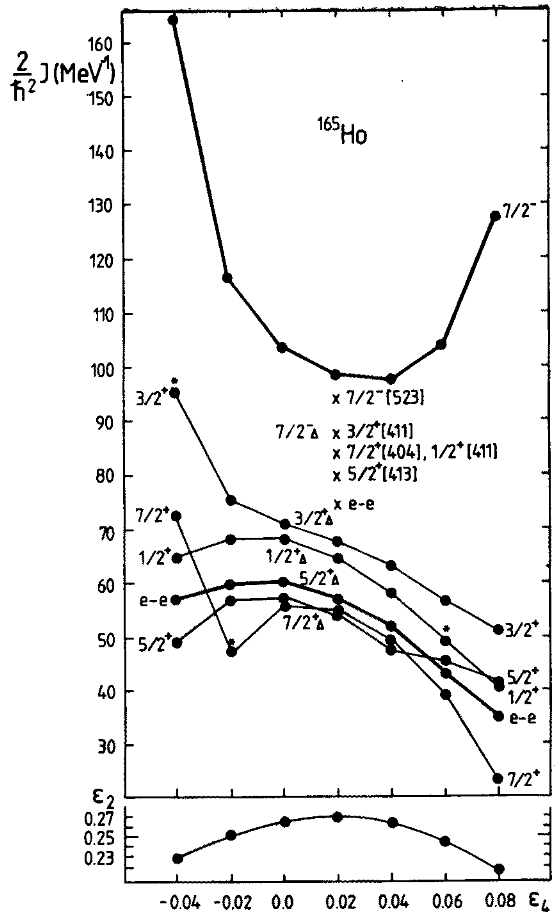

Fig. 3

Fig. 2. The same as in Fig. 1 but evaluated including the blocking effect (in BCS equation only)

Fig. 3. Dependence of the moment of inertia of ^{165}Ho in the ground and excited states on the strength of the pairing interaction G/G_{st}. The corresponding values of the energy gaps Δ are plotted in the bottom parts of the diagrams

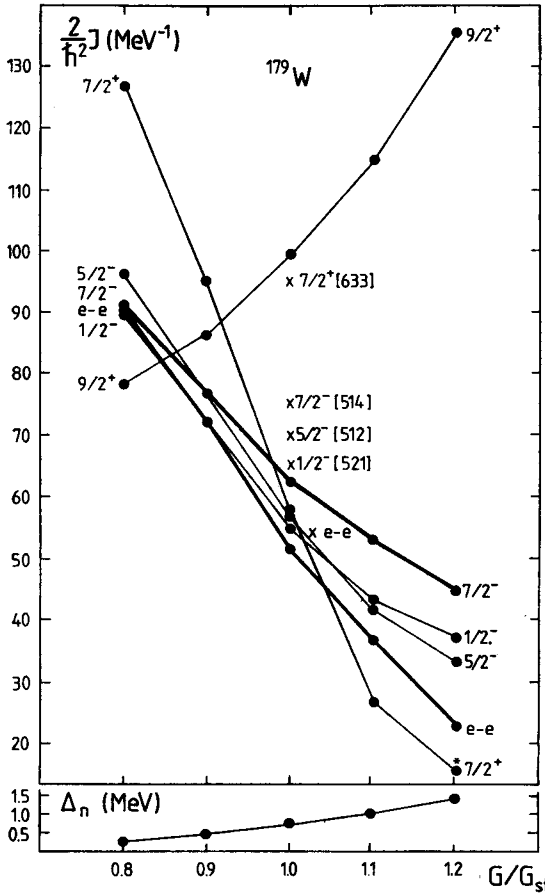

Fig. 4. The same as in Fig. 3 but for ^{179}W

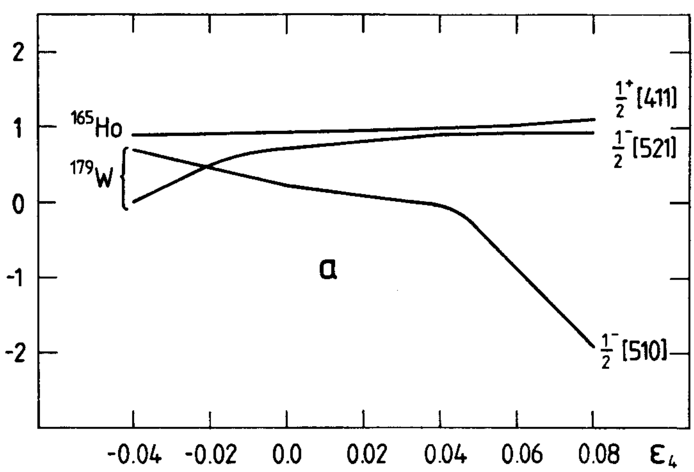

Fig. 5. Dependence on the hexadecapole deformations of the Coriolis decoupling parameter for a few lowest in energy $K = \frac{1}{2}$ bands in ^{165}Ho and ^{179}W nuclei

account the coupling of the oscillator shells via the hexadecapole term in the Nilsson potential. The magnitude of a depends rather weakly on the choice of the pairing forces.

At the end we would like to stress that our investigations have rather qualitative character and it was not our aim to get the best fit to the observables. Nevertheless the theoretical estimates obtained here with the standard set of the parameters are in pretty good agreement with the experimental data.

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